



An Association for Retired Professional Engineers

NEWSLETTER April 2024

President's message

Hello everyone, as this season comes to an end, welcome to the April Newsletter.

I feel I must mention the sad passing just before Christmas of a long serving committee member and past president, David Thomas. David was always there with advice and ideas on talks and visits and will be sadly missed by everyone.

This season we have had another full year of monthly talks and are already working on September onwards. The talks have been varied and well attended, averaging 35 on each occasion.

As we now move towards the summer, our thoughts turn to visits and your committee has already arranged 2 visits during May and June (details are within this newsletter) which I hope will be well supported by the members. Please keep a close eye on your in-boxes as Mike will be sending things through as they crop up.

The coffee mornings continue each month, with folk meeting on the 3rd Thursday of the month at the Spotted Cow and the last Thursday of the month at the Swallows Return with partners. Why not give it a go?

Do please note that the coffee morning on 20th June has been relocated to the Swallows Return rather than the Spotted Cow.

The AGM will start off our new season on September 17th and once again the usual cry goes out for new members to join us.

We do value the input of our members to arrange talks and visits as new / different thoughts bring fresh ideas. So, if you feel this is for you, please talk to me or anyone else on the committee for more information.

I would like to place on record, my sincere thanks to my fellow committee members for ALL their hard work and long may it continue.

All that remains is to wish you all a pleasant summer, keep your eye on emails from Mike and look forward to September when we can do it all again.

Take Care and Stay Safe.

George Woollard

President
April 2024

PROGRAMME OF EVENTS May 2024 – September 2024

7 th May	Tuesday	Visit – Shoreham lifeboat station
16 th May	Thursday	Coffee – at Spotted Cow, Angmering
30 th May	Thursday	Coffee – with Partners at Swallow's Return
5 th Jun	Wednesday	Visit – AMEX stadium, Brighton
20 th Jun	Thursday	Coffee – at Swallow's Return (changed venue)
27 th Jun	Thursday	Coffee – with Partners at Swallow's Return
18 th Jul	Thursday	Coffee – at Spotted Cow, Angmering
25 th Jul	Thursday	Coffee – with Partners at Swallow's Return
15 th Aug	Thursday	Coffee – at Spotted Cow, Angmering
29 th Aug	Thursday	Coffee – with Partners at Swallow's Return
17 th Sep	Tuesday	AGM & Talk – The Bloodhound project
19 th Sep	Thursday	Coffee – at Spotted Cow, Angmering
26 th Sep	Thursday	Coffee – with Partners at Swallow's Return

All Talks and Meetings will commence at 2.30 pm and are held in the Pavilion, 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. Please note that the coffee morning on 20th June has been relocated to the Swallows Return and is members only.

We apologise for only being able to publish a very short list of our forthcoming events. We are increasingly having to inform our members of late changes to our programme by email and suggest that members should regularly check our website at **www.rceasussex.org.uk** for up-to-date details of 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. All our talks are open to the general public as are our visits and outings, but priority will always be given to members if there is any limit imposed on numbers attending.

We also need more speakers to give talks to us on Tuesday afternoons from September to March/April. 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.

New Members

Roy Allen, MIET BSc (Eng) ACGI PGCE
Peter Wyld, B.Sc. (Eng)

East Preston
Steyning

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.

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 May 2024 – September 2024

Visit

Tuesday 7 May, 2.30pm. Visit to Shoreham Lifeboat station, BN43 6RN.

Mike Wooldridge is making all arrangements by Email due to limited time left following publication of this newsletter.

Wednesday 5th June 2024 AMEX Stadium, Falmer

We have arranged a tour of the stadium which 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 Wednesday 5th June, 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.

Reply Slip is on page 21 at the end of this Newsletter.

Visit

Mullard Space Laboratory, Dorking.

We are currently in discussions and hopeful that we can organise a visit – maybe in July. Watch this space. We will keep you posted by email.

Talk

Tuesday, 17th September 2024 – The Journey of Bloodhound ssc (supersonic car) so far
Cris Rickard – member

The talk will start with discussing how it was decided to design and build a car to do 1,000 mph, and how the team managed to persuade the Ministry to loan them the typhoon jet engines needed for the project by starting up an education program around STEM.

Some short videos will be shown regarding the design process, and the problems and mistakes made securing funding for the project.

The talk will then move on to the testing done in Newquay to prove to Rolls Royce that the design could provide sufficient air intake to enable Max Re-burn from the EJ 200 standing still.

Finally, the talk will explain how the project went broke and the receivers were called in. Fortunately, things were saved at the last minute enabling the project to proceed to testing in South Africa, which is where Bloodhound is currently.

Reports

Talk

Tuesday, 12th December 2023 – A cluttered and noisy sky? Meeting the challenge of satellite constellations.

Robert Massey, Royal Astronomical Society

Robert began his talk by explaining that he would be dealing primarily with the challenges that the increasing number of satellites pose to the astronomical community.

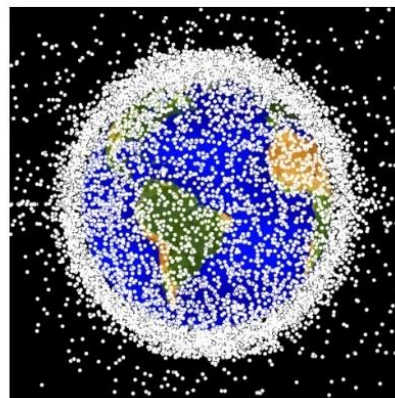
Satellites date back to 1957 with the launch of Sputnik 1, followed closely by Explorer1 in 1958 and by Ariel 1 (which is now inoperative) in 1962.

Whilst satellites provide a valuable service as listed in the slide below on the left, the sheer increase in their numbers and the future projections as shown in the slide below on the right do cause serious concerns in the astronomical community. (LEO stands for Low Earth Orbit).

Where we were, and where we're heading...

- Communications
 - Weather
 - Earth Observation
 - Geophysics
 - Environmental change
 - Astronomy
 - Espionage(!)
 - Navigation
- 2019: around 2,000 active satellites deployed in Low Earth Orbit (up to 2,000 km altitude)
 - Now: *additional* 5000 Starlink satellites at 550 km, 648 OneWeb satellites at 1200 km
 - Prospect of 400,000 (or many more) satellites in LEO by 2030

Image: NASA ODPO



Currently Starlink and OneWeb have ambitions to provide much improved web and communications access to those people living in poorly served parts of the world using large numbers of satellites, as shown in the slides below, Starlink is on the left and OneWeb is on the right.

Starlink

- Constellation delivers Internet access
 - Phase 1 consists of c. 3,100 satellites
 - Phase 2 consists of c. 30,000 larger satellites
- Images: SpaceX



OneWeb

- Internet access through 648 satellites
 - Part-owned by UK government (£400m stake)
- Image: NASA / Kim Shiflett



In addition to Starlink and OneWeb, AST Spacemobile's new satellite, Bluewalker3 launches shortly aiming to test if AST can provide 4G/5G from space to individual mobile phones. This requires a very large antenna which would be extremely bright.

Robert also talked about two other satellite projects, Kuiper shown in the slide on the left, and European ambitions to rival Starlink, shown in the slide on the right.

Project Kuiper

- Amazon subsidiary
 - Will deliver Internet access via 3236 LEO satellites
 - First two spacecraft launched and deployed October 2023
- Image: Amazon



European ambitions

- EU proposal for €7 billion constellation
- Mooted to tackle Internet dead zones in Africa as well as Europe
- Feasibility studies underway
- Could be built via European Space Agency



Historically, Astronomers have sited observatories in remote parts of the world where interference from man-made light and radio emissions is minimal. However, the increasing number of satellites result in additional background light pollution, approximately 10% of visible stars being satellites, and a major increase in radio interference since downlink transmission from satellites can be billions of times more powerful than astronomical sources. Consequently, remote sites for observatories are no solution to the problem.

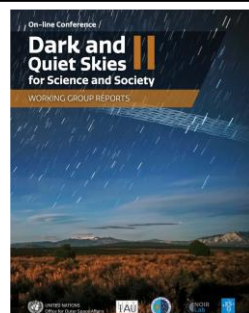
Robert then discussed the environmental impact of launches and re-entry of material, in particular the impact on the ozone layer of solid propellant and the steep increase in aluminium entering the atmosphere.

Astronomers are now pinning their hopes upon regulation ultimately providing some degree of protection such that astronomy can co-exist alongside the undoubted benefits that satellites provide. Currently the Federal Communications Commission, Ofcom and the International Telecommunications Union regulate the deployment of satellites, and the radio spectrum is already regulated, but there is no optical equivalent.

The following four slides show some recent initiatives where some progress is being made to enhance regulation of the skies.

IAU, AAS, RAS, EAS

- Astronomical organisations expressed concern in June 2019
- Organisational working groups include major observatories and satellite operators
- Two detailed IAU reports on issue and solutions
- Centre for Protection of Dark and Quiet Skies

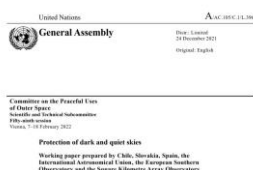


Outer Space Treaty

- 1967 treaty intended to prevent military activity in space
- 112 Countries parties to treaty, further 23 are signatories
- Article VI: state parties responsible for and authorise national activities in outer space
- Article IX: state parties can request consultation on activities by other parties believed to be harmful



UN Committee on the Peaceful Uses of Outer Space (COPUOS)



World news story
UK Statement on Dark & Quiet Skies at the 59th session of the Scientific and Technical Subcommittee of COPUOS
Delivered by Tamojen Morgan, Beyond Earth Orbit Lead, UK Space Agency, 15 February 2022



IAU centre (established 2022)

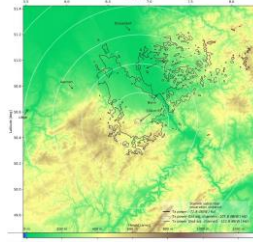
- Joint initiative of SKAO and NOIRLab
- SatHub (data repositories, orbital solutions, software, training)
- I&T Hub (Industry and Technology, mitigations, tools, best practices)
- CE Hub (community engagement)
- Policy Hub (national and international policies and regulation)



As an alternative to regulation, Robert instanced two initiatives aimed at keeping the skies uncluttered, the Effelsberg agreement in the slide below on the left, and the Astra Carta in the slide below on the right.

“Effelsberg agreement”

- Effelsberg radio observatory 100-m steerable radio telescope in western Germany
- Starlink satellite receivers prohibited in area around observatory
- Starlink downlink beams prohibited from illuminating observatory



“Astra Carta”

- Sustainable Markets Initiative
- Launched by King Charles III



Our speaker offered several suggestions on how this issue can receive greater publicity.

- Support work of new IAU Centre and ESSI – and international efforts.
- Continue to make the political case.
- Engaging with the press and the public.
- Better links with environmental movement? Case for “space environmentalism”
- Write to your MP (good to keep up profile of this issue).
- (For amateur astronomers) observe the satellites and send your results to Trailblazer <https://trailblazer.dirac.dev/>.

Following a break for refreshments, a number of questions were raised by the audience, amongst which were two of particular note.

Is the quantity of space debris important?

Answer Yes. This then raised a second question.

Can you clean up this debris by catching the defunct satellites and disposing of them?

Answer No, because they still belong to the country that launched them. Yet another good example of the need for international regulation.

Our thanks to Robert for an interesting and thought-provoking insight into the challenges faced by the astronomical community.

Malcolm Hind

Talk

Tuesday, 9th January 2024 – Flight Simulation – Commercial Aircraft.

Jeremy Hopkins - member

Jeremy introduced himself by describing his career, which began when he joined Singer Link Miles in Lancing in 1987. The company underwent a series of name changes, becoming the Simulator Division of Thomson CSF, France, then Thomson Training & Simulation Ltd, followed by Thales Training & Simulation and finally in 2017, L3 Harris Commercial Training Solutions (CTS).

Flight Simulators are produced to a number of classification levels, from A with the least fidelity, to D with the highest level of fidelity.

The one shown in the picture on the right is for a Boeing 787 and is a Full Flight Simulator to level D.

It comprises: -

- Flight deck
- Flight Controls
- Visual system
- Motion system
- Sound system.
- Instructor Operating Station (IOS)
- Computer system
-

Our speaker then went on to describe each of these systems in detail.



Flight Deck

The simulator should provide a faithful physical replica of the aircraft cockpit as shown in the picture below on the left which was taken in a simulator. It needs to cover: -

Avionics – FMC, Nav aids, TCAS, GPWS, WxR, Comms

Displays – PFD, Nav displays, warnings etc.

Autopilot / autothrottle.

Landing gear – gear up/down indicators.

Alternate systems (electrical, mechanical)

HUD (head up display)

Flight controls

There is often a debate as to whether actual aircraft instruments should be used in the Simulator, which is discussed in the slide below on the right.



Flight Deck – simulation vs stimulation

- Q. Should we use “real” aircraft instruments (and stimulate them), or provide replicas (simulations)?
- Pros/Cons of using as-aircraft equipment
 - 100% accurate to real aircraft but very expensive.
 - Possibly difficult to interface to the simulation host computing system
 - Can be difficult to stimulate for certain functions (e.g. repositions)
- Pros /Cons of using Simulated instruments
 - Cheaper to manufacture – no need for stringent airworthiness certification
 - Difficult to ensure an accurate replica if detailed data is not available
 - Have to continuously monitor / update changes

Flight Controls

The list in the centre of the picture below shows which Flight Controls need to be incorporated within the Simulator, being different for the two major manufacturers Airbus (on the left below) and Boeing (on the right below).



Side stick (for Airbus)
Yoke “Column & Wheel”
(for Boeing),
Identical movement and feel
as the aircraft controls.
Accurate force feedback to
replicate actual aircraft.
Stick shaker (Boeing)
Pitch trim.
“Stab Trim” (Boeing)
Trimmable Horizontal
Stabilizer “THS” (Airbus)



Visual Systems

The design of the visual system in a simulator is particularly important in providing the pilot(s) with a real-world view of their surroundings and the effect of their actions when ‘flying’ the simulator. The visual system consists of an image generator and a display system.

The image generator must provide an ‘Out the Window’ view of acceptable quality, high-definition airport models, crash indication “red screen”, calibration patterns and terrain elevation data to the simulator.

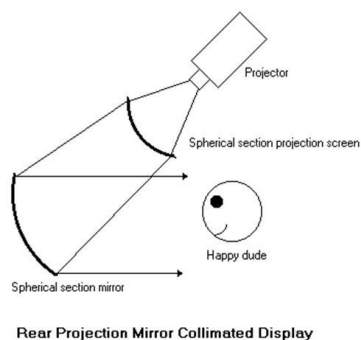
The display system must provide adequate Field of View – typically 200 to 225 deg. Horizontal x 45 deg. Vertical (typically +15, -30) and real and virtual images and collimation.

Collimation is particularly important to ensure that the pilots see clear images focussed at infinity which is what they would see through the real cockpit window.

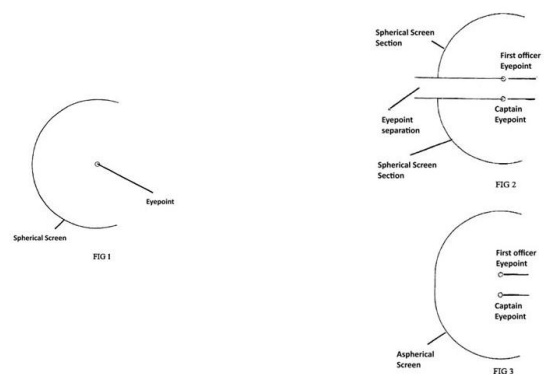
Jeremy presented the following slides (two below, two overpage) to illustrate how this is achieved, starting with the basics of collimation shown in the left side of the first slide (Display System1) through to the final slide (Display System4) showing how the visual system largely dominates the overall size of the simulator.

Display System 1 - Collimation

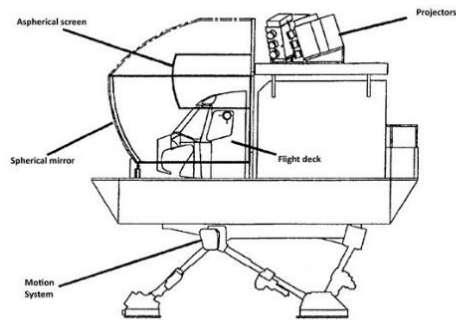
Real image vs Virtual image and problems with real images in commercial simulation



Display System 2 – Collimation 2

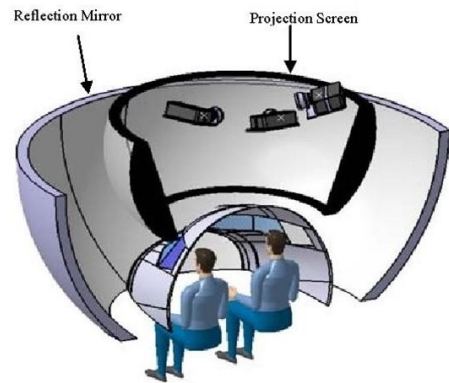


Display System 3



General setup of the collimated display system on a commercial flight simulator

Display System 4



Motion System

During his talk Jeremy was able to demonstrate a typical motion system in operation on video. The slide below provides the pertinent details of the system.

Motion System



- Six degrees of freedom
 - Surge, Heave, Sway
 - Pitch, Roll, Yaw
 - “Hexapod” hydraulic or electric actuators
- Purpose of the motion system
 - Acceleration cues
 - Special effects
 - Vibration (engines, aerodynamic)
 - Impacts (terrain, vehicles)
 - Upsets (microbursts, windshear etc.)
 - Turbulence (wake turbulence, rough air, storms etc.)

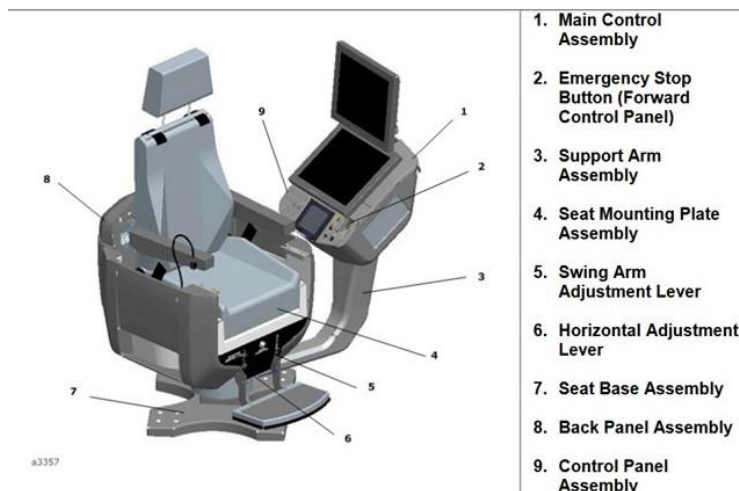


Sound System

The sound system must provide: -

- Realistic simulation of sounds under various conditions
- Aerodynamic sounds
- Engine sounds – turbines, stall
- Environmental sounds – rain, hail etc.
- Alerts & warnings – altitude alerts, autopilot disconnect, engine fire etc.
- GPWS warnings – “Terrain Terrain, pull up” etc.
- TCAS warnings – “Traffic”, “Climb now” etc.
- Special effects – decompression, terrain / vehicle impact, type squeal / judder
- Automatic Terminal Information Service (ATIS) – Weather, active runway, equipment status
- Crew communications – Inter pilot, crew to ATC etc.

Instructor Operating System



A typical Instructor Operating configuration is shown in the picture on the left, and caters for:

-
- Aircraft configuration – weight (ZFW + fuel + cargo) and CG
- Initial position – Departure Airport, gate, taxi, hold, take off
- Environmental – time of day, precipitation, visibility, wind
- Destination airport
- Malfunctions – active or armed
- Lesson plans

The instructor can choose from some 200-300 ‘malfunctions’ during a training session for the pilot to handle.

Computer System

Jeremy described the evolution in computer systems from relatively large computers to today’s much smaller but more powerful PC based systems as listed in the slide on the right.

Of particular importance is the rate at which all outputs are updated to ensure that users get close to real-world experience whilst using the simulator.

- “Host Computer” - Power PC based 0.5 U 19” rack mounted unit
- Flight simulation software – frame based real-time scheduler at 60Hz (16.66 mS / frame)
 - critical loop - latency
 - equations of motion
 - weight and balance
 - ground effects
- Retargeted aircraft software components
- SIMSOFT
- Aircraft avionics network – ISS, FMC etc.
- Visual interface (typ. Ethernet)
- Motion interface (ethernet)
- I/O (Linkage) digital and analog
- Separate “management” computer (PC) for loading real-time host, and background housekeeping

Our speaker concluded his talk by discussing certification and approval, which is undertaken by the Civil Aviation Authority (CAA) in the UK, the Federal Aviation Authority (FAA) in the USA and the European Aviation Safety Agency (EASA) in Europe. Some countries use one of these three agencies, some have their own approval bodies e.g. CAAC (China).

Certification has two elements – subjective assessment and objective assessment.

Subjective assessment involves flyouts by experienced pilots & instructors, performance, handling, malfunctions, avionics and instructor facilities.

Objective assessment covers the Qualification Test Guide (QTG), aircraft performance including manoeuvring, accelerations, ground handling, engines thrust, fuel consumption, EGT, EPR, sound – quiet cockpit, take-off, approach, cruise, visual and motion latency. The results are plotted against actual aircraft data for analysis.

Following the refreshment break, several questions were posed including questions about the programming language (used to be Fortran, now C). Jeremy also talked about his experience with weapons training simulators, which are used principally by marksmen.

Our thanks to Jeremy for a very detailed exposé of this fascinating subject.

Talk

Tuesday, 13th February 2024 – The decline of the British automotive industry and the lean revolution that helped restore (some of) it.

Laurie West C.Eng. MBA

Laurie explained that his talk would focus on the demise of the British motor industry and the massive change that was brought about by the Japanese companies Nissan and Toyota and how they helped save the UK motor industry, especially the supply base, from total decline.

He started his talk by giving us some history of the British automotive industry from the 1950s up to 2008 as shown in the two slides below.

Talk to Retired Engineers
by Laurie West Feb. 2024

INDUSTRY HISTORY



- 1950's ; The UK was the largest vehicle exporter in the world.
- Japanese and mainland European Industries recovering from war
- Mid 1950's ;European plants rebuilt with more productive processes
- The UK suffers from aging factories and products.
- Austin and Morris merged in 1952 to form BMC.
- 1966 ; BMH formed with the addition of Jaguar
- 1968 ; Leyland, Triumph and Rover joined to form BL
- 1975 ; B.L. nationalised.



AC, ALLARD, ALVIS, ARMSTRONG SIDDELEY, AUSTIN, AUSTIN HEALEY, ASTON MARTIN, BENTLEY, BRISTOL, CATERHAM, DAIMLER, FORD, GILBERT, HILLMAN, HUMBER, HRG, JAGUAR, JENSEN, LAND ROVER, LANCHESTER, LAGONDA, LOTUS, MORRIS, MCLAREN, MARCOS, MORGAN, MG, PANTHER, RELIANT, RANGE ROVER, RILEY, ROVER, ROLLS ROYCE, SINGER, SUNBEAM, STANDARD, TALBOT, TRIUMPH, TVR, VAUXHALL, WOLSELEY

Talk to Retired Engineers
by Laurie West Feb. 2024

INDUSTRY HISTORY Cont.



- 1979 Rover Group and Honda join forces.
- 1994 BAe sell Rover Group to BMW for £800m.
(Honda unceremoniously abandoned)
- 2000 BMW sell Rover to The Phoenix Four for £10
(and Land Rover to Ford, but keep Mini)
- 2008 Rover goes bust and ceases to exist
- Meanwhile, creeping up on the inside;
- 1986 Nissan plant opened in Sunderland
- 1992 Toyota plants opened in Derby and Deeside
- 1999 Ford acquire Jaguar, Land Rover, Aston Martin and Volvo
- 2008 Ford sell Jaguar & Land Rover to TATA of India

Today, it ranks a lowly fourteenth (below the likes of Thailand). Even automakers widely regarded as being quintessentially 'British' – including Jaguar, Land Rover, Rolls-Royce, Bentley, MINI, Lotus, and Aston Martin – are in fact now all foreign-owned. So, what ever happened to the powerhouse that was the British automotive industry?

With Japanese and mainland European industry still recovering from the devastation of World War II, British automakers were better placed to meet post-war demand for new vehicles. However, by the mid-50s new European car factories were being rebuilt to accommodate modern and more productive manufacturing processes. With its labour-intensive production methods, aging factories and wide model ranges, the British auto industry had higher unit costs than those of its global competitors. Strained industrial relations resulted in long strikes that hit both production numbers and quality. Most importantly, there was a lack of investment in new product development.

Laurie's career began with a technical engineering apprenticeship with the Ford Motor Company, following which he started as a Process Planning Engineer at the Dagenham Engine Plant in 1969. After 3 years he was selected to go on a 6-month course and moved into a production management role on the shop floor.

The culture was typical of the industry and very much a blame game. Aggression and adversarial relations were the norm. The sole objective for production management was to make your pieces by fair means or foul. Keep machines running at all costs. Machine utilisation was a key performance indicator, whether you needed the parts for assembly or not. Inter- departmental rivalry was rife. This had an adverse effect on quality and productivity. Industrial relations were poor, but you just accepted that as the norm.

But Ford was doing great so why change? The Ford costing system and marketing strategy was brilliant and significant investment in their new model line-up resulted in Escorts, Cortinas and Fiestas holding the top selling spot for over a decade. They had invested in a state-of-the-art R & D facility at Dunton in Essex.

Laurie recalled a standing joke involving a discussion between the test engineer on the final trim assembly line at Dagenham with his oppo on the BL Austin Allegro line. The Ford guy says we use the "cat test". He explained; we put a cat in the car, shut all the doors and windows and after 3 mins if the cat is dead the car passes. The guy from BL says, yes, we use the cat test too. We put a cat in the car shut all the doors and windows, return after 3 minutes and if the cat is still in there the car passes!

He left Ford and eventually joined Britax Automotive as Production Director and was later promoted to MD with responsibility for three plants in the UK and plants in the US and Australia. Britax, who manufactured seat belts and door mirrors, were supplying all the major OEMs. who would put extreme pressure on suppliers and threaten them at every opportunity. In short, supplier relationships were adversarial, secretive, and unhelpful but that was the way it was, and you succeeded by being tough.

Fortunately, things were about to improve with the arrival of Nissan in Washington in the northeast (left hand slide below) in 1985, and Toyota in Derby (right hand slide below) a few years later.



Britax quoted for Nissan's business and put on impressive tours round the plants as part of the Nissan European supplier selection process. Most importantly, Nissan were assessing people as much as they were the products and facilities. We started to hear buzz words like TQM, JIT and quality circles. We cynically thought "we know how to run factories and build cars and components; after all we did win the war". We were about to learn a thing or two that would result in a paradigm shift in thinking and performance!

At that time, Ford had over 22,000 suppliers in Europe as they maintained multiple sources for each component. They used this as a threat for price reduction demands. By way of contrast, Nissan selected just 300. They knew they couldn't build relationships of trust with many more.

Britax were successful in winning the Bluebird business and Nissan immediately placed a Supplier development team of 6 highly trained people to work permanently in our factory, at no cost to us, to teach us how to introduce lean manufacturing techniques. Their approach required that all personnel, operators, supervisors, and managers participated in improvement projects. With training, operators were encouraged to identify and implement improvements and stop the process if something was wrong. They took to it immediately. What Nissan subtly demonstrated was that the person doing the job knows it best. The methodology engaged 500 brains not just the Management few! Everyone had to up their game.

We replaced assembly lines with cells with much reduced work in progress, and as a result saved a lot of space. The space saved was cordoned off and not used until Nissan launched their second model the Primera and then Micra, which we were awarded. This space accommodated the additional volume and as our overheads were already covered and our costs came down massively as we were building twice the volume in the same space and only increased costs by direct material & labour.

When Britax invested millions of pounds in a new automated robotic paint plant capable of changing colours in 5 seconds they got into serious problems trying to commission the plant. At one point they were literally flying parts up to Washington from Goodwood in a private chartered plane each evening to keep the car assembly line running. Unlike the bad old days, Nissan sent six expert paint technicians to work full time in our plant to properly commission the facility at absolutely no cost to us.

From then on, we would bend over backwards to do anything we could for Nissan.

After 3 or 4 years with Nissan, although we thought we knew it all, we still had lots to learn. At this time Toyota were setting up their supply base to serve their new assembly plant in Derby. Britax were successful in winning the Corolla business for Toyota UK, and it was the first introduction to the Toyota Production System, in particular the lean process which is illustrated in the two slides overpage.

AN INTRODUCTION TO LEAN

THE 5 PRINCIPLES OF LEAN

- 1) Agree and understand what your customer actually wants.
*This involves fundamentally reviewing and agreeing what your customer **really** wants*
- 2) Understand your process.
This involves defining the complete process or value stream and removing all waste.
- 3) Smooth the flow.
This means shifting towards continuous single one-piece flow with no batches or queues.
- 4) Shift from push to pull.
This is all about allowing customer demand to pull delivery
- 5) Continue to attack waste and strive for perfection.
However much has been done there is always scope for further continuous improvement.

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AN INTRODUCTION TO LEAN Cont.

Lean will only work, however if;

- Senior managers are genuinely committed to making it work
- There is a planned and disciplined approach.
- The culture is positive, the environment blame free and there is an acceptance that lean is a continuous journey, not a destination.

Lean relies on the input from everybody.
People need to be **committed** not just **involved**!



11

Laurie went on to discuss some examples of the tools and techniques that develop and underpin lean processes using the lean toolbox shown in the slide on the right.

Lean companies relentlessly attack waste in all its forms. Reducing batch sizes is key to eliminating waste. Excessive inventory hides all the other wastes.

Stock must be counted for financial reporting, it can spoil, it can be obsoleted, it takes up non-productive space. Reducing stock generates cash which investors love.

THE LEAN TOOLBOX (examples)

- QUICK CHANGEOVER of EQUIPMENT (s.m.e.d.)
- VISUAL MANAGEMENT
- VALUE STREAM MAPPING.
- FOOL PROOFING (POKA YOE)
- 5S HOUSEKEEPING.
- SPAGHETTI DIAGRAMS
- PROBLEM SOLVING : 5 WHY'S etc.
- TOTAL PRODUCTIVE MAINTENANCE (T.P.M.)
- TRAINING MATRICES
- JUST IN TIME (JIT); KANBANS, PULL SYSTEMS



"Production Managers think the glass is half full, Finance Managers think the glass is half empty.
Lean Managers think you've used too much glass".

12

Concurrent with improving production processes they also addressed the business processes.

Here are some examples.

To improve new product development, they implemented Concurrent/Simultaneous engineering and reorganised into customer focused, co-located dedicated teams. It typically took 5 years to develop a new car. By working concurrently and not sequentially with suppliers this was reduced to 15 months; a massive cost saving but here is the clever bit, it is much easier for marketing to figure out what the customer wants in 15 months' time as opposed to 5 years! They stole a massive march on the competition. This is only possible if there is genuine trust and respect between companies that they would not be divulging secrets to competitors.

They changed our mindset from the pricing model of Selling Price = Cost + Profit, to Cost = Selling Price – Profit mindset to achieve target costing; What the market will bear is the selling price. It approaches the issue from a different angle. Open book costing; use their purchasing power.

With Toyota's help, Britax implemented a Policy/ Strategy deployment process. This has been a major benefit. Having a process to develop and execute strategy has been a game changer in subsequent companies Laurie has worked with.

Toyota set up and ran a European Supplier Development Council facilitating companies to solve quality and cost problems in non-compete company groups. Laurie was asked by Toyota to chair those monthly meetings which were held at a different supplier plant each month. You wanted to prepare for the sessions so you could be proud of your teams' improvements. Another example of continuous improvement. How smart is that; non-competing companies, working together, benchmarking each other, leveraging best practice, and mentored by experts to improve quality and costs for Toyota?

A common misconception is that lean can only be applied to volume repetitive assembly. Car companies produce each vehicle to a unique spec.

BUSINESS PROCESS IMPROVEMENTS examples.

- CROSS FUNCTIONAL, CO-LOCATED, DEDICATED TEAMS.
- SIMULTANEOUS/ CONCURRENT ENGINEERING
- MARKET PRICING/TARGET COSTING
(From $SP=C+P$ to $C=SP - P$)
- OPEN BOOK COSTING
- POLICY (STRATEGY) DEPLOYMENT
- SUPPLIER DEVELOPMENT PROGRAMMES & BENCHMARKING.



PBIT, EBITDA , FREE CASH FLOW & SHARE PRICE ALL SIGNIFICANTLY IMPROVED.

14

Laurie moved on to Weir as MD of the largest engineering company in Scotland.

Weir operated in the oil, gas, and mining sector making massive pumps, valves, and equipment where lean was introduced very successfully helping the share price grow tenfold over 5 years.

Our thanks to Laurie for a very interesting and thought-provoking talk.

Malcolm Hind

Talk

Tuesday, 12th March 2024 – Unravelling Tobacco: Data Publication and Data Suppression

Ian Stolerman, Department of Addictions, Institute of Psychiatry Psychology and Neuroscience, King's College, London

Acknowledging that his audience today was largely composed of engineers, Ian described himself as a Behavioural Engineer, studying the effects of nicotine addiction on human behaviour.

He began his presentation by showing a brief history of tobacco use (left hand slide below), and the effects of smoking it (right hand slide below).

Tobacco use began in the Americas, then spread to Europe in 16th century.
Early use was both recreational and medicinal.

- 1577: In England tobacco recommended for toothache, falling fingernails, worms, halitosis, lockjaw & cancer.
- 1880: Patenting of the first working cigarette-manufacturing machine. Previously all hand-rolled. Machines in widespread use by early 20th century facilitating availability of large quantities of cheap cigarettes.
- 1950s: Evidence for lung cancer in cigarette smokers (Sir Richard Doll & Bradford Hill 1950)
- 1970s: Evidence starts to accumulate for tobacco use as addictive drug-taking behaviour.
- 1990s: Raised awareness of major public health issues leads to major restrictions on tobacco use in some cultures.
- 2000+: Spread of the restrictions through much of the western world.

Cigarettes are nicotine delivery devices

- Smoking tobacco delivers pharmacologically active doses of nicotine to the body.
- During inhalation of cigarette smoke, 95% of the nicotine is absorbed through the lungs (acidic smoke).
- Nicotine from alkaline cigar and pipe smoke, chewing tobacco, nicotine gum, and snuff is absorbed in the mouth.
- Nicotine travels from lungs to brain and other parts of the body within seconds.

As shown in the left-hand slide above, it was not until the 70s that anecdotal evidence began to emerge that smoking tobacco was addictive. Ian gave two examples of the power of addiction, one of a man who despite having amputations as a direct result of smoking continued to smoke having been told of the risks, and the bartering of food for tobacco in concentration camps.

Gradually clinical reports began to be published, backing up this anecdotal evidence with data as shown in the left-hand slide overpage. The slide on the right-hand side overpage provides more information on the dangerous components of tobacco smoke.

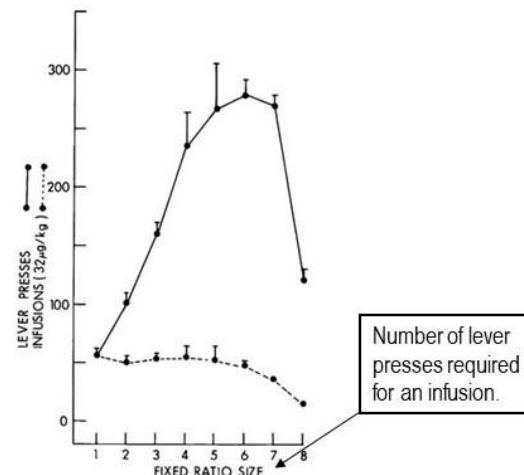
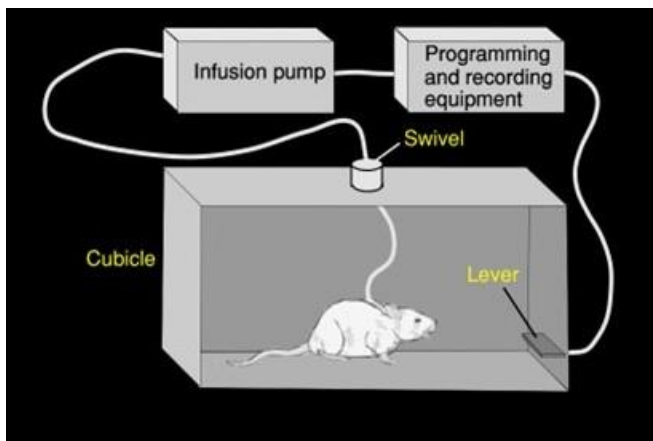
- Unaided attempts to quit don't work; only 3-5% succeed.
- **Approx. 50% of smokers light up within 30 min of waking.**
- After laryngectomy, 40% of smokers tried to smoke.
- After heart attacks, 40% resumed smoking in hospital, often within 48 h of leaving intensive care.
- After surgery for lung cancer, 50% of survivors resumed smoking.
- Smoking as few as four cigarettes leads to long-term daily use.
- **Approx. 95% of smokers use cigarettes daily. Very few stabilise at <5 cigarettes per day.**

- Nicotine occurs naturally present in tobacco.
- Carbon monoxide - toxic gas produced by burning tobacco leaves.
- Tobacco 'tar' – condensate produced by burning leaves. Contains > 4,000 substances including many carcinogens.
- Nicotine is mainly responsible for tobacco addiction and cardiovascular diseases of smokers.
- Tobacco 'tar' and carbon monoxide cause most other damage to health including cancer.

As the quantity of evidence mounted, both animal and human studies were carried out in order to get a more scientific basis to present the concerns about the dangers of smoking to the tobacco industry and public.

Early studies involved the use of rats as shown in the left-hand slide below. Researchers implanted the rats with a venous catheter as a delivery mechanism through which they could self-administer a controlled quantity of nicotine by depressing the lever in their cubicle. Each lever press is recorded, and as a control measure, parallel experiments were conducted with no infusion of nicotine.

In the slide on the right-hand side below, the solid line shows lever presses, the dotted line infusions. It is noticeable that once the rat receives enough nicotine it reduces the number of lever presses with a corresponding reduction in infusions.



The two slides below show some of the results of these studies along with similar experiments in humans.

- Withdrawal signs after stopping nicotine intake.
- Animals and people take solutions of pure nicotine through drips.
- Cigarette smokers smoke different cigarettes to obtain fairly constant doses of nicotine e.g. holding cigarettes in such a way as to block ventilation holes.
- A nicotine drip decreases cigarette smoking. Drugs that block effects of nicotine on the brain increase cigarette smoking.
- Tolerance to nicotine (reduced effects when taken repeatedly).
- Withdrawal signs after stopping nicotine intake.
- Self-administration of solutions of pure nicotine.
- Cigarette smokers adjust the way they smoke different cigarettes to obtain fairly constant doses of nicotine, e.g. by holding cigarettes in such a way as to block ventilation holes.
- A nicotine drip decreases cigarette smoking. The nicotine antagonist drug mecamylamine blocks effects of nicotine in the central nervous system and increases cigarette smoking.
- The tobacco industry and its apologists have denied the existence or relevance of ALL the above phenomena.

Ian then discussed the way in which nicotine affects the brain as shown in the slide below.

- Nicotine receptors are ion channels.
- Nicotine on receptor changes shape of the receptor protein and ion channel opens (Nigel Unwin)
- Flow of ions depolarises cell membrane, causes nerve cell to fire.

Brain Pathway to Nicotine Addiction

Nerve Cell Receptors for Nicotine (nicotinic acetylcholine receptors)

The diagram illustrates the mechanism of nicotine addiction at the cellular level. It shows a cross-section of a cell membrane with a nicotinic acetylcholine receptor (nAChR) embedded in it. The receptor is composed of two $\alpha 4$ subunits and two β subunits. Nicotine molecules, represented by a circle with an 'N', are shown binding to the $\alpha 4$ subunits. This binding causes the receptor to change shape, opening an ion channel. Labels include 'Receptor Subunits', 'Cell membrane', and 'Channel Opens'.

As the adverse health effects of nicotine addiction became better publicised, a number of cessation techniques were introduced with varying success rates.

Nicotine replacement therapies such as chewing gum or patches were marketed as a substitute for nicotine. Although they were much less harmful than tobacco, their success rates as aids to quitting were only about 18-24%

Cytisine is a drug from the laburnum tree with weak nicotine-like effects. It partly substitutes for nicotine in some of the receptors in the brain blocking some of the sensory effects of nicotine and hence reducing the urge to smoke. It is used with some success in some East European countries as an aid to quitting.

Varenicline is a synthetic drug developed by Pfizer, chemically similar to Cytisine, with a success rate of 40%. Both have a number of side effects and contraindications.

Although the tobacco industry was aware of this mounting evidence, they continued to deny that smoking was harmful and attempted to counter the health risks of smoking tobacco by promoting fruit-flavoured cigarettes and introducing cartoon characters to their branding.

Flavours such as vanilla, cherry, chocolate, blueberry were introduced, emulating flavours from popular children's cereals. The use of flavours in cigarettes, with the glaring exception of menthol cigarettes, was prohibited in 2009, but cigars, e-cigarettes and other tobacco products are still made and sold with candy and fruit flavourings.

"Smooth" cartoon characters such as Joe Camel were deployed to appeal to young audiences at an impressionable age. One 1991 study found that Joe Camel was at least as well-known as Mickey Mouse among children aged three to six.

Even as late as 1990, the tobacco industry was still alleging that 'There is no evidence that smoking causes cancer', despite all the scientific evidence to the contrary.

Following the break for refreshments, Ian's talk had clearly prompted a number of questions from our audience.

In particular, the current debate concerning vaping was raised. Ian was not enthusiastic about vaping, pointing to the fact that in general those using vapes had little or no information on the substances contained within the device and the potentially harmful health effects that they might cause.

Our thanks to Ian for an interesting and topical talk, which judging from the turnout and the number of ladies present, was much appreciated by the audience.

Malcolm Hind

Talk

Tuesday, 9th April 2024 – Vehicle Homologation and Nissan.

Frank Riddle

Frank Riddle began his career in Canada working with both British Leyland and Toyota who were exporting vehicles to the Canadian market.

Canada was a particularly difficult market for automobile manufacturers, due principally to the extreme climate where temperatures got down as low as -40°C during the winters. This caused oil to become grease, reduced battery voltage and freezing rain to enter door locks etc. Windscreens need lots of heat and rutted snow rips off exhausts.

During his time with Toyota he was introduced to Keizan which proved invaluable in solving some of these issues.

Vehicle Certification

In 1973 he returned to the UK and took a job with the embryonic Datsun UK (became Nissan UK). He worked for Nissan's Design Administration Department in Japan (but based in UK) and worked closely with Octav Botnar, who was largely responsible for growing Datsun UK from zero to selling 150,000 cars per year.

Frank's particular expertise was in homologation; certifying cars for compliance with British, European and International regulations; Federal American, Australian Design Rule etc.

The slide on the right shows how different countries approach vehicle certification.

Worldwide Vehicle Legislation Framework & the EU

- **European Union** – has a “type approval” system where vehicles types are tested and approved with QA assurance for series production. EC directive & UNECE certificates are issued. “Virtual testing” by computer analysis is being developed to reduce test costs.
- **USA Federal MVSS and Canadian MVSS** use mainly a “self certification” system where manufactures declare compliance with the Standard. Manufacturers use a third party test to verify compliance but recalls are used if non-compliance is found.
- **Japan JASIC and Middle East (SASO)** use their own standards with varying methods of compliance. UN ECE approvals are sometimes valid.
- **Australian Design Rule** is separate with acceptance of UN ECE.
- There is an aim toward world harmonisation of some standards that would drastically reduce compliance test costs Braking Approval ECE13H , Emission Test cycle.

1973 Britain joins the EU

1947 The Economic Commission for Europe ECE is formed

1958 onward it produced Regulations covering Motor vehicles and their parts. About 21 countries worldwide accept ECE Regulations on Motor vehicle component and systems e.g. Glass 43R., Brakes 13R.

1958 The newly formed European Economic Community EEC was formed and in 1970 started producing Directives mostly parallel to the ECE Regulations. E.g. Seat belt Anchorages ECE14 R is the same as directive 76/115EEC .

1973 Britain joins the EU . In 1978 a British National Type Approval of 12 subjects was established and only valid in UK.

1998 on “European Whole Vehicle Type Approval” of about 50 approvals. The approvals for each subject can be issued by any EC member state and a WVTA issued by one member State is valid in all member states as a prerequisite to registration .

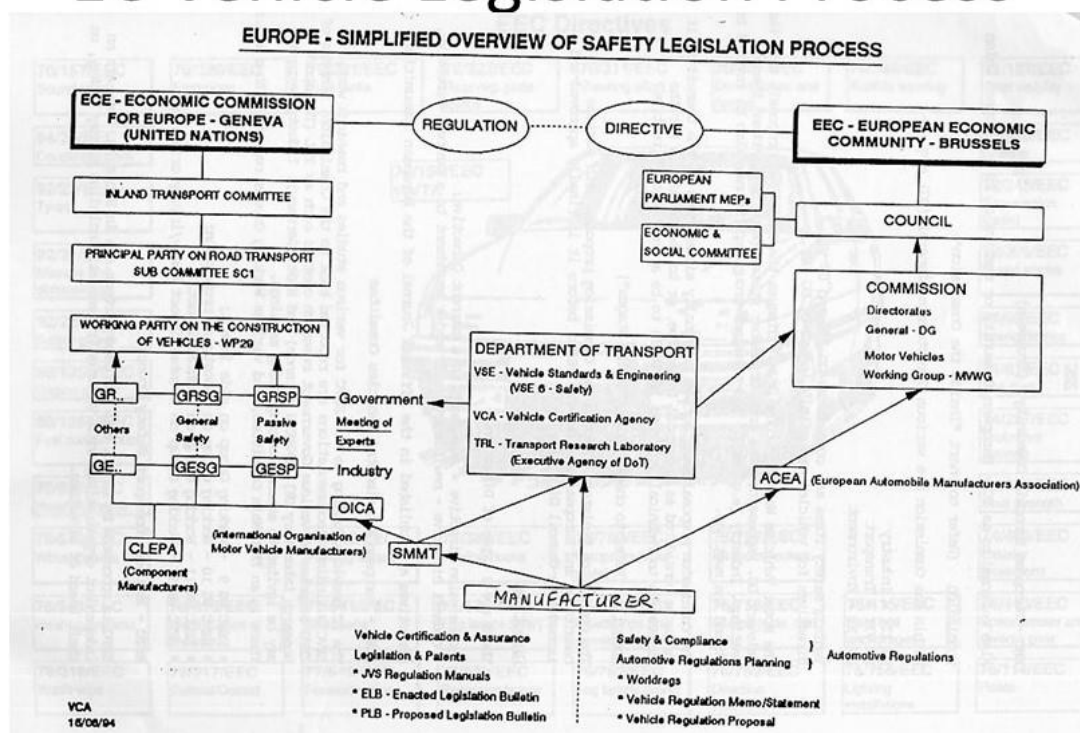
Having returned to the UK, Frank was mostly concerned with the EU regulations, the development of which he described in detail as shown on the left-hand slide.

EU Vehicle Approvals for Whole Vehicle Type approval required for registration

Frank then went on to discuss in detail the whole vehicle type approval process as shown in the slide on the right.

ENVIRONMENTAL	CRASH RELATED	VISION RELATED	GENERAL
Noise ¹	Door Latches and Retention ⁶	Installation of Lamps ²⁰	Carriage of Dangerous Goods ^{5, 6}
Emissions ^{2, 42}	Frontal Impact ¹⁴	Reflex Reflectors ²¹	General safety ⁶
Engine Power ⁴⁰	Lateral Protection Side Impact ⁵⁴	Front & Rear Position Lamps ²²	Electrical Safety ^{6, 9}
Hydrogen systems ⁶²	Interior Fittings ⁴⁹	Daytime Running Lamps ²²	Braking ⁹
CNG Installation ⁷⁰	Exterior Projections ⁵⁸	Side Marker Lamps ²²	Manufacturer's Plate VIN ^{1, 8}
LPG Installation ⁶⁷	Pedestrian Protection ^{15, 38}	Direction Indicators ²³	Masses & Dimensions ^{4, 8}
Air Conditioning systems ⁶¹	Seats & Anchorages Head Restraints ^{15, 38}	Regn. Plate Lamps ²⁴	Identification of Hand Controls & Tell Tales ^{1, 3}
Electromagnetic Compatibility ¹⁰	Seat Belt Anchorages ^{15, 31}	Regn. Plate Space ⁴	Spray Suppression ^{4, 3}
Recyclability ⁵⁹	Safety Belts & Restraints ^{15, 31}	Headlamps;- Gas discharge, LED, Adaptive ²⁵	Vehicle access & Manoeuvrability ^{1, 6}
	Prevention of Fire ³	Front Foglamps ²⁶	Vehicle Alarms ^{6, 8}
		Rear Foglamps ²⁸	Anti-theft ^{1, 3}
		Reverse Lamps ²⁹	Speedometer ^{1, 7}
		Parking Lamps ³⁰	Heating ³
		Audible Warning ⁷	Tyres ^{4, 6}
			Towing Devices ²
			Mechanical Couplings ^{5, 10}

EC Vehicle Legislation Process



Obtaining approval is a time-consuming process as Frank showed by discussing all the detailed steps required as illustrated in the slide on the left.

Vehicle Emissions

Although emissions are often thought of as a relatively new issue, Frank illustrated in the slide on the left below that the subject has been around in one form or another for a much longer time. The slide on the right below shows the progress of the well-known Euro Emission Standards up to Euro 7 which is currently in development.

Emission History in UK

- **1700s**; saw the start of the Industrial Revolution with its resultant pollution of land sea and air. For transport in Britain the following was made law by Acts of Parliament.
- **1800s** Highways Act; mainly control of horse dung!
- **1900-1970** Cars; No ash, cinders or excessive smoke.
- **1970s** Introduction of CO% at idle in C & U Regs.
- **1973 Britain joins the EU**. Emissions EEC 70/220 or ECE 15R including crankcase ventilation, EGR, SCR control became mandatory.
- **1991** Introduction of a mandatory directive 91/441EC (Euro1) Emissions. UK's wanted the so called "Luxembourg compromise" (about half the severity). This directive has been amended many times drastically reducing the pollutant limits each time.
- **2025** "Euro7" under development and includes tyre & brake emissions.

EURO EMISSION STANDARDS EURO 1 TO EURO 7 Cars

Euro 1, the first standard introduced in 1992.

Euro 4 of 2005 has a NO_x limit of 80 mgms/test for Petrol

Euro 6 of 2014 has a NO_x limit of 80 mgms/test for Diesel

London's ULEZ. Petrol must meet Euro 4 and Diesels must meet Euro 6.

Euro 7 aligns the NO_x limit of 60 mgms/test for all vehicles regardless of fuel.

Brexit has caused difficulty as UK can't issue certification for all EU directives but the British UK Vehicle Certification Agency can do testing for the Dutch and Swedish Governments.

After Market Cheats. Its easy to get more power by 'chipping' the ECU to switch off EGR that reduces combustion temperature to control NO_x. This is widespread and illegal!

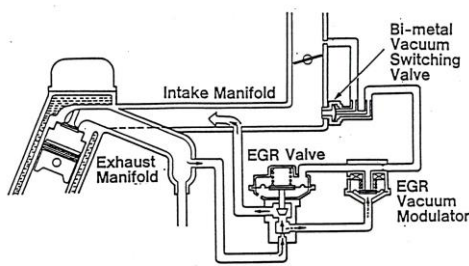
As each Emission Standard has come into law, vehicle manufacturers have had to add more and more complexity (and usually cost) to their vehicles in order to provide compliance.

Frank discussed some of the many methods used to reduce, in particular, exhaust emissions, including the use of exhaust gas recirculation as shown in the left-hand slide below.

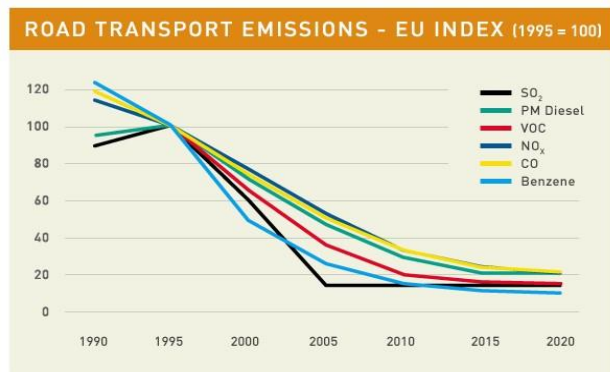
This has the effect of reducing combustion chamber temperatures which in turn reduces the formation of NO_x (oxides of nitrogen). In the slide on the right-hand side, we can see the overall reduction in exhaust emissions over the period 1990-2012.

Exhaust gas recirculation.

After about 2012 manufacturers started to cool the exhaust gas that is redirected into the induction system



EU Emission reduction 1990 - 2012



EURO 7

Mention was made earlier to Euro7 which is still in development.

The slide on the right-hand side shows some of the more important requirements of Euro7.

Frank drew our attention to some completely new requirements which will also affect electric cars for the first time, which might require significant design changes to, for example, the tyres and braking systems.

Euro 7 rules comes into force from 1 July 2025, for all new cars but low volume manufacturers <10,000 cars a year by 2030.

Euro 7 takes the lowest limits from Euro 6, and applies them to all new cars, regardless of what fuel they run on. The NOx limit is reduced to 60 mgms/test

Tougher test procedure s for short trips, and in ambient temperatures up to 45°C.

Limits for how much brake dust and tyre particles can be produced by new cars.

Cars must stay cleaner for longer: Euro 7 increases the period over which compliance is checked to 10 years 200,000km.

Electronic sensors to automatically detect engine faults.

Longevity assessments for electric car batteries: an entirely new requirement.

The EU Commission estimates Euro 7 will add a cost of €304. Cars last on average 14 years so most Euro 7 cars will be on the road until 2044 or 2049.

Octav Botnar

Frank did work closely with Octav Botnar over most of his career, and whilst accepting that he was a demanding manager who did on occasions take some risks in order to succeed in business, emphasised Botnar's philanthropism, giving over £100m to charity as well as supporting numerous charities for less able children.

This is particularly evident here in Sussex with the Camelia Botnar Foundation which supports and trains young people who are having a tough time, in most cases providing them with the skills needed to transform their lives.

A busy question and answer session followed the break for tea, demonstrating the considerable interest in Frank's talk which was very appreciated.

Malcolm Hind

REPLY SLIP VISIT TO AMEX STADIUM, FALMER

**To: George Woollard 18 St Lawrence Ave, Worthing West Sussex
BN14 7JF (07541 224769)**

E Mail: Georgec2507@outlook.com

Can you please reserve me places for the visit to The AMEX
Stadium at Falmer on **Wednesday 5th June 2024 at 11.00am**

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)

I have paid £..... by BACS to **RCEA** Sort Code **30-95-09** Account No.
00430758

Applications by Friday 31st May 2024

Only 20 places available, so first come, first served.

Email bookings acceptable.

**AMEX Stadium,
Village Way,
Falmer,
East Sussex
BN1 9BL**

End of Newsletter

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