AEGIS an ikos company

NEWS

THE POSITIVE CHOICE

Issue 18 - Spring/Summer 2022

Welcome to the AEGIS SPRING/SUMMER NEWSLETTER

Welcome everyone to our Spring/Summer Newsletter. We've advanced our clocks by 1 hour as we herald British Summer Time. And whilst we might have lost an hour's sleep that's a small price to pay for the impending glorious days of sunshine, the explosion of colour in our countryside and gardens and the post pandemic enjoyment of a cool drink and a packet of pork scratchings (other non-animal-based snacks are available) in our pub gardens. But as usual the British weather didn't get the memo! Did I expect any different I hear you say; well not really. The past is the best predictor of the future after all.

Looking to the past it seems incredible that it has been a whole year since AEGIS was acquired by the Ikos Group. With the future very much in mind, over 100 AEGIS and Ikos colleagues met recently in Derby to participate in the AEGIS/IKOS 2025 Strategy event. The event was held at the Derbyshire County Cricket Club with a friendly match between Lancashire and Derbyshire going on in the background. It certainly tested the language barrier; how do you explain silly mid-on and leg before wicket to a group of French colleagues?

The event itself involved a series of structured interactive workshops aimed at exploring and capturing ideas as inputs to the strategic direction of the business in the next few years. The morning sessions were given over to brainstorming ideas on topics as diverse as Organisation and Integration, Business Growth, Services, Working Environment and Staff Wellbeing. In the afternoon we focussed on elaborating specific ideas with the aim of proposing strategies for their implementation. It was great to see and sometimes hear the passion with which our future was discussed. The event culminated in a series of presentations, sometimes hilarious but always inspiring, showing that the future of AEGIS/IKOS is going to be innovative, passion filled and exciting.

To round it all off we met in the evening for a long overdue Christmas party. The same colleagues who were planning the future in the afternoon were now taking us back to the past with a never to be repeated (please) rendition of the Macarena!

However, in today's climate I can't finish without noting with gratitude that we are able to gather for these events at all, in peace and security, and thinking of the people of Ukraine where no doubt there are other companies just like ours who were also expecting to be planning future growth this spring. We hope and pray that, one day soon, they will be able to pick up those dreams again.

Mark McCool

Some Current Highlights

Leading the way to the digital railway

AEGIS is proud to be supporting several clients on their quest to evolve from conventional signalling to advanced train control systems such as ETCS. We are providing technical consultancy, product acceptance support and development and safety assurance activities in the following areas:

- Our expertise in a range of Computer Based Interlocking (CBI) systems allows us to work on the technical aspects of preparing these platforms for interfaces to ETCS and other trackside systems and technologies. This includes defining the required connections and the evolution of signalling control systems as well understanding the working principles of new applications using ladder logic and advanced systems engineering concepts.
- Facilitating the assurance process for the product acceptance of new CBIs. AEGIS are leading the delivery of the Safety Case for new products as well as application specific safety cases to allow new interlocking systems to be commissioned successfully.
- Cloud based testing operations and development of trackside links supporting clients in creating new test and validation processes and methods in preparation for the introduction of the digital railway.

We are using our signalling infrastructure and testing expertise to work closely with clients, understanding their requirements for implementing ambitious and innovative projects to improve visibility of trackside operations, reliability of interlockings and connectivity across the whole railway system whilst reducing the risks for maintenance staff.

Vivarail Battery Train

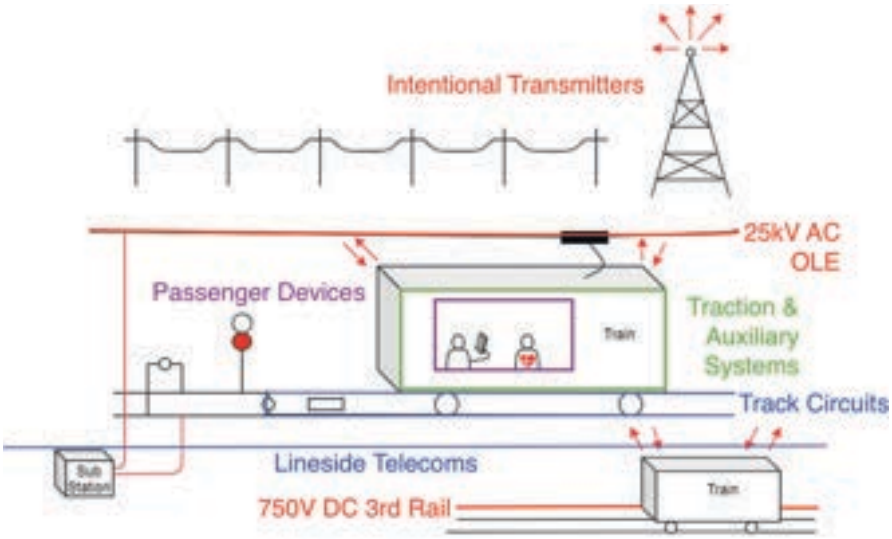
The Vivarail D-Train is a new concept designed specifically for regional services that utilises the bodyshells and bogies of ex London Underground D78 stock. The D-Train has many variants including a DEMU; Third Rail EMU; Diesel-Battery Hybrid; and a Battery (only) Train that was initially manufactured as a demonstrator unit for the 2021 United Nations Climate Change Conference, COP26, in Glasgow. AEGIS has developed a strong working relationship with Vivarail supporting the safety & compatibility approvals of the D-Train designs, including the COP26 Battery Train. Vivarail's COP26 Battery Train successfully demonstrated at the event, a practical and economical solution towards the decarbonisation of the railways.

Compatibility Strategy

In order to manufacture the Battery Train and have the necessary approvals in place in time for the COP26 event, Vivarail had to work to ambitious timescales. AEGIS devised a compatibility strategy that utilised delta analysis and an optimised EMC test plan to expedite Network Rail's acceptance. This allowed mainline testing to commence as early as possible and meant that Vivarail was able to progress the project unimpeded by constraints on the test programme, which is of vital importance to a project of this nature.

Electromagnetic Compatibility (EMC)

EMC forms a major part of the infrastructure compatibility assessment of any train being introduced to new routes. The railway is a harsh and complex electromagnetic environment that contains powerful electrical emissions sources and potentially susceptible, safety critical, low power electronics in close proximity. Hence, the proper assessment and control of any EMC threats is essential for a safe and reliable railway. As the COP26 Battery Train is self-powered the scope of credible EMC threats is less than that of a train powered using infrastructure electrification. However, the novel nature of battery trains means they introduce new considerations not yet fully covered by standards, this includes EMC during traction battery charging from a shore supply.



Overview of Typical Railway EMC Considerations

Another consequence of introducing this relatively novel train traction supply technology is that many of the battery systems and sub-systems manufacturers do not yet have railway EMC standards compliance. AEGIS's team of EMC specialist engineers combined their expertise in EMC, rolling stock and railway infrastructure to devise a practical and effective method of demonstrating that EMC threats are acceptably controlled. This approach maximised efficiency through a combination of comparison and gap analysis to form robust engineering arguments, which then only needed to be supplemented by a simple test programme. Network Rail was engaged and informed throughout the process which facilitated their prompt acceptance at each stage and allowed Vivarail to focus on other aspects of the project, knowing AEGIS was effectively managing EMC on their behalf.

Radiated Emissions Testing of the COP26 Battery Train

D-Train Development

AEGIS has defined and managed all required EMC and EMF activities for the D Train development, including as required:

- Producing all necessary EMC and EMF documentation
- Battery traction system design
- Creation of the EMC & EMF Requirements document
- Test specification and management
- Longitudinal voltage assessment

Because AEGIS has worked with Vivarail throughout the development of the different D-Train platforms we have been able to utilise our existing knowledge to reuse existing evidence wherever possible, optimising the introduction of each new variant by omitting any unnecessary repetition of activities allowing us to facilitate Vivarail's agile and ambitious progress.

Forming Lasting Partnerships

AEGIS's ongoing commitment to remain flexible whilst delivering quality work in short timescales has been recognised by Vivarail, meaning we continue to develop a strong working relationship. Some existing Vivarail projects AEGIS has supported include:

- Route compatibility (EMC, EE&CS and non-EE&CS) of Class 230 Diesel Battery Hybrid units for Wales & Borders transit and operational routes.
- EMC and safety approvals of Class 484 750VDC 3rd rail variant for the Isle of Wight, including the specification and management of all EMC testing.
- EMC and safety approvals of Vivarail's patented Fast Charge Battery System

The AEGIS Difference

The AEGIS Safety and EMC teams offer an unparalleled combination of expertise in all areas of safety (for EMC, EE&CS and non-EE&CS) with the added ability to provide a full suite of EMC test services.

This gives Vivarail the assurance that it is partnering with a company that has the expertise and capability to take ownership of delivering its Safety, Approvals and EMC activities, from start to finish, with continuity and the same high quality of work throughout.

Glasgow Subway - Rolling Stock ISA

The Strathclyde Partnership for Transport (SPT) is implementing a modernisation programme of the Glasgow Subway that will include refurbished stations with platform screen doors and an enhanced signalling & Control system with new Operation Control Centre (OCC). The modernised subway will be serviced by new metro rolling stock manufactured by Stadler.

Glasgow's Subway comprises a four-foot gauge double track in a circular 10.5km tunnel. First opened in 1896, it is the world's third oldest underground railway after London and Budapest. The modernisation marks the first major enhancement of the subway for 40 years and will link to other transport infrastructure improvements across Glasgow to contribute to the city's regeneration programme.

The subway modernisation represents a step change in train operation and signalling systems with the deployment of Communications Based Train Control (CBTC) for the implementation of automatic train protection (ATP) and automatic train operation (ATO). The new trains will eventually operate driverless in Unattended Train Operation (UTO), Grade of Automation 4 (GOA4).

The transition to UTO requires a complex programme of test and commissioning, including type testing on the purpose-built test track at Edmiston Drive before testing in the tunnel at night when there is no public service. Once commissioned, the new units will be operated alongside the existing trains in semi-automatic mode during a transitional period until withdrawal of the existing fleet and introduction of UTO.

AEGIS Certification Services (ACS) has been appointed by Stadler as Independent Safety Assessor (ISA) for the activities leading from final approved design to the completion of phase GOA2, which will form the basis for the subsequent phase GOA4.

We were able to assist Stadler at a challenging stage of the project where the transition from design ISA to test stage ISA required careful review to ensure that there were no gaps in assessment and open points were fully addressed. Our support included the review and assessment of key safety documentation deliverables, including the hazard record supporting the Authorisation for Test 2 (AfT2) stage of test and commissioning activities. The achievement of Aft2 enabled test vehicles to enter the subway tunnels for the first time.

A key activity for the safety assessment of this project stage was the safety audit undertaken by ACS at the new test facility at Edmiston Drive, Glasgow. The stabling depot and test track allows the new 3-car metro trains to be tested with the integrated signalling system supplied by Stadler's project partner Hitachi STS. The ACS ISA team undertook a walkthrough inspection of a test unit, interviewed test and commissioning staff and witnessed a typical test activity on the test track.

To support Stadler's safety case for test activities within the subway tunnels, ACS has provided independent review of the gauging strategy, assurance statement and supporting technical reports including standards compliance evidence in order to support the acceptance of the approach adopted and assessment data presented.

Working within the project time constraints, ACS completed the staged ISA review to provide Stadler with an ISA declaration of no objection for tunnel entry. Subsequently, a new passenger unit successfully entered the tunnel for the first time in November 2021.

ACS will continue to provide ISA support as progressive sections of the tunnel are accessed according to the gauging strategy and further type test activities are undertaken.

New era for weed spray on GB Railways

On 4th February 2022, spray trains #2 and #3 departed Derby for final testing, they join the previously commissioned Bayer spray train 1. All three trains were ready to start work on the UK railway infrastructure in March 2022, AEGIS played a key role in the successful conclusion to the manufacturing and approvals of these innovative trains.

Background

The control of weeds on or near the railway is a vital part of infrastructure maintenance. Untreated weeds can cause numerous issues such as increased track maintenance due to poor ballast conditions, reduced signal sighting, railhead adhesion issues and blocking personnel access routes increasing safety risks. In extreme cases weeds can cause gauging issues and reduce embankment slope stability.

Railway companies have for many years employed weed spray trains as part of their herbicide control management, the current weed spray used on the GB infrastructure is delivered by life expired multi-purpose vehicles.

Bayer Crop Science UK (Bayer) Environmental Science department were awarded a contract by Network Rail to manage herbicides control of circa 20,000 km of line per annum and will employ three new weed spray trains for this treatment.

Bayer Smart Weeding System

AEGIS joined the project in late 2019 to provide engineering support as AEGIS Engineering Systems (AES) Ltd and independent accreditation as AEGIS Certification Services Ltd (ACS), with Bayer contracting SOCOFER of Saint-Pierre-des-Corps, Loire, France to manufacture and GB Railfreight (GBRf) to operate the Smart Weeding System (SWS).

The first task was to consider how these new trains could be introduced onto the UK infrastructure. The concept was to use the technology from Bayer's existing spray trains operating in Germany and employ this in the UK. Demountable modules would be fitted onto three already approved intermodal flat wagons via ISO twist locks. This combination of modules and wagons would be considered as an On Track Machine.

AEGIS developed a Safety and Approvals Strategy and agreed with all interested parties, this strategy contained how the project would review the following:

- Standards Compliance,
- Common Safety Method for Risk Evaluation and Assessment (CSM-RA),
- Compatibility.

Gauging and Compatibility

The conversion of existing flat intermodal wagons is not a novel concept and has been undertaken by other European suppliers. One of the biggest challenges is always compatibility with the UK network, namely gauging and Electromagnetic Compatibility (EMC).

AEGIS supported the project by creating a gauging strategy outlining the potential options and issues in securing a gauging certificate. Detailed as built measurements were taken allowing for the development of a Vampire® model. With the help of a specialist gauging company, it was possible to analyse and interpretate the data. After multiple hours of study and some redesign work of the spray nozzle and access steps it was possible to secure a Network Rail Gauging Certificate (NRGC) demonstrating the train compliant to W6a.

AEGIS' EMC team worked with the Original Equipment Manufacturer (OEM) of the modules, SOCOFER in the development of an acceptable EMC test specification and EMC technical file, this enabled the issue a CE certificate declaring compliance EU Directive related to electromagnetic compatibility.

A RIS-8270-RST Compatibility Report was created, this detailed the technical compatibility assessments carried out and submitted to Network Rail in the hope of issuing of a Summary of Compatibility (NRSC). Working with GBRf, the operator of the SWS, it was also possible to compline a Statement of Compatibility.

Common Safety Method and Human Factors Study

As with any new introduction or significant change to railway, AEGIS undertook a significance decision which is prerequisite when complying with the Common Safety Method for Risk Evaluation and Assessment (CSM-RA) regulations.

This was followed up with Hazard Identification workshops and the successful management of safety requirements, one of the many outputs of this work, was to support SOCOFER in the development of a very comprehensive operations manual.

AEGIS undertook a Human Factors Study (HF) on the SWS. Originally it was planned to have three operators onboard the SWS, this would be the two spray operators and a third member of the operational team to ride with the locomotive driver and act as a 'Spotter'.

The HF work demonstrated that the CCTV on board technology was sufficient to replace the cab spotter. The study considered the level of technology, CCTV resolution, angle of view of the camara, position of the screen in the operating cabin and if the operating team had sufficient time between other duties to monitor the screens appropriately. By completing this HF work, it has given Bayer the opportunity to substantially reduce its operating costs during the life of the contact.

The CSM-RA works were concluded successful with AEGIS Certification Services Ltd (ACS), who are an independent accredited Assessment Body (AsBo) issuing their final Safety Assessment Report (SAR).

Standards Compliance

Compliance to standards remains a complex issue and this was compounded by the Brexit transition period.

At the start of the project Technical Specifications for Interoperability (TSIs) were enforced with reviews undertaken by Notified Bodies (NoBo) and Designated Bodies (DeBo), responsible for the review against Notified National Technical Rules (NNTRs). In 2020 following Brexit, this changed to National Technical Specification Notices (NTSNs) with reviews undertaken by Approved Bodies (ApBo) and the DeBo reviewing National Technical Rules (NTRs).

AEGIS worked very closely with the OEM, SOCOFER, to identify the relevant standards to be adhered to during the project. With the assistance of AEGIS Engineering Systems (AES), a Standards and Requirements list was created. To ensure that each of the requirements were addressed work packages were created for each of the technical subject areas such as:

- Structural and Attachments,
- Ride and Vehicle Dynamics,
- Electrical,
- Mass,
- Safety and RAMS,
- Fire and Materials.

The work packs contained requirements from varying standards allowing for the grouping of all standards relevant to that topic or technical area. This approach was favoured over the traditional method of a checklist for each standard as it would reduce review time by combining similar justifications for multiple requirements and avoid duplication of work.

During early engagement with the Office of Rail and Road (ORR) it was agreed that the fitment of the modules and reconfiguration of the wagons to On Track Machine would not require reauthorisation.

To ensure that it was still possible for the project to seek re-authorisation, if ever required later, ACS complied a full ApBo/NoBo technical file. The technical file contained the reviews ApBo/NoBo and DeBo against the relevant standards as defined in the Standards and Requirements list.

The project was completed during the height of the COVID-19 pandemic. This involved working in new ways to be able to successfully deliver, AEGIS carried out remote Standards compliance workshops and Module SD

Quality Management System (QMS) audits, this involved multiple day video teleconferences with evidence provided with the use of photographic and video evidence.

An open dialogue was established between all parties, this was a very efficient means of understanding and developing the required standards compliance submissions and allowed for AEGIS to provide independent review, support, and guidance where necessary.

Ecological and environmental Benefits

The Bayer SWS is expected to achieve a reduction of up to 70% in pesticide and herbicide chemical use compared with similar machines. Excessive chemical use raises environmental concerns such as chemical run-off and the reduction of herbicide and pesticide use has the additional benefits of reducing consumable operating costs, reducing water consumption and associated logistics of replenishment.

By employing high speed detection systems and artificial intelligence boosted algorithms for weed recognition, the control system switches some of the spraying pumps and nozzle on and off as required, to achieve maximum efficiency whilst still delivering effective vegetation control.

Using highly accurate Global Position Systems (GPS) it is possible to use geo-localisation and automatically stop spraying in Non-Treatment Zones (NTZ) for example watercourses and other environmental locations, such as Sites of Special Scientific Interest (SSSI). The system also facilitates accurate location records to be compiled, where each pesticide and herbicide product is sprayed and to generate historical data.

Co-ordination between AES and ACS

AEGIS is made up of two companies all under the umbrella of AEGIS Rail Holdings Limited.

- AEGIS Engineering Systems (AES)
- AEGIS Certification Services (ACS)

The project is prime example of the advantages of using both AES and ACS as a partnership in the commissioning and approvals process.
ACS have independent accreditation for the following:

- Approvals Body (ApBo) assessment
- Designated Body (DeBo)
- Assessment Body (AsBo)
- Assessment Party (VeBo)
- Plant Assessment Body (PAB).

The AES and ACS teams worked in a proactive manner to avoid any issues affecting project timescales, whilst maintaining and respecting the independence of the process and client confidentiality.

Regular project meetings were held between all parties, which helped maintain the level and quality of work package submissions and provided the OEM with the justification why certain activities and evidence needed to be submitted. In these meeting any potential issues were raised, and resolutions developed and provided an opportunity to co-ordination of activities to ensure that the verification activities aligned with the completion manufacturing and CSM-RA hazard evidence.

Outcome

The Bayer SWS demonstrated how AEGIS can work dynamically to support our client Bayer, who are not a traditional railway company, break into a vital infrastructure maintenance sector of the GB railway and how we have worked closely with non-UK manufactures, to help them understand the complex and demanding UK approvals arrangements.

AEGIS Structural Assessment Capabilities

For many years AEGIS has been delivering structural assessments for its clients in the railway industry. Our clients include Alstom, Hitachi Rail, Sperry Rail, ROSCOs and TOCs plus many more. AEGIS employs a large team of engineers and works with many associates who specialise in structural assessment. We use the market reference Finite Element Analysis (FEA) package Ansys to perform the structural analysis.

Our approach and services

Our services ranges from simple hand calculations of a single bracket to FEA of a full vehicle body. We start working with our clients by fully understanding the scope of work and their requirements. We then perform a load case study to define the mandatory and operational load requirements. At the initial results stage AEGIS informs the client on the pass/fail outcome of the analysis. If required, we suggest design changes to address any problem areas. The optimised design is revaluated, and a structural report delivered to the client. We also collaborate with other companies so can provide a comprehensive material testing service.

Finite Element Analysis (FEA) is our main tool for assessing structural integrity of more complex designs. We either build the design from available drawings, in-house measurements or use 3D CAD models. The mathematical representation of the design is then subject to relevant loading and boundary conditions to extract stresses, deformations and joint forces. We provide a detailed structural report at the end of each analysis.

Design Optimisation is to help our clients arrive at the optimal design. When the analysis of the design identifies opportunity for improvements or a failed initial assessment, we endeavour to provide the customer with a solution to the problem. This way we can work quickly and efficiently within the given timescales. Our software can be set up to use an iterative process to optimise the design for weight, stiffness and stress reduction.

Fatigue assessment is performed for most of the structural assessments carried out by AEGIS. We use a cumulative damage approach as specified in the industry recognised standards such as BS 7608 or BS EN 1993-1-9 to ensure compliance.

Modal analysis is required to be performed to derive fundamental modes of vibration of the analysed equipment. By carrying out modal analysis we check whether the design is sufficiently decoupled or separated from the modes of vibration of the body structure and suspension, to avoid any undesirable responses.

Bolted Joint analysis is usually undertaken by post-processing the FEA results, extracting the bolt forces from the FEA software. A set of calculations is then performed to check the joint integrity. Nonlinear contact modelling between components increases the accuracy and allows capture of the physical behaviour of the joint.

A few recent examples of projects we have undertaken for our clients include:

- Full vehicle structural assessment of compliance with relevant Railway Industry Standards
- Natural frequency analysis to investigate a traction motor fatigue failure
- Design validation of bogie and axle box mounted components
- Multiple structural analyses of a train saloon and underframe mounted equipment.

Please get in touch if you have any similar need for structural assessment support and design analysis.
sales@aegisengineering.co.uk

IKOS Technical Conference and Networking Reception - Applying Model-Based Systems Engineering to Complex Railway - 3:30pm May 19th - at IMechE HQ, London.

Complex railway signalling systems such as ETCS and CBTC are increasingly being adopted worldwide. The deployment of such technologically advanced solutions involves significant efforts on the part of the different stakeholders to manage and successfully master the entire V life-cycle. Systems Engineering is one of the key activities within the development cycle and covers the definition of system requirements and the associated traceability and validation/verification, but it is not just this. Critically, it is also about safety and performance.

In this technical lecture, we will see how the Model Based Systems Engineering approach covers these aspects of complex projects and how IKOS can propose innovative solutions in the modelling and simulation of complex requirements applied in the digital railway signalling environment.

We have limited places available, if interested in attending please email **communication@ikosconsulting.com** by 9th May for more information and to register.

The Big Rail Diversity Challenge
On 22nd June, AEGIS will take part in the Big Rail Diversity Challenge at Newark Showground. We were excited to take part in this event for the third time as the diversity initiative fits squarely with our company core values and being founder signatories of the EDI charter with RIA in partnership with Women in Rail to champion equality, diversity, and inclusion in the UK railway industry.

RSN 2022
AEGIS is exhibiting at RSN 2022 at Derby Arena on 7th July alongside 150 other rail companies. Come along and visit our stand and talk to our experts. Register to visit for free: **https://www.rsnevents.co.uk/**

AEGIS - RECRUITMENT

We have been busy recruiting and increasing our expertise over the last few months. Meet the new members of the AEGIS team.

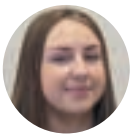
We continue to seek the right people to join our expanding team, have a look at the careers page on our website:

www.aegisengineering.co.uk/home/careers

if you are interested in joining our team, please get in touch by emailing your CV and covering letter to:

katygrace@aegisengineering.co.uk

Everlyn Zunan
Senior Engineer - Infrastructure Team



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Business Administrator Apprentice

Adam Howe
Core Services Support Apprentice

Elizabeth Jackson
Head of Rolling Stock Assurance

Amanda Thomas
Senior Engineer - Assessment Body Team

Sarah Hunt
Certification Assistant - Assurance Team

Joanne Wood
Senior Engineer - Assessment Body Team

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