Innovation and Technology
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Do you really do that?

This booklet showcases some of the technologies and innovations from across our business. Usually developed for a specific market, we often find they have application in other areas. This booklet is designed to help us share these great innovations and ideas.

“All over Amec Foster Wheeler we have clever people inventing new ways of working, solving problems, using technology, designing technology, innovating for our customers."

Jim Lenton
Project Delivery Director, NECIS
ANSWERS® software service

The ANSWERS® software service has, for more than 30 years, provided customers in the nuclear industry with high quality software and consultancy services.

ANSWERS® codes are widely used in more than 30 countries around the world.

ANSWERS® codes are used for studies on a range of reactor types, including AGR, Magnox, PWR, BWR, CANDU, VVER, RBMK, PBMR and experimental reactors.

Benefits of ANSWERS® products

- Unrivalled geometry modelling capability for optimum accuracy and efficiency of analysis
- Some products allow rapid calculations for fuller exploration of design variations
- An effective and reliable analysis tool in safety case submissions to regulators
- Proven track record, including validation studies, for a wide range of power and experimental reactors
- Nuclear data libraries are available to support international needs and to provide valuable cross-checking capabilities
- Continually maintained and developed to meet customers’ operational needs

MONK® provides advanced geometry modelling and detailed continuous energy collision treatment to create realistic 3D models for an accurate Monte Carlo simulation of neutronic behaviour. The superhistory algorithm used by MONK® provides robust and reliable estimates of the neutron multiplication factor, k-effective and other parameters of interest.

MCBEND calculates neutron, gamma-ray and charged particle transport in sub-critical systems using Monte Carlo radiation transport algorithms, as well as the coupling between these different radiation types.

RANKERN is a fast-running point kernel package for assessing complex gamma-ray shielding.

WIMS can model a wide range of reactor physics problems ranging from simple pin cell reactivity calculations to whole core estimates of power flux distributions for all thermal reactor types, including research reactors.

PANTHER is the leading neutron diffusion and thermal hydraulics code for the analysis of any thermal reactor core.
**FISPIN** calculates the changes occurring in the numbers of atoms of the nuclides of various species (heavy isotopes or actinides, fission products and structural or activation materials) as a sample of nuclear fuel is subject to periods of irradiation and cooling. It contains data for more than 3,000 nuclides to allow it to cover a wide range of applications.

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Building Information Modelling

Building Information Modelling (BIM) is an information-rich, object orientated business process in which data is generated, communicated and managed to add value throughout the full lifecycle of an asset.

It utilises 3D design technologies, data-centric workflows and information standards to produce a highly collaborative working environment which is unconstrained by organisational or geographic boundaries. A ‘soft landing’ philosophy underpins the process to ensure active collaboration with the customer and operator and embed a user focus throughout the development life cycle an asset.

The BIM process comprises two key components, the common data environment (CDE) and object orientated 3D virtual models.

The CDE is a centralised data repository for all project information which is structured to maintain a ‘single source of truth’ for project data. Information is controlled though digitally managed work flows providing rigorous governance to design development. The CDE underpins object orientated 3D models, used within the BIM process to communicate and coordinate project intent.

A BIM object comprises many things:

- Information defining a product
- Product properties (i.e. thermal performance)
- Geometry representing the product’s physical characteristics
- Visualisation data making the object recognisable
- Functional data, (i.e. detection zones) enabling the object to be positioned and behave as the product itself

3D models comprising BIM objects facilitate virtual construction within the built environment. This adds value through enabling identification and resolution of potential clashes earlier in the project lifecycle. The 3D interface also provides an effective basis for coordinating input between project stakeholders thus ensuring the end product is optimised at an early stage for greatest benefit. Linking the schedule to the model aids development of commissioning and construction sequencing plans to maximise on-site efficiency and minimise impact on existing assets or operations. Linking cost data to BIM objects enables better informed decisions through greater understanding of financial implications of options.
How it has been applied

The Lyneham project provided planning advice and technical support requiring the coordination of input from 116 staff across 12 disciplines. The project received a Royal Town Planning Institute (RTPI) commendation in the RTPI’s South West Awards for Planning Excellence.

The UK Government has mandated the use of BIM on all publically procured infrastructure projects from April 2016 in a drive to deliver 20% efficiency targets. BIM is already established to a degree within the UK construction industry with interest growing globally.

Where else it might be applied

The BIM process comprises elements which could be applied to most projects in the sectors within which Amec Foster Wheeler operates.

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Competency Assurance System (CAS)

Amec Foster Wheeler has well-established and mature competency management and assurance processes which covers professional and trades workers. It represents best practice to select, mobilise, train and assure the capability of its workforces.

Amec Foster Wheeler’s competency management processes recognise there are three strands to managing and assuring competency, as shown right. The approach captures these three strands, giving a rounded perspective on the competence of those deployed onto our projects.

Professional workers, including engineers, designers and scientists, will tend to have their competency managed via the explicit and tacit measures, with trades and craft workers normally having their competency manage via explicit and implicit measures.

Explicit measures of competency are for theoretical knowledge and document a worker’s successful completion of training and the qualifications they hold.

Tacit competency attributes provide a measure of skill for activities and areas of skills application where it is not possible to pre-define the tasks involved. This may be because of the novel nature of the activities as well as their complexity.

Implicit measures are task based breakdown of skills that can be demonstrated against the level of skills deemed necessary for performing the task. These measures can be used to cover pre-defined activities which can be broken into definable tasks.
The holistic view of competency management deployed by Amec Foster Wheeler

- **Explicit**
  - Qualifications
  - Training

- **Implicit**
  - Role Profile
  - Job Specification

- **Tacit**
  - Experience
  - Professional Skills

**Type of knowledge**

- **Type of competency system**

- **CAS is designed to cover tacit competency**

**Enabling assessment and management of...**

- Competence: Performance reviews; task performance assessments; similar
- Competency: Skills; ability; knowledge assessments

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ConnectFlow

ConnectFlow is a suite of subsurface modelling software used to assess safety of geological disposal of nuclear materials, enhance production of hydrocarbon and geothermal resources, and assess ground contamination and environmental impacts.

ConnectFlow provides a flexible modelling environment for integrated assessment of structural geology, engineering, hydrogeology, hydrogeochemistry and contaminant transport processes. Facilities are provided to simulate the migration of fluids and solutes through the subsurface and their interactions with rock. The software has industry leading capabilities in the representation of fractured rock hydrogeology and hydrogeochemistry.

ConnectFlow is actively developed and is available for free use within Amec Foster Wheeler. It is also commercially licensed to external customers along with support, training and consultancy services.

ConnectFlow uniquely provides a discrete representation of rock fractures and their role as fluid conduits, as well as the more classical porous medium representation of hydrogeology.

A variety of physics are supported to address a wide range of subsurface issues related to geological disposal, rock engineering, well performance, and assessing the migration and remediation of contaminants.

- Contaminant and radionuclide migration can be assessed considering groundwater flow, fluid-rock diffusive and reactive transport
- Effects of dewatering can be analysed considering unsaturated flow
- Effects of saline intrusion and thermal buoyancy can be simulated
- Hydraulic stimulation of reservoirs and changes in reservoir properties due to hydrocarbon injection/production can be simulated considering hydromechanical effects in rock fractures

A graphical user environment provides an interface for data analysis, model definition, flow and transport simulations, model interpretation and 3D visualisation.
How it has been applied

- Site characterisation and environmental safety cases for construction licensing of spent nuclear fuel repositories in Finland (Posiva) and Sweden (SKB)
- Site characterisation, engineering optimisation and environmental safety of the UK Low Level Waste Repository
- Assessment of contaminated land at Sellafield
- Assessment of engineering impacts of proposed new nuclear power plants at Moorside
- Fracture characterisation & reservoir property models of oil reservoirs for ADCO, Saudi Aramco, PDO and BP
- Hydrostructural modelling of geothermal reservoirs for Star Energy and Geodynamics

Where else it might be applied

- Broader applications in field development planning of hydrocarbon and geothermal reservoirs, including hydraulic stimulation of unconventional resources
- Support to rock engineering for mining operations and underground infrastructure projects
- Carbon capture and storage projects

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Link to more details

http://www.amecfw.com/services/specialist-services/connectflow
http://www.connectflow.com
Emissions Compiler

Emissions Compiler is a secure, auditable and simple way to reduce the burden of emissions legislation.

Emissions legislation is a complex matter, with each operator having to compile different systems to record, audit and report different pollutants and wastes (e.g. ETS and EEMS). It is often found that different spreadsheets are setup by individuals for each, however, such systems lack auditability and are open to error.

Emissions Compiler gives operators a ‘one stop shop’ that fulfils all emissions reporting requirements, which links to the historian and calculates the emissions automatically.

Emissions Compiler is a truly flexible system. It can be tailored to suit your needs and combined with the emissions forecaster to create a comprehensive and controllable emissions reporting system.

How it has been applied

It has been the first choice of several customers to help eliminate spreadsheet errors and provides a robust system. Sites where the software has been installed includes Britannia (BOL) and Dunlin (Fairfield).

Where else it might be applied

Any sites (non-Oil & Gas) wishing to improve their environmental reporting.
Emissions Forecaster

Legislation, reputation management and social obligation have meant that the reduction of greenhouse gas (GHG) being emitted from installations is now a key corporate driver, with a number of operators applying their own voluntary GHG targets.

Emissions Forecaster is a consistent, robust software tool used for forecasting GHG emissions. It is able to accurately estimate the energy usage, \( CO_2 \) and NOx emissions for a specific asset under varying operating scenarios.

**How it works**

The user inputs data pertaining to predicted site throughputs for a number of periods together with equipment maximum operating parameters. Emissions Forecaster will then accurately calculate the required machine configuration together with energy for each period scenario. Advance Expert modes can be used for further tuning if needed.

Full details are included in article SPE 111527 Developing Rigorous GHG Forecasts for E&P Operations: GHG Forecaster Tool. M. Guinee et al.

**User friendly**

Outputs are displayed in a clear, presentable fashion with further breakdown of energy consumption and equipment operating efficiencies being just a click away.

As such, sensitivity studies allow various options for new designs to be reviewed, culminating with a preferred solution that demonstrates Best Available Technique (BAT).

By promoting sustainability and operational excellence, PI continually demonstrates substantial OPEX reductions, whilst maintaining and increasing production throughput for our international customer base. Our specialist software products can be used in all stages of the asset lifecycle and add real value to forecast and monitor energy and emissions performance.
How it has been applied

Having been rigorously tested over the last five years, the tool now boasts an uncertainty of less than 5%, with results being achievable in a matter of hours.

The software has been the central point of various Best Available Technique (BAT) studies we’ve conducted for new developments. Sites include Rosebank, (Chevron), Solan (Premier), Laggan Tormore (Total), Clair Ridge (BP), Q204 (BP), Huntingdon (Eon), EnQuest Producer (EnQuest), Cygnus (GDF), Jackdaw (BG), Corrib (Shell), Fram (Shell) and Kraken (EnQuest).

It is also used by numerous customers to help optimise future emissions on Brownfield sites including BP, Maersk, BG and Fairfield. PI has recently signed a corporate agreement with BP worldwide to use the software.

Where else it might be applied

Any greenfield/brownfield customer in oil and gas or power wishing to reduce their atmospheric emissions.

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Energy Tracker

Energy Tracker is a software tool designed specifically to monitor the energy efficiency of an offshore installation and help companies comply with new demands from environmental emissions regulations.

This software tool is used to track the efficiency of offshore rotating and combustion equipment, monitoring energy usage and machine efficiency.

It helps to identify and reduce loss, ultimately reducing the amount of CO₂ released into the atmosphere. Actual and avoidable CO₂ emissions are calculated and displayed.

Overall plant operation and individual train and machine performance graphs are displayed across a hierarchy of screens. In each case, the actual running conditions are shown compared to the 'ideal' design operation. In addition, offline simulations can be carried out using the tool to provide users with the predicted costs of running different scenarios.

Energy Tracker is a web based system allowing for minimal disruption when installed. It interfaces to existing plant via Amec Foster Wheeler’s Data Access Layer (DAL).

Energy Tracker application will save you money by:
- Identifying inefficiencies
- Reducing fuel consumption
- Preventing excessive energy use
- Reducing operational costs
- Monitoring machine performance
- Assisting with legislative compliance
- User-configurable
- Reducing hassle
How it has been applied

PI continually demonstrates substantial OPEX reductions, whilst maintaining and increasing production throughput for our international customer base. PI has recently signed a corporate agreement with BP worldwide to use the software.

Where else it might be applied

Can be used in all stages of the asset lifecycle and add real value to forecast and monitor energy and emissions performance. Energy Tracker is currently being used worldwide with great success. It can be either stand alone or web based and is backed up by a large team of multi-disciplinary engineers to offer continuous technical support.

Energy Tracker was a BP Helios Award finalist in 2004.

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Expanding foam

To prevent dip pipes becoming dropped objects, the team worked with Furmanite to develop a method of using expanding foam to encapsulate the dip pipes throughout the length of the caisson prior to its removal. The foam also acted to restrain the dip pipes during mechanical cutting of the caisson sections. The suitability of this method was confirmed in an onshore trial.

How it has been applied

The team also worked closely with Oil States to ensure the delivery of a bespoke subsea caisson plug. This plug was deployed by ROV to the underside of the caisson, attached to rigging passed through the caisson and lifted to dip pipe termination where it was set in position.

Using a lift and pin removal methodology, the team designed a lifting frame complete with trolley arrangement and ultra low hoists to suit the complex spatial constraints of the caisson location within the cellar deck. This would allow for removal of the caisson in 2m lengths, utilising the maximum available headroom.

The offshore work was safely completed one day ahead of schedule after engineering was fast-tracked from 22 weeks to eight weeks. Two new technologies were conceived, designed, tested and proven within the eight week period, allowing BG Group and Amec Foster Wheeler to deliver an industry first in caisson removal methods.

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Link to more details

http://www.bg-group.com/~tiles/?tiletype=news&id=782
Do you really do that?
Geographical Information Systems (GIS) and mobile data collection

Amec Foster Wheeler’s Information Management Technology Services provides technology solutions that complement our traditional engineering services by adding efficiency to our projects and value for our customers.

The information management team delivers solutions in support of numerous industry sectors, including all levels of government, resources, transportation, nuclear, environmental and facilities management. Our range of services includes: strategic consultancy advice; environmental modelling and analysis; development of customised GIS applications database design and development; scoping and specification studies; data capture; training; web mapping and remote sensing.

A growing service in recent years has been the capture, storage, manipulation, analysis and display of geospatial data using mobile smartphone and/or tablet devices. This work has included the development and use of data forms allowing data validation and visualisation in the field.

These developments have led to a number of important operational benefits. These include:

- Improving the quality of data input
- Immediate delivery of data to the office
- Providing users with access to real-time information
- Providing accurate GPS based positioning
- Reducing data capture time

How it has been applied

A number of mobile GIS tools have been developed and deployed by the US E&I information management team. This includes the development of a mobile application and web portal to facilitate the data collection (including photos) of over 5,000 storm water assets. This data was sent in real-time to a secured server where it was viewed, managed, edited and integrated with other systems. The US team has also deployed similar applications for FEMA in the US and for the US Army operating in Afghanistan.

In the UK, our mobile data collection solutions has focus on the use of the ESRI ArcGIS Collector App hosted on standard iPad tablets. This tool integrates fully with our wider corporate use of ESRI ArcGIS desktop and ArcGIS online software and also works on both iOS and Android devices.
A key feature of the ESRI Collector App is its potential to be configured to enable the collection and update of information either online or offline and then sync when reconnected back in the office or hotel.

The use of the Collector App has been central to range of work being undertaken by T&D and E&I staff working on the nationally important North West Coast Connection FEED scheme which is currently being delivered for National Grid.

This scheme proposes the development of a 400kV OHL connection to the national electricity transmission system to serve the proposed Moorside Nuclear Power Station, in West Cumbria.

The T&D design team has been tasked with identifying construction/demolition and scaffold access for the new route, while E&I team are working on parallel hydrological and transport studies.

Where else it might be applied

Mobile GIS and data collection has the potential to be applied in any study where there is a need to capture, view or analyse spatial information.

Potential application areas include:

- Identification of exclusion areas and hazardous areas
- Viewing the ownership of land and thereby limiting on-site issues
- Tracking the location of vehicles and staff and thereby assist in the management of health/safety issues
- Recording ecological and land use change as part of long term environmental monitoring programmes
- Assessing changes in land topography
- Ensuring the sensitive removal and potential reinstatement of buildings and vegetation
- Viewing the proposed location and potential impacts of proposed access, roads, fences, lighting and security measures

Links to more details

http://www.esri.com/software/arcgis/collector-for-arcgis
GoTechnology® completions and commissioning software application

A suite of tools designed to assist with critical areas of commissioning project management and technical integrity of new and existing projects to help minimising the risks of revenue and reputation loss.

GoPreserve® is an optional module within GoCompletions®. This tool has been created especially for major greenfield projects for the generation and ongoing monitoring of preservation routines where equipment is being purchased then stored or installed for long periods prior to being energised at the commissioning stage.

GoProcedures® is a tool that allows commissioning procedures to be generated, modified, progressed and executed. It also acts as a library and storage facility for commissioning, start-up, operating and preservation procedures.

Each application can be used on its own, or in combination with other GoTechnology® Hub applications to provide seamless integration between products and disciplines.

Each product has a range of options and a variety of configurations which can be defined as part of the project setup, meaning you receive a solution that works best for you.

Large-scale data changes can be performed via a bespoke interface module capable of taking and formatting data in any commonly used transfer protocol or by using Microsoft Excel format spreadsheets, including importing and exporting of all information contained in the database.

Attachments to database objects can be uploaded and downloaded, for example scanned drawings can be attached to tags.

How it has been applied

GoTechnology, and specifically GoCompletions®, is the mandated, go to, completions system for both Shell and BP and qedi hold global agreements with both of these companies. Many other oil companies and service companies use GoTechnology including some of Amec Foster Wheeler’s competitors! In fact, the GoTechnology® suite of applications is currently used by over 7,000 people on more than 650 projects world-wide, for around two dozen different customers.
Where else it might be applied

Technical integrity, commissioning and completions principles are very transferable to other industries. The systems, have already been used extensively in mining and refineries. This year the first nuclear project to use the system starts in earnest and qedi are in the final stages of negotiating to implement the systems on a major rail infrastructure project. Wherever there is a construction and commissioning element the technology is appropriate.

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Links to more details

http://www.qed-i.com/gotechnology
Improving communication between site and design - SMART comms

A mobile app is being developed to improve communication between site and the design office, moving from recording information using pen and paper to inputting data into a tablet. This makes the process quicker and information more understandable.

When the project is selected from a drop down menu, the scheme number and customer are automatically updated. Appropriate as built check sheets are also loaded to the app. Drawings can be seen on the hand held device so that the measurements can be checked against the original design. The person who is carrying out the checks on site then fills in the required information on the app. There is also the opportunity to add additional comments if any information needs to be returned to the design office related to a specific issue. When information has been collected it is then sent back to the lead engineer in the design office. Here it can be checked, ensuring that no mistakes were made in the construction of the route and that nothing needs to be changed.

Future development includes a traffic light system which will be shown with the data which has been recorded. Values that are shown to be green match the design, amber do not match the design exactly but are within the limits set by the standards and red means values are outside the limit or that particular section is yet to be inspected. This is advantageous as it speeds up analysis of the data. As well as this, constant feedback is being provided to the lead engineer so if an issue does occur, it will be picked up on quickly, and therefore it will be fixed in a timely manner, reducing delays to project completion.
The app has largely been developed to be used for as built surveys, to ensure no errors have taken place during construction. However, it could be further developed and used within different areas of Amec Foster Wheeler. For example, when surveying, excavating foundations and other significant parts of programmes. By using the app for these activities, it can be ensured that the measurement and coordinates which are being used are accurate. A further advantage to this is the ability to pin point locations of teams who are out on site. Therefore increasing their safety whilst at work.

In order for the app to be regularly used on site minimal training is required. This is due to the fact that technology is already used on many sites and the information which needs to be provided by the site team is not changing. This means that use of the app can be rolled out quickly across sites.

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More 4 Less

Amec Foster Wheeler’s strategy for delivering efficient modifications is straightforward and breaks modifications down into three distinct categories; modifications, minor modifications and repair orders.

Efficient Modifications is based on the ability to flex our approach with the risk and complexity of each category, which have scalable norms, processes and deliverables as depicted in the graphic below.

Our Efficient Modifications process focuses on people, process and performance management:

**People:** One team working towards aligned measurable objectives with an accountable, collaborative culture of continuous improvement and challenging the conventional way of working with no compromise to safety or integrity

Fit for purpose **processes** for the delivery of modifications, where process steps, assurance activities and approvals are scaled in line with the risk and complexity of the modification

A clear **performance** management system which is visible to all levels of the organisation, building an aligned understanding of objectives and how we are performing against them

At every stage Efficient Modifications focuses exclusively on deliverables that are essential to either; Build it, Buy it or Assure it – cutting out waste and non-value adding work.

**How it has been applied**

We are implementing Efficient Modifications across our portfolio and are achieving significant efficiency improvements as a result, at contract and job level.

- 30% savings* for modifications
- 45% savings* for minor modifications
- 60% savings* for repair orders
- 50% cost reduction in engineering costs
- 40% reduction in engineering to construction hours ratio
- 8 week schedule improvement
- 20% reduction in hourly costs

*Compared to traditional approaches

**Where else it might be applied**

Nuclear, projects, FEEDs, O&M.
Do you really do that?

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Links to more details
https://onespace.amecfw.com/Pages/More-4-less.aspx
Overhead Line (OHL) condition assessment inspection

A streamlined inspection service as an integral part of our design capability. This has increased our presence in the industry and strengthened our role within the total ‘cycle’ of OHL design and construction.

How it has been applied

Following a number of desktop and live climbing trials, carried out at Darlington training centre, this method has been successfully implemented on a growing number of recent contracts. Substantial efficiencies have been achieved in both pure inspection schemes and in providing support to other projects where required. This has reduced the need to outsource vital work and in future allows us to quickly build upon our current base, working towards a comprehensive asset management offering.

Collaboration between different divisions with established practices, such as O&G, will add value and ensure a continuous, pertinent approach to forecasting future works is realised for any business unit and its customers.

With feedback from site and design staff, in-house software was promptly authored by our senior programmer, Tim Pilgrim, for use on mobile devices. Combined with the engineering expertise from our colleagues in Chennai and the latest rugged tablet technologies, the team has produced an efficient method to accurately record and report asset health condition data.
Where else it might be applied

Business units with asset health monitoring requirements.

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RAIDS prioritisation tool

Resources (money, offshore beds and engineering resources) are often insufficient to execute all identified work. It is therefore critical that only the highest value jobs are undertaken.

Integrity upgrades have historically resulted in limited value creation. Decisions are often subjective leading to modifications being cancelled mid-cycle or requiring change which erodes value.

Most companies use a simple risk grid to assess value of integrity upgrades. This provides poor information on risk reduction versus money invested, resulting in the differing opinions and changing priorities.

Our straightforward RAIDS tool attributes a risk reduction value to an integrity modification, allowing the value created to be balanced with the cost of the modification.

This allows jobs to be prioritised based on risk reduction and return on investment. Low value jobs are rejected early in the process and the focus is on the successful delivery of the high value modifications - creating value. Providing consistent ranking of modifications, which gives clear explanation to the workforce and regulatory bodies as to which modifications have been selected and why.
Once a scope has been deemed to add value, and the estimate developed, the resources (onshore, offshore personnel, beds availability and budget) to execute the scope, are reviewed. Where potential resources constraints are identified, the execution options are discussed. Options typically include delaying other jobs (or this job), increasing personnel to deliver on time (linked to deemed priority of scope, driven by HSSE shutdown, production related, OPEX impact and/or overall return considerations).

A way forward is then agreed with all stakeholders. The plan is updated to reflect the new scope and any changes to existing scopes. A list of priority scopes for delivery over the next 12 months is maintained by the contract team and reviewed regularly. Critically this list is developed in close collaboration with the operations team to ensure we are focusing on delivering the same high value scopes.

Where this clear prioritisation approach has been applied we have seen a significant reduction in the number of jobs which are started, but not executed. This reduces one of the biggest sources of inefficiency in the modifications process.

We monitor our performance in this area via two of our proposed level one KPIs:

- Execute high value jobs, eliminate low value jobs early in process
- Finish every job we start - one pass through

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Remote installation, manipulation & inspection

We can offer bespoke innovative engineering solutions to remotely access complex environments - including radioactive environments. We can develop remotely operated equipment (robotics) to access and address complex problems in extremely inaccessible areas.

For example we have remotely accessed and fed small components through a gap less than 5mm wide. One engineer described the process as, “like changing the fuse on your TV at home, but doing it through your chimney pot.” In another project we designed and tested on a full-scale rig mock up a number of specialized tooling packages to remotely position a gas deflecting cowl in the centre of a reactor. This particular project has been likened to “changing the tap upstairs in your bathroom and having to route the tooling around the upper floor, down the stairs and out the front door with the only access being through the letterbox”.

How it has been applied

A customer had detected a steady rise in temperature of the hot box dome components in some of its power stations. The dome separates cooler, high-pressure gas from the hotter gas sent to the boilers. To address the issue, a limited output was instigated at one of the reactors with a similar limit likely to be placed on other reactors. This reduced output posed concerns (and potential loss of income) for the customer.

We devised and implemented solutions to get the reactors working again at full generating capacity in the shortest possible timescales. Initially, remotely-operated tooling, position sensing, drilling and welding packages, specialised grabs, manipulators and camera were designed, manufactured and tested on a full-scale rig mockup. Fully-trained teams were deployed on the various sites and all affected reactors were successfully modified - this allowed our client to extend the license to generate by 5 years.

Subsequently, to enhance further cooling capability at one of the power stations, fitted a gas-deflecting cowl inside the reactor, around the central control rod channel. This was an extremely challenging task, successfully executed, using newly-developed novel tooling and components, including a friction-reducing reactor-compatible nylon roller chain. The cowl was introduced through a TV penetration and then transported to the centre of the reactor before being fixed in position using screw fasteners. These were remotely inserted and tightened, with the specified torque values confirmed using indirect electrical and optical methods. Finally, the fasteners were locked in position by a combination of
remote welding and remotely-dispensed high-temperature liquid thread locking adhesive.

Where else it might be applied

Camera systems, robotics and tools used for plant modification, inspection and recovery operations can be fully deployed in any environment.

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Risk and Value Engineering (RAVE™) methodology

Risk and Value Engineering (RAVE™) is a proprietary methodology used to quantify and substantiate strategic decisions.

Without performing any detailed engineering, you can identify the optimum value and identify the primary risks on a project or business model. The method enables effective collaborative problem solving across all disciplines, as well as rapid identification and ranking of alternative investment options.

Integrating models of all the key areas for a field development study, it incorporates a full pressure network solution including constraints on deliverability. The optimisation algorithm maximises point-by-point production and value, including gas-lift optimisation, all within the resource constraints imposed at the facility. It allows thousands of simulations to be run to test all the options, risks and parameters; over the complete life-of-field enabling rapid evaluation of numerous potential development solutions. Case input data is configured to enable the impact of both technical and economic risks to be evaluated, either deterministically or stochastically.

The approach ensures individual cases are compared on a consistent basis, leading to a rigorous identification of the most compelling proposal. The RAVE™ methodology has been designed to fit within the stage gate processes adopted by oil and gas companies.

How it has been applied

The approach was used to undertake techno-economic value analysis of a system, from reservoir and wells to export routes on the Azure over Blue project. The findings led to an increased return on investment for the Azure field asset owners by enabling a 35% increase in production capacity over the Blue platform.
Do you really do that?

Where else it might be applied

It can also be used with Ingen’s Carbon Balance programme to calculate the carbon footprint of system components from project initiation to abandonment.

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Links to more details


http://www.ingen-ideas.com/services/technology
Scopus - dimensional control

Dimensional control can be applied across various greenfield and brownfield projects, from modular build construction or build verification through to individual repair orders. It ensures that all items will fit together first time, be this a single pipe spool change out, or an entire package fabricated off site.

Benefits
- Utilising our own in-house developed survey software package, it allows accurate off-site fabrication and first-time fit
- Eliminates welding and unnecessary hot work
- Decreasing schedule

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Applications
- On a major hook up at BP ETAP Scopus saved 18 weeks on the original estimated hook-up duration, in addition to saving 76% on estimated man hours and 75% on offshore cost
- Significantly reduced site welding on the Theddlethorpe project

Links to more details
http://www.scopuseng.com/
http://www.scopuseng.com/services/dimensional-control/
Scopus - 360° PhotoScan

PhotoScan allows you to reduce site visits and costs, while improving safety and communication; all without the need for software installation.

PhotoScan works through the use of integrated point cloud data via in-built camera in laser scanner which is dimensionally accurate to approximately 3mm.

Benefits

- The ability to ‘be offshore’, on site or at your desk via web-based software, and easily share information across multiple locations
- Allows multi-user planning/PUWER assessments/ constructability reviews which reduces site visits and costs, as well as improving safety
- The ability to extract real 3D co-ordinates and accurately measure distance; assisting equipment installation and defining scaffolding volume required
- No software required - remote login access from any location

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Links to more details

http://www.scopuseng.com/
Scopus - laser scanning

Rapid 3D as-built data capture allows details design and engineering to proceed at pace, resulting in reduced program durations and re-work and reduced cost for site teams. It is also effectively utilised to reverse engineer assets for decommissioning.

By creating a 3D as-built model of the asset all design work can be undertaken within the point cloud. This eliminates the requirement to travel to sites, making it ideal for remote access projects, from manned or unmanned offshore assets, onshore refineries, or nuclear sites where frequent access is not an option.

3D Point Cloud scanners which are dimensionally accurate to approximately 3mm, capture over 1 million points per second at 360°, both horizontally and vertically, with a range reaching over 80 metres. 3D as-built models can be directly interfaced with all CAD platforms including AutoCAD, Microstation, Smart Plant 3D, PDMS and E3D.

Benefits

- Laser scans of the Brent assets were taken prior to decommissioning. This enabled the engineering team to assess the scope limits and requirements in order to safely plan a decommissioning concept and methodology. Scopus is currently undertaking a similar process for the Fairfield Dunlin asset.

Applications

- Full colour laser scans were undertaken of multiple Shell SNS assets. Many of the assets are unmanned, making trips sporadic and costly. By bringing the as-built data to the desktop, all major and minor modifications could be designed and planned remotely with confidence, saving time and cost

- Design from your desktop

- Eliminate site visits, helicopter travel and bed space pressures

- Eliminate clashes with new design and ensure first time fit

- Increased management of cost, risk and change

- As-built verification of old plant

- Reduced project durations and cost

- Ongoing maintenance activities made easier and safer

- An integral part of PDMS and E3D – allowing data management, 3D modelling, links to P&IDs and drawings
Do you really do that?

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Links to more details
http://www.scopuseng.com/news/?nID=29
http://www.scopuseng.com/
Radioactive waste generated during the nuclear fuel cycle is hazardous and expensive to manage; handling this waste effectively and efficiently is a priority. We understand the problems that disposal of radioactive sludge and resins can bring. SIAL® is an innovative technology for encapsulation of radioactive waste.

Our experience and depth of understanding of the challenges surrounding the removal and storage of waste has helped us to deliver a viable alternative to current methods. Not only is the SIAL® matrix technology efficient in terms of cost and waste loading, but it also provides additional key benefits:

- Low energy and environmentally friendly
- Efficient and practical on-site treatment of radioactive waste streams at room temperature
- Incorporates four times as much waste as a cement matrix
- The equipment used to deploy SIAL® is also flexible and versatile. Modular in nature it can be taken to where the waste is located, enabling on-site operations and on-site waste treatment and storage, and negating the need for costly off site treatment facilities. This also minimizes the need to transport loose contaminated materials, therefore reducing risk
- It can encapsulate waste and set under water

In addition, the SIAL® technology is characterised by excellent mechanical and physical properties, compared with the earlier generation encapsulation processes, and as detailed in the table below:

- High mechanical strength
- Low leachability
- Low volatility, posing a low fire risk
- High physical stability in the presence of frost and water (doesn’t develop cracks which can distort and damage the integrity of waste packages)

How it has been applied

SIAL® has been used to successfully immobilise approximately 700 tons of waste which includes sludge and resin from Bohunice, Slovakia and approximately 350 m3 of spent ion exchange resins and sludge from tanks on site at the Dukovany nuclear plant, Czech Republic. It has a track record of over 15 years which includes on-going research and development and over 12 years of actual nuclear on site usage.
In 2010, The World Association of Nuclear Operators (WANO) and the Operational Safety Review Team (OSART) evaluated the SIAL® matrix technology at NPP Dukovany as an example of best practice.

Applying the SIAL® technology, we safely solidified the waste on site, saving the customer significant time and cost on the original plan by treating the waste much quicker than the traditional cement method. The final wasteform drum packages, immobilized for storage was reduced by 75% compared to traditional cement encapsulation. Through treatment on site, we also eliminated the cost of disposing of contaminated transport materials (such as piping and tools).

**Where else it might be applied**

SIAL® can be applied on site, avoiding the need to transport dangerous active and non-active waste to another site for treatment; eliminating the cost of disposing contaminated transport materials, and negating the need for costly off site treatment facilities.

[Link to more details](www.amecfw.sk)

Do you really do that?
The Skysok system has been developed to enable the replacement of multiple conductor configurations whilst minimising risk to infrastructure below and maximising efficiencies during the replacement works.

The system will provide our customers with increased flexibility for scheme development whilst reducing temporary protection costs, risk and programme. Skysok does not require any disruptions during the conductor replacement works with the new headboard solution.

Skysok is CE marked in accordance with EU directives and will achieve Network Rail Certification Board approval and an Agreement in Principle with the Highways Agency.

Skysok has been developed primarily for Quad – Triple refurbishment. The system now also has suitability for twin configurations.

**How it has been applied**

The proposals below have developed as the standard approach to product development within T & D services, Amec Foster Wheeler.


- Highways Agency (HA) Agreement in Principle (AiP), in progress

- Certification in accordance with Network Rail Certification Board, in progress.

- TNO & DNO approvals pending
Where else it might be applied
Developed for and being developed for use on the refurbishment of transmission line assets.

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Track & Trace

Amec Foster Wheeler’s Track & Trace programme controls and tracks the movement of materials across the globe. Delivered in partnership with DAI, it is a proven technology and has the capability of being extended from its current ‘per project’ focus to a ‘cross enterprise’ focus, and potentially a ‘cross sector’ focus.

Track & Trace has been developed specifically to meet the unique oil and gas sector challenges. It tracks the movement and status of materials and tools across the global supply chain from supplier to point of installation offshore.

The solution ensures that the right materials get to the right place at the right time with the right certification and are correctly issued for use against the right job cards / work orders. In doing so it provides real time visibility of progress to stakeholders. It also integrates with existing procurement and project management systems for improved planning and management decisions based on real time inventory status.

Track & Trace mitigates project delivery risks by limiting schedule impact due to key material losses. It reduces material re-orders, manual data errors, warehousing inefficiency, material contingency purchases, misidentification, misuse, material reconciliation costs and non-certification.

The factors noted here work together to ensure that Track & Trace helps in reducing cost, time, and wastage – whilst increasing safety, efficiency, predictability and integrity.

Furthermore, at the end of the project the delivered asset has a full auditable history in place for every component part. This can then feed forward into operations and maintenance, and through eventually into decommissioning.

How it has been applied

Track & Trace has been deployed on ConocoPhillips Alder, Talisman Montrose Arbroath Area Redevelopment, BP Clair Ridge Hook Up and Talisman HUC projects.

DAI’s mature, cross industry proven product is used by ASDA, Tesco, DHL, Adidas, Coca Cola, among others, to manage business critical material logistics functions across their internal and external supply chains.

Initial results from the Talisman MAR project 5 month flotel campaign show 99.96% of project materials being receipted and issued offshore, on schedule, along with complete certification records (i.e. 4,998 out of a total of 5,000 line items).
Where else it might be applied

Nuclear, mining.

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Links to more details

Video - https://youtu.be/-HJ-9xxwP_o
Article - http://www.amecfw.com/media/blog/blog-folder/track-and-trace

(00) 0 0123456 000000001 8
Waste logistics model

We have developed an in-house waste logistics model enabling the costs of managing waste through a network of existing (or potential) waste treatment and disposal facilities to be optimised on a regional basis.

How it has been applied

The tool was originally developed through a project with a leading UK water utility and was applied to the managing of waste water treatment (sludge) networks.

Once set up the network of waste sources, treatment sites and outlets is configured (including identification of locations, capabilities and unit costs) the model seeks to allocate material based on lowest cost, logistics or other parameter to which numerical inputs can be assigned, e.g. carbon emissions. The model comprises a front end spreadsheet where the user defines the scenario to be assessed, and then a coded executable file enabling calculations to be undertaken much faster than would be the case using a spreadsheet platform. The model generates a number of reports explaining waste flows through the system, along with mapped outputs showing flows between sites.

Where else it might be applied

Due to similarities in the waste streams the model could readily be applied to leachate treatment networks enabling owners of operational and closed landfills to reduce their aftercare costs and potentially collaborate across sites to find the best combination of treatment location and configuration.

With additional investment the model could be applied to a wider range of waste streams. The potential to invest in the model to enable it to be configured to support options appraisal around oil and gas waste management is currently being considered.
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Weight estimating: Monte Carlo analysis

Over the lifecycle of a project the Monte Carlo analysis of weight can evaluate the likely spread of weight outcomes at the various stages. As the engineering and design process progresses the item accuracy allowances change to reflect the increasing definition of the topsides design.

This may give a way of using the Monte Carlo analysis tool to assist in defining probable weight outcomes. Use item accuracy allowances as the basis for the probability distribution values input into the analysis tool.

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</tbody>
</table>

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Do you really do that?
Amec Foster Wheeler (www.amecfw.com) designs, delivers and maintains strategic and complex assets for its customers across the global energy and related sectors.

With pro-forma 2014 scope revenues of £5.5bn and over 40,000 people in more than 55 countries, the company operates across the whole of the oil and gas industry - from production through to refining, processing and distribution of derivative products - and in the mining, clean energy, power generation, pharma, environment and infrastructure markets.

Amec Foster Wheeler shares are publicly traded on the London Stock Exchange and its American Depositary Shares are traded on the New York Stock Exchange. Both trade under the ticker AMFW.