

FOCUS

Digital Transformation

Building Security-by-Design Into Your Digital Transformation Projects

Delivering Digital Transformation Programmes

Adopting disruptive technologies brings many challenges, one of which is security risk management. As corporate enterprises become increasingly connected, technology becomes more complex.

Changing Our Customers' Worlds

Our customers are using digital twin technology and BMT Deep™ to drive reductions in field development costs and maximise the operating life of their offshore assets.

Demystifying Digital Twins

We see digital twins as a key element of industry 4.0, having seen the benefits and savings they are bringing to our customers. Our Whole-of-Mine digital Twin is just one of many bespoke examples.

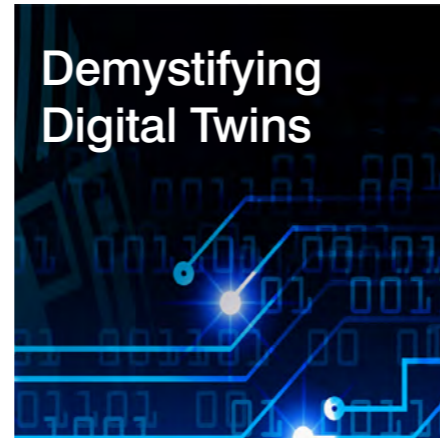
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Exploiting Behavioural Science

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Welcome to the first issue of Focus for 2020, which covers the theme of Digital Transformation. It is brought to you as we navigate our way through a pandemic that has become one of the greatest global challenges in our lifetimes, and many will be finding they have been catapulted into their journey into digital transformation almost overnight.

Covid-19 has certainly stress-tested many, if not all, businesses in recent months. Those who have not been digitally prepared have, no doubt, been presented with particular business continuity and security challenges, and discovered that their talent, operations and platforms have lost some momentum.

The way in which the pandemic has spread around the world, and disrupted the way we all work, has driven an urgent need to mobilise remote, secure, nimble workforces, changing the way that we communicate, collaborate and deliver. Many businesses are now reflecting on what has been learnt from the past few months, assessing the benefits and opportunities that this rapid digital transformation presents to fundamentally reset and recalibrate their organisations.

As organisations have adapted, we have seen a necessary acceptance, and perhaps trust, of technological change. At the same time, there is a growing recognition that while a global pandemic is the cause today, it could be something else tomorrow that disrupts lives and businesses worldwide. In any case, there is growing acceptance that things may never return to 'normal', and perhaps in this case, that is a good thing.

So, we are seeing a notable push to understand how emerging technologies can be adopted more quickly, in all fields of work, with digital resilience now seen as an operational imperative. For BMT, this emerges as an opportunity for us to continue to help our customers with crisis planning and thinking about the eventual shape of their businesses when they start to recover, ensuring that they are set up to weather times of uncertainty and extreme environmental volatility.

I hope that the articles in this edition of Focus will inspire thought, and debate. It is only through creating a diversity and depth of ideas and opinions that we will be able to guide ourselves, our customers, and partners, through these turbulent times.

It is by engaging with each other that we will come to understand how to build sustainability and resilience into our businesses and take advantage of the opportunities this great transformation brings with it.

Sarah Kenny, OBE
Chief Executive



Delivering Successful Digital Transformation Programmes

Many organisations across both the private and public sectors are currently completing or embarking on Digital Transformation programmes.

Some of these programmes are being delivered by internal employees, but many, around 70%, are being outsourced. We help our customers to capitalise on these projects to achieve a competitive advantage.

As a 'customer friend', we provide blended teams of systems engineers, data scientists, artificial intelligence (AI) and cyber experts to help businesses demystify the jargon and make evidence-based decisions.

These multi-skilled teams can then work together to help with enterprise-level change management, strategy development, process design and architecture, and implementing digital services.

Digital Transformation programmes identify the efficiencies created through emerging and disruptive technologies, like Big Data, Cloud Technology, building Digital Twins, Machine Learning and AI, the Industrial Internet of Things (IIoT) and Blockchain.

By aligning and reorganising business functions to exploit these technologies, companies can maintain or enhance their marketplace standing and future outlook.

However, readers should also recognise that Digital Transformation programmes are change programmes that require stakeholders to shift and adapt their mindsets and behaviours.

So, in addition to establishing enterprise-wide technical architectures, senior leadership teams must also establish effective 'action architectures' to implement the required change in their staff's behaviours.

This helps effect the necessary cultural changes. "Without this 'action architecture', Digital Transformation programmes will simply not succeed!" advises Jon Heaton, our Lead Cyber Security Consultant.

Adopting and implementing these disruptive technologies brings many challenges, one of the most vital is security risk management. As corporate enterprises become increasingly connected, technology becomes more complex.

Furthermore, employees will progressively flit between conducting work and private information interactions, for example, which collectively increases the corporate threat landscape.

One of our roles is to help ensure that our customers are using industry best practices and are abiding by governance while we handle commercially-sensitive tasks such as risk analysis, cloud configuration and data protection requirements.

It's worth knowing that retrospectively fitting cyber security measures to a Digital Transformation programme is both financially costly and resource intensive.

In other words, "invest effort in cyber security early on in your Digital Transformation programme if you wish to succeed", advises Heaton.

There is no industry-accepted model for the stages of a Digital Transformation programme but it is suggested that these changes should start small and scale in an iterative process.

This allows a small team to demonstrate tangible evidence of the benefits and efficiencies that Digital Transformation can bring and how the challenges associated with changes to roles and culture can be overcome. It is important to understand that these initiatives require a transformational leadership style and it is vital to understand where your data is.

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“ Invest effort in cyber security early in your Digital Transformation programme, if you wish to succeed ”

Jon Heaton, BMT

Jon Heaton



Lead Cyber Security Consultant, BMT

With over 30 years' experience in the communications industry, Jon's experience was primarily accrued from a full career in the British Army where he completed a myriad of roles and deployments including his final 7 years being spent in cyber appointments.

Jon is the cyber capability lead within BMT's Technology and Innovation Services (TIS) team, where he heads up a burgeoning cyber practice that is currently delivering a number of high profile contracts and looking to grow further.

Jon has a particular interest and expertise in the human elements of cyber security, instigated through an MSc dissertation in the domain. He is also a Chartered Engineer, Chartered IT Professional and an active Fellow of the British Computer Society.



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BMT Experts

Alan Hodgson



Strategic Advisor, Security, Policing and Justice, BMT

Alan joined BMT following a 31-year career with the Metropolitan Police Service (MPS) – New Scotland Yard.

He spent his career tackling the whole spectrum of crime, gangs and organised criminals with an absolute passion to cut crime, cut costs, improve public confidence and keep the public safe and secure.



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Marco Casassa
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Principal Cyber Consultant, BMT

Marco is responsible for the delivery of cyber security projects in defence and security, business development support and cyber security R&D innovation. Marco has significant hands-on, deep technical expertise in various cyber security areas, including big data for security, cyber analytics for threat detection & prediction, cyber risk analysis, enterprise security solutions and architectures.



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Lisa Gralewski



Principal Data Scientist, BMT

Lisa is a data analyst and chartered engineer with excellent skills in data science. She is experienced in technically leading defence, government and industrial projects.

She has worked on numerous data analytics projects from predictive maintenance of fast jets to intelligence reporting.



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Communication, sensitivity and transparency are absolutely vital

In addition to new tools and functions, successful Digital Transformation relies on people. By investing in developing their skills and confidence so they can lead and manage change, and by consulting with them, they will be empowered to work differently and have the confidence to 'fail fast, learn faster'. In this way, they can become cultural change agents that help deliver the transformative corporate vision and strategy.

"Change is a constant. It has never been this fast and it will never be this slow again", observes Alan Hodgson, BMT's Strategic Advisor for Security, Policing and Justice, who is passionate about a people-centred approach to Digital Transformation. "So, we need to develop people. They are the most important asset and they need to be supported by their supervisors, peers and senior leaders in order to thrive".

Transformation programmes often miss that key step of effectively engaging their teams and seeking their ideas when designing, implementing and embedding new organisational structures, systems and ways of working. Without this, you will never change the culture and learn to innovate.

You may change where teams are working from, the brand, the company name, what a person does or how they access and deliver services, but this will not change behaviours.

"By digitally transforming, enterprises can achieve new levels of innovation and productivity to adapt to future changes", says Hodgson.

"Often, the easiest thing to focus on is the technology," concurs BMT's Principal Data Scientist, Lisa Gralewski, "but we need to make sure that requirements are driven by user need."

In our role as customer friend, we help our clients deliver successful technology projects by navigating the tension that often arises between the leadership's vision, the resources available to deliver what users want on the ground and what the technology itself can do.

"With any big transformation project there will be many user communities and different rates of adoption. Communication, sensitivity and transparency are absolutely vital", says Gralewski.

Within the initial stage of a Digital Transformation programme, when the 'target setting' activity is conducted, a prudent Programme Board begins by considering the value of their corporate and clients' data.

This would include categorising the levels of criticality of that data remaining secure, both for operational and reputational reasons.

This should ideally lead to the establishment of a cyber security KPI to ensure that data is appropriately understood, secured and exploited and both planning, and rehearsal takes place in preparation for when (and not if) an information security breach takes place.

We focus on obtaining a complete understanding of business functions to determine cyber security activities so we can incorporate 'security-by-design', 'defence-in-depth' and 'zero trust' principles at the earliest possible stage, as part of the organisation's broader risk management processes.

"Digital Transformation processes are a unique opportunity for organisations to apply best cyber security practices to their new, digital capabilities", says Marco Casassa Mont, BMT's Principal Cyber Consultant.

"Some senior leadership teams seem to be reluctant to embark on Digital Transformation programmes, however, we believe that the cost-benefits and efficiency-gains can be extraordinary if managed correctly. If in doubt, remember to start with small projects to build confidence and understanding."



BMT has traditionally operated in the upstream production sector, connecting with both major oil company operators and large engineering, procurement and construction companies (EPCs). Data has always been an important asset across the oil and gas field development life cycle, from initial reserve assessment right through to decommissioning.

How Digital Transformation is Changing Our Customers' Worlds

Data has always been an important asset across the oil and gas field development life cycle, from initial reserve assessment right through to decommissioning.

In recent years, we've seen significant shifts on the client side to leaner operating structures, a push to reduce field development costs through standardisation and a desire to maximise the operating life of current assets.

Data is key to achieving these objectives and our customers, who have been collecting asset integrity and operational data for many years, have increasingly been mining and analysing that data to make decisions on everything from supply chain to life extension.

Industry expectations have increased in line with the rate and speed of technological change. For example, the need to reduce costs has made manual data cleansing too time-consuming, leading to advances in how this process can be automated.

Inevitably, user demographics have also changed, with younger engineers coming into the business expecting data 'now', rather than waiting for data scientists to manually analyse it, or for it to be shipped from offshore to onshore, as used to be the case.

They expect applications, rather than traditional data hosting sites.

More recently, there is a real push towards the idea of data sharing, with industrial giants in all sectors giving free access to datasets and offering to pay for insights where these will improve operational efficiencies.

So, it will be interesting to see how these 'data liberation' movements progress.

How has BMT been adapting to this changing landscape?

"We understand sensors and we understand data. We have always seen ourselves as a data delivery company, identifying early on the need for Digital Transformation to increase margins and keep pace with industry and demographic expectations.

"Historically, our sensors and instrumentation systems were mainly used as indicators to support safe operations offshore.

"Our helideck monitoring systems, for example, are used to let operators know whether conditions are safe for a helicopter to land on an offshore platform, while the systems we put on risers and mooring lines let operators know whether their assets are stable and safe to use for oil production.

"In some cases, regulators have mandated the use of these kinds of sensors and instrumentation systems in order to keep production running and protect the environment.

"Over many years, we realised that our real-time systems had collected an immense amount of environmental, metocean and asset structural integrity data."



Head of Instrumentation Services, BMT

Andy leads a global team of project managers, multi-disciplinary engineers and field service technicians that provide design, engineering, assembly, integration, commissioning and long-term maintenance of surface and subsea integrity monitoring/ advisory systems throughout the Offshore Energy value chain.

Andy has a deep working knowledge of sensor technologies, data acquisition and data processing approaches for offshore marine applications and has been influential in developing innovative solutions in response to industry changes over the last 15 years.



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Business Unit Manager, Data Services, BMT

Dr Soma Maraju leads BMT's Data Services team, providing customers expertise in Big Data and Cloud-based solutions to deliver insights from large amounts of measured data, either collected offshore, marine, subsea or from numerical simulations.

He has a rich body of experience in the analysis of the hydrodynamic aspects of deep-water floating production and drilling offshore platforms. His team provides customers with data services including data management, processing, comprehensive analyses, and insights.

He has a masters in Computer Science and PhD in Naval Architecture and Ocean Engineering.



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"We initially began managing that data through a data centre so that we could create fleet-wide status reports for our operator clients.

"But, as the data analysis and consulting side of the business grew, we realised that we needed to change our business model to provide higher-value services to our customers and make our delivery more efficient. So, we moved our services to the cloud and developed a proprietary data analytics platform that we call BMT Deep™.

"This digital platform allows us to provide operational insights and generate data quality assurance and other detailed reports in near real-time. Accordingly, we've moved away from the unit pricing of reports to a subscription model, driving costs down for our customers.

"Our analysts, data scientists and customers can now focus on mining the data to look for long-term trends, which can be anything from seabed subsidence

to structural fatigue. It's this high-value work that drives efficiencies and cost savings.

"But, for these 'big data' analytics to be useful, it's important to have a high degree of confidence in the base data sets, so we're very focused on addressing the issue of long-term data quality and making sure that we organise these multi-year data sets efficiently.

"In recent years, we've adjusted our internal instrumentation systems engineering processes to include data traceability analysis.

"This allows us to trace processed data variables back to our instruments, providing a fully audited data trail. We've also included real-time automated quality assurance (QA) on our local acquisition system software.

"This gives operators an early indication of a sensor malfunction so that they can pre-emptively schedule maintenance,

thus reducing downtime and risk. In addition to automated data QA checks, we've added numerous additional features to BMT Deep™ over time, such as custom analytics. For example, for one major operator in the North Sea, we're developing a set of applications that automate hull fatigue analysis and deliver reports that can be accessed directly by local regulatory authorities."

So, is BMT Deep™ an IoT data analytics platform, then?

"An interesting question. BMT Deep™ can be described as a data management platform that provides customers with a digital replica (or twin, if you like), of their assets, whatever those assets might be.

"We do this by applying data fusion and machine learning principles to sensor data and converting this into graphics.

"This gives engineers and operations managers a complete virtual and interactive picture of how their assets are performing in real-time and flags up where pre-emptive actions can be scheduled to reduce downtime or increase safety.

The same principles apply whether the asset is an oil rig, an industrial plant, a vessel or a piece of mining machinery.

"Some commercial data analytics platforms can either be somewhat generalist, or in the energy sector, they may focus on something very specific, such as optimising production, so the tool monitors control data, such as temperature, flow of oil or pump pressure.

"What our engineers have understood is how critical asset design and performance is across a number of sectors, and they have embedded these specialist insights into the BMT Deep™

platform to provide a fully integrated whole-of-life picture to the operation of the asset.

"BMT Deep™ was designed by engineers who have been analysing industrial sensor data on behalf of other engineers and operations managers for many years so the dashboards and graphics are very intuitive for these end users, they are also interactive and customisable, allowing them to drill down into each dataset.

"This is important, because not everyone who has access to data may know how to process, clean and organise that data in ways that make sense, and not everyone who may be asked to look at a dataset will understand what they should be looking for within the data or even how to interpret that data to add value and save costs.

"Adding structure and highlighting the value of this data is precisely where we can help, relieving the end user's frustration at having to filter large data sets to find the event or behaviour of the asset that they're most interested in.

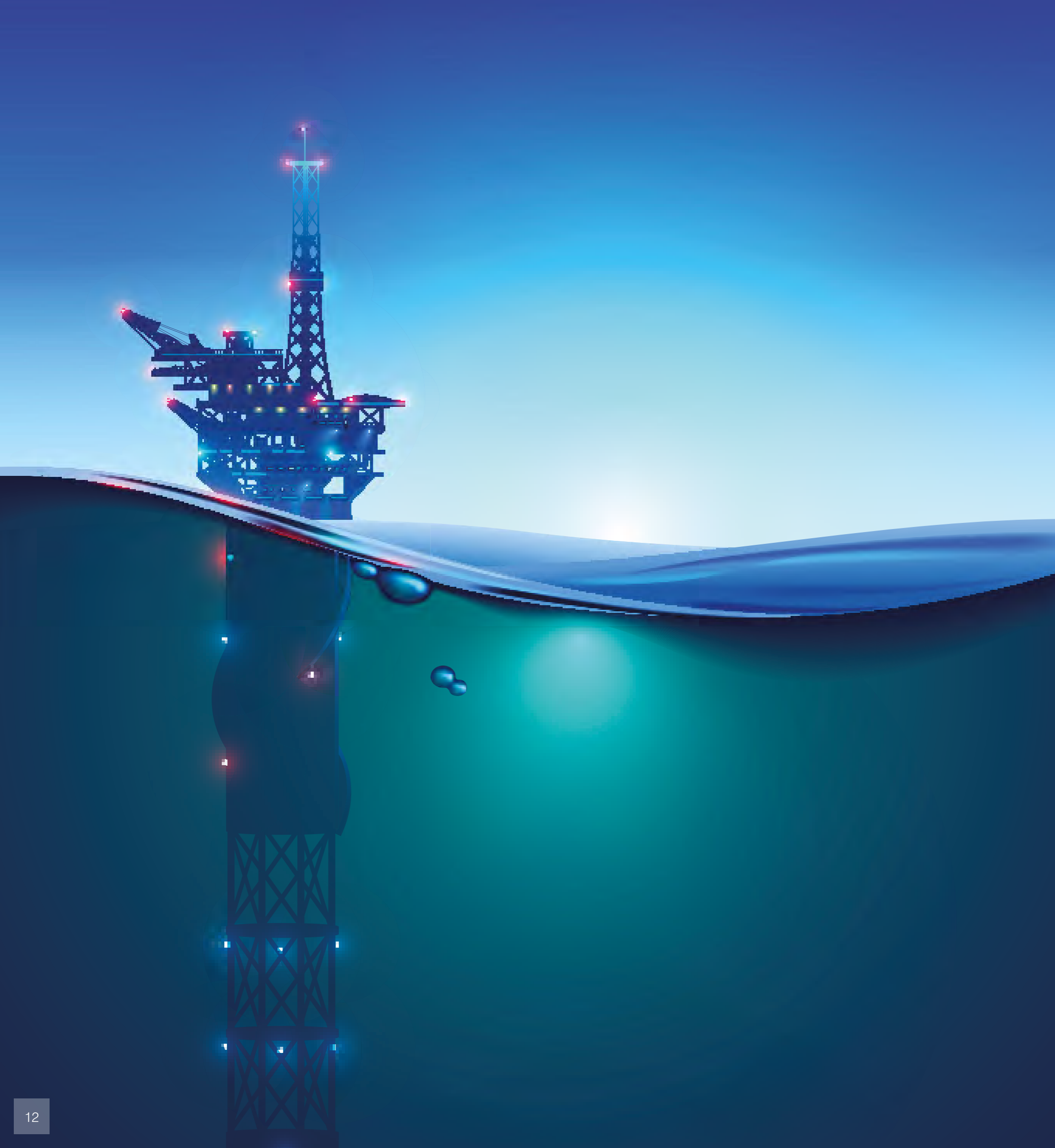
"Let's take a large asset, like a Floating Production Storage Offshore (FPSO) platform that is located out at sea. During a storm event, the asset may suffer damage. An unexpected event, such as a large wave, may impact the platform and break a mooring line.

"Without data on the asset's behaviour, this may go undetected and to understand more about what has happened, knowledge about how the onboard sensors have been configured, the sampling rates and the synchronisation of their in-built clocks will be critical to forensically investigate what has caused the damage."

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“ It's our understanding of data-centric engineering that makes what we do unique in this field and BMT Deep™ is our platform of choice because it's a game-changer. ”

Andy Aldrich, BMT



What has Digital Transformation meant for BMT?

"It's been fascinating to see how this process of Digital Transformation has allowed us to diversify and add value to our bottom line. Having automated the laborious and time-consuming aspects of data processing and cleansing, we've reduced overheads and exponentially increased the volume of data we can manage.

"Crucially, this has enabled our data scientists and analysts to do more interesting and meaningful work. It's gratifying to see how this technology can be usefully applied more widely.

"We can, for example, help monitor maritime pollution and environmental performance by taking water quality telemetered data from on-site sensors and present a complete timeseries that not only shows whether operations are meeting water quality objectives, but can also alert stakeholders of any potential exceedances, with details of location and impact.

"So, our business model has changed and we now work collaboratively with our customers, using our technology to help support their own Digital Transformations. Digital teams working on the client side are trying to consolidate their digital footprint and streamline the way they serve their internal and external stakeholders in all markets and sectors. Our role is to listen to their transformation objectives, share our own learning and apply our data science and engineering expertise to solve their problems.

"We are also now in the next phase of a disruptive transformation program. This will see us delivering a modularised 'data toolbox' approach, both to our data acquisition software platform product, BMT Deep™, and our sensor and instrumentation project-delivery process.

"Our aim is to continuously reduce capital expenditure costs for our customers, providing confidence in our integrated life-of-field solutions through a configuration management and systems engineering approach."

How are we innovating to solve customer problems?

"Our data acquisition instrumentation systems and sensors need to be able to operate in a particularly challenging, heavily regulated maritime environment.

"They operate on the digital edge, measuring both the external forces present on customer assets, such as wind, waves and ocean current, and the asset's physical and structural responses to these forces. As a result, we're constantly innovating in this space to increase safety and reduce costs.

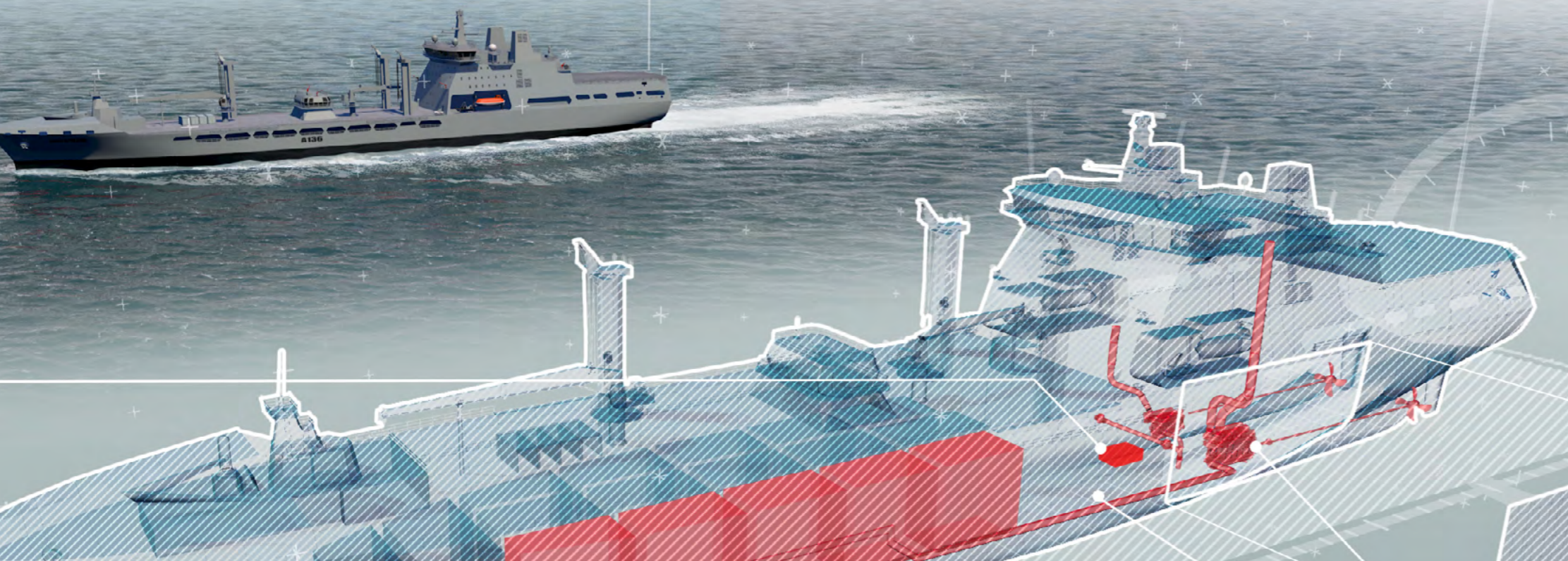
"To avoid the need for saturation divers to install sensors, which is a high-risk activity, we've developed sensor systems that can be deployed by underwater Remote Operated Vehicles (ROVs).

"And we're innovating with Artificial Intelligence, by using algorithms to monitor mooring lines, for example. As the name suggests, these lines are anchored to secure the offshore platform to the seabed. Measuring the tension in a mooring line is challenging and systems tend to have a high failure rate.

"So, to address that, we developed a proprietary 'Position Response Learning System' that uses deep-water simulation technology to accurately predict mooring line tension through inputs of GPS position and motion. We found that the accuracy of our simulations improved when we added metocean data, such as wind and sea current data.

"Using our AI algorithms means our customers can use existing surface-based sensors to understand mooring tension and these are, of course, much more affordable and easier to service than deep water instrumentation systems!

"In short, it's an exciting time to be working at the intersection of data and engineering and we look forward to the challenges ahead."



Demystifying Digital Twins

All models are wrong, but some are useful

The 'digital twin' is now a recognised core component of the Industry 4.0 journey, helping organisations understand their complex processes, resources and data to provide insight into their business and help optimise their operations.

But while 'digital twins' can sometimes mean different things to different people, we at BMT define them as "precise, virtual copies of machines or systems". These digital models receive regular data input from the relevant physical system, thus providing intelligent support for operational decisions.

Twins are, first and foremost, **learning** systems, driven by data that's collected from sensors in real time. This means that sets of complex digital models can adapt to mirror every element of a product, process or service.

The efficiencies of an asset digital twins' product life-cycle management can typically offer powerful benefits in four areas:

1. Operations optimisation

Using variables like weather, fleet size, energy costs or performance factors, models are triggered to run hundreds or thousands of "what-if" simulations to evaluate readiness or make necessary adjustments to current system set-points. This enables system operations to be optimised or controlled during operation to mitigate risk, reduce cost or gain any number of system efficiencies.

2. Predictive maintenance

In industry 4.0 applications, models can determine the remaining useful life of an item of equipment and advise operators on the best time to service or replace it.

3. Anomaly detection

The model runs in parallel to the relevant real asset and immediately flags any operational behaviour that deviates from expected (simulated) behaviour.

For example, a petroleum company may stream sensor data from offshore oil rigs that operate continuously and the digital twin model will look for anomalies in the operational behaviour to help avoid catastrophic damage.

4. Fault isolation

Anomalies can trigger a battery of simulations to isolate the fault and identify its root cause, so that engineers, or the system, can take appropriate action.

A good deal of progress has been made across several sectors since the original inception of the twin concept in 2002, which initially began by gaining momentum within high-value product manufacturing industries, such as mining, automotive and aerospace.

Typically, specific elements of a twin were developed to help achieve a specific aim for a specific system or sub-system. Since then, the digital twin concept has proliferated, taking on many interpretations and variations and has found increasing relevance across many other sectors.

However, there's still much to be done before the benefits of twins can be realised across industry on a wider scale.

For instance, there are no standards in place for such tools, and many challenges yet remain around open data capture, data storage, and performing effective analysis to support decisions with confidence.

Indeed, a standard definition of a digital twin has not yet been established and there are many variations in the accepted scope of a twin across sectors. To add further complexity, what began as a niche engineering model is increasingly being expanded in scope and aligned to wider digital transformation initiatives.

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Ross Mansfield



Head of Systems Engineering, BMT

Ross is currently the Head of Systems Engineering for BMT, specialising in Defence & Security. The team work across maritime, land, joint, and defence digital, providing full project lifecycle consultancy support to our customers.

Ross has significant experience in integrated digital design and system simulation and modelling, and has worked across civil aerospace, defence, energy and medical sectors. He has implemented pioneering digital twin systems in the oil and gas and energy sectors and worked closely with academia on developing prognostic methods for condition based maintenance applications.

Ross has a background in simulation and modelling of platform dynamics and platform systems, using these models to inform the design process and develop control and automation strategies and software. He has a strong interest in the use of digital twins at all stages of the project lifecycle to manage risk effectively and to optimise assets throughout their lifecycle.



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Jake Rigby



Research and Development Lead, BMT

Jake is a chartered engineer and Honorary Professor at the University of Exeter. His role involves the portfolio management of BMT's internally funded research work supporting our customers and strategic initiatives in a range of areas including Digital Transformation and AI.

He also looks after academic engagement, ensuring new and emerging technologies from academia are pulled through into industry.

He is part of BMT's horizon scanning team, highlighting and mapping external signals and trends. These signals can be explored to stimulate thinking about the range of future possibilities.



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The complexity of twins

To provide benefits across an entire enterprise, a digital twin must be more than a single entity.

Fully-featured digital twins will be realised as a family of twins, each of which matures and grows in depth and value through its life.

The models used to support asset performance may differ from those used in design and development, but there will be clear data linkages across all of these model sets that need to be managed. Twins will both consume and create high volumes of data throughout their lives.

Several coherent twins will be created in the design phase, from basic 3D geometric and design information through to complex high order simulation models and wider design information management. This "Design Twin" set will mature through the build phase to create a "Manufacturing Twin" - a key enabler for the future digital shipyard.

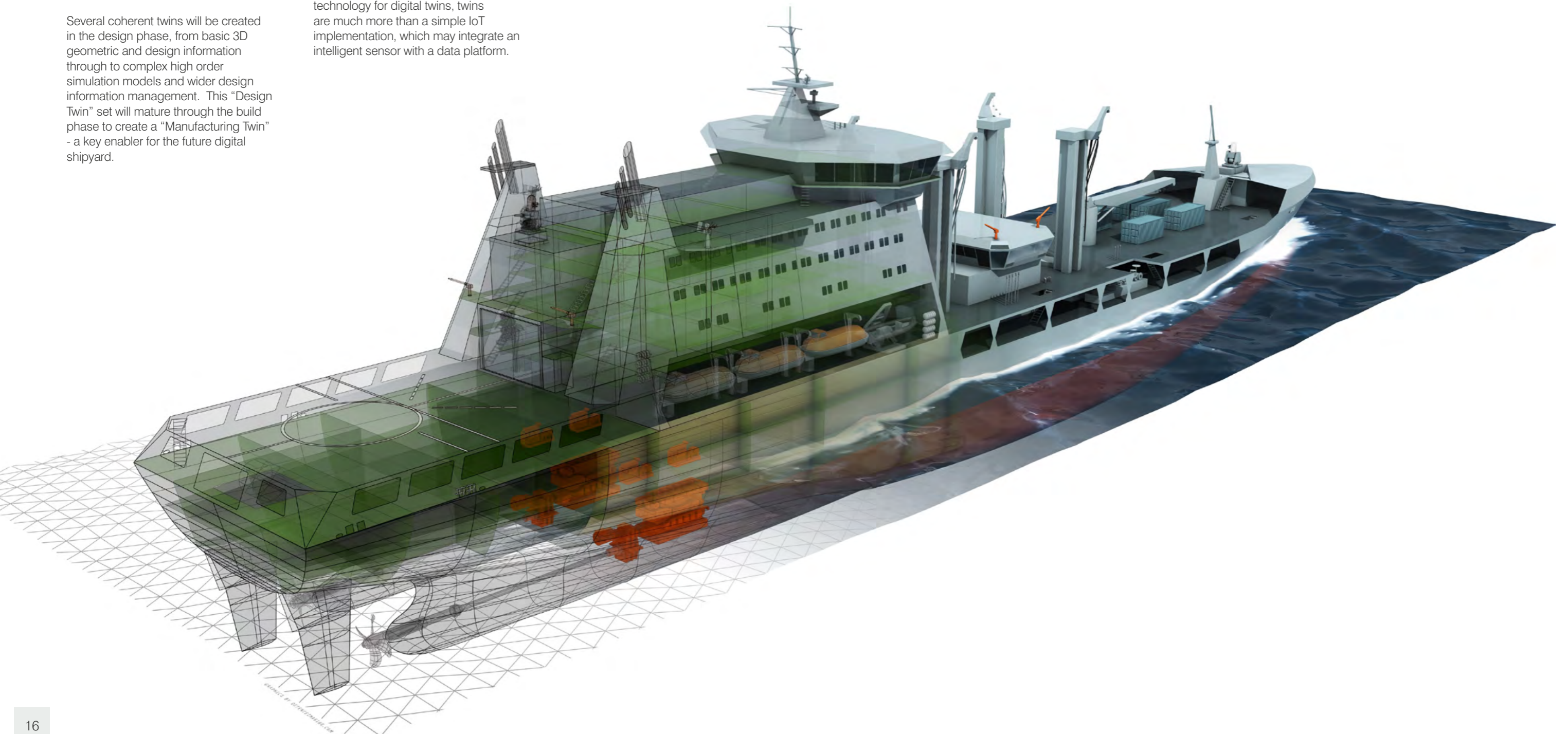
This evolution will continue through to the in-service phase, where sensor inputs from the physical asset will help realise the final "Digital Twin." Further models will need to be created at this point, typically fast surrogate models that include a measure of their own uncertainty to effectively provide predictive and prognostic outputs in response to real-time input data.

The creation of a twin is therefore a complex process and relies upon a continuous digital thread throughout the lifecycle.

Although IoT is a key enabling technology for digital twins, twins are much more than a simple IoT implementation, which may integrate an intelligent sensor with a data platform.

Twins bring together on-platform sensing with other data sources (e.g. environmental data, historical maintenance data) and match this data with a set of models, applying analytics and machine learning to enable predictive and prognostic insights. These insights provide effective decision support in an intelligent asset management context.

Due to the complexity and volume of data, the effective visualisation of twin outputs is critical to enable usability and layered consumption of data.



Digital twins: Why now?

The concept of a digital twin isn't a new one - the term was first used in 2002 and the original information concepts date back to the 1980s.

However, there are several enabling factors that are coming together to accelerate the implementation of twins. The first of these is cheap, high bandwidth sensing availability - IOT is a key enabler for twins.

The second is 'big data', there is now an abundance of cheap data storage and associated advances in data management and mining.

The third is the increased accessibility of the high-performance computing (HPC) required to manage the computing burden of a functioning twin.

Finally, advances in integrated design and analysis environments are creating key digital threads at the start of the lifecycle, enabling the later creation of a twin.

These design digital threads link 3D information and multi-physics with integrated data management to create a configuration managed environment that can be maintained and augmented through production.

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Challenges to adoption

Within the defence maritime enterprise, many of the challenges to adoption do not just come from the technical domain, but also as products of the commercial and supply chain environment.

Defence maritime has traditionally contracted separately for design, build and maintenance contracts. These contracts are focused on providing physical equipment rather than data and models and this approach typically requires the involvement of multiple prime

contractors for each asset through life, along with a correspondingly complex supply chain network.

There is currently no mechanism to allow data and digital models to flow freely and securely through this enterprise whilst protecting Original Equipment Manufacturer's intellectual property. It is likely that a future digital twin for defence maritime will span multiple solution platforms, multiple companies, and multiple solution platform vendors.

BMT's focus

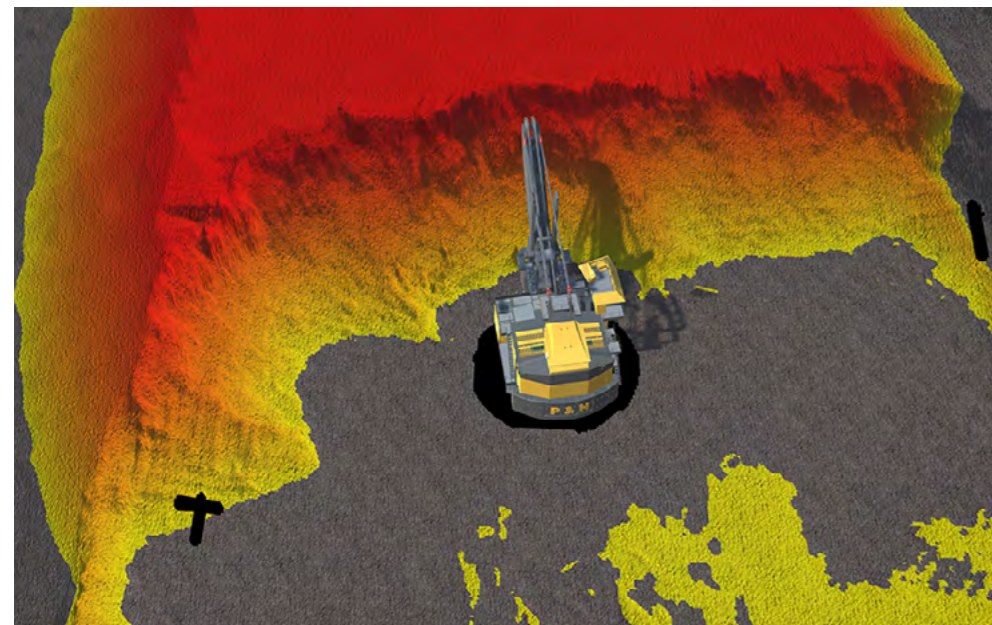
BMT sees digital twins as a key element of industry 4.0, having seen the benefits and savings they are bringing to our customers. BMT's Whole-of-Mine Digital Twin is just one of many bespoke examples.

Built on our Remote Operations Automation and Robotics (ROAR) software platform and using lidar mapping capabilities and expertise in 3D algorithmic decision making, our solution integrates precise terrain data, machine data, health data and production metrics into a single 3D immersive and intuitive interface.

This allows production teams and planners to measure, monitor, report and optimise mining operations in real-time, reducing costs and risks.

BMT continues to develop and expand our digital twin technology into other submarkets, with ongoing projects that are delivering Autonomous TLO (Train Load Out) Digital Twins, Hopper Surface Mapping and Wagon Surface Mapping solutions for train unloading rail operations, for example.

Other technologies are in development for Stockyard Mapping and Ship Hold Surface Mapping for bulk materials handling customers in ports.



Future maritime defence digital twins

To support future maritime defence digital twins, we're taking a multi-threaded approach through a range of internal strategic initiatives and R&D activities, as follows:

1. Digital threads in design, enabling the creation of the twin

We're mapping out our design toolset of the future for ship design, creating an integrated digital design twin with advanced integrated simulation and analysis capabilities that allow the left-shift of risk from physical testing back into the design phase.

2. Integrity, security

End-to-end (sensor to decision) secure data transmission, management and verification; digital twin cyber threat detection, protection, response and recovery. A digital twin ship or fleet is susceptible to threats that are similar to those seen by physical ships.

3. Interoperability, supply chain engagement

Federated twin high level architectures and APIs that enable prime contractors and OEMS to support a digital ship with 'digital equipment' whilst protecting I.P. and ensuring the interoperability of 'digital assets'.

4. Digital twin return on investment

Research into future intelligent asset management - a digital twin creates value when embedded into a holistic intelligent asset management system, supporting decision-making and business model optimisation at portfolio and organisational levels.

These solutions not only highlight our abilities and expertise in developing bespoke customer solutions, but are also a testament to our commitment to Digital Transformation programmes in the industries we serve.

The Role of Artificial Intelligence in Digital Transformation

A conversation with BMT's Principal AI Lead, Dr Esin Turkbeyler

It was Dr Turkbeyler's natural interest in maths and physics that guided her towards a degree in electrical engineering, but her journey into Artificial Intelligence really began after she won a NATO Science Scholarship and started her PhD at Imperial College, London.

"This was towards the end of the 90's", she says, "when several scientific theories and techniques converged into AI."

But what exactly is AI?

"Well," says Dr Turkbeyler, "many of our customers ask the same thing and really, they just want to understand how it can benefit their businesses. Artificial Intelligence algorithms", she says, "are learning algorithms."

"They aren't rules-based. They reason. Some even self correct, learning from successes and failures. In short, they use computer systems to simulate how human intelligence works.

"AI can help make complex decisions at great speeds based on vast quantities of data, rather than human interpretation or instinct, which can be slow or flawed. They detect patterns, anomalies and threats and can produce predictive analyses to forecast what's most likely

to happen next and, therefore, what the best available option is likely to be. This is why they are so good for predictive maintenance and cyber security as well as scheduling and planning.

"Given the amount of data that organisations now have access to, you can see why they want to understand it to make accurate analysis and predictions. And given its potential to save time and money, it's clear why data has become so valuable.

"It also explains why human-machine teaming has thrived, because at what point do we let a computer make the decisions and what happens if an algorithm gets it wrong?"

After earning her PhD, Dr Turkbeyler started applying AI theories to solve real-world problems. She worked in the field of computer vision, processing video footage by recognising images and detecting and tracking the movement of people.

"The development of computer vision learning algorithms was a great field to be working in at the time", she says, "Humans take for granted the speed at which our brains can process the complexity of what our eyes are seeing, but computers struggled to make sense of these images, detect movement, and identify a person between different field of views.

Identifying problematic scenarios

"The quality of video footage from static surveillance cameras can vary, as can the lighting, so we'd need to identify each problematic scenario and programme an algorithm to help a computer understand how to deal with it.

"With footage from a moving drone, for example, a computer would perceive everything to be moving, including the ground and buildings, so we'd have to programme algorithms that could differentiate between a building that's actually static and the movement of people."

Data fusion and decision-making

Towards the end of the 2000's, Dr Turkbeyler became Technology and Team Lead in Data and Information Fusion, where she and her team integrated data from multiple sources and sensor outputs such as sound, images and radar to enable computers to create a complete operational picture.

Their work with Bayesian networks, taught algorithms not just to distinguish images but to start making decisions for themselves. This is the same technology that's used in autonomous ships and vehicles.

Cont'd ➔

Esin Turkbeyler



Principal AI Lead, BMT

Esin has significant experience in AI for the last 30 years. She has developed several AI based solutions in Computer Vision.

She has delivered many projects using earlier AI techniques to recent Deep Learning algorithms for Defence and private industry.

She has been PhD supervisor to several students researching AI in the fields of Computer Vision and Knowledge Representation at leading UK Universities.

Dr Turkbeyler now oversees a team of Data Scientists and AI specialists who apply AI in a huge range of fields, from satellite data, imagery, text data, natural language processing to cybersecurity.



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“ At what point do we let a computer make the decisions and what happens if an algorithm gets it wrong? ”

Ask Esin Turkbeyler, BMT



Deep learning and deep neural networks

Later, Dr Turkbeyler and the team began working successfully with deep learning and deep neural networks because there was now an enormous amount of data available from social media in the form of text and images. While huge advances in the processing power of hardware meant that they could train powerful new algorithms more quickly.

Now, it wasn't just a case of recognising faces in images or identifying objects - industries could use AI to detect impurities in images and reveal imperfections in production line components that are imperceptible to the human eye, reducing future re-work.

Today's applications

Today, Dr Turkbeyler oversees a team of Data Scientists and AI specialists who apply AI in a huge range of fields, from satellite data, imagery, text data and natural language processing to cybersecurity.

"AI, together with Intelligent chatbots and robotics, are making a big difference to companies and are a relatable example of how cutting-edge technology like Artificial Intelligence and Deep Learning drives Digital Transformation and changes the way companies operate.

"There's lots of hype about AI", Dr Turkbeyler cautions. "But practical cases can vary widely, from helping companies gather and analyse data from sensors, images, files, audio, video and documents, and collating these into a complete operational picture to using machine learning to digitise technical drawings, documents. This is one of the first steps on the journey towards producing design digital twins.

"It can be about helping businesses with small Digital Transformation projects, where they can explore how AI can remove the manual aspects of what people do, so that they can add value in other, more meaningful ways. In this context, human-machine teaming helps to build skills and confidence and drive the challenging cultural changes associated with Digital Transformation."

Algorithmic biases, trust and ethics

Other commercial applications of AI include those that determine a person's age or their sentiment from an image. In the rail industry. Using CCTV cameras to detect 'destructive and unusual behaviours' can help prevent incidents by alerting an operative that someone might be about to engage in risky behaviour. But, while these applications may set out to save lives, they do start to raise some very ethical questions.

"At BMT, we're particularly mindful of how biases can pervade each stage of the data journey, from the origination of the data itself, to those tasked with using it to programme an algorithm. The team pays attention to the training data given to the algorithm to learn, to ensure inputs are varied and unbiased. If left unchecked, these biases can reinforce, rather than correct, the systems and practices that discriminate against vulnerable communities on the basis of race, ethnicity or disability, among other factors."

One such example is the idea that future crime can be predicted based on police data of arrests and incarcerations, where it has been well-documented that these have disproportionately targeted the black community.

In this age of Digital Transformation, it's more vital than ever that our scientists and engineers are as neurologically, ethnically and linguistically aware and diverse as possible.

AI in smart cities and disaster relief

"On a more positive note, we see local government using AI to improve services by detecting graffiti and potholes, while utilities companies can optimise energy usage by predicting demand and regulating the amount of renewable energy supplied to the grid.

"We've been able to use Deep Convolutional Neural Networks and Generative Adversarial Networks in Rapid AI Mapping project work. This turns satellite imagery into usable maps that allow geospatial analysts to automatically extract map features, like roads and buildings to support urgent disaster relief operations."

Biomimicry in AI and Swarm Technology

"By mimicking nature and applying deep reinforced learning algorithms, our scientists have taught drones to perform a perched landing, as a bird would do and are now teaching a swarm of underwater vehicles to collect information collaboratively and return it for analysis", Dr Turkbeyler shares. "This is something that would previously have been complex and expensive for human operators to do."

AI in design and engineering

BMT research and development also extends into applying AI towards traditionally computationally complex problems like fluid dynamics. By using our wind speed data sourced from thousands of fluid dynamics projects, we are working towards shortcutting the often expensive and time-consuming task of scale model testing, reducing the number of design iterations needed.

The future of AI

And this brings Dr Turkbeyler to the future of AI. "Robotics and AI will keep making our daily lives easier", she suggests, "and we won't even notice it's happening. But trust and ethics will remain paramount, a principle she describes as 'explainability'. In other words, we shouldn't use AI algorithms if we can't explain how they came to their decisions. At the same time, less scrupulous groups are using AI technology for political and financial gain, whilst ignoring ethical standards, so this issue must be understood and addressed and testing and verification will dominate this field, especially for safety-critical systems.

"So, whilst this is an interesting time to be working in this field" says Dr Turkbeyler, "our focus remains on helping our customers to shape a future in which AI is ethical, accountable, responsible and transparent."

Exploiting Behavioural Science to Support a Digital Transformation Programme

The introductory article in this edition alluded, not just to the importance of establishing technical architectures to support a Digital Transformation programme, but for a complimentary ‘action architecture’ to be created by the Senior Leadership Team to enable behavioural change to take place.

Whilst numerous Digital Transformation programmes successfully deliver the technological change, persuading stakeholders to embrace and fully exploit the new tools and functionality that they will have at their disposal can be an uphill battle.

This can be achieved by establishing an effective and inclusive ‘action architecture’, but many programmes insufficiently resource them or fail to establish one at all.

For six decades now, researchers have studied human behaviour and there can be little doubt that there’s a science to the art of persuasion. One of the most eminent and respected behavioural scientists in this area is Professor Robert Cialdini.

Cialdini has studied this phenomenon for years, his management books have sold millions and organisations embarking on Digital Transformation programmes would do well to read his work.

Cialdini’s 6 principles

Cialdini’s work in this domain has determined six factors that guide human behaviour. These are: Reciprocity, Scarcity, Authority, Consistency, Liking and Consensus.

If Digital Transformation Programme Board members are able to understand these shortcuts and can employ them in an ethical manner, then the likelihood of stakeholders

being persuaded to change their behaviours can be significantly increased and this will enhance the likelihood of the benefits being realised from a Digital Transformation Programme’s Business Case.

Readers wishing to read more on Cialdini’s work can find it here.

Applying principles of persuasion to a Digital Transformation programme

There are numerous ways that Cialdini’s principles can be applied within a Digital Transformation Programme and these are likely to depend on the culture of the company and the willingness of the Programme Board to use them. Here we explore the use of Authority, Consistency and Consensus.

Authority: This principle is about the concept that people will follow the lead of knowledgeable and trustworthy experts. So if stakeholders believe that there is unanimous support for the programme from the senior leadership team and the external company that has been brought in to support the delivery of the programme is credible and has a solid track record of success, then they will buy into the change. This might include testimonials of the previous programmes that they have supported and the business benefits that have been realised by previous clients.

Jon Heaton



Lead Cyber Security Consultant, BMT

With over 30 years’ experience in the communications industry, Jon’s experience was primarily accrued from a full career in the British Army where he completed a myriad of roles and deployments including his final 7 years being spent in cyber appointments.

Jon is the cyber capability lead within BMT’s Technology and Innovation Services (TIS) team, where he heads up a burgeoning cyber practice that is currently delivering a number of high profile contracts and looking to grow further.

Jon has a particular interest and expertise in the human elements of cyber security, instigated through an MSc dissertation in the domain. He is also a Chartered Engineer, Chartered IT Professional and an active Fellow of the British Computer Society.



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Consistency: This principle is predicated on the idea that people are partial to things that they have previously said or done. So, by engaging with stakeholders early and asking them for a small commitment or action, it will then be far easier for this commitment to be increased rather than delaying engagement and then asking for a significant commitment when change is imminent and required. A Digital Transformation Programme could therefore release a Beta version of a future tool to get users familiar with some of its mechanisms for building cross-functional support across a less-siloed organisation, in preparation for migration to full functionality later.

This breaking down of organisational silos (and internal vertical alignment and open architecture structures) supports a culture that is far more inclusive and agile, and one that is not shy of cross-functional collaboration.

Consensus: The final principle that could be applied is Consensus. This is particularly useful as it is most applicable when people are uncertain. This is when stakeholders will choose to look at the behaviours and actions of their co-workers to determine their own. If these social norms are supportive of the programme, then they are more likely to buy in too.

This could be applied by promulgating statistics of the number of staff that are already using a new tool or piece of functionality, along with recommendations of its utility. When uncertain users see this level of adoption, they are far more likely to follow.

As these simple steps require few resources to implement while yet yielding significant benefits, including a significant ROI on a business’ strategy, shareholder value and team morale, it seems a no-brainer then for programme teams to consider persuasion science as one of their delivery agents.

“ It seems like a no-brainer for programme teams to consider persuasion science as one of their delivery agents. ”

Jon Heaton, BMT



Creating Digital Trust in Systems

“Digital technology is re-shaping nearly every aspect of daily life, including how we interact with each other and what we expect of people. As a result, our cities are becoming increasingly transformed through digitalisation and data, re-inventing how our urban economies function and how people live and work”, says Freyja Lockwood: Smart City & Innovation Manager, Bristol City Council.

“There’s a major focus on the digital economy providing a rich source of data about people, places and things - especially personal data. Both the public and private sectors are looking at how they can exploit these technologies in our cities to improve services, reduce costs and open up new markets with disruptive economic models.

“In the digital economy, cities are a key setting for the collection of the data that enables modern technology and service firms to thrive, from sharing economy platforms like Uber or Airbnb, to providers of the technology that power local services.

“But as the lines between human agency and smart agent-like devices become increasingly blurred, there’s an emerging challenge in building trust and public acceptance. With these new threats and governance challenges come fundamental questions that we should be exploring in order to understand how to develop systems that people trust and to unlock the immense opportunities that Digital Transformation can bring to citizens and their city spaces.”

And it is precisely this challenge - that of developing safe, high-integrity systems - that Dr Chris Mobley, Founder of Blueskytec set out to address when he founded his company in 2013. Having observed that military systems and submarines had implemented strong cyber security and secure data links to protect against online interception and malware propagation, Dr Mobley did not think the same could always be said for the proliferation of connected IoT devices that were being rolled out and that are at the core of future infrastructure.

So he found a way to secure the data that feeds into high-value, mission and safety-critical assets such as drones and UAVs, satellites, ships, autonomous cars and the platforms and digital systems that are making our cities smarter, more connected and more ‘bullet-proof’ against potential cyber penetration or electronic attacks from known and unknown sources.

“Integrity is the root of all trust - whether this is between people or systems. With our technology, we assume that all communications are compromised and lack integrity unless they share our technology’s backbone. We believe that a physical asset needs to be physically secured with hardware”, says Dr Mobley.

His patented hardware and encryption techniques create a physical ‘trust anchor’ among system components. Something that can serve as proof of absolute trust between devices in a system, like a secret handshake among friends or a secret code phrase.

Except this handshake or phrase cannot be shared, observed or understood by outsiders and, according to Dr Mobley, guarantees absolute data security when applied. This hardware-based trust anchor works by pre-placing a block of coded key material into any physical asset or system to create an infallible root for trust between those systems.

Cont’d →

Freyja Lockwood



Smart City & Innovation Manager, Bristol City Council

Freyja leads Bristol City Council’s City Innovation Team. Along with the city-wide partners, the team is exploring, developing and implementing ‘smart’, citizen-centred solutions to improve their city space.

As a chartered Human Factors specialist and systems thinker, Freyja brings a people-centred approach to technology-driven change. In 2017, she co-authored the widely cited Global Marine Technology Trends 2030 Maritime Autonomous Systems that explored the potential impact of emerging technology on the maritime sector.



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Dr Chris Mobley



Director and Founder of Blueskytec

Dr Chris Mobley has a background in defence and national security on both sides of the Atlantic. He worked on electronic warfare projects before moving into cryptographic solutions to secure the UK’s battle space with MoD and GCHQ.

His work with his colleagues for US and UK intelligence agencies provided a deep understanding of future cyber security threats and led to the development of technology using a quantum derived hi-grade crypto to secure control systems and monitor anomalous behaviour utilising machine learning.



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In Columbia, these assets happen to be bikes. Here, they are working with local government on a smart city initiative to address air and plastic pollution by incentivising young people to collect plastic bottles. These bottles are crushed to create colourful bicycle frames which are fitted with Dr Mobley's patented technology and environmental sensors.'

"In this way, young, inner city people get access to bicycles in exchange for cleaning up plastic waste and the data from the sensors helps parents and local government securely track the location of the bikes, along with CO2 levels, speeds and the state of local roads", says Dr. Mobley.

But the asset could also be an autonomous car. "If we think about the Artificial Intelligence (AI) that we're training, like those in autonomous cars, we assume that we're operating that car in a benign environment, but this isn't necessarily true".

"There are people who are also training AI to do bad things, who may get hold of an unsecured device with the intention of altering its base programming. Dangerous situations like these need to be avoided.

"For the AIs in autonomous cars to function correctly, they must upload the information they've gathered during the day into a database to be shared with other AI cars".

"This is then rolled back out overnight so that all the cars can benefit from what that one AI has learnt that day, allowing a car that is operational in sunny California to learn how to drive in snowy weather conditions from one that's operational in Austria, for example. It knows because the other cars know!

"But this key process of AI training is open to abuse from malicious actors if the data exchange is not secured. For these systems to be safe and reliable, their integrity is critical. We need to be able to trust these systems and know that the updates we are getting from other AI systems and environmental sensors are also trustworthy.

"Training AI algorithms on untrusted or infected data could cause it to make bad decisions, which would be catastrophic in the case of a car. And if humans start to see that autonomous cars are showing signs of not behaving properly, then they will cease to trust them" says Dr Mobley.

"By using a 'trust anchor', an autonomous car can drive off round the countryside and we can digitally ask it questions. If the right answers come back, then we know we are speaking to the right car and can exchange information we can trust. Equally, that car will know not to respond if it gets questions from a device that is asking it the wrong questions." This simple exchange methodology can be used to create trust", says Mobley.

Securing data between physical industrial systems and IT systems is fundamentally different.

"When people think about cyber security, they are often thinking about securing just IT systems, where confidentiality, integrity and availability (CIA) of the system are what matters most to the user", says Mobley. "But with digital twins and industrial instrumentation systems and sensors, where data interacts with humans, this paradigm is flipped and the most important factor is that the device and the data are safe to use.

"Blueskytec's digital anchors are manufactured in the UK through a trusted supply chain and ensure that IoT/IloT devices talk to their endpoint server first, before talking to the cloud.

"This guarantees data security and addresses the trusted systems paradox.

"As we move towards autonomy, hyper connectivity and embrace AI at scale in our future cities, we must elevate our thinking about security and integrity of the systems we are developing. We must understand the social implications and work to build people's trust.

"Without a solid foundation that encompasses an individual's or company's or society's Security, Privacy Safety and Ethics, these latest advances and applications in IoT/IloT technologies will be significantly undermined and will result in the proliferation of new threats and vulnerabilities".

“ As we move towards autonomy, hyper connectivity and embrace AI at scale in our future cities, we must elevate our thinking about security and integrity of the systems we are developing. We must understand the social implications and work to build people's trust. ”

Dr Chris Mobley

Digital Transformation Needs a Diverse Workforce

Dr Nancy Doyle, Occupational Psychologist and CEO of Genius Within

Digital Transformation is well underway, with Cloud usage the norm and connectivity bringing the Internet of Things into everyone's life, with recent events accelerating this process beyond our imaginations.

As well as AI and robotics in manufacturing and logistics, we've heard about digital adoption in the service sector with mindfulness apps replacing counsellors, chatbots used in call centres, and facial recognition 'improving' selection and assessment in HR teams. How worried should we be about these changes from a personal perspective and will the promised benefits outweigh any negatives?

The World Economic Forum report in 2016 produced a table of 'winners' and 'losers' in the AI revolution, highlighting a growing digitally-enabled service sector for those people who have enhanced discretionary spend for the first time. Disability inclusion is being transformed through technology. We now have the power to create, record and communicate without relying on dexterity, sensory ability and literacy. Remote working also creates accessibility for those with muscular-skeletal disability or social anxiety.

However, as with any enterprise technology, we need to keep a close eye on the widest possible population when considering adopting or even allowing technology to transform our working lives. 15-20 per cent of the UK population has a neurodevelopmental or acquired condition.

Whether it's an individual with ADHD, Dyslexia, mental health issues or anxiety, it's clear neurodiversity can no longer be seen as an anomaly.

And, when you add neurodiversity to the number of people with a physical disability, it's easy to see why organisations need to think differently about their workforce's needs in relation to Digital Transformation.

In HR, for example, visual recognition software being used to pre-screen candidates via video link doesn't allow for sight-loss, facial tics, paralysis or autism. AI can have inherent bias written into the coding and Machine Learning is almost impossible to 'correct' in comparison to other code-based software as it's no longer possible to single out an error.

More and more high-profile organisations, are already seeing neurodiversity as a talent strategy and recognise the strengths neurodiverse people can bring to the workplace. University College London reports neurodiversity diagnoses for over 50% of their undergraduate engineering. We're shifting the entry barriers for unusual thinking styles and placing it firmly in the talent agenda as the demand for analytics, problem-solving and radical innovation grows.

And, at the management level, we are going to need higher cognitive flexibility, critical thinking and innovation, with team leaders who can respond and change; managers who can park their biases and welcome a diverse team, maintaining their own learning while attending to others.

With Digital Transformation, all organisations need to become learning organisations. It's time to welcome in the new. Our customer base needs to be reflected in our staff team, in order to ensure we design for all.

New technology, new ways of working and a more diverse group of talented colleagues are needed more than ever; unusual minds for unusual times.

Nancy Doyle



Occupational Psychologist and CEO of Genius Within

Nancy is a Registered Occupational Psychologist with 20 years' experience of assessing, coaching and researching neurodiversity at work. Nancy has always worked closely with Occupational Health, HR, Managers and individuals to ensure win-win solutions.

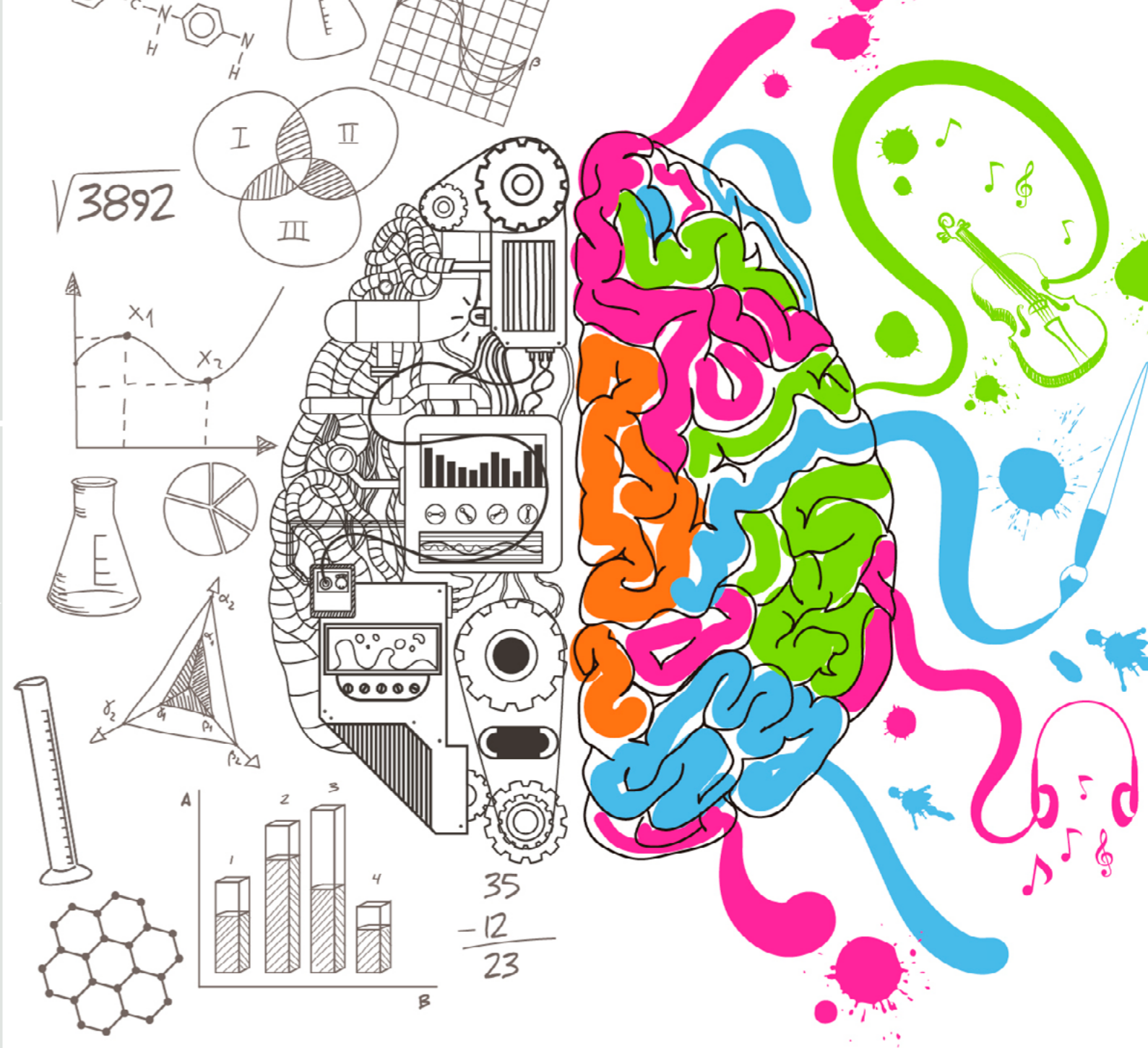
Nancy has delivered on New Deal, Work Programme and the National Offender Management Service and is committed to promoting the talents of neurodiverse people as a means of social inclusion. Nancy was part of the development and delivery of the Royal Television Society's Documentary of the Year 2016, 'Employable Me'. This BBC series illustrates the difficulties that people with disabilities face in modern workplaces and how these can be overcome through Positive Assessment and simple reasonable adjustments.



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“ We are a committed equal opportunities, employer that aims to recruit, retain and motivate the best talent from all sections of society. We take pride in being an inclusive organisation where everyone is treated with respect and dignity, and where their unique contribution is sought after and valued.

Our diversity drives creativity, better decision making and innovation and helps to create a culture of equality alongside higher levels of employee engagement. Like most consulting industries ours has changed and is changing, but the industry needs to keep working in this area to realise the business benefits of having diverse teams and inclusive environments.

Our HR Strategy has at its heart the need and necessity to have more diverse and inclusive representation as part of our wider strategic workforce planning, and this is true for all roles from juniors to seniors, across our global community.

During the last few years we have rolled out a broad range of learning and development programmes to all our employees including a 'Young Professionals Network', 'Consulting Woman Programme' 'Employee Engagement Group' and training in Diversity and Inclusion'.

Diversity and Inclusion also feature strongly in our competency framework and in our Leadership Programmes. We are about to launch a 'Recruitment Passport' where all our recruiting managers will undertake specific training in selection and recruitment with an emphasis on recruiting from as diverse a pool of candidates as is possible to enrich our inclusive culture and innovation across BMT.

If you are interested in finding out more, either about BMT's Diversity and Inclusion activities or the work of 'The Genius Within', please contact the editor. ”

Anne Segall,
BMT's HR Director



Joining Forces With Bayards UP

We proudly announced our partnership with Bayards UP, the inspection and maintenance division within the Bayards Group, to jointly provide helideck services in the Gulf of Mexico. With our local presence in the Gulf of Mexico, we'll carry out all helideck inspections and friction tests for Bayards UP, thus using our joint knowledge, experience and skills to provide the best helideck related services for our offshore clients in the region. Subsequent additional services required as a result of the inspections, such as maintenance, surface friction reinstatement, replacements, repairs, upgrades or spare parts, will be provided by Bayards UP.

STEM home challenge for students between the ages of 10 and 16

Earlier this year, we launched a Science, Technology, Engineering and Maths (STEM) home challenge for students between the ages of 10 and 16. We asked students to use their STEM knowledge to tell us how Transport, Drones or Satellites could be used to save our planet.

We were very impressed by the level of entries that were submitted and are delighted to announce Arushi as the winner.

Arushi designed a dragonfly drone to track down and trap locusts in Asia and Africa. Arushi hopes that her design will improve food security, by keeping locusts away from crops.

"It was really inspiring to see that Arushi had applied a nature inspired design in her drone, to solve a very current and growing problem," commented Laura Blake, Sustainability Manager.

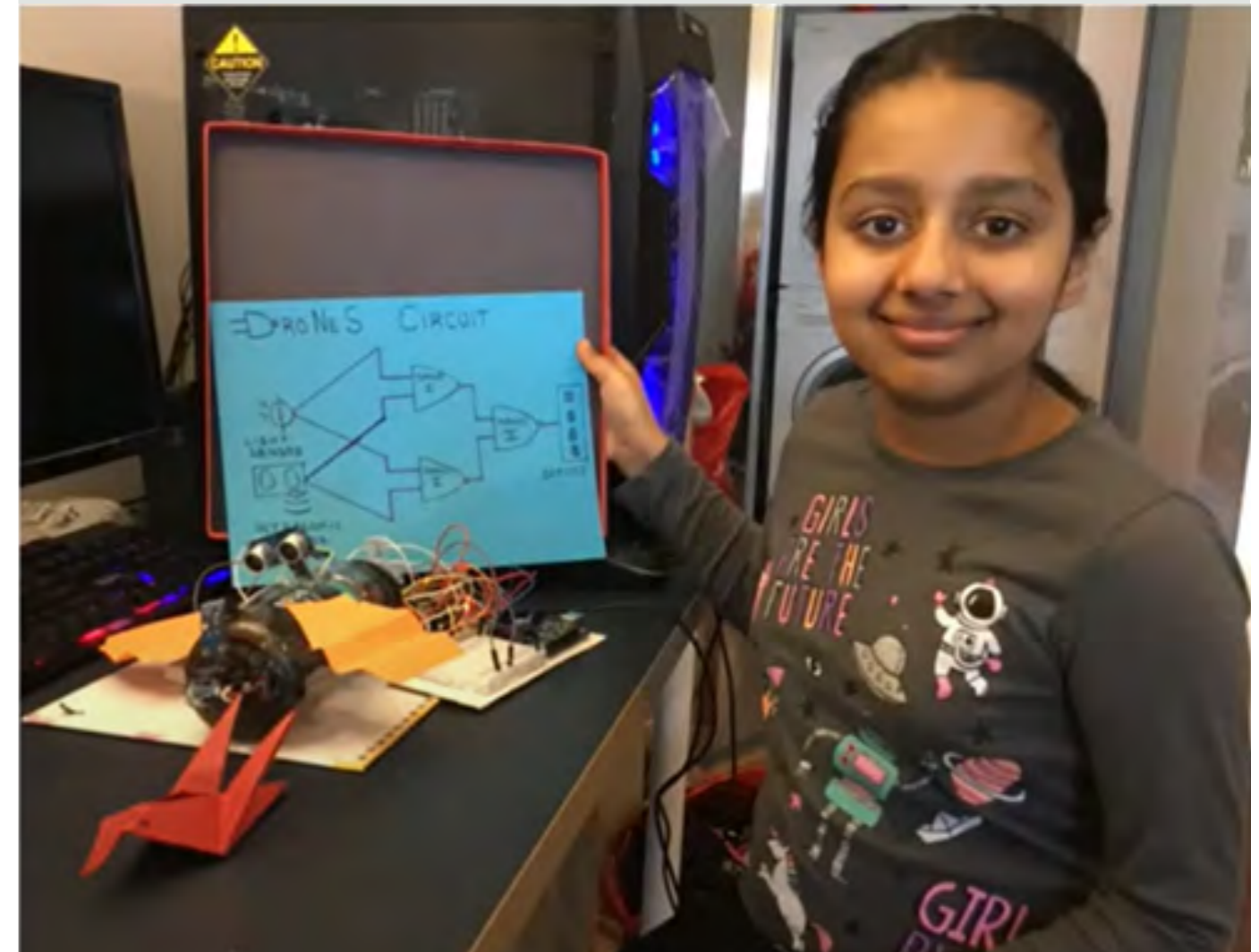
Using drones to fight off locusts is not a new concept. However, using lessons learned from nature (biomimicry), could unlock many opportunities to improve drones and improve how locusts are located and dispersed.

Arushi is a great model for the future generation. We hope her work inspires other students to use their knowledge to make a difference. We look forward to supporting Arushi, as she develops her design further.

Winning 'Support Vessel of the Year' Award

With a top speed of 30 knots, a "walk to work" system, an interceptor-based ride control system and luxurious business-class seating, our design for the Alkahfi Chief won Offshore Support Journal's "Support Vessel of the Year Award 2020" for its innovation, speed and design specifications.

Noel Tomlinson, Head of Business Development for Specialised Ship Design said "We're delighted to have won this accolade for Support Vessel of the Year. The Alkahfi Chief has set a new industry benchmark through its innovative design, efficient operation and quality of the amenities offered to the crew and personnel."





Upgrading HMAS Choules

The Royal Australian Navy (RAN) purchased the Largs Bay from the UK Royal Fleet Auxiliary in order to help support its operations around the world.

After extensive sea trials to confirm the condition of the vessel and a major refit to make her suitable for RAN services, she was commissioned as HMAS Choules.

As a 16,000-tonne amphibious Landing Ship Dock capable of carrying over 300 troops, 23 Abrams tanks, 150 light trucks, landing craft and capable of operating Navy helicopters, it expanded the RAN fleet's formidable capability to get landing forces and equipment ashore.

However, a number of the warship's onboard systems were still retained in the UK Royal Fleet Auxiliary configuration, so the Navy undertook a three-year project to carry out the necessary engineering changes that would bring the ship fully into line with Australian Navy requirements.

The vessel's in-service support contractor, A&P appointed us as in-house design support.

This represents the first time that we've had such a close and involved relationship with an International Ship Security Certificate and a major escalation in the ability to undertake engineering services on an in-service vessel.

Our Research Project Receives Grant from MaRI-UK

We are proud to be a member of Maritime Research and Innovation UK (MaRI-UK), a collaboration between UK industry and academia to jointly tackle innovation and technology challenges.

This week, MaRI-UK announced the results of its first funding call; £1.4m has been awarded to 10 organisations as part of the Clean Maritime Call, a MaRI-UK initiative funded by the Department for Transport (DfT).

One of those projects is led by us. We are investigating alternative Asset Leasing Models (ALMs) that could be used to accelerate adoption on ships for certain Energy Saving Technologies (ESTs).

ESTs are designed to improve vessel efficiency, lower fuel costs and reduce the pollution generated by shipping. By understanding existing commercial leasing models in other sectors and industries, we are hoping to harness best practice and provide a further economic incentive for ship owners and operators to adopt such technologies.



Image used with permission from Anemol Marine Technologies Ltd.

Our Marine Expertise Supports Australia's Blue Economy CRC

The Blue Economy Cooperative Research Centre (BECRC) recently announced 17 short-term scoping projects, involving collaboration between industry and research partners to guide the CRC's future.

The new projects are spread across five BECRC research program areas, involving 40 participant organisations across the world.

The scoping projects cover a range of areas, including research into the following:

- Key challenges for offshore high-energy salmon aquaculture production;
 - Integrated offshore aquaculture and renewable energy infrastructure designs;
 - Types of marine energy conversion devices suited to offshore conditions that support energy export (such as hydrogen) and storage, as well as aquaculture applications;
 - Robust site selection procedures, and environmental and operational monitoring strategies including the application of remote monitoring technologies;
- Decision support tools for identifying trade-offs and synergies among emerging blue industries and human activities; and Policy and regulatory frameworks for Australia's emerging Blue Economy.



Protecting Precious Coastlines

The Seychelles suffered severe degradation of its coral reefs after a number of mass coral bleaching events that left these fragile ecosystems devastated. The subsequent damage to the resilience of the country's coasts resulted in increased coastal erosion and flooding of local communities.

A rising sea level caused by climate change would only exacerbate the situation even further and current attempts to restore the reefs simply weren't sufficient to counteract the effects.

Faced with this significant environmental challenge, the World Bank Group appointed us to develop a strategy that would help the Government of Seychelles to implement and finance large-scale restoration of its coral reefs and improve the resilience of its coasts.

Our team of specialists worked closely with economists, the University of the Seychelles and two NGOs with coral restoration expertise to cover every aspect of the strategy.

Funded through the "Resilience to Climate Change" program of the Global Facility of Disaster Reduction and Recovery (GFDRR), upscaling of spatial scales was critical to the strategy's success, including geographic coverage for the larger populated islands of the Seychelles and increasing the extent of individual restoration initiatives.

Our holistic approach combined economics, ecology and coastal management with a strong focus on teaming with local partners. We developed a framework for evaluating the risks and opportunities for restoration in an environmental context and used this to prioritise restoration sites and activities.

We also developed an economic guidance framework which was applied to two sites as case studies, following which we prepared a detailed business case for large-scale coral reef restoration that highlighted the opportunities to take advantage of sustainable financing options. Thanks to our work on the project, the Seychelles will be the first country in the world to have a national coral reef restoration strategy.



Breaking Ice (and Records)

The Nuyina is Australia's game-changing new icebreaking research and supply vessel (RSV), intended to support Australian bases on Antarctica. Capable of deploying helicopters, landing barges and amphibious trucks to support resupply operations, and with a large moon pool for launching and retrieving sampling equipment and remotely operated vehicles, it's the world-leader for its class and provides a cutting-edge platform for marine science research in both sea ice and open water.

RSV Nuyina represents an important and significant expansion of Australia's Antarctic and Southern Ocean capabilities. So important, in fact, that the Australian government invested nearly \$2 billion to cover the design, build and 30-year operational and maintenance lifespan of the vessel - the single biggest investment in the history of Australia's Antarctic Program.

As the Prime Contractors for this prestigious project, Serco turned to us for our decades of engineering expertise and we've been instrumental in ensuring milestone achievements and capability delivery to-date thanks to our support through design, build and transition into service.

From key maintenance engineering advice to programmatic and systems engineering requirements, we've used our embedded resources and our local and international capabilities to help overcome the build and transition into service of this large and complex sea platform that presented numerous unique and bespoke requirements.

We're proud that our support of the RSV Nuyina has helped to provide Australia with a key enabler and new, game-changing capability for the future of its Antarctic program for decades to come.



'Team Resolute', a New Co-operation for Future Solid Support (FSS) Ships

BMT stands ready with Harland & Wolff and Navantia to offer a modern approach to the FSS program that will contribute to sovereign shipbuilding and prosperity for the UK for years to come.

Team Resolute combines 159 years of shipbuilding experience at one of the UK's biggest shipyards, including the two largest dry docks in Europe, with unrivalled auxiliary design experience from UK designer BMT and a world-leading auxiliary shipbuilding track record from Navantia.

John Wood, CEO of InfraStrata, said:

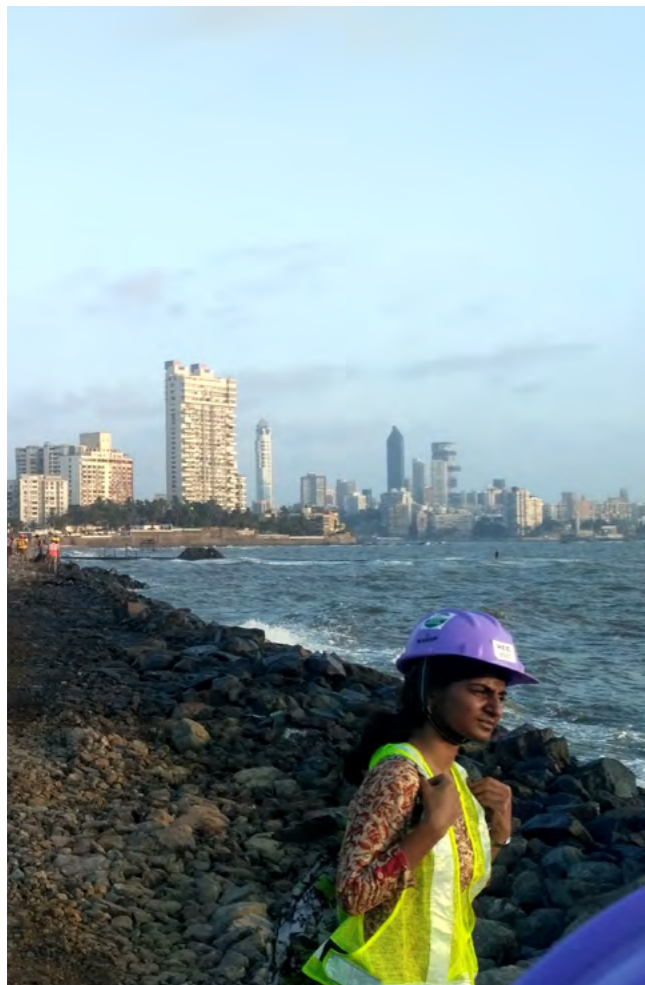
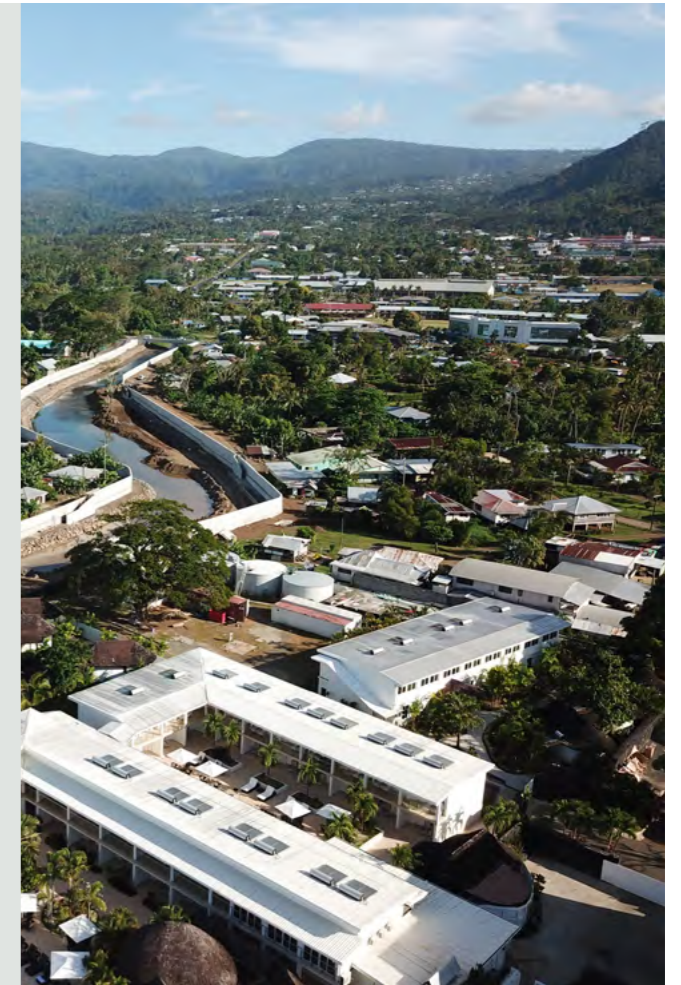
"This partnership has the capability and credibility to disrupt the UK defence shipbuilding duopoly that currently exists, providing much needed competition in the defence sector to ensure value for money and guaranteed delivery."

Keeping Samoa Safe

We've worked with the United Nations Development Programme to develop a flood mitigation strategy for the Vaisigano River in Samoa.

Funded by the Green Climate Fund, the project was vital to assessing and managing the floods and drainage in the area.

Our flood management team rose to the challenge, using our TUFLOW HPC hydraulic modelling software to assess a wide range of mitigation options to develop an optimal flood mitigation strategy. We're proud that our high-resolution flood modelling and mapping of the catchment will provide a clearer picture of how best to mitigate destructive floods and help keep residents safe.



Driving Progress in Mumbai

As the financial hub of India, the bustling city of Mumbai had to develop its infrastructure to keep pace with its booming population and the busy lifestyle of its inhabitants. The ever-increasing traffic resulted in the proposal of the Mumbai Coastal Road Project (MCRP) – one of India's landmark national infrastructure projects.

The extent of the first phase of this ambitious 29 km project is 9.98 km, consisting of three packages with roads, bridges, interchanges, tunnels, reclamation and seawalls forming the key components.

Thanks to our world-class expertise, a joint venture of the Hindustan Construction Company and Hyundai Development Corporation awarded us the design of the reclamation and seawall marine elements for 2.7 km (Package II) of the first phase of this prestigious project, further cementing our reputation as leaders in the Coastal Infrastructure sector.

Our work includes the design of essential rubble-mound seawall and reclamation fill and the subsequent update of the design to incorporate the results of physical model testing.

Creating a World-First in Train Loading Systems

We've developed the first autonomous clamshell Train Loadout System (TLO) in the world.

Not only does our ground-breaking solution deliver optimised train loading with industry-leading reliability and repeatability, but it also provides a virtual reality remote operations interface to allow operators to monitor the facility in an immersive, real-time environment.

As a result, our system ensures consistent, continuous loadout of trains that will help companies realise operational efficiencies, maximise their stockpile capacity, minimise the costly use of mobile plants, and reduce the cost per tonne handling rate.





LNG Ferries Designed by BMT Complete Sea Trials

We have successfully completed sea trials for our latest design, the first of two 70m 100% LNG-fuelled ROPAX ferries designed for the operator Rederij Doeksen in the Netherlands.

The two sisterships 'Willem Barentsz' and 'Willem de Vlamingh' were built by Strategic Marine Shipyard (Vietnam) while final outfit and commissioning were completed by Rederij Doeksen.

With an operating area within an UNESCO World Heritage Site (The 'Wadden Sea'), the main focus for Rederij Doeksen, led by its managing director Paul Melles, was to reduce the environmental impact of the vessel operation.

We supported this ambition and provided the technical solution to reduce NOx, CO2, and noise while increasing the efficiency of the design to achieve lower operational costs.

In order to support the increased traffic on the route between Harlingen and Terschelling, different newbuild options were considered. The medium speed aluminium catamaran platform was selected to achieve significant fuel consumption reduction compared to an equivalent monohull.

Having considered these requirements together with the specificity of the route, we developed the full ship detailed design.

Sylvain Julien, Director of Naval Architecture at Specialised Ship Design, BMT, commented:

“ The development of full aluminium vessels to meet national rules that typically assumes steel construction has, as always, been a challenge. Despite this, the end result demonstrates the benefits in terms of low power consumption, and specifically for Rederij Doeksen's operation, the low operating draft. ”

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