Accelerating the application of research.

Last year we outlined plans for major new programmes including the safety of complex systems, end of life decommissioning of high-hazard engineering assets and the Lloyd's Register Safety Accelerator Programme.

Highlights from our charitable activities and new grants

Partnerships with the Royal Academy of Engineering (RAEng)

Three new programmes totalling £15 million awarded in 2018 to the RAEng are now well underway with initial development and delivery. The 'Safer Complex Industrial and Engineered Systems' programme has appointed Dame Judith Hackett as chair of its programme board. The 'Enhanced Safety in Decommissioning and End of Engineering Life' programme board met for the first time in late November and agreed a focus for the first year on major infrastructure decommissioning in the oil and gas and marine sectors. The programme will also commission an evidence base identifying the major global hotspots for waste across multiple sectors. Professor William Powrie (Southampton University) is chairing the board. The 'Developing Skills' programme was announced at the RAEng annual conference for its international engineering education programmes and stakeholders on 24th September 2018, with the RAEng issuing a call for expressions of interest during the conference. Professor Peter Goodhew has agreed to chair the programme board and will contribute with his expertise in engineering education. Calls for proposals were announced in early 2019 with a closing date of July 2019. The responses are currently being reviewed.

Maritime Blockchain Labs

Maritime Blockchain Labs (MBL), a BLOC (Blockchain Labs for Open Collaboration) initiative in which the Foundation is a founding partner, was announced as a member of Massachusetts Institute of Technology (MIT) newest Solve class. Solve is a MIT initiative that advances lasting solutions from tech entrepreneurs to address the world's most pressing problems. MBL was selected for its work on developing shipping emissions monitoring, reporting and verification solutions, which build upon the blockchain-based Marine Fuel Assurance prototype developed through the Foundation's grant funding. Our grant to MBL of £490,000 was awarded in April 2018.

Assuring Autonomy International Programme (AAIP)

In 2017 we awarded a £10 million grant to York University in the field of assuring autonomy. In its first 18 months the AAIP programme has rapidly established itself. It has focused on five key areas: demonstrator projects; foundational research; international community building; education and training; and public engagement. With nine international demonstrators underway, research on dynamic risk assessment, an international community that includes visiting industrial fellows that share real world problems and solutions, user-inspired training for senior leader through to systems engineers, and public outreach through articles in *The Conversation and New Statesman*, the programme is leading in an area that has previously been under-recognised.

The AAIP programme's influence is also growing. Programme Director, Prof John McDermid, chairs the BSI's Centre for Autonomous Vehicles Advisory Board and has presented to the All-Party Parliamentary Group on Artificial Intelligence (AI). Programme manager Anna MacIntosh has been an invited panellist in Washington DC on AI policy with the UK Office for AI. The programme's relevance and importance has been acknowledged through the awarding of £10 million from the UK Research Partnership Investment Fund (UKRPIF) enabling an expansion of the programme's capability and capacity.

Sharing engineering data for the public good

In November 2018 the Foundation awarded a grant of £99,337 with the Open Data Institute (ODI) to investigate ways of sharing engineering data in industry and business for the public good. Prof Richard Clegg and Prof Sir Nigel Shadbolt (Lead author of our Big Data Foresight Review) shared the stage at the Open Data Institute summit in November 2018 to announce a new initiative using shared and open data to improve safety in our built infrastructure and across society. ODI and Lloyd's Register Foundation will collaborate together with a range of engineering and safety organisations across the UK, to identify how increasing access to data can help inform engineering design, monitor safety, and improve operations of key infrastructure.

Fullagar Technologies Ltd

A proportion of our funding for the National Structural Integrity Research Centre (NSIRC) programme awarded to The Welding Institute (TWI) in 2014 has been set aside for the accelerating research to application; in this case the commercialisation of safety enabling technology is happening through a joint venture between TWI and Lloyd's Register Business Assurance and Inspection Services. With seed funding from the Foundation, Fullagar Technologies is initially developing three products: one that can identify a serious form of cracking in pipelines; one that can cheaply monitor thickness reduction due to corrosion; and one that can prove the ongoing quality of electron beams used for joining and additive manufacture of critical components.

Next generation prediction methodologies and tools for system safety analysis

This story started when the Lloyd's Register Educational Trust awarded funding to Nottingham University to build a team researching methods for assessing dynamic (changing) risk in the rail industry. We took over that commitment when the Foundation was created in 2012 and since then have been working with Nottingham University on its direction and application. Ten years later, with Foundation support, the team has leveraged more than £6 million of additional funding from other sources and grown to 43 team members having a leading global reputation in dynamic risk assessment. The methodologies created have been openly disseminated but the Foundation is now supporting the development of the programme to include the nuclear, aerospace and other sectors. To maximise impact, Nottingham's methodology will be embedded in commercially available LR Group software called RiskSpectrum and made available to other interested parties.

HiLo

HiLO is a new not-for-profit organisation which works across the shipping industry to gain predictive insights through sharing operational data in a trusted way. Actions taken as a result of data sharing through HiLo has resulted in a 72% reduction in risk from lifeboat accidents, the risk of engine room fire reduced by 65%, and the risk of bunker spills by 25%. In total we have awarded £980,000 in grants to HiLo in two equal phases to establish their operating model. The final phase of £490,000 was awarded in July 2018.

Global Manufacturing & Industrialisation Summit (GMIS)

Globally, the development and introduction of the fourth Industrial Revolution (4IR) is accelerating. 4IR combines manufacturing and digitisation to provide multiple manufacturing benefits. Safety of those using the systems, of the systems themselves and the products have not received the focus necessary to understand or minimise risks. Working through the Global Manufacturing & Industrialisation Summit network, chaired by the UAE Ministry of Energy & Industry and the United Nations Industrial Development Organization (UNIDO), the Foundation is supporting the elevation of safety aspects to the attention of global leaders, directors of international companies and academics through the award of a grant of £249,650 to GMIS in December 2018.

Discovering Safety's first pilot study reports back

In 2017 the Foundation awarded a £10 million grant to UK Health and Safety Executive (HSE) to create the Discovering Safety programme. It's aim is to explore and unlock the value within the UK Health & Safety Executive's accident and incident data repository. The first pilot study completed during the year was on the topic of industrial 'loss of containment'. The results provide confidence that the data does contain valuable insight, but also shows how there may be better ways of collecting data that could unlock greater insight in the future.

SafetyTech

Digital technologies have enabled some sectors to advance rapidly, with FinTech and HealthTech industries as two high profile examples. There is no digital community that specifically focuses on safety and we believe that the creation of a SafetyTech community could significantly reduce the accidents that occur today. The Lloyd's Register Safety Accelerator is an important step in the creation of this community, but to successfully bring people into this space it is important to indicate the size of the market and multiple ways to engage and be recognised. We have been undertaking activity to understand better what is involved to create a SafetyTech community and what role we could play in making this happen. We will be taking this forward in our new Foundation strategy as a way of bringing multiple stakeholders together to grow investment in the safety-related market.

Future plans

In 2020 we will:

- **Initiate activity towards establishing a SafetyTech community utilising the Foundation's unique position as a thought leader and funder in this space.**
- **Our new challenge-led strategy that we are launching next year will continue to look for opportunities to accelerate the uptake and application of technology and good ideas.**

Resilience Shift

In 2016 we awarded a £10 million grant to Arup to establish the Resilience Shift (RS) programme. In 2018 four new grantees were appointed by RS to develop industry specific resilience primers. RS has worked on resilient water governance and developed and published a prototype of a digital tool, named WaterShare. Developed in partnership with the City Water Resilience Framework, Stockholm International Water Institute (SIWI) and Organisation for Economic Co-operation and Development (OECD) the tool specifically tackles the need for collaboration, for sharing information across departments, between levels of government and between critical sectors. After a global search Dr Angela Wilkinson was announced as the new director for the RS.

Polar shipping

In 2017 we awarded a £680,000 grant over four years to Aalto University in Finland to develop guidance notes on scenario-based risk management for polar shipping. It builds on previous Foundation funded research in Arctic operations to significantly update recommended practice. It enables the International Maritime Organisation (IMO), government agencies, class societies and industry to establish and maintain the highest standards of safety for shipping operations in the Polar areas.

CASE STUDY

Lloyd's Register Safety Accelerator.

The Lloyd's Register Safety Accelerator is a challenge-based accelerator programme, creating, facilitating and guiding collaboration between innovative digital startups and industry.

The Safety Accelerator is a joint initiative for public benefit between Lloyd's Register Foundation and the Lloyd's Register Group. The Safety Accelerator is run in partnership with Plug and Play Tech Centre, the largest, global innovation platform and most active venture capital fund in Silicon Valley. Our aim is to make the world a safer place, by encouraging the growth of a SafetyTech industry and accelerating the adoption of digital technology for safety.

Each quarter, the Lloyd's Register Safety Accelerator calls for applications from startups to help solve critical safety challenges set in conjunction with leading industry corporations. Successful startups receive trial funding from the Safety Accelerator to pilot their solution with the industry challenge partner and receive access to domain expertise, mentoring and entrepreneurial support to help bring their solutions to market.

In its first year the Safety Accelerator has completed four rounds supporting innovators by bringing together industry problem owners with startups possessing solutions. These are: looking at human safety on board ships; detection and management of infrastructure risks; risk detection; and data analytics applications. Example challenges include tracing food allergens, early pre-fire heat detection systems on vehicle-carrying ships, and early leak detection on Liquified Natural Gas ("LNG") ships.

Building on the success of the Safety Accelerator, work has started on investigating whether and how to establish a 'SafetyTech' community of innovators in safety. This work will include a market estimation, led by Gartner, of the value of safety technologies.