THE NATIONAL ROBOTARIUM PEOPLE CENTRED :: INTELLIGENCE DRIVEN



2022/23

INTRODUCTION

The National Robotarium is a world-leading centre in robotics and AI, based at Heriot-Watt University in partnership with The University of Edinburgh.

We create innovative solutions to global challenges, working directly with industry to research, test and develop robotic, AI and automated technologies that have a positive impact on the economy and society.

The National Robotarium uses Al and robotics to help make us safer, healthier, and more productive. Through its globally significant work, the National Robotarium develops talent and shapes the future, having a positive impact on the economy and society.



FOREWORD



Professor Gill Murray, **Deputy Principal for Enterprise, Heriot-Watt University**

It is my pleasure to present this year's National Robotarium annual report. As senior stakeholder for Heriot-Watt University, it has been a joy to see the centre fully realised after many years of planning, discussion, and construction.

As world-leaders in science and innovation, with a clear focus on advancing research to address global challenges, Heriot-Watt has invested in a number of Global Research Institutes, delivering groundbreaking science and answering some of the planet's most pressing questions. The National Robotarium is a lynchpin in Heriot-Watt's GRI portfolio, successfully forming new partnerships with industry that span research, skills innovation and commercialisation, helping to drive productivity and create new opportunities for a variety of sectors.

Its four industry residents are benefitting from inhouse business acceleration and support, with a number of them already attracting significant support from funders and angel investors, demonstrating the need to support our up and coming businesses, spinouts and entrepreneurs to innovate; a key goal in our enterprise agenda.

As well as its research and enterprise agenda, the National Robotarium and its partners are helping to nurture and grow the UK's pool of talented and creative people by delivering transformative education that removes barriers within traditional student models and seeks to build understanding and skills in robotics, data and AI for a wide demographic of workers and learners. This inspiring work helps to ensure that Scotland and the UK will have the required skills and know-how in a future that is becoming more and more reliant on automation and Al.

Centres like the National Robotarium are vital not only as innovation and incubation spaces but also for encouraging ethical discussions around our growing dependency on learning technologies. They have an incredible - and growing! - team of engineers, scientists and technicians to highlight the many benefits that robots and AI can bring to people's lives and their highly successful outreach and engagement programme has produced over 50 events in the first year, spreading the positive word about robotics and highlighting the many opportunities that the future brings. I look forward to the next part of that journey.

FOREWORD



Professor Yvan Petillot. Academic co-lead **Heriot-Watt University**

On 28 September 2022, we officially opened the National Robotarium, one of Heriot-Watt's flagship Global Research Institutes (GRIs) for robotic and artificial intelligence. As one of the first academic co-leads, I have been involved with the GRI for a number of years, overseeing its research strategy and strengthening our research outputs and opportunities alongside my counterparts at The University of Edinburgh. It is a true pleasure to see the centre fully realised and operational.

Industrial and autonomous robots have always had the potential to revolutionise how we work in different environments. Thanks to state-of-the-art facilities like the National Robotarium, we are now able to test and develop these new technologies, all underpinned by decades of scientific knowledge and interdisciplinary collaborations.

Through such cross-collaborations, we are continuing to attract significant research funding across our distinct research themes; Robotics and Autonomous Systems (RAS), Human-Robot Interaction (HRI), and Precision Laser Applications (PLA), allowing us to accelerate the advancement of robotics to work alongside or under the control of humans, helping us do things safely and more productively.

One such RAS project, UNITE, delivered in partnership with Fugro, leads on from the success of our predecessor project ORCA to develop smart robotic sensors for underwater ROVs to undertake offshore asset maintenance and management. UNITE presents the opportunity to advance the next generation of underwater technologies as well as the skills and expertise needed to support the transition to net zero.

Centres like the National Robotarium are vital not only as innovation spaces but also for encouraging ethical discussions around our growing dependency on learning technologies. While we explore these new areas, maintaining high standards in ethics, security and governance remain very important to us. It is encouraging that complementary research strands such as the National Robotarium's UKRI Trust in Autonomous Systems Node and the development of a new UK-based Test and Certification Centre for Offshore Robotics – as part of our OLTER partnership - are each addressing key ethical and regulatory questions surrounding the growing prevalence of data analytics and artificial intelligence.

These are just some examples of the National Robotarium's enormous potential to deliver worldwide economic and environmental impact that can benefit people, industry and communities around the world.

FOREWORD



Professor Oliver Lemon Academic co-lead **Heriot-Watt University**

The development of the National Robotarium shows that the UK is serious in investing in robotics and AI as part of its vision as an 'innovation nation'.

Since I joined as academic co-lead in August 2023, we have seen exciting developments across our research themes, drawing upon the expertise of highly-skilled researchers who are using the Robotarium's facilities, people, and technology to develop science-led robotics and AI solutions to address societal needs.

For example, in the area of Human-Robot Interaction (HRI), I'm pleased that both our Laboratory for Assistive Robotic living (the 'LARA lab') and the HRI labs are home to several projects focused on improving health and wellbeing. Some examples include SPRING, which has just reached an important milestone in its goal to deploy socially assistive robots in a working hospital, and EMERGENCE, a UK-wide network to shape robotics and assistive technologies for improved independent living for an ageing population.

Growing the UK's AI and robotics capabilities has also been at the forefront of our activities, and we have recently been inducted into the Alan Turing Institute Al network, which opens up opportunities to collaborate with other research centres and industry bodies within the UK's AI and data science ecosystem.

In addition, colleagues have also been successful in a bid for a new UKRI Centre for Doctoral Training in Dependable and Deployable Artificial Intelligence for Robotics, ensuring that the next generation of roboticists at Edinburgh Centre for Robotics are advancing smart robotic technologies that can interact safely with the environment and users.

As outlined in the UK Research & Innovation 2025 Strategy: "Innovation not only delivers new products and services, but it also transforms processes, supply chains, and public services. It creates new business models and enables all kinds of organisations to increase productivity and adapt to change."

A number of such projects and activities are described in this report. They showcase the real-world impact of research in everyday life and work.

These activities demonstrate the strength of our world-leading robotics and AI research programmes at Heriot-Watt University, and provide evidence that the National Robotarium is influencing robotics and Al on a national scale. I am excited to be part of shaping its future.

WELCOME STATEMENT



Stewart Miller Chief Executive Officer

Welcome to the National Robotarium Annual Report 2022/23. Since our official opening in September 2022, we have had a phenomenally busy first year of operation and I'm proud to present on our success and achievements so far.

The establishment of the National Robotarium, thanks to funding from both the UK and Scottish Governments as part of the Edinburgh and South-East Scotland City Region Deal, has delivered a global centre of excellence for robotics, Artificial Intelligence and data science.

The completion of **our £22.4m facility**, after a 2-year build beset by Covid and Brexit, heralded an exciting milestone and I'm pleased to have watched the space grow more active, with people, projects and robots, both inside and out. Recent improvements to the site include the installation of 4G technology and the erection of an outdoor testbed facility for testing all-terrain robots.

The facility is now home to a growing team of 35 fulltime staff, encompassing Robotics Engineers, Project and Business Managers, Leads for Outreach and Engagement, and other professional support staff, all of whom are passionate and driven to deliver results to our stakeholders and demonstrate to the wider world the positive benefits robotics can have on society.

Within the National Robotarium, we are **advancing** robotics science and technology to address challenges in a wide range of areas, including healthcare, social care, offshore energy, agriculture, and construction, and have formed new partnerships, working with global industry leaders, like Tata Consultancy Services, who have invested £500k of funding to support doctoral studentships, to start-up SMEs, such as our **industry resident companies** Touchlab, Crover and BioLiberty, to develop, define and produce robotic solutions that work for - and with people on a macro and micro scale.

We have a thriving portfolio of live industry projects running across our labs and have generated £1.8m in revenue from working with global names, such as Fugro, Chevron, OLTER, Thermo Fisher, Senai Cimetec, and Honda. There are also a number of exciting potential projects in the pipeline following positive discussions with other companies such as Cisco, Marks and Spencer, KLM, Scottish Water, Leonardo, Universal Robotics, Astra Zeneca, NHS Grampian, and Fife Council. The volume and variety of industries we're talking to. I think, demonstrates the clearness of our mission; that the National Robotarium uses robotics and AI to help people do things better.

It's important to properly recognise that the rapid delivery of our initial goals wouldn't be possible without the legacy and development of research. As well as supporting ongoing projects within the facility, we are actively engaging with other Schools across Heriot-Watt University, including Engineering and Physical Sciences, Maths and Computing Science, the Edinburgh Business School, EGIS and fellow Global Research Institute, The Lyell Centre, to develop new research funding, teaching and event opportunities.

We are also fostering a number of research projects with partners at The University of Edinburgh, highlighting the benefits of working across disciplines and HEIs, and cementing the success of ongoing joint ventures like the Edinburgh Centre for Robotics research and student programmes.

Another exciting prospect that will lift our international credentials is the formulation of a new Heriot-Watt Dubai arm of the Robotarium, currently being explored by our colleagues in the UAE. Such expansion cements the University's credentials as a globally connected institution that breaks down barriers and encourages international collaborations and partnerships, a key feature in Strategy 2025.

Through such cross-collaborations, we have secured an additional £9m in research funding across our distinct research themes; Robotics and Autonomous Systems (RAS), Human-Robot Interaction (HRI), and Precision Laser Applications (PLA).

One such RAS project, UNITE, leads on from the success of our predecessor project ORCA, working with international energy company Fugro, to develop smart robotic sensors for underwater ROVs to undertake offshore asset maintenance and management, removing humans from hazardous and unpredictable environments at sea.

We have also been at the forefront of developing new innovations in soft robotics, working with international partners Senai Cimatec and Shell to create soft robotic tentacle-like manipulators to improve sensing capacity and inspection of offshore units.

Other notable projects include the UK-wide EMERGENCE network, being led by HRI researcher Dr Mauro Dragone, which is using robotic technologies, smart sensors and IoT (Internet of Things) within our **Laboratory for Robotic** Assistive living (LARA) to enhance independent living for an ageing population. Also within the LARA lab is a groundbreaking study into the use of assistive robots and sensors for the earlier detection of UTIs (Urinary Tract Infections), a project being delivered in partnership with leading researchers from the School of Informatics at The University of Edinburgh which, when announced, received global media attention, including a feature in The Washington Post.

However, having such traction worldwide hasn't distracted us from delivering on our goals closer to home. Another one of our main delivery strands is to 'inspire the next generation of roboticists' and our dedicated Outreach and Engagement team has gone from strength-to-strength to drive robotics engagement across schools in Scotland and the UK. In our first year we reached a milestone of 10,000 young people engaging with us through the delivery of over 50 events, workshops, festivals and virtual lessons. This work has also raised our profile with other Higher Education and Further Education providers, creating links with Napier University, the University of Strathclyde, the University of Glasgow, and West Lothian and Edinburgh Colleges.

We have also been **building and strengthening** relationships with local, Scottish and UK Governments, with local MSP Gordon MacDonald being the first parliamentarian to visit the facility upon its completion (the Rt. Hon Michael Gove MP, then Secretary of State for Levelling Up, visited earlier in the year however we were still very much under construction at the time). The success of Mr MacDonald's tour and visit yielded an extremely positive National Robotarium-focused crossparty debate at the Scottish Parliament in January 2022, which then led to a busy few months of meetings and tours with other parliamentarians keen to see inside our new building and discuss what the future of robotics could like for the four nations.

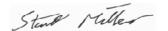
As I have said to many a politician and policymaker over the last year, centres like the National Robotarium play a crucial role in positioning the UK as a player in the global robotics network, and conversations are ongoing to **develop a Robotics Cluster**, a fully operational robotics ecosystem that moves ideas from lab to production line to market, without leaving the UK.

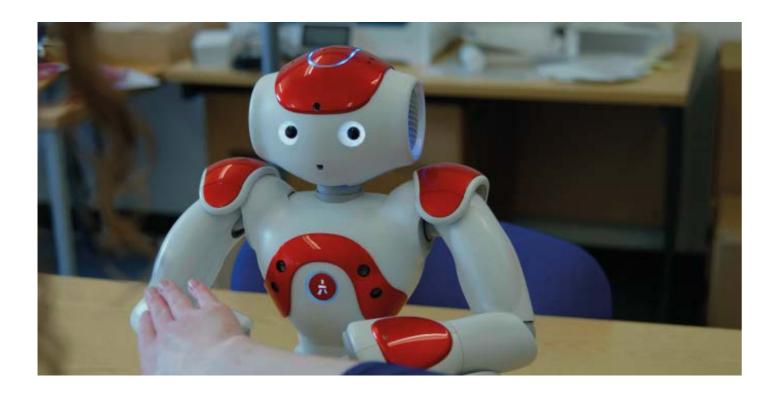
The relationship with Scottish Government has matured and strengthened over the last year to such an extent that I now have a seat on the Scottish Government **Leadership Group for Manufacturing**, which gives me the opportunity to promote the potential of this proposal to leaders from industry and policy, and I will soon be leading a new group, Robotics Scotland, focused on the development and establishment of the Scottish Robotics Cluster. We have also had a number of fruitful discussions with Innovate UK, mapping the way to expand the UK robotics network capabilities through increased investment in innovation and development.

Our collective work connecting with government, industry, educators, learners and the general public over the past year has established the National Robotarium as a leader and an authority on robotics for Scotland and the UK. I am keen we continue this momentum of engagement with audiences across demographics and am pleased that we can do this via the relaunch of the National Robotarium website. The site provides a hub of information and activity for everyone from the casual passerby to hardcore robot enthusiast to find out more about the latest goings-on as they happen.

The launch of the new website complements our ongoing engagement with followers across our social media channels. In the past year, we have **grown our** social media network by over 40% on LinkedIn and over 60% on X/Twitter. A quick look over our feeds shows a steady stream of activities, events, news and announcements. I encourage you to follow us and keep abreast of the latest goings-on as we have many more exciting updates in the pipeline.

I hope you enjoy reading about these and other developments from our first year in this report. As for the next 12 months, I anticipate we will continue to deliver apace on our existing deliverables for robotics in industry, research and society, and, quite possibly, start work on some new missions further afield. Watch this





OUR MISSION

Our mission is to use robotics and AI to:

- Help keep us safe;
- Help keep us healthy;
- Help us be productive;
- Help us develop talent;
- Help us shape the future

OUR FACILITY

Our stunning £22.4m, purpose-built facility, located on Heriot-Watt University's Edinburgh campus, has unrivalled laboratories and collaboration spaces for the testing and development of robotics and Al solutions.

Our scientists and robot engineers work with specialist, high-spec equipment and technologies that facilitate cutting-edge research and development across Robotics and Autonomous Systems (RAS), Human-Robot Interaction (HRI) and Precision Laser Applications (PLA).

The physical presence of the National Robotarium provides access to a range of incubation and colocation spaces, test facilities – including a wave tank and outdoor testing area – lab spaces, robots, and human expertise.

The layout of the National Robotarium was designed to promote **open collaboration** by placing our distinct research labs around an eye-catching and welcoming Atrium space.

The facility provides physical and visual transparency and connectivity for all building users, the mix of space types and finishes complementing the overall experience and has instantly become recognisably the **face of robotics in Scotland.**

The award-winning National Robotarium facility was designed with sustainability and energy efficiency at its heart and boasts an intelligent facade, clean energy and EV charging points.



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OUR RESEARCH

The National Robotarium is a global leader in advancing research and innovation in Robotics and Artificial Intelligence. Led by Heriot-Watt University, and supported by The University of Edinburgh, the centre promotes a vibrant ecosystem of research, building upon the legacy of scientific excellence from both institutions.

Robotics and Autonomous Systems (RAS)

The Robotics and Autonomous Systems lab focuses on the application of robotics and automation for industry. Through the testing and development of a range of **mobile robotics, quadrupeds, underwater ROVs** (remote operated vehicles), **co-bots** and **autonomous all-terrain vehicles**, our team of RAS Engineers and researchers are exploring ways that companies, from SMEs to large international conglomerates, can adopt robotic solutions to improve efficiency, staff safety and reduce costs.

Human-Robot Interaction

Our <u>Human-Robot Interaction</u> labs are specially-designed reconfigurable experimental spaces for studying how humans interact with and respond to robots. Research in the group ranges from **conversational robots with multimodal language learning** to the use of **sensors** and **IOT (Internet of Things)** to provide assistive living support and monitor wellbeing. The team address scientific and technical challenges that underpin the next generation of **user-centred healthy ageing** and independent living systems, including how to **build human trust in robots** to encourage adoption.

Precision Laser Applications

The Precision Laser Application (PLA) labs research laser-based applications from a micro to macro scale. Research groups based within the labs are the Applied Optics and Photonics Group (AOP), with a focus on the development of novel processes ranging from **fibre-optic sensors**, **laser surgery** and **laser-based manufacturing**; and the Photonic Instrumentation Group (PHI), who investigate multidisciplinary light applications, including ultrafast laser inscribed waveguides, optical fibre probes, and single photon-sensing techniques. The PLA lab research can be applied to healthcare and astronomy, amongst other sectors.

Industry-ready graduates



As we work to create the next generation of roboticists, Alspecialists and researchers, we aim to attract the brightest minds and entrepreneurial brains to produce highly-

skilled graduates who are trained to conduct responsible research with industry and market awareness.

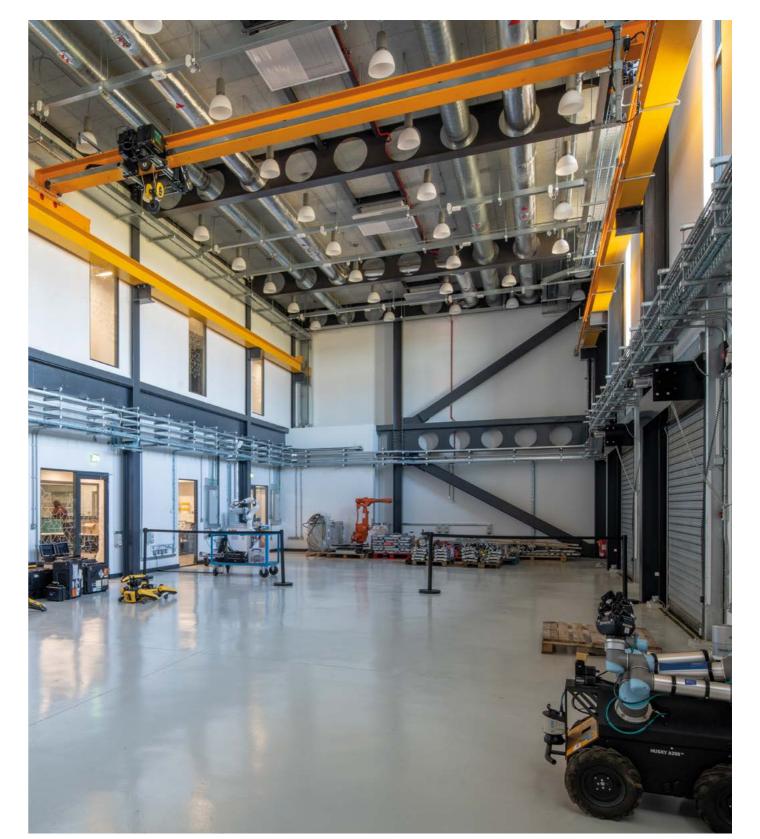
The National Robotarium provides space for students in the EPSRC Centre for Doctoral Training in Robotics and Autonomous Systems (CDT-RAS) to conduct cutting-edge responsible research, often directly with industry partners, helping them build effective, scientific, creative and enterprise skills that can be applied within academia and to society as a whole. Through its 4-year PhD training programme, the CDT-RAS produces highly-skilled graduates from Heriot-Watt and the University of Edinburgh, shaping the future of robotics with the relevant expertise to advance the UK's skills, talent and knowledge base.

Doctoral candidates are provided with individuallytailored courses and project portfolios that ensure all students have an excellent general grounding in current theory, methods and applications.

In June of this year, the National Robotarium extended a warm welcome to six MSc students from Heriot-Watt University specialising and studying in Robotics. These students were tasked with taking on an industry-specific project, involving a 4-month collaboration with a prominent Biotechnology company.



Heriot-Watt 'career-ready' interns



Our Robotics and Autonomous Systems Lab

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DEVELOPING SOLUTIONS FOR INDUSTRY

Informed by sectoral needs, we work collaboratively with partners around the globe to define, develop and resolve industry challenges through the application of Robotics and Al. Working with the National Robotarium can add value to industry by reducing cost, risk and time-to-market.

We also have a positive impact on the UK economy by supporting start-ups and SMEs from across the UK, and act as a gateway to the UK Robotics sector and Government support.

Industry partnerships

The National Robotarium is committed to **advancing robotic solutions to address real-world problems**. A key challenge for many industries is the ability to

A key challenge for many industries is the ability to adopt robotics, automation and AI into the workplace efficiently, and at scale.

We **collaborate with industry partners across multiple sectors** to explore safe, reliable and practical robotic applications. We create robotic solutions that work for –

and with – people, helping them do things better whilst directly addressing business needs.

Many of our research grants support both fundamental research and translation activities and through this mechanism our relationships with industry are becoming deeper and stronger.

Sectors we are currently working with include:

- Agriculture
- · Health and social care
- Offshore energy
- Construction
- Manufacturing
- Hospitality
- Travel and Tourism
- Space

A number of these projects are also developing commercialisation opportunities and our pipeline of spin-outs is growing as a consequence.

THE NATIONAL ROBOTARIUM

Announcing a new partnership with Tata Consultancy Services

GROWING THE ECOSYSTEM

The National Robotarium plays a crucial role in growing the UK's robotics ecosystem and capabilities. We seek to augment the existing framework and provide a bridge to connect members of our network to world-leading science and technology, industry expertise, funding and investment, government, regulators and manufacturers, cementing the UK's reputation as a main player in the global robotics community.

Business support

We offer **business acceleration and incubation support** to start-up tech companies, spin-outs and SMEs. As well as providing access to office space, labs, equipment and engineering expertise, we can act as a gateway to the Scottish and UK robotics network, research funding and Government support.

Our **dedicated Business Development team** connect with a wide range of sectors to explore how robotics and AI can address industry challenges, reducing costs and improve safety and productivity.

Industry residents

The National Robotarium is home to a number of start-up robotics companies, providing them with incubation space and access to the facility's state-of-the-art labs, technology and robotics expertise, aiding the development of their technologies and accelerating their business.

Touchlab Ltd was the first start-up robotics company to move into the National Robotarium incubation space. They are developing and manufacturing a biomimetic e-skin system that is thinner than human skin and can be used with hard or soft robotics to sense pressure, location and direction in real-time.

Their unique nanotechnology enables operators to experience 'true presence' through a machine whilst being able to withstand extreme environments and temperatures. It has been tested in a real-life hospital setting as part of a pilot in Laakso Hospital in Helsinki, Finland, where robots were used to carry out day-to-day clinical tasks, such as measuring vital signs, serving meals and moving assistive devices, all under the watch of experienced, purpose-trained staff.



Industry residents Touchlab Ltd.

Crover is on a mission to help grain storage operators reduce losses and maintain optimum storage conditions through the development of their unique t-shaped robotic drone (pictured). The compact device has in-built moisture and temperature sensors and uses two domed-shaped wheels to propel itself through grain and bulk stack silos, feeding back data on the environmental conditions. Founded by Lorenzo Conti, the company have received significant investment from Innovate UK, Scottish Enterprise and private funders to advance their technology, which could reduce the amount of commodity grain lost (currently 30% globally) due to lack of ventilation or pest infestation.



Scottish technology firm **Bioliberty** are creators of the Lifeglov – a soft robotic rehabilitative glove that provides resistance and monitors key metric to help patients develop and build their natural hand strength. Developed for use by patients and professionals, it comes with a Digital Therapy Platform that provides tailored exercises and real-time feedback on technique and progress. They have received £2.2m of investment allowing the team to complete development of the trial product and platform, and begin commercial engagement in the US with rehabilitation clinics.

Shakey Robotics moved into the National Robotarium with the aim of advancing robotics for submergible vehicles. They contributed to the robotic programming of the Spy Whale (pictured), the most sophisticated semi-autonomous sea creature ever developed. The Spy Whale 'Mobiwan' starred in the BBC series Spy in the Ocean and now takes pride of place in the National Robotarium Atrium space.



Chromacity relocated to the National Robotarium on a temporary basis. The manufacturers of high-performance, ultrafast lasers were afforded office, lab and production space during their short-term tenancy.

PARTNERSHIPS

Tata Consultancy Services

On the day of its official launch in September 2022, the National Robotarium announced its first major applied engineering and research partnership with multi-billiondollar company Tata Consultancy Services. Utilising expertise from both Heriot-Watt University and the University of Edinburgh, TCS Research has invested £500k to collaborate with the National Robotarium and create innovative solutions to global challenges using cutting-edge robotics and AI research, product design and new technology creation. In its first year, **the TCS** partnership has supported a number of fully-funded **doctoral positions,** providing much-need support to researchers in Robot Motor Intelligence (RoMI) to improve the agility and versatility of quadruped and other legged robots. These robots can be deployed by a number of industries working in hazardous environments including construction, and disaster response.

BE-ST

In May 2023, we announced a **new partnership agreement with Built Environment-Smarter Transformation (BE-ST)**, Scotland's innovation centre for accelerating the built environment's transition to zero carbon emissions. The partnership was launched at a special event, 'The Robots Are Here', which brought representatives from construction, trade, science and policy to the National Robotarium for a half-day of talks and demonstrations to raise awareness of the environmental benefits of greater automation and use of robotics in the sector.



At the launch of a new partnership with BE-ST

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Virgin Media O2

Global telecommunications giants Virgin Media O2 Business have been in development discussions with us for a number of months, exploring the potential installation of superfast 5G connectivity to support live robotics projects. Having formally signed a Memorandum of Understanding earlier in the year, the partner organisations intend to develop the efficacy of VMO2's '5G in a box', a mobile, pop-up 5G centre, testing its potential to power robotic and AI technologies for multiple sectors working in different environments.

Northumbrian Water Group Innovation Festival

Along with MOU partners, Virgin Media O2 Business, the National Robotarium co-hosted a robot-themed design sprint event at the Northumbrian Water **Group Innovation Festival** in July 2023. 'We, Robot' was a unique, five-stage 'design sprint' workshop that brought participants from a wide range of backgrounds - including academia, utilities, computer software and fashion – to develop new ideas to improve safety and efficiency in utilities using Robotics, Al and Co-bots (collaborative robots). A number of ideas from the sprint are currently in development with interest and potential funding from bodies such as the Water Services Regulation Authority, Ofwat.

Fourier Intelligence

Through an MOU (Memorandum of Understanding) with international medical technology company Fourier Intelligence researchers at the National Robotarium are utilising its sophisticated therapeutic equipment to improve understanding of the use of robotics and AI for assisted living, movement and patient rehabilitation. One study is focused on the effectiveness of socially assistive robots to support physical rehabilitation and cognitive exercises, using technology donated in-kind by Fourier.

ServiceKey

The National Robotarium have joined forces with ServiceKey, a UK-based digital technology start-up.

Through the utilisation of ServiceKey's Perpetual Innovation™ Al-empowered toolset, **the National** Robotarium will benefit from enhanced project **solution development**, reducing time and cost, and identifying otherwise hidden alternative solutions. The facility will also work with ServiceKey personnel on joint activities using the ServiceKey methodologies to enhance live projects with industry partners and customers.

Small Robot Company and James Hutton Institute

In spring 2023, the National Robotarium became the first commercial buyers of a Tom v4 robot from the Small Robot Company. Tom v4 (pictured) is a pioneering autonomous robot that helps farmers better monitor the health status of individual crop plants and reduce herbicide.



In partnership with the James Hutton Institute. Tom will be tested in real crop fields to assess its capabilities for advancing agricultural research and precision breeding.

The partnership has resulted in two new research grants awarded to advance the Tom robot's data capabilities and improve its GPS navigation for better per-plant farming. SRC are also benefitting from the National Robotarium's business acceleration support function, and are our first 'virtual residents', receiving access to our labs, facilities and engineering expertise ondemand, allowing them to branch out from their base in Salisbury and grow their network in Scotland.

ENGAGEMENT

The National Robotarium wants to advance knowledge and understanding of robotics for all. A vital part of our activity is focused on engaging with a myriad of different audiences to showcase how robots can help humans do things better, and provide positive societal benefits.



Schools outreach and engagement

A main delivery strand of the National Robotarium is to 'inspire the next generation of roboticists' and, in our first year of operation, we have successfully reached a milestone; engaging with a total of 10,000+ young people since our inception and delivering over 50 events, workshops, festivals, and virtual lessons.

Led by a dedicated outreach and engagement team of two, we have developed a tried-and-tested programme of activities that use robotics to drive engagement across a number of key engagement themes in young people.

These include:

- increasing equality, inclusion and diversity in computer science, engineering, maths and other STEM subjects;
- tackling digital exclusion and reducing the attainment and achievement gap for those living in areas of poverty and deprivation;
- addressing future skills gaps in the workforce by building skills in design, engineering and computer programming;
- raising awareness of the positive impact robotics, Al and automation have on society;
- increasing understanding and adoption of robotics in the classroom, workplace and at home.



DataKirk

The National Robotarium is developing a partnership with DataKirk, an Edinburgh-based charity that is addressing both the data divide and attainment gap in Scotland. They provide training for Data Analytics and Data Science to underrepresented and vulnerable groups. DataKirk have visited the National Robotarium on several occasions and both sides are collaborating on the creation of a robotics course for young people involved with the charity, raising awareness and equipping them with the Computing Science, Robotics and Al skills required to pursue a career in the sector.

DataLab

The National Robotarium and DataLab are forming a strategic partnership to combine efforts and help Scotland become a beacon for the tech and Al spaces. DataLab operates from partner institution The University of Edinburgh and helps companies better understand what opportunities exist in the data and AI space and works with them to grow their skills in data and AI, with the end goal of ensuring Scotland becomes a more productive and sustainable place in the way we use Al and data technology.

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PUBLIC ENGAGEMENT



The robotics public engagement team receive the Highly Commended Prize at the Heriot-Watt Celebrating Our People Awards

We have also been involved in delivering public engagement and outreach activities for all ages, educating and informing the public about the positive benefits robotics and AI can have on their lives.

XPrize

Former ISS astronaut and current CEO of XPRIZE, Anousheh Ansari (pictured) delivered the keynote address at 'Robotics Automation and AI – pushing the frontiers of human potential', a special event held at the National Robotarium in January 2023.

The event, co-hosted by National Robotarium residents Touchlab Ltd., was attended by over 180 academic and industry professionals with many keen to share ideas to develop the use of robotics, automation and artificial intelligence for different industries, including the space sector.

Anousheh also delivered a motivational talk to over 150 local school children as part of the morning programme of activities, which also included robot demonstrations and talks on robotics education and career opportunities.



Robots After Dark at the Edinburgh Science Festival

Nearly 200 people attended our sell-out event, 'Robots After Dark', a special evening programme held at the facility, as part of Edinburgh Science Festival 2023. Selfies with robots, brain-controlled drones and a quadruped waiter were just some of the activities on show at the adults-only event. The audience also heard talks from leading experts in robotics, psychology and design, highlighting the many ways we are **exploring** the topic of trust in robots.



Edinburgh Science Festival photobooth

Science Saturday

Our public engagement team hosted activities at the National Museum of Scotland as part of British Science Week 2023, delving into 'The Science behind Dr Who'. The team engaged with an audience of 100s, young and old, demonstrating how we are using humanoid robots to study human-robot interaction, perception and cognition.

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Spy in the Ocean screening event

Industry residents Shakey Robotics held a special evening event at the National Robotarium to mark the **broadcast** of BBC series Spy in the Ocean, featuring its robotic submergible whale, the most sophisticated of its kind. 50 representatives from industry, academia and government gathered in our Atrium space to watch the screening and learn more about the whale's production.

Orkney Science Festival

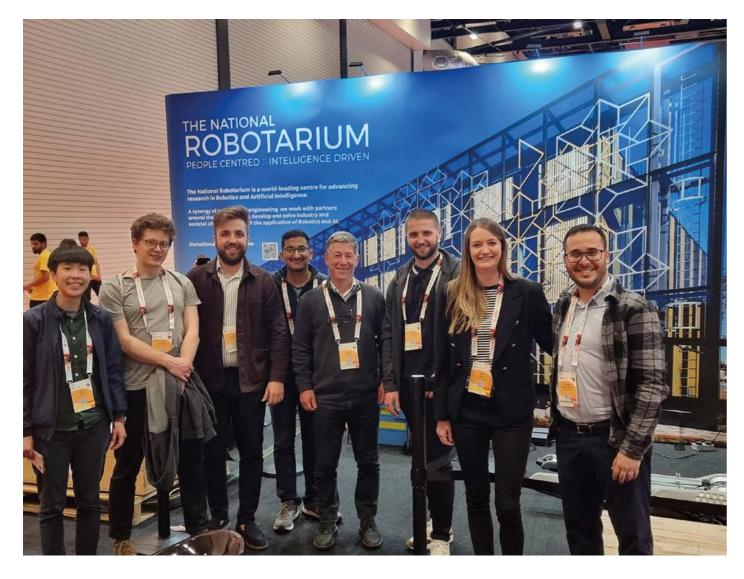
Several of the team flew to the Orkney islands in September 2023 to take part in the annual science festival. There they spoke to audiences young and old about robotics careers, soft robotics and the work the National Robotarium is doing to improve people's lives in rural communities using innovative robotic technologies.



A school group in Orkney learn about careers in robotics

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EVENTS AND EXHIBITIONS



ICRA 2023

The National Robotarium was a prominent presence in ICRA 2023, a major **International Conference on Robotics and Automation**, held in London's ExCeL centre from 29 May - 2 June. With an audience of over 6000 experts from science, industry and research, the team showcased the facility's latest robotic technology and demonstrated how we're using it to address challenges in sectors including offshore energy, asset maintenance, construction and healthcare.

The Royal Highland Show

Senior figures from the National Robotarium were invited to represent the facility as **part of the UK Government tent at the 2023 Royal Highland Show**.

The event coincided with a new agricultural partnership announcement with Small Robot Company and James Hutton Institute.

During the four-day event, CEO Stewart Miller attended a private reception hosted by Secretary of State for Scotland, Alistair Jack, and Business Development Manager Lisa Farrell discussed with First Minister Humza Yousaf (pictured) how the National Robotarium is strengthening Scotland's robotics capabilities.

IFA Berlin

IFA is one of the world's biggest international technology and innovation conferences bringing together trade experts, retailers, buyers and the general public from over 130 countries. Leaders from the National Robotarium, CEO Stewart Miller and COO Steve Maclaren, were both invited to speak as part of the three-day event. Stewart appeared in a Leaders Summit programme panel, debating the robot and automation revolution, alongside industry residents Touchlab COO Laura Garcia Caberol, whilst Steve spoke on the role of robotics for achieving a sustainable future, as part of the Sustainability Village programme.

Scottish Manufacturing and Supply Chain Conference

The National Robotarium were gold sponsors of the Scotland Manufacturing and Supply Chain conference and exhibition, held in Glasgow's Scottish Event Campus on 13 October. Alongside the Husky robot, members of the team spoke to retailers, manufacturers, and operations organisations about how robotics technology and science can help improve safety, productivity and efficiency in the sector.

Digital construction week and UK Construction Week (with BE-ST)

Following our partnership launch event we joined forces with BE-ST (Built Environment – Smarter Transformation), again for both Digital Construction Week and UK Construction Week. The events mark our commitment to improve sustainability in construction and the built environment through the application of robotics, automation, data and Al.



Lisa Farrell with First Minister Humza Yousaf



At Digital Construction Week 2023

ENGAGING WITH GOVERNMENT

Investment into the creation of the National Robotarium by the UK and Scottish Governments has cemented its strategic role in growing the UK's robotics capabilities.

Debate at Scottish Parliament

The National Robotarium was lauded as the 'gold standard' in a Scottish Parliament debate on the future of robotics technology in Scotland and the UK. Led by Gordon Macdonald MSP for Edinburgh Pentlands, the debate in January 2022 received cross-party support with ministers in agreement that the UK would greatly benefit by giving prioritisation to growing its robotics skills, technology and manufacturing capabilities. Points raised during the debate were largely in favour of developing a strategic policy for the robotics sector, including factors such as testing and development, production, education, skills, ethics and regulation, to ensure the UK doesn't continue to fall behind its global competitors.

Cross-Party Group for Science and Technology

Members of the Scottish Parliament Cross-Party Group on Science and Technology visited the National Robotarium on 16 May. The delegation, led by convenor Clare Adamson MSP, met with CEO Stewart Miller who gave an overview of the facility's journey so far and how continued investment can make the UK a competitive player in the global demand for robotics and AI. Following the visit, during a Scottish Government debate on trustworthy AI on 1 June, Ms Adamson namechecked the centre and the positive impact we're having on robotic research and development.

Scottish Development International

This year we have **hosted several tours with** international ambassadors, led by Scottish Development International to promote Scotland as a place for investment and trade. Following tours of our high-spec labs, robotic demonstrations and meetings with senior leaders, we have subsequently been in discussion with representatives from countries including Estonia, Italy, Iraq and Kuwait about potential collaborations, expanding the Scottish science and technology ecosystem overseas and helping to grow the nation's reputation in robotics and Al.



Team from the National Robotarium at the Scottish Parliament

Visits from government officials and parliamentarians

Over the first year of operation, the National Robotarium has played host to a number of ministers, parliamentarians, MSPs and government experts.

These are as follows:

- 4 October 2022 Ivan McKee MSP, Glasgow Provan (as part of the Interface Knowledge Exchange Awards launch event)
- 4 November 2022 Gordon MacDonald MSP, Edinburah Pentlands
- 24 November Former UK Government Chief Scientist Sir Patrick Vallance and Chief Scientific Adviser to the Scottish Government, Professor Julie Fitzpatrick
- 28 February Douglas Ross MSP, Leader of the Scottish Conservatives, and Sue Webber MSP,
- 23 March Jamie Hepburn MSP, Cumbernauld and Kilsyth and Minister for Independence and Chief Scientific Adviser to the Scottish Government, Professor Julie Fitzpatrick
- 31 March Joanna Cherry MP, Edinburgh South West
- 21 April Ian Murray MP, Edinburgh South and Shadow Secretary of State for Scotland
- 24 April Michelle Thomson MSP, Falkirk East
- 13 September Councillor David Ross, Leader of Fife
- 19 September Liam Kerr MSP, NE Scotland (Region) and Roz McCall MSP, Mid Scotland and Fife (Region)

We have also hosted a number of Scottish Government meetings, including:

- Scottish Government Digital Connectivity forum
- · Scottish Leadership Group for Manufacturing
- Innovate UK



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FEATURED PROJECTS

OLTER

The Offshore Low Touch Energy Robotics and Autonomous Systems (OLTER) project aims to deliver a Robotics and Autonomous Systems (RAS) service to scale and commercialise robotics for use in offshore energy environments. Members of the National Robotarium research and engineering teams have been involved with the project since its inception, joining the consortium under the ORCA hub banner. Since then, our involvement has grown and we are now playing a leading role in its development, taking forward the strand to create a test and certification centre for ensuring the efficacy of mobile and airborne robotics and cobots.

As well as delivering on improved regulation of robotics for the offshore sector, we have also **received additional funding to develop a new talent and skills programme**, identifying and addressing potential skills gaps in the sector to ensure operators are properly equipped to manage the technologies in the future.

UNITE

The £1.4m Underwater Intervention for Offshore Renewable Energies (UNITE) project is **developing electric remotely operated vehicles (eROVs) to perform maintenance and repair tasks on offshore wind turbines**. Delivered in partnership with Fugro, the world's leading Geo-data specialists, the eROVs aim to dramatically improve health and safety for workers, reduce carbon emissions and improve efficiency.



FEATHER

The FEATHER (Facilitating health and wellbeing by developing systems for early recognition of urinary tract infections) project is **developing AI and robotics to enable earlier identification of UTI symptoms**. Led by The University of Edinburgh's School of Informatics in collaboration with the National Robotarium and social healthcare providers Leuchie House, researchers are working with social care and residential homes to develop smart sensors and data systems that can alert individuals and carers of potential infection. Earlier diagnosis of UTIs, affecting 150 million people worldwide each year, can reduce requirement for emergency care, ensure the appropriate prescription of antibiotics and improve patient care.

Smartrawl

Smartrawl is an Al-empowered fishing net designed to prevent marine bycatch by trawlers. The brainchild of Heriot-Watt Professor and marine technology expert Paul Fernandes, who is based at sister Global Research Institute, The Lyell Centre, the National Robotarium are helping to develop the effectiveness of the device's smart-patented gate system that will ensure that fishers catch only the fish they're targeting, allowing other animals to be released back into their natural environment quickly and without harm.

Neuro4PD

The novel Neurorobotics Model of Parkinson's Disease project, led by the Edinburgh Centre for Robotics in the UK and Digital Metropolis Institute in Brazil, combined the use of humanoid robots with neuroscience to better understand the mechanisms of Parkinson's disease. Using the National Robotarium's iCub (pictured), a 1m tall open-source humanoid crafted to mirror the sensory and physical attributes of a young child, researchers replicated the intricate dynamics of both healthy and Parkinsonian brains, inducing varying degrees of motor disruption during the execution of behavioural tasks. These future models could conceivably pave the way for groundbreaking advancements in Parkinson's disease therapies, offering an even more promising alternative to animal testing. The Neuro4PD project received backing from The Royal Society and the Newton Fund.

Manufacturing lasers

Scientists in the Precision Laser Applications (PLA) labs are exploring the potential use of **robotics to assist in manufacturing lasers**. In a three-year project funded by the UKRI EPSRC, the team are working with optical components manufacturer Gooch & Housego, aerospace giants Leonardo and laser makers Luxinar, to test the use of robots to undertake time-consuming and repetitive assembly and alignment steps. If successful, it will allow humans more time to concentrate on the important testing and quality-control steps.

Amazon SimBot competition

A team of students from Heriot-Watt University developed a sophisticated embodied AI agent that can accurately respond to people's demands and commands online. Team EMMA created the bot for the 2023 Amazon Alexa Prize SimBot Challenge, a challenge to help advance the next generation of virtual assistants, and successfully made it through to the final five in the global competition, the only non-US team to do so.



The ICub humanoid robot



PRESS, PR AND MEDIA

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September 2023

The Scotsman – Stewart Miller: Take the reins now and robotics and AI will serve Scotland well

Tech Xplore - An embodied conversational agent that merges large language models and domain-specific assistance

The Scotsman - Data Capital: unlocking the full potential of robotics at Heriot-Watt University

BBC Newsround - The National Robotarium: 10,000 young people learn more about robotics

August 2023

Farmers Weekly - OPINION Fernando Auat Cheein: Give farmers information to tackle water scarcity

BBC Business – How long until a robot is doing your chores?

July 2023

Mail Online – Al fishing net identifies and sorts fish to prevent discard deaths

Manufacturing Today – Stewart Miller: Taking ideas from laboratory to factory

Health Tech World – "The dull, the dirty and the dangerous": The future of robotics in healthcare

The Press and Journal – How our businesses are developing the skills needed to harness Al

IFA Berlin - No, you shouldn't be scared about robots

June 2023

Farming UK – Farm bot 'Tom' to help farmers create herbicide 'treatment maps'

The Engineer – Clinicians set to get remote 'feel' for patients in trial of Välkky telerobot

May 2023

Sustainable Business Magazine – Crop-bots: How Robotics and AI can help revolutionise farming

National Centre for Universities and Business – Artificial Intelligence: the present and future of technology

April 2023

i4.0 today – Stewart Miller: Taking ideas from laboratory to

The Conversation – Professor Thusha Rajendran: We need to discuss what jobs robots should do, before the decision is made for us

The Press and Journal – How drones went from Christmas toys to business tools

Daily Record - Scots firm's robot that can 'swim' through grain stores could stop crops going to waste

March 2023

Scottish Al Alliance – Let's Talk Al Jobs

The Scottish Sun – Tech a Break: Why spending hours on housework could become a thing of the past within 10

January 2023

Robotics and Innovation Magazine – Stewart Miller: The robots are coming – let's use 2023 to spark a debate

The Telegraph – Could M3GAN exist? The scientific truth about killer robots

The Carer – Robotics collaborations are giving social care

The Washington Post – Al and robots could help detect urinary tract infections earlier

Engineering Matters (PODCAST) - #232 Future of Technology and Engineering

December 2022

The Scotsman - The National Robotarium: taking Al and robotics to schoolchildren to create a better world

November 2022

Cosmopolitan – Al voice assistants are often women: here's why it's a problem

BBC Click – Voice banking and robots

Assistive Technology Today - Clever adjustable bathroom and kitchen solutions chosen to feature in the National Robotarium

Arable Farming - Dr Fernando Auat Cheein: Designing robots for local requirements

October 2022

Robot Talks [PODCAST] - Episode 21, Sean Katagiri, Robotics Engineer

September 2022

BBC World Service Digital Planet – Tiny robot cure mice with deadly pneumonia

BBC News - Firefighters trial new smart helmet which could save lives

FutureScot – Scotland's new 'national robotarium' opens with major industry partnership agreement

The National – National Robotarium: UK's biggest and most advanced robotics centre opens in Edinburgh

Building Design Online - Robotics and Al: The future of designing for assisted living

SOCIAL MEDIA

Sept 2022 - Sept 2023

LinkedIn

- 4547 total followers
- +2713 new followers since launch
- 14,602 page views
- 5653 unique visitors
- 356,547 impressions
- 8986 post and content reactions
- 167 comments
- 557 reposts
- · Visitor demographics

Top 5 industries

- Engineering
- Business Development
- Education
- Research
- Programme and Project Management

Top 5 countries

- United Kingdom
- India
- The Netherlands
- USA
- Singapore

X/Twitter

- 2036 total followers
 - +775 new followers since launch
- Impressions 239,338
- Profile visits 17240





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Dr Jonatan Scharff-Senior Robotics Engineer

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2023 – Awarded the Royal Academy of Engineering Enterprise Fellowship to commercialise spinout Frontier Robotics



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Dr Alix Partridge Senior Robotics Engineer a.partridge@hw.ac.uk



Kyle.Walker@hw.ac.uk 2023 – Completed PhD in Marine and Soft Robotics from The University of Edinburgh

Dr Kyle Walker

Robotics Engineer



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Alex Sleat



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2022 – Equality, Diversity and Inclusion Chair for 5th IEEE International Conference on Soft Robotics 2023 – Inducted into UK Young Academy



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2023 - Highly Commended Award for public engagement at the Heriot-Watt Celebrating our People Awards.



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2023 - Highly Commended Award for public engagement at the Heriot-Watt Celebrating our People Awards.



Louise Jack Communications Manager

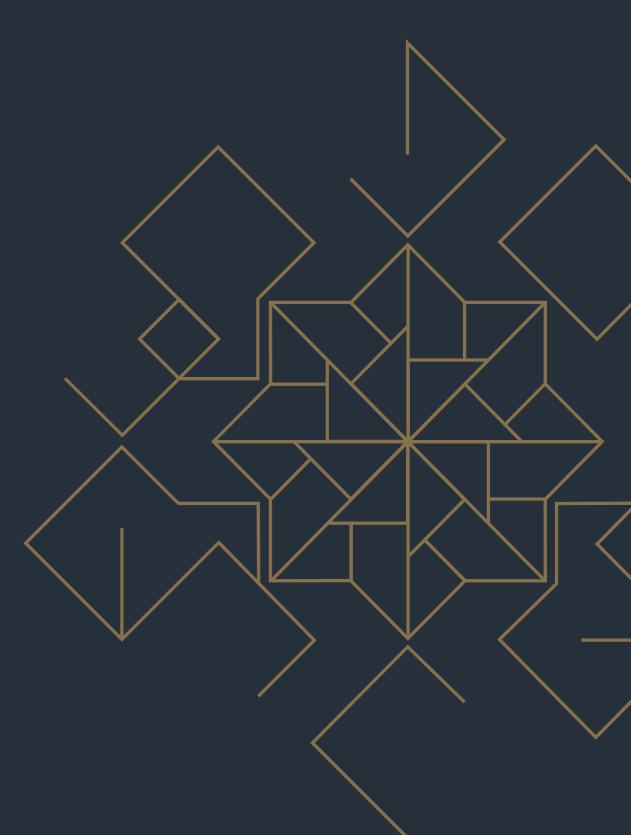
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2023 – Completed the ILM Associate Course, Stepping into Management





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