SCIENCE MUSEUM GROUP

MAKING DIGITAL HISTORY

ANNUAL REVIEW 2018–19

HER MAJESTY'S INSTAGRAM

HERE COMES THE SUN

THE WEB TURNS 30

ROCKET GOES NORTH

A DAZZLING NEW VENUE

ROYAL APPROVAL

Her Majesty The Queen formally opened the new Smith Centre at the Science Museum by sharing her first Instagram post

The Science Museum made digital history this year when Her Majesty The Queen chose to share her first Instagram post from its new Smith Centre.

The Queen formally opened the centre during her official visit to the museum on 7 March. The suite of rooms replaces the original Smith Centre, which opened in 2006 and was named in honour of Martin and Elise Smith. They wanted the museum to have a centre for debates, lectures and philanthropy, and a space for our supporters and patrons to use.

During her visit, the Queen inspected Tim Berners-Lee's NeXT computer with Tilly Blyth, the museum's head of collections. Berners-Lee used the computer to design the prototype World Wide Web 30 years ago, when he was working for CERN, the European Organization for Nuclear Research, in the late 1980s (*see page 20*).

However, the highlight of the royal visit was a historic first, both for the monarch and the museum: Her Majesty shared her first Instagram post. She was pictured posting it from an iPad beside the Group director, Ian Blatchford, and in front of the largest painting in the Group's collection, *Electrical Engineering Workshop*, by Terence Cuneo, which now hangs in the Smith Centre. Cuneo, who had been official artist for the Coronation in 1953, was commissioned in 1956 to paint this enormous canvas for the museum's galleries.

The Queen's Instagram post featured an image of a letter from the Royal Archives. It was sent by Charles Babbage, the Victorian computer pioneer, to Prince Albert, the Queen's great-great-grandfather, in 1843. In the letter, Babbage told Queen Victoria and Prince Albert about his invention, the Analytical Engine, upon which the first computer programs were designed by Ada Lovelace.

'It is always a pleasure to welcome Her Majesty to the Science Museum, and I am delighted that HM The Queen has taken the opportunity to post on Instagram for the first time'

Ian Blatchford, director, Science Museum Group

Her Majesty wrote: 'Today, I had the pleasure of learning about children's computer coding initiatives and it seems fitting to me that I publish this Instagram post at the Science Museum, which has long championed technology, innovation and inspired the next generation of inventors.' She signed her message: Elizabeth R.

The Queen's first tweet in 2014 was also sent from the Science Museum to launch the *Information Age* gallery, part of which was guest-curated by Berners-Lee.

During her visit, the Queen also announced a major new exhibition at the Science Museum: *Top Secret: From Ciphers to Cyber Security*, which traces the development of Britain's intelligence gathering. It opens on 10 July and coincides with the 100th anniversary of the establishment of GCHQ, the UK's intelligence and security organisation.

The new Smith Centre was designed with the aim of creating a space in which the Group could host meetings, debates, lectures and conferences, and welcome VIPs and Fellows. Designed by HAT Architects, the centre includes a boardroom, conference suite, grand salon and a space to house permanent objects and temporary exhibitions. It occupies a former 19th-century Royal Mail sorting office with many fine period details, which the architects were careful to preserve.

Above: The Queen inspects the Enigma machine with Ian Blatchford, Group director, Hannah Daley, project leader of exhibitions at the Science Museum, and Tony Corner, historian of GCHQ
Above right: The Queen and Ian Blatchford, moments after Her Majesty shared her first Instagram post
Right: Martin and Elise Smith greet the Queen at the opening of the Smith Centre

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‘Today, I had the pleasure of learning about children’s computer coding initiatives and it seems fitting to me that I publish this Instagram post at the Science Museum, which has long championed technology, innovation and inspired the next generation of inventors’

Her Majesty The Queen

‘The idea behind the National Science and Media Museum’s exhibition didn’t just provoke an interesting conversation – it was the catalyst for the BBC trying a new way of reporting the news’

David Sillito, BBC media and arts correspondent

‘I loved visiting the National Railway Museum today. It is a treasure trove of famous locomotives and trains’

David Walliams, writer and comedian

‘Locomotion is one of County Durham’s most important visitor attractions. There are few museums that bring the region’s local history to life so dramatically, providing an interactive experience for visitors that appeals across the board to different generations’

Michelle Gorman, managing director, Visit County Durham

‘This museum inspires people about what science and industry can do. The Academy is now promising to take that to a different level, and will play a major role in building a more sustainable and inclusive economy in the city region that everybody will benefit from’

Richard Leese, leader of Manchester City Council, at the launch of the Group's Academy at the Science and Industry Museum

OUR FIVE WORLD-BEATING MUSEUMS

Science Museum, London
National Railway Museum, York
Science and Industry Museum, Manchester
National Science and Media Museum, Bradford
Locomotion, Shildon

SUPPORT OUR MUSEUMS

Visit sciencemuseum.org.uk/about-us/support-us
or for corporate membership and patrons see page 59

THE YEAR ON VIDEO

sciencemuseum.org.uk/annual-review-video

SCIENCE MUSEUM GROUP ANNUAL REVIEW 2018–19

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Cover image: Her Majesty The Queen formally opens the Smith Centre at the Science Museum on 7 March 2019. Photography by Jody Kingzett for the Science Museum **Back image:** Tim Peake stands in front of his Soyuz spacecraft during its 12-week display in Peterborough Cathedral in 2018. Photography by Jody Kingzett

OUR GLOBAL AUDIENCE

Through our touring exhibitions and education programmes, the influence of the Science Museum Group continues to grow nationally and around the world, says Mary Archer

Top: Fabiola Gianotti, director-general of CERN, receives a Fellowship to the Science Museum from Mary Archer, Group chairman, at the Director’s Annual Dinner
Above: Ian Blatchford, Group director, is appointed Knight Bachelor by HRH The Prince of Wales

I was delighted to see the central role of science in the economy, culture and promotion of the UK abroad acknowledged in the 2019 New Year Honours. There were knighthoods for Jeremy Farrar, director of Wellcome; Patrick Vallance, the government’s chief scientific adviser; our very own Donald Brydon, chairman of the Science Museum Foundation, and Ian Blatchford, director and chief executive of the Science Museum Group.

Ian’s honour for ‘services to cultural education’ rightly recognises his dynamic leadership of the world’s most significant science museum organisation. Under his guidance, the Group has grown in size and reputation, led the way in sharing our greatest objects, delivered Europe’s largest informal education programme, started pioneering work to open our collection to more of the public through digitisation and the development of our National Collections Centre near Swindon, and toured our exhibitions abroad. *Superbugs: The Fight for Our Lives*, which focuses on the global challenge of antibiotic resistance, will visit China and India in 2019 (*see page 15*).

It goes (almost) without saying that this success rests on the hard work of many people: the 1,203 members of staff, 200 casual members of staff, 1,108 volunteers and many contractors who work across our five museums and collections facilities, and our extensive network of advisers, experts and Board of Trustees.

The Prime Minister recently appointed eight new trustees to our Board. All are chosen purely on merit and for the range of skills and experience they bring, so it’s pleasing to note that, for the first time, the Board will have more women than men. At the same time, we have had to bid farewell in the course of 2019 to six trustees who have come to the end of their terms of office: Matthew d’Ancona, Richard Faulkner, Andreas Goss, Michael Grade, Simon Linnett and David Willetts. We thank them all for their dedicated service to the Board and to the Group.

Among our new intake of trustees is Peter Hendy, chairman of Network Rail, and this brings me to our boldest project of all, at our National Railway Museum in York (*see pages 4-5*). This museum will be the cultural heart of the large York Central development, which has enormous potential to deliver economic growth, jobs and sustainable housing to the city of York. I’m delighted to be supporting this important addition to the Northern Powerhouse by chairing the York Central Strategic Board. In the pages that follow, Ian will explain how we, through Vision 2025, our most ambitious fundraising campaign ever, plan to turn our York institution into the world’s greatest railway museum.

‘The Science Museum is a special place for me. It’s been a tremendous privilege for me to be on that stage. The audience out there were pretty amazing, and you – the Web Foundation and the Science Museum – are special. All of you must be thanked’

Tim Berners-Lee, founder of the World Wide Web, at its 30th anniversary celebrations in the Science Museum (*p20*)

‘The best in the world’

Fabiola Gianotti, director-general of CERN, describes the Science Museum during her talk at the Director’s Annual Dinner

‘The record number of people who saw Tim Peake’s Soyuz spacecraft highlights how science and space travel continue to inspire us’

Jeremy Wright, Culture Secretary

‘The Science Museum Group has helped to deliver a tangible and positive shift in attitudes towards engineering careers among young people on which we look forward to building in 2019 and beyond’

Nusrat Ghani, minister, Department for Transport

Detail from the M-209 B cipher machine, on display as part of the Top Secret exhibition at the Science Museum. It was used as a portable cipher machine by the US Army in the Second World War and the Korean War

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An artist's impression of the South Yard at the National Railway Museum under the Vision 2025 redevelopment

VISION FOR THE FUTURE

As the National Railway Museum in York looks forward to its 50th birthday, it is launching Vision 2025 – a spectacular city-centre transformation that will reimagine this much-loved museum and the history of the British railways, says Group director Ian Blatchford

DIRECTOR'S WELCOME

'The arrival of Rocket in York marks the start of a major renewal for the National Railway Museum, the Group's greatest priority in terms of audience development, economic impact and cultural balance'

Ian Blatchford, Group director

One of my greatest pleasures last year was seeing Stephenson's *Rocket* return to the city where it was built, when it went on display at the Discovery Museum in Newcastle. It looked magnificent and was a star attraction in *The Great Exhibition of the North*, and was enhanced by the display of original Rainhill Trial archives from the National Railway Museum. These chart the vital importance of the Rainhill Trials, the 1829 competition which, thanks to *Rocket*, established the supremacy of the steam locomotive in the birth of the railways and the Industrial Revolution.

Rocket was saved for the nation from dereliction – and even the threat of destruction – by the Patent Office Museum (later to become the Science Museum) in 1862. It is sobering to think that this Victorian icon was almost lost for ever, because today its fame is global. I was reminded of this when visiting senior Chinese figures from the worlds of culture and science in Beijing in 2018. They were all well-versed in the history of the Industrial Revolution, and thought that *Rocket* was one of the greatest breakthroughs not only in the history of engineering, but also of economics and culture.

Rocket looked so splendid in Newcastle that it inspired us to think a little differently about our exhibits. It reminded the Science Museum Group that we need to do all we can to share our outstanding collection across the country. As a result, we sent it next to the Science and Industry Museum in Manchester. In many ways, this also felt like a homecoming because the museum occupies the original terminus of the Liverpool and Manchester Railway, and *Rocket* powered across this line in 1830. It will stay in Manchester until September 2019, when it will move to the National Railway Museum in York and will remain there for the next decade.

The arrival of *Rocket* in York marks the start of a major renewal for the National Railway Museum, the Group's greatest priority in terms of audience development, economic impact and cultural balance. Since the museum opened in 1975, it has been visited by more than 33 million people. As we approach the 200th anniversary of the world's first public steam railway in 2025, and the museum's own 50th birthday, the National Railway Museum is launching Vision 2025. This is an ambitious plan that will transform the museum site and reimagine how we share the inspirational story of Britain's railways with visitors. It will mean excellence in education and apprenticeships, and will encourage rigorous debate about the future shape of our railways.

Vision 2025 is at the heart of York Central, one of the largest city-centre redevelopment projects in the UK, delivered in partnership with the City of York Council, Homes England and Network Rail. It is expected to deliver £1.16 billion to the economy, including more than 6,500 jobs, and thus will be a major contribution to the prosperity of Yorkshire and the rest of the country. Fundraising and planning are well underway but unveiling *Rocket* later this year will be one of the first and most visible signs that Vision 2025 is becoming a reality.

Our work at the Science Museum Group is always aimed at benefiting the country at large, not just visitors to our museums. Last year, we opened, thanks to generous support from BP, our Science Museum Academy, with centres in London and Manchester. This offers research-led training and resources to all those involved in science teaching, in order to inspire the next generation of scientists, engineers and technicians. We are also committed to ensuring that young people's future in science, technology, engineering and maths will be welcoming, inclusive and diverse.

But perhaps nothing could be more inspiring to young minds than an actual spaceship, and this year we concluded one of our most successful experiments in sharing star objects. The Soyuz spacecraft, which in 2016 carried Tim Peake, the first official British astronaut to visit the International Space Station, safely back to Earth, completed its tour of eight venues and was seen by more than 1.3 million people. In each venue, the excitement generated by this thrilling exhibit was palpable, and we are grateful for the incredible support from our sponsor Samsung to realise this project. My favourite fact, of all the copious information and statistics in this report, is that during its 12-week visit to Peterborough Cathedral, the church's visitor numbers rose by 810%. Even the pioneers of the railways would have been impressed by that.

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1 Ian Blatchford, Group director, with Tim Peake, ESA astronaut, Mary Archer, Group chairman and Peter Dalliston, dean of Peterborough Cathedral, at the opening of Tim Peake's Spacecraft in Peterborough Cathedral

2 Mary Archer, Group chairman, presents a Fellowship to HRH The Princess Royal at the Director's Dinner

3 Broadcaster and scientist Maggie Aderin-Pocock speaking at the Science Museum at the launch of nominations for the new £50 note

4 Musician Joe Stilgoe and writer Phil Ball in conversation with Jon Milton, Group head of content, at the Science of Music and Mood event at the Science Museum

5 Fabiola Gianotti, director-general of CERN, at the Director's Dinner, where she received a Fellowship to the Science Museum

6 Louise Brown, the first person to be born through IVF, is presented with a cake and card on her 40th birthday by Group science director Roger Highfield at the Science Museum's Birthday Lates

7 Roger Penrose, University of Oxford Emeritus Rouse Ball professor of mathematics, in conversation with broadcaster Hannah Fry at the Oxford Mathematics London Public Lecture at the Science Museum

8 Simon Jenkins, columnist for The Guardian, at the National Railway Museum's Director's Dinner

9 Bob Ward, policy and communications director at the Grantham Research Institute on Climate Change and the Environment, Roger Highfield, Group science director, and Patrick Vallance, chief scientific adviser to the UK government, at the Science Museum's Sun Lates

10 Illustrator Quentin Blake at the unveiling of a series of his artworks created exclusively for the Science Museum's Wonderlab: The Equinor Gallery

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12 Blue Peter presenter Lindsey Russell at the National Railway Museum's Future Engineers event

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14 Richard Leese, leader of Manchester City Council, at the launch of the Manchester Academy

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'I am delighted that the Science Museum's new exhibition, The Sun: Living With Our Star, will engage many more people in the amazing science of our Sun'

Jim Bridenstine, NASA administrator

STEP INSIDE OUR STAR

Our trailblazing exhibition devoted to the Sun examines its profound influence on the way we live

The year's autumn blockbuster, *The Sun: Living With Our Star*, opened at the Science Museum in October to reveal the power, beauty and dark side of the Sun and shed fresh light on our evolving relationship with our closest star.

From beautiful early Nordic Bronze Age artefacts, which reveal ancient beliefs of how the Sun was transported across the sky, to details of upcoming NASA and ESA solar missions, this groundbreaking exhibition looked at humankind's dependence on, and changing understanding of, our star.

Highlights from the Group's collection included an astronomical spectroscope made for Norman Lockyer – one of the original founders of the Science Museum – who used it to discover helium in the Sun's atmosphere in 1868, before going on to identify its presence on Earth. It was, therefore, the first 'extra-terrestrial' element to be discovered. The exhibition coincided with the 150th anniversary of Lockyer's discovery.

Left: An early Nordic bronze sculpture depicting the Sun being transported across the sky
Below centre: A child explores a display
Below: An 18th-century French clock featuring an orrery planetary model of the Sun, Earth and Moon

Also on display was the original orrery, a mechanical model of the Solar System, made for the Earl of Orrery in 1712 to demonstrate the motions of the Earth and Moon around the Sun.

Dr Harry Cliff, lead curator of the exhibition and particle physicist at the University of Cambridge, said: 'The fact that the Sun has had such a profound influence on the way we live makes it an incredibly rich subject for an exhibition, crossing huge expanses of time and place. It's also a subject that is increasingly relevant to the way we live now, from the threat of solar storms to the upcoming space missions that will allow humankind to touch the Sun for the first time.'

The exhibition looked at the ongoing work to recreate the nuclear reactions that power the Sun. Visitors here on Earth got close to a Tokamak ST25-HTS, a prototype nuclear fusion reactor which successfully created and sustained plasma for a record-breaking 29 hours in 2015.

Giving visitors the opportunity to experience and explore the power of the Sun, the exhibition featured several interactive experiences. These included a huge illuminated wall display that saw the Sun rise in different seasons and different locations around the world, a sunray art installation, and a digital mirror that let visitors try on a range of virtual sunglasses, including the world's first pair.

'It can't fail to change how visitors will feel when they look skywards'

Nature

Over many centuries people have worked to unlock the secrets of the Sun, and this exhibition explored the great advances made since the invention of the telescope in the early 1600s. Detailed and beautiful sketches, prints, paintings and photographs of the Sun reveal the important observations recorded by artists and astronomers between the mid-1800s and mid-1900s, including the sunspot paintings of James Nasmyth and photographs by Elizabeth Beckley, one of the first female employees of an astronomical observatory.

Designers Sam Jacob Studio and Fraser Muggeridge Studio ensured the exhibition was instructional but also evocative, reminding visitors of their sensory and emotional responses to the Sun, and their awareness of how it regulates time and the seasons. The Sun's role in our visual and artistic language was also crucial.

Speaking via a video link at the exhibition's opening, Jim Bridenstine, NASA administrator, said: 'Since the beginning of civilisation humanity has been fascinated by the power and influence of our Sun. Over the last several decades NASA and researchers from around the world have harnessed space technologies to bring us closer to understanding our star than ever before. I am delighted that the Science Museum's new exhibition, *The Sun: Living With Our Star*, will tell these stories and engage many more people in the amazing science of our Sun.'

Ian Blatchford, director of the Group, echoed the sentiment: 'Since people first looked up at the sky the Sun has been a source of fascination, awe and inspiration and I am sure that this exhibition will delight, inspire and amaze visitors of all ages when it opens in October. *The Sun: Living With Our Star* will take people on a richly visual and action-packed adventure filled with remarkable stories, people and artefacts.'

Alongside this exhibition the Science Museum Group and a team of scientists at the University of Reading launched a citizen science project to research patterns in solar storm activity and ultimately try to improve space weather predictions. This project has seen thousands of images of solar storms analysed and the early results are already looking promising. Further details of the findings will be announced in Manchester, during the next leg of this spectacular show.

The exhibition was supported by Airbus, the Engineering and Physical Sciences Research Council, and the Swiss Department of Foreign Affairs.

The Sun: Living With Our Star (sponsored by Bechtel) opens at the Science and Industry Museum in July 2019, where it is expected to dazzle thousands more visitors, before embarking on a world tour.

Above: Exhibition designers Sam Jacob and Fraser Muggeridge designed an evocative, sensory experience for visitors

'Curated by the particle physicist Dr Harry Cliff with intelligent attention to both curious children and sun-worshipping adults'

The Daily Telegraph

SPACE INVADER

The Beagle 2 mission to Mars in 2003 was long thought a heroic failure, until fresh evidence revealed it had deployed successfully. The Science Museum is determined to preserve its legacy

To mark the 15th anniversary of the very day – 19 December 2003 – that the £45 million Beagle 2 spacecraft was successfully deployed from the Mars Express Orbiter, many of the original mission team gathered in the Science Museum to discuss how to capture the remarkable legacy of the mission. It was an important conversation, but a long overdue one, because for more than a decade the mission had been considered a failure.

The probe, a model of which can be seen in the Science Museum's Exploring Space gallery, looked like a giant pocket watch, with a protective outer casing that would unfold into four solar panels, so that Beagle 2 could get to work to hunt for signs of possible life on Mars and identify Martian geology, weather and climate.

The mission team was led by Colin Pillinger, the visionary Open University scientist who, in 1997, persuaded the European Space Agency to include a lander in its Mars Express mission, and then had to convince the British government to underwrite the costs. Pillinger named the probe after HMS *Beagle*, the ship that carried Charles Darwin on his survey voyage around the world.

Pillinger was an effective and charismatic communicator. To publicise the mission, he asked the science correspondent Roger Highfield, who is now science director of the Group, to meet Dave Rowntree and Alex James of the pop group Blur, and report for *The Daily Telegraph* on their support for the project – and the special 'call sign' they had composed for the spacecraft that would play when it landed on Mars.

Unfortunately, the expected radio contact on Christmas Day 2003 never came. Beagle 2 was declared lost, and Pillinger sadly died in May 2014 thinking that he had merely left a dent in the red planet.

However, Beagle 2's significance in the history of space exploration was re-evaluated after the discovery in late 2014 of a glinting object in the Isidis Planitia region by the Mars Reconnaissance Orbiter's HiRISE camera. The images confirmed that Beagle 2 did indeed survive the landing sequence and successfully deployed its parachute and gasbags to 'bounce down' on the Martian surface. It appears that the mission had come very close to success.

Among those who gathered with the Beagle 2 mission team members was Judith Pillinger, Colin's widow. She had thought it a shame that a decision had been made not to capture the legacy of the mission, simply because it had never generated any scientific data.

The Science Museum hopes to remedy this. Doug Millard, deputy keeper of technologies and engineering at the Science Museum, arranged for the acquisition of several Beagle 2 developmental models for the museum and is anxious that other mission records and materials are preserved and made available for future research and display.

'Beagle 2 was always a highly significant mission that needed to be represented in our *Exploring Space* gallery,' says Millard. 'Its successful landing on Mars only adds to its importance.'

An early developmental model of the Beagle 2 spacecraft

The Beagle 2 was declared lost, and Pillinger sadly died in May 2014 thinking that he had merely left a dent in the red planet

‘If Stephen Hawking and Willy Wonka designed the ultimate science playground then it might go a little like this’

Time Out

WORLD OF A MILLION WONDERS

Wonderlab, our interactive gallery concept, is inspiring a love of science in a younger generation and has just welcomed its millionth visitor

It is less than three years since the Science Museum opened *Wonderlab: The Equinor Gallery*, a pioneering interactive space. It’s had a lot to live up to, replacing the much-loved *Launchpad*, which had thrilled several generations of children. *Wonderlab* enjoys not only tremendous popularity with the public, but has also had a powerful impact on the way the Science Museum Group thinks about interactive experiences. It welcomed its millionth visitor in 2019 – Sofia Cohen-Chavez, who came with her family, said: ‘Everything about the museum is really fun and interactive, and you just learn so much.’

Wonderlab was built with a singular vision: to reveal, through hands-on experimentation, the building blocks of scientific theory that underpin the technology in our collections. Fifty exhibits spread across seven different zones allow you to see lightning in front of your eyes, feel friction in action on three giant slides, and experience space travel under a canopy of stars. The Tesla coil used in the regular electricity demonstrations discharges lightning at 1 million volts (mains electricity in UK homes is 240 volts).

This authentic, experiential approach to science embodies the values we hold dear: to ignite curiosity and reveal wonder.

We know that these moments of revelation can be extremely important in planting seeds in young minds, and creating the scientists, engineers, creators and artists who will tackle the big challenges that face our world.

What we didn’t know when the gallery opened in London is that it would prove to be just as popular with adults of all ages, many of whom are mesmerised by its sense of fun and openness. As *Time Out* put it: ‘If Stephen Hawking and Willy Wonka designed the ultimate science playground then it might go a little like this.’

Part of the reason for the gallery’s success is its design. As an interactive space, it needed to break new ground, but also sit in harmony with the rest of the museum. Our London *Wonderlab* was designed by Muf Architecture, which chose materials and colour palettes that not only created a visually sophisticated, beautiful gallery, but one that both children and adults would enjoy spending time in.

Of the million visitors who have experienced *Wonderlab*, more than a third have been free education visitors. Overall visitor numbers have continued to increase year on year, with tickets often sold out during peak periods. Satisfaction levels are at 98%.

‘Everything about the museum is really fun and interactive, and you just learn so much’

Sofia Cohen-Chavez, Wonderlab’s millionth visitor

Top: Sofia Cohen-Chavez, Wonderlab’s millionth visitor, with her family at the Science Museum
Above, middle row: The hands-on interactive exhibits at Wonderlab appeal to both children and adults
Right: A girl experiments with colour and light at the Science Museum’s Wonderlab gallery

Northern powerhouse

The National Science and Media Museum in Bradford opened its own *Wonderlab*, designed by Ab Rogers Design, in March 2017, inviting visitors to step inside and ‘discover the new home of wow’. It launched a new visual identity and name for the museum at the same time.

Wonderlab in Bradford shares much with its London sibling in terms of its design ethos and approach to interactivity. However, its exhibits are also tailored to shine a light on the museum’s world-leading collection of sound and vision technology.

Children are encouraged to think like scientists – to touch, play, experiment and take photographs as they navigate their way through more than 20 mind-bending exhibits. They can hear their voices echo through a 15m-long tube, get lost in a mirror maze, create art using light, and travel through a laser tunnel.

And while a sense of fun and playfulness is key to the experience, it is not the end goal. By experimenting, manipulating and exploring, children begin to understand how light and sound are the foundations of the technology they use every day.

Bradford’s *Wonderlab* has been a game-changer in the city. Since opening in 2017, the majority of the museum’s 718,000 general-admission visitors have experienced its magic and 50,000 education group visitors have been inspired to see, hear, think and do more.

The National Railway Museum in York is beginning to plan its own distinctive *Wonderlab* – exploring the principles of speed, power and motion that drive our railways – as part of Vision 2025 (*see pages 4-5*).

The Science and Industry Museum in Manchester is to follow suit with its own *Wonderlab* experience in the longer term, applying the same techniques that have proved so effective in London and Bradford.

As we hoped from the start, *Wonderlab* is spreading the wonder of science across the country – and even across the world (it has inspired a new gallery in Brisbane, Australia, which is featured overleaf). It is fast becoming a brand in its own right and a standard-bearer for interactivity in museums everywhere.

‘Visitors can step inside SparkLab to test ideas and find creative ways to solve problems – the very same skills that scientists, engineers and mathematicians use every day’

Leeanne Enoch, science and arts minister for Queensland

Left: SparkLab in the Queensland Museum in Brisbane, Australia

Below: Children love SparkLab's interactive exhibits

BRIGHT SPARKS

Our pioneering Wonderlab concept has inspired a new gallery in Australia

The Science Museum Group’s *Wonderlab* concept was always too good to stay in one country, and in the past year it has inspired a new gallery on the other side of the planet, thanks to an innovative partnership with one of Australia’s leading museums.

Members of the talented team that created our popular galleries in Bradford and London have collaborated with colleagues at the Queensland Museum, Brisbane, over an 18-month period to transform its existing science centre, based around the approach they took for *Wonderlab* in the UK.

The result is a stunning $9.4 million (£5.1 million) space called *SparkLab*, with 40 interactive exhibits that aim to show visitors how science, technology, engineering and maths form an integral part of our daily life. The new centre has harnessed the expertise of the Science Museum Group to deliver fun, exciting, hands-on learning in a way that is tailored to the Queensland Museum, its audiences and the Australian school curriculum. It is hoped that *SparkLab* will awaken children’s interest in science, technology, engineering and maths as a career in the long term.

Speaking at the opening of the gallery, Leeanne Enoch, science and arts minister for Queensland, said: ‘Visitors can step inside *SparkLab* to test ideas and find creative ways to solve problems – the very same skills that scientists, engineers and mathematicians use every day.’

The Science Museum’s support for the team in Queensland extended across every aspect of the project, from content curation and design to marketing, photography and learning resources for the gallery. In what was a highly collaborative, consultative project, the Science Museum sent several team members to Australia over a period of a year to share their expertise, research, philosophy and contacts.

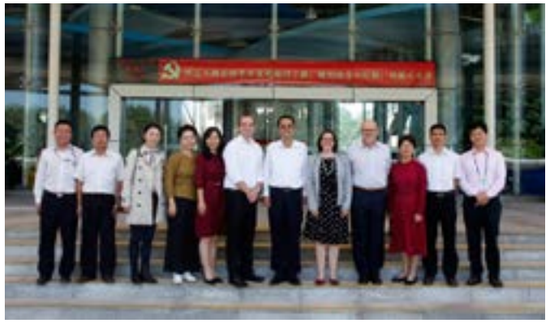
SparkLab opened to public and critical acclaim in August 2018 and the collaboration led to the creation of the Science Museum Group’s Cultural and Commercial Partnerships team, which is dedicated to building on the global impact of our group.

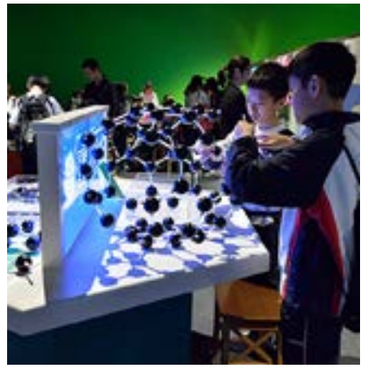
ON THE WORLD STAGE

Touring exhibitions and collaborations allow us to build vital global partnerships and show our work to an international audience

‘We’re hoping to tour more of our exhibitions in coming years... so next time you’re holidaying in a foreign clime you might find a bit of Manchester in the local museum’

Sarah Hanson, touring exhibitions coordinator, Science and Industry Museum





Above: Members of the Group’s Manchester team with the Hong Kong Science Museum team
Far left: Children play with interactive displays at the Wonder Materials: Graphene and Beyond exhibition in Hong Kong
Left: Installations were both informative and hands-on, explaining the science behind graphene

The Science Museum Group’s commitment to forge relationships with countries and cultures across the globe grows stronger every year. Building on the previous successes of our touring exhibitions, over the past year we have had several more important partnerships with exhibition centres around the world.

Wonder Materials: Graphene and Beyond, our first touring exhibition from the Science and Industry Museum in Manchester, concluded its tour with an impressive 142,200 visitors during its four-month display at the Hong Kong Science Museum, which has been a longstanding supporter of our touring exhibitions programme.

At the same venue in Hong Kong, we also collaborated on *The Treasures of Time*, an exhibition that blended science, art and history. Our team provided curatorial support and objects on loan which highlighted the production and trade of clocks and watches between Britain and China in the 18th century. The Group’s exhibits enjoyed pride of place in the exhibition alongside 120 of the finest clocks from the Palace Museum in Beijing, many of which will be shown in a forthcoming exhibition at the Science Museum in 2020.

In Australia, we built on an existing successful relationship with the Queensland Museum after the well-received tour of *Collider* in 2016–17. Our team was key in a major redevelopment of its science centre, using our own *Wonderlab* galleries as inspiration.

Furthermore, we are delighted that *Superbugs: The Fight for Our Lives* has been awarded a grant from Wellcome to support parallel tours in India and China this year. The exhibition team in London is co-curating the display, adapting it to the audiences of each country, working closely with the Guangdong Science Centre in China and the National Council of Science Museums in India. The exhibition will tour four cities in each country. The Chinese show opens in Guangzhou in July, while the Indian event launches in Delhi in September.

Our Blueprint Packs, in which we supply content that can be adapted to local exhibits, have also provided a prestigious opportunity to showcase the work of the Group. The Blueprint Pack for *Superbugs* resulted in displays opening at the State Biological Museum in Moscow, Russia, and at the Science Cultural Centre in Buenos Aires, Argentina.

SPACE ODYSSEY

The extensive UK tour of the Soyuz spacecraft, which brought Tim Peake safely back to Earth in 2016, has been an astonishing success, surpassing all expectations and drawing in well over a million visitors

The Science Museum Group boasts many star objects, but perhaps none in recent years has quite matched the superstar appeal of Soyuz TMA-19M, the spacecraft that returned Tim Peake, Yuri Malenchenko and Tim Kopra safely from the International Space Station in 2016. Taking off in September 2017 on its national tour of the UK – which was presented in partnership with Samsung – the Soyuz has landed at venues across the country, inspiring millions of people by bringing to life the wonder of space travel.

It is the first time the Science Museum Group has undertaken such an extensive tour of one of its star objects, visiting all the Group's sites outside London as well as major museums in Scotland, Wales and Northern Ireland. In addition, a national competition to host the capsule was won by Peterborough Cathedral, resulting in new audiences seeing the spacecraft in a spectacular and thought-provoking location.

And what a success it has been. We have given more than 1.3 million visitors the opportunity to see this iconic object up close, bringing people closer to the science behind space travel and helping to inspire future generations.

Across four of the Group's sites in Bradford, Shildon, York and Manchester visitor numbers reached almost half a million, surpassing the tour's midway target by 100,000. Tour venues have seen a significant surge in visitors during the period they have hosted the display, with Peterborough Cathedral reporting a staggering 810% increase in visitors during the time the spacecraft was in situ.

Sharing key objects in the Group's collection across the country is key to director Ian Blatchford's mission. 'It is rare to see the star objects in Britain's great museum collections touring the length and breadth of the country, and I am so pleased with the success of the Soyuz tour to date,' he said.

'I am thrilled that so many people have had the opportunity to see this extraordinary artefact of recent space history and be inspired by Tim Peake's mission.'

'It has been a great privilege to host this remarkable exhibition in Peterborough Cathedral. It has also been humbling to see how fascinated people are to see these instruments of 21st century space travel in our ancient, sacred space'

Chris Dalliston, Dean of Peterborough Cathedral

Opposite, left and right: The Soyuz arrives at the National Museum Cardiff and is carefully hoisted out
Clockwise from above left: Tim Peake's Sokol KV-2 spacesuit; the Soyuz arrives in Peterborough Cathedral; the Revd Chris Dalliston, Dean of the cathedral, at the opening of the display; Tim Peake gives a talk to schoolchildren at the National Science and Media Museum in Bradford; the Space Descent VR experience

‘It’s crucial that children have access to these kinds of resources – it expands their education and interest in STEM subjects, and is key to defining the career choices that children go on to make’

Danielle George, astrophysicist and TV presenter

Peake has been an avid supporter of the tour, helping to spread the word ahead of each stop on the Soyuz’s journey and appearing in person at several venues. ‘You do become very attached to your spacecraft because it definitely does save your life,’ he said.

Above: Samsung’s ‘selfie spacesuit’

Above: The Samsung VR Bus outside Peterborough Cathedral, in which visitors could enjoy a virtual reality experience inside the Soyuz, narrated by Tim Peake
Left: Visitors enjoy the Space Descent experience in virtual reality headsets in Samsung’s VR Lounge

‘I’m particularly happy that people up and down the UK now have had the opportunity to discover more about my Principia mission and space travel, and that the Science Museum Group – with the support of Samsung – are doing so much to inspire the next generation of scientists and engineers.’

The display of the spacecraft is accompanied by *Space Descent VR* – the Group’s award-winning virtual reality experience designed by Alchemy VR. Narrated by Peake, it simulates the experience inside the Soyuz capsule on its incredible 400km journey back to Earth from the International Space Station. Presented within a specially curated immersive Samsung VR lounge using Gear VR, the experience has so far received 50,000 visitors.

Alongside the tour, Samsung is working with the Group’s learning team to provide an education outreach programme to reach KS3 and KS4 students, targeting schools and areas with low cultural engagement rates, where students may be disengaged from science, technology, engineering and maths (STEM) subjects.

Across the eight tour sites the programme has been delivered to over 20,000 students from more than 68 schools.

This outreach programme includes three core components: the Soyuz Rocket Show delivered at schools with low science engagement; a visit for students to their local tour venue to see the display, where they take part in a STEM-themed day; and a visit from the immersive Samsung VR Bus, the interior of which echoes the design of the International Space Station. By delivering science in an exciting and interactive way, along with the innovative Samsung technology on board the VR Bus, this programme has enabled us to reach students in a fresh and appealing way.

The Sokol KV-2 spacesuit worn by Peake joined the Soyuz tour in Manchester, following its acquisition by the Group. It was announced at the end of last year that once the tour has finished, the Sokol spacesuit will go on long-term display at the National Space Centre, Leicester, allowing even more people across the country the chance to learn more about Peake’s mission and the science behind space travel.

The national tour and education outreach programme have received overwhelmingly positive feedback, with the inspirational experiences both inside and outside the venues helping us to reach diverse audiences at levels far exceeding our expectations.

MISSION TO THE MOON

It is 50 years since the Moon landings and the Group has celebrated the anniversary with a series of events around Apollo 10, the ground-breaking spacecraft that paved the way for this historic mission and which we are fortunate to have in the Science Museum.

The Apollo 10 Command Module carried NASA astronauts Thomas Stafford, John Young and Eugene Cernan (who was also the last man on the Moon) in May 1969 on a lunar orbital mission, the dress rehearsal for the Apollo 11 landing.

The 50th anniversary of humankind’s first steps on the Moon was the perfect opportunity to present a new, enhanced display for this spacecraft in the Science Museum. Through this, we have been able to show our London audiences how the Apollo 10 astronauts were trained and how the lessons learned from their mission were vital in making Apollo 11 and the lunar landing a success two months later. The landing was the culmination of a programme that cost around $25 billion in 1960s dollars.

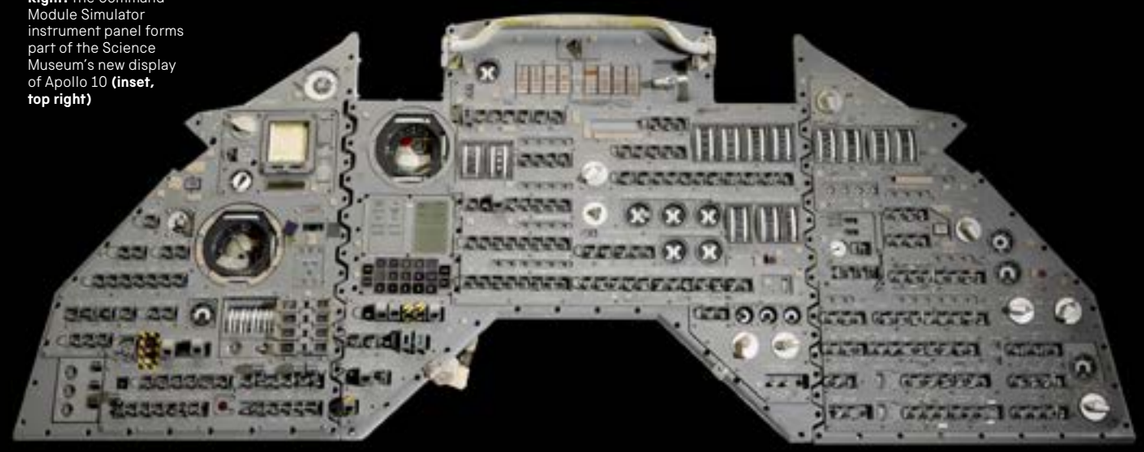
The refreshed display includes the Command Module Simulator instrument panel, on loan from NASA/Smithsonian, which has never been shown in the UK; a new graphic and audiovisual display with additional archival footage and imagery; and, for the Apollo 10 Command Module, a new non-reflective hatch to make it easier to look into the capsule’s cramped interior.

Tim Peake’s Soyuz spacecraft, which has now been seen by 1.3 million people on its UK tour (*see page 16*), also returned to the museum’s *Exploring Space* gallery – a reminder of how Soyuz was originally part of a rival Soviet programme initially intended to put a cosmonaut on the Moon by the late 1960s.

Events to celebrate Apollo have been arranged between the end of May and the end of the summer holidays, notably with a galaxy of space scientists, including astronomer royal Martin Rees and rock star and astrophysicist Brian May, a new Apollo IMAX film, volunteer tours, a space-themed *Lates* and an *Astronights* sleepover extravaganza for 600 people on 20 July, which is the anniversary of the Moon landing by Neil Armstrong and Buzz Aldrin.

In Bradford, the National Science and Media Museum celebrates the 50th anniversary in July with a summer exhibition that explores the sound and vision technologies used to probe the cosmos and the extraordinary global media response to the Apollo 11 mission.

Right: The Command Module Simulator instrument panel forms part of the Science Museum’s new display of Apollo 10 **(inset, top right)**



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30 YEARS OF THE WEB

Tim Berners-Lee, the engineer and computer scientist who changed the world for ever, spoke to a huge crowd at the Science Museum to celebrate the 30th birthday of his revolutionary invention

'Sometimes people say that without the web "We wouldn't be alive" or "We wouldn't be in love" '

Tim Berners-Lee, founder of the World Wide Web

The marine chronometer, the steam engine, the passenger railway, the jet engine... they are part of a long list of ingenious British inventions whose effects were globally significant. We can add to them one that has transformed almost every aspect of our lives within recent memory: the World Wide Web.

On 12 March, the 30th anniversary of this revolutionary technology, a huge audience gathered at the Science Museum to pay tribute to its brilliant British inventor, Tim Berners-Lee.

To an Energy Hall packed with 1,500 people, and with thousands more watching live online, Berners-Lee marked the anniversary with a plea for global action to fight for the future of the web and 'to think actively about the kind of web we want'.

Matt Brittin of Google, Anne-Marie Imafidon, founder of Stemettes, and television presenters Rachel Riley and Samira Ahmed were among those who spoke at the event with Berners-Lee, and discussed what governments, companies and all of us as citizens need to do to make sure the web is protected for future generations.

Introducing Berners-Lee to the stage at the 'world-renowned Science Museum', Sadiq Khan, the Mayor of London, paid tribute to 'one of the greatest, most pioneering minds of the past century'.

Berners-Lee delivered his speech in front of his famous NeXT computer that, thanks to the generosity of CERN, usually resides in the Science Museum's *Information Age* gallery. Recalling his supervisor's memorable 'vague but exciting' response to his 1989 proposal for the World Wide Web, Berners-Lee said: 'Thank goodness he didn't write "exciting but vague".'

In what he called 'a hometown gig', Berners-Lee began by recalling his 'happy days' as a child when he explored the Science Museum to inspect steam engines and press buttons – a formative experience that helped to inspire his love of science. 'It is great to be back in this museum,' he said.

After his speech, Berners-Lee sat down for an interview with Samira Ahmed, who asked him if he had any favourite 'unintended consequences' of the web.

'A range of things,' he replied. 'Sometimes people say that without the web "We wouldn't be alive" or "We wouldn't be in love".'

And did he ever think 'there would be so many cats on the web?' 'I've never told anyone this, but that was the plan all along!' he quipped, to cheers and laughter from the audience.

The heart of Berners-Lee's birthday message was, however, serious – and a call to action. The World Wide Web Foundation that he began is demanding that governments, companies and citizens come together to build a new 'contract for the web'. 'There is a lot of work to do,' he told the audience.

Berners-Lee spoke of the stark digital divide in terms of quality of access to the web and the way it exaggerates existing inequalities: although half the planet is now online, men are on average 25% more likely than women to have access to the web and English is the language of more than half the content on the web, despite accounting for only a small proportion of the spoken word across the world.

Smith Centre tribute
Ian Blatchford, director of the Group, spoke of our museums' role in this global endeavour: 'We can take pride in being a trusted source of robust information both on-site and across our digital channels.'

At a private reception in the Smith Centre to celebrate the web's 30th anniversary, Mary Archer, chairman of the Group, invited Berners-Lee to accept a Science Museum Fellowship in recognition of the scale of his achievement.

He accepted it to warm applause from the guests present, who included Wikipedia founder Jimmy Wales, Royal Society president Venki Ramakrishnan, astronaut Helen Sharman and actor David Tennant.

Rosemary Leith, founding director of the World Wide Web Foundation, and the wife of Berners-Lee, gave a speech about their organisation's important work to promote the web as a public good and a basic right. She received a rousing response from the distinguished guests present when she said that 'one of the most important things we can do is to make the web more female'.

From top left: Speakers at the event included singer and songwriter Imogen Heap, tech entrepreneur Roya Mahboob, Mayor of London Sadiq Khan, and Stemettes founder Anne-Marie Imafidon

Main image: TV presenter Rachel Riley, World Wide Web founder Tim Berners-Lee, and actor David Tennant pose for a selfie at the anniversary event at the Science Museum
Right: Visitors poured into the Science Museum's Energy Hall to hear Berners-Lee speak

THE GREATEST SHOWS IN TOWN

The Manchester and Bradford Science Festivals are reaching wider audiences than ever before with cutting-edge technology and innovative ideas

Science Museum Group festivals change lives. It's a daring claim, but being daring is what our events are all about – creating experiences that can't be found elsewhere and inspiring a love of science in audiences who are too often overlooked by other celebrations of the subject. And this was more evident than ever at our 2018 festivals in Manchester and Bradford, which took place at locations across both cities in order to appeal to as many people as possible. They offered a wide range of activities, demonstrations, games and discussions to appeal to every age group.

Accessible to everyone

At the Manchester Science Festival, the award-winning *Touch the Stars* event, hosted by the astrophysicist and science communicator Matthew Allen, opened physics up to a new audience by creating astronomy resources for people with visual impairments. Meanwhile, children from Abraham Moss Warriors junior football club took over the *Pi: Platform for Investigation* for a day, taking on the role of the scientists and researchers and sharing the results of their summer science project.

The headline event *You Have Been Upgraded* featured two amputees in its line-up, Tilly Lockey and James Young, who talked about the technologically advanced prosthetics they use, alongside panellists such as Manel Muñoz who identifies as a cyborg, and Lepht Anonym, who specialises in biohacking.

The Commonplace bus took science out into the community, with families enjoying slime-making activities in various everyday locations, including a shopping centre and a church.

At the Bradford Science Festival, the wonders of engineering were celebrated with battling robots, a supersonic car and 'Time Lord tech' from the world of *Doctor Who*. The event is proud to attract one of the most diverse audiences in the country for any science festival, reflecting the rich ethnic makeup of the city. Our team also worked with a group of adults with special educational needs to create Disability Lab, a series of science experiment films that were shown on the big screen in City Park throughout the event.

Above, centre: Visitors at the immersive Distortions in Spacetime exhibit at the Manchester Science Festival
Far left: Titan the Robot entertains the crowds in Bradford
Left: Festival visitors take a look at the Science on a Sphere exhibit in Bradford's Wonderlab gallery

Far left: A collection of elements owned by Louis Lucien Bonaparte, which went on display at the Science Museum as part of ChemFest

Left: Tilly Lockey talks about her high-tech prosthetic limbs at the Manchester Science Festival

Frontline research

While striving to be popular – the Bradford Science Festival was visited by 34,500 people over two days, and Manchester attracted 113,500 visits over 11 days, making it the largest science festival of its type in the country – our events are also devoted to cutting-edge science. In Manchester, the latest ideas and research on topics from AI to music were discussed by high-profile scientists, including Jim Al-Khalili, Marcus du Sautoy and Trevor Cox.

Tomorrow's scientists

One of the most important aims of our festivals is to inspire the next generation of scientists and engineers. For example, *Space Descent VR with Tim Peake*, which is touring the UK courtesy of Samsung (*see page 16*), encouraged youngsters in Bradford to look at the stars and imagine life as an astronaut, while Manchester's headline immersive experience, *Distortions in Spacetime*, took visitors inside a black hole. Back on Earth, the stars of *Robot Wars* battled it out live and our 9ft tall Titan the Robot delighted audiences in Bradford.

Winning formula

The Group's festivals proved once again our commitment to collaboration to deliver the most innovative and enjoyable experiences. In the past year, we have worked with a huge range of organisations from science, the arts, industry and education. As a result, Manchester and Bradford offered 200 events, and worked with more than 160 partners, from artists and actors to zoos and universities.

The impact our festivals have on their visitors is clear from the feedback the museums receive. In Bradford, visitors said the festival made them feel 'proud' of their city and that Bradford would be a great place in which to pursue a science, technology, engineering or maths (STEM) career. In Manchester, an audience member at the *In Conversation: Plastics Action* event, organised with the BBC, said they would be making changes to their lifestyle, while a parent at *Pi: Biggest Eyes to the Skies* said they were sure it had set their two young daughters 'on a science path'.

The wide-ranging impact of these events is perhaps best summed up by Susan Raikes, director of learning at the Group, who says: 'Once again, our festivals have proved to be the most innovative, playful and high-quality events of their kind. It is always an enormous pleasure to look back on our successes, and the ways in which our partners have continued to surprise us with new ideas for ways to get more people excited about the science that shapes our lives.'

CHEMFEST 2019

To celebrate 150 years of the periodic table of the elements in 2019, the Science Museum, V&A, Imperial College London, Royal College of Art, Royal Commission for the Exhibition of 1851, Royal Albert Hall, Royal Society of Chemistry and the Royal Institution collaborated on ChemFest, a festival of chemistry in South Kensington. The event, which took place during the UN's International Year of the Periodic Table of Chemical Elements, included family-friendly activities at the Science Museum and Imperial College London, a chemistry-themed *Lates* for adults at the Science Museum and two one-day academic conferences exploring the history of chemistry and its future.

A free temporary display was also unveiled at the Science Museum to celebrate the anniversary. The display includes Dmitri Mendeleev's first published periodic table, printed in March 1869, and a beautiful collection of more than 50 elements collected by Napoleon's nephew, Louis Lucien Bonaparte.

SHOCK AND AWE

What happens if the lights go off? That was just one of the questions posed by *Electricity: The Spark of Life*, the super-charged major exhibition at the Science and Industry Museum in Manchester.

The exhibition explored how this invisible force has for centuries captivated writers, artists, scientists and inventors, and how it has transformed our lives in the modern world.

From early encounters with natural wonders such as the aurora borealis and Luigi Galvani's experiments (which inspired Mary Shelley's *Frankenstein*), to the taming of power for use in domestic appliances, *Electricity: The Spark of Life* looked at how humans have wrestled this elemental force into submission and used it to serve us.

The impressive displays included a commission from Tekja, the data visualisation artists, which showed the scale of electricity used in Manchester and the North West, using real data provided by Electricity North West, the region's power network operator and an event partner for the exhibition.

Another popular exhibit was a traditional red phone box that had been repurposed to tell stories of the Lancaster blackout of 2015, when tens of thousands of homes were left without power in the wake of Storm Desmond. For younger visitors who have never known a life without mobile phones, or had any experience using a landline, this charming example of analogue technology that served an entire community was a source of curiosity and conversation.

Visitors were also able to meet some of the giants of electricity, including Thomas Edison, Nikola Tesla, Sebastian de Ferranti and Galvani, whose determination to be at the forefront of electrical invention made them among the best-known scientific names of their time.

At a time when we are more reliant on electricity than ever before, the exhibits also invited people to think about our ongoing relationship with this form of energy, the environmental impact of our choices and what future energy technologies might look like.

The exhibition was in collaboration with the Wellcome Collection in London and Teylers Museum in Haarlem, the Netherlands, with support from our major sponsor Shell, our sponsor the Engineering and Physical Sciences Research Council, and our event partner Electricity North West.

Above: Visitors delve into the exhibits at the Manchester exhibition, which included **(top right)** an immersive visualisation of electricity use in the city and **(above left)** a traditional red telephone box

LAST TSAR: ROMANOV MURDER MYSTERY

Science and medicine have cast new light on the last Russian imperial family and their deaths

'We at Russian Railways are very pleased to be able to support this exhibition, and care deeply about the preservation of our shared culture and history'

Vadim Mikhailov, first deputy chief executive officer, JSC Russian Railways

One hundred years to the day since the murder of Tsar Nicholas II and his family by the Bolsheviks on 17 July 1918, the Science Museum announced a new exhibition about one of the great mysteries of the 20th century.

Set against a turbulent backdrop of social upheaval and war between 1900 and 1918, *The Last Tsar: Blood and Revolution* explored the medical history of the Russian imperial family and the advances in forensic science that, more than 70 years later, transformed the investigation into their disappearance in 1918.

From the haemophilia B – a rare blood condition passed down from Queen Victoria – that blighted the short life of Tsarevich Alexei, upon whom the future of the dynasty relied, to the Tsarina's fertility and the training of the Tsar's daughters as Red Cross nurses, the exhibition juxtaposed the family's reliance on the latest medical discoveries of the time against their misplaced trust in the notorious spiritual healer Rasputin.

To celebrate the opening of the exhibition, the museum held an evening reception with guest speakers Vadim Mikhailov of JSC Russian Railways and Peter Gill, a forensic scientist, who revealed how the case was not only important historically but also 'to the development of forensic science and new techniques to solve crime'.

Visitors to the exhibition were able to examine evidence from the scene of the imperial family's execution – from a single diamond earring belonging to the Tsarina, to an icon damaged by bullets – and piece together the events of that night.

Among other rare artefacts on display were two imperial Fabergé eggs presented by the Tsar to his wife just a year before the fall of the royal dynasty, as well as photo albums of the royal family taken by their English tutor, which are part of the Science Museum Group Collection and have never been exhibited before.

Ian Blatchford, director of the Group, said: 'This exhibition explores one of the most dramatic periods in Russian history, all through the unique lens of science. Our curatorial team has brought together an exceptional, rare and poignant collection to tell this remarkable story.'

A special Russian-themed *Lates* accompanied the exhibition in February. After-hours visitors received a lesson in making a Fabergé egg, enjoyed a performance of Russian music and viewed radical art from the period.

The exhibition was supported by associate sponsor JSC Russian Railways and media partner *The Telegraph*.

Above: An imperial Fabergé egg presented to the Tsarina by the Tsar
Left: Vadim Mikhailov of JSC Russian Railways, Group chairman Mary Archer, Prince Edward, Duke of Kent, forensic scientist Peter Gill and Group director Ian Blatchford at the evening reception

OUR FRIEND IN THE NORTH

The return of Stephenson's Rocket to Newcastle, where it was built, and Manchester, where it made its official debut, were moving moments and attracted thousands of visitors. For this remarkable locomotive, however, the best is yet to come when it makes its final stop

The Science Museum Group is proud to have several items in its collection that changed the world, and one of the most recognised and well-loved is Robert Stephenson's *Rocket*, the 1829 locomotive that ushered in the railway age.

But even we are sometimes taken aback by just how enduringly popular it is. For the first time in almost 20 years, *Rocket* has been on tour, and has spent much of the past year drawing in many thousands of visitors from across the north of England. In June 2018, the locomotive began a rather poignant journey back to the city in which it was built more than 150 years ago, going on display at the Discovery Museum in Newcastle as part of *The Great Exhibition of the North*.

Not many objects need a tailored protective jacket and large lifting equipment to be moved safely, but the Group's conservation team were taking no chances with *Rocket*. They went to enormous lengths to ensure the locomotive was not damaged during its journey to Newcastle, carefully removing its chimney and 18 unique nuts and bolts, and closely supervising every stage of the movement of the vehicle.

The BBC's *The One Show* was on hand to record *Rocket*'s journey north, interviewing Science Museum Group experts and following the team on the trip, for a feature that was seen by millions of viewers. *Rocket*'s journey, together with historical facts and relevant collection items, was also shared on Twitter to an audience of more than 160,000.

Once it arrived in Newcastle, *Rocket* was displayed, appropriately, alongside another star of the steam age: *Turbinia*, the 1894 steam-turbine-powered ship that was once the fastest vessel in the world. Suspended solar shading and night-time lighting panels gave an impression of clouds of steam issuing from *Rocket*'s chimney, visually animating this beautiful locomotive, and giving viewers an impression of how dynamic it must have seemed while in operation.

The Great Exhibition of the North celebrated railway innovation over four centuries and included John Rastrick's notebook from the Group's collection (the first time it has been loaned) which detailed *Rocket*'s triumph at the Rainhill Trials.

Over the 80 days the locomotive was on display, *The Great Exhibition of the North* attracted 176,000 visitors, an 80% increase on the year before. Almost 6,000 schoolchildren engaged with the learning programme (a 143% increase on the previous year) and social media content about *Rocket* reached a 2-million-strong audience.

Sarah Stewart, chief executive of the Newcastle Gateshead Initiative, lead partner for *The Great Exhibition of the North*, said: '*Rocket* returning to Newcastle really caught the imagination and stirred up regional pride among local people and there was great excitement following its progress from the Science Museum in London to its temporary home at the Discovery Museum. Once it arrived, the enthusiasm continued as thousands of people visited to see *Rocket* back "home".'

Above and right: Stephenson's Rocket, built in 1829

Top right: Contractors in the Science Museum prepare for the painstaking process of transporting Rocket

'Rocket returning to Newcastle really caught the imagination and stirred up regional pride amongst local people'

Sarah Stewart, chief executive, Newcastle Gateshead Initiative, lead partner for The Great Exhibition of the North

‘We are excited to be finding new ways to tell these huge stories in the run-up to the 200th anniversary of the Liverpool and Manchester Railway in 2030’

Sally MacDonald, director, Science and Industry Museum

Right: Rocket takes pride of place in the Science and Industry Museum, Manchester **Far right:** Rocket is unloaded outside the Science and Industry Museum in Manchester **Below right:** Judith McNicol, director of the National Railway Museum, Archbishop John Sentamu and his wife Margaret, Group chairman Mary Archer, and Group director Ian Blatchford at the museum’s Annual Dinner

‘Rocket will inspire new generations of visitors to pursue their own futures in engineering’

Judith McNicol, director, National Railway Museum

Above: An impression of Rocket by our Digital Lab **Right:** Sally MacDonald, director of the Science and Industry Museum at the unveiling of Rocket in Manchester, with June Hitchen, Lord Mayor of Manchester, and Jonathan Newby, Group managing director

Digital model
Before heading north, *Rocket* was 3D-scanned as part of the Group's Digital Lab, supported by Samsung. The locomotive was particularly challenging to scan due to its colour, glossy texture and large, complex shape. Eleven hours were spent recording every angle of the vehicle, taking LIDAR (laser-imaging) scans and more than 2,500 photographs. After six weeks of processing the LIDAR data and 220GB of photography, a highly detailed point cloud was produced containing colour and intensity values for 750 million coordinates.

This data was used to create a high-resolution annotated 3D model, which was published on Sketchfab (the world’s largest 3D content platform) to celebrate *Rocket*’s arrival at the Science and Industry Museum in Manchester. The 3D model enabled audiences across the globe to examine this iconic locomotive in unprecedented detail, allowing them to peer underneath it and spin the 3-tonne locomotive around. It was celebrated as a ‘Staff Pick’ by Sketchfab, and the 3D model has since been viewed 11,000 times and can also be seen on the Science Museum Group Collection website.

Manchester reunion
After Newcastle, *Rocket* returned to Manchester for the first time in more than 180 years. This was another moment of historical and emotional significance: the locomotive originally ran on the Liverpool and Manchester Railway, so it was fitting that it should be displayed at the Science and Industry Museum, which stands on the site of the Manchester terminus of that railway. The Grade I-listed booking office and first-class waiting room are still open to the public.

Sally MacDonald, director of the Science and Industry Museum, said: ‘The story of Manchester’s role as the world’s first industrial city is one that is at the heart of our museum, and we are excited to be finding new ways to tell these huge stories in the run-up to the 200th anniversary of the Liverpool and Manchester Railway in 2030.

‘That first day when I came in and saw *Rocket* standing in the entrance hall looking so dramatic was a really emotional moment for me; it really felt like a special occasion.’

Shaping history
Alongside *Mallard* and *Flying Scotsman*, *Rocket* is one of the few steam locomotives to hold a place in popular consciousness. Because of this, it enables us to tell broader stories about the history of the railways and engineering. Although not the first steam locomotive, *Rocket* is one of the most significant because of its participation in the Rainhill Trials of 1829, the point at which powered mechanical rail propulsion came of age. The trials were undertaken on the Liverpool and Manchester Railway – the world’s first intercity railway – the construction of which presented the opportunity to prove that steam locomotion provided the best form of motive power for the railway company’s needs.

Rocket established the basic engineering design principles that would last until the end of steam in 1968. It brought together the latest technological innovations of the time, such as angled cylinders, a more efficient multi-tubular boiler, a blast pipe and a separate firebox, to create a mechanically and technically superior locomotive. Through its successful performance, *Rocket* convinced investors, politicians and the public that the railways had a viable future, spurring nearly two centuries of network construction and technological development.

The National Railway Museum is fortunate to have a treasure trove of original archive sources and objects from the early days of the railways. This includes engineer John Rastrick’s notebook used at the Rainhill Trials, and souvenirs associated with the opening of the Liverpool and Manchester Railway. These items will be displayed alongside *Rocket*, giving the story added context and depth. Bringing *Rocket* to the National Railway Museum underlines the place the British railway system had as the prototype for global adoption.

Inspiring engineers
For many, too, the National Railway Museum will be the place where they take their first steps towards a career in science, technology, engineering or maths (STEM). As part of Vision 2025, the ambitious £55 million project to transform the site (*see pages 4-5*), the museum will play an important role in addressing the UK’s engineering skills gap by doubling the number of schoolchildren coming through its doors and driving visitor growth to 1.2 million. It will also provide interactive and engaging experiences alongside traditional exhibits.

As Judith McNicol, director at the National Railway Museum, says: ‘We have a clear mission – to inspire the engineers and innovators of tomorrow. By making the world’s greatest railway collection accessible and relevant for all, we can sow the seeds of future railway ingenuity. *Rocket* will join the museum as a potent example of what can be achieved through STEM and it will inspire new generations of visitors to pursue their own futures in engineering.’

Rocket will initially form part of a new exhibition of rare and early model locomotives, with the working title of *Brass, Steel and Fire*, before moving to a purpose-built location at the entrance of the museum’s Great Hall. The exhibition will examine the creativity of engineering through 100 years of model-making. These experimental prototypes helped engineering innovations become reality and were used to test ideas or persuade others of their success. They played a crucial role in the development of the early railways. *Brass, Steel and Fire* will lead visitors through this engineering process, involving experimentation and prototyping, before they arrive at *Rocket* – the historic design breakthrough that enabled railways to exist as we know them today. It will be the first in a new programme of exhibitions that combine dramatic storytelling and engineering genius.

OBJECT LESSONS

Work has begun on the mammoth task of digitising and transporting 300,000 items to our new state-of-the-art centre in Wiltshire

This year work began in earnest on the Group's ambitious programme to study, digitise and safely transport more than 300,000 items from the Blythe House object store in London to the Science Museum Group Collection's new publicly accessible home at the National Collections Centre in Wiltshire.

An impressive 140,000 items have updated records and have been checked for hazards since work began in April 2018. New curatorial research is also increasing our knowledge of the collection, including the identification of 200 previously unknown chemical compounds. Items from the childhood chemical laboratory of Nobel-winner Ronald G W Norrish have also been documented, with research and possible display being explored.

Volunteers worked directly with the collection for the first time as part of this project. More than 50 (including 11 employee placements) have contributed 2,000 hours of their valuable time. Volunteer Ian Thomas said: 'I'm grateful for the opportunity to work with your absolutely fascinating collection. Without exception everyone I met was both engaging and enthusiastic.'

Following a successful planning application and positive response from local residents, construction began at the National Collections Centre in February 2019. Due to be completed in early 2020, this sustainable, operationally efficient facility will set new standards for collection care. Designed with public access in mind, the facility will open for public tours and school and research visits from 2023.

Sian Williams, programme director at the Group, said: 'We are delighted that construction is underway at the National Collections Centre, creating a new permanent home for the national collection in Wiltshire. This new facility will transform public access to one of the most significant scientific collections in the world, and we can't wait to welcome visitors.'

Fifty thousand objects have been photographed so far as part of the project, and thousands of new images of the collection have been published online for the first time, contributing to over a million visits to the Science Museum Group Collection website since 2017. Audiences are engaging with the collection in new and exciting ways, from reading long-form online content exploring materials and matter in 2019, to watching a new Group-wide YouTube series featuring items not on public display and discovering objects from across the collection using the Random Object Generator webpage and a new Google Chrome extension.

Ian Blatchford, director of the Group, said: 'Spending just a few minutes with the Random Object Generator reveals ordinary, surprising and wondrous items from across the Science Museum Group Collection. It's a hugely enjoyable experience and the first in a series of tools the Group will publish to encourage more audiences across the world to engage with our astonishing collection.'

'This new facility will transform public access to one of the most significant scientific collections in the world'

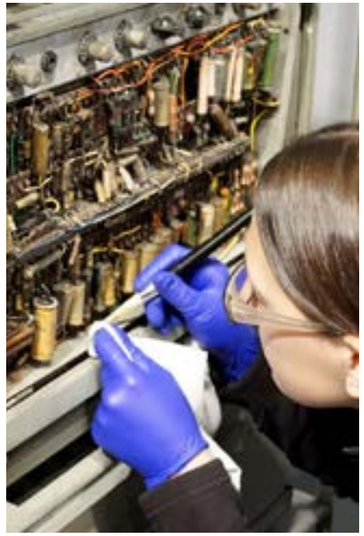
Sian Williams, programme director, Science Museum Group

Far left: A volunteer helps with digitisation as part of One Collection
Left: A One Collection hazards surveyor at work in the stores at Blythe House

Right: A microfadometer, which assesses how vulnerable materials are to light, in action

Below right: Cleaning a 1948 camera control rack for the Action Replay exhibition in Bradford

Right: The One Collection team outside Blythe House, London



Reviewing what we have

For over a century we have collected objects, photographs and archive materials that illustrate the impact of science, technology, engineering, medicine and media on our world. Work began this year on a major review of the Science Museum Group Collection, which will re-examine the significance of the items in our care and provide a greater understanding of the collection. The review will identify priorities for future collecting, research and public programming across the Group and is an opportunity to ensure the national collection is sustainable and can be enjoyed for generations to come.

Short summaries about the collection produced during the review process have already been published on the Science Museum Group Collection website, sharing curatorial insights with our online audiences.

Ian Blatchford said: 'Our goal is to sustain and grow the Science Museum Group's world-class collection so it can be enjoyed, explored and used for many years to come. This review enables us to reach that goal, ultimately creating a global resource for research and exhibitions while increasing public access to the incredible collection we care for.'

Conservation duties

To prepare for the *Action Replay* exhibition at the National Science and Media Museum in Bradford, the conservation team painstakingly cleaned a unique 1948 camera control rack. A sticky brown tar-like substance, probably caused by cigarette smoke, was removed ahead of the item going on public display.

In July 2018, the Science and Industry Museum in Manchester reopened its *Textiles* gallery. A George III half-penny coin found in Decker Mill, Manchester, was cleaned by the conservation team ahead of going on display. Corrosion was removed to avoid further deterioration and text on the 1799 coin was revealed. It's likely the coin was concealed during construction of the mill in 1801 to bring luck.

A microfadometer was delivered to the National Collections Centre's conservation laboratory in November. The equipment assesses surface stability of an object, enabling the conservation team to determine how long an item can be on display before noticeably fading. The microfadometer has already been used to study items in the Science Museum's Medicine Galleries.

Unusual acquisitions

In September we acquired items from a medical facility in Sierra Leone which provided care during the 2014–15 Ebola outbreak. From protective clothing used by frontline staff to diagnostic equipment and public health awareness materials, this represents a unique archive from a global medical emergency.

Laboratory equipment used for research and quality control at the Horlicks factory has been acquired following the factory's closure. These items will enable rich social and cultural stories of scientific practice associated with a global brand to be told.

Highlights from the 944 new acquisitions in the Science Museum Group Collection in 2018–19 are featured on page 54, or can be seen by visiting collection.sciencemuseum.org.uk

INSPIRING MINDS

Another year of innovative events and activities has engaged children in science and encouraged young people to consider a career in science and technology

It is testimony to the Science Museum Group's continuing success as a national leader in science, technology, engineering and maths (STEM) learning that over the past year we received more than 600,000 school-age visitors on booked tours, making us the most visited UK museum for this category. Thanks to an ambitious range of events and resources, the Science Museum Group has brought informal science education to a diverse range of audiences and age groups around the country.

A snapshot of some of our more imaginative events over the past year shows how we are engaging young minds and helping parents and teachers to keep their curiosity alive.

Design your own den
Budding young engineers and designers were invited to take part in a special October half-term experience in Bradford. The National Science and Media Museum teamed up with the hit CBBC programme *The Dengineers* to create a series of free activities centred around the theme of creating dens, which challenged youngsters to solve design and engineering problems.

CBBC presenter Lauren Layfield hosted a live show introducing her favourite dens from the show, which included an amazing 'military coding den' designed by Yusuf Karim, 11, from Bradford. The museum welcomed 22,000 people over the nine-day event.

A book at bedtime
Hundreds of families enjoyed a mass 'bedtime story' as part of a scheme to boost reading and oral skills in Bradford. Children and their parents from nine schools in the area visited the museum to take part in reading-focused and science-themed activities. The event was designed to highlight the importance of reading to young children – and to present it as an activity the whole family can be involved in.

It was attended by 1,400 parents and children, all of whom came from an area with complex issues relating to social deprivation. Many of these families were visiting the museum for the first time. We hope this will be the first of many visits.

'One student asked me if what we had said was real, whether we actually do the cool things we had mentioned about our jobs. Seeing their eyes light up was great'

Will, STEM Ambassador, Mission to Mars careers workshops, Manchester

Learn how to code
To encourage young people to take an interest in programming, the Science Museum is hosting *CoderDojo*, a free coding class. Developed in collaboration with Raspberry Pi, the affordable coding computer, the monthly sessions allow children aged seven and up to take on coding challenges, such as game design and website development, whatever their level of experience.

Young engineers
The *Future Engineers* event returned to the National Railway Museum in York for two weeks in October and November with a programme of free activities and shows for families and secondary-school students. Just over 29,000 visitors took part in activities which imagined the future of rail travel and posed unusual challenges to children, such as designing a robot railway and making music out of code. There were also live performances and demonstrations. *Future Engineers* was funded by the People's Postcode Lottery, Angel Trains, Evershot Rail and Porterbrook.

Professional engineers were on hand throughout the event to talk to children, answer questions, explain to them what their jobs are all about, and ensure the programme was accessible and relevant to everyone.

Award-winning gameplay
Easter half term saw the launch of *Treasure Hunters*, our new app for families. This fast-paced game encourages players to look beyond the most popular items in our museums by photographing objects in response to a series of questions and challenges. The game went on to win a prestigious Lovie Award, in honour of its contribution to digital media. *Treasure Hunters* was recently translated into five languages so visitors from overseas can play it too.

Last summer we unveiled a new online game for children, which imagines a town suddenly plunged into the dark. *Total Darkness* encourages players to reflect on their personal relationship with STEM in their everyday lives, solve problems in a contemporary setting, and recognise that science is something everyone can be part of. The game challenges players to explore a town, use their science skills to try to get the power back on and solve the mystery of the power failure. So far, *Total Darkness* has been played 147,000 times by people around the world. totaldarkness.sciencemuseum.org.uk

Science ambassadors
The Science Museum Group continued to deliver its exciting STEM Ambassador programme across three regions in the north of England. The STEM Ambassador Trans-Pennine Hub, managed by the Group on behalf of STEM Learning, the UK's largest provider of education and careers support in the field, connects schools, business and communities in the shared goal of inspiring young people to consider a career in STEM.

For example, in March the Ambassador Hub and the learning team from the National Science and Media Museum worked together to deliver *People Like Me*, which gave female pupils in Year 8 the opportunity to meet locally based female STEM Ambassadors working in science and engineering.

Royal Institution lectures
In December, visitors to the Science and Industry Museum in Manchester were treated to an exclusive livestream broadcast of the Royal Institution's Christmas lectures, *Who Am I?*, presented by Alice Roberts, ahead of their broadcast on the BBC (*see page 45*). The event, which was aimed at families, adults and young people, sold out quickly.

Opposite: Pupils in Bradford tell their own graffiti tales at Bedtime Stories
Top: Lauren Layfield with Yusuf Karim, 11, whose military coding den was selected for the CBBC show The Dengineers
Left: Industry ambassadors interact with children during Future Engineers in York

CLOSE ENCOUNTERS
Our collections, which are an astonishing record of scientific, technological and medical change since the 18th century, allow us to build relationships with academics and other museum professionals who work in learning and education. We held our first seminar looking at how museums can use their objects to engage visitors over two days in June last year. Titled 'Object encounters: past, present and future', the event was the result of a collaboration with the Reflexive Engagement Network at UCL Institute of Archaeology. Featuring 14 speakers, the seminar explored how people are exposed to science, technology and medical objects and the different ways in which museums and academics can engage the public through their exhibitions and programmes.

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TEACHING THE EXPERTS

Our new Science Museum Group Academy offers inspiration and practical resources to teachers and professionals working in science, technology, engineering and maths

The Group is passionate about helping educators of all kinds inspire the next generation, and in the past year we have added an important resource to our learning portfolio: the Science Museum Group Academy.

The Academy is an international centre of excellence for science engagement and offers inspirational, research-informed training and resources for teachers and museum and other professionals involved in science, technology, engineering and mathematics (STEM) communication and learning.

Bringing more than 25 years of training experience, and audience and wider education research, the Group has been leading the development of the practical application of the 'science capital' (*see box, opposite*) concept for the informal science learning sector. The Science Museum Group Academy is the latest result of this work.

Supported by founding partner BP, the Academy opened in October 2018 and was praised by Sam Gyimah, MP, the then UK science minister, and Andria Zafirakou, 'the world's best teacher' who won the 2018 Global Teacher Prize.

Gyimah said the Academy 'will equip teachers, museum staff and STEM professionals with further expertise to continue to inspire the next generation', while Ms Zafirakou said it would help teachers in their ultimate goal of inspiring children to 'to learn beyond the classroom'.

The Academy delivers a broad programme of training courses packed with creative and practical ideas. Hubs have been launched in London and Manchester, with our courses extending across the Group's sites and internationally. Teacher courses include Science Engagement,

'As teachers we all strive to answer the same questions. How do I get my students to love my subject? To want to learn beyond the classroom... and take up my subject in their future studies and careers?'

Andria Zafirakou, 2018 Global Teacher Prize winner, at the launch event

The Science Museum Group Academy offers practical training and help to teachers and other professionals working in STEM communication

WHAT IS SCIENCE CAPITAL?
Science capital is a measure of your relationship to science: what you know about it, how much you value it, and whether you feel it is 'for you'. It looks at what influences may have shaped your attitudes towards science, technology, engineering and maths – for example, your experiences of learning about science, your opinions of it, and what science-related activities you do, if any. It also looks at who you know in your life who uses and talks about science.

where teachers learn how to run more effective discussions and build their students' creative thinking skills, while STEM and museum professionals attending our Audience Engagement course can learn how to communicate their work to a diverse range of audiences.

A series of other events such as *Teacher Lates* provide further opportunities for teachers to engage with our learning programme. The Academy also offers an abundant range of learning resources (available online) designed to help course attendees apply what they have learned.

The atmosphere during the courses so far has been very positive as teachers explore and discuss ideas and enjoy themselves in the process. One teacher said that it had reminded her why she teaches sciences – probably our most rewarding piece of feedback so far, and exactly what we want the Academy to do.

The launch of the Academy is just the start of many new opportunities. We look forward to welcoming our next groups of participants over the coming year and inspiring them to engage young people with the wonders of STEM.

Above: Sam Gyimah MP with Jonathan Newby, Group managing director
Left: Sally MacDonald, director of the Science and Industry Museum, at the launch of our Manchester Academy

Above and right: Academy courses are lively and fun, with plenty of student engagement
Left: Group chairman Mary Archer, Group director Ian Blatchford, Global Teacher Prize winner Andria Zafirakou, BP Europe president Peter Mather and Group head of learning Susan Raikes at the launch of the SMG Academy

THE HOTTEST TICKET IN TOWN

In just 10 years, Lates, our monthly evenings aimed at adult visitors looking to relax with a beer and learn something new, have become one of our most popular and lively events

It's 10 years since the Science Museum embarked on a modest experiment: what if, one evening, the museum opened its doors to adult Londoners looking for a fun new way to socialise over a beer, explore the museum in a relaxed, child-free environment and learn something mind-blowing at the same time? Our little experiment paid off. The evening was a runaway hit, and *Lates* quickly went on to become an established monthly diary fixture. Our themed evenings in the Group's museums have entertained 405,000 adults over the past decade – most of them under-35s – and continue to be very popular.

To mark the tenth anniversary, the Science Museum held a special birthday *Lates* in September last year, with a remixed selection of the most popular evenings. The very first *Lates* in 2008, for example, was inspired by an exhibition at the Science Museum on Japanese cars. To understand the immediate popularity of these evenings, consider that, for that first night, our Cultural Events team had set themselves a conservative goal of just 500 visitors; in fact, we ended up welcoming 2,000 people.

'When friends suggest a catch-up, I suggest meeting at a Lates event. They would all agree with me that Lates are one of the best evenings of adult entertainment and enlightenment in London. It is the dream evening of food for the brain and joy for the heart'

Bobby Seagull, maths teacher, doctorate student, author, TV presenter and ambassador for National Numeracy

Left: Group director Ian Blatchford, Hu Pinghua, Chinese Ambassador Liu Xiaoming, Group chairman Mary Archer and the culture and media minister Michael Ellis at a special China Lates

'It is a real delight to join you for the China Lates at the Science Museum. I look forward to a charming and beautiful night of Chinese culture and science with friends old and new'

Liu Xiaoming, Chinese Ambassador to the UK

Left: Dancing the night away at a silent disco at the Science Museum
Above: Bobby Seagull, far right, with his brother, father and writer and TV personality Johnny Ball
Middle: A Power-themed Lates in the Science and Industry Museum in Manchester
Right: Author and science communicator Jon Chase performs one of his 'science raps'

Each month, a fresh theme encourages people to explore the galleries at the end of the working day. From partnering with Pride in London on a special sexuality-themed *Lates*, to celebrating 70 years of the National Health Service, our *Lates* have touched on a wide variety of topics. While the themes change, every *Lates* is designed to inspire new audiences through talks, activities and the chance to see the museum in a new light.

In July 2018, the hottest English summer on record provided the perfect opportunity to showcase our Manchester museum's beautiful outdoor spaces with a bee-themed *Lates*. Visitors basked in the sunshine on specially designed deckchairs, which featured vintage prints from our archive, enjoyed drinks in the 'bee garden' to the sound of a string quartet and learned how important bees are to the world.

In October, *Power* was the theme for the Manchester Science Festival *Lates*, inspired by the exhibition *Electricity: The Spark of Life*. It featured comedy by computer programmers Foxdog Studios, and delicious cycle-powered smoothies.

Also in October, the National Railway Museum held its first *Lates* event themed around science, technology, engineering and maths. The evening saw adults take part in activities adapted from the museum's popular *Future Engineers* family event among the dramatically lit locomotives of the Great Hall. There were also live acts, including the science communicator and rapper Jon Chase and the coding advocates Sonic Pi. Attendees could also try activities that brought the principles of engineering alive, and dance the night away at a silent disco.

In an exciting change for January 2019, the Science Museum followed the lead of our Manchester museum and began ticketing *Lates*. *The Daily Telegraph* also came on board as our media partner. Moving to a ticketing model for *Lates* has been a tremendous success. Tickets were free and could be booked in advance online or bought on the door. On the first night, the museum hosted more than 4,500 people, all keen to celebrate Chinese New Year in an amazing location that offered so many exciting activities.

The museum also welcomed Liu Xiaoming, the Chinese Ambassador, his wife Hu Pinghua, and Michael Ellis, the culture and media minister. A troupe of lion dancers from the London Chinatown Chinese Association took the group on a tour through the museum, culminating in our blockbuster exhibition *The Sun: Living With Our Star*. Liu praised the 'festive atmosphere' of the occasion, and thanked the museum for its 'continued support' of exchange and cooperation in the fields of science and technology between China and the UK.

UNMISSABLE **EXHIBITIONS**

Superbabe
'It's very weird to think I started off life in that tiny dish.' That was how the world's first 'test tube baby,' Louise Brown, referred to her glass incubator that featured in the Science Museum's temporary exhibition *IVF: 6 Million Babies Later.*

The museum was delighted to welcome Louise to celebrate the 40th anniversary of her birth, just before midnight on 25 July 1978. She joined Roger Highfield, our science director, and Professor Roger Gosden, an expert in female reproductive medicine, for a talk at the IMAX at a special *Lates*, which was attended by 3,500 people. The evening honoured the birth of the reproductive science revolution and the 70th anniversary of the NHS.

The event also served as a birthday party for Louise and other people who were conceived by IVF. Joining the celebrations in the *IVF: 6 Million Babies Later* exhibition space were fertility specialists, exhibition curators Connie Orbach and Ling Lee, and members of the public (*see page 6*).

Over its five-month run, the exhibition drew 180,000 visitors.

Connected world
Over the past 12 months, the National Science and Media Museum has explored the trailblazing history of sports broadcasting in the UK and the recent explosion in the 'internet of things', and installed a virtual reality experience that transported visitors to the world's first photography exhibition 180 years ago.

Action Replay: A History of Sports Broadcasting explored the technological triumphs that have made it possible for people around the globe to experience great sporting events live. Roger Mosey, former head of sport at the BBC, opened the exhibition and said it was a 'truly wonderful' display.

For *Thresholds*, the museum welcomed the artist Mat Collishaw and a ground-breaking virtual reality installation. His recreation of the 1839 exhibition of W H F Talbot's photographs in Birmingham featured digital imagery produced from Talbot's images and equipment held by the museum. *Thresholds* ran alongside *Immersion*, an exploration of 3D and other immersive technologies.

Never Alone: What Happens When Everything is Connected? focused on trends and issues around internet-connected devices. *Never Alone* recognised the positive part this technology plays in many people's lives, but also investigated concerns over the industry's access to personal data.

Top: Artist Mat Collishaw with Jo Quinton-Tulloch, director of the National Science and Media Museum, at Thresholds **Above:** Internet-connected toys at Never Alone at the National Science and Media Museum **Left:** Louise Brown, with the dish in which she was incubated, at the Science Museum's IVF: 6 Million Babies Later

'This exhibition is really important because it shows what IVF was like in the past and what it could be like in the future. It's got lots of information about my birth and it's fantastic'

Louise Brown, the world's first IVF baby, speaking at the launch of IVF: 6 Million Babies Later in the Science Museum

Left: Industrious, a bee sculpture by Tim Sutcliffe, at the Science and Industry Museum
Right and below: Testing at the National Railway Museum revealed the secrets of prototyping, including a Crossrail Elizabeth Line test station

Let it bee
There was a buzz in the air at the Science and Industry Museum last summer, thanks to the hugely popular *Bee in the City* trail that took place across Manchester.

The council initiative saw more than 100 bees placed in locations across the city, including *Industrious*, a beautiful sculpture of a giant worker bee – one of the best-known symbols of Manchester – by the artist Tim Sutcliffe. The artwork spent the summer in the Upper Yard of the museum.

Extending the bee theme further, the museum worked with garden designer Alexandra Froggatt to create a garden in the yard that would encourage bees and butterflies, and built a 'bee hotel'.

By the end of the summer, more than 3 million people had seen the bees in their various locations across the city, thousands of whom also visited the museum. This helped to boost August visitor figures by 12%.

In honour of *Industrious*, the museum's contemporary science team continued the bee theme for the summer *Lates* event, which featured robot bees, face-painting and sensory beehive installations. At the end of the summer, all the bee installations were auctioned, raising a total of £1.1 million for the Lord Mayor's We Love MCR charity.

'Truly wonderful'

Roger Mosey, former BBC head of sport, at Action Replay in Bradford

Ultimate test
Experimentation, prototyping and testing are all a vital – and exciting – part of the engineering and science process, but they usually go on behind the scenes, out of the public eye. The National Railway Museum decided to open up this world to visitors by exploring these practices in relation to the rail industry in its recent exhibition *Testing*, which opened in October 2018.

Testing brought people face-to-face with technology used in major contemporary engineering projects such as Crossrail and HS2. Visitors were able to step inside laboratories and test stations where new ideas and rail technologies are put through their paces.

Exhibition highlights included the UK's first experimental Hyperloop pod prototype, which gave visitors an idea of what high-speed travel could look like in the future, a high-speed-train testing rig and a recreated Crossrail Elizabeth Line test station. Even the benches at the station must meet a rigorous set of design and engineering challenges.

Testing has pioneered a new style of exhibition that makes the behind-the-scenes thinking in our rail industry accessible to visitors. It was part of the government's Year of Engineering campaign to inspire young people to consider science and engineering as a profession (*see page 64*).

LET THE GAMES BEGIN

What goes into making a great videogame? Fans can explore this question at events that host notable developers from around the world – with plenty of time left over for some serious console action

'This festival is really important and treats the games industry, which is worth about £1.5 billion a year in the UK, with a credibility similar to film and music'

Keith Stuart, bestselling author and games correspondent for The Guardian

It's scarcely 50 years old, but the videogames industry already dwarfs its entertainment rivals in music and cinema. In 2018, videogames outsold both music and films combined in the UK for the first time. It's an astonishing fact not lost on the Science Museum Group, which has long recognised the creative and technological brilliance of this fast-moving industry.

Two major videogame events already take place across the Group, and both have expanded over the past 12 months: the Yorkshire Games Festival at the National Science and Media Museum in Bradford, and *Power UP* at the Science Museum in London and the Science and Industry Museum in Manchester.

Yorkshire Games Festival

This year, the third Yorkshire Games Festival (supported by the City of Bradford Metropolitan District Council and the West Yorkshire Combined Authority) showcased some of the greatest talent and titles from across the videogames spectrum, providing gamers and budding game-makers with unrivalled access to the industry, alongside live shows and events.

Taking place over five days in February, it welcomed its greatest number of women speakers to date and had a distinctly international feel, as designers and developers from studios in the Netherlands, Denmark and Sweden joined their peers from the UK. Delegates were given a behind-the-scenes tour of games such as the *Wolfenstein* series, the smash-hit *Dead Cells*, and one of 2019's biggest releases for PlayStation 4, *Dreams*.

A new partnership was unveiled as the festival teamed up with BAFTA Young Game Designers for the UK's first Young Developer's Conference, which featured 200 pupils from six schools and home education groups attending activities and workshops that covered coding, the history of games design and much more.

Keith Stuart, author of *The Boy Made of Blocks*, and former games editor at *The Guardian*, said: 'This festival is really important and treats the games industry, which is worth about £1.5 billion a year in the UK, with a credibility similar to film and music. It helps young people understand that some of the biggest, most creative games in the world are made in the UK, and that they can be a part of it too.'

In addition, the *Let's Play* family weekend featured a range of new games, interactive live shows and challenges, plus education and careers advice from BAFTA Young Game Designers and Bradford College. It was also an opportunity to celebrate the great talent from the region, with developers from Bradford, Leeds and Sheffield in attendance and giving talks.

In total, the 2019 Yorkshire Games Festival had more than 7,600 admissions and recorded a 58% increase in pass sales compared with the first event.

Above: Exploring the innovative games in the Videogames, But... showcase at the Yorkshire Games Festival

Above right: Taking up the console challenge at a Power UP event at the Science Museum

Power UP

What better way to spend your school holidays than playing games in our museums? *Power UP*, an 'extravaganza of games', has been running during selected school holidays since 2015 at the Science and Industry Museum in Manchester and since 2016 at the Science Museum in London. It boasts nearly 200 consoles, a PC gaming section and virtual reality technology, giving visitors access to more than 1,300 titles covering nearly 50 years of games history. There's also a hands-on timeline demonstrating four decades of console development, with playable versions of the 1970s Binatone Pong machine, through to the latest generation PlayStation and Xbox.

Developments from the past 12 months include the first autism-friendly games session at the Science Museum, which takes place again this year. The event also saw high levels of volunteer support, with more than 30 volunteers for each session, many returning year after year. Meanwhile, income generated by 23,500 ticket sales in 2018–19 means the Group can now invest in its own consoles and screens.

Mark Cutmore, the Group's head of commercial experiences, said: '*Power UP* is proving exceptionally popular at both sites, so much so we are now able to fully invest in our own equipment – 250 consoles, plus games and accessories – instead of hiring them. This will allow us to increase income and deliver *Power UP* more flexibly around the Group. The popularity and publicity are supported by the fact that 100% of visitors to *Power UP* at the Science Museum this year knew about the event ahead of arrival.'

Main image: The Yorkshire Games Festival at the National Science and Media Museum welcomed developers from the Netherlands, Denmark and Sweden as well from the UK

Right: The Yorkshire Games Festival held many events for young videogame fans

INDUSTRIAL FABRIC

The redesigned Textiles gallery in Manchester tells the stories of the people, ideas and machines that turned the city into a 19th-century superpower

With its operational mill machinery, 19th-century photographs and insights into the lives of the mill workers, our *Textiles* gallery has long been one of the Manchester's museum's most popular galleries. A recent redesign of the gallery, which is housed in our beautiful Grade II-listed New Warehouse, aims to show in even more vivid detail how cotton transformed Manchester into a city at the heart of the Industrial Revolution.

Among the new objects on display are a pair of child-sized clogs, dating from 1870, from Manchester's Charter Street Ragged School, a charity that helped the poorest children. These clogs were lent to children from families who were too poor to afford shoes – but had to be stamped with instructions not to be pawned. Poverty meant that families would consider swapping their borrowed shoes for a hot meal.

The gallery also tackles the difficult topic of the link between the cotton industry and slavery in the American South for the first time, with the display of a cotton gin – a machine that separated seeds and husks from cotton fibres – that was made in Manchester around 1860. The invention of the cotton gin in 1793 revolutionised the cotton industry in the US, but also led to the growth of slavery. It is estimated to have resulted in a million more enslaved people being forced to grow cotton. The wealth and success of Manchester's cotton industry depended on this appalling system of human exploitation.

Much-loved objects, such as Richard Arkwright's incredible Water Frame, which revolutionised cotton production, enjoy better display positions, while the ever-popular 'Explainer' displays, dotted among the working mill machinery, have been updated to give visitors deeper insight into the birth of the Industrial Revolution.

The makeover of the *Textiles* gallery (supported by The Bowland Charitable Trust and the Zochonis Charitable Trust) is part of an ambitious programme of work in the run-up to the 200th anniversary of the Manchester site in 2030, which is remarkable for its architectural and historical significance. The programme will reveal more of the fascinating stories behind these impressive buildings and the objects they contain, and their role in the development of Manchester and the industrial world.

'Part of the reason why we're here is because science is helping to transform the macro-economy, the future of finance, and the future of money'

Mark Carney, governor of the Bank of England

Left: Mark Carney spoke of the 'huge heritage' in the Science Museum during his speech to invite nominations for the new £50 note

A SCIENTIFIC NAME TO NOTE

Bank notes – and who is depicted on them – reflect our sense of national identity and pride. That explains why last year, in the space of just a few weeks, more than 225,000 people responded to an invitation from Mark Carney, the governor of the Bank of England, to nominate a scientist to be the face on the new £50 note. Carney made the appeal to the public during a visit to the Science Museum in London in November, where he confirmed that the polymer note will celebrate the UK's achievements in science.

The nominations covered 989 people, demonstrating the breadth and depth of the UK's contribution to science. They included many scientists whose stories are told and whose inventions are celebrated across the five museums in our Group.

While it will be for the Bank to decide the winner, which will be announced this summer, Ian Blatchford, our director, spoke for many when he nominated Dorothy Hodgkin for the honour. 'She is the only British woman to win one of the science Nobel prizes,' he noted. 'And her work has taken on new relevance with the rise of superbugs that are resistant to antibiotics.'

On VE Day in 1945, Hodgkin completed the three-dimensional structure of penicillin at a time when its chemical formula was still the subject of much debate. We have her model of the structure in our collection. This was just the first of several significant contributions she made to science, including revealing the structures of vitamin B12 and insulin.

When making their nominations, Carney urged people to 'think creatively and think widely about what science means'. He described the process as 'an opportunity to celebrate the diversity of UK society' and pointed to the 'huge heritage in this museum and, of course, in this country' of scientists and scientific discoveries.

The Science Museum hosted several high-profile figures to hear Carney's announcement. They included Helen Sharman, Britain's first astronaut, and Maggie Aderin-Pocock, the space scientist. They joined Emily Grossman, Simon Schaffer, Simon Singh and representatives from the Bank of England on a committee that has drawn up a shortlist from the names put forward by the public.

Aderin-Pocock said she was 'hoping to see nominations from a diverse and wide group' and pointed out the importance of inspiring the next generation to tackle the 'deficit of scientists and engineers' in the UK.

Her own 'crazy dream' of a career in space science had, she pointed out, been inspired by childhood visits to the museum. 'I used to come here regularly and see all the amazing science and tech displayed here,' she said. 'It gave me the desire to aspire to be a space scientist.'

As well as the face of a notable scientist, the new note will benefit from a range of technological advances, from fraud prevention measures to features to help partially sighted people, and material advances that reduce the carbon footprint of notes.

HONOURING HAWKING

The Science Museum was proud to launch the final book by the late Stephen Hawking, the legendary scientist who was such an enthusiastic supporter of our work

'So remember to look up at the stars and not down at your feet. Try to make sense of what you see and wonder about what makes the universe exist'

Stephen Hawking

Stephen Hawking, who died in March 2018, had been a regular visitor to the Science Museum since the age of eight. Over the years we have held an exhibition, celebrations and events in honour of the world's best-known scientist, commissioned a portrait by David Hockney and made him a Fellow of the Science Museum, too. So it seemed entirely appropriate that his family chose the museum to launch his final book, *Brief Answers to the Big Questions*.

The event was attended by two of his children, Lucy and Tim Hawking, and introduced by Mary Archer, chairman of the trustees of the Science Museum Group. Roger Highfield, science director, chaired this special launch event.

With them were the co-authors of Hawking's final research paper, Malcolm Perry from the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge; Andrew Strominger from Harvard University; and Fay Dowker – a one-time student of Hawking, now professor of theoretical physics at Imperial College London.

The three discussed Hawking's final research about black holes, and what it was like to work with him, before the event ended with an inspiring statement from the great man, recorded before he died using his voice synthesiser – and which could have been aimed directly at the 400,000 children who visit as part of education groups each year:

'Opening up the thrill and wonder of scientific discovery, creating innovative and accessible ways to reach out to the widest young audience possible, greatly increases the chances of finding and inspiring the new Einstein. Wherever she might be.

'And however difficult life may seem, there is always something you can do and succeed at. It matters that you don't just give up. Unleash your imagination. Shape the future.'

Tim Hawking, Lucy Hawking, Roger Highfield, Malcolm Perry, Andrew Strominger and Fay Dowker at the launch of Hawking's final book, Brief Answers to the Big Questions

'I loved working on creating this Perfect Body. I've always been a big fan of projects which combine art and science'

Alice Roberts, anatomist, author and broadcaster

Left: Alice Roberts with Group science director Roger Highfield at the unveiling of the Perfect Body at a special Science Museum Lates

ULTIMATE HUMAN

Roger Highfield, science director, challenged Alice Roberts to iron out the scars of human evolution for a new display

Most of us have at some time wished we could change our bodies, but perhaps not quite in the way imagined by Alice Roberts, the science broadcaster and University of Birmingham anatomist. Her *Perfect Body* – a model of which went on display at the Science Museum last June – was a response to an unusual challenge laid down to her by Roger Highfield, the Group's science director: to design a new and improved human body, with all its evolutionary design flaws ironed out.

Roberts has often criticised the human body, which she calls a 'hodge podge of assembled parts'. In her view, many aspects of it function inefficiently or let us down as we age, such as our backs, hearts and knees. 'It works well – most of the time,' she says, 'but there are so many incompatible constraints on the design of individual elements that some of them end up failing long before each of us shuffles off this mortal coil – and others are just plain untidy.'

The result of Roberts' improvements, seen in the sculpture designed by the anatomical artist Scott Eaton and the prosthetic sculptor Sangeet Probhakar, was startling. The model, based on Roberts' own body, was unveiled at a special Science Museum *Lates* hosted by Highfield and attended by 150 people. It prompted gasps from the audience, and even from Roberts herself. At first glance, the 'improved' body looks far more alien than human. But once Roberts explained her thinking, this optimum *Homo sapiens* started to make a great deal of sense.

Roberts made improvements to several areas, including the lumbar spine, eyes, ears, airway, heart and lungs. For each improvement, she took inspiration from an animal that 'does it better', ranging from chimpanzees to cats, birds and octopuses.

The most arresting improvement was to the process of human childbirth. Our large-headed babies can make childbirth difficult and painful, so Roberts followed the lead from marsupials and designed a human who gives birth early in pregnancy, and then keeps the baby in a pouch until it is ready to be independent.

Troublesome knees? They won't be a problem with Roberts' high-performance legs. The ostrich gave Roberts the idea to move the muscle mass of the human leg upwards and closer to the centre of the body – resulting in a shorter, denser thigh – leaving the feet light and easy to move. Large tendons provide high shock absorption.

Last but not least, Roberts ensured that her perfect body can change its skin pigment, in the same way as a cephalopod, to suit the prevailing climate. This meant she would be able to avoid sunburn and its attendant cancer risk in hot weather, but still absorb plenty of vitamin D in low sunlight.

'Art can open up different perspectives on science, stimulate new questions, and help make the science accessible to a wider audience as well,' says Roberts. 'In the end, I was happy to stick with my own body, with all its flaws and glitches. And trying to remodel it demonstrated well how the overall bodily structure of living organisms represents solutions to multiple design challenges and constraints.'

Alice Roberts' *Perfect Body* went on display in the *Who Am I?* gallery in June 2018. The project attracted widespread media interest and was the subject of a BBC Four documentary, *Can Science Make Me Perfect?*

LIGHT FANTASTIC

Illuminate, our glamorous new private events space with panoramic views across London, is fast becoming one of the capital's most sought-after venues

The Science Museum is fortunate to be in the cultural heart of South Kensington, one of London's most beautiful and fashionable districts. Who wouldn't want to go to a party there? In view of the museum's world-beating reputation and its prestigious location, the Group has been developing a spectacular space that can be hired exclusively for private parties, receptions and conferences on the upper floors of the building. After much thought, planning and work, we were delighted to open Illuminate on 1 March this year.

Illuminate is unlike any other venue in London. Located on Levels 4 and 5 of the Science Museum, it boasts glorious panoramic views of the city and offers two distinct entertaining and presentation spaces. It occupies the site of the old medicine galleries (which are moving to an even bigger and better space, designed by the top architectural practice Wilkinson Eyre, on Level 1 in autumn 2019). The floors had not been updated in over 30 years and the challenge presented to Duggan Morris Architects was to reinvigorate them while also respecting the language and history of the building.

The result is an inspiring and aesthetically satisfying experience, in keeping with the museum's visually creative ways of exploring science and innovation. Even the colour spectrums and patterns used in Illuminate are based on the science of how particular moods can be evoked by interior design. 'When people enter the space, we want them to feel the spirit of creation and discovery that the Science Museum showcases,' says lead architect Mary Duggan.

One of the most striking visual themes of Illuminate is the contrast between light and dark across two floors. This is illustrated in the journey that guests make across its two levels. Level 4 is a blacked-out space that gives hosts control of the creative lighting so they can immerse guests in a particular mood or brand experience. By contrast, as they go up to Level 5, the room is flooded with natural light from panoramic floor-to-ceiling windows, which offer sweeping views of London's skyline. This feature has, unsurprisingly, dazzled guests and has been a strong selling point for organisations looking to create an elegant and memorable occasion.

Illuminate was designed in response to two demands: a blue-chip venue that would be available to hire during daytime hours, and one with an abundance of natural daylight.

Main image and left: The top floor of Illuminate is a dazzling, light-filled room with views across London

Above, left and right: Illuminate hosts the Scientists Meet the Media event, organised by the Science Museum and Royal Society, supported by Wired and sponsored by Johnson & Johnson Innovation
Right: Level 4 is a blacked-out space that allows hosts control of the creative lighting

'We had a great event. The food, the audio-visual production, that view across London, and the feeling of space all added to its success'

Barry Jordan, head of business transformation, Royal Osteoporosis Society

As Ben Lheureux, head of catering and events at the Group, explains: 'Nowhere in the industry is there a space in a cultural organisation like the Science Museum where you can host conferences or awards ceremonies during the day. We have built a space based on what the industry is looking for and we have built something we think can evolve in the future.'

Indeed, an important motive in the Group's decision to create a self-sufficient events space was to generate income, particularly as our sector's government grants status remains frozen. Corporate events, according to Lheureux, 'are consistently showing a strong performance and are a good business model for museums as they don't rely on visitor footfall'. Illuminate can host up to 400 guests for dinners and conferences and 450 people for drinks receptions.

The Group was keen to offer a streamlined package along with this magnificent space, so our exclusive suppliers Moving Venue catering and White Light production can complete the occasion with delicious food and drink, and state-of-the-art audio, visual and lighting technology, ensuring a convenient, cost-effective planning process for hosts.

Illuminate, which has been hailed as one of London's top venue openings in 2019 by Banks Sadler, global event management agency, now sits alongside the Science Museum's portfolio of 12 other galleries that can be hired for private occasions, and has strengthened the Group's appeal to the charity and corporate sector.

Illuminate has added great value to what the Science Museum has already, says Lheureux. 'We've had organisations book a daytime event in Illuminate, then add on a gallery for an evening drinks reception. It makes our portfolio more profitable than ever.'

According to Jonathan Newby, managing director of the Science Museum Group, 'Illuminate will not only enable us to reach new segments of the events industry, but it will also help the Science Museum Group to deliver its very ambitious development plans and maintain its position as a world-leading cultural organisation.

'With the addition of these stunning spaces to our already iconic galleries, the Science Museum can ensure our events guests have as unforgettable and inspiring an experience as our visitors.'

GIVING THEIR ALL

‘My work at the museum enriches my life. I regard it as a privilege to be able to volunteer there’

Science Museum Group volunteer, satisfaction survey

The contribution made by our hundreds of volunteers cannot be overestimated, and the Group has been investing in their talents, making the experience more exciting and rewarding for them – and our audiences

This year has been a remarkable one for volunteering. We smashed our own record, with 1,100 volunteers giving an incredible 103,000 hours of their time – a 20% increase on the previous year, and an 88% increase since we introduced our volunteering strategy. Furthermore, we have created new and innovative ways for people to get involved, transformed the experience for our supervisors and played a leading role within the voluntary sector.

In June volunteers began supporting One Collection, our ambitious plan to document, digitise and rehouse more than 300,000 objects from London to a purpose-built storage facility at the Group’s National Collections Centre. By becoming embedded in the project, volunteers have made a big impact, contributing 4,500 hours and increasing the number of objects we have been able to digitise and document. Alongside this, we’ve introduced volunteering opportunities for employees, something we’ve also done at the Science Museum through our communications team volunteer role. Both allow employees to learn about different areas of the museum and provide great development opportunities.

Through online roles, volunteers can also now support us from home. Working with Portsmouth University, our *Railway Work, Life and Death* team have produced a publicly accessible database of 4,000 railway worker accidents.

Also giving time from home are our volunteers at the National Science and Media Museum in Bradford, who have blogged about new exhibitions and events,

promoting the museum in a fresh, word-of-mouth way through personal insight.

By involving corporate volunteers, we have increased the ways in which businesses can support us. This year, Hitachi employees led learning workshops at Locomotion in Shildon, while Network Rail volunteers re-packed our photographic collections and prepared The Depot at the National Railway Museum for reopening. At the Science and Industry Museum in Manchester, corporate volunteers helped with the summer ‘bee Garden’, *Power UP* and the city’s Science Festival, with employees from BNY Mellon giving a total of 264 hours.

This year we created new roles aimed at improving the visitor experience. In Bradford, ‘Early Bird’ volunteers ran activities for families with children who prefer a quieter museum experience. At the Science Museum, creative storytelling and engagement volunteers brought the *Frankenstein Festival* to life, while our coding mentors supported young people at coding workshops.

During *Future Engineers* at our York museum, and the Year of Engineering Festival, 450 volunteers gave 4,000 hours to run science, technology, engineering and maths (STEM) activities at the museums. Alongside this, our visitor welcome and engagement team at the Science and Industry Museum is now providing a friendly and informative introduction to the museum.

All this has been delivered while maintaining a museum experience that feels effortlessly professional. This year, volunteers gave 2,500 hours to the Manchester Science Festival and at the National Railway Museum ensured that our model railway ran 362 days of the year.

In the London museum they gave tours to 8,000 visitors and at Locomotion they provided 34,000 visitors with access to our locomotives. Meanwhile, in Bradford our ‘Memory Makers’ – a fantastic initiative that sees older visitors use photographs, films and television programmes from the archives to unlock memories of life in the past – delivered regular reminiscence sessions throughout the year.

None of this would have been possible without our amazing volunteer supervisors. In recognition of this, in 2018 we ran our first volunteer management conference, delivered volunteer management training to 150 colleagues and launched our Volunteer Supervisor of the Year Award, which was won by Anne Sharman, documentation officer, for her outstanding work with her collections information volunteers at the National Railway Museum.

Outside the museum, we have continued to play a leading role in volunteering in the sector. We hosted the Heritage Volunteering Group’s annual Volunteer Management Conference, which was attended by 140 people. Working with the Museum Association, the National Council for Voluntary Organisations and Agenda Consulting, we conducted the sector’s first major study into volunteering in 10 years. This work provides the data the sector needs to develop its approach to volunteering and ensures we are at the forefront of the field.

Main image: Christine, one of our volunteers, answering visitors’ questions at the Baby computer display in the Science and Industry Museum
Above: Volunteers play a vital role in helping to catalogue and preserve our collection
Left: A volunteer explains the engineering behind the locomotives at Locomotion

DISCOVERY CHANNELS

Our museums aim to lead the way in research in areas ranging from energy consumption to immersive technologies

'Research is thriving at the Science Museum Group in an exciting programme of funded work, a flourishing e-journal and events programme and, most impressive of all, in a culture where the "everyday" research of team members across the organisation is fostered and celebrated'

Sarah Dry, historian of science and Science Museum Group trustee

Above: Yanyue (Selena) Yuan is researching a science and technology-themed exhibition for the Group
Above right: The Group is a partner in the Audience of the Future project, which explores immersive technologies
Right: David Rooney teaching a class on infrastructure as part of the Science Museum's MSc teaching for UCL

This year Science Museum Group trustees approved a new research strategy with the ambitious aim that the Group should become the most research-informed museum group in the world. This is emblematic of our approach to research: that it should be embedded in all our museums' activity, driving the highest-quality content in everything we do.

The strategy recognises that there are many kinds of research that go on in people's everyday work practice and we plan to reinforce that with a curriculum of research skills training to make sure all staff are equipped to thrive in our organisation.

With that in mind, we are extending the role of the research department, which will now be explicitly a service department working across the Group. It is moving beyond its existing focus on the history of collections and technology to support research ambitions in digital, learning and conservation.

This is already bearing fruit: the Science Museum in London is running a project to research how digital techniques can be combined with scholarship in the display of complex artefacts, using clocks from the Palace Museum, Beijing as the case study. The project is funded by the Arts and Humanities Research Council (AHRC).

Key projects
The Group is a partner in several initiatives: one is Audience of the Future, a project to explore immersive technologies in areas such as learning, entertainment and retail, supported by £4 million from Innovate UK, the country's innovation agency. Another is Creative Clusters, which is funded by AHRC and aims to encourage collaboration between the UK's creative industries and its world-renowned universities.

The Group has also taken decisive steps as an Independent Research Organisation affiliated to UK Research and Innovation, the new umbrella organisation for the UK research councils. Metropolitan Science, a research project funded by the Leverhulme Trust and linked to the *Science City* gallery, which opens this autumn in London, is in its second year. Led by Rebekah Higgitt, a historian of science at the University of Kent, this is an investigation into the themes the gallery features: how London, a trading city without a university, became a capital of science.

Bradford's National Museum research project, also funded by AHRC, is embedded in both the local community and the city's National Science and Media Museum, examining how they could be closer. Here, Helen Graham, from the University of Leeds, is working with museum staff in a demonstration of the ways in which research can help our museums get better at what they do.

Meanwhile, Hiroki Shin, based in the Group's Dana Research Centre in London, is leading the AHRC-funded Communicating Material Cultures of Energy. He is working across the Group with stakeholders and public audiences to explore how better understanding of our usage of energy in the past may inform responsible consumption in the future.

Focus on China
Science and technology in China may be the theme of a major touring exhibition in the next few years. This year we were able, thanks to a grant from the Department for Business, Energy and Industrial Strategy, to start the research for this project, employing Yanyue (Selena) Yuan to research and propose exhibition narratives. Jing Zhu also joined the team to explore the Group's existing China-related objects, which are divided between many of our collections, and which range from ship models and medical instruments to archive photographs.

The project culminated in an international workshop in the Dana Research Centre – Chinese Science, Technology and Medicine: Cultures, Histories and Global Connections. Details can be found at https://tinyurl.com/y5jd5tax

Medical collections
Thanks to support from Wellcome, we have a particularly lively research community devoted to our medical collections, under the leadership of Sarah Wade, research manager. In association with our major Medicine Galleries project, which will culminate in late 2019 with the opening of a suite of five medical galleries in London, we have welcomed scholars to undertake a range of research projects on topics including colour-blindness, iron lungs and dialysis machines, human remains and culturally sensitive objects in our collection.

Alongside this, Wellcome also supports a secondment fellowship scheme, under which doctoral or postdoctoral researchers can extend their research funding to undertake more vocational projects, applying their existing research expertise to the Group's museums and collections. This year, we have welcomed Hannah Bower to help us to understand the significance of some of our early modern medical books, which are part of a significant and under-researched library collection of early books. Julia Swallow, who brings her expertise in the sociology of cancer, is joining us under the same scheme to help the development of our proposed future exhibition on this topic, due to open in London in 2021 before going on tour.

These are just some of the research initiatives relating specifically to the Group's medical collections; from the diversity of these projects, we have 'proof of concept' for our big ambition: to become a hub for the medical humanities where museum professionals and academics can come together to forge a lively and continuing culture of research.

The research department publishes an Annual Report detailing the Group's research activities. Please write to research@sciencemuseum.ac.uk for a copy.

Below left: Science Museum research fellow Hiroki Shin
Below: Above the Noise was part of the research for Bradford's National Museum project
Bottom left: Experimental practice at the Burden Neurological Institute from a Science Museum Group Journal article by Wellcome secondment fellow David Saunders

Moments in our research year
In Bradford, in March 2019, the exhibition *Above the Noise* opened, examining how local communities in the city have bypassed established media to tell their own stories (*see inside back cover*). The exhibition is not only about science, media and the people of the city, but also part of the research for Bradford's National Museum project.

Overseas, in São Paolo, Brazil, Sophie Vohra, one of our collaborative doctoral students, presented a conference paper on the commemoration of railway pioneers at the annual Federation of Public History meeting.

In the Dana Research Centre, in London, 16 Masters students gathered round a group of rare early modern scientific instruments to examine their significance as part of their 10-week option in 'Curating Science and Technology'.

The Science Museum Group Journal published a dialogue between Jan Hicks, archivist at the Science and Industry Museum in Manchester, and the renowned media artist Bill Morrison, a collaboration that arose from their work together on the exhibition *Electricity: The Spark of Life*.

RAILWAY AMBASSADOR

Locomotion is more than a museum – it is rooted in the place that gave birth to the railways, and its updated collections continue to bring that inspiring story to life

The railways were part of a social and technological revolution in Britain, and few museums explain the history of that transformation better than Locomotion, located in the world's first railway town, Shildon, in County Durham. The museum uses its historic setting – Shildon was the departure point for the first steam-powered train to run on the Stockton and Darlington Railway in 1825 – to demonstrate the social, economic and technological impact of the railways.

Locomotion, which opened in 2004, became part of the Science Museum Group in 2017 and work is now underway to improve the displays of the vehicles in the main Collection Building. The significance of the site in the history of the railways has been key to rethinking the display content, which focuses on the themes of 'moving goods, moving people and moving forward'. Shildon, for example, was home to the early railway pioneer, Timothy Hackworth, and the Shildon Wagon Works was, by the 1970s, the largest in Europe, employing 2,600 people.

Locomotion's conservation workshop honours this proud tradition of engine- and wagon-building. This year our team of restorers and volunteers in the workshop completed the first phase of the restoration of a railway carriage that will still be familiar to many: the electric two-car 2HAP No. 4308, a 'slam-door' commuter unit that was in service from 1959 to 1994, and which travelled over 2.7 million miles. It now sits resplendent on the floor of the Collection Building. Its place in the workshop has been taken by another electric vehicle, Class 71 E5001, the only preserved example of its class.

Older forms of rail travel are, of course, celebrated as well. Locomotion's five-month Festival of Steam began in May 2018 when *Eustace Forth*, an operating steam locomotive, arrived on loan. Visitors were also treated to a display of spectacular road steam vehicles. In July, the festival welcomed *Flying Scotsman*, which, as always, proved enormously popular, with 27,000 visitors coming to see the renowned engine in just three weeks. The event concluded in September with the annual gala – and the star of the show was *Oliver Cromwell*, a Britannia-class locomotive that pulled the last main-line steam passenger service in 1968.

'I am always delighted to see so many young people inspired and fascinated by the stories of the railways and the great engineers that created them'

Michelle Gorman, managing director, Visit County Durham

Sarah Price, head of Locomotion
Sarah joined as head of Locomotion at the end of August and was the first senior appointment since the museum moved under the management of the Science Museum Group in December 2017. Previously, Sarah had worked at Durham University as head of engagement and learning, where she was responsible for the visitor operations and public programme at all of Culture Durham's venues. This included working on award-winning programmes such as the Lindisfarne Gospels and Magna Carta exhibitions in Durham University, overseeing the development of the new Durham Light Infantry Gallery and leading the overhaul of the learning programme that resulted in a ten-fold expansion of visits. Since joining Locomotion, Sarah has been taking charge of updating the interpretation across site, reinvigorating the museum's programme of events and forging stronger links with the local community.

Left: Flying Scotsman visited Locomotion during the Festival of Steam **Below left:** Recreating the famous British Rail logo on a vintage commuter train **Below right:** Peering inside the historic carriages in the main Collection Building

WHAT WE ACQUIRED

In 2018–19 we added 944 objects to the Science Museum Group Collection. Here are 10 highlights

Tim Peake's space food, 2018
Seven recipes, from sizzling sausage to baked apple and the first bacon sandwich in space, were developed by Heston Blumenthal for British ESA astronaut Tim Peake to eat during his Principia mission to the International Space Station in 2015–16.

Midas XL3 live performance mixing console, 2018
This console was used by well-known musicians and bands – including Prince, Björk, Amy Winehouse, The Who, Coldplay, Madness, Robbie Williams and Jay-Z – for live shows from its manufacture in 1990 until 2018, when it joined the collection.

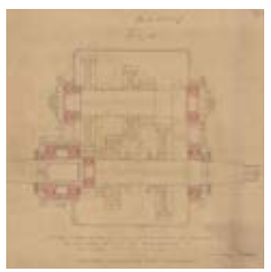
White House solar panel, 2018
This panel was installed on the White House roof in 1979 by President Jimmy Carter as a public symbol of his faith in 'the power of the sun to enrich our lives as we move away from our crippling dependence on foreign oil'. It can be seen in *The Sun: Living With Our Star*.

High Speed Freight Vehicle 1
It may not look impressive, but this is one of the most significant railway vehicles of the modern age. Railways across the globe use technology originally developed by this vehicle, which can now be seen on display at Locomotion in County Durham.

Letter from Charles Dickens, 2019
In 1869 a horsebox laden with parcels caught fire near Hanwell Station. Letters of apology were sent to the parcel owners, one of whom was Charles Dickens. Dickens replied that he 'took the loss with unbroken good humour towards the Great Western Railway Company' and signed the letter with his customary flourish.

Archive related to construction and test flights of Concorde 002, 2018
Fifty years since Concorde first flew, we have acquired an archive that comprehensively documents seven years of test flights, consisting of 500 plans, information relating to the aircraft, meeting notes and photographs.

Capacitor with two crocodile clips, 2018
Equipment made by Geoff Tootill for use during development of Baby, the Manchester Small-Scale Experimental Machine. Accompanied by a handwritten note stating it was found in the pocket of his lab coat.



Engineering drawings of early petrol car engines, 2018
These drawings from around 1900 were made during the early development of a petrol car engine at the Strickland and Co works, established by Major Frederic Strickland for building experimental motor vehicles.

Programme for Queen Victoria's Diamond Jubilee procession, 2018
Priced at 1 shilling, this illustrated programme of the Royal Jubilee procession was published in 1897 in aid of the Prince of Wales Hospital Fund for London.

Computer and coding kit prototype, 2018
This coding kit was developed by London-based Kano in 2012. Powered by a Raspberry Pi, the kit is designed to de-mystify the inner workings of a computer and represents efforts to make computing open and inclusive.

WHAT WE LOANED

In the past year, the Group loaned 2,585 objects to 165 different venues in the UK and 168 objects to another 24 venues overseas. Here are 10 highlights

British Railways Class 40 locomotive D200, 1958
To: East Lancashire Railway, Bury, UK
The first of its class, the locomotive joined six others at the gala event *40s at 60*, celebrating its 60th anniversary.

Orrery planetary model, 18th century
To: New York Historical Society Museum & Library, USA
Miniature orrery with armillary bands by John Troughton, London. Loaned for the exhibition *Harry Potter: A History of Magic.*

Arrival of Queen Victoria at King's Cross Station, c.1852
To: City Museum Simeonstift, Trier, Germany
This watercolour painting was loaned for the exhibition *Karl Marx 1818–1883 Life, Works, Time: Stations of a Life.*

Album of 'Cyanotypes of British and Foreign Ferns', 1853
To: New York Public Library, USA
These beautiful early photographic works were loaned for the exhibition *Blue Prints: The Pioneering Photographs of Anna Atkins.*

Beattie well tank locomotive, 1874
To: Avon Valley Railway, Gloucestershire, UK
This locomotive originally operated for 90 years and is still in working order. It was loaned for the railway's end-of-season gala.

Travelling microscope, 1843
To: Manchester Central Library, UK
Loaned for a Manchester Science Festival event commemorating the 200th anniversary of the birth of physicist James Joule, the microscope's owner.

Pomander, 17th century
To: Torquay Museum, UK
Silver pomander, in the form of a book, with a rat engraved on the side. Loaned for the exhibition *Spanish Flu and the Threat of Pandemic.*

Zvezda spacesuit, 1991
To: Tyne and Wear Archives and Museums, Newcastle upon Tyne, UK
Made by Sokol and used by astronaut Helen Sharman. One of a large number of loans to *The Great Exhibition of the North.*

Napoleon's toothbrush, Europe, 1790–1821
To: Wellcome Collection, London, UK
The silver-gilt handle of this toothbrush is engraved with Napoleon's coat of arms. Loaned for the exhibition *Teeth.*

Glass bottles containing mauveine, c.1858–60
To: Victoria and Albert Museum, London, UK
Chemist William Perkin created the first synthetic dye, mauveine. Loaned to the exhibition *Fashioned from Nature.*

FINANCIAL OVERVIEW: COMMERCIAL AND CULTURAL SUCCESS

By Jonathan Newby, managing director of the Group

Jonathan Newby, managing director of the Group, in the Science Museum's Information Age gallery

THE YEAR'S HIGHLIGHTS

The Science Museum Group attracted a total of 5,210,000 visits during the past year.

The Science Museum attracted 3,168,000 visits, which is level with the previous year. The programme included the exhibitions *The Sun: Living With Our Star* and *The Last Tsar: Blood and Revolution*. This total includes 433,000 visits in education groups, which is at similar levels to the previous year.

The Science and Industry Museum attracted 652,000 visits (-5%). The first half of the year performed strongly. Visits fell compared with the previous year due to the highly popular nature of the programme towards the end of 2017–18, and closures of part of the site as a result of the need for building conservation and maintenance. The total includes 88,000 visits in education groups (+9%).

The National Railway Museum had a very strong year attracting 782,000 visits (+3%). This performance was helped by the launch of the museum's new brand and marketing campaign, which increased the visibility of the museum within York. The total includes 37,000 visits in education groups (-9%). This was similar to years prior to last year's record-breaking year, which benefited from the Soyuz spacecraft tour.

Locomotion attracted 153,000 visits overall (-23%). Performance was behind the previous year which had benefited from the hugely successful Soyuz tour. A transition in programming to more science, technology, engineering and mathematics-focused subject matter, along with locomotive events, has also had an impact on numbers this year. This year's total includes 7,000 visits in education groups (-40%). This was similar to years prior to last year's record-breaking figures, which benefited from the Soyuz spacecraft tour.

The National Science and Media Museum attracted 455,000 visits (-10%). This was in line with expectations as the previous year was the first year of the relaunched museum brand, associated *Wonderlab* interactive gallery and the successful debut of the Soyuz on its UK tour. Performance this year remains ahead of that prior to 2017–18, continuing to reverse the gradual decline experienced then. The total includes 38,000 visits in education groups, which is level with the prior year.

Off-site visits: in total there were the 300,000 instances of participation in off-site learning activities delivered across the Group; 76,000 visits to *Flying Scotsman* as it toured heritage railways and provided main-line services, and more than 1 million visits to our touring exhibitions – our largest annual attendance since launching the programme in 2014. This was boosted by the tour of the Soyuz spacecraft which was seen by more than 1.3 million people during its 20-month tour of the UK.

SMG's digital audience: there were 10.4 million visits to the Group's websites, below the previous year. This fall is due to changes in our reporting method and the time taken for the new websites to establish themselves. We expect these figures to recover in future years.

SCIENCE MUSEUM GROUP VISIT NUMBERS 2018–19

Total number of visits to the museums	London	Manchester	York	Locomotion	Bradford	Group
2017–18	3,178,000	684,000	760,000	199,000	505,000	5,325,000
2018–19	**3,168,000**	**652,000**	**782,000**	**153,000**	**455,000**	**5,210,000**

Visits in education groups	London	Manchester	York	Locomotion	Bradford	Group
2017–18	429,000	80,000	41,000	13,000	38,000	601,000
2018–19	**429,000**	**88,000**	**37,000**	**7,000**	**38,000**	**603,000**

Any anomalies in totals and % differences arise from roundings

SCIENCE MUSEUM GROUP FINANCIAL SUMMARY 2018–19

In 2018–19, our Grant In Aid from the Department for Digital, Culture, Media and Sport increased to £47.9 million (from £45.2 million in 2017–18). The increase was mainly related to capital projects, while the allocation to core activities remained stable. One of the major capital projects is One Collection, which will relocate collections currently stored at Blythe House in West Kensington to a purpose-built facility at the National Collections Centre in Wiltshire.

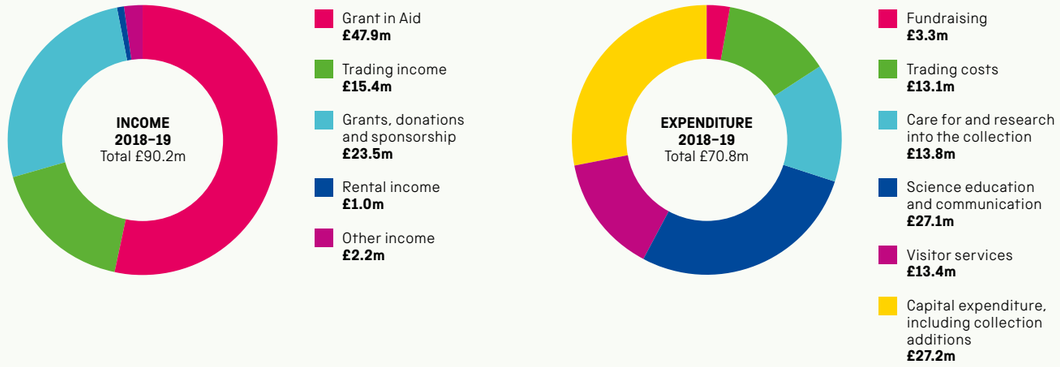
A very successful year in fundraising saw a £4.7 million increase in donations, grants and sponsorship to £23.5 million. This included grants and sponsorship towards our new galleries and exhibitions such as the Medicine Galleries, *Science City 1550–1800: The Linbury Gallery*, and the Special Exhibition Gallery at the Science and Industry Museum. We are excited to partner with the Gatsby Charitable Foundation to create a new gallery dedicated to technicians at the Science Museum. The David and Claudia Harding Foundation has also generously extended its support for the Science Museum's work, and Wellcome's support has allowed *Superbugs* to tour other museums.

We launched the STEM Circle, a new corporate membership programme, which has attracted its first members, including Cisco, Bloomberg Philanthropies, BT, MathWorks and Sanofi. We are particularly grateful to our visitors, who donated £2.7 million across our museums this year. This income is vital to sustain our museums in an uncertain funding environment. There was also an increase in ticket income, in part thanks to ticket admissions to *Wonderlab: The Equinor Gallery.*

Despite strong performances from *Wonderlab* and corporate events in the North, we did see a downturn in trading. This is in part due to the closure of areas to make way for new galleries and commercial outlets in the Science Museum. The main shop is being redesigned to increase footfall and the closure for this work resulted in a fall in profit. The timing of the touring exhibition programme also contributed to weaker results. We saw a challenging performance with *The Sun: Living With Our Star* exhibition. However, *The Last Tsar* exceeded targets. The lack of content in digital format hindered our IMAX performance, which is being addressed with the upgrade plans.

Good performance in fundraising meant that in 2018–19 Grant In Aid represented 53% of our total income, a further demonstration of our commitment to become more financially sustainable and diversify income streams.

SCIENCE MUSEUM GROUP INCOME/EXPENDITURE 2018–19



These charts are based on unaudited financial information extracted from management accounts as at 31 March 2019

OUR GENEROUS SUPPORTERS

The financial support of visitors and partners provides critical funding for the Science Museum Group's core priorities and future plans. We are hugely grateful to everyone who has supported our work during 2018–19

Our supporters have come together over the last year to enable a wide range of exhibitions and programmes of work that have reached hundreds of thousands of people across the UK and further afield. Together we are bringing science, technology, engineering and mathematics to life, creating curiosity and wonder, and inspiring the next generation of creative thinkers.

We thank all the individuals and organisations listed below, and those donors who wish to remain anonymous, who have made a significant contribution to this vital work.

SCIENCE MUSEUM

Individual philanthropists, trusts, foundations and government
Arts and Humanities Research Council
Arts Council England
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Biological Sciences Research Council
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British Council India
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Airbus attend the opening of the The Sun: Living With Our Star at the Science Museum. From left: Colin James, Bettina Nerb, Jeremy Close, Al Meredith, Cambridge physicist Harry Cliff, Helen Pasquier, Science Museum project leader Emma Hedderwick, Gavin Wingate Pearse, Andrew Stroomer, Lynn Sadler

NATIONAL SCIENCE AND MEDIA MUSEUM

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West Yorkshire Combined Authority

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The Broadway Bradford
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LOCOMOTION

Trusts, foundations and government
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SCIENCE MUSEUM FOUNDATION

The Science Museum Foundation is a registered charity committed to providing resources and advocacy to support the vision and mission of the Science Museum Group.

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SUPPORTING THE SCIENCE MUSEUM GROUP

Do you have a passion for inspiring the next generation of scientists? Does your organisation need a STEM-literate workforce? Or do you want to ensure that the wider public engage with science and our scientific heritage? If the answer is yes, then you have a stake in our mission to inspire futures. We can only achieve this with your support and hope you will consider partnering with us to continue our vital work.

By partnering with the Science Museum Group, you will get to know our work, collections and experts better, gain insight into how science has shaped the world we live in, and how it can tackle the pressing issues of today and tomorrow. You can help us fulfil our mission, while we support you to fulfil your philanthropic or business objectives in creative and tangible ways. Together we will inspire the nation, including your staff, customers and stakeholders.

For further information please contact us at development@sciencemuseum.ac.uk

WHO'S WHO IN OUR GREAT SCIENCE ALLIANCE

THE SCIENCE MUSEUM GROUP COMPRISES:
Science Museum, London
National Railway Museum, York
Science and Industry Museum, Manchester
National Science and Media Museum, Bradford
Locomotion, Shildon
SCMG Enterprises Ltd

BOARD OF TRUSTEES OF THE SCIENCE MUSEUM GROUP
The Board of Trustees of the Science Museum is responsible for the whole of the Science Museum Group. The trustees, who may number between 12 and 20, are appointed by and responsible to the Prime Minister through the Department for Digital, Culture, Media and Sport (DCMS). The director of the Science Museum Group, as chief executive officer, is responsible to the Board of Trustees and, as accounting officer, is accountable to DCMS for compliance with the management agreement. Within the framework of their statutory duties as stated under the National Heritage Act 1983, the role of the trustees is to establish Group policy, review performance and endorse appointments to key management positions. Their primary activity is to assist the chair in meeting the Board's overall responsibilities, in accordance with the policies of the secretary of state, and in compliance with charity law. The Board of Trustees also offers guidance and expertise on setting and implementing the strategy for the Group.

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Serving during the financial year April 2018 to April 2019

NEW FELLOWS OF THE SCIENCE MUSEUM

The Science Museum Fellows Programme recognises scientists and individuals who have changed our world through academic research, design, technology and philanthropy.

Sir Neil Cossons in recognition of an outstanding record of promoting Britain's scientific, engineering and industrial heritage.

Sir Tim Berners-Lee in recognition of his great distinction in pioneering a technological innovation, the World Wide Web, which continues to benefit people all over the world, and his continued support of the Science Museum Group.

Dr Fabiola Gianotti in recognition of her distinguished contribution to the advancement of physics education and dedication to encouraging female leadership positions in science, technology, engineering and mathematics.

Lady Anya Sainsbury in recognition of her contribution to the cultural sector and the Science Museum Group and, in particular, her help in shaping the vision of *Science City 1550–1800*: *The Linbury Gallery*.

Sir Kenneth Grange in recognition of a distinguished career in design, which has helped to shape the industrial future of the modern world, and of his continued support of the National Railway Museum.

THE SCIENCE MUSEUM GROUP

The Science Museum Group is devoted to the history and contemporary practice of science, medicine, technology, industry and media. For more than a century we have innovated and developed, becoming the world's most significant museum group for science, technology and engineering, and attracting more than five million visits annually

Heritage, mission and objectives
Our collections form an enduring record of scientific, technological and medical change since the 18th century. The Group incorporates the Science Museum, its Library and Archives; the National Railway Museum in York; Locomotion in Shildon; the Science and Industry Museum in Manchester; and the National Science and Media Museum in Bradford. We have two major collections facilities, the National Collections Centre at Wroughton in Wiltshire and Blythe House in west London.

The Science Museum Group is a non-departmental public body that aspires to the highest international museum standards in the care and preservation of collections, scholarship, programming, learning and advocacy for our subject areas.

Inspiring futures
In 2017 the Science Museum Group adapted its strategic approach and priorities for the period 2017–30.

Vision – A society that celebrates science, technology and engineering and their impact on our lives, now and in the future.

Mission – We inspire futures by:
- Creative exploration of science, technical innovation and industry, and how these made and still sustain modern society
- Building a scientifically literate society, using the history, present and future of science, technology, medicine, transport and media to grow 'science capital'
- Inspiring the next generations of scientists, inventors and engineers

Strategic priorities – We will:
- Grow 'science capital' in individuals and society
- Grow our audiences and exceed their expectations
- Sustain and grow our world-class collection
- Extend our international reach
- Transform our estate
- Harness the potential of digital
- Increase income

'I used to come to the Science Museum regularly and see all the amazing science and tech displayed here. It gave me the desire to aspire to be a space scientist'

Maggie Aderin-Pocock, scientist and broadcaster

THE CHARITY

The Board of Trustees of the Science Museum was established under the National Heritage Act 1983. The Science Museum Group is an exempt charity under the Third Schedule of the Charities Act 2011.

Tim Peake's radio headset used with his Sokol KV-2 emergency suit during the Principia mission to the International Space Station, 2016

SCIENCE MUSEUM GROUP
LONDON, YORK, MANCHESTER

SCIENCE MUSEUM

Director: Ian Blatchford
Exhibition Road
London SW7 2DD
sciencemuseum.org.uk

Heritage
Tracing its origins from the Great Exhibition of 1851, the Science Museum has pioneered interactive science interpretation for more than eight decades and is the most visited museum in the UK by school groups. Among key objects on display are Stephenson's steam engine *Rocket* (1829), Alan Turing's Pilot ACE computer (1950) and the Apollo 10 capsule that went into lunar orbit in 1969.

Our Library and Archives include rare and significant items such as the first printed translation and commentary of Ptolemy's *Almagest* and Charles Babbage's drawings for his calculating machines. The museum attracts 3.2 million visits annually.

Masterplan
Over the past five years one third of the museum's public space has been undergoing a transformation. Exciting new galleries are set to open this autumn: *Science City 1550–1800: The Linbury Gallery* will explore London's unique role in the evolution of scientific thinking; and new Medicine Galleries across most of the first floor of the museum will create a home for the extraordinary collections of Henry Wellcome and the Science Museum.

NATIONAL RAILWAY MUSEUM

Director: Judith McNicol
Leeman Road
York YO26 4XJ
railwaymuseum.org.uk

Heritage
The National Railway Museum in York houses the world's greatest collection of railway items and objects from the past 200 years. Set in former railway buildings close to York Station, the museum attracts visitors from around the world and tells inspiring stories of railway history and engineering. It has an unrivalled collection of famous locomotives and royal carriages and has a busy programme of learning activities, exhibitions and events.

Vision 2025
As the National Railway Museum approaches its 50th anniversary, it is embarking on a far-reaching £55 million transformation called Vision 2025. Split across nine separate projects, Vision 2025 will reimagine the National Railway Museum to tell epic stories of how the railways shaped the world, providing a more interactive and engineering-focused experience for visitors. Vision 2025 is part of York Central, a large city-centre development.

The project will establish a new Central Gallery to show innovations from the rail industry and a *Wonderlab* gallery. The museum's grounds will also be redeveloped to create a green park and civic spaces.

SCIENCE AND INDUSTRY MUSEUM

Director: Sally MacDonald
Liverpool Road, Castlefield
Manchester M3 4FP
scienceandindustrymuseum.org.uk

Heritage
The Science and Industry Museum tells the story of where science met industry and the modern world began. Manchester was one of the first global, industrial cities, and its epic rise, decline and resurrection has been echoed in countless other cities around the world. From textiles to computers, the objects and documents held in the museum's collection tell stories of everyday life over the last 200 years, from light bulbs to locomotives. The museum's vision is to inspire all its visitors, including future scientists and inventors, with the story of how ideas can change the world, from the Industrial Revolution to today and beyond.

Masterplan
Work continues on the new Special Exhibitions Gallery, an ambitious project which will provide a venue for world-class contemporary science exhibitions in the New Warehouse. Supported by Wellcome, Garfield Weston Foundation, Kirby Laing Foundation and Zochonis Charitable Trust, it is planned for completion in 2020 and will help develop our reputation and Manchester's as a globally significant place for science innovation and understanding.

Above, from left: The Sun: Living With Our Star exhibition at the Science Museum; the Great Hall in the National Railway Museum; Rocket on display in the Science and Industry Museum; the Wonderlab galleries in the National Science and Media Museum; Flying Scotsman outside Locomotion; an artist's impression of the completed National Collections Centre

SCIENCE MUSEUM GROUP
BRADFORD, SHILDON, WROUGHTON

NATIONAL SCIENCE AND MEDIA MUSEUM

Director: Jo Quinton-Tulloch
Pictureville
Bradford BD1 1NQ
scienceandmediamuseum.org.uk

Heritage
At the National Science and Media Museum, in the heart of Bradford, we explore the science and culture of image and sound technologies and their impact on our lives.

Our galleries and exhibition spaces help us illuminate world-famous collections in photography, film and television. Our team of Explainers creates learning activities that fuel the imagination and get under the skin of our collections and exhibitions. And our three cinema screens – including an IMAX theatre – allow us to showcase the magic of moving images from around the world in Bradford, the first UNESCO City of Film.

Three annual festivals – Widescreen Weekend, the Yorkshire Games Festival and the Bradford Science Festival bring cutting-edge technology and industry experts to the museum, inspiring the scientists, engineers and creators of the future to see more, hear more, think more and do more.

Masterplan
The *Sound and Vision* galleries – due to open in 2022 – will bring together the star objects from our collection for the first time, presenting a comprehensive history of the still and moving image.

LOCOMOTION

Head: Sarah Price
Dale Road
Shildon DL4 2RE
locomotion.org.uk

Heritage
Based in the world's first railway town, Shildon in County Durham, Locomotion offers visitors the opportunity to see more than 70 vehicles from the national collection. Highlights include the prototype Deltic, British Rail's Advanced Passenger Train and the iconic LNER locomotive No. 4771 *Green Arrow*. Locomotion's workshop carries out a range of restoration projects which visitors can watch from a purpose-built viewing platform. This year the team completed the restoration of a 2HAP EMU, the most-travelled unit in the National Railway Museum collection, which is now on display. The museum continues to host a busy programme of events, exhibitions and activities from steam spectaculars to guided tours. Locomotion continues to benefit enormously from its partnership with Durham County Council, which includes generous financial support.

Masterplan
Work on the restoration of the historic buildings, including the home of the railway pioneer Timothy Hackworth, has started with options for their future use being explored. Plans are also in development for a new building to explore further the railways on a site adjacent to the existing Collection Building. Planned for completion in 2022, this will allow us to expand the number of vehicles housed on the site and boost our visitor offer.

NATIONAL COLLECTIONS CENTRE

Wroughton SN4 9LT
(Pre-booked research visitors only)

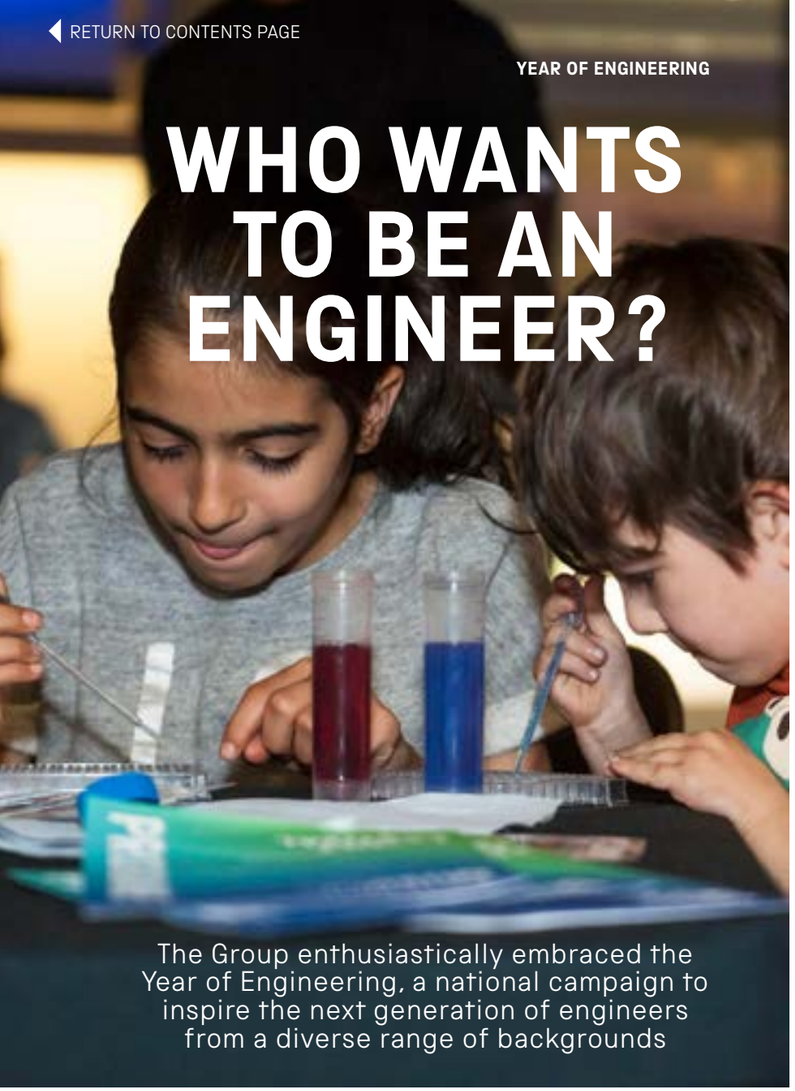
The Science Museum Group's site in Wiltshire was founded in 1979 on a 545-acre former airfield. It houses a superb range of large artefacts – such as the world's first hovercraft and an early robotic arm used in manufacturing – as well as the Science Museum's Library and Archives. In February 2019 construction started on our new collections management facility. By 2023 the facility will become home to more than 300,000 historic items, providing stable conditions for their long-term care and greatly increased public access to the collection.

BLYTHE HOUSE COLLECTIONS STORE

Olympia
London W14 0QX
(Staff and volunteers access only)

Blythe House at Olympia in London is used by the Science Museum, V&A and British Museum for small-object storage. Following the government's allocation of £150 million for all three museums to relocate, we plan to move 320,000 objects to the National Collections Centre, uniting the Science Museum Group Collection and improving public access. This year we captured information on 140,000 objects and published 20,000 new photographs of the collection online. This digitisation effort will create the most extensive online scientific collection in the world.

WHO WANTS TO BE AN ENGINEER?



The Group enthusiastically embraced the Year of Engineering, a national campaign to inspire the next generation of engineers from a diverse range of backgrounds

Britain needs a lot more engineers – and quickly. Some experts have estimated that we need around 1 million more by 2020 if our industry and economy are to continue to thrive. To help meet this target, and to inspire the next generation of engineers, the Science Museum Group was a key partner in the Year of Engineering, a national government campaign led by the Department for Transport.

In its largest ever cross-Group collaborative project, the Science Museum Group offered a varied events programme over the past year, including a new initiative through which expert volunteers were invited to share their experiences with visitors. More than 900 volunteers, many of them industry engineers, helped with the programme, collectively contributing well over 7,000 hours of their time to help inspire the futures of young audiences. Of these volunteers, 42% were female, which is four times the percentage of women in the UK's engineering workforce.

Meanwhile, statistics show that only 10% of UK engineers are women and fewer than 8% are from black and minority ethnic backgrounds. By bringing young people from all backgrounds face to face with engineering role-models, our initiative set out to widen the pool of young people who enter the profession.

Regular engineering-themed workshops and shows alongside flagship family festivals – including *Future Engineers* in York, *We Are Engineers* in London, and the Bradford and Manchester Science Festivals – meant that families across the country were able explore the wonders of engineering. The Group also welcomed hundreds of school visits, inviting students to build their own catapults in London, design robotic racers in Manchester or to write code and fix hardware in York.

'I'm delighted that Bechtel partnered with the Science Museum Group throughout 2018 as part of our commitment to the government's Year of Engineering campaign'

Paul Gibbs, UK managing director, Bechtel

Left: Children take part in Race The Robot at the Science Museum's Family Festival **Above:** Science journalist Angela Saini, engineer Yewande Akinola, AI scientist Maja Pantic and engineer Nike Folayan take part in a panel discussion after an IMAX screening of Marvel's Black Panther

The campaign saw almost half a million people explore engineering-themed galleries across the Group, and tens of thousands watch our flagship engineering IMAX film, *Dream Big: Engineering Our World*.

The Year of Engineering programme was also supported by events aimed at adult audiences. We offered engineering-themed *Lates* at the National Science and Media Museum in Bradford, the Science Museum in London and the National Railway Museum in York. There were also panel discussions, such as 'The Science of Formula 1' and 'Art of Engineering', and an IMAX screening of Marvel's *Black Panther*, supported by the Royal Academy of Engineering, as part of the Women in Engineering Family Festival, to explore the importance of diversity in engineering.

In the end, more than 270,000 people saw or took part in a Science Museum Group Year of Engineering event, of which 142,300 were children participating in a live event – 14.2% of the Year of Engineering's target of 1 million young people.

BRADFORD BEAT

A pioneering project at the National Science and Media Museum shows how our research is engaging local communities

Above the Noise: 15 Stories from Bradford wasn't just a new exhibition when it opened at the National Science and Media Museum in March this year, but a whole new approach to engaging the local community. It had a notable impact on the museum's home city and inspired a national broadcaster to rethink its approach to local news.

Above the Noise grew from a recent initiative, Bradford's National Museum project, which has been exploring ways to develop closer connections between the National Science and Media Museum and local people. It is a partnership that includes the University of Leeds, Bradford Community Broadcasting radio station, Tim Smith Photos, Khanani, Alchemy and Bradford Museums and Galleries, among others.

The result was a collaborative exhibition focusing on the ingenuity and activism of communities in Bradford – in contrast to the negative perceptions of the city in the media.

Not only was *Above the Noise* a considerable success, it also inspired the BBC to rethink its approach to the city and set up a week-long pop-up newsroom in Bradford. The city and its local stories were featured in national news schedules in a series of programmes called *We Are Bradford*.

Above the Noise comprised of individual stories told by people from Bradford, examining what they considered to be the under-represented and positive experiences of life in the city. It also explored the technologies and social networks – from community radio and film clubs to cassette tapes and photography – they have used over the years to bypass the mainstream media. In this way, they stayed in touch and spread local news and information, despite 'the noise' from elsewhere.

Mary Dowson, co-founder of partner organisation BCB Radio, said: 'The collaborative nature of the project, with the museum reaching out, as well as inviting in, has enabled people to feel real ownership of the content. The impact for Bradford's diverse communities in seeing themselves and their lives positively reflected in a national institution will provide the building blocks for much deeper and wider community engagement with the museum.'

David Sillito, media and arts correspondent at the BBC, said: 'The idea behind the exhibition didn't just provoke an interesting conversation – it was the catalyst for the BBC trying a new way of reporting the news.

'Above the Noise was the inspiration for the BBC's *We Are Bradford* – a way of trying to reflect a wider and perhaps fairer picture of the city.

'This model of journalism is now being tried out in other cities following the success of what began in Bradford.'

Main image: DJ Radical Sister spins the decks in Bradford in the 1980s
Left: Belle Vue photographic studio, which documented the Asian communities who arrived in the city in the 1950s and 1960s
Below: Bradford Community Broadcasting (BCB) Radio

'Above the Noise was the inspiration for the BBC's We Are Bradford – a way of trying to reflect a wider and perhaps fairer picture of the city'

David Sillito, BBC media and arts correspondent

Left: Students at Belle Vue Girls Academy

Above: The Polish community celebrating at Our Lady of Czestochowa in 1987

‘The Soyuz tour’s success underlines why we make our world-class culture accessible to everyone in all corners of the country’

Jeremy Wright, Culture Secretary

SHARING OUR VISION

By Ian Blatchford, Group director

The Science Museum Group is firmly committed to sharing our ‘star exhibits’ – the most dazzling examples from our great collection of more than 7 million things – with the rest of the country so they can be seen by as large and diverse an audience as possible.

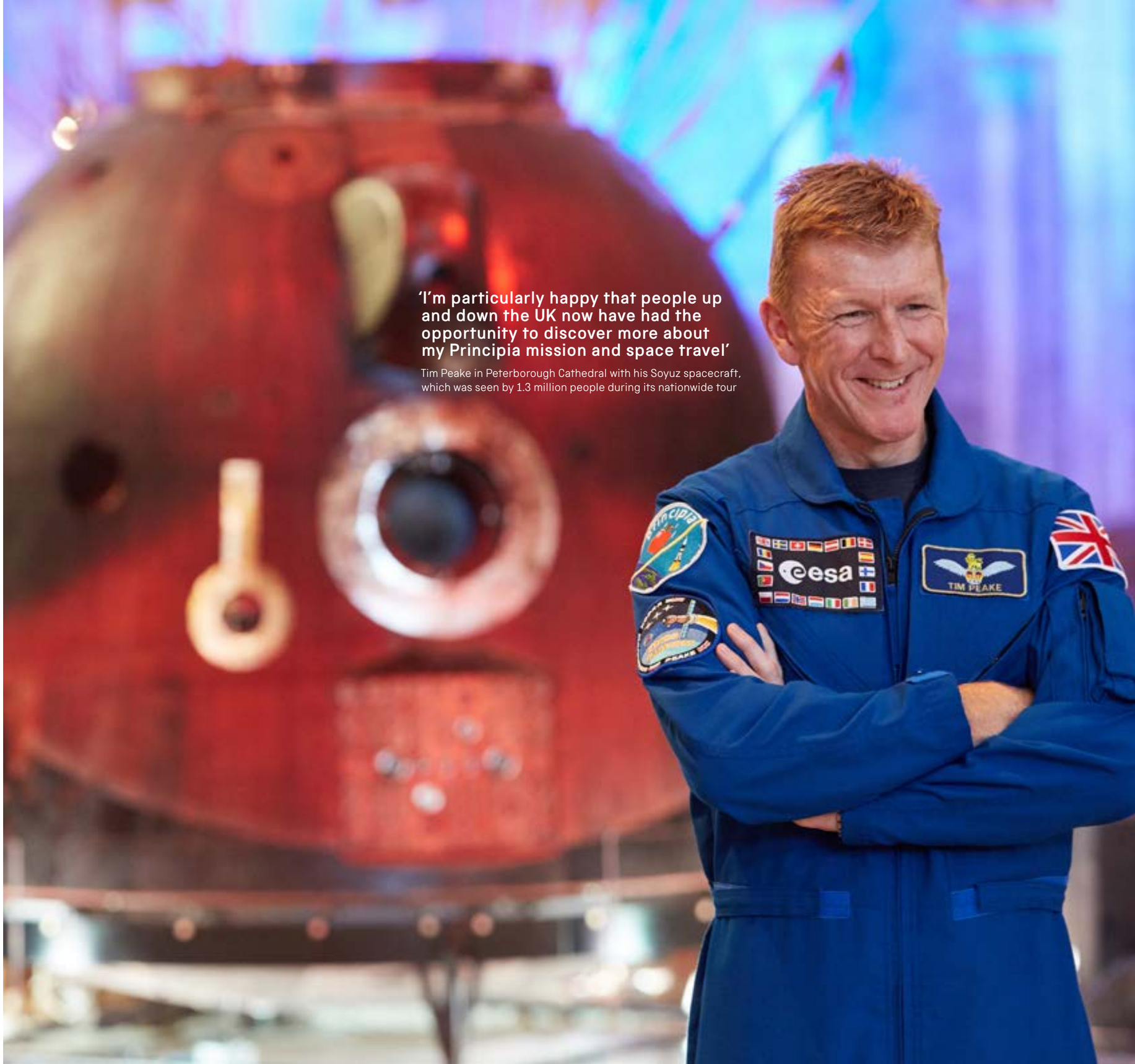
That commitment is in part driven by an awareness that much of the country’s rich cultural life is sometimes perceived as too London-centric. Our brief, therefore, is to make it easier for people from every region of the country to see and be inspired by our national collection. We also believe that seeing our star objects in new and unusual locations is stimulating, encouraging all of us to reflect on the achievements of science and technology, and where they might take us in the future.

To this end, two of our most treasured ‘stars’ have spent the past year on the move. *Rocket*, the 1829 steam locomotive built in Newcastle, and which ran on the Liverpool to Manchester line, has enjoyed a highly successful tour ‘back home’ in Newcastle and Manchester, and will soon move to the National Railway Museum in York.

The Group’s most successful sharing experiment has also been the most daring and the response from the public has been astonishing. The nationwide tour of the Soyuz spacecraft that brought astronaut Tim Peake safely back to Earth in 2016 has drawn in 1.3 million visitors during its tour of eight cities – including Cardiff, Belfast and Edinburgh. It also spent 12 weeks inside Peterborough Cathedral, a 12th-century Norman church that provided a spectacular and thought-provoking setting for an object that has travelled beyond our Earth. The Soyuz boosted visitor numbers to the cathedral by an incredible 810%.

Our conservation team is meticulous in its attention to detail before these objects go on the road, ensuring they are not damaged in transition or in their new locations. And one needs to remember, of course, that many of our greatest exhibits were built to push the boundaries of human knowledge and withstand extraordinary circumstances. After all, if the Soyuz can cope with burning through the atmosphere at 5 miles a second, it can probably cope with a trip up to Durham.

We look forward to sharing more of our world-beating exhibits with the nation to celebrate our amazing heritage and inspire the next generation of innovators.



‘I’m particularly happy that people up and down the UK now have had the opportunity to discover more about my Principia mission and space travel’

Tim Peake in Peterborough Cathedral with his Soyuz spacecraft, which was seen by 1.3 million people during its nationwide tour