

A QUIET REVOLUTION

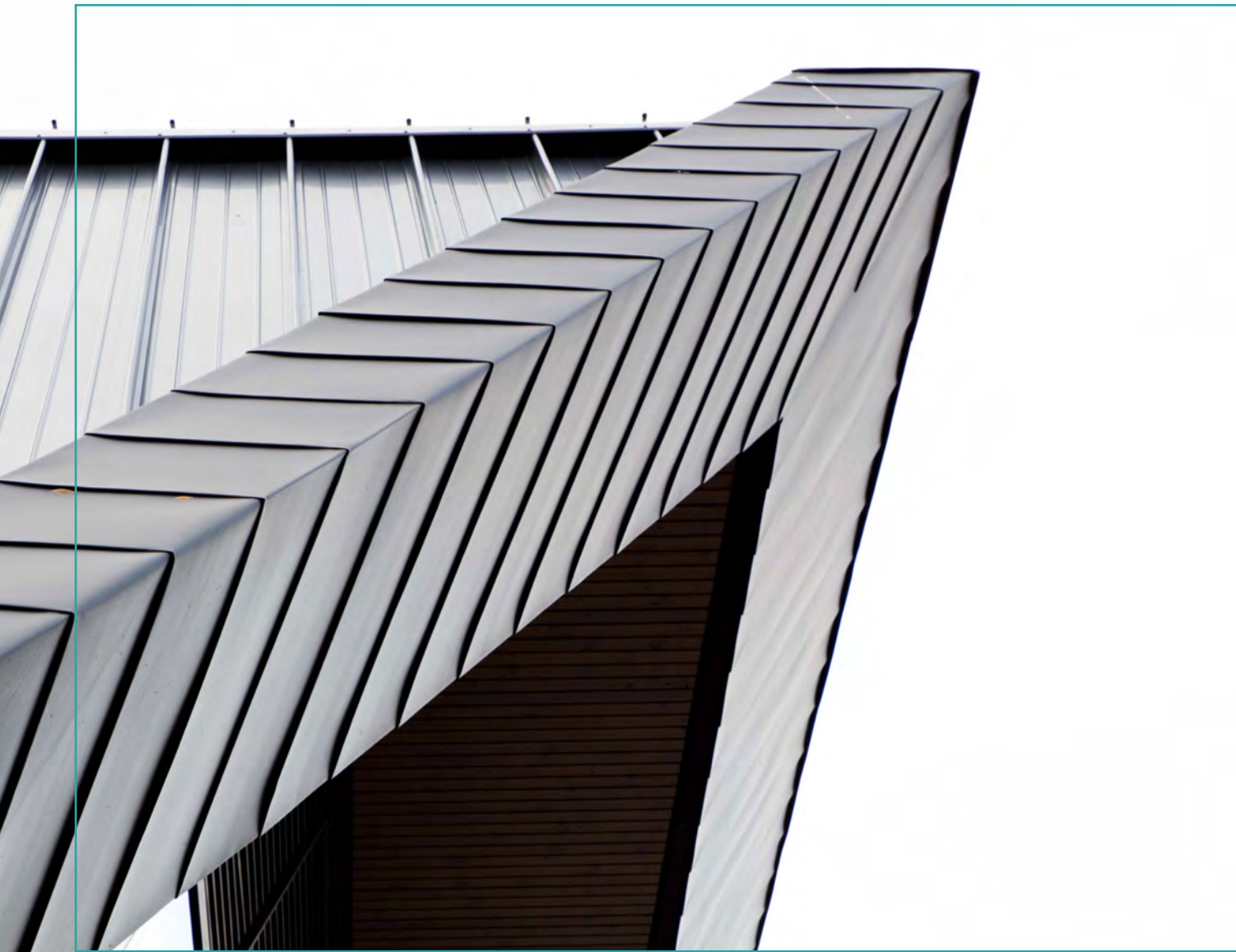
DATA:SCIENCE:IMPACT





Over the last 10 years we have argued the importance of our science and the importance of the best modelling and supercomputing capability for climate change forecasting. An international summit of leading scientists in 2007 agreed this strategy and we have now the funding to provide the biggest facility in Europe for weather and climate science.

Professor Julia Slingo
Chief Scientist of the Met Office



PHOTOGRAPHY : Hannah Hodeman

Our Story



SUMMER 2013

When Our Story Begins...



THE BACK STORY

PROJECT PARTICULARS

AN INNOVATIVE PARTNERSHIP

ETHOS

BEYOND CUTTING EDGE

BY DESIGN

ADDED VALUE

LEGACY

GALLERY

THE FUTURE

AUGUST 2013

Met Office, Scape Group & Willmott Dixon Come Together

The Back Story

INSPIRED BY THE MOVIE 'TRON', A COMPUTER PROGRAMMER WHO WAS TRANSPORTED INSIDE THE SOFTWARE WORLD OF A MAINFRAME COMPUTER.

Extreme weather events and climate change is front page news in today's world; whether you're jumping on a plane, grabbing a bite to eat or simply driving to work, the weather dictates every day decision making on a monumental scale.

With more sophisticated weather and climate models and improved observations, combined with science modelling and physics, the future of forecasting is revolutionising science and technology to make our world safe and secure.

With the age of Big Data, the balance between human and technological intelligence is evolving. Supercomputers provide a catalyst for investment and unlock enhanced forecasting to support economic growth, prosperity and global safety.

The Met Office is the leading meteorological expert and to maintain this, faster and more

sophisticated data processing is necessary for Big Science.

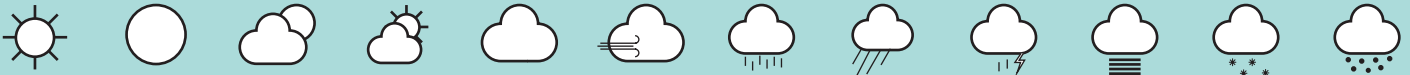
With significant investment, a new home for one of the fastest supercomputers has arrived in the West Country, the Met Office's new computer is up to fifteen times larger than its predecessor and is capable of performing up to 14,000 trillion calculations per second, which is the equivalent to 2 million calculations per second for every man, woman and child on the planet.

It has been described as 'a spark of science fiction in the West Country... its angular, computer-circuitry design and turquoise neon [was] inspired by the movie Tron.' Now, the UK is a world leader in climate and weather analysis with advanced science research that brings a Big Impact of over £2 billion of social economic benefit.



The Met Office's new supercomputer is exactly the sort of high tech investment that the Exeter and East Devon Growth Point was designed to attract. Siting it at the Science Park will strengthen the economic growth of the area and act as a real catalyst in driving job growth and private sector investment.

Councillor Andrew Leadbetter, Devon County Council's Cabinet Member for Economy and Growth



SEPTEMBER 2013



Met Office Adopts Scope as their Preferred Procurement Route



OCTOBER 2013





We are delighted to have had the opportunity to share our expertise in construction management, to complement science, and proudly play our part in meteorological advancements.

Nathan Howells
Willmott Dixon

NOVEMBER 2013

UK Government Approves Business Justification

Project Particulars

CUSTOMER	MET OFFICE
PROJECT	HIGH PERFORMANCE COMPUTER HALL & COLLABORATION SPACE
SECTOR	SCIENCE & TECHNOLOGY
VALUE	CIRCA £19 MILLION
PROCUREMENT ROUTE	SCAPE NATIONAL MAJOR WORKS FRAMEWORK
CONTRACT FORM	NEW ENGINEERING CONTRACT (NEC): OPTION A
MAIN CONTRACTOR	WILLMOTT DIXON
CONCEPTUAL ARCHITECT	ATKINS
DETAILED ARCHITECT	STRIDE TREGLOWN
SERVICES ENGINEER	ARUP
STRUCTURAL ENGINEER	WSP / PARSONS BRINKERHOFF
BUILDING SERVICES CONTRACTOR	NG BAILEY

DECEMBER 2013

Collaborative Tour of the Existing Facilities









A world class asset.

Kareem Hassan,
Chief Executive of Exeter City Council



EXETER SCIENCE PARK MASTERPLAN

-  Centre Cluster
-  Redhayes Cluster
-  Global Environmental Futures Campus
Home of the High Performance
Computer Hall and Collaboration Space
-  Tithebarn Cluster
-  Langaton Cluster
-  Blackhorse Cluster



JANUARY 2014



THE EARTH SYSTEM MODEL

This UK research led project captures all major aspects of the Earth's climate system to better understand our:

- atmosphere
- oceans
- atmospheric chemistry
- terrestrial carbon cycle
- ocean biogeochemistry

PLANNING FOR CLIMATE CHANGE CHALLENGES

Helping governments, businesses and individuals with the potential to protect life on an international scale.

PROTECTING LIFE AND PROPERTY

Science services provide enhanced risk management.

TIDES AND WEATHER

Precision of forecasting within a 1/4 mile radius.

ACCURACY

By 2020, the Met Office expects a 24-hour forecast to be as accurate as a 12-hour forecast in 2014.

COMMERCIAL

Helping the retail industry better prepare for trends in weather related products.

SAVING LIVES

Increased accuracy of extreme forecasting, specifically mountain area and marine forecasts.

GLOBAL AVIATION

Saving approximately 20,000,000 tonnes of CO² per year through wind which reduces fuel consumption.

IMPROVED PREDICTIONS

For flooding, coastal and river impacts, as well as atmospheric dispersion used for volcanic ash and disease spread.

FEBRUARY 2014

An Innovative Partnership

MET OFFICE

Met Office is a trading fund of the Department for Business, Energy and Industrial Strategy (BEIS). It has been providing world leading weather forecasting services for more than 160 years and has a long history in ground-breaking climate services. (www.metoffice.gov.uk)

WILLMOTT DIXON

Willmott Dixon has changed a lot since its establishment in 1852, but their values have always emphasised the importance of people, relationships, communities and the environment, helping stand the test of time, and making them unique.

SCAPE GROUP

Scape Group is the leading national expert in providing efficient, collaborative, cost-effective procurement solutions for customers across the public sector with a ten year history of delivering exceptional results, worth over £5 billion, for over 500 customers.



FEBRUARY 2014

Willmott Dixon Assessment Shared with the Met Office

BENEFIT REALISATION

Through a formal process, the Scape process map provided a clear and simple guide.

DELIVERY OF CHANGE

Effective planning and implementation in an integrated way mitigated adverse affects on programme. Smooth transition between current and future business operations through clear recognition and responsibility assisted in new ways of working.

ALIGNMENT BETWEEN STRATEGY & PROJECT

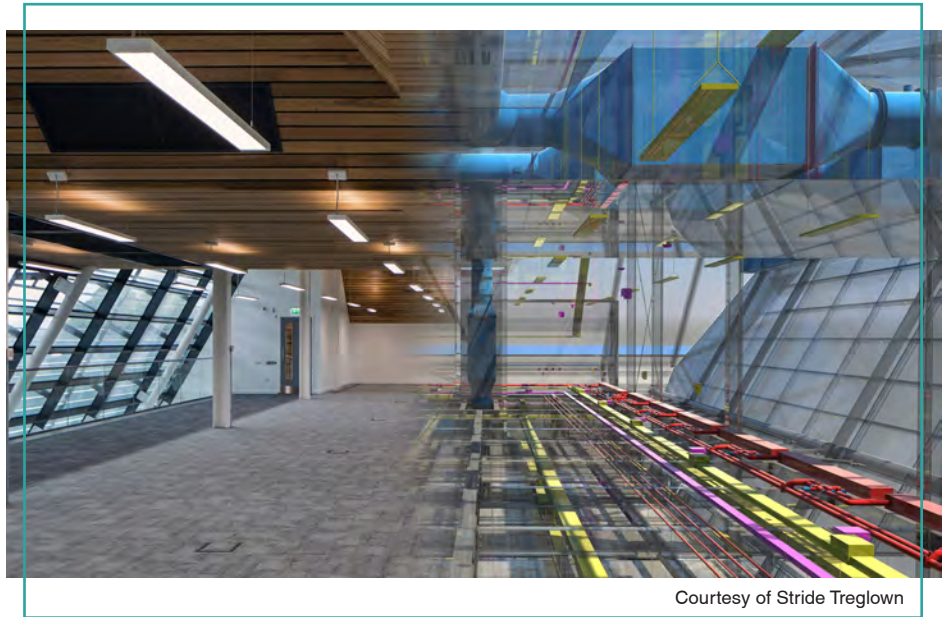
Effective responses by 'filling the gap' between strategy and the project. Achieving a consistent system of new or amended policies, standards, and work practices through the integrated definition, planning, delivery and assurance of the required changes.

MANAGEMENT CONTROL & SUPPORT

Improved control that measures and assesses the costs of introducing new infrastructure, standards and quality regimes. Focused attention on the business change objectives by providing a direct and managed change process.

CO-ORDINATION & CONTROL

Efficient co-ordination and control of a complex range of activities through clearly defined roles and responsibilities, enabling the benefits to be realised and delivered by the project.



Courtesy of Stride Treglown

ENHANCED COMMUNICATION

Greater communication and escalation to the senior management team enabling better decisions.

RISK MANAGEMENT

Enhanced risk profiling from strategic and holistic understandings. Common risks were better managed at a project level.

RESOURCE MANAGEMENT

Efficient management of resources provided a mechanism for project prioritisation and integration.

GUIDANCE

A bespoke guide illustrating essential information to successfully manage the project from instigation to occupation was available to the project and wider users.

TESTING THE BRIEF

Collaborative peer reviews as a holistic team brought the wider team together to share aspirations, constraints, findings and challenges.

MARCH 2014

Procurement of Detailed Design Consultants Commenced

Ethos

TOGETHER, THE MET OFFICE, SCAPE GROUP AND WILLMOTT DIXON HAVE FUSED THEIR VALUES, TO UNIQUELY COLLABORATE AND FACILITATE WORLD LEADING WEATHER AND CLIMATE SERVICES.

LET'S CELEBRATE THE CREATION OF ONE OF THE FASTEST SUPERCOMPUTERS IN THE WORLD – CAPABLE OF CARRYING OUT 14 PETAFL0P* CALCULATIONS EVERY SECOND, THE SAME COMPUTING POWER AS 20,000 EVERYDAY PERSONAL COMPUTERS.

THIS CULTURE HAS CHALLENGED THE ORDINARY AND THIS IS OUR STORY...

*14 thousand trillion

DIRECT & ENTREPRENEURIAL

Market leaders with industry firsts.
Innovators and investors in great ideas.
Promoting 'change for the better' with incentives for all.

HUMAN TOUCH

Health and safety always comes first.
'It's all about people' - complementary teams are the most efficient.
Supporting diversity and career development.

RELATIONSHIP FOCUSED

Transparency, openness and collaboration are paramount.
Like-minded partners are critical to build long-term loyalty.
Supply Chains are a reflection of the ethos whom share the success.

VISIBLE & ACCOUNTABLE

Brands are valued and promoted through professional and ethical integrity.
Community engagement matters and localism is encouraged.
Clear vision that is effectively communicated.

SUSTAINABLE

Committed to ongoing waste and carbon reduction.
Determined to procure resources on a sustainable basis.

SELF AWARE

Self-awareness and adoption of best practice to the significant of the positive impact on the world.

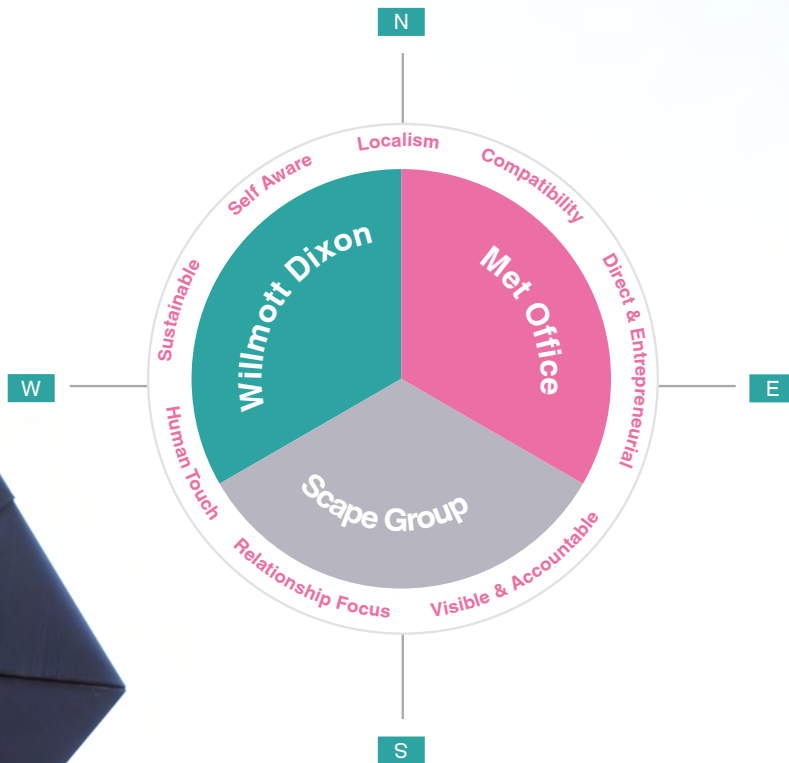
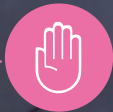
LOCALISM

Providing local opportunities for local people through a robust Supply Chain network.
Supporting the next generation through internships and apprenticeships (board members of the South West Shared Apprentice Scheme).
Actively promoting new and established events such as Open Doors and Women in Property.

COMPATIBILITY

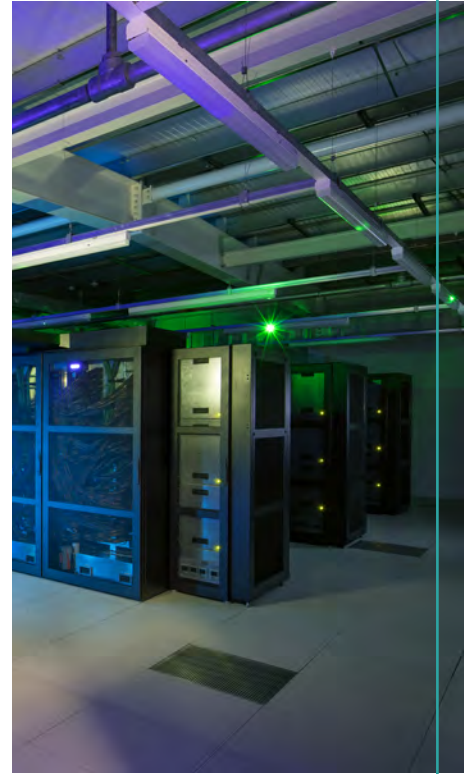
Being mindful of the business and strategic drivers of each partner.
Shared goals as a one team culture.

APRIL 2014



APRIL 2014

Planning Application Registered



1980s

Cray's first multiprocessor supercomputer.
Broke the one gigaflop capability.

EARLY 1990s

The world's first wireless supercomputer.
Most popular supercomputer, with over 400
systems sold.

LATE 1990s

First supercomputer to sustain 1 trillion
floating-point operations/second, or teraflops,
on a real-world application.

JULY 2014

Collaborative Team Workshop



SEYMOUR CRAY

(1925 - 1996)

Recognised as the forefather of supercomputing and credited as a pioneer in the industry for decades, Cray's legacy dates back to 1972 when he founded Cray Research and lives on today through the Met Office's next generation Cray CX40.

The first Cray®-1 system was installed in 1976 with a 160 megaflop capacity.

Much like the Met Office's new design, the revolutionary architecture reflected the technical hurdles faced by the supercomputer; using a unique 'C' shape to place circuits closely together and a refrigeration system developed by Cray using Freon to avoid intense overheating.

Beyond Cutting Edge

CONCEALED WITHIN THE DEVONSHIRE LANDSCAPE LIES THE CRAY CX40, ONE OF THE FASTEST SUPERCOMPUTERS BRINGING AN UNPRECEDENTED £2 BILLION BOOST EXPECTED TO THE UK SOCIAL ECONOMY.



2000s

The first petaflop system in academia, with Oak Ridge National Laboratory supercomputer being declared world's fastest (2009).

2010s

By fusing supercomputing, storage and data analysis technologies, customers are enabled to make new discoveries, develop better products and make positive impacts on the world.

2017

The Met Office supercomputer becomes the most powerful weather forecasting computer.

JULY 2014

Planning Application Submitted

14 Petaflops



One of the **20 fastest** computers in the world with the same computing power as **20,000** everyday personal computers

That's the same as **2 million** calculations per second for every person on the planet



Capable of carrying out **14,000 trillion** calculations per second

Has **23 million** gigabytes (**23 petabytes**) of data storage, enough for **100 years** of HD movies



Weights **140 tonnes** the equivalent of **9** double decker buses

Holds **1.6 million** gigabytes of memory, the equivalent of **100,000** smart phones



RESOURCE EFFICIENCY

To mitigate any over stretching of resources, through collaborative discussions at project workshops, a balanced programme was implemented.

ACCOMMODATING CHANGE

By ensuring the original design was flexible, changes to the supercomputer's chip enhancement (which frequently occurs) were reconfigured without impacting on the supercomputer's delivery date.

SPECIALIST SUPPLY CHAIN

A highly specialist Supply Chain was procured, coordinated and managed due to the nature of the facility and computer.

UK FIRST DESIGN

Achieved through collaborative customer design meetings with award winning local Design Consultants.

A ROBUST NETWORK

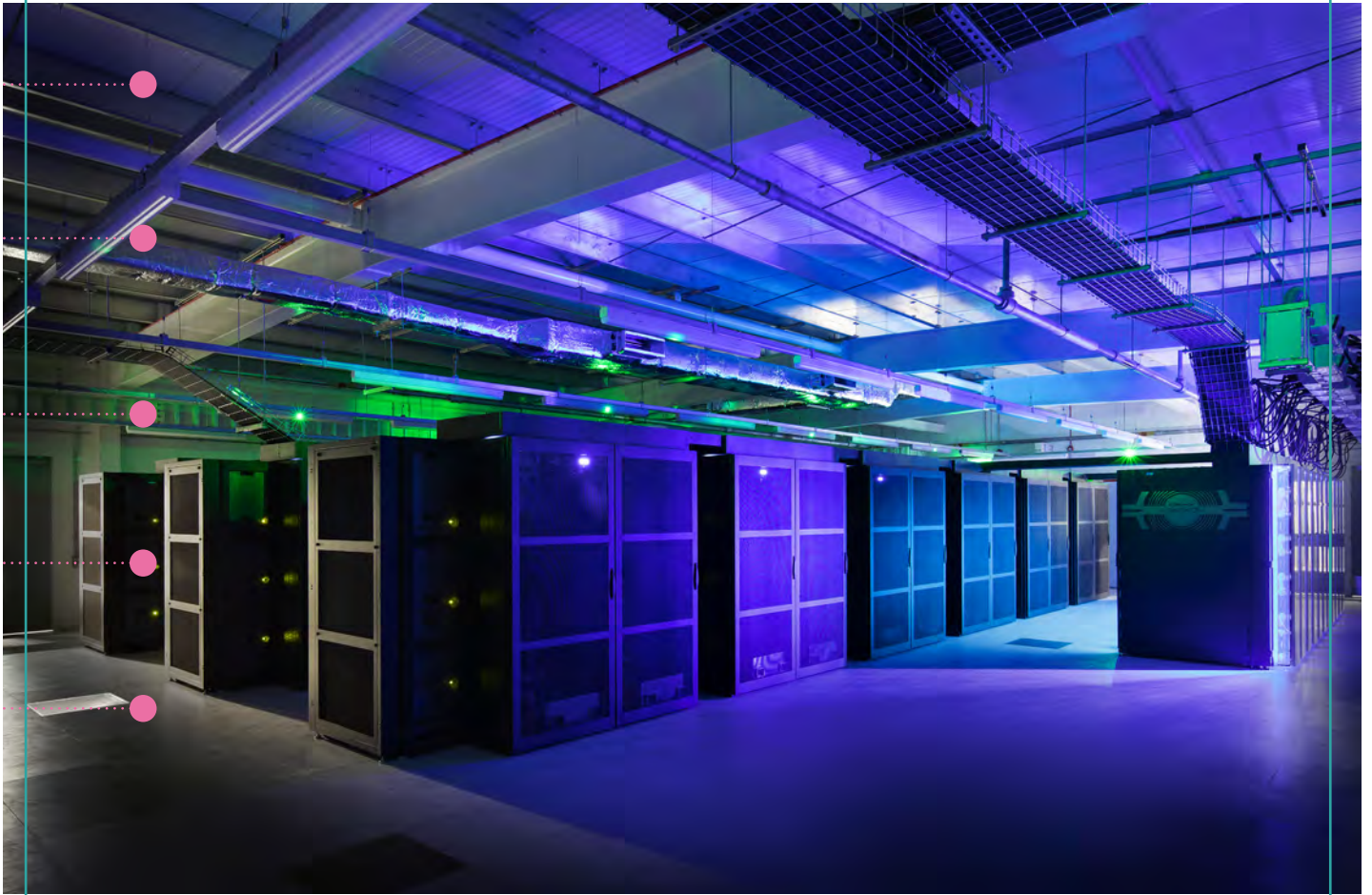
To power some of the world's most intelligent technology a robust network is essential. 2 diverse, high capacity optical circuits, each carrying 6 x 1Gbps, 1 x 10Gbps and 1 x 100Gbps Ethernet services.

History in the making

The concept of weather forecasts using dynamic equations was first contemplated by English mathematician, Lewis Fry Richardson, who in 1922 estimated it would take 64,000 people to perform the calculations by hand in time.

Equations are created which seek to mirror processes found in the atmosphere. Built out of lines of computer code, they combine together to make 'models', which attempt to recreate the dynamics of the atmosphere through maths and enables us to predict what might happen next.

AUGUST 2014



PHOTOGRAPHY : Michael Whitestone

Embracing the computer age in 1959, the Met Office purchased a Ferranti Mercury, 'Meteor,' capable of 30,000 calculations/second. A major step in the evolution of weather forecasting, scientists were able to regularly use numerical methods to make their forecasts.

In 1965 the Met Office bought the Electric KDF9, capable of 50,000 calculations/second. More than 60% faster, more complex forecasts could be made. By 1982, the CDC Cyber 205 could do 200 million calculations/second, but by 1997 a Cray T3E was doing more than a trillion.

2017 sees the Cray CX40 take 100,000s of global weather observations to run an atmospheric model of more than a million lines of code.

SEPTEMBER 2014

Overall Cost Assessment Established

By Design

IN SUPPORT OF EXETER'S ECONOMIC GROWTH, THIS IS AN ICONIC CLUSTER OF BUILDINGS AT ONE OF THE TOP TEN MOST PROFITABLE LOCATIONS FOR A BUSINESS IN THE UK.

PHOTOGRAPHY: Hannah Hodsman

As a collaborative team, all aspects of the design were interrogated using the skills and knowledge of the Design Consultants and Supply Chain partners, resulting in beneficial savings of circa £4 million.

The project consists of two elemental spaces;

THE HIGH PERFORMANCE COMPUTER HALL

The cutting edge, 3,200m² High Performance Computer Hall provides a space for high energy demand with a purely information technology driven environment and a level of security.

THE COLLABORATION SPACE

A low energy, highly visible, publicly accessible space with a cutting edge collaborative working environment (for people and computers) that demonstrably adds value to its immediate community. The world's brightest and best scientists will gather in this hexagon-shaped building inspired by patterns in computer-circuitry.



A spark of science fiction in the West Country.

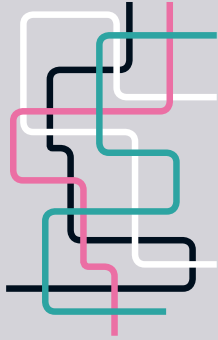
Atkins



OCTOBER 2014

Detailed Design Consultants Selected Together



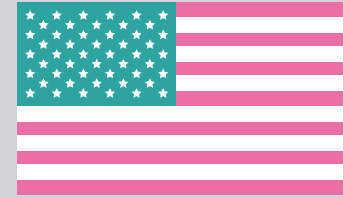


A raised access floor conceals the network of the building services and equipment that feed and supply the 36 compute frames that make up the supercomputer.



As well as large glazed façades, the building is wrapped in zinc cladding.

To mitigate any clashes and deal with unusual geometry and complex cladding details, a laser survey provided a 3D model. This enabled efficient development of all envelope installations.



As an American manufactured supercomputer, the measurements were supplied in imperial, while the pipes for the cooling and gas suppression system was in metric.

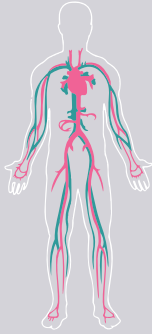
To counteract this problem, manufacturer Cray sent a series of full-size stencil diagrams to be laid out, enabling accurately sized holes to be cut through the floor in the correct positions.

OCTOBER 2014

Preconstruction Phase Commenced, led by Willmott Dixon

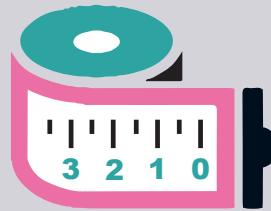
Innovative cooling technology uses water instead of air to keep 10,000s of microprocessors at the optimal operating speed and increasing peak performance.

10 times as compact and consuming 40% less energy than a comparable air-cooled system, the design was inspired by the human circulatory system. World class power usage efficiency figures.



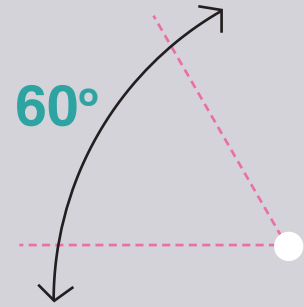
The High Performance Computer Hall is a steel and concrete block building with a reinforced concrete floor slab.

The single storey steel portal framed structure measures approximately 90 metres long by 25 metres wide, but importantly offering a central 15 metre wide free span for the computer hall.



A celebration of metal, glass and timber, the Collaboration Hub is a far more complex sealed structure, leaning in two directions, both at a 60° angle.

This required enhanced stability systems to resist forces generated by the complex eccentric geometry.



OCTOBER 2014

Building Regulations Approval



TECHNICAL CHALLENGES

An extensive array of technical aspects tested the holistic team but through effective programme management and careful redesign, any time impacts were mitigated.

Extensive ground works involved close liaison with Exeter Science Park and their respective consultants.

The unique form and incline of the curtain walling and steel frame, particularly around the detailing and adjacencies of the external and internal timber soffits.

Specification change of the supercomputer and associated proposals within the High Performance Computer Hall.

VISUALISATION THROUGH BUILDING INFORMATION MODELLING (BIM)

Visualising a project of this nature required the merits of a BIM environment. The team could visualise any unforeseen challenges early, enabling forecasting of any additional costs & programme implications.

A 3D survey was undertaken after the steel frame was installed, to check coordinates against the BIM Level 2 model due to the high level of accuracy required, providing full and accurate information at handover.

Through early engagement of the whole team and drawing upon specialist expertise, the technical aspects were developed holistically and in line with the requirements to provide a robust facility, flexible for future use.

INTERACTIONS EVERYWHERE

Clear and timely communications are not only essential but fundamental to the success of any project. The mechanisms to share information and knowledge through a variety of communication channels (i.e. digital and physical) enabled the transition from reactive to predictive attention and action.

Supply Chain Partners received daily text notifications from the Met Office to advise of site weather conditions that went above and beyond publicly available data to better predict and inform the timing of site operations and to ensure a quality building was delivered.

NOVEMBER 2014

Planning Permission Granted

The Living Wall

VERTICAL GARDENS HAVE BEEN A PART OF THE HUMAN NARRATIVE SINCE 500BC WHEN KING NEBUCHADNEZZAR II BUILT THE HANGING GARDENS OF BABYLON TO CURE THE HOMESICKNESS THAT AILED HIS WIFE. THE THERAPEUTIC BENEFITS OF GARDENS AND THE PRACTICE OF GARDENING ARE RECOGNISED IN MODERN WESTERN MEDICINE, BUT AS THE GLOBAL POPULATION SURPASSES 7 BILLION, SPACE IS LIMITED.



APRIL 2015

Preconstruction Phase Completed



Improves concentration, productivity & mood



Enhances air quality



Prevents graffiti



Relaxed ambiance



Increases local biodiversity



Sympathetic to the surrounding environment



Combats air pollution from traffic



High-profile green statement reflects the Met Office brand



Improved health & well-being



Reduces urban heat



Pre-vegetated security



Reduces flooding by absorbing rainwater

SUMMER 2015

Government Funding Approval

Added Value



Willmott Dixon is the overarching organisation, but it's the individuals that are making 'success...' their positive character is infectious, along with their willingness to do the work.

Ralph James
Met Office

JULY 2015

Preconstruction Phase Completed

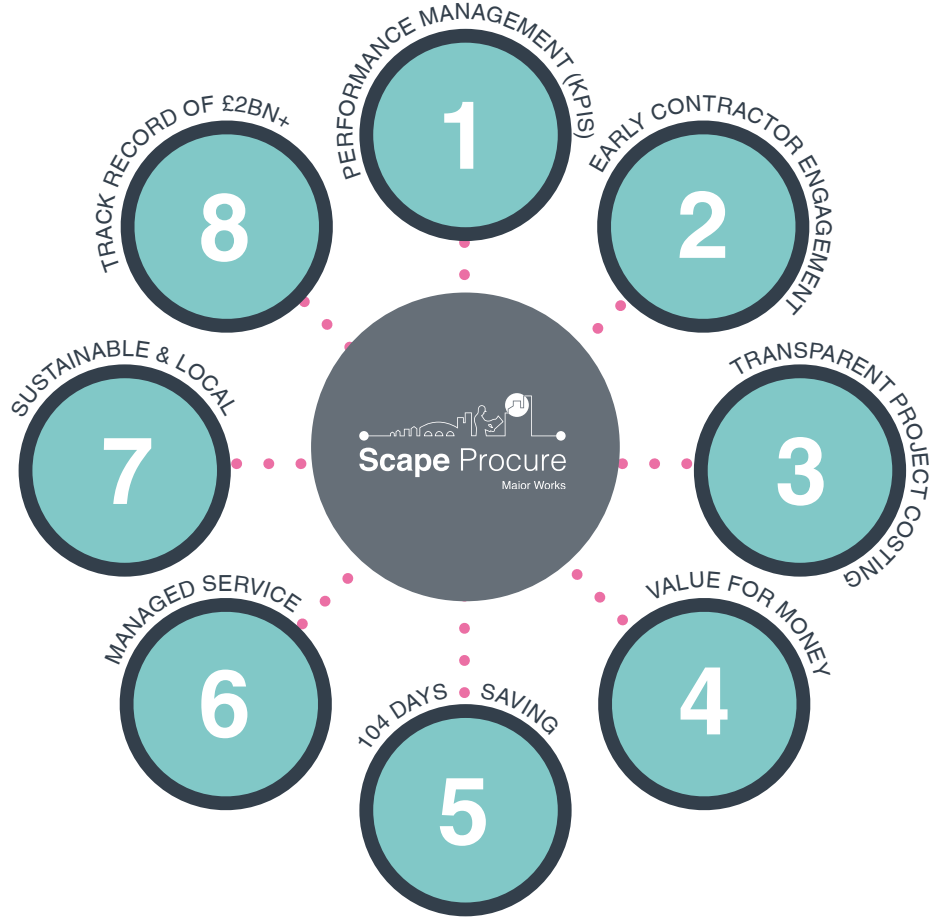


www.scapegroup.co.uk

Scape Group is a public sector owned built environment specialist.

First trading in 2006, Scape offer a suite of OJEU compliant frameworks and innovative design solutions that are available to any public body in the United Kingdom.

The National Major Works framework is designed to deliver construction projects with a value of over £2m. Led by Willmott Dixon, one of the UK's largest privately owned contracting, residential development and property support companies, this framework covers every aspect of construction for major works.



JULY 2015

Collaborative Team Launch



The UK is a leader in science and technology and ground-breaking projects like the supercomputer help advance this position on a global stage. We are proud that our framework has played its part by facilitating the creation of this iconic hub, as well as generating a ripple effect of benefits for people and businesses in Exeter.

Mark Robinson
Chief Executive of Scape Group



JULY 2015

Collaborative Risk Profiling

42
50

CONSIDERATE CONSTRUCTOR SCORE (INDUSTRY AVERAGE 36)



100% WASTE DIVERTED FROM LANDFILL



75% LOCAL PEOPLE & 76% SPENT WITHIN A 40 MILE RADIUS



100% ON TIME



100% WITHIN BUDGET



BREEAM 'EXCELLENT' RATED



100% DEFECT FREE HANDOVER



90% CUSTOMER SATISFACTION



BIM LEVEL 2 ACHIEVED



CONSTRUCTION VALUE CIRCA £20 MILLION

mi project

milproject is a Willmott Dixon owned and developed online portal for capturing, storing and sharing data.

As a UK's leading construction company, Willmott Dixon reports upon all projects against a set of industry recognised performance targets to benchmark performance against industry averages and competitors, whilst utilising robust procedures and forms to aid successful delivery. This ensures that the project performs in line with pre-agreed customer requirements in a consistent way across the UK, allowing best practice to be shared effectively and lesser performance to be pin-pointed early.



NOVEMBER 2015

Collaborative Showcase Tour



Promoting science and technology across the region through open days



Encouraging future career development through career presentations



Sharing skills and expertise through work experience placements



Preparing the next generation for the future with mock interview days



Awarding apprenticeships and internships in specialist areas

Legacy

FEBRUARY 2016

Topping Out Ceremony

Marking the Highest Stage of Construction



Investing time and talent totalling 2,687 people hours



Encouraging localism with an 11.67% increase in newly approved local suppliers



Advocates of recognised events like Open Doors and Women in Property



Championing sustainability in construction through community talks

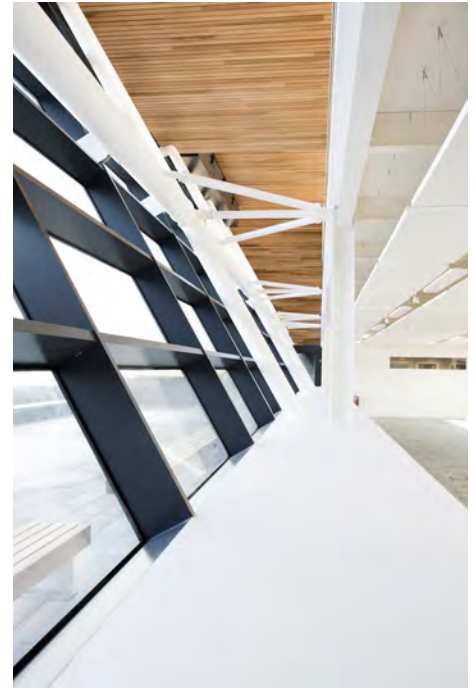


The most energy efficient building of its type in the UK

APRIL 2016

"The Sun Always Shines on TV"

by Ralph James, Met Office & James Harrison, Atkins



Gallery

WOW FACTORS
EVERYWHERE

ICONIC

The perspective and approach to the facility cannot be overlooked. Whether you are travelling on the major M5 Motorway southbound or on the approach road, the facility is distinctive.

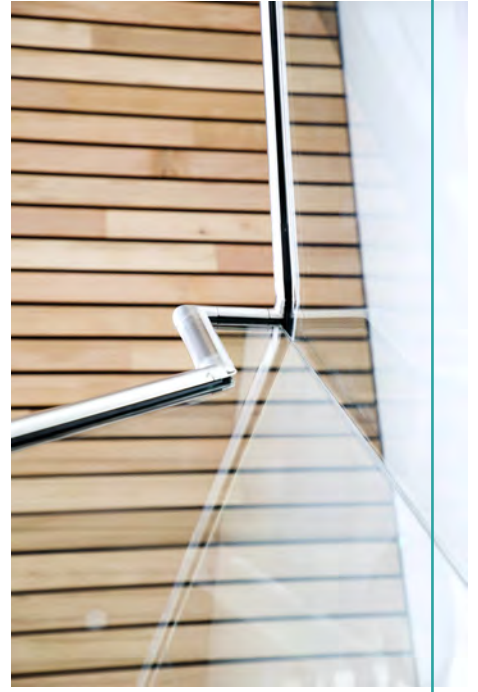
CONNECTED ENVIRONMENT

With a clear connection to the Devonshire landscapes, the design encourages interconnection between the external and internal spaces, whether it's the undulating fields to the North or the delightful landscaping solution to the South, the 'outside is brought inside'.

CHANGING THE WAY WE LIVE

The Cray supercomputer – the brains of the hub and ranked number 11 in the Top 500 supercomputer listings. With 36 compute frames, it truly is a wonderful sight.

AUTUMN 2016



DECEMBER 2016

Construction Phase Completed

The Future

THIS PROJECT REFLECTS THE CHANGING PRIORITIES FOR WEATHER AND CLIMATE RESEARCH, MODELLING AND PREDICTION THAT ENABLES THE MET OFFICE TO BE MORE FLEXIBLE, NOW AND IN THE FUTURE IN RESPONSE TO THE CHALLENGES OF INTERNALISATION OF WEATHER AND CLIMATE PREDICTION SERVICES.

DELIVERING ON TIME AND WITHIN BUDGET, THE MET OFFICE, SCAPE GROUP AND WILLMOTT DIXON HAVE COME TOGETHER TO PROVIDE A HOME THAT WILL ENSURE AN INCREASINGLY ACCURATE AND RELIABLE SERVICE ACROSS ALL SECTORS THAT ARE VULNERABLE TO THE EFFECTS OF ADVERSE WEATHER AND CLIMATE, NOW AND IN THE FUTURE.



We are very excited about this new investment in UK science. It will lead to a step change in weather forecasting and climate prediction, and give us the capability to strengthen our collaborations with partners in the South West, UK & the world.

Rob Varley
Chief Executive of the Met Office

SPRING 2017



Official Opening Ceremony



PHOTOGRAPHY : Hannah Hodeman



