Driving industry engagement

Rachel Freeman, Diamond Light Source

From Portacabins to Nobel Prizes: Malcolm Skingle looks back on his Journey with Diamond

Diamond Light Source, the national synchrotron based on the Harwell campus, has proved its vital role behind acceleration of the UK's research and development over the past two decades. Its use of high intensity x-rays to harnesses the power of electrons, produces intensely bright light that enables scientists to study the structure and properties of a wide range of organic and inorganic materials, ranging from fossils to metals and components, soft matter, viruses to vaccines.

Malcolm Skingle, a pivotal figure in Diamond's Industrial Advisory Committee, (DISCo), who retired from his role as Chair at the end of last year, shares his insights with readers on some of the remarkable changes and achievements witnessed during the growth of this aptly described national treasure.

> *"In my diverse career, there have only been two places that have given me a real buzz and made my hair stand on end; one is walking through Westminster and the other is Diamond!" Malcolm Skingle*

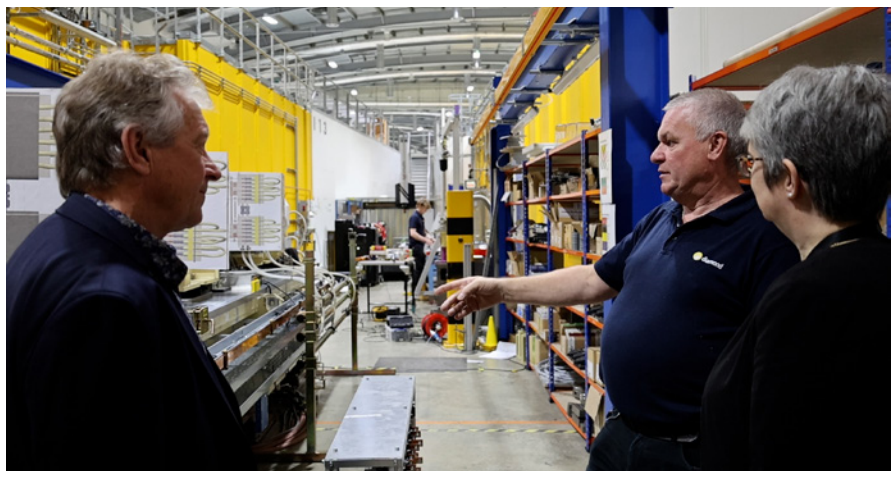
Reflecting on 20 years of progress at Diamond

Malcolm's involvement in the progression of Diamond took root following a meeting in a portacabin with David Clark from the Engineering and Physical Sciences Research Council (EPSRC) and Gerd Materlik, Diamond's founding CEO, before the facility even existed. He has since watched Diamond take a key role in generating data to underpin the Structural Genomics Consortium and contributing to the Protein Data Bank [1], as well as the input that led to a Nobel Prize in Chemistry for AlphaFold, the AI that predicts protein structures and which now forms a key part of Diamond's research pipelines.

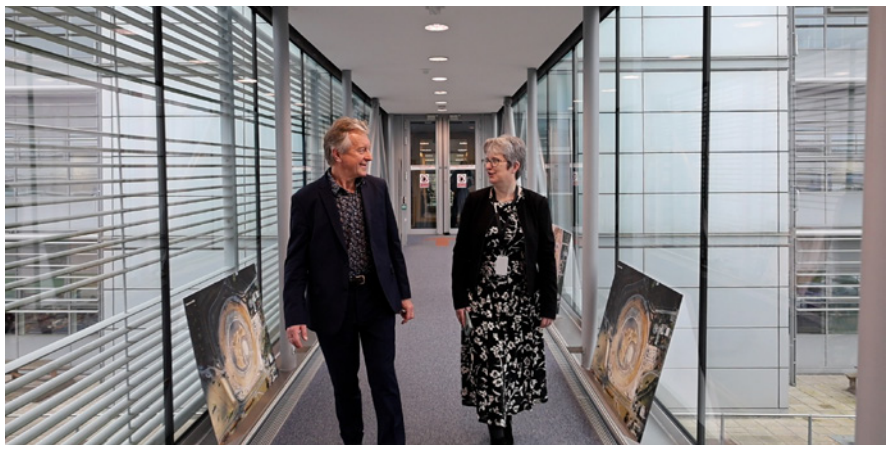
Challenges and growth

Having been asked to lead the committee and tasked with investigating how other countries were using synchrotrons to advance their research, Malcolm quickly grasped the scale of challenges he would face as Chair. He was first to admit: "I'm not a physicist, what do I know about this?" But his humility turned out to be his greatest strength in the role, which as David Clark put it, enabled Malcolm to "ask all of the difficult questions that potential users might want answering!"

Following his investigations it became obvious what an asset a home-based facility could be for the UK science and the business community: "I felt compelled to drive forward the business case to secure funding for what would be a key national resource," said Malcolm. "The Diamond synchrotron now not only rivals those in other countries but stands at the cutting edge, which was especially clear during the COVID pandemic."



Left to right: Malcolm Skingle (Former Chair of DISCo), Martin Small (Accelerator Mechanical Team Leader), Elizabeth Shotton (Head of Industrial Liaison) by the Diamond-II test girder.



Malcolm Skingle with Elizabeth Shotton, Head of Industrial Liaison at Diamond.

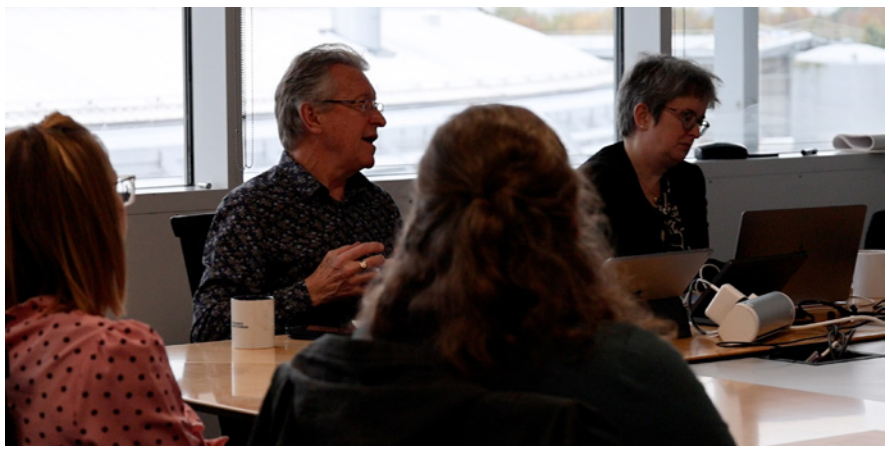
Engaging with industry

By engaging with scientists and researchers from the outset on what was needed to achieve their goals, he commented on how services provision at the synchrotron has developed into a whole system that stands out: "Diamond has really listened to industry and made it both simple and flexible to access these advanced capabilities, enabling industrial research, in particular drug design and material science, to move forward at a monumental pace."

Malcolm recalls the early days when teams of people came to Diamond with a collection of crystals and would do 8-hour shifts to conduct experiments. A team would then follow and work on it for 2-3 days. "No one wanted the night shift, of course, but someone inevitably drew the short straw. We've now transitioned to a seamless model whereby you can mail in your samples to be uploaded by the Diamond team, change samples, and collect data remotely – from your back bedroom if you want to.

"There are a whole range of options available to collect and analyse the data; you can either do this yourself, with help from the Diamond team if required, or they can do it on your behalf. There is no longer a need for those 8-hour shifts or to schedule work on the back of academic research."

The key value of using a high-end facility such as Diamond is that you are armed with real-time information and insights to make informed decisions for your R&D projects. For example, during COVID, it allowed medicinal chemists to develop structures and see how a protein would bind with potential anti-viral molecules. As the virus mutated, you could see in real-time how the physical changes were taking place, and which drugs would bind to it well.

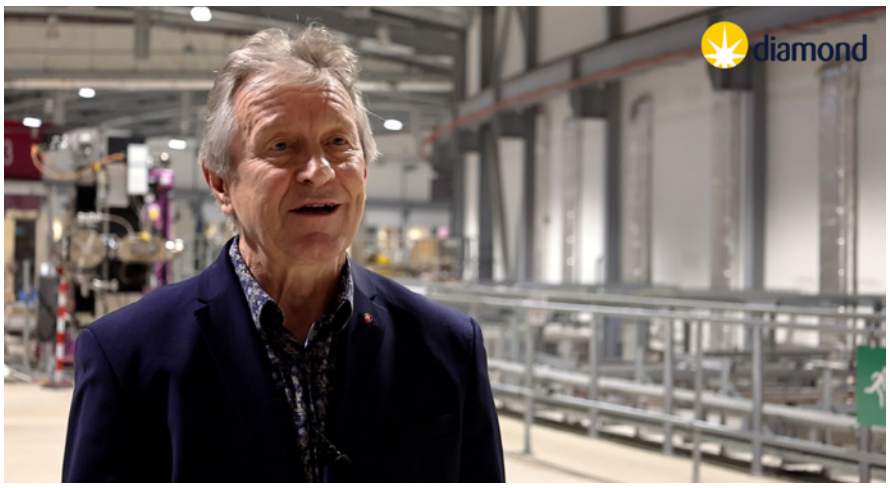


Malcolm chairing his last meeting at Diamond, with members of DISCo and Elizabeth Shotton.

Malcolm Skingle with members of DISCo on his last day as Chair.

Advancements in technology

As a former pharmacologist, Malcolm remembers using laborious methods like organ baths to see how compounds added to a piece of 'live tissue' would cause it to contract or relax and how this activity could then be 'blocked' using an antagonist. "Nowadays," he says, "things have moved on - the introduction of robotics, automation, state-of-the-art analytics, and the packaging of the data has completely changed how experiments are run at Diamond. Users can now optimise both the time and outputs of their experiments."



Malcolm in Diamond's Experimental Hall.

The evolving ecosystem

The accelerated advancements around Diamond and the wider Harwell have provided an evolving ecosystem; for example, the introduction of complementary approaches such as cryo-EM and Fragment Screening for drug discovery, along with a range of complementary services for crystallisation, work hand in hand with other scientific facilities all co-located on one campus. "The diversity of capabilities at Diamond and Harwell is superb and works across sectors perfectly," Malcolm added.

Commitment to industry engagement

Under the scope of DISCo, Elizabeth Shotton, Head of Industrial Liaison at Diamond and her industry team have been very open to trying different ways of working to align with industry needs, an approach that has been key to Diamond's success. The clear commitment from industry for a facility like Diamond also sends a clear signal to global companies that the UK is serious about business, which acts as an anchor for good science. The yearly increases in user numbers and the high number of repeat customers from industry, is a testament to the efficient processes that they have evolved over many years.

A dedicated team

A key asset for Diamond is the dedicated, close-knit industry team who support this research. Malcolm emphasises how "nice it is to be able to pick up the phone and speak to a friendly person who is both a specialist in their field and has the experience of working with industry so can help with any challenges."

Looking ahead

During his time at Diamond, Malcolm has seen three CEOs: Gerd Materlik, who was there from the start of Diamond and set out a clear plan for the operational deployment of Diamond; Andrew Harrison, who was a great advocate of Diamond worldwide for both users and at the cabinet level; and the current CEO, Gianluigi Botton, who has done a great job in plans to take Diamond to the next level and deploy Diamond II. He has been amazing at engaging with both staff and users to bring them on this exciting journey.

"I have great faith in Diamond and its work with industry," added Malcolm. "For industry to be still engaged in DISCo and Diamond after 20 years, we must be doing something right. I will be keeping a close eye on developments at Diamond both as a trustee of the Rosalind Franklin Institute and through personal interest and I am excited for the next stage of its development. I'd encourage anyone, even if just exploring their options, to get in touch with the industry team and have a chat to see how they can help. The expertise in Diamond's industry team is second to none and with an open attitude and advanced capabilities, pretty much anything is possible!"

In its seventeenth year of experiments, Diamond is now operating with 33 beamlines and eight electron microscopes dedicated for experiments. A further five instruments are available for experiment support and sample preparation. Ten of the instruments specialise in life sciences and make up eBIC (electron Bio-Imaging Centre), with two provided for industry use in partnership with Thermo Fisher Scientific. Two of the electron microscopes are dedicated to advanced materials research and are supplied by Johnson Matthey and the University of Oxford. These, along with a further instrument for sample preparation, form ePSIC (electron Physical Science Imaging Centre) and are operated under strategic collaboration agreements to provide for substantial dedicated peer reviewed user access.

Both eBIC and ePSIC are next to the Hard X-ray Nanoprobe beamline (I14). Along with eBIC and ePSIC, the UK X-ray Free Electron Laser (XFEL) Hub, the Membrane Protein Laboratory (MPL), the XChem fragrment screening facility, the LabSAXS facility and the Active Materials Laboratory make up the complementary integrated facilities available at Diamond.

For academic research, Diamond instruments (beamlines and microscopes) are free at the point of access through peer review. For proprietary research, access can be secured through Diamond's industry team.

Diamond II funding announced in September 2023 amounted to £519.4 million from UK Govt through UK research and Innovation (UKRI) and the Wellcome Trust. This will support a major upgrade of the machine's storage ring to a low emittance multibend achromat lattice, which together with an increase in energy from 3 to 3.5 GeV will enhance the brightness in the hard X-ray region of the spectrum by up to a factor 70. The booster ring will also be upgraded to allow injection in the storage ring.

Three new flagship beamlines will be introduced, along with upgrades to existing beamlines to enable the use of higher performance insertion device sources and several critical beamline upgrades that are required in order the beamlines to remain operational in Diamond-II.

Investments will also be made into core software, controls and computing to manage the greater quantities of data that will be produced by the upgraded facility, as well as extensions to buildings and infrastructure including office and lab space.

To find out more, look at how industry is applying Diamond across different sectors to their research – **https://www.diamond.ac.uk/industry/Case-Studies.html**

Get in touch - **https://www.diamond.ac.uk/industry.html**

Link to enquiries form: - **https://www.rcsb.org/**

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