THE SCIENCE AND TECHNOLOGY FACILITIES COUNCIL

Dr Andrew Taylor

Long term scientific research cannot be adequately funded on short-term budgets determined by a three-year government spending cycle. Dr Andrew Taylor is responsible for facilities development and operations at the Science and Technology Facilities Council. He says a more sustainable approach to funding the operation of facilities is essential to long-term UK prosperity but requires political commitment and courage during difficult financial times.

The UK research community is celebrating the recent completion of the second target station at the ISIS neutron source, a world-leading research centre operated by the Science and Technology Facilities Council (STFC) in Oxfordshire. For 25 years, scientists and engineers at ISIS have kept the UK at the forefront of neutron research. ISIS has delivered economic and social benefits from a wide range of research. The instruments at the new target station will extend its reach and make new impacts in the life sciences and in the study of soft matter.

ISIS is just one of the many world-class facilities which STFC operates at the Rutherford Appleton Laboratory (RAL) on the Harwell Science and Innovation Campus. It is co-located with the Diamond Light Source, the UK's Central Laser Facility and our Space Science, Technology and Particle Physics departments.

STFC is one of the UK's seven national research councils. Our work ranges from the subatomic world of particle physics to the vastness of space. In addition to ownership and operation of the UK's major science facilities, STFC funds university researchers in astronomy, particle physics, space science and nuclear physics. STFC is the agency through which the UK contributes to international science organisations such as CERN and the European Space Agency.

RETURN ON INVESTMENT

Science offers an excellent long-term return on investment, though this isn't always obvious to those looking for immediate and tangible results to justify spending.

Public-funded scientific research delivers vast benefits, ranging from skills and jobs to economic competitiveness and solutions to society's most pressing problems. It always has, but we've perhaps not always been very good at communicating the outcomes of our activities.

Our national research facilities are the result of a sustained public investment over many years. They provide UK and international researchers with the best equipment in the world. Building and maintaining these facilities is part of government's strategy to maintain UK competitiveness in a changing global economy. This investment stems from a conviction that scientific research is central to our future prospects. It will underpin future economies, help us to deal with global security and environmental threats, and make the UK a better place to live and invest in.

We're not asking politicians and policy makers to make a great leap of faith. We can point to evidence that long-term investment delivers benefits. We recently closed the Synchroton Radiation Source (SRS) at Daresbury after 28 years of highly productive operation. Total investment in SRS was £500m. One company alone (e2v, the principal UK manufacturer of high power RF power sources) has created a business worth £250m from technology developed to build the SRS. The SRS unravelled the structure of the foot and mouth virus with a potential economic impact worth billions, to cite another example of its impact.

However, big science facilities operate on timescales far longer than the life of the average Parliament, or even the average government.

Unlike economic cycles, our facilities have a useful life measured in decades. The £200m second target station at ISIS, the leading neutron research facility of its kind in the world, builds on work from over the past 25 years.

These facilities require sustained investment and teams of specialist scientists, engineers and technicians to maintain them safely and productively so they deliver to their potential.

These are not the sorts of things that can be turned on and off. We began planning the second target station at ISIS in the late 1990s and the commitment to build it was based on a projected 20-year operating life. There is already a consultation under way about the science and business case for the next-generation neutron source.

Those who made the decision to proceed with the

new target station at ISIS had studied the numbers and understood not just the research benefits, but also the long-term impact it would have on the huge medical, environmental and social challenges facing the world.

They knew that the UK would rise to the scientific, engineering and technical challenge, and that it would reap the long-term benefits. Without this long-range planning, and courageous decisions to proceed with projects which may only start operating under a different government, the UK's international scientific reputation would decline.

This decline might not be noticeable for many years. But its ultimate impact would be catastrophic, and by the time anybody took notice we'd have fallen a whole generation behind our competitors.

It is vital that we continue to invest in the UK's world class research base, and if we are to exploit our investment to the maximum, we should move to a position where long-term sustainable funding will allow us to operate our facilities with maximum efficiency without falling prey to funding variations arising from the three year spending review cycle.

We must position ourselves for UK science to get the best advantage for an economic recovery.

CASE STUDIES – THE IMPACT OF STFC SCIENCE

Safer chips for aerospace

STFC's ISIS neutron source is helping leading aerospace companies tackle the challenge of cosmic radiation and its damaging effect on microchips in aircraft. Neutrons in the atmosphere can interfere with the normal operation of electronic equipment. One way of tackling the issue is to test the quality and susceptibility of components under accelerated conditions. ISIS can replicate thousands of hours of flying in a very short time. Its research allows manufacturers to build the appropriate redundancy into their electronic components. This increased confidence in the quality of electronic systems makes both civil and military aircraft safer.

Understanding infant lung structure

STFC scientists are contributing to research that could help save the lives of premature babies. A coating of natural lung surfactant lines the internal surface of our lungs and each breath adjusts the tension to let oxygen into the bloodstream. The absence of this surfactant in premature babies causes Respiratory Distress Syndrome and breathing difficulties. It is currently treated with a surfactant aerosol sprayed directly into the lungs. Researchers at the ISIS neutron source are helping to develop synthetic lung surfactants which can be more precisely targeted at clinical needs and made more accessible in developing countries.

Search and detection

Lite Thru is a company which grew out of RAL's Central Laser Facility. It pioneered a spectroscopy technique which can not only assist the search for illegal drugs and the quality control of legal pharmaceuticals, but has potential as a non-invasive technique for detection of cancer.

STFC FACILITIES AT THE RUTHERFORD APPLETON LABORATORY, OXFORDSHIRE

ISIS

ISIS is a centre for research in the physical and life sciences. It produces beams of neutrons and muons to study materials at the atomic level. The construction of the ISIS second target station was funded with £200m from the Large Facilities Capital Fund — and it was completed on time and on budget. ISIS supports an international community of more than 2,000 scientists who use neutrons and muons for research in physics, chemistry, materials science, geology, engineering and biology.

Diamond Light Source

The Diamond Light Source uses intense beams of synchrotron light to investigate the structure of matter. This exceptionally bright light is around 100 billion times brighter than a hospital X-ray. Diamond represents the largest UK scientific investment for 40 years, again drawing on funding from the Large Facilities Capital Fund, and will ultimately host up to 40 beamlines.

Particle Physics, Space Science and Technology Departments

Sensitive underground detectors and astronomical observations let UK particle physicists and astronomers peer into the fundamental structure of nature in the quest to understand the nature of the universe. Technology developed for these projects to make them such a success – detectors, electronics, data acquisition systems, grid-enabled computer analysis and data curation – is now being used to give other scientific endeavours – ISIS, Diamond and Lasers – a cutting edge advantage.

Central Laser Facility

ULTRA is a new laser facility under development at RAL. It will enable UK scientists to monitor biological processes at a millionth of a millionth of a second using light from the ultraviolet to the infra-red. ULTRA has been funded through a major facility development grant of £1.8m, funded equally by STFC and the Biotechnology and Biological Sciences Research Council. Astra Gemini is another unique international laser facility, and it will help the UK maintain its influence in photon science. The facility opened in January 2008 and has been helping scientists to target at key priorities such as the pursuit of fusion power and oncology treatment techniques.

STFC facilities at the Daresbury Laboratory, Cheshire

ALICE (Accelerators and Lasers In Combined Experiments) is a prototype accelerator which has been designed and built at Daresbury Laboratory.

The Hartree Centre is a new computational sciences institute for the UK bringing together academic, government and industry. The centre will provide a step-change in modelling capabilities for strategic themes in energy, life sciences, the environment and materials.