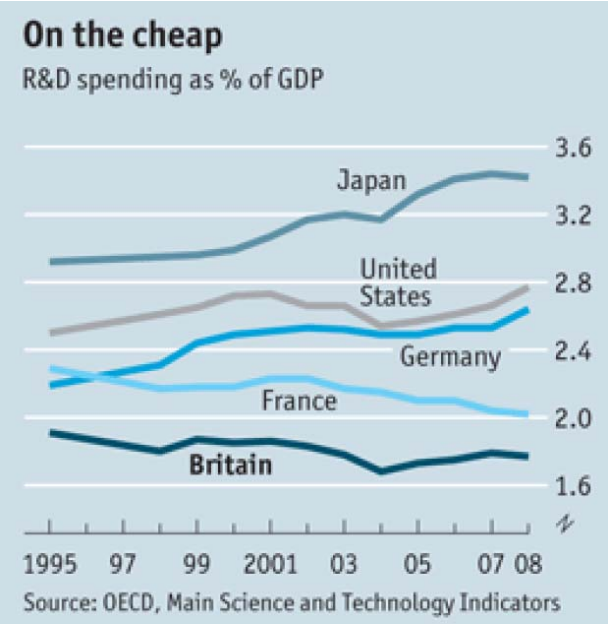
Written evidence submitted by Daresbury Laboratory Section of Prospect (APP 09)

Capital funding for Astronomy and Particle Physics

The Prospect Section Committee at Daresbury Laboratory wish to communicate the following points to the Select Committee:



The UK has a reputation for being the lowest spender on research and development as a function of GDP when compared to the other major world economies. The graph compiled by the OECD clearly illustrates this point.

This reputation extends to collaborations with counterparts overseas who are often reluctant to engage with UK-based groups because we have a poor record on delivery due to the funding constraints under which the UK's science infrastructure works, and the un-ending uncertainty over mid-to-long-term funding for big projects. These factors combine to cause significant damage to the UK's ability to do 'big science' and to collaborate in world projects.

Within STFC, capital is extremely limited, but there are apparently significant funds for restructuring. This is completely the wrong scenario under which to carry out cutting-edge science, and it sends the wrong message to stakeholders, both internal and external. The most important internal stakeholder is of course the staff, and as a consequence of the continued uncertainty over the future of big science, morale within STFC is lower than ever, and continues to fall as we move towards what is expected to be a wide-spread redundancy programme. This will further reduce the UK's credibility overseas, and further limit our ability both to compete at the cutting edge, and to collaborate with the rest of the world.

One of the first casualties as resources fall is outreach because it is a 'soft option'. Outreach is generally 'tagged on' to a person's responsibilities, and as resources dwindle and pressure increases to get more things done more quickly, the 'day job' has to take priority and secondary duties such as outreach fall by the wayside. Consequently, a feedback loop is created whereby the next generation of scientists are not being drawn out of the university population, so again reducing our ability to compete with the rest of the world. STFC's staff work in some of the key areas that fuel young people's interest in science. They may stay with these areas or move on to other areas of science,

but without the showcase areas of astronomy and particle physics, they might not become interested in science at all. STFC staff have a vital role to play in inspiring an interest in science and involving young people in it as they progress through education.

There is an apparent failure of the '*dipole model*' which seeks to focus all of the UK's major scientific infrastructure at the Harwell and Daresbury campuses. While Daresbury is losing capabilities with the forthcoming closure in March of the last two on-site user facilities (NCESS and MEIS) and de-commissioning infrastructure (such as the SRS synchrotron radiation source), all of the recent expansions have been focussed on the Harwell campus. Examples include Target Station 2 (TS2) on the ISIS neutron source, expansion of the Diamond Light Source (DLS) capabilities through delivery of the third phase of experimental beamlines, and the establishment of the UK space agency.

It should be noted that DLS have in previous phases of their beamline installation placed a significant amount of overseas orders for equipment and capabilities which are available within the UK, from the STFC and high-tech UK businesses. This must not be allowed to happen in the forthcoming phase III work as it will be completely indefensible if UK science funding from the large facilities capital fund is being spent overseas when the STFC is making its staff redundant and undergoing costly restructuring and UK companies are struggling to survive.

With a delay of 3 to 5 years on the UK's next accelerator-based light source (NLS), the NLS design team (most of whom are based at Daresbury) are struggling to find work, and we risk losing this talent to overseas facilities. In addition, the NLS prototype machine (ALICE) at Daresbury is experiencing severe cuts in its capital funding, which severely limits the operational usage of the machine. ALICE is a unique machine: it is one of only four machines in the world which is capable of accelerating a particle beam, exploiting it to produce radiation in the UK's only operating free-electron laser, then decelerating the beam and recovering the energy. Daresbury is becoming reliant on this machine to retain its core skills, and retain the UK's ability to build the NLS, yet this machine is drastically under-funded, and struggling to achieve its full potential.

The EMMA accelerator is unique triumph of UK technical achievement, a world-first particle accelerator showcasing UK science, engineering and skills world-wide. It offers a technology that will save lives by supporting hadron therapy to treat otherwise inoperable cancerous tumours, and opens the door to safer, cleaner, cheaper power generation supporting thorium-fuelled reactors. This machine is also suffering from a lack of capital to realise its full potential, and suffers indirectly due to its reliance on the ALICE machine which is also suffering.

In the construction of ALICE and EMMA, Daresbury staff pushed UK companies into areas that demanded new skills and capabilities to help them build world-leading machines. UK companies are now able to reap the benefits of this as they compete in a competitive global marketplace[1].

To redress the imbalance between the Harwell and Daresbury campuses, it has been proposed that an accelerator research centre be established at Daresbury. The aim is to build on the technical

[1] For example: TESLA Engineering delivered focussing magnets with high-quality field over a large physical aperture; VG Scienta & Kurt J. Lesker delivered precision vacuum chambers with integral beam position monitors; Q-Par Angus delivered a specialist 1.3 GHz RF distribution system which included hybrid devices to control the split and phase of the RF power in each of the 19 accelerating cavities in EMMA.

successes so far achieved on the ALICE accelerator, and to continue R&D for the NLS and future accelerator projects. This venture will require significant capital input, but we are already being told that capital is limited, and we will have to compete for what little is available. This is at odds with other Government-stated priorities such as healthcare, energy security and border security, all of which can benefit directly from the advances being made in particle accelerator technology at Daresbury Laboratory. Furthermore, senior STFC management have stated that there will be no new money available for the establishment of this centre. Their focus is on commercial partnerships based on market opportunities with short-term payback periods, even though particle accelerators are national research tools with payback periods which typically run to decades. This mindset is an unrealistic baseline for the creation of the accelerator centre.

This funding approach has been evident in reviews carried out by senior STFC management for other business cases such as the establishment of an engineering technology centre (ETC) as a capability within STFC. This is essential to on-going underpinning research in the field of particle accelerators as the engineering solutions must match the challenging requirements of the physicists who design the machines, and the harsh environments in which the equipment is required to function.

A huge amount of work has been undertaken within STFC in the preparation of business cases for two major technology centres. The Hartree centre is planned to be a world-leading centre-of-excellence in computational science and engineering (CSE). This institute would be based at Daresbury, and would expand the current CSE group and its capabilities by forging stronger links with the academic community, following a similar model to the successful Cockcroft Institute of accelerator science already at Daresbury. The Detector Systems centre is planned to focus the STFC's expertise in detector technology (for applications within space science, security, medical imaging etc.) whilst at the same time strengthening links to academic and industrial groups with similar expertise. The Hartree business case has passed all project gateway reviews with either green or amber status, but has been held at the Minister's desk pending approval for access to the LFCF. Given the cost and effort already invested in this case, it would be a criminal act not to fund this centre. The case for the detector systems centre is less advanced, but the need is real.

The current funding scenario is also pressurising a newly-established capability at Daresbury, which appears to 'tick all the boxes' in terms of external collaboration and innovation, but is now threatened. The I-TAC (Innovation Technology Access Centre) seeks to provide laboratory space and access to specialists and capabilities at Daresbury for start-up and small/medium high-tech companies, and has recently won an award for this. However, it seems that its funding may now be withdrawn just as its customer base is building and its reputation growing.

Daresbury Laboratory provides essential support to the local economy, and as its programs suffer due to restrictions in capital, or indeed are cancelled altogether, so the local economy suffers too.

It is clear that the STFC senior management have not made the case in a sufficiently robust fashion to DBIS for an appropriate level of capital funding required by STFC to even maintain the UK's current level of technical expertise, let alone advancing our capabilities. They are also failing to represent the interests of STFC's staff, and in particular, the scientific staff who are the STFC's biggest asset, many of whom are now looking for job opportunities elsewhere.

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14 February 2011