A.Chilingarian's report on participation in study tour in UK
"Commercialisation of Science and Technology
and the Formation of Successful Businesses based on Nuclear and Accelerator technologies"

23^{th} – 27^{th} February 2009

Aim of Study Tour

The main aim of the 2009 Study Tour is to provide an opportunity for Directors of nuclear research institutes to see how the UK, faced with similar challenges of lacking of funds for fundamental science, is developing effective commercialisation processes leading to the establishment of successful new enterprises.

The study tour was an integral part of the UK's Closed Nuclear Centres Programme with CIS countries which forms a part of the UK's contribution to the Global Partnership. This was launched at the G8 summit in 2002 to combat the threat of nuclear proliferation. The key objective of the CNCP programme is to create sustainable job opportunities for former weapons scientists and technicians working in the Nuclear Sector in CIS countries. The programme is managed by HTSPE Ltd and AEA Technology Ltd on behalf of the Department of Business, Enterprise and Regulatory Reform. It provides assistance in four ways:

- it provides grants to commercial spin outs and new businesses which have the capacity to create jobs for former weapons staff working in the Institutes;
- it supports a range of training programmes;
- it stimulates collaboration between UK and CIS firms and research institutions; and
- it supports the economic development initiatives such as the establishment of business advisory agencies.

Objectives

The main objectives for the 2009 Study Tour were:

1. Provide a series of case studies to illustrate how major research institutes and universities have developed programmes to support the commercial exploitation of their research;

2. Examine how research institutes and universities manage their intellectual property (IP) and how the value of research is divided between the various participants;

3. Show how technological developments can be successfully commercialised and new businesses set up, creating jobs and strengthening local and regional economies;

4. Meet companies that have been engaged in the commercialisation of research to understand the critical factors for success, and lessons that they have learnt;

5. Look at the role of advice, consultancy support and venture funding can assist the process and reduce risk.

The study tour provides an opportunity for delegation members to meet with a wide variety of senior level individuals within organizations that have been in similar situations and are successfully making the transition.

Following scientific centres/innovation companies were visited:

Isis Innovation Ltd, Ewert House, Ewert Place, Summertown, Oxford

Isis Innovation was established by the University of Oxford in 1997 to mange its intellectual property portfolio and assist academics wishing to commercialise their research. It is engaged in patenting, licensing, the formation of spin out companies, the provision of consultancy services, technology transfer consultancy and the sale of research materials. It employs 35 staff and in 2006 they handled 780 projects, filed 57 patents, signed 45 licensing agreements and set up 6 spin out companies. Since its formation a total of 48 spin out companies have been formed.

Oxford University provide critical mass for innovation and technology transfer: 4,200 scientists and 6.700 PhD students. The appropriate adopted politics according to IP holder is the key issue in commercialization. University get a M303 £ in 2006 for research, from scientific councils (the major governmental funding agency in UK, there are 8 such councils in UK, for major science brunch and technology); from EU projects; from industry; from charity organizations.
University owns rights for IP generated by its employees. University helps scientists who want to commercialize their ideas by paying for patenting, consulting, organizing spin-outs. The scientists get their share of profit from licences, from stocks from consulting.
University use initial seed fund of M4 £ to support commercial activity and other money comes from business angels. University stimulates meetings of the business and scientific communities by dinners (3 times a year) of the Oxford Innovation Society.
ISIS is owned by University to provide all mentioned services for scientists go to innovation. ISIS turnover in 2008 was M4.7 £. Isis returns M2.5 £ to the University for distribution to its researchers, departments and centrally. Isis concluded in 2008 74 licensing and option deals, 102 consulting deals, created 4 new spin-outs and filled 68 new priority patent applications.

The key issue in out-spinning is technology transfer and management of IP. It is very difficult to estimate the price of new company without going public. When you go public you get the price, but you sell your company already, may be for very low price.

DSTL Porton Down, Ploughshare Innovations, and the Porton Science Park/ Tetricus

The Defence Science and Technology Laboratory (Dstl) is an agency of the Ministry of Defence (MOD) and exists to service the needs of the MOD and other government departments. Dstl, is the centre of scientific excellence for the UK Ministry of Defence, housing one of the largest groups of scientists and engineers in public service in the country. It has a 3,500-strong workforce including some of the nation's most talented and creative scientists. With the brief to ensure that the UK Armed Forces and Government are supported by world class scientific advice, Dstl delivers defence research, specialist technical services and the ability to track global technological developments.

Dstl does not engage in work that can be done outside Government and therefore does not compete for business with Industry, nor does it undertake commercial work unless specifically tasked by the MOD. In cases where our work has potential for exploitation for the benefit of the nation, the intellectual property is handled by Ploughshare Innovations Limited, DSTL's technology transfer company which was set up in 2005.

Ploughshare Innovations - a wholly-owned subsidiary of DSTL – is tasked is to exploit selected Dstl Intellectual Property in non-MOD markets. Ploughshare will therefore aim to spin out those technologies that have commercial potential, applying professional expertise to find the best investment partners and license deals. Although wholly owned by Dstl, Ploughshare operates at arms-length from its parent.

IP emerges during research. Each scientist should be interested to discover, report and protect IP. MOB gives permission to transfer technology and after registration of IP technology can be transferred to private sector. Scientists get a first portion (300 – 500) £ after patent registration and second (from 100 down to 1%, dependant on the company profit) after firm gets grant for patent application.
If patent generates profit the scientists get their share, usually not very large and also they own a portion of stocks if company gets public.
Patenting is rather expensive; therefore it is of vital importance to decide which patents should be protected on long term basis. Following criteria is applied:
Novelty; the team qualification and management skills; the market size; the time needed for start production; strong IP; existence of investors.

Daresbury Laboratories of the Science and Technology Council (STFC)

The Daresbury facilities in Cheshire are part of the STFC which runs a number of large and expensive scientific facilities for use by researchers in universities, research institutes and industry. Daresbury has led the UK's efforts in synchrotron radiation science. Since 1981, Daresbury built and brought into service, the world's first dedicated synchrotron

radiation source, which closed at the end of 2008, following the opening of a more intense light source, Diamond, at the STFC's facility at the Rutherford Appleton Laboratory at Harwell near Oxford. These changes have presented significant challenges for management and the 500 mainly scientific staff currently employed at Daresbury.

The Cockroft Institute, a collaboration between academia, national labs, industry and local economy – brings together the best accelerator scientists, engineers, educators and industrialists to conceive design, construct and use innovation instruments of discovery at all scales and lead the UK's participation in flagship international experiments.
After the closure of the SRS facility a new energy recovery linac prototype, ALICE, 4-th generation light source, laser-plasma accelerator was designed and commissioned. Small scale facility (cost M18 £) uses novel experimental technologies: superconducting magnets, photonic band-gap materials, and laser-plasma-electron beam interaction, femto-and atto-second ultrafast techniques.
The next generation of particle accelerators pose technological challenges at every level. They drive advances in new technologies on which they rely to succeed. Cockroft institute provides a unique platform in which radical new ideas and developments, driven by the demands of basic science, are pursued to fruition with major industrial development and commercialization always in mind. Interested Industrial partners are engaged in various aspect of Knowledge Exchange via traditional Acceleratur Club, working in sinergy with Defence club and Industrial processing club and major national and international companies.
Darebury Science & Innovation Campus consists of new luxury building and constitutes a new model for the delivery of innovative science into successful businesses. It brings together "best in class" expertise and capabilities in science, innovation, business & entrepreneurship.

Dalton Nuclear Institute, Manchester University

The Dalton Nuclear Institute's vision is to become: "A world class institute for nuclear science, research, innovation, exploitation and education". The Dalton Nuclear Institute operates on an interdisciplinary basis across a number of research centres within the University. The Institute's interest extends beyond the more traditional areas of engineering, physics and chemistry into medical applications, nuclear decommissioning and fusion. The new technology areas being developed by the Institute, such as Reactor Technology and Radiation Sciences, will see the establishment of additional collaborative activities.

In support of this objective the Dalton Nuclear Institute aims to:

- establish an interdisciplinary research portfolio to support the development of expertise to underpin the UK's nuclear clean-up programme
- facilitate the maintenance of skills for any future new- build programme and help develop the expertise and competences needed

- bring together industrial sectors that share common requirements for nuclear science and engineering technologies including the medical and fusion energy communities
- develop modern packages for nuclear education that are relevant to the needs of the nuclear sector
- participate in international networks to ensure the UK has access to technological advances in research and education
- be recognized as an independent and authoritative source of information and advice in nuclear policy, technology and assessment.

The number of the "nuclear" scientists in UK reduces from 8,000 in seventieths down to 600 now. To provide necessary assistance to planned 20-30 reactors to be build in next 10 year, only for education UK plan to spent M100 £ annually.

London ministry; Presentation by Nathan Hill, Chief Executive of Qi3 Ltd

Qi3 is a specialist service, providing sales, marketing and business development support to technology enterprises and government. Since its inception in 1999, founder Nathan Hill has worked hard to hold a number of contracts to facilitate the identification and exploitation of technologies with commercial potential, including the UK Science and Technology Facilities Council (which oversees the work of the Rutherford Appleton Laboratories at Harwell) and with CERN in Geneva.

Technologies developed are typically at a high Technology Readiness Level (TRL) at the time at which they are deployed in astronomy, space science and particle physics experiments. Qi3 has had considerable success in transferring these technologies for use in a variety of industrial and other research applications.

For providing successful technology transfer from CERN it is necessary to:
Determine options of sensors and particle detector which can be commercialized;
Estimate of size of possible market;
Are there key alternative technologies and is it possible to easily change them;
What can prevent to go to market?
Are there any other applications of sensors and detectors?
What can be the best business mode?
What kind of additional research can be needed?
As a convincing example of particle detector technology transfer was named the gamma-burst detector on board of the Newton gamma-ray observatory. The homeland security ministry offers a M222 $ contract for implementation of this technology for a dirty A-bomb screening.

Workshop on commercialisation led by Tim Rubidge, a leading Commercialisation and Technology Transfer Consultant

Tim Rubidge is currently working as the Operations Director of the Training Hub for Operative Technologies in Healthcare (THOTH), which was set up in January 2006 with funding from the NHS and the Department of Trade and Industry. The aim is to help create and disseminate innovative training tools that will accelerate the adoption of new healthcare technologies in the NHS and beyond. THOTH works in partnership with NHS, academic, educational and information technology bodies and medical device companies to encourage knowledge exchange and promote best practice in medical technology training.

For successful technology transfer we need:

- *Proven technology;*
- *Clear and close market application;*
- *Competitive management;*

Then we need to set out the method for running a specific activity over a specific future period, i.e. a Business Plan setting out:

- *…where you are now…*
- *…where you want to be…*
- *…how to get from here to there*
- *What is the potential profit?*
- *How can the profit be generated?*
- *How much investment is needed?*
- *How can the risks be managed?*

Some conclusions and recommendations:

The tour highlighted all problems connected with science support and technology transfer/knowledge sharing. It is highly important for each nation, not only have fundamental science, but also be very instrumental to profit from it:

- First of all we have to have world-class science. In each centre we visited was very clearly declared in which field they are world leaders and where they are world class. It is of utmost importance for Armenia to re-examine the fundamental science we have and outline competitive fields. Only competitive science can produce ideas leading to products and services with any market value.

- Sciences should have all what they need for work: clean and modern laboratories, offices with all necessary facilities, including fast Internet, money for travel and leave. It is absolutely nonsense to support thousands of scientists with providing no means for their productive work. In addition it is bad strategy to apply for very

large funds for large facilities and then complain when refused. Small scale experiments with modern equipment are key of keeping science alive and entering international collaborations.

- In is necessary to form a unit in Institute to estimate value of generated IP, help scientists to find applications and to apply for seed funds. In addition this unit will be responsible for explaining to scientists the economical and social benefits of technology transfer.

- Each large physical scientific institution should organize education center on his premises. Physical education was and is basis for any applied science and technological application.

- Space Science and particle detectors are the source of new ideas and facilities with huge commercial potential. Armenia should be connected to the Space science. Also production of different sensors and high precision radiation sources along with properly developed metrology is very fast developing field of business applications.

For Yerevan Physics Institute following immediate actions will be implemented:

- Form a council for commercialization chairing by the institute director;
- Introduce in courses for the physical department students ideas of technology transfer/ knowledge sharing;
- Prepare and submit new CNCP projects