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The Economic Impact of the Synchrotron Radiation Source

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*“Role of Research Infrastructures for a Competitive Knowledge Economy”
Brussels, 29th June 2009*

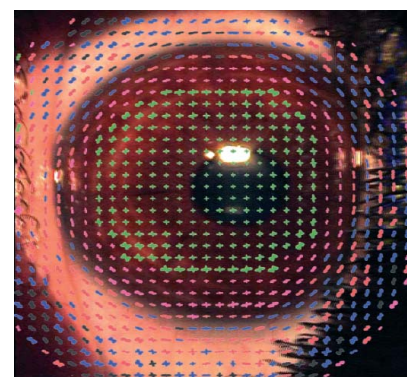


Contents

- Introduction to STFC
- EI definition & framework
- SRS and the EI study
- Highlights of the study
- Issues & lessons learned
- What next?



*Bronze age helmet,
examined on SRS*



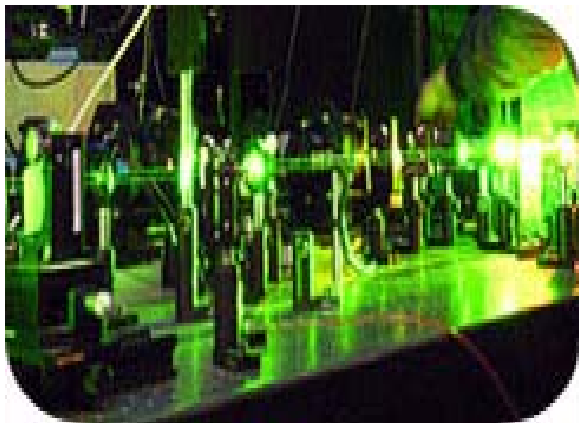
*Retinal research carried
out on SRS*



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- 1 of 7 UK Gov. funded RCs, £1.8 billion budget 2008 - 2011
- Fund part of UK's research base (basic & applied research)
- One of Europe's largest multidisciplinary research organisations

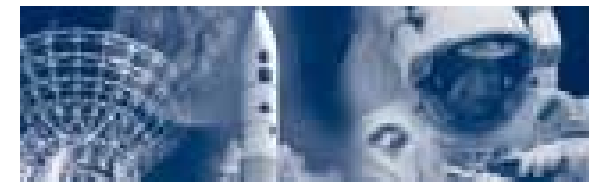
Access to our
own facilities



Grant funding

Particle Physics
Astronomy
Nuclear Physics

International
subscriptions





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Economic Impact

What does it mean?



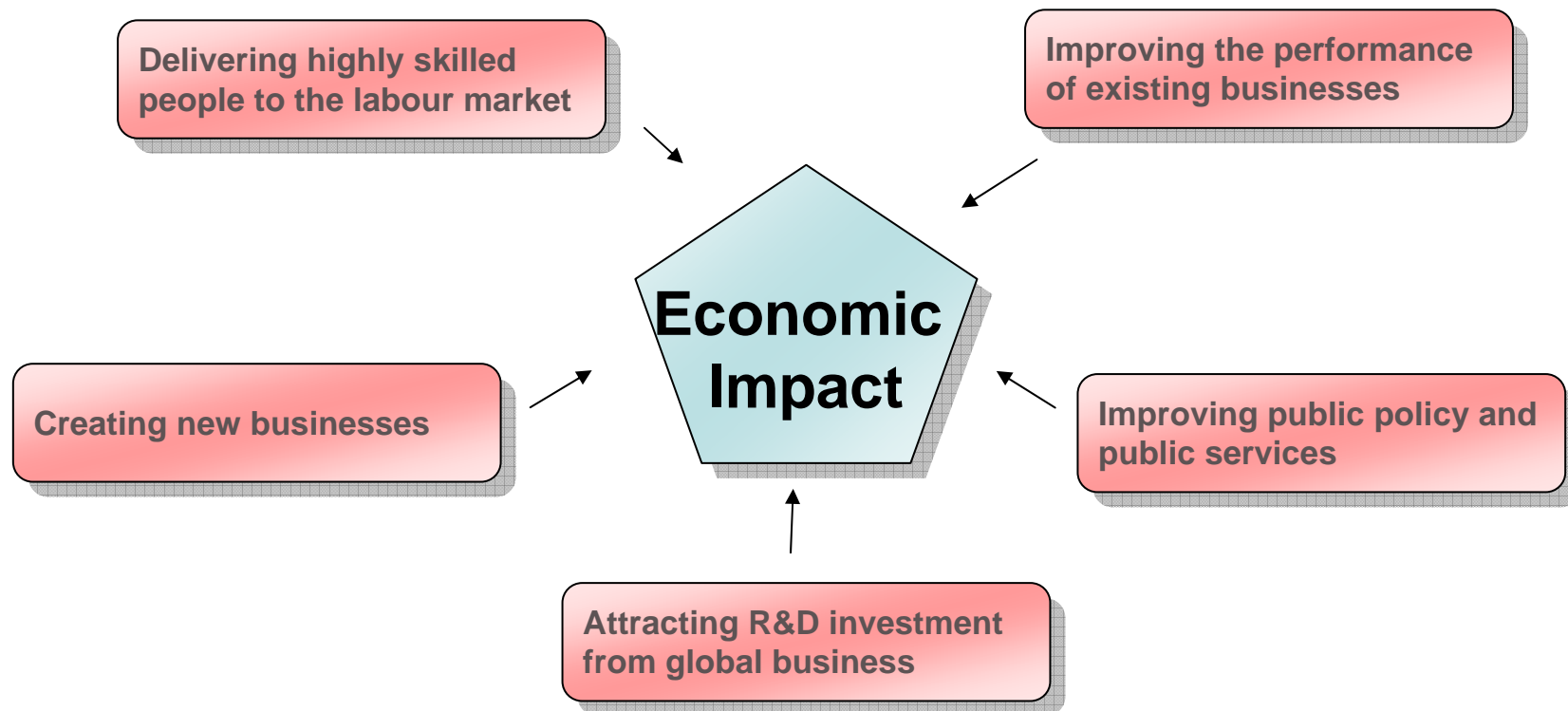
What is Economic Impact?

Treasury Green Book Definition -

*'An action or activity has an economic impact when it affects the welfare of **consumers**, the profits of **firms** and/or the revenue of **government**. Economic impacts range from those that are **readily quantifiable**, in terms of greater wealth, cheaper prices and more revenue, to those **less easily quantifiable**, such as effects on the environment, public health and quality of life'*



Five Key Ways of Generating Economic Impact from Research





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Economic Impact study on SRS



Synchrotron Radiation Source

- World's 1st 2nd gen. SR source
- Owned by STFC & predecessors
- X-rays to examine detailed structure of matter
- Multi science
- Academic & industrial users
- Closed in 2008 after 28 year operation
- ~ £470M total spend

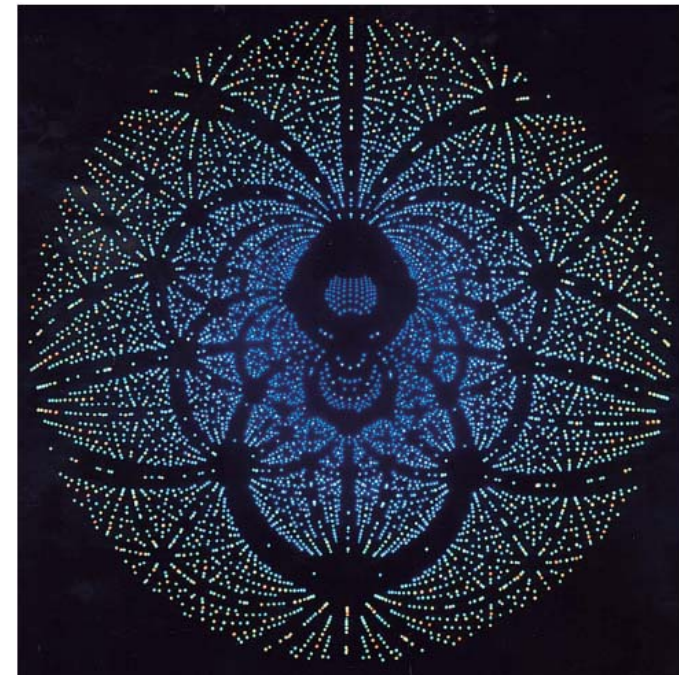


Ariel image of the Daresbury Laboratory



SRS Economic Impact Study

- Project to capture the considerable impact from a UK large science facility
- SRS closure in 2008, impact over the lifetime of the facility
- Methodology – desk research, interviews with key stakeholders, statistical data
- Why?
 - Reflection of UK Government's increased focus on EI
 - Methodology development
 - In house expertise
 - Highlight any issues with EI measurement



Pea Lectern imaged on SRS



DSIC
Tenants at the DL
Clustering of facilities

Scientific impact
Influence on
synchrotron community

Financial impact & jobs

SRS **Impacts**

PUS
Skills/qualifications
Technical capabilities

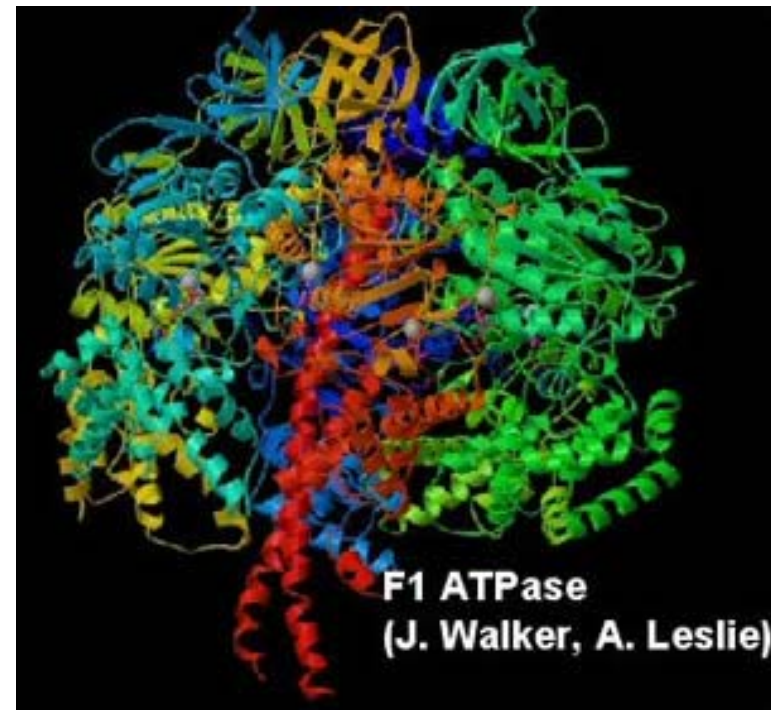
Commercialisation
Technology development
Industrial usage



SRS Economic Impact

Bringing scientific influence & impact to daily lives

- 2 million hours of science – diseases, global warming, new medicines, historical artefacts etc
- 5000 papers, 10 high impact pubs/yr (Nature, Science etc),
- 80,000 citations
- 1200 protein structures (PX)
- Nobel prize
- 70 synchrotrons operational worldwide in 2008
 - Exemplar facility
 - SRS staff have been involved in over 50%
 - Staff transfer



*Nobel prize winning protein structure
of F1 ATPase*



SRS Economic Impact

Delivering skilled people to the labour market

- 11,000 users from over 25 countries
 - 4,000 PhD students & 2,000 post-docs
- 500 work experience students & 110 apprentices
- 6000 public & schools visitors per year
- Development of skills & technologies
 - Accelerators, cryogenics, detectors, software, safety systems etc
 - Ability to develop new facilities (DLS, NLS)



Demonstration for school visit



SRS Economic Impact

Impacting the local economy

- £468M total spend, majority in local area
- Av 230 staff/yr employed over lifetime
- 300 local businesses – goods & services
- Induced & indirect EI from spend & employment ~£357M (using ONS I/O multiplier for R&D sector of 1.84)
- Clustering of companies & facilities on site/area
- Critical mass of expertise
 - 1 driver for creation of Daresbury Science & innovation Campus



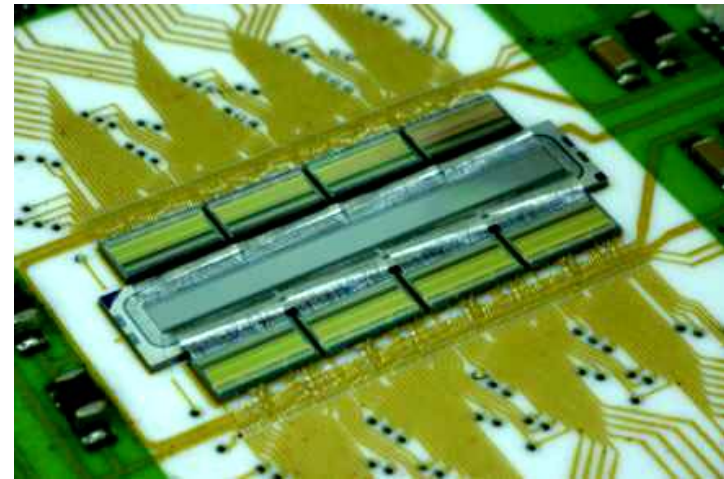
*Breakfast meeting at Daresbury
Innovation Centre*



SRS Economic Impact

Creating new companies

- 6 direct spin-outs, 3 indirect spin-outs, 1 commercial service provider
- Industries - Scientific instrumentation, detectors, cholesterol monitoring, software, cryogenics & drug discovery
- 25 patents created (from employees)
- 11 licenses, revenue ~£1million – UK sales?



*XSTRIP detector, marketed by
Quantum Detectors*



SRS Economic Impact

Improving the performance of UK business

- 200 proprietary customers
- 11 out of the top 25 companies in the UK R&D Scoreboard (2008)
 - ICI, BP, Unilever, Shell, GSK, AstraZeneca and Pfizer
- Technology development projects with industry – KE
- Contracts of £300M won by UK industry as a direct result of working with the SRS



*Double-crystal monochromator
manufactured by Vacuum
Generators in 1995 and delivered to
the new Advanced Photon source*



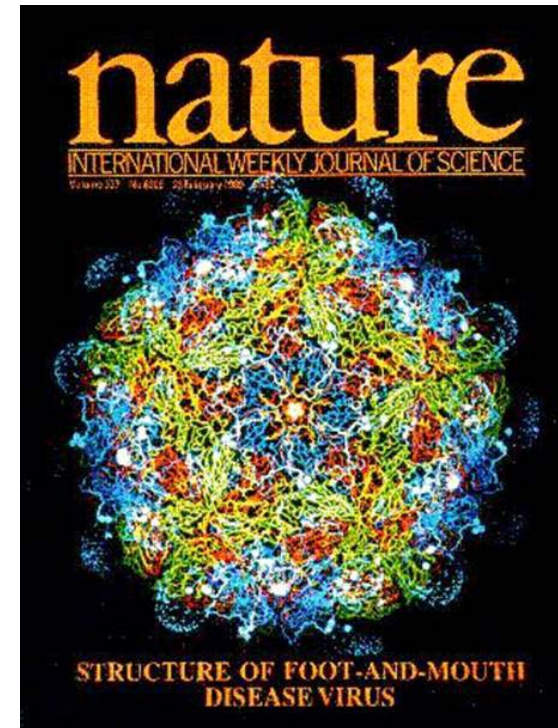
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SRS Economic Impact Study Examples



Foot and Mouth Disease Virus

- Research undertaken by Oxford University, Wellcome Biotech & Porton Down on SRS in 1980's
- FMDV structure determined
- Led to development of vaccines
- 2001 outbreak estimated at £8.4bn cost to UK
 - Vaccines were available



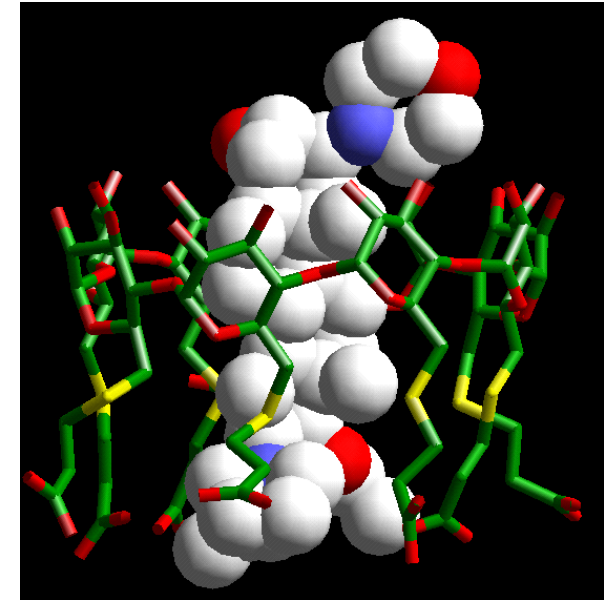
Nature front cover, structure of FMDV

**Beneficiaries – Researchers, drug development companies,
Government, taxpayer, Farmers, general public**



Drug development - Sugamadex

- Commercial usage of SRS by Organon
- Drug which reverses effects of drugs administered during anaesthesia
- Sugamedex trialled & released - owned Shering-Plough
- Recovery times have been reduced to 1-2 minutes from 30-60 minutes - removing the need for all patients to be moved to an intensive care unit
- Cost to NHS of ICT beds £2K/day vs £200/day on wards



Crystal structure of the blocker complex

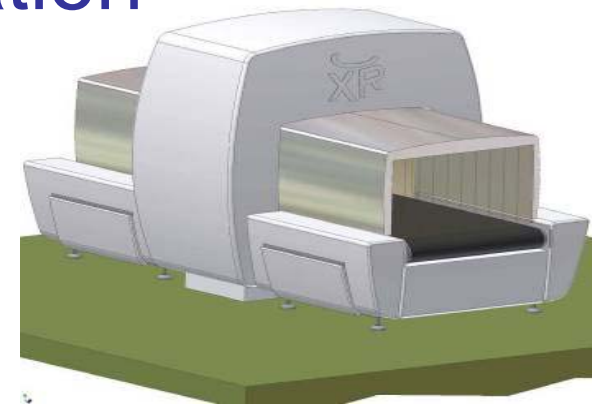


Beneficiaries – Drug companies, STFC, NHS, taxpayer, patients



CXR Ltd – co-location for skills exploitation

- Multiple X-ray sources for 3D images of suitcases and baggage – detection of banned fluids
- Located at DL initially to exploit skills built up through supporting the SRS
- Company have benefited from expertise in vacuum, engineering design, project management, testing, high vac cleaning
- Recently installed a system at Manchester Airport



X-ray baggage scanner



Image of a scanned suitcase

Beneficiaries – CXR, STFC, airports, travellers



SRS & e2v – Technology Transfer

- Radio-frequency (RF) power equipment is critical to particle accelerators
- Long term & successful relationship with radio-frequency equipment manufacturer, e2v
- Transfer of technology from SRS to e2v on business critical coating
- E2v dominant player in this market for 30 years, gaining sales of £250M
- Fruitful relationship continues in wider STFC

e2v



E2v RF system

Beneficiaries – e2v, STFC, Government, consumers



Summary

- Large scale facilities have a vast economic & social impact
- The SRS impacted through –
 - Scientific influence
 - Impact to daily lives
 - Creating new companies
 - Technology development
 - Improving the performance of UK business
 - Impacts to the local economy
 - Delivering skilled people to the labour market

Methodological issues

- Timescales
- Attribution
- Confidentiality
- Industry contacts
- Industrial access through academics
- Lack of recorded data
- Quantification of impacts – both qualitative & quantitative
- Under estimation



SRS Annual Report front covers



Benefits

- 1st in depth lifetime study of a large facility in UK (or overseas?)
- Demonstration of impact from large scale facility
- In house expertise
- Methodology
- Publicity
- Evidence of impact for UK Government



*Diamond Light Source, the UK's 3rd
Generation Light Source*



What next?

- Publish document (www.stfc.ac.uk)
- Strengthen methodology
 - How much is a PhD worth?
 - Robust methods for induced and indirect financial impacts
- Apply methodology to other studies
 - Next generation light sources, lasers and telescopes
- Implement measurement systems for all STFC research
- Share best practise & work with other stakeholders