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Institution: University of Leicester
Unit of Assessment: UoA 9 Physics
<p>a. Context</p> <p>The Department of Physics and Astronomy at the University of Leicester (UL), which is coterminous with this UoA, consists of six research groups, Condensed Matter Physics (CMP), Earth Observation Science (EOS), Radio and Space Plasma Physics (RSPP), Space Science and Instrumentation (SSI), Theoretical Astrophysics (TA), and X-Ray and Observational Astronomy (XROA). Each research group has specialist skills and experience which are of direct use to external users; our research groups can and do deliver Impact. Our research influences policy making, for example through specific documented contributions to the climate change debate and the development of a new space nuclear power capability which has led to significant investment in UK industry (see case studies), develops new products and processes (e.g. through our work on X-ray spectroscopic techniques where we have new devices for medical and other applications), engages with regional businesses (e.g. through specific programmes such as G-STEP and Space IDEAS Hub), and national industry, through long term strategic partnerships (e.g. with Astrium-UK), and adds to the cultural benefit of society through our outreach programme.</p> <p>Since RAE 2008, the university has restructured its academic programme into Colleges such that the Unit is a member of the College of Science and Engineering (CSE). The CSE has a leading role in the Enterprise agenda for the University with significant interactions and impacts in public and private sector industry across all Departments. The Unit contributes at all levels of the University and College enterprise structures. CSE also maintains a Business and Industry Advisory Board, members of which represent companies including Alstom Grid, Atomic Weapons Establishment, Environment Agency, Infoterra, PERA, Perceptive, Photonis, and Rio Tinto, a number of which had an original involvement with the University via the Unit.</p>
<p>b. Approach to impact</p> <p>The Unit is committed to contributing and enhancing the Impact of our research. We (i) deliver enterprising impact through the alignment of our research with major global and industrial challenges; (ii) address the opportunities to play a positive role in the economic development of our region (e.g. G-STEP, Space IDEAS Hub), and the UK; (iii) deploy our research in the development of skills and capability within a broad spectrum of public and private sector industry, e.g. through training for MOD personnel; (iv) provide expert advice and guidance to industry and policy makers, e.g. through contributions to Government's policy on climate change and space nuclear power; (v) ensure that our valued intellectual property is effectively transferred and disseminated, e.g. through spin out companies, patents etc.; and (vi) contribute to the wider cultural benefit of society through an enterprising and engaging outreach programme. Within the broader University and College context, the Unit is supported by an Enterprise and Business Development Office (EBDO) which works with academics and external stakeholders to create maximum impact in the local, national and international community.</p> <p><i>Working with Industrial Partners</i></p> <p>We successfully work with many industrial partners, some of which are discussed in our case studies. For example, space instrumentation often requires direct links with industry, either with international companies, such as Astrium, or small business enterprises, such as Magna Parva, as well as national and international space agencies, e.g. NASA, ESA, JAXA, CSA, etc., and other bodies. The European space nuclear power programme is a direct result of the confluence of the world class nuclear and space industries in the UK, in which UL is a key partner. Partnerships with the UK's National Nuclear Laboratory, Astrium UK and SME's including European Thermodynamics are fundamental to the sustainability of the Unit's impact strategy. In addition to those mentioned in the case studies, other notable examples include the work of the CMP Group in solar cell design in collaboration with the Norwegian company Ensol. The EOS Group also plays leading roles in several joint academic-industrial ventures including the Centre for Earth Observation Instrumentation (CEOI) and the Climate and Environment Monitoring Facility (CEMS). The RSPP Group trains Ministry of Defence personnel (80 staff in the REF period) in the understanding of the propagation of HF radio waves through the ionosphere and the consequent effects on the performance of HF radio systems. Such training is considered essential in the</p>

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improvement of the performance of both staff and radio systems and is of significant strategic importance. The expertise of the SSI group in sensors is the basis for long-term relationships with Industry and for working across discipline boundaries, e.g., formal collaborative agreements with large (EADS Astrium) and small (Leicester-based SME Magna Parva Ltd) companies.

Working with Research Councils

Members of the Unit have been successful in winning KE Fellowships from STFC (Dr Lees, the grant holder, Mr Maskell as the Fellow) and NERC (Dr Leigh, grant holder and Fellow). These Fellowships have been a successful part of our Impact work, and will continue to act as catalysts for our future Impact plans, e.g. Maskell contributes significantly to the Space IDEAS Hub, and Lees to one of the spin out companies, Gamma Technologies, while Leigh is developing links with local government on pollution control, as well as several other commercial ventures.

Influencing Government Policy

The work of the EOS Group has influenced Government policy on climate change (see Case Study) with support from DECC; academics in the EOS Group, particularly Professor Remedios, have served on advisory committees for DEFRA and BIS/UKSA. Professor Sims was heavily involved in producing the Innovation and Growth (IGS) for Space Report, published in 2010, which led to the then Labour government identifying Space as a priority area for UK economic growth, a view supported also by the current subsequent coalition government (see Case Study). Professor Remedios is a member of the Steering Board for the market-orientated Space Innovation and Growth Strategy IGS Re-stack, while Professor Barstow was a member of Theme 7 team on the Harwell Innovation Cluster. In addition the research of the SSI group has led to changes in government policy regarding Space Nuclear Power (see Case Study).

Spin out Companies and Contracts

There are three existing spin-out companies (Bioastral, Gamma Technologies and Spectral ID) from the work of the SSI group. All three companies have secured investment and are engaged with relevant industry partners; in the last case, Spectral ID, the technological advantage is an ability, using optical spectroscopy, to distinguish real from counterfeit or diluted whisky "in the bottle" (i.e. without breaking the seal) and discussions with the Scotch Whisky Research Institute, near Edinburgh, are ongoing. The RSPG Group has, in the period of the REF, won contract income exceeding £2m to build HF radio and radar systems.

Outreach

The Unit places a great emphasis on Outreach to the Public through a range of activities and has a highly successful reputation for this. Major highlights from the period 2008 and 2013 include: (i) Sustained involvement in the programmes of the National Space Centre (NSC) in Leicester, which attracts 200,000 visitors per year; (ii) Supplying space-related artefacts and expert scientific opinion to the Science Museum; (iii) Organising and hosting annual residential UK Space Schools which, every year, attract ~120 school students in the age range 14-18 to an intensive week of immersion in all aspects of the space endeavour; (iv) Acting as East Midlands regional focus for the 2013 BBC Stargazing Live event. On January 8th 2013 (a very wet Tuesday evening) over 4000 members of the public learned "in situ" about the Unit's programmes in planetary science and astrophysics. We have recently demonstrated the significant improvement for a small cohort of students involved in NSC related support (see the Case Study). Furthermore, we now have a sufficiently long time history of students involved in Space School that we can measure their performance at school and at University. This is now informing our strategy in this area where we propose to monitor and measure the direct outcomes of our Outreach work.

Staff Development and Training

We actively encourage our staff to be involved in all aspects of Impact and recognise staff who are involved in such activities. Recognition for staff of their work in Impact can be achieved through the University's promotions system, e.g. one member of staff (Lees) was promoted to Reader based on research work which has a significant impact contribution. The Unit actively encourages members of staff interested to use Impact related University training courses and to engage with central resources such as EBDO. Our mentoring scheme for academic staff leads to the

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development of the necessary skills in these areas. We do not limit ourselves to academic staff only, a particular example of engaging our non-academic staff has been that of a Grade 7 mechanical engineer working on new developments in additive manufacturing. Piyal Samara-Ratna has led the interaction with both industry and European Space Agency (ESA) for the production of both one-piece structures for Cubesats and novel X-ray collimators.

College and University

The University has provided considerable resource to support G-STEP through the provision of off campus offices easily accessible for industrial partners. Another key element both for the Unit, College and University is to provide sources of matched funding support for critical areas and this has been particularly successful in recent years in supporting G/STEP and Space IDEAS Hub. Other funding sources also available through the EBDO include the Prof of Concept scheme, designed specifically for early ideas, Innovation Fellowships, now Enterprise Fellowships designed to support commercial development. The Unit has been a beneficiary of these sources of funding on a number of occasions, e.g. to develop new radio systems and real time oil analysis. University Enterprise activities are coordinated centrally through the EBDO, overseen by a Director. Links to the Departments are strong and EBDO has business partners embedded within each college to give direct assistance to academics. The Unit plays a central role in the CSE 3rd Stream Engagement committee which is one of the main mechanisms for dissemination of information and acts as a conduit for enquiries and funding opportunities. The committee has representatives from each Department and each College Research Theme. It also germinates ideas for proposals for cross-college enterprise projects. The approach to impact is reviewed by the Business and Industry Advisory Board (BIAB) which meets twice yearly.

c. Strategy and plans

The long term strategy of the Unit in impact has four elements: (a) to continue to support and develop the skills and experience of staff in the Unit which enable us to work with industry; (b) to ensure that current links with external research users in industry are fostered and new links developed; (c) to ensure that the Unit remains at the heart of new College and University initiatives for Impact and enterprise activity; and (d) to develop our successful Outreach programme with particular emphasis on developing our efforts to develop valid outcome measures.

The Unit currently has two specific Impact related initiatives for SMEs, G-STEP and Space IDEAS Hub, which form the basis of our local Impact engagement. Of these two initiatives, one, G-STEP is described in an Impact Case Study, while the other, Space IDEAS Hub, is at a stage where we believe the outcomes, while equally positive are not as mature. Some 6 – 8 staff (the number fluctuates as short term contracts begin and end) are employed directly in this area by the Unit. In addition there are at least another 10 staff involved part time in engagement with local and national SMEs. Our plan, in the medium term, is to at least retain this level of staff, or possibly to increase at a modest level, and a key element of this is to ensure the long term sustainability for both G-STEP and Space IDEAS Hub. We have several ways in which we will do this, including engagement with the European Union and the Horizon 2020 programme which we believe is well suited for these initiatives, as well as engagement at the national level with the Space Catapult.

To increase the level of staff involvement, we will provide new staff at all levels opportunities to develop the skills and interests required to engage with industrial partners through our mentoring and training schemes. We recognise that engagement with industry often develops through project related research involving staff on research contracts and thus staff at all levels in the Unit will receive these opportunities.

The success that members of in Unit have had in winning KE Fellowships from STFC (Dr Lees) and NERC (Dr Leigh) will continue to act as catalysts for our future impact plans. Both Fellowships will continue into the next period after the REF and will therefore enable us to deliver on the initiatives already started. In addition, these staff will act as mentors for other staff looking at engaging with Industry, thereby broadening our potential for the future.

We will also access the “Innovation through Research Support Accelerator (IRSA)”, a scheme

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championed by the College, which will support between 30 and 50 full funded stipends available through MSc/PhD projects which can be focussed on delivering business needs for regional SMEs.

We intend to build all our impact-related partnerships on a long term basis. The applied research conducted in the Unit is dependent on building strategic relationships with industry and other academic partners, where the most successful examples are the result of programmes of mutual benefit to the academic-industry collaboration. We plan to maximise further our engagements through selected companies, such as Photonis, National Nuclear Laboratory, Astrium, Thales Alenia, amongst others, while also engaging with Government's catapults, in particular the Space Catapult at Harwell.

The Unit will continue to contribute at all levels of the University and College enterprise structures. The Unit will also ensure that it takes advantage of long term strategic partnerships to deliver impact, while also contributing to interdisciplinary research themes across the College which are strongly aligned to global and industrial challenges, such as climate change, environment and sustainability, transport, materials science, healthcare and space. In the latter case the College BIAB, will be central to developing our interdisciplinary activity in this area. Our strategy is to remain closely coupled to these College bodies and to the University EBDO, not losing sight of national developments, particularly centred on Harwell in the space arena.

d. Relationship to case studies

National Space Centre. The NSC, developed from the world leading research programme in space science, attracts over 200,000 visitors each year, contributes significantly to the local economy, and has had a measureable positive influence on performance in students at school. The new analysis of results demonstrating improved performance is informing our overall strategy for Outreach.

Climate Change. Our contribution to the Climate Change debate has been developed from the research programme that we initiated in the 1990s and is a result of our strategy to communicate our results widely in different fields.

Space Nuclear Power. As a pioneer in the field of americium-based radioisotope space nuclear power systems, we have contributed to the delivery of a major new technology initiative in space nuclear power by UK government with ESA, developed technology transfer opportunities and created and sustained high value jobs within the UK. It represents a clear example of the culture of Enterprise and Impact embedded within the Unit.

From space science into medicine. Spin out companies were developed to take forward several different ideas in this area. The support from the Unit for staff involved in Impact included the appointment of Dr Lees to a University baseline funded post to ensure its continuation.

Research affecting UK government space policy and the UK space industry. Our world class research programme in space instrumentation led to critical contributions to the 2010 Innovation and Growth Strategy (IGS) for Space developed by Government, significantly impacting on the economic base of many companies.

Building industrial capacity through exploitation of EO data. This has developed from the research programme of EOS who recognised that downstream uses of these data were many and varied. The development of G-STEP, and consequent engagement with regional industry, resulted from our approach to Impact through support for Staff, e.g. funding, infrastructure.