

research community has grown by 2.5 times, from 2150 in 2002 to over 5400 in 2011. Biopolis itself holds over 2500 public and private sector researchers of over 70 nationalities.

biologists with chemists, physicists and engineers. One example is the Silicon Biophotonics programme for cancer biomarker discovery. The team leverages on the Institute of Microelectronics' advanced

*... unprecedented opportunities for collaborations...*

#### IV Integration for the Future

##### Integrating Biomedical and Physical & Engineering Sciences

It is recognised world-wide that the integration and convergence of different scientific disciplines is key to future major progress in biomedicine, which will create innovations and products of value to companies. In A\*STAR the biomedical and physical sciences and engineering capabilities are under a single agency and located within the compact one-north area. This gives unprecedented opportunities for collaborations and has proved to be attractive to companies in locating their R&D in Singapore.

Through A\*STAR's Joint Council Office, many initiatives have been started to connect

silicon nano-fabrication technologies and molecular diagnostic device capability, and the Institute of Molecular and Cellular Biology's expertise in cancer research.

One strategic area with large growth potential is Medical Technology. The MedTech programme leverages on the interdisciplinary capabilities of A\*STAR Institutes, spanning electronics, precision engineering and biomedical sciences, and also links to the strong network of clinical researchers and companies. Thus, Singapore is positioned as the Asia MedTech Hub. By 2015, MedTech is expected to contribute \$5 billion to manufacturing output.

##### Integrating with the Clinical Research Community

To bring scientific discoveries from bench to bedside and to make greater impact for human healthcare, Singapore fosters close collaboration between research institutions and the clinical community. The Translational and Clinical Research (TCR) Flagship Programmes, administered by NMRC under MOH, were started to bring clinicians and scientists to work together in specific disease areas.

*... scientific discoveries from bench to bedside ...*

The joint NUS/A\*STAR Clinical Imaging Research Centre was one of the first cases of a major collaborative programme. Other examples include: the concerted programme in stratified medicine, a partnership between the Genome Institute of Singapore, and several public Healthcare Institutions; a comprehensive birth cohort study towards healthy outcomes, focusing on epigenetics, involving A\*STAR's Singapore Institute for Clinical Sciences with NUH and KK Women's and Children's Hospital.

##### Conclusion

Singapore's R&D achievements were rooted in firm and dedicated government support, well-coordinated research governance, a daringness to implement bold new initiatives with speed, an open talent strategy, and efficient frameworks for the integration of scientific disciplines and research performers. All these factors can be encapsulated in Singapore's BMS Initiative.

As President Tony Tan stated in

a dinner celebrating Biopolis' 10th Anniversary, *"The success of Biopolis and the BMS sector is symbolic of Singapore's commitment to anchor BMS as the fourth pillar of Singapore's economic strategy...The fact that this was achieved in 10 years could not have happened without the close cooperation of A\*STAR, EDB and JTC, with strong support from MTI, MOH, NRF and many other agencies."*

## ROCKETING SKY HIGH: UK & RUSSIA IN SPACE



Dr Julia Knights, First Secretary, Head Science & Innovation Network (SIN) – Russia

The UK's relationship with Russia has never been stronger in science and space. Our nations are ideally matched for collaboration. Russia accounts for 40% of rocket launches globally; the UK is world number one in small satellites, Europe number one in telecommunications satellites and has a strong upstream and downstream space industry. Both our nations share a goal to

own 10% of the global space market by 2030.

In May 2013, our Science & Innovation Network (SIN) – Russia based at the British Embassy in Moscow provided high level briefing in liaison with the UK Space Agency (UKSA) for a meeting between President Putin and Prime Minister Cameron. They agreed to step up collaboration in science and Space.

SIN Russia put this agreement into practice by organising a UK Russia Ministerial Joint Committee Science & Technology co-chaired by the Secretary of State for BIS, Minister Cable and Minister Dmitry Livanov of Russia's Ministry of Education and Science on 17th October 2013, hosted by the Royal Society. A Statement was signed by both ministers with agreement to

step up collaboration in two of the UK's 'Eight Great Technologies' (Space and Life sciences) as well as energy efficiency, Arctic and climate science, accelerator science and particle physics.

SIN Russia showcased exciting space commercial and research projects and events at the Ministerial Joint Committee under the forthcoming UK Russia Year of Culture 2014 (which includes Space science) and the EU Russia Year of Science 2014. Highlights include the UKSA and the Russian Federal Space Agency (Roscosmos) agreeing to discuss an "Intergovernmental Agreement on Space" and the UK agreeing in principle to a Glonass (Russia's global navigation system) ground based station on UK soil. Major Tim Peake, our British astronaut will train at Star City in Moscow



Celebrating the 20th anniversary of Helen Sharman's flight to the Mir Space Station with Cosmonauts Krikalev & Artsibarski at SIN Russia's Space Reception at the British Ambassador's Residence (From left to right: Dr Julia Knights, Head of SIN-Russia at the British Embassy-Moscow, Cosmonaut Alexey Leonov, Cosmonaut Sergei Krikalev, Dr Marina Sokolova in SIN-Russia & Cosmonaut Anatoly Artsibarski)

payloads include suites for maritime, space environment, platform technology and air and land monitoring to enable

measurements on sea state, ship tracking, meteorology, oceanography, climate science and space debris. UK partners include SSTL, Astrium, Surrey Space Centre, Mullard Space Science Laboratory, Rutherford Appleton Laboratory, SSBV, Cranfield University, Imperial College and Oxford University.

### ... our British astronaut will train at Star City ...

The UK's Rutherford Appleton Laboratory (RAL-Space) have also recently signed a contract with the Russian INASAN Institute of Astronomy to work with UK company E2V to deliver an £11 million electronics detector project for the Russian Spectrum-UV follow-on mission known as the World Space Observatory (WSO).

### ... Russia accounts for 40% of rocket launches ...

before his flight to the International Space Station in November 2015.

Two UK Satellites will also be launched together on a Russian Soyuz this Spring from Baikonur. "UKube-1", a shoebox-sized spacecraft known as a cubesat is the UKSA's pilot mission, built by UK spacecraft manufacturer Clyde Space Ltd in Glasgow. This will provide cost-effective access to space for innovative technologies whilst inspiring UK school pupils to take up STEM subjects and train the next generation of engineers and scientists.

"Tech Demo Sat-1" is a larger technology demonstration mission developed by Surrey Satellite Technology Ltd (SSTL) with funding from the UK's Technology Strategy Board, industry and academia. The

A "Russia Space Quest" exhibition at the London Science Museum will launch this November (2014) to highlight Soviet and Russian prowess in Space. This world-class six month flagship exhibition will include objects associated with Sergei Korolev's visionary engineering space programme and heroic cosmonauts including the first man in Space, Yuri Gagarin, and the first man to conduct a space walk, Cosmonaut Leonov. For the last two years, SIN Russia has been setting up meetings between the London Science Museum

and Roscosmos and Russia's Deputy Prime Minister, Golodets, to facilitate the loan of priceless flown satellites and capsules for this exhibition, including first woman in Space, Valentina Tereshkova's descent module.

SIN Russia set up a "UK-Russia Year of Space" two years ago, and we delivered a raft of commercial outcomes including negotiating with Roscosmos to

waive tax on UK imports of space equipment into Russia saving £50 million a year.

We also held a series of joint world-class Space Science lectures. Outcomes include stronger links on instrumentation for the ESA/Roscosmos Exomars project between the UCL Mullard Space Laboratory and IKI, (Russia's Institute of Space); an MOU on SuperDarn and solar flares collaboration signed between Leicester University and the Institute of solar Terrestrial Physics in Irkutsk, Siberia; and a joint project satellite project designed to predict earthquake eruptions between UCL and the Institute of the Physics of the Earth and Russia's innovation hub. Finally last February, SIN-Russia organised for the Open University (OU) be the first to analyse the Chelyabinsk meteorite with Russia's Vernadsky Institute. Their joint results have been submitted to Science journal.

Dr Julia Knights is Head of Science & Innovation Network (SIN) - Russia at the British Embassy in Moscow. The UK's Global SIN network is funded jointly by the Foreign & Commonwealth Office (FCO) and the Department for Business, Innovation & Skills (BIS) with over 90 staff in 28 countries in 47 cities. For more information visit: <https://www.gov.uk/government/priority/uk-science-and-innovation-network-sin-russia>

For information on the EU Russia Year of Science 2014, visit: <http://www.eu-russia-yearofscience.eu/en/1518.php>

For information on the UK's Global Science & Innovation Network (SIN), visit: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/264713/bis-13-1331-uk-science-and-innovation-annual-report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/264713/bis-13-1331-uk-science-and-innovation-annual-report.pdf)