

## **Skolkovo Innovation Center and the Renaissance of Russian Science**

Dr. Evgeni Magid, University of Tsukuba

XXth century was a period of great scientific discoveries all over the world and Soviet Union was one of the most scientifically developed states of the century. In the Soviet Union science and technology were important components of national politics. From the Great October Revolution in 1917 until the collapse of the USSR in 1991, science and technology being strongly connected to the communist ideology of the state developed both similar and distinct from other countries models. While in capitalist countries most of research work was conducted at universities, in the USSR special research institutes were set up. The most prestigious of them were associated with the USSR Academy of Sciences, which by 1985 consolidated about 330 research institutions and 57,000 full-time researchers [1]; others were within the system of specialized academies and various government ministries research centers.

Soviet scientists excelled in all fields of science including mathematics and physics, biology and chemistry, engineering and astronomy. In 1956 Soviet chemist and physicist Nikolay Semenov was the first Soviet citizen to win a Nobel Prize in chemistry; by 1978 USSR scientists received 7 Nobel prizes in physics, 1 in chemistry and 1 in economics [2]. It was Soviet Union who launched the first artificial space satellite (1957) and the first rocket to reach the Moon surface (1959), successfully delivered first animals into space (1960) and the first human, Yuri Gagarin (1961). Science development was specified as a national priority, emphasized at all levels of education. To be a scientist was a great honor and the Soviet government showered top scientists with rewards and privileges.

In the Soviet period the scientific institutions of the USSR were designed to serve all of its 15 federative republics collectively. The collapse of the USSR in 1991 and establishment of 15 independent states led to the drastic decrease of the state support for science and technology in all 15 newly formed states, which caused so called “brain drain migration” - many Soviet scientists and university graduates immigrated to Europe or United States in order to be able to continue their education and research work. By the time of the collapse about 67% of the major research institutes and researchers, and 60% of all research organizations of the USSR were located in Russian Soviet Federative Socialist Republic (RSFSR) providing a prospective basis for the further absorption and restructuring of Soviet science [2]. By 1991 the number of high

qualification scientists in RSFSR, including teaching and scientific research staff, increased to almost 1.2 million people - about 75% of USSR employees engaged in science [1].

In 1991, as RSFSR transformed into Russian Federation (RF), USSR Academy of Sciences was also restructured into Russian Academy of Sciences (RAS) with about 79,900 researchers engaged. By 1998 the number of employed high-qualified scientists in Russia decreased to about 670,000 people; as for RAS, the number of researchers decreased by 21% to 62,900 people and almost reached the level of RSFSR section of USSR Academy of Sciences in middle of 1980s [1]. While the Russian<sup>1</sup> annual output in internationally published research articles was permanently growing from 1980 to 1990, it fell by 24% in 1991 and regained 1980's output value only by 2000. Due to "brain drain migration" the proportion of Russian papers produced in collaboration with other nations has grown from 6% in the early 1980s to 31% in 2000 and the principal collaboration regions shifted from other USSR republics and socialist countries of East Europe to Western Europe, USA and Japan [4]. Further, in 2010 Vice-President of RAS Valerij Kozlov reported about the decrease of RAS researcher employees to 48,000 people with the average age of 64 years for PhDs and over 70 years for academicians, while only 12,000 of scientists were under age of 35 [5]. As it was disclosed by Chairman of Young Scientists Council of RAS's Siberian Branch Andrey Matveev, young scientists are disappointed with unsatisfactory low salary (64% of the survey participants) and outdated equipment (52%), complain about lack of demand for research results by domestic consumers (48%) and experience significant troubles with housing (65%) [5]. The following statistics is shocking: in 2006, expenditure on scientific research and experimental design work in the United States were 330 milliard USD, in China - 136 milliard USD, Japan - 130 milliard USD, while RF allocated for science only 3 milliard USD that is about 2.62% of the total expenditure of RF federal budget [6]. Even though the expenditures for science grew from 2.04% of federal budget in 2002 to 4% in 2010, such funding was not enough to catch up with the leading countries. Thus it is not surprising that to be a scientist in Russia is not popular anymore – because of the mentioned above difficulties many talented scientists switch to commerce and business which provide a far better life level. As a result, while there are still a plenty of gifted scientists and potential inventors, Russian science is increasingly lagging behind other developed countries and scientist average age grows every year.

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<sup>1</sup> In this paragraph when referring to "Russian" we compare the rates of RSFSR and RF.

To improve the situation in Russian science and technology the government launched a campaign aimed at modernization and innovation. In September 2009 Russian President Dmitry Medvedev emphasized the top priorities for the country's technological development: energy efficiency and new fuels, medical technologies and pharmaceuticals, nuclear power engineering, information technologies, space and telecommunications [7]. Some progress already has been achieved, with Russia having completed GLONASS, the only global satellite navigation system apart from American GPS; GLONASS had achieved 100% coverage of RF's territory by 2010 and full orbital constellation of 24 satellites provided complete global coverage in October 2011 [8].

On November 12, 2009 President Medvedev announced the development program of Skolkovo Innovation Center (also known as Russian Silicon Valley in Skolkovo) - a high technology business area to be built at Skolkovo near Moscow aiming to strengthen the links between Russian and international science, technology and education [9]. The site is intended to be a highly modern complex composed of five R&D clusters, a Technopark and Skolkovo Institute of Technology. The complex is headed by Russian oligarch Viktor Vekselberg and co-chaired by former Intel CEO Craig Barrett. Among international partners of the Center are such research and industry giants as Siemens, SAP, Microsoft, Boeing, Intel, Cisco, IBM, Johnson & Johnson, Dow Chemical and Ericsson. Skolkovo Foundation signed cooperation agreements with renowned research institutes worldwide including the Massachusetts Institute of Technology (MIT), Waseda University and Imperial College of London.

The author believes that one of the most attractive spots of the Innovation Center will be The Skolkovo Institute of Science and Technology (Skolkovo Tech) - a new private non-profit international graduate research university established in collaboration with the MIT and integrating advanced research and education. Skolkovo Tech's first research centers are to be established in 2012. The Institute will launch a pilot course in 2013 and will be fully operational on its campus in Skolkovo by 2014. The Institute will employ 200 professors and 300 postgraduates for research activities and teaching of 1200 Master's and Doctoral degree students with all lectures conducted in English language. Initially five educational and research programs are planned in the institute corresponding to Skolkovo's priority activities, namely: energy, information, biomedical, space sciences and technologies, as well as civil nuclear science and technologies. Skolkovo Tech will have fifteen associated distributed research centers supporting the

academic programs with the participation of the leading Russian and international scientific and research institutes and universities.

Meanwhile a large number of local and several international academic events have got started in RF annually; about 40% of the conferences, symposia and specialized exhibitions are hosted in Moscow metropolis and Saint-Petersburg, the so-called cultural capital of RF; others are taking place in smaller local cities like Kursk, Taganrog, Kazan, Zelenograd etc. In August 2011 Saint-Petersburg hosted IEEE International Symposium on Information Theory (ISIT 2011). IEEE - Institute of Electrical and Electronics Engineers - is the world's largest technical professional society established in 1884 and dedicated to advancing technological innovation and excellence for the benefit of humanity inspiring a global community through IEEE's highly cited publications, conferences, technology standards, professional and educational activities [10]. And, in author's opinion, this IEEE trust in Russian scientific achievements demonstrates optimistic trends for the further Renaissance of science in Russia.



Figure 1: The XIIth International Conference "Basic and applied research, development and application of high technologies in the industry" poster (<http://htfi.org/index.php?p=1319>)

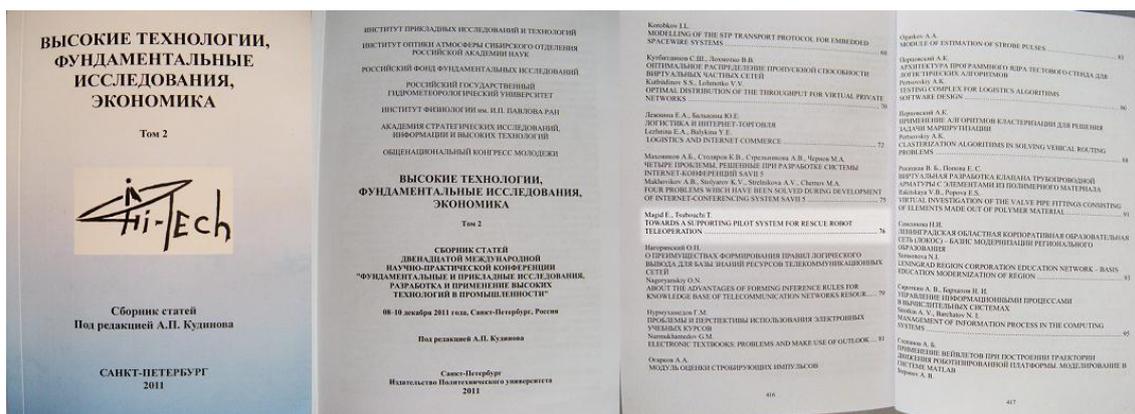


Figure 2: The conference proceedings book and contents. Author's paper is marked with a light rectangular.

To get acquainted with the current level of science if RF in person, the author participated in the XIIth International Conference "Basic and applied research, development and application of high technologies in the industry" which took place in December 8-10, 2011 in Saint-Petersburg. The conference was organized by RAS and hosted by Pavlov Institute of Physiology and it was devoted to the 50<sup>th</sup> anniversary of the first flight of human in space, Soviet cosmonaut Yuri Gagarin.

About 200 researchers from various parts of former USSR and from abroad participated in the conference plenary and section oral sessions. The age of the participants ranged from 20 to 70 and above, presenting all layers of moderns R&D – famous Academicians and Professors, young scientists and prospective students. Four volumes of conference proceedings presented more 422 research papers in various branches of science including computer and material sciences, chemistry and physics, robotics and e-education.

The conference started from welcome talk of the committee Chairs: Deputy Director of Atmospheric Optics Institute of Siberian Branch of RAS, Director of Institute for Applied Research and Technology and Academician of Strategic Research, Information and High Technology Academy A.P.Kudinov, Professor N.A.Sedyh from Military Engineering and Technology Institute and Provost of Saint-Peterburg Bonch-Bruевич University of Telecommunications Dr. V.I.Andrianov. Next during the plenary session eleven major 30-minutes presentations by most respected speakers – mainly Academicians and Professors from various institutions of RAS – took place at the Conference Hall of Pavlov Institute of Physiology. Unfortunately, the previously mentioned report of Young Scientists Council Chairman Andrey Matveev turned to be

still actual: the majority of Russian honored speakers ended their presentations with complains about lack of demand for research results by domestic consumers and insufficient financial support.



Figure 3(Left): Conference Chair Academician A.P.Kudinov (second from the right), the author (second from the left) and the winners of the Best Student Paper Award.

Figure 4(Right): Academician A.P.Kudinov with young scientists after the banquet

The author had an honor to be one of the 11 plenary speakers with his work on a supporting pilot system for rescue robot teleoperation. Due to generous support of Atsumi International Foundation the author could familiarize the audience with the importance and current trends in rescue robotics research. Movies of my experiments with Kenaf rescue robot inspired the audience to ask a lot of questions about the robot hardware and software, Fukushima I Nuclear Power Plant reconnaissance by Japanese and foreign robots, future research plans etc., – at some point the Chair of the conference had to cease the Q&A discussion in order to continue the session. After the plenary session a spokesman of a one of research foundations for young scientists of RF introduced himself to me suggesting a financial support of the future research – in the case the author will conduct it in Russia. Several prospective students and young researchers were turned on by the presentation, approached me with additional questions after the plenary session and even asked a favor to take a photo together.

Because of the presented topics variety, after a lunch break and a short poster session the participants separated into two parallel section sessions. First section of eleven 15-minutes presentations was hosted in the same Conference Hall and dealt with IT, physics, chemistry, nanotechnology, biotechnology and medicine. Second section of fifteen 15-minutes presentations was located at Saint-Petersburg National Research University of Information Technologies, Mechanics and Optics and concentrated on mining, energy, metallurgy, engineering and industry. On the second day the section

sessions continued and another forty talks were presented in both sections, followed by panel discussions. The closing ceremony was followed by official banquet – with delicious food, traditional in Russian culture toasts<sup>2</sup> and comparatively elaborate and fixed protocol for toasting in order of guests importance.

On the next day the conference participants could take a pleasure of the cultural program which included visits to the must-see cultural sights of the cultural capital of RF. We started from "The Bronze Horseman" monument to founder of St. Petersburg Peter the Great at the bank of Neva River. After short stops near The Church of Our Savior on Spilled Blood constructed on the spot where Emperor Alexander II was assassinated in 1881, and Rostral Columns built as beacons for ships navigating the waters of Neva River, we continued to beautiful Winter Palace. St. Petersburg's finest and most famous palace, it is one of the greatest royal residences of the world, the home of Romanov Emperors for two hundred years, and the main building of Hermitage Museum. Next we enjoyed the located in the middle of Palace Square, opposite to the Winter Palace, The Alexander Column - an impressive 47.5 meters tall column made of a single piece of red granite. In the afternoon we visited The Cruiser "Aurora", Russian Battleship which was built at the end of the 19th century, served in the Russo-Japanese War of 1904-5 and played a vital role in the October Revolution of 1917. In our days the cruiser serves as a fascinating museum to the history and achievements of the Russian Navy.

Next stop was St. Isaac's Cathedral, St. Petersburg's largest church which took forty years to build and boasts superb views of the city from its colonnade. Finally we arrived to Peter and Paul Fortress, the historical heart of the city and one of St. Petersburg's most famous landmarks. The fortress contains several notable buildings clustered around the Peter and Paul Cathedral which has a 123.2 m bell-tower - the tallest in the city centre. Inside the cathedral are the extravagant tombs of almost all the Russian Tsars since Peter the Great to Alexander III, with the exception of Peter II. People still leave fresh flowers on Peter's grave. Other structures inside the fortress include the still

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<sup>2</sup> A toast is a ritual in which consuming a drink is connected with ideas of celebration and honor.

Verbal expression of honor may be elaborate and formal, merely raising one's glass towards someone or something and then drinking is essentially a toast as well, the message being one of goodwill towards the person or thing indicated. (Taken from the definition of toast by Wikipedia, the free encyclopedia) While in Japan a short "Kampai!" expression is usually enough, Russians prefer long toasts which may include historical stories, citations, memories and jokes.

functioning mint building, the Trubetskoy and Alekseyevsky bastions with their grim prison cells, and the city museum. According to a centuries-old tradition, a cannon is fired each noon from the Naryshkin Bastion; unfortunately, our tour took place in the late afternoon so we missed a chance to hear the cannon.



Figure 5(Left): Next to the Cruiser "Aurora". From left to right: Dr. Zolotarev (Reshetnev Siberian State Aerospace University, Russia), Dr. Sultanbaeva (Bekturov Institute of Chemical Sciences, Kazakhstan), Dr. Magid (University of Tsukuba, Japan).

Figure 6(Right): At The Church of Our Savior on Spilled Blood

Within this week I had great time meeting a lot of new people, famous scientists and young researchers, listening presentations and participating in discussions, and visiting beautiful historical places of Saint-Petersburg. I would like to thank Atsumi International Foundation for this unique opportunity to present my research to honored academic audience and discover good promising trends for further Renaissance of the Science in Russia.

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