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# Central Asia Centre for Engineering Education (CACEE)

**Yuri P. Pokholkov**

**Alexander I. Chuchalin**

*Tomsk Polytechnic University  
30 Lenin Avenue, Tomsk 634034, Russia*

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The Central Asia Centre for Engineering Education (CACEE) was founded at the Tomsk Polytechnic University (TPU), Tomsk, Russia, as a satellite centre of the UNESCO International Centre for Engineering Education (UICEE), which is based at Monash University, Melbourne, Australia. This has been accomplished within the framework of a Memorandum of Understanding between the TPU and the UICEE, which became effective on 1 January 2001. In the article, the authors discuss the history, current status and structure of the TPU. The authors also elaborate on the aims and major fields of activities of the CACEE, as well as its vision for future involvement in the internationalisation of engineering education.

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## TOMSK POLYTECHNIC UNIVERSITY

The most striking element about the Russian city of Tomsk, which was founded in 1604 in Siberia, is its student life and its emphasis on science; one out of every six persons there is a student. There are 10 academic institutes and seven institutions, with the two oldest being Tomsk State University and Tomsk Polytechnic University (TPU). This academic intensity has given the city the name of the *Siberian Athens*.

Furthermore, the opening of the Tomsk Higher Technical School (now known as the TPU), the first technical institute in eastern Russia, is linked with the awakening of the *hibernating Siberian bear*. It was founded on 29 April 1896, although classes actually began on 9 October 1900. From that moment on, the genesis of the local scientific intelligentsia began. It soon became the focal point for engineers and scientific personnel within this Asiatic region of Russia.

TPU graduates have contributed to the building of bridges for the Siberian railroad, to the research and creation of projects for new power and transmission lines, as well as new civil buildings. Other examples include mapping ground pollution, the construction of the Moscow metro line, the generation of Russian tractor building, helicopter design, the development of Russia's aviation and space programmes (including lunar boring stations), the invention of the first turbo-drill and the development of the first Russian automobile,

among others. Furthermore, the first Russian electron accelerator was created at the TPU in 1948. These examples, just some of many, demonstrate the critical role that the TPU has performed in the economic, scientific and cultural development of Siberia, and indeed Russia.

An important focus has been the development of strong international with scientific establishments around the world, including the USA, Germany, France, Japan, South Korea, China, Australia and other countries.

The TPU recognises the importance of engineering education and has established a Central Asia Centre for Engineering Education (CACEE), a satellite centre of the UNESCO International Centre for Engineering Education (UICEE), thereby strengthening the so-called *UICEE Global Family of Engineering Educators*. This is also augmented through the work of several units, such as an institute for improving personnel skills, a department for improving teacher skills, an organisation centre for objective and additional student training and employment, the TPU publishing house, and other areas.

Upon the 100<sup>th</sup> anniversary of its foundation, the TPU was designated as a historical and cultural monument by Presidential Decree. The TPU has also been recognised to be at the forefront of Russian education, making it to the highest level of Russian higher learning establishments and being among the top five technical universities.

## HISTORY OF THE UNIVERSITY

The Tomsk Polytechnic University is the first engineering higher educational institution in Asian Russia. It was established in 1896 and opened in 1900 as the Nikolai II Tomsk Institute of Technology. Despite the remoteness of Tomsk from the European centre of Russia, famous academics and the best alumni from universities and institutes of St Petersburg, Moscow, Kiev, Kharkov, Warsaw, Tartu and other European cities arrived in Tomsk.

The first professors of the Tomsk Institute of Technology were highly educated teachers, prominent scientists and practitioners. They taught students to acquire not just knowledge, but also scientific and practical experience. Since the foundation of the Tomsk Institute of Technology, more than 100 years have passed. The Institute was redesignated over time; in 1930, it was dubbed the Tomsk Industrial Institute, while in 1944, it was renamed the Tomsk Polytechnic Institute, and then in 1991, it was called the Tomsk Polytechnic University.

The Tomsk Polytechnic Institute became the progenitor of Siberian engineering education. It became the basis for the creation of new higher educational institutions in Asian Russia. More than 20 higher educational and research institutions in Krasnoyarsk, Irkutsk, Novosibirsk, Omsk, Kemerovo and other cities have their origins in Tomsk.

In 2000, the Tomsk Polytechnic University celebrated the centenary of the delivery of the first lecture. Since that time, more than 100,000 students have graduated from the TPU, specialising in various fields of science, engineering and technology. The old-established traditions of the University in the fields of scientific, educational and spiritual life serve to define its image today.

## THE UNIVERSITY TODAY

The TPU is currently one of the advanced higher educational institutions in Russia. According to the authorised rating of the Russian Ministry of Education, the TPU ranks fourth among 160 higher engineering schools, including 100 Russian technical universities. In 1997, the Tomsk Polytechnic University was recognised as a National Treasure of Russian Culture by Presidential Decree.

There are three research institutes at the TPU, namely:

- Nuclear Physics;
- High Voltage;
- Non-Destructive Testing.

Further, there are eight educational institutes, specifically:

- Geology and Oil & Gas Industry;
- Electrical Engineering;
- Computer Science and Engineering;
- Languages and Communication;
- Engineering Pedagogy;
- Distance Learning;
- Continuing Education;
- International Education.

At the TPU, there are eight full-time faculties as follows:

- Applied Physics and Engineering;
- Electrophysics and Electronic Equipment;
- Economics and Management
- Mechanical Engineering;
- Chemistry and Chemical Engineering;
- Heat-Power Engineering;
- Natural Science and Mathematics;
- Humanities

These faculties provide 77 majors across the Bachelor, Engineer, Master and Doctoral levels.

There are 22,000 students, including over 10,000 full-time students at the Tomsk Polytechnic University. The TPU's academic staff number 1,800 researchers and teachers. The University's campus contains 19 buildings. The TPU has a unique set of scientific and educational facilities: a research nuclear reactor, a 1.5 GeV electronic synchrotron, a 1.2 m poles diameter cyclotron, a 2.5 MeV electric generator, a betatron complex plus others.

The research and training of highly qualified specialists focuses on the main scientific trends of the University, including:

- Atomic and nuclear physics;
- High-voltage pulse engineering;
- Electrical power engineering and electronics;
- Information and telecommunication systems;
- Material sciences;
- Chemical engineering in the field of organic and inorganic materials;
- Minerals geology and their search;
- Market relations;
- Science and education, etc.

The main directions of research activity coincide with the fundamental education and professional training of undergraduate and postgraduate students.

The TPU's mission is to satisfy the intellectual,

cultural, ethical and creative needs of individuals through higher education that is of the best quality. The aim of the University is to keep and strengthen its intellectual leadership and to train qualified specialists for various enterprises, business and research institutes all over the Siberia, Far East Russia, Asian countries, and the world.

### **International Collaboration**

Integration with the worldwide educational and research community is one of the most important tasks of the TPU. The University participates in diverse international programmes, including fundamental research, technology transfer, academic exchanges of lecturers and students, and distance learning.

At the TPU, foreign students are offered a unique curriculum in engineering, natural and social science, humanities in either the Russian or English language. In its turn, while training Russian students, the TPU utilises the experience of foreign institutions through the cooperation with universities and research centres in the USA, Germany, the UK, France, China, Japan, South Korea, and other countries.

In 2001, the Global Alliance for Transnational Education (GATE, USA) awarded certification to TPU Bachelor degree programmes. In 2002, the Quality Management System of the TPU was certified by the National Quality Assurance Ltd (NQA, UK) as meeting the ISO 9001-2000 requirements for the design and provision of higher education, research and other specialised training services.

### **THE CENTRAL ASIA CENTRE FOR ENGINEERING EDUCATION**

The Central Asia Centre for Engineering Education (CACEE) was established on 1 January 2001 at the TPU as a satellite centre of the UICEE within the framework of a Memorandum of Agreement signed between these two institutions.

### **International Tasks**

The international tasks of the TPU in the field of research and education match those of the UICEE in the field of globalising engineering education. Relative to this, the tasks of the CACEE are as follows:

- Exchange of information, experience and knowledge in the field of engineering education between higher educational institutions, research institutes and industrial enterprises in the various countries of Central Asia, including Asian Russia.
- Assistance in attracting international funds for the higher educational institutions of the Central Asia Region for the purpose of supporting innovation in engineering education.
- Transfer of technologies, development and implementation of educational programmes of different levels in the field of high technologies (BE, MSc, PhD), as well as the advanced training and retraining of specialists.
- Development of databases on high technologies, research services and qualified specialists, appropriate educational programmes, fostering cooperation between universities, research institutes and industrial enterprises of Russia in the areas of exporting and importing educational technologies and programmes within the Central Asia Region.
- Development of a system of independent public accreditation of educational programmes and the certification of specialists in the field of engineering and technology in Asian Russia and countries of the Commonwealth of Independent States in Asia.
- Assistance in international accreditation of educational programmes offered by the educational institutions of the Central Asia Region, as well as the international recognition of academic degrees and diplomas.
- Establishment of international academic exchange activities and assistance in the creation of University branches abroad, which serve to foster the internationalisation of engineering education.
- Development of an international system of distance learning for the export and import of transnational educational programmes in the area of engineering and technology.
- Improvement of the engineering education science and the development of the communication skills of specialists, including fluency in foreign languages, particularly English as the language of international communication.
- Assistance in importing educational programmes from advanced universities in different parts of the world to the Central Asia Region with a view to expand engineering education globally.
- Organisation of regional seminars and conferences and assistance in holding international fora to discuss problems of the internationalisation of engineering education and quality assurance in engineering and technology.
- Dissemination of periodicals and other materials on the issues of internationalisation and the advancement of education in the fields of engineering and technology, engineering educational science and the use of new information

technologies and other relevant matter related to engineering education.

- Assistance in developing and facilitating memoranda, contracts and agreements between universities of different countries.
- Drawing up reports on engineering education.

### International Agreements

Under the auspices of the UICEE, the University concluded a number of Memoranda of Understanding with different foreign universities and organisations, namely:

- Glasgow Caledonian University (Scotland, UK);
- Anna University (India);
- King Mongkut's University of Technology Thonburi (Thailand);
- The All India Council for Technical Education (India);
- Monash University (Australia);
- The National Board of Accreditation;
- The Accreditation Board for Engineering and Technology (USA);
- The Russian Association for Engineering Education (Russia).

It should be noted that the first four listed above are Partner institutional members of the UICEE, while Monash university is the host of the UICEE.

### International Conference Participation

Due to the persistent activities of the Central Asia Centre for Engineering Education (CACEE), many scientists and teachers have participated in various international conferences organised or supported by the UICEE, as follows:

- *2<sup>nd</sup> Asia-Pacific Forum on Engineering and Technology Education* (Sydney, Australia, 1999);
- *2<sup>nd</sup> Global Congress on Engineering Education* (Wismar, Germany, 2000);
- *1<sup>st</sup> Russian Seminar on Engineering Education* (Tomsk, Russia, 2000);
- *4<sup>th</sup> UICEE Annual Conference on Engineering Education*, (Bangkok, Thailand, 2001);
- *3<sup>rd</sup> Asia-Pacific Forum on Engineering and Technology Education* (Changhua, Taiwan, 2001);
- *5<sup>th</sup> Baltic region Seminar on Engineering Education* (Gdynia, Poland, 2001);
- *2<sup>nd</sup> Russian Seminar on Engineering Education* (Tambov, Russia, 2001);

- *5<sup>th</sup> UICEE Annual Conference on Engineering Education* (Chennai, India, 2002);
- *5<sup>th</sup> International Conference on Engineering Education* (Tomsk, Russia, 2002);
- *3<sup>rd</sup> Global Congress on Engineering Education* (Glasgow, Scotland, UK, 2002);
- *6<sup>th</sup> Baltic Region Seminar on Engineering Education* (Wismar/Warnemünde, Germany, 2002);
- *6<sup>th</sup> UICEE Annual Conference on Engineering Education* (Cairns, Australia, 2003);
- *7<sup>th</sup> Baltic Region Seminar on Engineering Education* (St Petersburg, Russia, 2003), etc.

### International Academic Exchanges

Within the CACEE's activities, international academic exchanges have been organised and facilitated with Anna University, Chennai, India, and Hochschule Wismar – University of Technology, Business & Design, Wismar, Germany.

Dr Bryan Temple from Glasgow Caledonian University (GCU), Glasgow, Scotland, UK, conducted a series of Seminars on multidisciplinary group projects for academic faculty staff and students of the TPU. In April 2003, Dr Temple and Marion Wienecke (Hochschule Wismar) visited the TPU in the context of preparing a trilateral Master programme on material science. Dr Inna Cheremissina, Head of the English Department at the TPU, has received an Individual Mobility Grant, which was awarded by the Tempus Department of the European Training Foundation, European Commission.

The goal of this collaboration is to work with the GCU on the principles for introducing multidisciplinary group projects into the engineering curriculum at Tomsk Polytechnic University. The principal objective can be stated as: to redesign a course of English as a foreign language for TPU students with a view to improving the ability to gain employment through greater attention to transferable skills within the curriculum. From September 2003 the redesigned course of English is being delivered to TPU students.

It has been agreed between the TPU and the GCU (specifically the Scottish Centre for Work-Based Learning – a UICEE satellite centre based at the GCU), that a new mode of teaching will be introduced into the engineering curriculum at the TPU. Work-based learning will be developed and introduced into the curriculum with the view to place students into the real work environment while at the university, thereby exposing them to multidisciplinary assignments that are related to the professional area, and have the opportunity to gain from this experiential learning.

The activity of the Central Asia Centre for Engineering Education is constantly expanding and progressing. Not long ago, a Memorandum of Understanding was concluded between the TPU and Kazakhstan National Satpaev Technical University, Almaty, Kazakhstan, as well as between the CACEE, the TPU and Kazakhstan National Satpaev Technical University.

### ***1<sup>st</sup> Russian Seminar on Engineering Education***

Given the scientific, cultural, economic, political, business and other positions in the world, Russian academics *must* influence the globalisation process of engineering education. It has therefore been one of the UICEE's strong objectives to bring Russian engineering education into its main stream of activities. This includes participation and support of the extremely successful seminar entitled *1<sup>st</sup> Siberian Seminar on Engineering Education*, which was carried out in Tomsk between 7 and 8 September 2000 at the TPU. The UICEE, the TPU and the Russian Ministry of Education organised this Seminar.

The paramount objective of this important meeting was to initiate a series of seminars on engineering education in Russia, under the common title *Russian Seminars on Engineering Education*. It is envisaged that this series of seminars will continue to be organised annually in different Russian engineering academic institutions in collaboration with the Russian Association for Engineering Education (RAEE) and other Russian organisations concerned about engineering and technology education.

The culmination of the TPU's 100<sup>th</sup> Anniversary celebrations was held between 6 and 7 September 2000. Several overseas visitors ventured to Siberia to experience the warmth and enormous hospitality provided by the Russians.

At this inaugural Seminar, two TPU academics directly involved with the CACEE received the UICEE's Silver Badge of Honour for *distinguished contributions to engineering education, outstanding achievements in the globalisation of engineering education through the activities of the Centre, and, in particular, for remarkable service to the UICEE*; the Rector, Prof. Yuri P. Pokholkov, and the Vice-Rector, Prof. Alexander I. Chuchalin.

On this occasion of the Seminar, the UICEE Director, Prof. Zenon J. Pudlowski, was honoured to receive the TPU 100<sup>th</sup> Anniversary Jubilee Medal for his *active contribution to the development of the international activities of the TPU*.

A volume of Proceedings was produced that includes 22 of the papers presented at the Seminar.

Importantly, this series of Seminars has continued to be held across Russia, and has been subsequently held in Tambov, Taganrog and St Petersburg, respectively.

### **Other Conference Activities**

In May 2001, the TPU and the CACEE conducted a seminar on the problems of participation of Russian scientific groups in European scientific and technological programmes. The participants of this Seminar included the administration of international departments of the Russian educational institutions and industrial and holding companies, as well as scientific management experts from different Russian cities. Seminar participants discussed programmes of the European Union Commission (EUC), regulations for participation, foreign partners quest mechanisms, preparation of applications for participation in project competitions, application assessment criteria, intellectual property rights and participation conditions for Russia in various EUC programmes.

Within the framework of the *1<sup>st</sup> Congress of the TPU Alumni*, held in early September 2001, the CACEE conducted a seminar devoted to Nikolay Gutowski's research and academic activities during the years of his rectorship (1921-1930), called *The Development of Engineering Education*. Seminar participants included representatives from CIS countries, Poland and Germany.

The Centre continues to organise annual seminars and publications devoted to different matters of engineering education. In late May 2002, the CACEE was among other organisers of the international conference on *Problems and Practice of Engineering Education*, with the topical subject of the international accreditation of educational programmes. The following problems were discussed:

- World trends in engineering education.
- Standards and quality assurance.
- Innovation in engineering education.
- Distance learning.
- Academic and professional mobility.
- Accreditation systems in engineering education.
- International recognition of diplomas, degrees and qualifications.
- UNESCO and international cooperation in engineering education.

### **SELECTED UICEE PUBLICATIONS**

Research at the TPU has been wide and varied, and includes the following conference papers and journal articles from UICEE publications.

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12. Chubik, P.S., Koshovkin, I.N., Mangazeev, P.V. and Smart, B.G.D., The training of oil engineers in a cooperative project between Heriot-Watt University and the Tomsk Polytechnic University. *Proc. 3<sup>rd</sup> Global Congress on Engng. Educ.*, Glasgow, Scotland, UK, 443-444 (2003).
13. Chuchalin, A.I., Sipailova, N.Y. and Korolev, S.F., Teaching materials for the course: Mathematical Simulation in Electromechanics. *Proc. 6<sup>th</sup> Baltic Region Seminar on Engng. Educ.*, Wismar/Warnemünde, Germany, 178-181 (2002).
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## CONTACT

Prof. Yuri P. Pokholkov  
*Central Asia Centre for Engineering Education*  
 (CACEE)  
 Tomsk Polytechnic University  
 30 Lenin Avenue  
 Tomsk 634034, Russia

## BIOGRAPHIES



Prof. Yuri P. Pokholkov is the Rector of the Tomsk Polytechnic University in Tomsk, Russia. He is also President of the Russian Association of Engineering Education. Prof. Pokholkov is a scientist and expert in the field of electro-isolation and cable technique, materials authority and the management of

higher technical education. He has founded the famous scientific school of manufacturing technology, quality control and provision of reliability index for electro-technical devices.

Prof. Pokholkov has published seven monographs and about 200 articles. He is the Special President of the Russian Federation Prize Laureate in the Field of Education for the development of the scientific basis of university education and its realisation at the leading higher schools of Russia. He received the UICEE

Silver Badge of Honour in 2000, and is a Deputy Chairman of the UICEE Academic Advisory Committee (UICEE AAC)



Prof. Alexander I. Chuchalin is currently the Vice-Rector for Academic Affairs at the Tomsk Polytechnic University (TPU), Tomsk, Russia. He received his engineering degree and PhD from the Tomsk Polytechnic Institute, and the DSc Degree from VNIIElectromash (St Petersburg) in 1974, 1979 and 1991,

respectively; these were all in electrical engineering. He subsequently worked for five years as a researcher at the Tomsk Polytechnic Institute. This was followed with 15 years of teaching and research, as Assistant Professor, Associated Professor and Professor of the Faculty of Electrical Engineering at the TPU. He is a Vice-Rector at the TPU since 1994. He is also a member of the International Academy of Energy since 1995, and a member of the International Higher Education Academy of Science since 1997.

His research interests include pulsed power electromechanical converters, mathematical simulation in electrical engineering, computer-aided teaching and training systems in education, problems of engineering education, as well as the internationalisation of higher education. He received the UICEE Silver Badge of Honour in 2000.