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THE RESEARCH AND TRAINING OF HIGHLY QUALIFIED SPECIALISTS AT TOMSK POLYTECHNIC UNIVERSITY

The article gives a brief analysis in the present state of research, scientific developments, and training highly qualified specialists at Tomsk Polytechnic University. TPU is one of the leading technical Universities of Russia in the field of science and education. The main components of its success are: scientific schools with their old traditions and powerful mental outfit; the developed R&D infrastructure consisting of 3 Research Institutes, the Institute «Cybernetic Center» and scientific centers and laboratories equipped for research in the field of nuclear and accelerating technology, as well as in high-voltage physics, dielectric physics, etc. In spite of conversion, the former experience acquired by Research Institutes while collaborating with military-industrial enterprises allows now to bring forward modern technologies and unique facilities to Russian and foreign markets. Due to this fact the main body of Research Institutes and laboratories is now working away, and new customers are being searched for in Russia and abroad. In 1996-97 30 percent of the R&D conducted by 33 higher institutions of Western Siberia under economic contracts fell to the University's share. The post-graduates' expansion, their intensive research activity form a reasonable basis of the optimistic future of Tomsk Polytechnic University.

Tomsk Polytechnic University is one of the greatest engineering educational institutions of Russia. It is a scientific and educational center with a well developed infrastructure of research and training highly qualified specialists. It includes a number of research institutions: 3 Research Institutes (Nuclear Physics, High Voltage, Introscopy), The Institute «Cybernetic Center», 62 faculty laboratories, and 5 centers (see Fig.1). More than one and a half thousand faculty and academic members work in the field of research and development. More than a half of them are Doctors of Science (D.Sc) and Philosophiae Doctors (Ph.D) (Fig. 2).

Ancient traditions of scientific schools, intelligence and the proper resource base provide favourable conditions for the highly qualified specialists' training. 420 postgraduates and 45 doctorates are being trained at postgraduate and doctorate courses. 135 professors, and about 50 associate professors actively participating in research are the advisors and leaders of postgraduate and doctorate training. The training of doctorates is offered in 22 scientific directions, postgraduates – in 61 directions. The University has 18 dissertation councils dealing with majors of doctorate and postgraduate studies. More than 60 professors and associate professors who have a command of foreign languages are ready to manage foreign postgraduate studies. The University started international cooperation in engineering education with scientific centers of the USA, Germany, China, South Korea, Cyprus, and others.

The University is equipped with up-to-date computers, the unique set of precise measuring and diagnostic equipment, and electrophysical installations, such as a nuclear test reactor; an electronic synchrotron with the energy of 1,5 GeV; a cyclotron; an electrostatic generator; a range of betatrons and high current accelerators; a high voltage laboratory, and others. Historical links established with higher educational and academic research institutions promote the possibility to conduct a comprehensive research by dint of a joint use of the expensive and unique test equipment.

The results of research conducted into nuclear physics; accelerating and high voltage technology; dielectric physics; material science; chemistry; geology; and a number of other scientific fields are widely known. It should be noted that the balanced attention paid both to basic research and technological developments is a characteristic of our scientists over the whole history of the University. Such applied directions as developing a small betatron, and methods of non-destructive testing materials and articles based on them; electric pulse and fuse engineering; beam and plasma engineering; ceramics engineering; engineering and technology based on new physical effects for forecasting earthquake and checking state of constructions are now in progress.

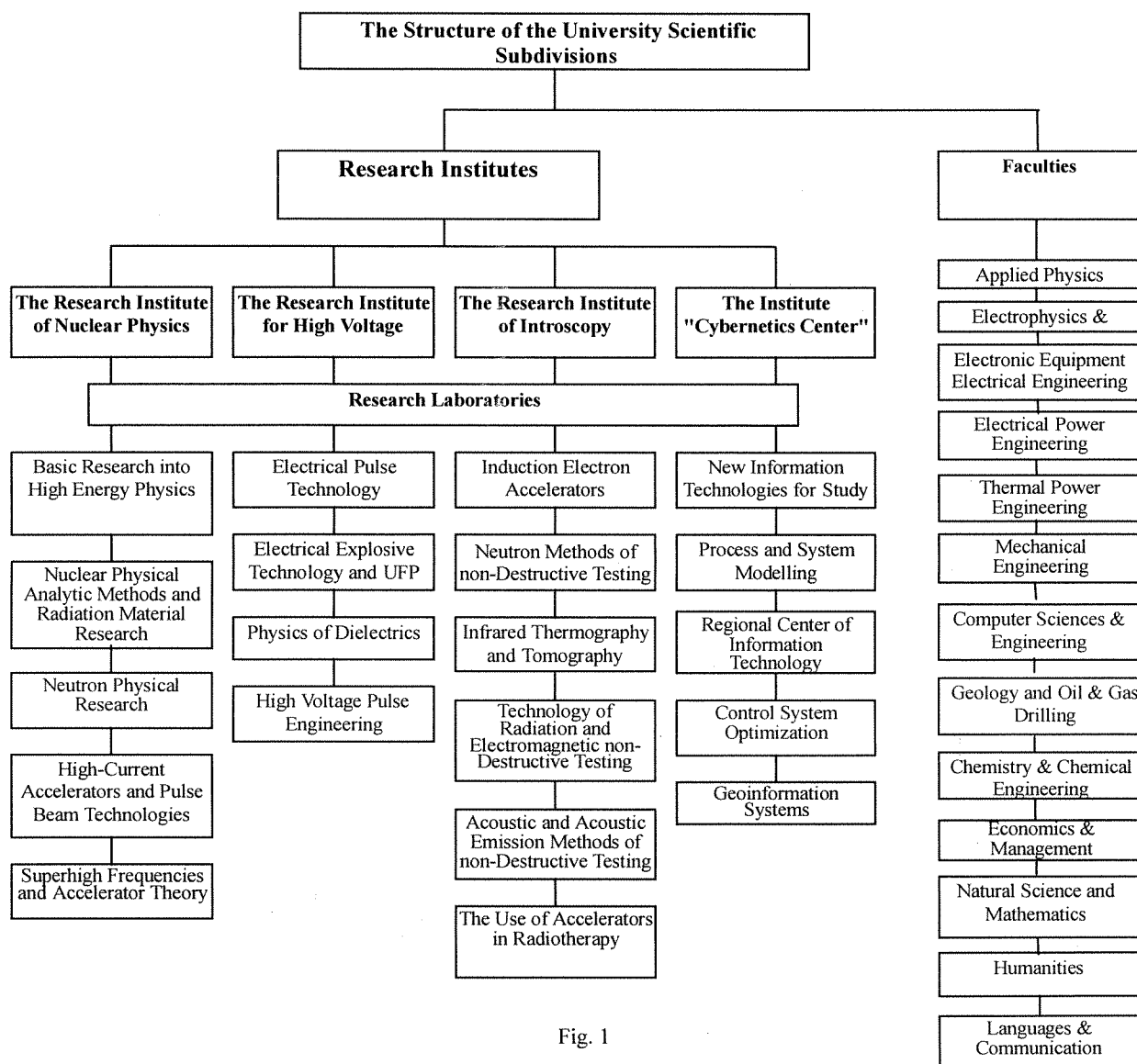


Fig. 1

**Personnel Scientific Potential of TPU
(The Overall Scientific Teaching Staff Members - 1934)**

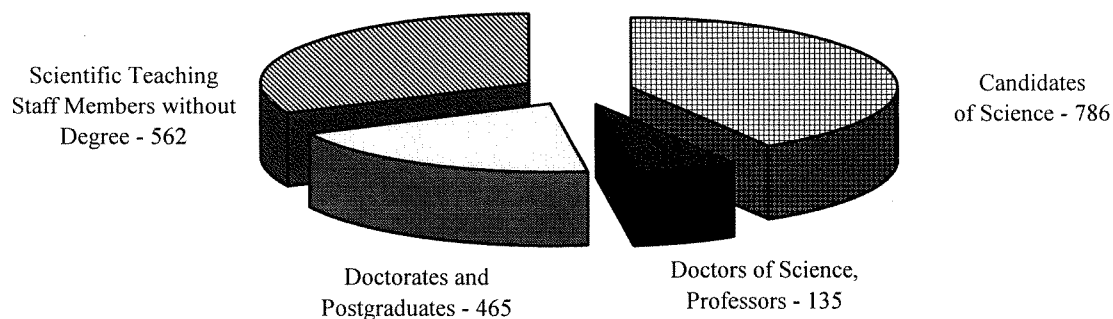


Fig. 2

The scientific fields developed and oriented towards the actual needs of Siberia and the whole country, strong productive links, integrated solution to formidable scientific problems – all this is connected with the history of TPU. The establishment of the Tomsk Institute of Technology in 1896 (now Tomsk Polytechnic University) should meet the needs of Russia in a rapid and integral development of Siberia, which grew at the end of 19 century. Siberian enterprises limited in the engineering staff, the extremely wide range of scientific and economic problems connected with the reorganization of Siberia, oriented our scientists and graduates towards meeting the needs and solving complicated problems. Many of founders of the University scientific schools had a great experience in production before they set about their teaching and scientific activities. They were able to cultivate in their students the striving for a high scientific search and the respectful attitude to every-day production needs. The development of Siberia was rather a complicated problem, and required its appropriate solution. A list of some paramount problems, in which solution our scientists took part, see below:

- a higher reliability and efficiency of Trans-Siberian main line;
- minerals search, prospecting, extraction, and its disposal;
- search and investigation of Siberian lands useful for peopling and agriculture;
- Siberian rivers mastered as main waterways and energy power sources;
- the new construction technology based on concrete use implemented within the severe conditions of Siberia;
- the development and introduction of the effective processing technologies for agricultural products, etc.

It is safe to say that our graduates have played a crucial part in technological reorganizations on the vast territory of Russia eastwards the Ural.

The hundred-year history of research and training of specialists at TPU reflects the dynamic process of responding to changing needs of the country, while many of ethic standards of the first scientific schools have been survived.

The research and training of specialists is focused today on the main scientific and technological directions, which should meet the requirements of Siberia and Russia on the whole.

Present-day scientific directions, which TPU is now working out are listed below:

1. The development and creation of charged particles' accelerators and other emitters; their scientific and technological use.
2. The theoretical and action research conducted into physics of elementary particles and nuclear physics.
3. The theoretical research and development of non-destructive testing materials and quality control devices.
4. The development of scientific and engineering basics; the creation of high-voltage pulse technology and engineering.
5. Automated control systems for the research, design and instruction on the basis of computer telecommunication networks.
6. Nuclear engineering and modern construction materials for nuclear power engineering.
7. Methods and instruments for measuring and physical values control based on new effects.
8. The development of physical, engineering and technological use of radiation effects for changing properties of materials.
9. The theoretical and action research conducted into the fields of high-power beam, plasma and microwave electronics.
10. Geology and mineral deposits prospecting in Siberia.
11. Effective technologies and equipment in the field of mechanical engineering.
12. Optimization of combustible refining and fuel production technology.
13. The development of effective technologies and materials based on natural and commercial raw materials and industrial waste.
14. The synthesis and technology of biologically active compounds (remedies), monomers and polymers for heat resistant materials.

15. The development of electrochemical engineering and high commercial materials and environmental objects methods.

16. The improving fuel utilization and heat-and-mass transfer in power engineering installations.

17. The research and development of highly effective and reliable electromechanical articles and valve engines.

18. The development of reliable service methods for electric power systems.

19. Market relations and a human element in production, science, and education.

The high authority of the university scientific schools promotes its entry into international scientific and educational association. Today the University is involved into research relations with 58 foreign universities, companies, and enterprises. More than 40 agreements including 22 contracts were concluded with advanced companies of the USA, Great Britain, Japan, South Korea, Germany, Belgium, France, China, Czech.

In 1998 about 2000 research works and 18 monographs were published by officers of the University. More than 100 of research works and 4 monographs were published abroad. Our scientists took part in 13 international exhibitions, and 118 international conferences. Seven international scientific symposiums were conducted on our initiative.

TPU takes the fifth place in the scientific rating among technical universities of Russia what testifies to its high research level. While comparing the science financing volume at TPU with that of 33 Siberian universities, we see that the realm of R&D at TPU was the following. In 1997 22 percent of the total scientific financing fell to the University's share; 30 percent of research was conducted under Russian and foreign contracts; and 10 percent of articles was published.

A great attention is paid to the student research work in order to maintain a great scientific potential and good traditions of the scientific schools. In spite of the problems in the student research arisen over the last few years, TPU provides it with the required support. These are, for example, annual scientific conferences held in the period of 1995 – 1998 years, when more than 400 students and postgraduates took place; proceedings of our scientists were also released. Student works presented annually at the all-Russia competition are conferred 30 – 40 grants from the Russian Ministry of Education.

It was not so easily for the authors to maintain an optimistic tone of this article which resumes the publication of «The Bulletin of Tomsk Polytechnic University», and starts its first issue with a number of research surveys carried out by TPU for last 5 – 8 years. In the course of the corporate research and training of highly qualified specialists the authors deal with well-known problems: a reduction of the basic research supported by the state as well as a reduction of company work orders; inventory acquisition costs significantly increasing; a fall of a living level, etc. As a result of these phenomena is an obsolescence and service wear; a staff reduction and its aging.

With due regard for problems mentioned above the authors consider there is a reasonable basis of the optimistic future of Tomsk Polytechnic University and Russian higher education on the whole.