

Siberian Electronics and Cultural Progress in the East Russia during the Last Century

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Abstract—The paper gives the short historical description of the social-cultural development of Siberia - the vast geographical region of the Asian part of Russia. Due to the low population density, severe climate and remoteness from centers of the world civilization Siberia up to the XIX century was the underdeveloped part of Russia in spite of the reach natural resources. Still during the last 200 years Siberia demonstrated rapid development of industry, science and culture. It is shown in the paper that this progress is connected with the leading brunches of knowledge - such as physics, electronics and information technologies. To-day Siberia is not only the highly developed industrial area but also one of the centers of the world science and culture.

Index Terms—Siberia, Russia, physics, electronics, culture, educational and scientific progress, XXth century.

I. INTRODUCTION

SIBERIA is a vast geographical region in the center of Russia limited by the Urals in the West, Far East regions in the East, the North Ocean in the North and by the boundaries with Kazakhstan, Mongolia and China in the South (Fig. 1). Siberia became a part of Russia in the XVI—XVII centuries. The area is 12.6 million km² (about 74% of the Russian territory). 26 million people live in Siberia and the Far East. The average population density is 2 people on 1 km².



Fig. 1. Siberia on the Russia map.

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Siberia is reach of recourses; there are here 85% of lead and platinum, 80% of coal and molybdenum, 70% of nickel, 69% of copper, 44% of silver and 40% of gold. In XVIII—XIX centuries mineral resource industry played the leading role. During the early history Siberia substantially supplied European part of the country with raw materials.

We can see three periods in the XIX—XX centuries that greatly influenced the social and cultural development of Siberia. **The first period** was the "golden fever" of 1819-1861. During this time there were extracted 570 tons of gold. This was the period of the private mine industry development and accumulation of the Siberian businessmen money, creation of the future Siberian cities fundament and conditions of their development. By the end of the XIX century in Tomsk and in Irkutsk lived 50 000 people each. 20 000 each lived in Omsk and Krasnoyarsk (to-day more than one million each) as well as in Tyumen and Barnaul. The center of the area more than 847 km² with population of 2 million people was Tomsk founded in 1604 (Fig. 2).



Fig. 2. Tomsk in XIX century.

The second period covers the end of the XIX century and the beginning of the XX. In 1878 in Tomsk there was founded the first Russian university east from the Volga (Fig. 3).



Fig. 3. First in Siberia Tomsk University.

To-day at this university there are 23 000 students, 800 postgraduates and PhDs. According to the QS Quacquarelli Symonds version the Tomsk State University is among the ten first universities of Russia.

1891 year was the beginning of the railway Moscow-Vladivostok 9288 km long. After ten years, in 1901 started the regular railway traffic. This second on the Earth long railway, built in a very short time, became a strong stimulus of Siberian cities industrial and cultural development. At the place of the village Krivoshchekovo with population in 1893 685 people has grown the nowadays capital of Siberia Novosibirsk with population of 1.5 million people (Figures 4 and 5).



Fig. 4. Krivoshchekovo in 1893.



Fig. 5. Novosibirsk to-day.

The third period was influenced by the Second World War. In 1941-1942 more than 300 plants (mainly of the defense production) were moved to Siberia from the European part of the USSR. Siberia accepted 1 million people - workers, specialists and their families. There was no return - the industry stayed in Siberia also after the War. Equipment and the staff of research institutes, cultural and museum objects, theatre groups were moved to Siberia from Moscow, Leningrad, west and south of the European parts of Russia, Ukraine and Byelorussia. There were also moved high schools from Moscow, Leningrad, Voronezh, Ukraine. All this influenced the development of science and culture of the eastern regions of the country [1].

II. ELECTRONICS IN SIBERIA IN THE FIRST HALF OF THE XX CENTURY

Development of radio in Siberia started in the 20-th of the last century. On the 5th of September 1926 the broadcasting station RV-6 of power 4 kW started regular translation. In August 1926 in Siberia there were 4144 radio amateurs receiving broadcasting. By the end of 30-th regular broadcasting was in the most regions of Siberia. Programs were formed according to the need of the authority and population. Radio formed cultural atmosphere and became the center of the region social and musical life.

In 1934 the radio amateur from Tomsk E.N. Silov supported communication with the rescuers of the ship "Chelyuskin" icebound in the Kara Sea. He was awarded to the Red Banner Order. In 2015 E.N. Silov, living in Tomsk, is 104 year old. He is still alive and active.

At the IV congress of Russian physicists in Leningrad in 1924 Tomsk was named one of the centers of the soviet physics. The first research organization solving the problems of radio was Siberian Physicotechnical Institute (SPTI) founded in 1928 as a part of the Tomsk University [2]. At the beginning of the 30-th at SPTI there were laboratories of electronic phenomenon (P.S. Tartakovski) and of electromagnetic oscillation (V.N. Kessenich). Here there was built under supervision of Prof. V.N. Kessenich the first in the country ionosphere sounder station. At this station on the 19th of June 1936 there were registered changes of the critical frequencies of short wave propagation. Further at this station there were investigated the main laws of the high atmosphere lays ionization at the height from 50 to 500 km.

III. SIBERIA BECOMES A BIG SCIENTIFIC, TECHNICAL AND EDUCATIONAL CENTRE OF RUSSIA

During and after the Second World War on the bases of the industry moved from the European part of the country there was founded in Siberian cities Novosibirsk, Krasnoyarsk, Omsk, Tomsk, Barnaul, Irkutsk and others a powerful base of science and industry, including tens of plants, research and design organizations. Such bodies as Novosibirsk Academgorodok, Tomsk and Krasnoyarsk Academy centers. The leading member of the space industry "Reshetnev Information Sputnik Systems" in Zheleznogorsk became famous all over the world.

A. Education

Tomsk became the first in Siberia center of high education and university research in the field of electronics. In 1951 there was organized radio faculty at the Tomsk Polytechnic Institute, in 1953 at the Tomsk State University there was organized radio physical faculty. In 1962 radio faculty of the Tomsk Polytechnic Institute became a new separate organization of high education - the Institute of Radio Electronics and Electronic Techniques - to-day it is the Tomsk State University of Control Systems and Radioelectronics (TUCSR). Graduates from Tomsk institutes and universities became the personnel foundation of electronic industry in Siberia, the Far East and in Central Asia republics. Only from

TUCSR in the 80-th there were graduated 2000 radio engineers, in 1962-2000 there were defended 64 DSc and 459 PhD dissertations in the field of electronics.

After Tomsk other cities (Novosibirsk from 1953, Irkutsk from 1961, Omsk from 1965, Yakutsk from 1974, Krasnoyarsk from 1981 as well as Tyumen, Barnaul, Khabarovsk, Vladivostok) started teaching new radio engineers and radio physicists.

B. Science

In the 50-th a new base of the Russian science started being organized - a complex of scientific institutes of the USSR Academy of Science. In 1957 there was organized the Siberian Branch of the Academy of Science. It was the beginning of Academic city in Novosibirsk, which became the scientific center known all over the world. There were organized 24 research institutes. Research centers of the Academy of Science Siberian Branch were organized in many big cities of Siberia: in Novosibirsk, Tomsk, Krasnoyarsk, Irkutsk, Yakutsk, Ulan-Ude, Kemerovo, Tyumen, Omsk. The main part of these institutes was oriented on research in the field of electronics and information technologies.

By the 70-th the Siberian Physicotechnical Institute (SPTI) in Tomsk still was one of the greatest research institution in the system of high education. In 1978 there were at SPTI 27 laboratories combined in five departments. They performed research in electronics, semiconductors, wave propagation, electrodynamics of transmission lines, diffraction, modulation amplification, cybernetics and theory of information. Institutes of higher education (first in Tomsk, then in other cities) in parallel with students teaching carried out research for industry. This helped to form new scientific schools in the field of radio physics and electronics. In 1956-1962 at the Tomsk Polytechnic Institute under supervision of Prof E.I. Fialko there was performed research in the field of the ionized meteor trails radiolocation, there was designed and tested the model of the meteor VHF radar with the phase system of direction finding. At the same time there was started investigation in the field of passive radiolocation, still going on. The circle of organizations taking part in the research became wider and wider. Besides Tomsk Polytechnic Institute research performed SPTI, Tomsk State University and organized in 1962 Tomsk Institute of Radioelectronics and Electronic Technique (F.I. Peregudov, V.P. Denisov, G.S. Sharygin, V.A. Philonenko, V.B. Fortes, V.I. Slutski and others).

The newly organized Institute of Radioelectronics and Electronic Techniques (now TUCSR) in 50 years became one of the leading specialized (radio electronic profile) technical universities of Russia [3] – see Fig. 6. Spheres of research at the University permanently widened. Now the volume of research per one member of staff is 1 mill rubles, making TUCSR the best in Russia from this point of view.

One of the main directions of research at the University is radiolocation and wave propagation of UHF in troposphere [4]. There were carried out many experiments, built prove grounds in Tomsk and at the North Caucasus, in the Crimea

and at the Kuril Islands for investigation of the far from horizon radio wave propagation. There were specially organized sea voyages to investigate troposphere wave propagation, published Troposphere Radioclimatic Atlas of the Pacific Ocean [5]. Results of investigation were utilized by industry in Tomsk, Leningrad and Kiev.



Fig. 6. Tomsk State University of Control Systems and Radioelectronics.

In 1999-2006 a group of researchers from TUCSR (V.N. Tatarinov, V.A. Khlusov) carried out research in the field of polarization radiolocation for the International Research Center of Telecommunications – Transmission and Radar of Delft University of Technology (L. Ligthart). There was organized a Siberian Branch of this Center and three international workshops on the subject [6].

Scientific schools of the electronic profile were also created at the Tomsk State University (Prof. V.P. Yakubov), Krasnoyarsk Polytechnic Institute (now Siberian Federal University) - Prof. G.Y. Shaydurov), Omsk Polytechnic University (Prof. N.S. Zhilin, Prof. V.A. Maystrenko), Novosibirsk Electrotechnic University and at the others.

C. Radio electronic industry

During the Second World War more than 300 industrial factories were moved from the central regions of the country to Siberia [1] (Krasnoyarsk, Tomsk, Omsk, Novosibirsk, Irkutsk) including electrotechnic and electronic plants. After the War they all stayed in Siberia. Besides, in the 50-th there were built many enterprises forming a company towns connected with nuclear, aviation, space and electronic. Siberia became a big industrial region of science-consuming industry.

In Novosibirsk and Omsk there were organized design-driven institutes and design departments to design communication systems and radar technique, as well as elements of electronic equipment. Electronic plants in Krasnoyarsk, Tomsk, Barnaul and others were modernized and widened. In addition to the electronic military means they produced communication equipment (Omsk, Novosibirsk), broadcast receivers (Novosibirsk), TV sets (Krasnoyarsk), tape recorders (Tomsk), computer driven machine tools (Tomsk) and many others.

In the Krasnoyarsk satellite town Zheleznogorsk there was built the biggest in Russia space oriented enterprise "Information Sputnik Systems" named after first director

Academician M.F. Reshetnev [7] – see Fig. 7. This organization designed, produced and put into the space more than 2000 apparatus, including all apparatus of the GLONASS system and transponder satellite for telecommunication. Many graduates of the electronic profile universities work at this enterprise.



Fig. 7. M.F. Reshetnev Information Sputnik System Ltd.

IV. SIBERIAN ELECTRONICS UNDER THE CONDITION OF THE RUSSIAN ECONOMIC MODEL

The USSR breakup and the hasty change of the Russian economy from the planned to the market one was a great deal for the science and education. Financing of research by industry was nearly stopped, especially fundamental, military and research of double application. The state also shortened financing of research though not so noticeably. The volume of research in comparable prices in 1995 was 10-12 times less than in 80-th. Badly was ruined the resource base, lessened the staff. The number of researchers became 3-4 times less. Experiments were nearly stopped, many laboratories and research prove grounds were preserved or fully stopped; research equipment was taken from the airplanes and ships. The new scientific production, books, papers, reports, thesis's mainly generalized early received theoretical and experimental results.

Started from 1995 some changes could be felt, not great at the beginning. It looked as if the crisis became less severe. Shortening of finances became smaller. From the 2000-th extent of research rapidly grew (see Fig. 3); more money was supplied by industry. More popular became research, especially concerning applied and concrete subjects.

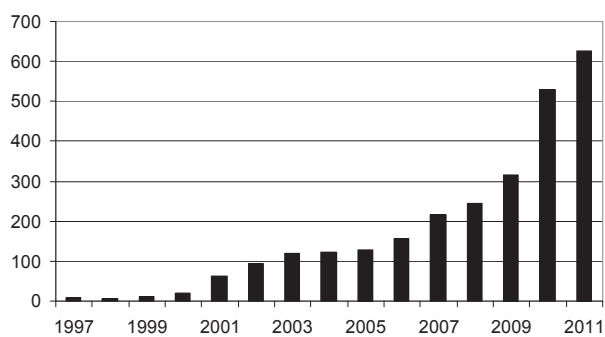


Fig. 3. Extent of research in TUCSR in millions roubles

Appeared and developed many private science consuming firms. This process is visible while looking at the Tomsk firm "Micran". In 1991 8 graduates under leadership of V.Y. Gyunter in a small room started production converters for reception of satellite TV. To-day at this firm work 1500 engineers and the firm is one of the fastest developing one in Russia. "Micran" produces UHF modules, telecommunication equipment, radio measuring and radar equipment.

On the basis of Tomsk universities there was organized the first in the country industrial park which became international business center. Exhibition, innovative and marketing activity of the industrial park helps to introduce the results of research into industry, makes known results of Tomsk scientists and engineers activity.

In 2004 there the first in Russia student business incubator "Druzhba" with 220 workplaces was opened in Tomsk. The incubator helps students and postgraduates to start own small-scale science intensive enterprises.

Under the conditions of the market economy the Siberian schools of higher education become the centers of education-scientific-innovation complexes. Strategic partnership of universities and industry is mutually important for teaching future engineers and introduction into industry results of scientific research and design. Electronic in this process is the leader.

V. CONCLUSION

During the last 100 years Siberia having been a backward region with raw materials base became a highly developed industrial region noticeably influencing the "face" of Russia in the field of education, science, culture and advanced technologies. Achievements of the Siberian scientists and engineers in the field of electronics, nuclear physics and space technologies are at the world level [8]. These achievements create the cultural level of population over vast territories.

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