

Professional and public accreditation for professional educational programs in the field of rocket engineering and space activities in Omsk State Technical University

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Abstract. The article is devoted to the professional and public accreditation in Omsk State Technical University for bachelor's and master's degree programs "Rocket Systems and Astronautics". A brief description of the university is given. The objectives of accreditation are stated. The procedure for its implementation is described. The evaluation criteria and the results of the accreditation are given. The main comments identified by experts and the strengths of educational programs are presented.

1 Introduction

Professional and public accreditation (PPA) of the main professional educational programs, basic and (or) additional professional training programs is a recognition of the training quality and level of graduates who have completed such educational programs in a specific organization engaged in educational activity meeting the requirements of professional standards, labor market requirements for specialists, workers and employees of the relevant profile [1].

Professional and public accreditation is an effective tool for regulating and improving the quality of education, recognition of the high level of specialists training by the professional community. Passing an independent accreditation allows an educational organization to declare the quality of training specialists, thereby increasing its competitiveness in the market of educational services, as well as to ensure the employment of its graduates [2].

At the beginning of 2019, Omsk State Technical University made a decision on the need for independent accreditation for the bachelor's and master's degree programs of an integrated group of specialties and fields 24.00.00 "Aviation and Rocket and Space Technology". The objectives of the PPA were:

- to demonstrate commitment to the high quality of educational services and training specialists with higher education, public statement on the high quality level of specialists training;
- to obtain an independent qualified quality assessment of educational programs and specialists training;

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- to analyse the strengths and weaknesses of the implemented educational programs, personal recommendations on updating educational programs from the State Corporation “ROSCOSMOS”, one of the largest employers’ associations;
- to ensure and improve the employment of graduates.

At that time, OmSTU had only two educational programs accredited by the Association for Engineering Education of Russia and the European Network for Accreditation of Engineering Education (ENAAE). It was the master’s program 28.04.02 “Nanoengineering” and the bachelor’s program 18.03.01 “Chemical Technology”. There was no experience of public accreditation for bachelor’s and master’s degree programs of related specializations at the university at that time.

OmSTU application for professional and public accreditation of educational programs in the areas of training in rocket technology and space activity 24.03.01 “Rocket Systems and Astronautics” (profile “Rocket Engineering”) and 24.04.01 “Rocket Systems and Astronautics” (profile “Rocket Design and Construction”) was submitted to the expert organization—Agency for Professional and Public Accreditation and independent assessment of qualifications (LLC “Profaccredagentstvo”, Moscow).

At the stage of considering the application by LLC “Profaccredagency”, a positive decision was made to conduct PPA based on the fulfillment of the following conditions:

- the declared educational programs correspond to the type (types) of professional activity for conducting PPA in the Council for Professional Qualifications in the field of rocket technology and space activity;
- the availability of the stated educational programs in the license for the implementation of OmSTU educational activity;
- the preparation for the declared educational programs is carried out by the applicant for a period not less than the one established for the development of the educational program (there is at least one issue).

After the decision was made to conduct the PPA, the expert organization formed a schedule for an accreditation examination and gave recommendations for self-examination and preparing a package of materials for educational programs. The preparation of a report on programs and materials self-examination for accreditation examination [3] was carried out for two months by the OmSTU department “Aircraft and Rocket Building”, which provides training in the areas declared for accreditation.

A group of independent experts was formed to conduct the accreditation examination by LLC “Profaccredagency”, the composition of which was approved by the Accreditation Council:

- 1) Filimonov Alexey Sergeevich, an independent expert, Associate Professor of the Department SM-12 “Technologies of Rocket and Space Engineering”, the Moscow State Technical University named after N.E. Bauman (National Research University), Candidate of Technical Sciences;
- 2) Mishchenko Vladimir Ivanovich, an independent expert, Head of the Department of Geometric Information and Cold Pressing No. 329 at IG “Polyot”—the branch of the Khrunichev State Research and Production Space Center in Omsk;
- 3) Yakovleva Svetlana Nikolaevna, a project supervisor from the accrediting organization, the chief specialist of the All-Russian Industrial Association of Employers “Union of Employers of the Rocket and Space Industry of Russia”;
- 4) Baranova Natalia Vasilievna, a project manager, Director of the expert organization “Profaccredagency”, Candidate of Pedagogical Sciences.

During the period of the accreditation examination (March–April 2019), the group of independent experts studied the materials submitted by OmSTU, formed a list of comments and clarifications. On April 16–17, 2019, an in-person visit of experts (on-site accreditation examination) took place, during which the expert group conducted interviews with the heads of the university, heads of educational programs, teachers of the Department of Aviation and Rocket Engineering, employees of the quality management system support group and the Regional Center for Graduate Employment Assistance, students, key partner employers, graduates, got acquainted with the university material and technical base and documents.

The educational programs presented for the PPA were developed in accordance with the Federal State Educational Standard:

- the field of education 24.03.01 “Rocket Systems and Astronautics” (bachelor’s degree level), approved by the Ministry of Education and Science of the Russian Federation Order No. 1430 (dated December 4, 2015) and updated taking into account professional standards (PS) 25.028 “Process Engineer for Assembly Operation in Aerospace Industry”, approved by the Ministry of Labor and Social Protection of the Russian Federation Order No. 997n (dated December 3, 2015) (registered with the Ministry of Justice of the Russian Federation on December 31, 2015, No. 40485) and PS 25.045 “Structural Engineer in Rocket Science”, approved by the Ministry of Labor and Social Protection of the Russian Federation Order No. 939n (dated December 2, 2015) (registered with the Ministry of Justice of the Russian Federation on December 31, 2015 No. 40419);
- the field of training 24.04.01 “Rocket Systems and Astronautics” (master’s degree level), approved by the Ministry of Education and Science of the Russian Federation Order No. 164 (dated March 6, 2015) and updated taking into account PS 25.045 “Structural Engineer in Rocket Science”, approved by the Ministry of Labor and Social Protection of the Russian Federation Order No. 939n (dated December 2, 2015) (registered with the Ministry of Justice of the Russian Federation on December 31, 2015 No. 40419).

The heads of the main educational programs are:

- 24.03.01—Yakovlev Alexey Borisovich, Head of the OmSTU department “Aircraft and Rocket Building”, Candidate of Technical Sciences, Associate Professor, Academician of the International Academy of Refrigeration;
- 24.04.01—Trushlyakov Valery Ivanovich, Professor at the OmSTU department “Aircraft and Rocket Building”, Doctor of Technical Sciences, Adviser to the Russian Academy of Rocket and Artillery Sciences, Director of the scientific and educational center “Space Ecology”.

The number of students enrolled in the program 24.03.01 is 77 students, all at the expense of state budget, including students studying under employer-sponsored financing agreements (38 students).

The number of students enrolled in the program 24.04.01 is 25 undergraduates, all at the expense of state budget, including those studying under employer-sponsored financing agreements (6 students).

2 General characteristics of the educational organization

Omsk State Technical University (OmSTU) traces its history back to 1942. The university was organized as the Omsk Machine-Building one on November 16, 1942 by the Decree No. 1828 of the Council of People’s Commissars of the USSR on the basis of the evacuated Voroshilovgrad Evening Machine-Building Institute. In 1963, by Order of the Ministry of Higher and Secondary Education of the RSFSR, the Omsk Machine-Building Institute was reorganized into Omsk Polytechnic Institute.

In 1965, the first recruitment for the specialty “Mechanical Equipment for Automated Installations” was carried out. In 1967 the department “Automated Installations” was established to train engineers for rocket launching and system performance. In 1985, the range of rocket and space specialties was expanded by the ones “Rocket engines” and “Rocket Building”. In 1988, in order to train personnel for Omsk enterprises in the rocket and space industry, the departments “Flight Engines” and “Flight Building” were organized.

On July 5, 1993, by Order of the State Committee of the Russian Federation for Higher Education, Omsk Polytechnic Institute was renamed Omsk State Technical University.

In 1996, two dissertation councils were opened at the university for the defense of candidate dissertations in scientific specialties related to aviation and rocket and space technology. Since 2004, OmSTU has been training bachelors, and since 2008 masters in the areas of aviation and rocket building. In 2004, the departments of the rocket and space field were combined into a single department “Aviation and Rocket Building”, which currently trains about 400 engineers, bachelors and masters for the needs of the aviation and space industry of Russia.

Since 2008, OmSTU has adopted a comprehensive development program by creating resource centers. OmSTU has set a course for an innovative-research type university with a developed scientific potential that trains in-demand and competitive specialists. The achieved results were the foundation and starting point for the “Strategic Development Program for 2012–2016”, with which the university became the winner in the Russian competition of development programs among 248 universities and became one of the 100 best universities in Russia. In March 2016 OmSTU received the status of the flagship university by joining the Omsk University of Design and Technology. In April 2018, OmSTU successfully passed the state accreditation for educational activity in the main professional educational programs.

At the period, the university implements 33 integrated groups of training areas. There are 183 main professional educational programs of higher education, of which: 73 are bachelor’s degree programs, 46 are master’s degree programs, 12 programs for specialists and 52 educational programs for graduate students.

The main competitors of OmSTU in the Omsk region are: The Siberian State Automobile and Highway University; Dostoevsky Omsk State University; Omsk State Transport University; Omsk State Agrarian University named after P.A. Stolypin.

In the Siberian and Ural regions, according to the IGSA educational programs 24.00.00 “Aviation and Rocket and Space Technology”, the main competitors are Novosibirsk State Technical University; Biysk Technological Institute; Reshetnev Siberian State University of Science and Technology (Krasnoyarsk); Perm National Research Polytechnic University; South Ural State University (Chelyabinsk).

The main influx of students to OmSTU is from the city of Omsk and Omsk region, the Republic of Kazakhstan, Novosibirsk Region, Tyumen Region and Khanty-Mansi Autonomous Okrug, Tomsk and Kurgan regions.

Today Omsk State Technical University is a modern technical university with a developed educational, scientific and industrial infrastructure, the largest university in the Omsk region. OmSTU is the driver of implementing the cluster model for industrial development of the Omsk region, the flagship regional university, distinguished by [4]:

- the use of modern domestic and foreign scientific achievements in the educational process;
- the orientation to close scientific and educational contacts with engineering companies and manufacturers of modern technology;
- the innovative infrastructure: research and educational resource centers, research laboratories, student design bureaus;
- a powerful human capital: highly qualified teaching staff and experienced researchers; support program for young teaching staff;

- the request from the enterprises of the military-industrial complex of Russia and industrial enterprises of the Omsk region for targeted training of students;
- the possibility of obtaining a labour profession;
- the opportunity to participate in international educational and cultural exchange programs;
- the effective system for professional orientation of schoolchildren.

The main key partners among the educational organizations are: Bauman University, Tomsk Polytechnic University, Moscow Aviation Institute, ITMO University, Polytechnic University of Milan, TU Wien. As well as leading scientific organizations are Omsk branch of Sobolev Institute of Mathematics SB RAS; JSC “Omsk Scientific-Research Institute of Instrument Engineering”; JSC Concern “Sea Underwater Weapon—Gidropribor”; Institute of Problems of Chemical Physics RAS; Space Research Institute RAS; Voevodsky Institute of Chemical Kinetics and Combustion SB RAS; Central Research Institute for Machine Building and others. The main employers and partners of the university from the professional sphere are IG “Polyot”—the branch of Khronichev State Research and Production Space Center, A.M. Isayev Chemical Engineering Design Bureau, Central Aerohydrodynamic Institute, Salyut Machine-Building Production Association, Omsk Engine Design Bureau, JSC “High Technologies”, JSC “Siberian devices and systems” and others.

The technical and technological orientation of the university forms the main list of educational programs and key areas for scientific research implemented in the field of technical, physical, mathematical and chemical sciences. The university has a number of world-class breakthroughs in the main areas of scientific specialization. 19 of 40 bachelor’s degree programs implemented by the university meet the priority areas of modernization and technological development of the Russian economy. The university is the region leader in employer-sponsored training for enterprises and organizations among universities subordinate to the Ministry of Education and Science of the Russian Federation.

OmSTU is the main executor of the Strategy for socio-economic development of the Omsk region up to 2025 in terms of priority economic clusters staffing. The university has stable develop ties with the leading enterprises of the region: the work of 15 basic departments carrying out targeted training of specialists has been organized. It is a leader among the region universities in the volume of research work, including the interests of industrial partners. The university accumulates work in the field of youth policy, culture and tourism development of the Omsk region, participates in ensuring intercultural and interethnic dialogue. OmSTU has more than 16 thousand students, including about 3 thousand foreign students, being the leader by this indicator in the region. The teaching staff consists of more than 840 employees, including scientists, doctors and candidates of sciences.

The University is allied with educational, industrial, research organizations and institutions in Russia, Belarus, Kazakhstan, Germany, Italy, Austria, the Republic of Korea, etc.

OmSTU has been developing dynamically in recent years: new specialties and specializations, new computer classrooms, the number of students is twice the average number of state-run university students in Russia. The library at OmSTU is the largest of the Omsk university libraries, the library fund together with its branches amounts to 1 million 327 thousand publications. Internet technologies and other modern forms of working with readers are used actively in OmSTU.

3 Results of the analysis of educational programs

The evaluation criteria by which the indicators are checked, the maximum score for each criterion, the evaluation results [5] and the notes of the expert commission on the bachelor’s educational program 24.03.01 “Rocket Systems and Astronautics” are shown in table 1.

Table 1. Evaluation results and notes of the expert commission on the program 24.03.01

Evaluation criterion	Maximum score	Evaluation result	Notes of the expert commission
Criterion 1. Passing a professional exam in the form of an independent qualification assessment by graduates of the professional educational program. Orientation of the planned program results to the requirements of professional standards	10	8	The degree of criterion 1 fulfillment was reduced by 20% because the independent assessment of graduates' qualification for compliance with the professional standards "Process Engineer for Assembly Operation in Aerospace Industry", and "Structural Engineer in Rocket Science" is not carried out
Criterion 2. Compliance of the planned results formulated in the educational program with professional standards in the rocket and space industry	6	5	There are no job descriptions, job responsibilities developed on the basis of the qualification requirements of employers. However, 31% of syllabuses are coordinated with the employer. The planned results of study of the educational program are limited only by two labor functions of the professional standard
Criterion 3. Compliance of curricula, syllabuses of academic subjects, courses, disciplines (modules), evaluation materials and procedures with the planned results of study of the educational program	14	11	It is necessary to update the Evaluation Tools in accordance with the recommendations of experts and to make additions to the regulations of the OmSTU quality management system, attaching the right for employers and other external experts to participate in the process of updating the educational program
Criterion 4. Human resources ensuring the formation, implementation and quality of the educational program	12	10	A small number of teaching staff (5.2%) involved in the implementation of the program have completed advanced training courses, retraining, and internships in specialized organizations. Insufficient number of teaching staff (10.4%) combines work in the educational organization with professional activity

Table 1. (Continue)

Evaluation criterion	Maximum score	Evaluation result	Notes of the expert commission
Criterion 5. Compliance of material and technical, information and communication resources and other ones influencing the quality of graduate training with the content of professional activity for which the graduate is trained	12	11	The basic department of the educational organization was transformed into a branch of the department on the basis of IG “Polyot”, i.e. there was the downgrading of the department. When working with the electronic information system, it was revealed that the methodological guidelines for providing educational program activity have not been updated since 2015
Criterion 6. The presence of demand for the educational program, the demand for graduates by employers	14	11	To work out a system for monitoring the retention of the program graduates in the workplaces of enterprises after the first year of employment
Criterion 7. Participation of employers in the preparation and implementation of the educational program	12	11	It is necessary to reconsider the approaches of involving employers in the development of evaluation tools used in the educational program

Table 2. Evaluation results and notes of the expert commission on the program 24.04.01

Evaluation criterion	Maximum score	Evaluation result	Notes of the expert commission
Criterion 1. Passing a professional exam in the form of an independent qualification assessment by graduates of the professional educational program. Orientation of the planned program results to the requirements of professional standards	10	7	The degree of criterion 1 fulfillment was reduced by 30% because the independent assessment of graduates’ qualifications for compliance with the professional standard “Structural Engineer in Rocket Science” is not carried out

Table 2. (Continue)

Evaluation criterion	Maximum score	Evaluation result	Notes of the expert commission
Criterion 2. Compliance of the planned results formulated in the educational program with professional standards in the rocket and space industry	6	5	The degree of criterion 2 fulfillment was reduced by 17% because there are no additional professional competencies as part of the planned results of study the educational program
Criterion 3. Compliance of curricula, syllabuses of academic subjects, courses, disciplines (modules), evaluation materials and procedures with the planned results of study of the educational program	14	11	The degree of criterion 3 fulfillment was reduced by 21.4% because the conformity of the evaluation procedures and tools used during the interim and final certification with the requirements established in the system of independent qualification assessment was not carried out
Criterion 4. Human resources ensuring the formation, implementation and quality of the educational program	12	11	The insufficient number of teaching staff (14%) have completed internship programs at enterprises of the rocket and space industry. It is necessary to improve the mechanism for monitoring employers' satisfaction with the quality of graduate training
Criterion 5. Compliance of material and technical, information and communication resources and other ones influencing the quality of graduate training with the content of professional activity for which the graduate is trained	12	11	The basic department was transformed into a branch of the department on the basis of IG "Polyot", i.e. there was the downgrading of the department. When working with the electronic information system, it was revealed that the methodological guidelines for providing educational program activities have not been updated since 2015
Criterion 6. The presence of demand for the educational program, the demand for graduates by employers	14	11	Monitoring the retention of graduates occurs through non-formalized sources. The educational organization needs to strengthen control over graduates at enterprises

Table 2. (Continue)

Evaluation criterion	Maximum score	Evaluation result	Notes of the expert commission
Criterion 7. Participation of employers in the preparation and implementation of the educational program	12	11	In the disciplines of the program, taught by representatives of employers, evaluation materials are developed by employers. The rest of the evaluation tools was developed by the teachers of the department

The evaluation criteria by which the indicators are checked, the maximum score for each criterion, the evaluation results and the notes of the expert commission on the master’s degree program 24.04.01 “Rocket Systems and Astronautics” are shown in table 2.

Experts noted the following strengths of the educational programs “Rocket Systems and Astronautics” 24.03.01 and 24.04.01.

1. Practical orientation in comparison with competitor programs. The results of study of educational programs are aimed at improving the competitiveness of the Omsk region, making OmSTU a driver for the implementation of the cluster model for industrial development in the region and the regional flagship university.
2. The practical orientation of the principal educational program is confirmed by a large proportion of practice-oriented materials in the syllabuses of disciplines and evaluation tools, discussed and approved with employers.
3. High demand for graduates.
4. The high publication activity of the teaching staff ensures better formation and implementation of programs.
5. The OmSTU quality management system of education with the established procedure for managing the measurement of customer satisfaction with the university’s services allows improving the quality of education.
6. The rating system operating at OmSTU for material rewards of the most active teachers in creative and scientific terms significantly improves the quality of educational programs.
7. The high state level of the OmSTU material base ensures high-quality fulfillment of all requirements for the educational process.
8. The current system of motivating promising young teachers contributes to their retention in OmSTU.

There were no significant deficiencies in the bachelor’s degree programs 24.03.01 “Rocket Systems and Astronautics” and the master’s degree 24.04.01 “Rocket Systems and Astronautics” as a result of the inspection by the commission.

On June 27, 2019, at the meeting of the Accreditation Council for Professional and Public Accreditation of professional educational programs in the field of rocket technology and space activity, it was unanimously decided to accredit and issue certificates for the two above-mentioned OmSTU programs until June 2024.

Based on the results of the comments made by the commission, the action plan was developed to eliminate them, which was successfully implemented in 2019–2020 academic year.

References

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