

INTERUNIVERSITY SPACE RESEARCH DEPARTMENT OF INTEGRATED EDUCATIONAL MASTER/PHD PROGRAMS

I.V. Belokonov, I.A. Timbai, A.V. Kramlikh, I.A. Kudryavtsev

Samara State Aerospace University, Samara, Russia

Development of integrated Masters science/PhD programs using the “project-based learning” technology is a prerequisite for entering of modern university into international education space. The term “project-based learning” means engaging students in real space-related project using results of their research work during all period of study.

Interuniversity Space Research Department (ISRD) was founded by Samara State Aerospace University (SSAU), Samara State University and Ulyanovsk State University and is based at SSAU, which is the National Research University. The specifics of the department are that only domestic and foreign masters and post-graduate students are training, and it fully matches the status of National Research University.

At now the training course contains two innovative master degree programs in space science and technologies:

- «Future Space Technologies and Experiments in Space”, the direction of Master degree is “Rocket technique and Cosmonautics”;
- «Space Information Systems and Nanosatellites. Navigation and Remote Sensing ”, the direction of Master degree is “Applied Mathematics and Physics”.

Master degree programs are designed in accordance with Russian Federal Educational Standards of higher education and contains five general disciplines, which differs by the complexity of the study and type of lessons. ECTS indexes of these disciplines are shown in Table 1.

Table 1. ECTS index of disciplines

Discipline	Master program	
	Future Space Technologies and Experiments in Space	«Space Information Systems and Nanosatellites. Navigation and Remote Sensing
Space Terrestrial Physics	3	4
Navigation and Control in Space	5	7,5
System Analysis of Space Missions	3	7
Modular Construction of micro/nanosatellites	2,5	4
Data Processing Methods	3	3,5

Special features of the master degree programs are:

- Practical training at the Russian and foreign scientific and educational organizations;
- Participation in scientific and research projects of the Department (design, construction and operation of nanosatellites);
- Application of personal research results in particular nanosatellite projects (mostly CubeSat) or space experiments.

Currently, the ISRD implements several projects: CubeSat3U nanosatellite for orientation and stabilization system testing technologies (2015), simple CubeSat2U for testing launch technology from transfer compartment of Soyuz rocket carrier (2016), CubeSat2U transformer nanosatellite (QB 50 project, 2016), CubeSat3U nanosatellite for Earth remote sensing (2017) and CubeSat3U within Russia-Belarus Union program designed for space weather monitoring (2018).

Session 3. Space education

In addition, the ISRD develops high-precision nanosatellite separation system using electromagnetic interference; maneuvering unit for nanosatellites; videonavigation equipment; device for transfer data via low-attitude satellite communication systems; standardized on-board systems for nanosatellites with improved performance; nanosatellite groups project for geophysical field monitoring (ionosphere and the density of upper Earth atmosphere); intelligent navigation systems with ability to adapt to the conditions of the flight and many other projects.

All of these projects are carried out in the ISRD by teachers, master and post-graduate students.

Also high-tech equipment of Samara Nanosatellite Testing Center could be used in research work.

As part of National Research University program the ISRD develops educational training programs for high-qualified scientific personnel (Doctors of Philosophy, PhD) for two specialities - "Space science" intender for graduates of "Applied Mathematics and Physics" master program and "Space Engineering and Technology" intender for graduates of "Rocket Technique and Cosmonautics" master program.

We accept citizens of the Russian Federation and other countries with a higher professional education (specialists and masters).

Training citizens of the Russian Federation carried out under contracts with tuition paid by individuals or legal entities, citizens of other countries under international agreements or direct contracts with foreign organizations or individuals.

The applicant for PhD degree should possess the following competencies:

- A systematic knowledge for research,
- To be able to integrate collected information into one text with accordance to the concept selected by applicant,
- An originality of thought that goes beyond exiting knowledge,
- To perform a synthesis and critical analysis of new ideas,
- To be able to interact with scientific community,
- To be able to distribute discovered information in the scientific community.

The training course for PhD is four years long. The main criteria of PhD educational course is getting more than 240 ECTS.

While training on specialties "Space Science" or "Space Engineering and Technologies" courses "System Analysis of Space Missions" and "Space Terrestrial Physics" could be considered for Master science degrees of "Future space technologies and experiments in space" and "Space information systems and nanosatellites. Navigation and remote sensing" courses.

The procedure of admission to the PhD training involves not only the provision of an appropriate set of documents showing the applicant knowledge level, but also includes an interview with two specialists on "Space Science" and "Space Engineering and Technology" profile who previously got aquatinted with the list of applicant's scientific publications or abstracts prepared by applicant.

The works of the doctoral student is controlled by scientific supervisor and the ISRD. Reports about the work done should be prepared at least twice a year. Doctoral students could use the University equipment, laboratories; classrooms, libraries and opportunity to travel for their research work same way as teaching and research staff of the University.

Due the course doctoral student should pass training on his dissertation profile at scientific organizations or educational institutions including foreign ones for at least six weeks. The department has appropriate agreements with foreign partner universities in Sweden, Belgium, Germany, France, Spain as well as Russian research organizations like Keldysh Institute of Applied Mathematics, Skobeltsyn Institute of Nuclear Physics of Moscow State University and etc.

Duration of the training at the doctoral course is four years, but it may be extended for one year. On the last two years doctoral student must prepare and organize a workshop for master grade students related on his dissertation profile.

The system of awarding of academic degrees in PhD course is related to international standards of scientific education.

Session 3. Space education

The degree of Doctor of Philosophy (PhD) is awarded by Dissertation Council depending on results of public defense of dissertation.

Work of the Dissertation Council is regulated by "Regulations on the dissertation council on dissertations defense for the degree of PhD at SSAU."

Dissertation for the degree of PhD should be science-qualified work which describes a complete solution to a specific problem and it should have essential value for science in "Space Science" and "Space Engineering and Technologies" scientific directions.

Dissertation for the degree of PhD must comply with the requirements described in the "Dublin descriptors" and "Qualifications Framework of the European Higher Education Area" for the third cycle of education, as well as in the "European Qualifications Framework for lifelong learning" for the 8th level of education.

Applicant for PhD degree provides the dissertation as manuscript or published monograph in Russian or English language.

The dissertation must be written individually and comprise a plurality of new research results (at least a part of research results) nominated by applicant for public defense and must have internal unity and witness of applicant's personal contribution into scientific direction. The new solutions proposed by author must be strictly substantiated and critically compared to the other known solutions.

The main solutions of the dissertation must be published as an article in reviewed scientific journals from a list approved by Scientific and Technical Council of the University.

The Dissertation Council approves the dissertation to defense and specifies the date and time of the defense.

After approving the dissertation, the Dissertation Council places abstracts and an advertisement with applicant name, dissertation title, scientific directions of the dissertation and the place of defense on the Internet at the official University site not later than three months before the defense.

In the abstract (up to one print page) should be shown main ideas and conclusions of the dissertation, the author's contribution in research work, the degree of novelty, the theoretical and practical importance of the research results.

The abstract must be delivered to the Dissertation Council members and related organizations not later than one month before the defense.

The list of organizations for sending abstract is determined by the Dissertation Council while approving a dissertation for the defense.

One copy of the approved dissertation and two copies of abstract must be sent to the University's library not later than one month before the defense and they are kept on the rights of manuscript.

The Dissertation Council appoints two official opponents from competent scientists who have to review of dissertation. Only one of the official opponents could be member of the Dissertation Council or employee of the University. Other opponents must represent other organizations including foreign ones.

Also the Dissertation Council appoints two opposing organizations from ones where applicant passed training or participation.

The public defense of the dissertation should be a matter of scientific debate and should pass in the atmosphere of high standards and be respected to scientific ethics.

After the end of defense the Dissertation Council members vote by a secret ballot for the award of the degree.

Decision taken by the Dissertation Council on the results of defense for a degree of Doctor of Philosophy (PhD) is the final and must be recorded in the protocol.

Individuals who have fully completed doctoral training course and successfully defended the dissertation are awarded with diploma of Doctor of Philosophy (PhD) on a standard form certifying the award of the required degree and academic record which contains a list of disciplines studied with rating and the number of assimilated credits according the curriculum.

This work was supported by the Ministry of Education and Science of the RF