

AL-FARABI KAZAKH NATIONAL UNIVERSITY

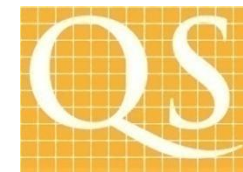


Implementation of the educational program on the specialty of "Space Engineering and Technology" in al-Farabi Kazakh National University: experience and sustainable development

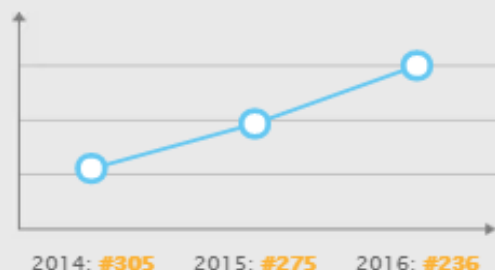
Maktagali Bektemessov, dean of the Faculty of Mechanics and Mathematics
Zaure Rakisheva, head of Department on Mechanics

SAMARA, 2017

KazNU in the top-250 (QS World University Rankings)



Al-Farabi Kazakh National University is the only university in Kazakhstan and Central Asia, which occupies the place No.236 according to the QS World University Rankings and since September 2016 has joined 250 leading universities of the world.



See the [full rankings table](#)



University profile: facts and figures

•University Profile

- **15** Faculties
- **67** Departments
- **59** Scientific Research Institutes and Centers
- **294** Research, Educational-Research and Educational laboratories
- A scientific technological techno-park

• Faculty profile

- More than **2,000** professors, doctors, and PhD's
- More than **100** members of academy of sciences
- about **30** researchers who received highest national awards of the Republic of Kazakhstan
- more than **30** laureates of State Awards of RK
- **40** laureates of the young scientists' awards
- **45** fellows of state scientific fellowships

• Students profile

- Enrolment of the University in both cycles amounts to more than 20 000 students including **1,000** overseas students



Department on Mechanics

One of the eldest in al-Farabi KazNU
Was established in **1935** (KazNU – in 1934)

Three levels of training in this specialty:

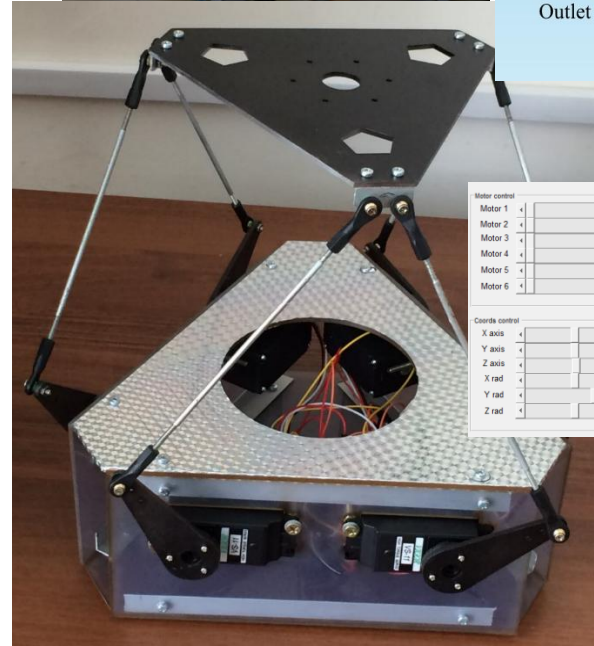
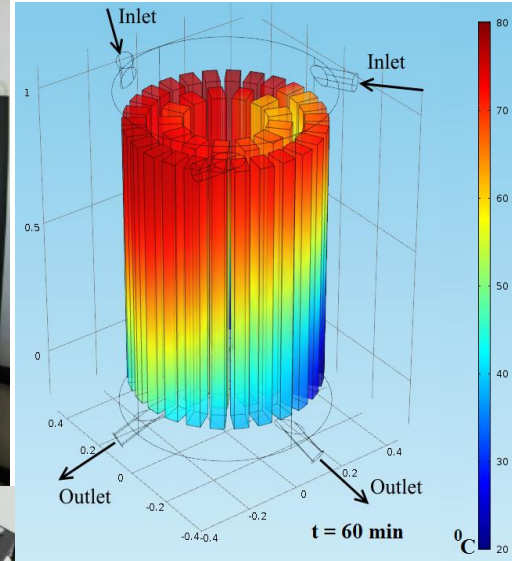
1. 5B060300 – Bachelor Program;
2. 6M060300 – Master Program;
3. 6D060300 – PhD Program.

Main directions of development of educational and scientific activities:

Theoretical and celestial mechanics

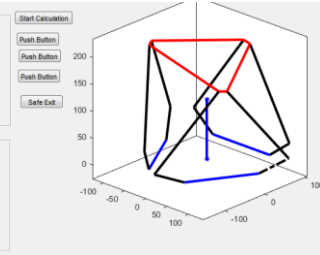
Fluid mechanics (plus renewable energy)

Mechanics of machines and mechanisms (plus robotics)



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Space engineering and technologies

In 2005 – Kazakhstan starts the own Space Program

In 2010 Department on Mechanics opens the new specialty «Space engineering and technologies».

Now we implement three levels of training in this specialty:

1. 5B074600 – Bachelor Program (since 2010);
2. 6M074600 – Master Program (since 2012);
3. 6D074600 – PhD Program (since 2013).

In 2014 – first issue of bachelors and masters

In 2016 - first PhD defended his thesis

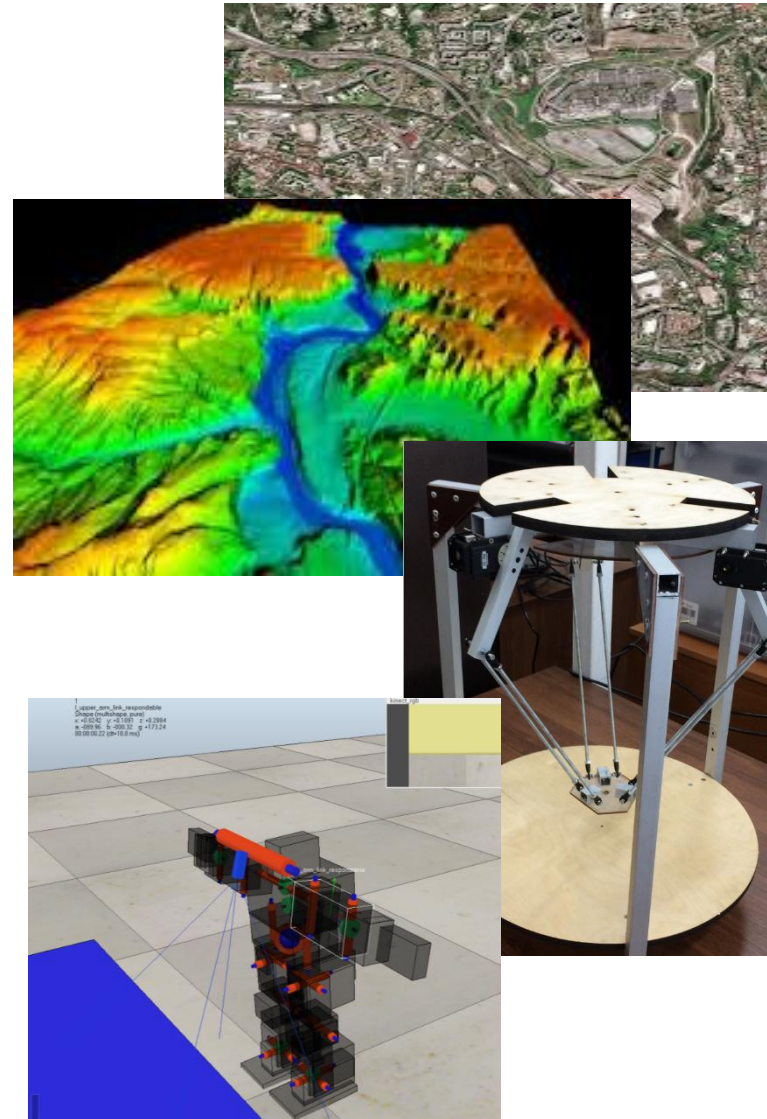


Space engineering and technologies

In 2015 by National Program of Innovative and Industry Development of RK (NPIID-2) new individual education trajectories «Information technology of space monitoring systems» had been opened within Master Program on specialty «Information systems» on Department on Mechanics.

IET «Information technology of space monitoring systems» is realized at the including the subjects from the project **Tempus-SESREMO** concerning space monitoring.

Within the NPIID-2 for enrollment 2016 the new IET was developed in addition «Design of the spacecraft».



International projects



Strengthening education in space-based remote sensing for monitoring of eco systems in Israel, Azerbaijan, Kazakhstan (SESREMO)
2014-2017

Applied curricula in space exploration and intelligent robotic systems (APPLE)
2016-2019

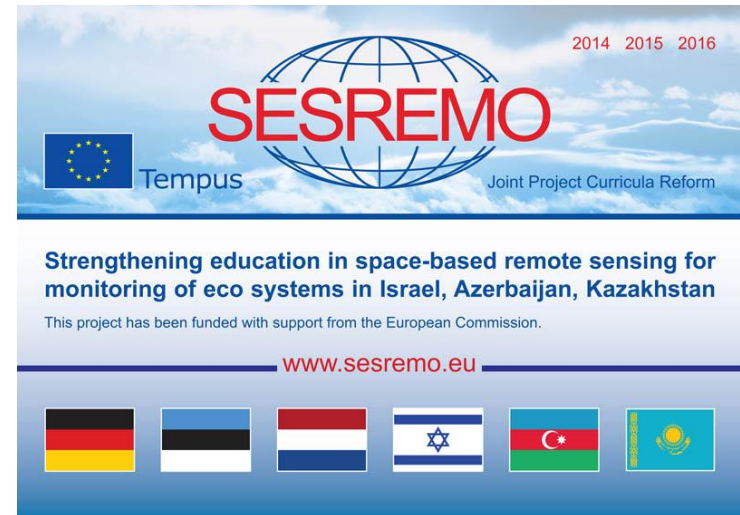


SESREMO (implementation and results)

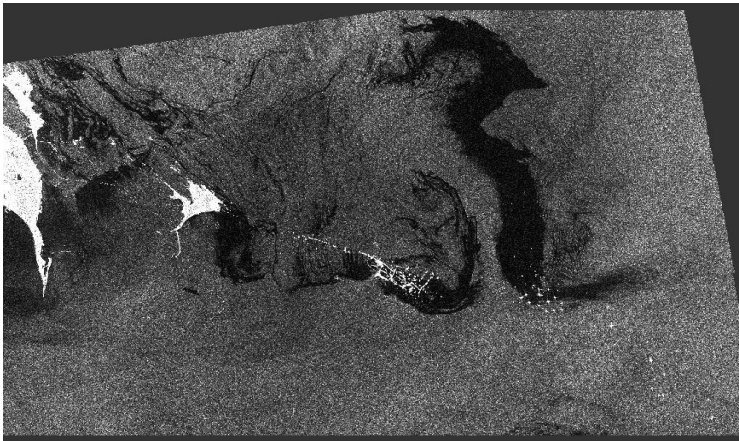
Title of the project: Strengthening education in Space-based remote sensing for monitoring of eco systems in Israel, Azerbaijan, Kazakhstan / SESREMO

Aim of the project: ensuring that the target Universities in AZ, IL and KZ can offer two cycle programmes in Space Based Remote Sensing Techniques to improve teaching in line with the new development in the area, the market demand and according to the Bologna Process, last recommendations in Bucharest communiqué and best practice.

The **mission of the project** is to introduce the applied educational program by reviewing/analyzing/upgrading the current curricula to recent advances in the target field; to develop, implement and accredit the new curricula inclusive B-learning and M-Learning; to modernize the existing and to establish the new equipped labs for effective education in frames of new educational program; retrain of academic staff/mentors in frames of new curricula; to conduct pilot teaching with the support of the stakeholders.



Research works of our master students in specialty «Information technology of space monitoring systems» (enrollment 2015)

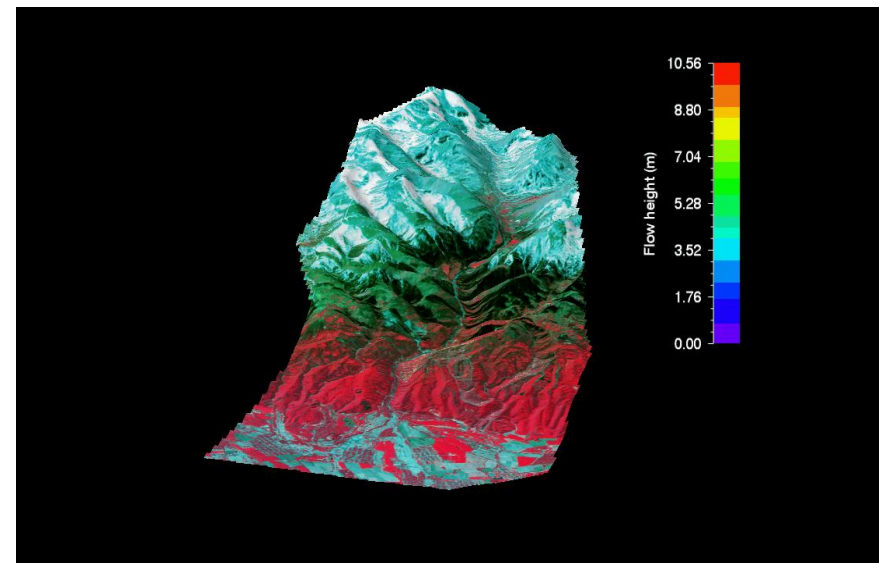


Satellite monitoring of oil in water reservoirs

Radar images were processed to monitor oil spills in the reservoirs of the RK and Azerbaijan

Space monitoring to predict and assess the situation of mudflow in Ile-Alatau

Monitoring and assessment of the mudflow regions in Ile-Alatau for the mudflow forecasting



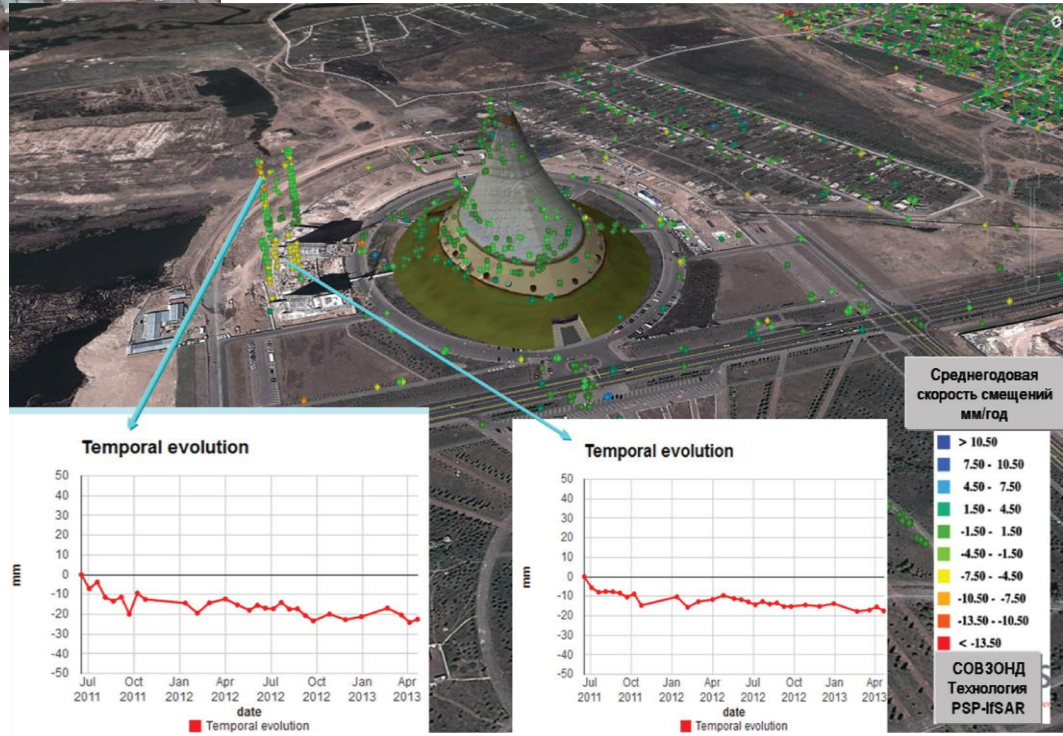


3D Zhezkazgan city

The three-dimensional model of the Zhezkazgan city was created based on the data of remote sensing and topographic maps

Vertical displacements of points of the Earth surface of the Astana city

Monitoring of the vertical displacement of the Earth's surface points in Astana was done using the interferometry method



ECOLOGICAL MONITORING SERVICE OFFICE

Together with the Faculty of Geography and Environmental Sciences we had organized the **Center of Space technologies and RS**. It was approved by Academic Council of KazNU (prot. No3 from 26.12.2016)

The MoU had signed with:

- University of Twente (Netherlands)
- Berlin Technical University (Germany)
- Embry-Riddle Aeronautical University (USA)
- Samara State Aerospace University (Russia)
- JSC «Galam» (Kazakhstan)

AGREEMENT ON ACADEMIC EXCHANGE AND COOPERATION BETWEEN AL-FARABI KAZAKH NATIONAL UNIVERSITY (REPUBLIC OF KAZ) AND TWENTE UNIV Faculty of Geo-Information Sciences (THE NETHERL)

The implementation of each program based upon this Agreement shall be regulated and agreed upon by the Parties under a separate agreement prior to the initiation of the particular program. This separate agreement will clearly describe the functions and activities to be developed, work schedule, personal profile, financing, rights and obligations of each Party, as well as the required documents necessary to determine the goals and scope of each program.

Article 1 Based on the principle of mutual benefit and Parties will foster:

- Faculty and administrative staff exchange;
- Students exchange at graduate (2 student work and undergraduate levels (3 student see Earth and Economics, Geographical Information Management (Student/semester numbers be period);
- Development and realization of joint educational double-diploma awarding (conditions to be discussed);
- Joint research activities;
- Organization of academic meetings and symposia;
- Publication of articles, reports, and other members, staff members and students in the field of Exchange of academic information, scientific data;
- Other forms of educational and scientific activities.

In order to give effect to these forms of cooperation within the two Parties will be encouraged to collaborate in any or all of the ways mentioned above.

Article 2 Prof. Anton Veldkamp Dean Faculty of Geo-Information Science and Earth Observation (ITC) University of Twente

Article 3 Prof. Anton Veldkamp Dean Faculty of Geo-Information Science and Earth Observation (ITC) University of Twente

Договор № 19/15 о прохождении практики

г. Астана «19» мая 2016

Republican State Enterprise in the capacity of «Kazakh National University named after Farabi»

г. Астана «19» мая 2016

Republican State Enterprise in the capacity of «Kazakh National University named after Farabi»

г. Астана «19» мая 2016

Article 1 Препаратив договора

В целях исполнения основной образовательной программы высшего образования и последовательности развития профессиональной деятельности студента (студентки), стороны признают целесообразность сотрудничества по видам практики практикантов (студентки) (далее – практикант).

Препаратив организует приобщение студента практики на безвозмездной основе, условия проведения практики и количество дней, направленных на выполнение работ, определяются в календарном графике, являясь неотъемлемой частью настоящего договора.

2. Обязанности Студент

Практикант обязуется:

- быть вольным, чем за один месяц до начала работ, предоставить Препаративу на выписку программу практики;
- предоставлять Препаративу на выписку календарный график, указав в нем, включая: дату рождения, возраст и курс обучения практикантов, направить практикантов для прохождения практики согласно календарному графику;

Internship contract № 19/15

Astana city May 19th 2016

Republican State Enterprise in the capacity of «Kazakh National University named after Farabi»

Article 1 The purpose of the contract is to carry out the internship of the student (intern) in the capacity of the Republican State Enterprise in the capacity of «Kazakh National University named after Farabi».

Article 2 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

СОГЛАШЕНИЕ О СОТРУДНИЧЕСТВЕ МЕЖДУ РГП «КАЗАХСКИЙ НАЦИОНАЛЬНЫЙ УНИВЕРСИТЕТ ИМЕНИ АЛЬ-ФАРАБИ» (РЕСПУБЛИКА КАЗАХСТАН) И УНИВЕРСИТЕТОМ АЭРОНАВТИКИ ЭМБРИ-РИДДА (СОЕДИНЕННЫЕ ШТАТЫ АМЕРИКИ)

г. Алматы

Article 1 The purpose of this agreement is to carry out the internship of the student (intern) in the capacity of the Republican State Enterprise in the capacity of «Kazakh National University named after Farabi».

Article 2 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 3 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 4 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 5 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 6 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 7 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 8 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 9 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

Article 10 The student (intern) is obliged to:

- be free, one month before the start of the internship, provide the preparatory work program to the preparatory work;
- provide the preparatory work to the preparatory work, indicating in it, including: date of birth, age and course of study of the interns, direct the interns for the internship according to the calendar schedule;

APPLE

Title of the project: Applied curricula in space exploration and intelligent robotic systems / APPLE

APPLE is *aimed to* adapt, modernize and restructure existing curricula in space exploration and intelligent robotic system; to develop new certified courses according to the new developments in the area, the labor market demand and the Bologna Process; to test innovated curricula and to disseminate the results. The planned curricular reform will focus on content, structure, teaching methods and use of new teaching materials with regard to the European modernization agenda for higher education.

The *mission of the project* is to introduce the applied educational program by reviewing/analyzing/upgrading the current curricula to recent advances in the target field; to develop, implement and accredit the new curricula inclusive B-learning and M-Learning; to modernize the existing and to establish the new equipped labs for effective education in frames of new educational program; retrain of academic staff/mentors in frames of new curricula; to conduct pilot teaching with the support of the stakeholders.



Updated courses within the framework of the project APPLE

SET – BA

1. **Intelligent robotic systems for space exploration** <- Space robotics

SET – MA (2 year)

2. **Optimization problems of spacecraft control** <- Celestial mechanics for space mission engineering
3. **Microprocessor technology on space systems** <- Development of space-grade embedded systems + Space electronics and remote sensing devices
4. **Digital processing of satellite data** <- Digital Signal Processing on Satellite Systems + Space electronics and remote sensing devices
5. **Modern satellite data processing packages** <- Processing and database creation for Ionosphere

IET-1 Space monitoring – MA (1,5 year)

6. **Application of GEONETCast for monitoring of environment of industrial regions** <- Processing and database creation for Ionosphere
7. **Basics of space management** <- Equipment and innovation strategy management

Updated courses within the framework of the project APPLE

IET-2 Spacecraft designing – MA (1,5 year)

8. Advanced microelectronics <- Advanced microelectronics: design of custom integrated circuits in CMOS technologies for space applications

IET-3 Mechanics of machines and manipulators, the creation of intellectual robots – MA (1,5 year)

9. Design and control of robots <- Combined robotic platform

10. Embedded processing - microcontrollers <- Embedded system and robotic education in a blended learning environment utilizing remote and virtual labs

11. Design of work of the humanoid robot <- Model based mechatronic systems modelling methodology in conceptual design stage

IET-2 Spacecraft designing – MA (1,5 year) **new subjects**

12. CAD/CAM/CAE design at space applications -> **CAD tools for design of systems on chip**

13. Spacecraft electrical system design -> **Electronic design and assembly of space systems**

14. Thermo-mechanical design of the satellites of micro- and nano- type -> **Energy efficiency of onboard systems and equipment**

Cooperation with Samara University

- **2015, December** – Associate professor of Samara University Kopenkov V.N. has read the discipline "Fundamentals of Remote Sensing" for master students
- **2016, February** – 4 master students of specialty "Space Engineering and Technologies" studied the discipline "Satellite power supply system" at Samara University
- **2016, July** – 6 master students of IET "Space Monitoring" have been training at the Institute of Additional Education of Samara University

4 11/04/2016
№6 ПОЛЁТ

Повзвщи. Достигнени

ВЫХОД В КОСМОС

Магистры из Казахстана учились в СГАУ собирать наноспутники

ТЕЛЕМЕТРИЯ

► Магистры КазНУ имени аль-Фараби

Управление международной деятельности совместно с двумя кафедрами вуза разработало образовательную программу повышения квалификации «Контроль и испытания устройств микроэлектроники космического назначения. Основы наноспутниковых технологий». Эта программа вызвала интерес у Казахского национального университета имени аль-Фараби. Две недели четверо молодых учёных КазНУ учились в Самаре.

«Перед управлением стоит задача привлечь в СГАУ магистров из-за рубежа. Начали с вузов ближнего зарубежья. Анализ запросов вузов Казахстана выявил интерес к темам наноспутников и микроэлектроники. — отметил Евгений Чурсин, начальник отдела мобильности и рекрутинга. — Так, в университете аль-Фараби — одном из лучших казахских вузов, ориентированных на космонавтику, — ведётся разработка студенческого наноспутника. А в СГАУ есть научная школа разработки и производства наноспутников, есть задел: в апреле ждем запуск нашего кубсата SamSat218. Разработанная программа получилась сильной,

конкурентоспособной: мы видим интерес к этой программе из других вузов СНГ и не только».

Программа разрабатывалась на стыке двух направлений подготовки. Она реализована учёными кафедры конструирования и технологии электронных систем и устройств и междвузовской кафедры космических исследований. В результате она охватывает широкий круг вопросов: от создания космической микроэлектроники и обеспечения её радиомощности для работы на орбите до проектирования, создания и испытаний наноспутников. Курс рассчитан на две недели.

«Развитие международной деятельности вновь набирает обороты. Теперь наряду с увеличением контингента иностранных студентов все активнее продаем нам научные разработки СГАУ за рубежом. Этому помогает создание ряда актуальных научно-образовательных программ на стыке различных областей науки. Они безусловно привлекут в Самарский университет магистров из-за рубежа. Реализованная программа — это наш первый опыт, который оказался успешным. Казахский национальный университет имени аль-Фараби, сильнейший вуз Казахстана, входит в список QS-300, отметил особую актуальность реализованной инициативы», — сказал Сергей Тит, руководитель управления международной деятельности СГАУ.

В Самару прибыли три магистра и докторант: Гулама-Гарип-Алишер Ибраев, Арман Муратбекұлы Муратбек, Ақжол Зыялдаулы Халез, Жанболат Лязат. Молодые учёные проявили серьёзную подготовку. «Мы очень быстро поняли, что гости готовы воспринимать более углублённую информацию, и скорректировали учебные планы программы», — отметил профессор Игорь Белоконов, заведующий кафедрой космических исследований.

Жанболат Лязат: «Космическая сфера в КазНУ развивается с большой скоростью. Работаем над двумя наноспутниками. Один будет решать задачи радиосвязи, другой — дистанционного зондирования Земли. В нашем университете создается лаборатория, которая будет оборудована так же серьёзно, как Центр испытаний космических аппаратов СГАУ».

«Мы планируем запуск наноспутника и как молодые специалисты понимаем, что нужны знания из различных сфер: электроники, физики космического пространства, динамики полёта», — отметил Ақжол Халез. — Поэтому были приятно удивлены количеству и качеству той информации, которую получили в СГАУ. Например, со мной поделились опытом создания электроники и бортовой аппаратуры спутников, которые только что отправили на космическом готовый спутник; успешно прошедший все испытания. Этот курс много рассказал по местам, объяснил, как нужно подходить к проектированию наноспутника, какие факторы космической

среды придётся учитывать при разработке. Мы работали в лабораториях, которые занимаются проектированием аппаратуры для малых спутников. Познакомились с учёными, которые уже побывали в космосе, узнали, как они делаются, кто их делает, из чего. Нам читали лекции специалисты ракетно-космического центра «Прогресс». Это всё очень ценно».

Арман Муратбек добавил: «Я очень остро ощутил, что в этом городе, в этом вузе началась история космонавтики, становление космической промышленности».

Наноспутник КазНУ делает Центр космических исследований и технологии Казахстана. По словам Евгения Чурсина, руководителя КазНУ заинтересовано в участии СГАУ в этом проекте. «Мы предлагаем разработать бортовую компьютер, антенные устройства», — отметил Евгений. Также рассматривается вопрос по разработке программ получения данных двух вузов — СГАУ и КазНУ.

Елена Валуурзла

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ «САМАРСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИМЕНИ АКАДЕМИКА С.П. КОРОЛЁВА»

УДОСТОВЕРЕНИЕ О ПОВЫШЕНИИ КВАЛИФИКАЦИИ

Настоящее удостоверение свидетельствует о том, что

Менхан Рүстем Талғатулы

с «18» июля 2016 года по «26» июля 2016 года повышал квалификацию в институте дополнительного образования:

«Обработка изображений, распознавание образов, работа с данными дистанционного зондирования Земли, работа с геоинформационными системами и геопорталами»

в объёме 40 часов

Ректор *И.В. Шахматов* Е.В. Шахматов
И.о. директора ИДО *С.А. Ишков* С.А. Ишков
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Город Самара Год 2016

Регистрационный номер 1270

Visit of delegation from Samara University to KazNU on 01.11.2016

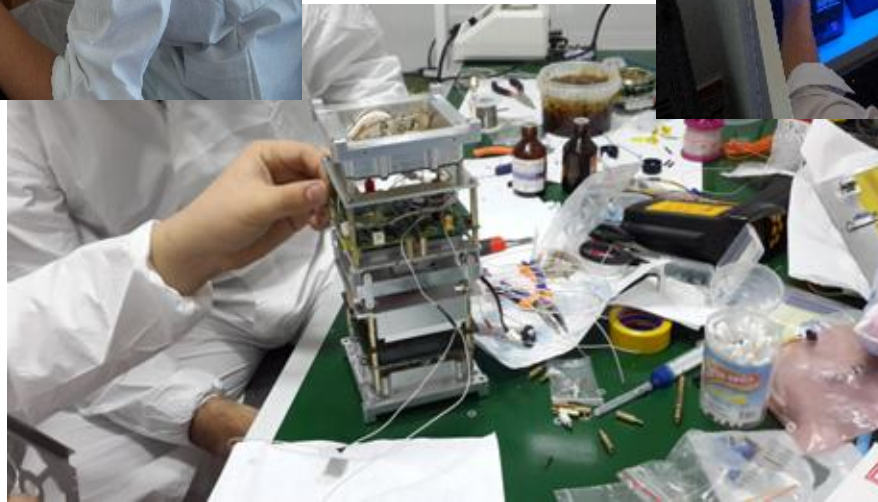


Scientific projects in KZ

- **Development of the hardware-software complex of a spacecraft and creation of the experimental sample of nano-satellite (2013-2015)**
The purpose of the Project: to develop and build software and hardware complex and create an experimental prototype made by students from Kazakhstan.
- **Development of the attitude control system of remote sensing small satellites and small satellites for scientific purposes (2015-2017)**
Goal of the Project: Development of mathematical and computer models of the attitude control system of small satellites for various purposes, upgrading of existing and the synthesis of new control laws, possible to be implemented on the planned remote sensing satellite and satellite for scientific purposes.
- **Establishment of the national scientific school on development of space engineering and technologies. Design, assembly and launch of the first nanosatellite of Kazakhstan (2015-2017)**
The Program goal: Development of the base for professional training for the space industry of Kazakhstan, development of the technology of creation, assembly and launch of the small spacecraft.

Nano-satellite «Al-Farabi-1»

The first student nano-satellite in Kazakhstan was developed by students of our specialty «Space engineering and technologies».

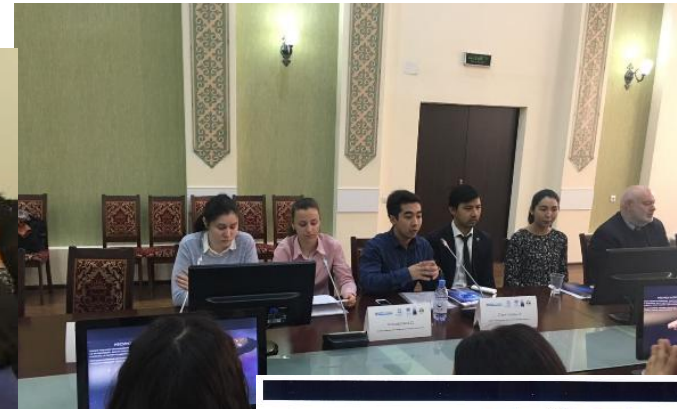


Submitted scientific projects for grant financing

- **Application of satellite altimetry data for the wave climate study of the Caspian Sea (2018-2020)**
Aims of the project: Determination of the main features of the wave climate of the North-Eastern part of the Caspian Sea and its influence on the state of the sea and the coast on the basis of the wave heights measurements. Identify the main changes of the wave climate of the Caspian Sea over the past 25 years. Obtaining a forecast of the state of the coastal regions of the Caspian Sea. Development of the recommendations for coastal building.
- **Control system design of the satellite formation motion for remote sensing of the Earth (2018-2020)**
The purpose of the project is development of the mathematical and simulation models of the motion control system for the satellite formations of the Earth remote sensing on the geostationary orbit to provide a real-time survey of the Earth's surface.

World Aviation and Cosmonautics Day with the support of the United Nations Information Office in Kazakhstan

12.04.2017





**THANK YOU
FOR YOUR ATTENTION!**