

# Growing knowledge and experience in space technology in Kazakhstan

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## Background

In the past decade the Kazakhstani National Space Agency - Kazcosmos (since 2016 Aerospace Committee of the Ministry of Defense and the Aerospace Industry of Republic of Kazakhstan) has implemented a set of space programs which has resulted in the creation and operation of space and ground segments for Telecommunication and Earth Observation Satellites. The Space Agency provides grant financial support to research institutions; space educational programs was created in cooperation with the Ministry of Education.

The beginning of the aerospace development in Kazakhstan started from the creation of the Space Research Institute in 1991 which, apart from the pursuance of basic and applied research in space technologies, coordinated the work during the development and implementation of Kazakhstani programs of scientific research and experimentation onboard of the Mir station and ISS, with the participation of astronauts T. Aubakirov, T. Mussabayev, A. Aimbetov.

JSC "National Company "Kazakhstan Gharysh Sapary" (KGS) was created in 2005 with the main objective to create space technologies in the interests of Kazakhstan. With evolving space activities the creation of the National Space Agency become necessary in 2007. With the new tasks and expansion of the organizations within Kazcosmos, the problem of the lack of skilled space industry personnel arose.



Kazakhstan



Astana,  
KazEOSat-1©2016 JSC "NC "KGS

## Training and professional development of staff members for the Space Industry of the Republic of Kazakhstan

The 'Concept of training and professional development of staff members for the Space Industry of the Republic of Kazakhstan' was prepared in 2009. It was used in the Program for the Development of Space Activities in the Republic of Kazakhstan for 2010-2014. It was planned to train about 700 specialists in the field of space activities.

The Developmental Training Centre was created in accordance with this Program, jointly with the Education Ministry was organised basic training via the creation of "Space Technique and Technology" specialty in several Kazakhstani universities.

Students of this specialty are practiced in organizations of the space industry of Kazakhstan, Baikonur and the Berlin Technical University. Annually associate professors are improved their professional skills on trainings within the framework of international projects (TEMPUS Sesremo, Erasmus + DOCMEN, Erasmus + Appl).



## Internship in leading companies

- Training and professional development in JSC NC "KGS" follows Kazcosmos's training program, and additionally through special professional training within Space Systems Creation Programs, and through being production facility for practical training of students in the specialty "Space Technique and Technology".
- Our specialists (21 person for KazEOSat1, KazEOSat2 Spacecraft and Mission Operating and 20 designers) had the opportunity to training at leading companies outside of Kazakhstan, such as Airbus in France and SSTL (Surrey Satellite Technology Ltd), a British company.
- The knowledge and experienced gained has been put into practice in the Spacecraft Operation Centres, operating the KazEOSat-1,-2 spacecrafts and mission.



## Training and professional development of staff members for the Space Industry of the Republic of Kazakhstan

By 2011 Training and Professional development had therefore been realized:

- In Kazakhstani universities (undergraduate, graduate and postgraduate studies);
- In the Developmental Training Centre for Kazcosmos space activities;
- By training in international universities and research centres via Bolashak (the Kazakhstani state system of international study programs);
- Targeted professional skills training within the frame of ongoing projects on space system creation;
- Training of Kazakhstani students at the branch of Moscow Aviation Institute (MAI) in Baikonur, Kazakhstan.

## Kazakhstani Earth Observation Satellites

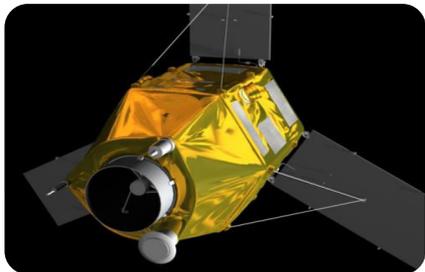
National Company “Kazakhstan Gharysh Sapary” operates the system of Earth Observation Satellites, including two EO spacecrafts, a ground control complex and a dedicated ground complex for receiving and processing satellite’s data.

The Kazakhstani EO Space System is a national system that supports Government policy and decision making in a number of key areas. These include agriculture, resource monitoring, resource management, land-use mapping and environmental monitoring, etc.



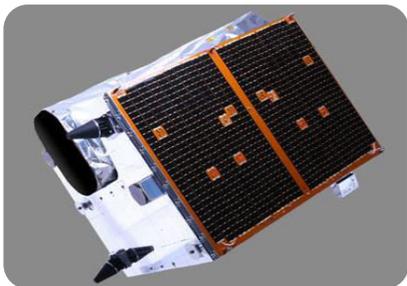
## Kazakhstani Earth Observation Satellites

### KazEOSat-1 launched in 30 April, 2014



Mission Operations	7 year operational lifetime
Launch mass	820 kg
Design orbit	SSO, altitude = 720 km
Imager GSD	1 m (Pan), 4 m (MS)
Spectral bands	4 (blue, green, red, NIR), Pan
Swath width	20 km
Observation area per day	220 000 km <sup>2</sup>

### KazEOSat-2 launched in 19 June, 2014



Mission Operations	7 year operational lifetime
Launch mass	180 kg
Design orbit	SSO, altitude = 630 km
Imager GSD	6.5 m
Spectral bands	5 (blue, green, red, red edge, NIR)
Swath width	77 km
Observation area per day	1 000 000 km <sup>2</sup>

## Mission Control Centre Activities

KazEOSat-2 is the medium resolution satellite, built upon heritage designs from the SSTL-150 class missions run by SSTL. Spacecraft Operations Centre is the control hub containing the infrastructure necessary to track, command, control and downlink data from KazEOSat-2.

- *Spacecraft Platform Maintenance*
- *Payload Maintenance*
- *Orbit Maintenance*
- *Maintaining infrastructure on the ground*

Mission Operations Centre plans and manages of satellite imaging acquisitions and processes of downloaded image data.

- *Image Tasking*
- *Planning payload operations*

•Satellite's operation team today not only performs routine operations but skillfully resolves occurring spacecraft anomalies, ground segment failures and enhances methods and facilities to efficiently monitor and control the system.



## Conclusion

The system of training and professional development of staff members for the Space Industry of Republic of Kazakhstan consists of:

- 1) Training in the Developmental Training Centre for Kazcosmos space activities;
- 2) Training, internships and advanced training of engineering and scientific personnel in the field of space activities within the framework of the international program "Bolashak";
- 3) Targeted professional training of specialists within the framework of ongoing projects to create space systems;
- 4) Scientific and educational programs on the space direction.

Space engineering and technology are in state of constant development. Kazakhstan is a country with a developing aerospace sector but does not have sufficient experience and expertise on its own. It is therefore necessary to learn from and partner with other countries and companies with leading and developed space technologies to grow our own knowledge. This is of the utmost importance in the design and launching of new satellites to replace our current ones. The opportunity of participation in international workshops, trainings and conferences is also essential for our professional employees to determine the right direction and choose the best technologies.

In general, despite the positive results of the developmental training system for Kazakhstani Space Industry engineering and research staff, there remain some problems.

The key problems are:

- Insufficient time and expertise for the creation of our own courses, experience and knowledge and lack of continuity in universities reduce the quality of engineering training.
- In employer-sponsored education, it is expected that the skilled person will work in the same position through the total project life span, with no means of further development or training.
- The poor quantity of applied projects, lack of companies working in the space industry and outside of Kazcosmos, limit employment options for young professionals.
- There is no program to support female professional development, employment and career growth.
- The general impossibility for engineering workers to participate in international conferences, academic and training workshops.

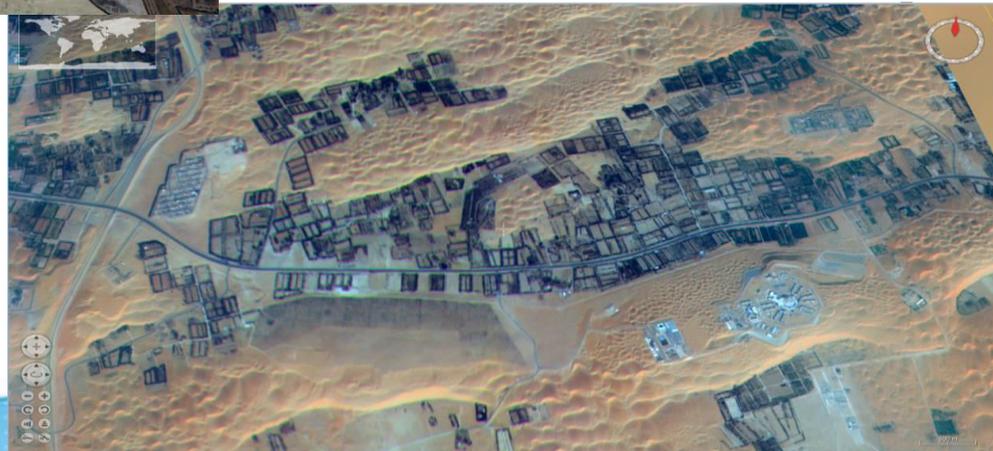
The solution of above-mentioned problems will take time and demand an improvement in the effectiveness of managing the professional training system. Agility in responding to changing circumstances, growth in the company's external credibility and improvement in the skills of engineering and academic personnel – the ultimate potential resources of the space industry - are essential for the successful completion of Kazcosmos's tasks.

## KazEOSat-2 Images of UAE

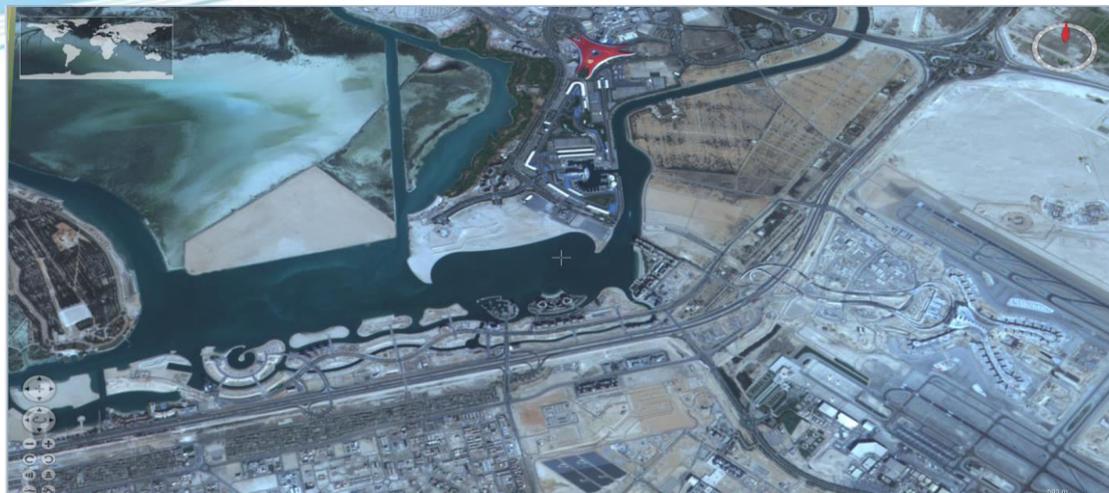


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## KazEOSat-2 Images of UAE



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**Thank you!**

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