ROADMAP 2020
(3rd stage 2017)

Vice-Rector
Vladimir Bogatyrev

March 2017, Moscow
FORMATION OF SATELLITE CONSTELLATION “AIST”

Satellite “BION-M” №1

Partner – Rocket and Space Center “Progress” (Roskosmos)

19.04.2013 AIST № 1 – Baikonur Cosmodrome

28.12.2013 AIST № 2 – Plesetsk Cosmodrome

28.04.2016 AIST-2D – Vostochniy Cosmodrome
KEY MILESTONES IN 2016

Management structure and infrastructure:
- Establishment of representation on space education at UN
- Development of 8 institutes based on SSAU and SamSU faculties

Implementation of megaprojects and national projects:
- Establishment of “Big Data” engineering center (state program “Industry development and its' competitiveness increase”)
- Project for space debris and micrometeoroids monitoring based on film sensors (Federal Targeted Program for Research and Development in Priority Areas of Development)
- QB-50 project for nanosatellite constellation establishment

Promotion:
- International Symposium being hosted by Samara University and conducted jointly with the United Nations Office for Outer Space Affairs, Samara Region Government and Roscosmos
- Delivery of MOOCs on the learning platform “Stepik” and Russian platform “Lectorium”

Concept of continuous learning:
- Establishment of laboratories and launching educational programs: “Robotics and quadcopter”, “Electronics” and “Spacecraft engineering” at Artek International Children’s Center (5000 school pupils)

Implementation of regional projects:
- Training students under the agreements with Samara region enterprises – 742 students
- Development of “Samara public transportation operator software” (up to 500 thousand enquires daily)
KEY PERFORMANCE INDICATORS

Publication activity (5 year period)

<table>
<thead>
<tr>
<th>Year Period</th>
<th>Papers (WoS fact)</th>
<th>Papers (WoS plan)</th>
<th>Papers (WoS new plan)</th>
<th>Citations (Scopus fact)</th>
<th>Citations (Scopus plan)</th>
<th>Citations (Scopus new plan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2013</td>
<td>498</td>
<td>973</td>
<td>1,236</td>
<td>1,629</td>
<td>1,119</td>
<td>1,450</td>
</tr>
<tr>
<td>2010-2014</td>
<td>578</td>
<td>1,236</td>
<td>2,177</td>
<td>2,857</td>
<td>3,407</td>
<td>3,700</td>
</tr>
<tr>
<td>2011-2015</td>
<td>828</td>
<td>1,629</td>
<td>6,500</td>
<td>4,947</td>
<td>6,700</td>
<td>6,500</td>
</tr>
<tr>
<td>2012-2016</td>
<td>1,119</td>
<td>2,177</td>
<td>14,500</td>
<td>3,700</td>
<td>3,700</td>
<td>2,956</td>
</tr>
<tr>
<td>2013-2017</td>
<td>1,450</td>
<td>2,228</td>
<td>27,800</td>
<td>2,194</td>
<td>2,194</td>
<td>2,194</td>
</tr>
</tbody>
</table>

Internationalization

Share of international faculty, %

- Fact
- Plan
- WoS
- Scopus

<table>
<thead>
<tr>
<th>Year</th>
<th>WoS fact</th>
<th>WoS plan</th>
<th>WoS new plan</th>
<th>Scopus fact</th>
<th>Scopus plan</th>
<th>Scopus new plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.4</td>
<td>0.5</td>
<td>1.0</td>
<td>1.7</td>
<td>2.0</td>
<td>2.8</td>
</tr>
<tr>
<td>2015</td>
<td>1.0</td>
<td>1.7</td>
<td>2.8</td>
<td>3.5</td>
<td>5.3</td>
<td>8.0</td>
</tr>
<tr>
<td>2016</td>
<td>2.0</td>
<td>2.8</td>
<td>4.0</td>
<td>8.0</td>
<td>9.5</td>
<td>11.0</td>
</tr>
<tr>
<td>2017</td>
<td>2.8</td>
<td>4.0</td>
<td>11.0</td>
<td>13.5</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>4.0</td>
<td>5.3</td>
<td>11.0</td>
<td>13.5</td>
<td>13.5</td>
<td></td>
</tr>
</tbody>
</table>

Share of international students, %

- Fact
- Plan

<table>
<thead>
<tr>
<th>Year</th>
<th>Fact</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>4.9</td>
<td>5.3</td>
</tr>
<tr>
<td>2015</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>2016</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>2017</td>
<td>8.0</td>
<td>9.5</td>
</tr>
<tr>
<td>2020</td>
<td>13.5</td>
<td></td>
</tr>
</tbody>
</table>

* - the result of universities merger (SSAU+SamSU)
# SAMARA UNIVERSITY RANKINGS PERFORMANCE

<table>
<thead>
<tr>
<th>Ranking</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfax University Ranking</td>
<td>51</td>
<td>21</td>
</tr>
<tr>
<td>University ranking «Expert-RA»</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>QS World University Ranking</td>
<td>873*</td>
<td>712*</td>
</tr>
<tr>
<td>QS by Subject (Physics &amp; Astronomy)</td>
<td>-</td>
<td>451-500</td>
</tr>
<tr>
<td>QS BRICS</td>
<td>151-200</td>
<td>151-200</td>
</tr>
<tr>
<td>QS EECA</td>
<td>141-150</td>
<td>101-110</td>
</tr>
<tr>
<td>THE World University Ranking</td>
<td>-</td>
<td>801+</td>
</tr>
<tr>
<td>THE BRICS &amp; EC</td>
<td>-</td>
<td>251-300</td>
</tr>
<tr>
<td>Webometrics World University Ranking</td>
<td>2413</td>
<td>1594</td>
</tr>
<tr>
<td>Webometrics Russian Federation</td>
<td>26</td>
<td>15</td>
</tr>
</tbody>
</table>

* - position without restrictions on input threshold

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**QS Analytics - Rankings Tracker | World Rankings Edition**

Prepared for Samara National Research University

Samara National Research University
Rusia | www.ssau.ru

Since 2014 SSAU has moved up 134 places Overall. The institution’s best position was at 712.
PROJECT-1: Design, manufacturing and testing of series of multifunction satellite laboratories of low mass and size, based on “AIST” and “AIST-2”

Key idea of the project:
Small satellites for big ideas!

Subject field by Scopus classification:
Aerospace Engineering

Subject field by Web of Science Core Collection subject categories:
Engineering, Aerospace

Period of project implementation:
from 2017 till 2022

The total amount of funding:
Subsidy of the Project 5-100 – 500 mln. rub. Co-financing by partners – 500 mln. rub.

Global scientific/technological challenge:
To develop space based instruments for testing advanced technologies and researching of the Earth's surface, Earth's atmosphere and outer space

Areas of achieving global excellence:
Small laboratory satellites, created on the basis of new unified space platforms of various mass and power supply capacity, enabling different data exchange intensity with the ground reception stations. Experimental small satellites (SS) have to be extremely cost-effective, but also be able to support long-term missions

Formation of the international aerospace university multilevel system:
► 2013 г. – SS «AIST» №1, №2
► 2016 г. – SS «AIST-2D»
► 2017 г. – SS «Samsat-QB50» (nanosatellite in frame of “QB50” project)
► 2019 г. – SS «AIST-T» (remote sensing)
► 2020 г. SS «AIST-M» (biomedical experiments)
► 2021 г. SS «AIST-R» (radar sensing)

Business result:
• certification of radio devices (from “industrial” to “space”)
• instruments for long-term research in space of biomedical objects
• instruments for the subsurface radar sensing of the Earth

Competitive advantage:
• united network of ground control centers
• united database of information from satellites available to all participants of the system – universities
• high reliability of “AIST” satellite platforms (confirmed service life > 3 years)
• short time of launch into the orbit

Partner organizations
Harbin Institute of Technology
Peter the Great St-P. Polytechnic University
Kazan Federal University
SRC “Progress”
PROJECT-2: Development of technologies for creating a family of energy efficient and environmentally safe biofuel burning gas turbines

Key idea of the project:
Effective technologies for alternative energy!

Subject field by Scopus classification:
Energy Engineering and Power Technology

Subject field by Web of Science Core Collection subject categories:
Energy and Fuels

Period of project implementation:
from 2017 till 2022

The total amount of funding:
Subsidy of the Project 5-100 – 400 mln. rub.
Co-financing by university – 200 mln. rub.
Co-financing by partners – 100 mln. rub.

Global scientific/technological challenge:
To solve the global scientific and technological issue of the transition to renewable energy sources and the global challenges related to the natural resources depletion and the environment deterioration

Areas of achieving global excellence:
Information technologies of design and manufacturing of energy efficient and environmentally safe biofuel-burning gas turbines

Partner organizations:

Business results
• facility for converting organic waste into electrical and heating energy
• mobile gas turbine power plants up to 400 kW capacity

Competitive advantages
• electricity cost < 0,8 rub/kW·h
• net electrical efficiency up to 36 %
• CO and NOx emissions < 5 ppm
• required design time < 2 years
• wide range of applications

Breakthrough technologies
• designing based on parametric virtual prototype
• global optimization and virtual simulation
• structuring the pollution free combustion in catalytic combustion chambers with micro-eddy matrix
• digital technologies for manufacturing of the 4th industrial revolution
• resource efficient additive manufacturing
Key idea of the project:
Photonics – “bridled light”:
We know how to steer the light.

Subject field by Scopus classification:
Electrical and Electronic Engineering

Subject field by Web of Science Core Collection subject categories:
Engineering, Electrical & Electronic

Period of project implementation:
from 2017 till 2022

The total amount of funding:
Subsidy of the Project 5-100 – 300 mln. rub.
Co-financing by partners – 165 mln. rub.

Global scientific/technological challenge:
To create a new component base for mobile information transmission, processing and remote sensing systems

Areas of achieving global excellence:
According to Elsevier SciVal system, the project members implement 8 worldclass competencies including “Beams; Lenses; Polarization”, “Transmissions; Plasmons; Metamaterials”, “Propagation; Laser beams”.
Implementation of the project will lead to further competencies emerging and strengthening

Common foundations:
Design of photonic nanostructures on the basis of the solution of Maxwell’s equations and modern nanotechnology

Competitive advantages:
• ultrafast all-optical information processing
• sharp light focusing in nanoscale regions
• ultra-compact hyperspectrometer for remote sensing systems

Partner organizations

34, Moskovskoye shosse, Samara, 443086, Russia, tel.: +7 (846) 335-18-26, fax: +7 (846) 335-18-36 www.ssau.ru, e-mail: ssau@ssau.ru
MAIN EXPECTED RESULTS IN 2018-2020

Implementation of megaprojects and national projects:
- Project for import substitution of desalination plants (in cooperation with JSC «Metallist», Resolution No. 218)
- Establishment of a laboratory for the finalization of combustion chambers for advanced gas turbine engines (in cooperation with United Engine Corporation)
- Project for development of physically based models of combustion processes (leading researcher Mebel A. M., Resolution No.220)

Promotion:
- Journal «Biomedical Photonics & Engineering» to be indexed in Scopus
- Journal «Computer optics» to be indexed in WoS
- Delivery of MOOCs on the Coursera platform

Concept of continuous learning:
- Implementation of training courses for Regional Centres for Space Science and Technology Education (affiliated to the United Nations) on satellites, navigation, Earth remote sensing
- Establishment of Center for gifted children in the areas of electronics, robotech, aerospace engineering
- All-Russian spacecraft design competition for young engineers and researchers “Sputnik” for pupils of grades (over 10 thousand participants)

Implementation of regional projects:
- Project for development of regional geoinformation system for space data processing, including ecological monitoring, geographic services, environmental monitoring and agricultural production support processes (by Order of the Samara region Government)
- Project for development of manufacturing technology for rolled stock with the desired properties from advanced Al-Li and Al-Mg-Sc alloys for Samara aerospace industry (in cooperation with VIAM and RSC Progress)
Technopolis “Gagarin-center” is the key investment project in Samara region in the area of education (according to the Strategy of socio-economic development of Samara region for the period until 2030). In 2018 it is planned to start construction of the first phase of "Gagarin-center". The University campus provided:

- research laboratories and academic buildings;
- housing for students and the faculty;
- social, cultural and sports facilities.

First phase of the construction

TOTAL AREA OF THE OVERGROUND 21300 m²
TOTAL AREA OF THE UNDERGROUND 4100 m²
ANNEX
**Small spacecraft «AIST-2M»**

**Project:** Development of technology for top-down design, engineering and experimental ground testing of advanced space instruments for Earth remote sensing with extended service life and combined rocket stages for Soyuz-2 carrier rocket for high orbits and heavy payloads.

**Alloy** | **σ_b, MPa** | **σ_0.2, MPa** |
---|---|---|
**B-1579** | 380-430 | 270-330 |
1570C | 375-400 | 245-300 |
5028 | 402 | 330 |
**AMg6** | 275-315 | 127-157 |

**Project:** Development of Rolled semi-finished products with a guaranteed level of mechanical properties of aluminum alloys Al-Mg-Sc for welded structures of advanced aerospace components.

**Project:** Development and implementation of design and manufacturing technology for high-loaded assemblies of aerospace structures made of composite material reinforced with short fibers of high strength.

**Planned co-financing funding in 2017:** 70.5 mln. RUB
**Project:** Development and pilot testing of additive technologies for the enterprises of the region

- **Swirler produced by SLS**
- **Case produced by SLS**

**Project:** Development of advanced technology to improve the efficiency of fuel combustion for gas turbine engines and power plants

**Planned co-financing funding in 2017:** 40 mln. RUB

- **JSC “Kuznetsov”**
- **JSC “Metallist”**
- **All-Russian scientific research Institute of aviation materials**

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**Project:** Development of new generation airborne and laboratory-based compact hyperspectral instrumentation.

**Project:** Development of information technologies and software system for integrated assessment and modeling the development of the territory using the remote sensing data of and GIS technologies.

*Demonstrator of a compact airborne hyperspectral camera in the visible range, based on the Offner scheme.*

*New dispersive elements with dual functionality, combining imaging and spectral distribution.*

*Planned co-financing funding in 2017: **20 mln. RUB***