

**Skoltech**

Skolkovo Institute of Science and Technology

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**MIT**  
**Skoltech**  
**Initiative**

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**INTERNATIONAL SPACE EXPLORATION  
STRATEGY GROUP**

# ADVANCING THE EXPLORATION FRONTIER

For the last forty years, human space exploration has made significant progress through international collaboration. The Apollo-Soyuz Test Project and Shuttle-Mir Programs marked the end of the Space Race, and advanced long duration spaceflight. The International Space Station (ISS) is now in its second decade as a continuously occupied human outpost in Low-Earth Orbit (LEO). While we expect productive utilization of ISS through at least 2020, there is currently no internationally recognized program for human exploration beyond LEO.

In recent years multiple reports have recommended international partners come together for strategic planning activities. However, many national government planning activities are severely limited in their consideration of international partners. Furthermore, government and industry planners may not have access to the latest technologies being developed at leading research institutions around the world. We believe an international graduate student working group is well-suited to generate and communicate the ideas that will

define exploration in the coming decades. The group will bring together the interests of all human spaceflight partners, rather than national interests subject to changing political influences. This project provides a unique opportunity for current and recent graduate student researchers to collaborate with others from around the world. Most importantly, participants will have the opportunity to influence the government and industry decision makers that define future human exploration strategy.

# ABOUT THE MIT/SKOLTECH INITIATIVE

The Skolkovo Institute of Science and Technology (Skoltech) is a private graduate research university in Skolkovo, Russia, a suburb of Moscow. Established in 2011 in collaboration with MIT, Skoltech will educate global leaders in innovation, advance scientific knowledge, and foster

new technologies to address critical issues facing Russia and the world. Applying international research and educational models, the university integrates the best Russian scientific traditions with twenty-first century entrepreneurship and innovation.

With ties to both US and Russian space research communities, this collaboration between MIT's Aero/Astro Department and Skoltech is uniquely suited to facilitate this study and disseminate it to a broad government agency and industry audience.

## LEADERSHIP



Edward Crawley

Edward Crawley is President of the Skolkovo Institute of Science and Technology (Skoltech). He received an S.B. and an S.M. in aeronautics and astronautics and an Sc.D. in aerospace structures, all from MIT.

Dr. Crawley's early research was on structural dynamics, aeroelasticity. His most recent research has focused on the architecture, design, and decision support in complex technical systems subject to economic and stakeholder constraints.

He is also a consultant on the design of actual systems. For example, he is working with the National Aeronautics and Space Administration (NASA) to design human exploration and earth observing systems. Professor Crawley has served as chairman of the NASA Technology and Commercialization Advisory Committee and as a member of the NASA Advisory Committee, the Presidential Advisory Committee on the Space Station Redesign. In 1993, he was a member of the Presidential Advisory Committee on the Space Station Redesign.

From 1996 to 2003, he was head of the Department of Aeronautics and Astronautics at MIT, during which time he directed the strategic realignment of the department.

For his service as chairman of the NASA Technology and Commercialization Advisory Committee and member of the NASA Advisory Committee, he was awarded the NASA Public Service Medal.



Edward Seidel III

Edward is a Senior Vice President for Research and Innovation at Skolkovo Institute of Science and Technology.

Edward Seidel is a distinguished researcher and international leader in scientific computing and astrophysics. He comes to Skoltech from the US National Science Foundation (NSF), where he served as the NSF Assistant Director for Mathematical and Physical Sciences (MPS).

At NSF, a USD\$7 billion US federal agency that supports research and education activities across all areas of science and engineering, Ed led the MPS Directorate, which possesses an annual budget of more than USD\$1.4 billion. Within the Directorate, he oversaw national programs in Astronomy, Chemistry, Materials Science, Mathematical Sciences, and Physics.



Alexey Ponomarev

Alexey Ponomarev has spent almost 30 years in both academia and research centers, culminating in an appointment as Deputy Minister for Education and Science of the Russian Federation in 2010. He has also been a board member of several of Russia's largest industrial companies and played an integral role in the reorganization of the country's aviation industry. In 1982 after graduating from Moscow Institute of Physics and Technology, Alexey began building ties within Russian academia and government as a researcher and lab director at the Defense Research Institute. After 10 years, he became general director for the Interdepartmental Analytical Center and continued in that position until 2010. At the Center Alexey oversaw research and analytical support in economics, innovation, industry, science and technology, and foreign economic policy. In 1998, he made his first steps into industry by becoming the First Deputy General Director for Tupolev. In 2005, he served as Vice President of the United Aircraft Consortium, executing a merger to establish the United Aircraft Corporation, or UAC. Upon the creation of the UAC, Alexey became the Development Director of Transportation Aircraft within UAC until 2008 when he shifted focus to the United Engine Corporation as Deputy General Director of Strategy, charged with turning the company into one of the top 5 world producers of turbine engines for aircraft. Alexey also taught at the Higher School of Economics in the department for restructuring and development of industries, and he has been awarded the Order of Honor and given the rank of Honored Science and Engineering Worker of the Russian Federation.

## ORGANIZING COMMITTEE



Jonathan Battatt

Jonathan Battatt received his undergraduate degree in Mechanical Engineering from Columbia University, a Master's of Science in Space Management from the International Space University, and a master's in aero/astro from MIT. Jonathan is particularly interested in the future of human spaceflight and has worked on different aspects of this topic at a private space company, under the guidance of former astronaut Dr. Buzz Aldrin, and at the Aerospace Corporation. His graduate research focused on developing tools to evaluate technology development projects through system architecture tradespace analysis for NASA. He is currently an employee of MIT developing collaborative projects related to future space exploration in partnership with the Skolkovo Institute of Science and Technology.



Yaroslav Menshenin

Yaroslav Menshenin graduated from the Department of Theoretical Physics of the National University of Science and Technology «MISIS», Moscow, Russia. He is also graduated from Singularity University, California, USA. He had been studying Global Grand Challenges, focusing on Space Challenges, and had been starting the zero-g project.

He works at the Center for Entrepreneurship and Innovation of the Skolkovo Institute of Science and Technology.

Before joining Skoltech Yaroslav served at Science Department of the Russian Federal Space Agency, where he have been involved in the project of radiation protection spacecrafts.

Yaroslav is also founded educational Space course called «Technological entrepreneurship in Space sector».



Peter Davison

Peter is currently pursuing a Masters in Aerospace Engineering at the Massachusetts Institute of Technology. He is a student in the System Architecture Lab at MIT with a research focus on technology development and architecture selection for complex systems, with a focus on space systems. Before coming to MIT Peter received his B.S. in Mechanical and Aerospace Engineering from Princeton University where he undertook research in distributed control of mobile sensor networks along with spacecraft attitude determination algorithms. Outside of class and research Peter enjoys playing a variety of sports (especially rugby and basketball), travelling, and spending time with friends and family.



Brendan Smith

Bachelor's Degree from MIT Aeronautics and Astronautics Department. Master's Degree from Space Systems focus area of System Design for Operational Effectiveness (SDOE) Program at Stevens Institute of Technology. 5 years work experience at Orbital Sciences Corporation in satellite integration, testing, and launch operations, as well as in liquid launch vehicle development, testing, and verification. Worked on Intelsat-11, Intelsat-15, Measat-3a, Thor 5, AMC-21, Dawn, AIM, NuStar, Glory, Horizons-2, and Antares programs. Supported launch operations onsite at Guiana Space Center for Intelsat-11 and Horizons-2 and at Baikonur Cosmodrome for Thor 5 and Measat-3a. Worked on test and verification of Antares 1st stage main engine, NK-33/AJ26-62 manufactured by Samara Science and Technology Complex. Staff member at Skolkovo Institute of Science and Technology since March 2012.

## PARTICIPANTS



Koki Ho

Koki Ho is a Ph.D. Candidate at Massachusetts Institute of Technology. He has his master's and bachelor's degrees from the University of Tokyo. He has involved in small satellite project, Nano-JASMINE, as both a thermal subsystem engineer and an ACS engineer. In his thesis project, he developed software and hardware for star trackers that can be used for small satellites. He also participated in the ACS system design of a Mercury spacecraft, Bepi-Colombo, as an intern in EADS-Astrium, Germany. His current research interest includes space systems, small satellite systems, and space logistics, and his Ph.D. research aims to find the optimal deployment strategy of space logistics infrastructure including ISRU plants and depots.



Laura Delgado Lopez

Laura M. Delgado López is the Earth observations associate at the Institute for Global Environmental Strategies (IGES), a non-profit located close to Washington, DC that specializes in Earth and space science education, outreach and environmental information.

Of note are her recent positions as a researcher with Project Ploughshare's Space Security Index and as a correspondent for SpacePolicyOnline.com since 2009. Her previous experiences include the Center for Strategic and International Studies and the National Academy of Sciences.

Ms. Delgado López's recent research has focused on emerging space programs in Latin America, public perception and communication of space activities, and the link between science fiction and space policy. She recently completed a master's degree in international science and technology from the George Washington University's Space Policy Institute, where she was a 2009 Truman Scholar and a Northrop Grumman Fellow. She also holds a bachelor's in political science from the University of Puerto Rico.

Her professional affiliations include: Board Member, American Astronautical Society (AAS); Member, Society and Aerospace Technology Technical Committee and International Activities Committee, American Institute for Aeronautics and Astronautics' (AIAA); Member, American Association for the Advancement of Science (AAAS); and Member, American Meteorological Society (AMS).



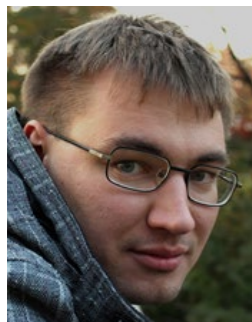
Alexander Burg

Alexander Burg (Alex) hails from Dobbs Ferry, NY, USA; a small village just outside of New York City. He is a Ph.D. student in the Engineering Management & Systems Engineering program at the George Washington University's School of Engineering and Applied Science in Washington, DC, USA. He holds a Bachelor's degree in Physics from MIT with a focus in astronomy and astrophysics and a Master's Degree in Applied Physics from Johns Hopkins University with a focus on Space Systems. Before starting at GW, Alex worked for nearly four years at Applied Research & Engineering Sciences (ARES) Corporation, specializing in risk analysis for NASA, the US Air Force, the US Navy, and Orbital Sciences. Alex is currently interning for the summer at the NASA Jet Propulsion Laboratory (JPL) in Pasadena, CA, USA, where he is researching the inter-relationships between technology development and mission sequencing for NASA's Planetary Science Division. His hobbies include amateur astronomy and playing and watching baseball and his favorite show is Aqua Teen Hunger Force.



Jonathan Mihaly

Jonathan (Jon) Mihaly received his PhD in Aerospace at the California Institute of Technology in 2013. During his thesis work, Jon developed a hypervelocity impact facility with concurrently operated diagnostics to characterize multiple impact phenomena in a single experiment. For his dissertation, he also developed an optical technique to characterize debris clouds produced in hypervelocity impacts. While at Caltech, Jon co-founded the Caltech Space Challenge: a five-day international student mission-design competition. Before his doctoral studies, Jon received a MS in Aeronautics at Caltech in 2008 and a BS in Aerospace Engineering from Syracuse University in 2007. Jon also participated in the NASA Academy at Ames for Space Exploration first as a student and then as a program manager. Besides space exploration, Jon's other interests include hiking, skiing, and photography. Jon is originally from Foxborough, Massachusetts in the United States.



Ivan Romodanov

I graduated from Bauman Moscow State Technical University at 2009, major is «Rocket engines». Thesis theme is «Two modes rocket engine on three components propellant». In 2010 I received additional specialty in the same University, qualification: «Developer of professional oriented systems». Thesis theme: «Software for control panel of test stand».

I obtained a certificate in Novosibirsk State University on program "Physics of high temperature plasma in open magnetic systems" in 2010.

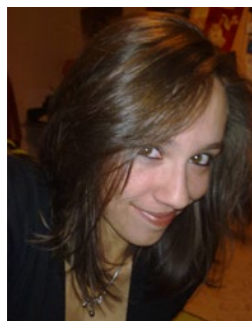
In 2009-2010 I have worked in Research Institute of Applied Mechanics as a team leader of Software development group. Mainly we developed software for stands to test final products (gyroscopes).

In 2010-2011 I worked for «Ultrafast Systems LLC» company, which is located in US, in research projects connected with photochemistry and ultra-fast spectroscopy.

Currently I am working in Samsung SDI Company, Core Technology Lab, CAE team, as a researcher. Mainly my job connected with Battery Management Systems and algorithm development for such systems.

I participated in experiments conducted on the installation for Field Reversed Configuration formation with in the Lebedev Physical Institute of the Russian Academy of Science.

Major research interests focus on plasma physics, numerical modeling, space propulsion, algorithm development, electro-chemical systems.



Valentina Lo Gatto

Born in Vibo Valentia, south Italy, the 9th of September 1988, she has dreamed of becoming an astronaut since she was a child. The charm that space has always exerted on her took her far from home at the age of eighteen in order to attend the studies of Aerospace Engineering at the University of Rome La Sapienza.

In Rome Valentia discovered a particular interest in the field of Space Missions and achieved her BE, graduating with 110/110, with a thesis on the exploration of a Galilean satellite (title: «A probe to explore the subsurface ocean of Europa»). She is determined and passionate, sunny as the place where she was born.

With a predilection for foreign languages, she began learning English and German when she was in high school and for three years she is studying Russian. Other hobbies are reading, travelling and sport - particularly running and horse riding.

Currently she lives in Rome where she is completing her Master Degree in Space Engineering focusing her researches in the areas of Space Missions and Space Systems Design, in particular for what concern: Interplanetary Trajectories Optimization, Space Environment and Instrumentation and Advanced In-Space Propulsion.



Paul Nizenkov

Paul Nizenkov is about to graduate in Aerospace Engineering with a Diploma degree from the University of Stuttgart, Germany. While working at the Institute of Thermodynamics and Institute of Space Systems, Paul was able to gather experience in the numerical simulation of supersonic combustion and re-entry. As part of his Diploma thesis, Paul conducts research on mixing and combustion efficiency of a SCRamjet model combustor.

After his studies abroad at the University of Maryland in USA, he participated in the Space Studies Program 2012 at the International Space University. The program combined lectures, workshops and a team project at the Florida Institute of Technology and Kennedy Space Centre. The team project, bringing together 34 participants from 19 countries, was on devising a network of spaceports in the inner solar system.

Moreover, Paul participated in several workshops like the Caltech Space Challenge concerned with the preliminary design of spacecraft and missions for space exploration in a demanding time frame. In his spare time, Paul enjoys spending time with friends and sports like soccer and basketball.



Emanuele Capparelli

Emanuele Capparelli is a space engineering student at La Sapienza University of Rome. His primary areas of study are system engineering and space propulsion. Emanuele worked in partnership with ELV on the system architecture of a new evolution of the VEGA launcher for his bachelor degree's thesis. He is now completing his master degree and working as intern for German Aerospace Center in Bremen at the Institute for System Engineering. His latest works include design of a navigation and communication infrastructure for robotic missions on the Moon and mission analysis and design for robotic exploration of Mars underground caves.



Victor Leonov

Victor Leonov was born on May 5, 1985, in Moscow, Russia. He graduated with honors from the Bauman Moscow State Technical University (BMSTU) in 2008. His specialty is Spacecrafts and Rocket Boosters. He earned his Ph.D. in applied mathematics from BMSTU in 2011.

Victor is currently associate professor at Department of Spacecrafts and Rocket Boosters of BMSTU and engineer at Perspective Space Technology Laboratory of Special Machinery Engineering Research and Educational Complex of BMSTU. He has some lecture and seminar classes: Spacecraft Thermal Condition, Mathematical Modeling of Technical Systems, Spacecraft and Rocket Constructions.

Victor is author of 1 monograph and over 30 research papers, mainly in conference papers and refereed journals. His areas of interest are: solar energy, heat transfer, spacecraft and rocket constructions, mathematical modeling, earth remote sensing and more.



Luis Zea

Luis works on space life sciences experiments sent to the International Space Station both on the engineering and the science sides. His engineering background includes a B.S. in Mechanical Engineering from Universidad del Valle de Guatemala, and an M.S. in Aerospace Engineering from University of Central Florida (UCF). He has also worked for ExxonMobil as a mechanical engineer, for UCF as a CO2 removal research project manager and for Siemens Energy, Inc. as a heat transfer engineer. As a Ph.D. candidate in Bioastronautics from University of Colorado, Boulder, Luis has made the leap from purely engineering projects to science, namely, gravitational microbiology. This program has allowed him to understand the requirements humans create on a space exploration missions and possible ways to meet these necessities.

During his masters he worked on a cubesat, on gas kinetics research and he was crew engineer for the Mars Desert Research Station Crew 65. During his Ph.D., Luis managed a graduate project to develop a cockpit architecture for the Dream Chaser and has been selected as a commercial astronaut candidate by Astronauts4Hire.

Luis is a scuba diver, a lifeguard, and fluently speaks German, Spanish, Portuguese and English plus basic French.

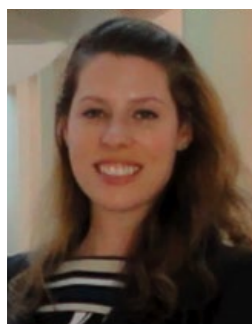


Oleg Mansurov

Oleg Mansurov is student of National University of Science and Technology «MISIS» Moscow, Russia. He receives degree of the specialist in Department of Ecotechnology and Engineering.

Oleg early research was on material science, manufacturing and mining in space, economy of precious metals. His most recent research has focused on the architecture, design, and strategy planning in Ministry of Economic Development of Russian Federation and in Joint Stock Company ALROSA.

He is also alumnus of Open University Skolkovo, where mastered courses in Entrepreneurship in Space and Creation of Foresights, and ended Program of Technological entrepreneurship in Moscow Institute of Physics and Technology.



Sara Langston

Sara M. Langston is an aerospace lawyer and consultant. Having recently relocated to Australia, Ms. Langston is currently teaching science and ethics courses at the University of Sydney where she is also pursuing a Ph.D. Originally from California, she obtained her Bachelors in Politics and History in 2003, a Doctor of Jurisprudence with a specialization in International Law in 2006, and a Master of Laws in Air and Space Law in 2008. In addition, Ms. Langston is an alum of the ISU Space Studies Program 2009 and is a member of the New York Bar.

Ms. Langston has served in various roles and industries across the United States, Europe, and Australia. Starting with a technical background in military aviation from the U.S. Army, she has worked at law firms, non-profit organizations, research institutes, academia, and independently as a consultant. Recently, she taught space law at the University of Mississippi's Center for Remote Sensing, Air, and Space Law. Her current topic of research pertains to the History and Philosophy of Science with regard to human spaceflight and space transportation. Her interdisciplinary research interests include the interplay of humanity and society with regard to space science and technology.

## INVITED GUESTS



Sergey Zhukov

Executive Director of the Space Technology and Telecommunications Cluster of Skolkovo Foundation



Vyacheslav Turyshev

Research Scientist at JPL NASA



Yuri Koptev

Chairman of the Science and Engineering Council.  
1992 – 2004, General Director of the Russian Space Agency



Mikhail Kokorich

Founder and President of Dauria Aerospace



Oleg Alifanov

Dean of Aerospace Faculty of Moscow Aviation Institute



**Dmitry Payson**

Director of Development of the Space Technology and Telecommunications Cluster of Skolkovo Foundation

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**Suni Williams**

Astronaut and Head of NASA Operations at Star City

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**Vitaly Davydov**

Deputy Director of the Center for Advanced Studies

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**Mikhail Marov**

Academician of Russian Academy of Science

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**Sergey Nedoroslev**

Kaskol Chairman

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**Vladimir Gershenson**

President of R&D Scanex

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**Vladimir Khalimanovich**

Director of the Industrial Center for Large-Sized Foldable Mechanical Structures at JSC «Academician M.F.Reshetnev Information Satellite Systems»

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