

# INTERNATIONAL SPACE MEDICINE SUMMIT 2016

November 3–6, 2016 • Rice University's Baker Institute for Public Policy • Houston, Texas



RICE UNIVERSITY'S  
**BAKER  
INSTITUTE**  
FOR PUBLIC POLICY



Baylor  
College of  
Medicine



**ENGINEERING**  
TEXAS A&M UNIVERSITY



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## *About the Event*

As we continue human space exploration, much more research is needed to prevent and/or mitigate the medical, psychological and biomedical challenges spacefarers face. The International Space Station provides an excellent laboratory in which to conduct such research. It is essential that the station be used to its fullest potential via cooperative studies and the sharing of equipment and instruments between the international partners. The application of the lessons learned from long-duration human spaceflight and analog research environments will not only lead to advances in technology and greater knowledge to protect future space travelers, but will also enhance life on Earth.

The 10th annual International Space Medicine Summit on November 3–6, 2016, will bring together the leading physicians, space biomedical scientists, engineers, astronauts, cosmonauts and educators from the world's spacefaring nations for high-level discussions to identify necessary space medicine research goals as well as ways to further enhance international cooperation and collaborative research. All ISS partners will be represented at the summit.

The summit is co-sponsored by the Baker Institute Space Policy Program, Texas A&M University College of Engineering, Baylor College of Medicine and the Boeing Company.

## *Organizing Partners*

### Rice University's Baker Institute for Public Policy

The mission of the Baker Institute is to help bridge the gap between the theory and practice of public policy by drawing together experts from academia, government, media, business and nongovernmental organizations. By involving policymakers, scholars and students, the institute seeks to improve the debate on selected public policy issues and to make a difference in the formulation, implementation and evaluation of public policy, both domestic and international. The Baker Institute is an integral part of Rice University, one of the nation's most distinguished institutions of higher education. The efforts of Baker Institute fellows and affiliated Rice faculty focus on several ongoing research projects, details of which can be found on the institute's website, [www.bakerinstitute.org](http://www.bakerinstitute.org).

### Baker Institute Space Policy Program

By virtue of a long-standing tradition of collaborative projects between NASA and Rice University, the Baker Institute Space Policy Program is distinctively positioned to influence the national and international debate on the future of manned and unmanned space exploration, commercial space efforts and international cooperation in space. Over 50 years ago, in a speech delivered at Rice University, President John F. Kennedy called for a great national effort to put a man on the moon by the end of the decade, declaring, "The exploration of space will go ahead, whether we join in it or not, and it is one of the great adventures of all time, and no nation which expects to be the leader of other nations can expect to stay behind in the race for space." Today, America's pre-eminent role in space is being challenged both internationally and domestically. Space policy has become a prominent and contentious public policy issue. The future of America's space program is at a critical point in time; decisions are being made that will affect not only our national security but also our ability to successfully compete with other countries in the commercial use of space.

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## Texas A&M University College of Engineering

Engineering has been a part of Texas A&M University since its inception in 1876 as the Agricultural and Mechanical College of Texas. Today, the College of Engineering is the largest college on the Texas A&M campus, with more than 350 faculty members and more than 15,000 engineering students in our 14 departments. The college is consistently ranked among the nation's top public programs and is also among the top universities in the number of National Merit Scholars, nationally recognized faculty and funded research.

As a major department within the Texas A&M University College of Engineering, Aerospace Engineering is among the top programs in the United States providing unique cutting-edge educational and research opportunities, including space exploration, national defense, air transportation, communications and sustainable energy. With an enrollment of nearly 500 undergraduate and 115 graduate students, we offer a modern curriculum that is balanced across the three principal disciplines of aerospace engineering: Aerodynamics and Propulsion, Dynamics and Control, and Materials and Structures. The program also benefits from strong connections to major aerospace industries, the Department of Defense and NASA.

## Baylor College of Medicine

Baylor College of Medicine is committed to being a national leader in advancing human health through the integration of patient care, research, education and community service. The college pursues this mission by promoting patient care of the highest standard, advancing basic and clinical biomedical research, sustaining educational excellence, and fostering public awareness of health and the prevention of disease. Since its founding in 1900, Baylor has grown into an internationally respected medical and research institution. Baylor offers patient care services through several of its Texas Medical Center affiliate hospitals and clinics, with more than 152,000 inpatient visits and 2.2 million outpatient visits annually. The college has more than 70 research and patient-care centers and units. More information can be found on the school's website, [www.bcm.edu](http://www.bcm.edu).

## Boeing

Boeing Space Exploration, headquartered in Houston, is a leading provider of human spaceflight and space exploration systems and services. Since the dawn of the Space Age, Boeing has designed, developed, built and operated human and robotic space vehicles as well as supporting hardware. The Boeing legacy began with the X-15 hypersonic aircraft, spanned the Gemini, Mercury, Apollo, Skylab and Shuttle programs, and continues with today's Space Launch System, International Space Station and Commercial Crew programs. As NASA's prime contractor for the space station, Boeing provides research integration, key engineering support services, end-to-end subsystem management, sustaining operations, hardware and software integration, and maintenance for the utilization of the station by NASA and its international partners. The International Space Station is advancing scientific knowledge in Earth, space, physical and biological sciences, for the benefit of humanity.

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## *Participating Organizations*

Association of Air Medical Services (AAMS)  
Association of American Medical Colleges (AAMC)  
Association of Space Explorers (ASE)  
Athena Global  
Bauman Moscow State Technical University  
(Bauman MSTU)  
Baylor College of Medicine (BCM)  
Boeing Space Exploration  
Boise State University  
Canadian Space Agency (CSA)  
China Astronaut Research and Training Center (ACC)  
Commonwealth Scientific and Industrial Research  
Organisation (CSIRO)  
Gagarin Cosmonaut Research and Training Center (GCTC)  
German Aerospace Center (DLR)  
European Space Agency (ESA)  
Foundation for International Space Education (FISE)  
Harvard University  
Hawaii Space Exploration Analog & Simulation (HI-SEAS)  
Henry Ford Health System (HFHS)  
Indian Space Research Organization (ISRO)  
Institute for Biomedical Problems (IBMP)  
International Space School Educational Trust (ISSET)  
Japan Aerospace Exploration Agency (JAXA)  
Johns Hopkins School of Medicine  
King's College London  
Lunar and Planetary Institute (LPI)  
Massachusetts Institute of Technology (MIT)  
The Methodist Hospital (TMH)  
Moscow State University  
The Museum of Flight  
National Aeronautics and Space Administration (NASA)  
National Institutes of Health (NIH)  
National Space Biomedical Research Institute (NSBRI)  
Rice University  
Rice University's Baker Institute for Public Policy  
Russian Academy of Sciences (RAS)  
Russian Federal Space Agency (ROSCOSMOS)  
SciArt Exchange  
Stanford University  
Swansea University  
Texas A&M University College of Engineering  
Tietronix/Safetronix  
UK Space Agency  
Universities Space Research Association (USRA)  
University College London (UCL)  
University of Geneva  
University of Houston (UH)  
University of Maryland  
University of Michigan  
University of Delhi, India  
University of Pennsylvania  
University of Roma Tor Vergata  
University of Southampton  
University of Wollongong, Australia  
The University of Texas Health Science Center at Houston  
(UTHSC)  
The University of Texas Medical Branch at Galveston  
(UTMB)  
The University of Texas Southwestern Medical Center  
at Dallas (UTSW)  
Wyle

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## Conference Agenda

### Thursday, November 3

1800      Opening Reception  
BioScience Research Collaborative, Rice University

### Friday, November 4

0800      Continental Breakfast

#### Welcome, Introductions and Opening Remarks

0830      **The Honorable Edward P. Djerejian**  
Director, Rice University's Baker Institute for Public Policy

**George W.S. Abbey**  
Senior Fellow in Space Policy, Rice University's Baker Institute for Public Policy

**Jeffrey Sutton**  
President and CEO, National Space Biomedical Research Institute

#### Opening Address

Introduction: George W.S. Abbey, Baker Institute

0845      **Thomas Reiter**  
Director, Human Spaceflight and Operations, European Space Agency

#### Panel I — Lunar Exploration

Introduction: George W.S. Abbey, Baker Institute

0915      **Moderator:** Leroy Chiao, Astronaut

##### Panelists

Bonnie Dunbar, Astronaut  
Oleg Kotov, Cosmonaut  
Michael Lembeck, CEPStone LLC  
Lee Morin, Astronaut  
Thomas Reiter, ESA  
Salizhan Sharipov, Cosmonaut  
Thomas Stafford, Astronaut

##### Topics

- Current plans for the program and plans for international cooperation
- Future human spaceflight activities

##### Discussion and Summation

1045      Break

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## Panel II — Maximizing the Use of the International Space Station

Introduction: Jeffrey Sutton, NSBRI

1100

**Moderators:** Dan Burbank, Astronaut; and Oleg Kotov, Cosmonaut

### Panelists

Michael Barratt, Astronaut  
Joe Dervay, NASA  
Mark Mulqueen, Boeing  
Dava Newman, NASA  
Irina Ogneva, IBMP  
Bill Paloski, NASA  
Koichi Wakata, Astronaut

### Topics

- Sharing facilities and data
- Cooperative research
- Effective utilization and sharing of crew time

### Discussion and Summation

## Luncheon

Introduction: Leroy Chiao, Astronaut

1230

### Transmission from Space

Video Presentation

1300

### Live Connection with Canadian Forces Arctic Research Station

## Panel III — One-Year Mission

Introduction: Graham Scott, NSBRI

1330

**Moderator:** John Charles, NASA

### Panelists

Michael Barratt, Astronaut  
Stevan Gilmore, NASA  
Vadim Gushchin, IBMP  
Oleg Kotov, Cosmonaut  
Mikhail Kornienko, Cosmonaut  
Salizhan Sharipov, Cosmonaut

### Topics

- Science planned and science accomplished
- Significant results
- Subsequent research planned for both sexes
- Possible future one-year and/or two-year studies

### Discussion and Summation

1530

Break

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## Panel IV — Twin Studies

Introduction: John Charles, NASA

1545

**Moderator:** Michael Barratt, Astronaut

### Panelists

Mathias Basner, University of Pennsylvania School of Medicine  
Stevan Gilmore, NASA  
William Paloski, NASA  
Victor Schneider, NASA  
Graham Scott, NSBRI  
Scott Smith, NASA  
Michael Snyder, Stanford University

### Topics

- Research objectives and challenges
- Ethical considerations relative to data
- Results and lessons learned
- Past lessons and results from twin studies
- OMICS studies

### Discussion and Summation

1700

Reception

## Dinner and Evening Address

Introduction: Bonnie Dunbar, Astronaut

1730

**Dimitris Lagoudas**

John and Bea Slattery Chair of Aerospace Engineering, Texas A&M University

Select pieces on display from the “Humans in Space” Youth Art Competition

The international **Humans in Space Youth Art Competition** encourages youth to “be inspired, creative and heard.” It asks them to think about the future of human spaceflight and to creatively communicate their ideas, and promises to make these ideas viewable worldwide. By including the next generation in the planning of the future, the competition aims to enhance their awareness, interest and support for human spaceflight and to allow their ideas to begin shaping the future now.

### International Competition — Opening November 2016

**CineMars**, a partnership between NASA and the nonprofit SciArt Exchange, is a global short video and visual art competition inviting high school students, college students and early career professionals to visualize the Journey to Mars. Submissions will be judged by a team of cinematography and graphics industry professionals and astronauts. The winning entries will be screened on “opening night” at all NASA visitor centers, museum consortium members, and other interested venues.

To foster interest in your area about Mars exploration, please encourage local participation in the competition or offer to host an artwork exhibit. For more information, contact [info@SciArtExchange.org](mailto:info@SciArtExchange.org).



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## *Saturday, November 5*

0800 Continental Breakfast

### Panel V — Nutrition Considerations for Spaceflight

Introduction: Richard Jennings, UTMB

0830 **Moderator:** Nicole Stott, Astronaut

#### **Panelists**

Leroy Chiao, Astronaut  
Grace Douglas, NASA  
Vickie Kloeris, NASA  
Oleg Kotov, Cosmonaut  
Douglas Paddon-Jones, UTMB  
Salizhan Sharipov, Cosmonaut  
Scott Smith, NASA

#### **Topics**

- Food as an effective countermeasure to the impacts of the space environment
- Potential food solutions for the countermeasure and psychological challenges associated with longer duration space exploration missions

#### **Discussion and Summation**

1000 Break

### Panel VI — 50th Anniversary of the Gemini Program: Precursor to Apollo

Introduction: George W.S. Abbey, Baker Institute

1015 **Moderator:** Glynn Lunney, NASA

#### **Panelists**

Charles Berry, NASA  
Bill Carpentier, Astronaut  
Gerry Griffin, Astronaut  
Thomas Stafford, Astronaut

#### **Topics**

- Challenges and achievements
- Lessons learned
- Contributions to the success of Apollo

#### **Discussion and Summation**

### Luncheon and Address

Introduction: George W.S. Abbey, Baker Institute

1145 **Charles F. Bolden, Jr.**  
Administrator, NASA



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## Panel VII — Radiation

Introduction: Jeffrey Sutton, NSBRI

1300

**Moderator:** Graham Scott, NSBRI

### Panelists

Michael Barratt, Astronaut  
Susan Bloomfield, Texas A&M University  
Jeff Chancellor, Texas A&M University  
Dorit Donoviel, NSBRI  
Jeffrey Jones, BCM  
Eddie Semones, NASA

### Topics

- Increased risks with mission lengths
- Mitigating risks
- Shielding for protection and countermeasures
- Long-term radiation effects on brain performance

### Discussion and Summation

1415

Break

## Panel VIII — Education and STEM Advances

Introduction: George W.S. Abbey, Baker Institute

1430

**Moderators:** Karl Doetsch, Athena Global; and Bonnie Dunbar, Astronaut

### Panelists

Olga Bannova, UH  
Heather Domjan, UH  
Francisco Fusco, FISE  
Amanda Hackler, NSBRI  
Michael Lembeck, CEPStone LLC  
Jancy McPhee, SciArt Exchange  
Andrew Turnage, ASE

### Topics

- Stimulating interest in science and engineering education
- Benefits of an international educational program
- Catalysts for creating young students' interest in science and engineering
- Benefits and opportunities for student exchange programs
- SPHERES

### Discussion and Summation

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## Panel IX — Cooperative Use of Analogs

Introduction: Graham Scott, NSBRI

1500

**Moderator:** Nicole Stott, Astronaut

### Panelists

Michael Barratt, Astronaut  
David Dinges, NSBRI  
Vadim Gushchin, IBMP  
Oleg Kotov, Cosmonaut  
Graham Scott, NSBRI

### Topics

- Application of remote expeditions to human performance
- Necessity for high fidelity and realistic analogs to simulate spaceflight

### Discussion and Summation

## Discussion Groups

The discussion groups provide an opportunity for all participants to collaborate with a group leader on an assigned topic. Each group will be tasked with developing a written report on their topic, to be presented Sunday morning.

Your group assignment can be found on your name tag. If you do not find a letter on your name tag, please check with our staff.

1600

### Group A

Cooperative Research

**Team Leaders:** Dan Burbank, Astronaut; and Oleg Kotov, Cosmonaut

### Group B

Cooperative Use of Analogs

**Team Leader:** Graham Scott, NSBRI

### Group C

Education

**Team Leaders:** Karl Doetsch, Athena Global; and Bonnie Dunbar, Astronaut

## Reception and Dinner

Introduction: George W.S. Abbey, Baker Institute

1800

### Bonnie Dunbar

Director, Institute of Engineering Education and Innovation,  
Texas A&M Engineering Experiment Station (TEES)

Music by Rice University's Shepherd School of Music Ensemble

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## *Sunday, November 6*

0830 Continental Breakfast

### Discussion Group Reports

0900 **Group A**  
Cooperative Research

**Group B**  
Cooperative Use of Analogs

**Group C**  
Education

### Closing Remarks

1100 **Jeffrey Sutton**  
President and CEO, National Space Biomedical Research Institute

**George W.S. Abbey**  
Senior Fellow in Space Policy, Rice University's Baker Institute for Public Policy

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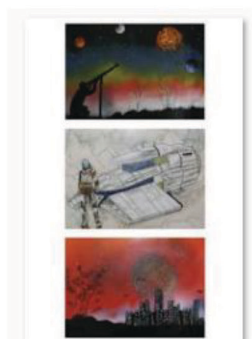
## Humans in Space Art Program Youth Art Competition

The international competition invites young people to think about the future of human spaceflight and creatively communicate their ideas. In return, we promise to make their ideas viewable worldwide. By including the next generation in the planning of the future, the competition enhances their awareness, interest in and support for human spaceflight and allows their ideas to begin shaping the future now.

[www.SciArtExchange.org](http://www.SciArtExchange.org)



Found Life  
Himaprabal Goud, 15 years old, India



2nd Planet With Life/  
1st Landing On Another Planet/  
A City On Another Planet  
Emilian Ailenei, 16 years old, Romania



BEAM: Base Exploration Aboard Moon  
Emily Miedema & Abby Bull,  
12 years old, Canada



The Prospector  
Frank Shiner, 15 years old, USA



Conquest  
Georgi Lomakin, 18 years old, Russian Fed.



Zero-G Aquatics  
Rachel Liu, 14 years old, USA



Future Space In My Eye  
Huen Wai Ko, 18 years old, Hong Kong



Space: Biologists' Future  
Maria Sotnikova, 14 years old, Russian Fed.



Next Ways of Transportation in Space  
Kei Wakisaka, 14 years old, Japan



Cherish Your Origination  
Arsla/Boeld/Münch, 16, Germany