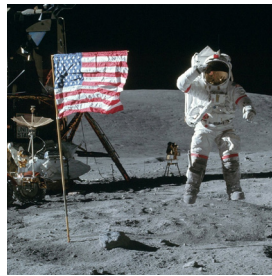
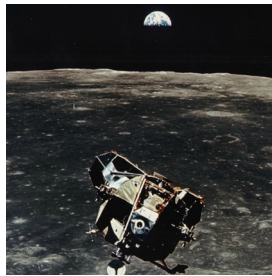


INTERNATIONAL SPACE MEDICINE SUMMIT 2019

October 10–13, 2019 • 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 13th annual International Space Medicine Summit on Oct. 10–13, 2019, brings 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 are represented at the summit.

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

Organizers

Rice University's Baker Institute for Public Policy

The mission of Rice University's 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 in a nonpartisan manner and to make a difference in the formulation, implementation and evaluation of public policy, both domestic and international. The Baker Institute is ranked No. 3 among university-affiliated think tanks in the world. 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.

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 preeminent 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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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.

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 its 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.

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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)
CEPStone LLC
Center for the Advancement of Science in Space (CASIS)
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)
Florida State University (FSU)
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)
International Space University (ISU)
Japan Aerospace Exploration Agency (JAXA)
Johns Hopkins School of Medicine
KBRwyle
King's College London
Lawrence Berkeley National Laboratory
Lone Star Flight Museum
Louisiana State University (LSU)
Lunar and Planetary Institute (LPI)
Massachusetts Institute of Technology (MIT)
Mayo Clinic Arizona
The Methodist Hospital (TMH)
Moscow State University
The Museum of Flight
National Aeronautics and Space Administration (NASA)
National Institutes of Health (NIH)
Norwegian Centre for Space-related Education (NAROM)
Rice University
Rice University's Baker Institute for Public Policy
RSC Energia
Russian Academy of Sciences (RAS)
Russian Federal Space Agency (ROSCOSMOS)
Saudi Space Commission (SSC)
SciArt Exchange
Space Center Houston
Stanford University
Swansea University
Texas A&M University (TAMU)
Texas A&M University College of Engineering
Texas A&M University at Galveston
Texas Health Resources
Tietronix/Safetronix
UK Space Agency
Universities Space Research Association (USRA)
University College London (UCL)
University of California, Davis
University of California, San Diego
University of Geneva
University of Houston (UH)
University of Illinois
University of Maryland
University of Michigan
University of Missouri
University on 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)

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Agenda

Thursday, October 10

1800 Opening Reception
James A. Baker III Hall, Rice University

Friday, October 11

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

Bonnie J. Dunbar
TEES Eminent Research Professor, Department of Aerospace Engineering, Texas A&M University

Jeffrey Sutton
Director, Center for Space Medicine, Baylor College of Medicine

Opening Address

Introduction: George W.S. Abbey, Baker Institute

0855 **Michael Fossum**
Vice President, Texas A&M University; and Chief Operating Officer, Texas A&M University at Galveston

Panel I – Lunar Exploration

Introduction: George W.S. Abbey, Baker Institute

0915 **Moderator:** Leroy Chiao, Astronaut

Panelists

Ken Bowersox, Astronaut
Walter Cunningham, Astronaut
Bonnie J. Dunbar, Astronaut
Michael Lembeck, University of Illinois
Donald Pettit, Astronaut
William Shepherd, Astronaut
Isabelle Tremblay, CSA

Topics

- Lunar exploration and international cooperation
- Private companies and their role in supporting lunar exploration

Discussion and Summation

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Panel II — Maximizing Use of the International Space Station

Introduction: Jeffrey Sutton, BCM

1030

Moderators: Donald Pettit, Astronaut; and Inesa Kozlovskaya, IBMP

Panelists

Michael Barratt, Astronaut
Bonnie J. Dunbar, Astronaut
Mikhail Kornienko, Cosmonaut
Kris Lenhardt, NASA
Soichi Noguchi, Astronaut
Alexey Polyakov, IBMP
Julie Robinson, NASA
Salizhan Sharipov, Cosmonaut
Eugenia Yarmanova, IBMP

Topics

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

Discussion and Summation

Luncheon and Panel III — Flight Surgeons

Introduction: Jeffrey Sutton, BCM

1145

Moderator: Richard Jennings, UTMB

Panelists

Serena Auñón-Chancellor, NASA
Michael Barratt, Astronaut
Alex Grishin, GCTC
Atsuhiko Mitsumaru, JAXA
Brian Pinkston, UTMB
Ed Powers, UTMB
Josef Schmid, NASA
William Shepherd, Astronaut

Topics

- Military flight surgeons interacting with crew on long deployments
- Flight surgeon-crew relationships preflight, in-flight and during rehabilitation for long-duration missions
- Application to exploration missions

Discussion and Summation

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Panel IV — Longitudinal Studies

Introduction: Bonnie J. Dunbar, Astronaut

1330 **Moderator:** Michael Barratt, Astronaut

Panelists

Susan Bloomfield, TAMU
Bill Carpentier, NASA
Bonnie J. Dunbar, Astronaut
Richard Jennings, UTMB
Soichi Noguchi, Astronaut
Ronak Shah, NASA
Mary Van Baalen, NASA
Cheryl Walker, BCM

Topics

- Information available concerning the short- and long-term medical consequences of long-duration exposure to space and subsequent readaptation to Earth's environment
- Uncertainties in the projection of the risks of late effects from space radiation
- Sharing data

Discussion and Summation

1500 Break

Panel V — New Frontiers in Space Medicine

Introduction: Jeffrey Sutton, BCM

1515 **Moderator:** Michael Barratt, Astronaut

Panelists

Serena Auñón-Chancellor, NASA
David Dinges, University of Pennsylvania
Karina Marshall Goebel, NASA
Fathi Kouria, NASA
Steve Laurie, KBRwyle
Brandon Macias, NASA
Eugenia Yarmanova, IBMP

Topics

- Assuring safety for participants with medical deficits
- Recent findings on Spaceflight Associated Neuro-ocular Syndrome (SANS) and vascular considerations in long-duration spaceflight
- Effects related to mission duration

Discussion and Summation

1700 Reception

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Dinner and Evening Address

Introduction: Bonnie J. Dunbar, Astronaut

1830

Melinda Sheffield–Moore

Professor and Department Head, Health and Kinesiology, Texas A&M University

Saturday, October 12

0800

Continental Breakfast

Panel VI – Genomics and Spaceflight

Introduction: Richard Jennings, UTMB

0830

Moderator: Michael Barratt, Astronaut

Panelists

Penelope Bonnen, BCM
Leroy Chiao, Astronaut
Marissa Covington, NASA
Dorit Donoviel, BCM
Elena Fomina, IBMP
Jonathon Galazka, NASA
Fathi Kouria, NASA

Topics

- Overview of NASA GeneLab project
- Contribution of 'omics studies to human research goals
- Enabling precision medicine for space crews
- Performing genomic experiments in the ISS laboratory
- Ethical issues in astronaut genomic studies

Discussion and Summation

1000

Break

Panel VII – Apollo: 50th Anniversary

Introduction: George W.S. Abbey, Baker Institute

1015

Moderator: Richard Jennings, UTMB

Panelists

Chuck Berry, NASA
Bill Carpentier, NASA
Walter Cunningham, Astronaut
Jay Honeycutt, NASA
Glynn Lunney, NASA
Thomas Stafford, Astronaut

Topics

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

Discussion and Summation

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Luncheon and Panel VIII — Human Spaceflight and Automation

Introduction: George W.S. Abbey, Baker Institute

1145 **Moderator:** Steve Robinson, UC Davis

Panelists

Tamara Ilina, RSC Energia
Lee Morin, Astronaut
William Shepherd, Astronaut
Heidi Weber, NASA

Topics

- Automated control criteria
- Requirements for human control
- Back-up control options
- Testing, verification and training

Discussion and Summation

Panel IX — Radiation

Introduction: Leroy Chiao, Astronaut

1315 **Moderator:** Jeffrey Sutton, BCM

Panelists

David Alexander, Rice University
Becky Blue, Mayo Clinic Arizona
Jeff Chancellor, LSU
John Charles, Space Center Houston
Kristin Fabre, BCM
Peter Norsk, BCM

Topics

- Increased risks with mission lengths
- Mitigating risks
- Shielding for protection and for countermeasures
- Effects of long-term radiation on brain performance

Discussion and Summation

1415 Break

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Panel X — Education and STEM Advances

Introduction: George W.S. Abbey, Baker Institute

1430 **Moderator:** Bonnie J. Dunbar, Astronaut

Panelists

Tony Antonelli, Lockheed Martin
Linda Godwin, Astronaut
Elena Fomina, IBMP
Kevin Fong, University College London
Michael Lembeck, University of Illinois
Stephen Robinson, UC Davis
Salizhan Sharipov, Cosmonaut
Isabelle Tremblay, CSA
Andrew Turnage, ASE

Topics

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

Discussion and Summation

Panel XI — Cooperative Use of Analogs

Introduction: Richard Jennings, UTMB

1530 **Moderator:** Michael Barratt, Astronaut

Panelists

Roni Cromwell, NASA
David Dinges, University of Pennsylvania
Mikhail Kornienko, Cosmonaut
Cheryl Lowry, UTMB
Scott Parazynski, Astronaut
Josef Schmid, NASA
Salizhan Sharipov, Cosmonaut
William Shepherd, Astronaut

Topics

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

Discussion and Summation

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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.

1630

Group A

Cooperative Research

Team Leaders: Donald Pettit, Astronaut; and Inesa Kozlovskaya, IBMP

Group B

Cooperative Use of Analogs

Team Leader: Michael Barratt, Astronaut

Group C

Education

Team Leader: Bonnie J. Dunbar, Astronaut

Dinner and Evening Address

Introduction: George W.S. Abbey, Baker Institute

1800

Donald Pettit

Astronaut, ISS Expedition 6, 30 and 31; Space Shuttle Endeavor (November 2008)

Sunday, October 13

0830

Continental Breakfast

Discussion Group Reports

0900

Group A

Cooperative Research

Group B

Cooperative Use of Analogs

Group C

Education

Closing Remarks

1100

Bonnie J. Dunbar

TEES Eminent Research Professor, Department of Aerospace Engineering, Texas A&M University

Jeffrey Sutton

Director, Center for Space Medicine, Baylor College of Medicine

George W.S. Abbey

Senior Fellow in Space Policy, Rice University's Baker Institute for Public Policy