

Sunday, May 27 - MORNING PLENARY (8:30 am - 9:45 am) Grand Ballroom

TITLE: Destinations - Putting People Into Space

PANELISTS: Brad Blair, Al Globus, Dr. Pascal Lee, Dr. Clive Neal, Rick Tumlinson, Dr. Robert Zubrin

Moderator: Madhu Thangavelu, Department of Astronautical Engineering, Viterbi School of Engineering & School of Architecture, University of Southern California

NSS remains committed to inspiring humanity to reach out, body and soul, not just robots, deep into into our solar system, and fly off to the stars. This group of luminaries and leaders will make the case for homesteading space and the planets and beyond. They debate various destinations ranging from orbiting settlements and our Moon, to other locations in our solar system and beyond that are suitable for humanity to live long, thrive and prosper (thanks, Mr. Spock).



Madhu Thangavelu conducts the ASTE527 graduate Space Exploration Architectures Concept Synthesis Studio in the Department of Astronautical Engineering within the Viterbi School of Engineering, and he is also a graduate thesis adviser in the School of Architecture at USC. He holds degrees in both engineering and architecture and has contributed extensively to concepts in space architecture, especially dealing with extraterrestrial development. He is the author or co-author of over 70 technical papers in space architecture, lunar base design and human factors, and co-author of the book *The Moon: Resources, Future Development and Settlement* (1999 & 2007). He is the invited author of the chapter "Living on the Moon" in the *Encyclopedia of Aerospace Engineering*, a major reference work published in 2010. He is on the faculty of the International Space University, an international organization that provides training for promising new generation of leaders and space professionals around the world.



Brad Blair is a geologist, mining engineer and mineral economist consulting from Idaho Springs, Colorado on advanced mining and aerospace technology, and the future economic use of space resources. He began researching lunar in-situ resource utilization (ISRU) in 1989 under NASA Space Exploration Initiative (SEI) funding as a Mining graduate student at the Colorado School of Mines. Brad has worked under U.S. and Canadian government research contracts, and consulted for aerospace and mining industry clients on ISRU design and economic analysis as well as advanced ISRU technologies. He is currently advising and participating in NewSpace startup companies.



One day in 1978 **Al Globus'** housemate brought home a stack of *CoEvolution Quarterly* issues, including an issue discussing Princeton professor Gerard O'Neill's vision of free space settlements. Al was electrified. As soon as he graduated he got a job as a contractor at NASA Ames Research Center eventually working on Hubble, ISS, X37, shuttle, earth observation, teleoperation, molecular nanotechnology, asteroid mining, and bone development in micro-g winning many awards and publishing many papers along the way. More important, he made two primary contributions to space settlement. The first was founding and managing the NASA Ames Space Settlement Contest for 6-12th grade students. The second involves revisiting the assumptions of the studies that electrified Al in the first place. Two of these assumptions, the need for radiation shielding and limited human tolerance of rotation, are not quite as iron clad as believed. This reduces the mass of the first space settlements by at least two orders of magnitude! The consequence is that small space settlements in Equatorial Low Earth Orbit may be practical even launching all the materials from Earth.



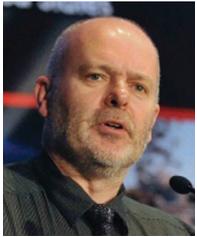
Dr. Pascal Lee is chairman of the Mars Institute, senior planetary scientist at the SETI Institute, and director of the NASA Haughton-Mars Project at NASA Ames Research Center.

For bio please see page 20 in the program book.

Plenary Events, Meal Speakers, Award Presentations (continued)

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Dr. Clive R. Neal grew up and was educated in the United Kingdom. He obtained his PhD in geochemistry and petrology in 1986. He moved to the United States later in that year where he spent 4 years as a post-doctoral research fellow at the University of Tennessee – Knoxville. While there, he studied mantle petrology and was introduced to the study of Apollo lunar samples, and has been involved in the study of the Moon since then using samples, as well as remotely sensed data from missions including and since Apollo. He is currently a Professor of Planetary Geology at the University of Notre Dame. Dr. Neal has served on numerous mission and research review panels, including being the Chair of the Lunar Sample Allocation subcommittee 2005-2009, and was a member of the Senior Review panel for NASA's Planetary Science Division in 2012 and chaired that panel in 2014. He was the chair of NASA's Lunar Exploration Analysis Group from 2006-2010, and again from 2015-2018. Neal is passionate about NASA and in returning humans to the Moon and beyond in a sustainable, economically beneficial way.



Rick Tumlinson has been called one of the world's top space "Visionaries" and is credited with helping create the NewSpace commercial space industry. He co-founded the Space Frontier Foundation, led the team that took over the Mir Space Station for a year as the world's first commercial space facility, signed up the first "space tourist" Dennis Tito. He worked with the founders of the International Space University, helped kick start the Lunar Prospector Project and helped or founded several other Frontier Enabling projects and organizations. A founding Board Member of the XPrize, he founded the Texas Space Alliance, started Silicon Valley based Deep Space Industries - an asteroid mining firm. Currently, his New Worlds organization is focused on developing the people and technology to settle the space frontier.



Dr. Robert Zubrin is the founder and President of the Mars Society, as well as a member of the organization's Board of Directors. Dr. Zubrin is also President of Pioneer Astronautics, an aerospace R&D company located in Lakewood, Colorado. Formerly a Staff Engineer at Lockheed Martin Astronautics in Denver, he holds a Masters degree in Aeronautics and Astronautics and a Ph.D. in Nuclear Engineering from the University of Washington. He is the inventor of several unique concepts for space propulsion and exploration, the author of more than 200 published technical and non-technical papers in the field, as well the non-fiction books including "The Case for Mars: The Plan to Settle the Red Planet and Why We Must." He is the founder of the Mars Society; an international organization dedicated to furthering the exploration and settlement of Mars by both public and private means. Prior to his work in astronautics, Dr. Zubrin was employed in areas of thermonuclear fusion research, nuclear engineering, radiation protection and as a high school science teacher.