



# PROJECT PoSSUM

Polar Suborbital Science in the Upper Mesosphere

## SCIENTIST-ASTRONAUT CLASS 1602 STUDENT GUIDE AND PRESS KIT



October 1-5, 2016

Embry-Riddle Aeronautical University, Daytona Beach, FL.



4 September, 2016

Dear PoSSUM Scientist-Astronaut Class 1602,


On behalf of Project PoSSUM, I would like to welcome you all to the Project PoSSUM scientist-astronaut class. This is an exciting time for everyone involved with Project PoSSUM, and your class marks a first step towards a great new era of citizen-science in our upper atmosphere.

In the next five days, you will embark upon a journey to understand the basic science behind the PoSSUM research program and we will assess your abilities to perform in simulated PoSSUM missions. Our Scientist-Astronauts enable cutting edge research and also serve as ambassadors that can engage and educate the public about the upper atmosphere and the vital role that it plays in the study of our global climate.

Even though man has maintained a presence in orbit for decades, the mesosphere is still largely an unknown. The mesosphere is a region that we have only briefly transited in our forays to orbital space. It is a region that harbors strange 'space clouds', strange electrical phenomena, and ionization that brings silence to vehicles reentering through it. It is an area too high to access by balloon or aircraft yet too low to access by orbital spacecraft. It is the most unknown part of our atmosphere, and yet soon we will have the means to access this elusive region and claim our presence there. Our PoSSUM scientist-astronauts will be the first explorers of the mesosphere, not just travelers passing through to orbit or returning from orbit, but there to understand.

As the tourist travels 'away from'; the explorer travels 'towards'. At the core, a scientist is an explorer; an explorer travels with an unbiased mind seeking to understand. To the explorer, the journey is the classroom. The explorer welcomes surprise. The explorer invites challenge to his assumptions and beliefs. The explorer realizes that everything and everyone that crosses the journey brings a lesson and an opportunity to grow, and welcomes the changes these influences bring. And as the explorer's environs reveal their secrets, the explorer accepts a responsibility to preserve the beauty of what is seen and experienced. The explorer becomes an ambassador and advocate of all that reveals itself during the journey, because one can never regain the ignorance of the times before the journey started.

We wish you all an exciting and rewarding week as you embark on your first step to becoming an explorer of the mesosphere and an ambassador of Project PoSSUM.

A handwritten signature in black ink, appearing to read "J. Reimuller", with a stylized flourish at the end.

Dr. Jason D. Reimuller, PhD  
Executive Director/Principal Investigator  
Project PoSSUM, Inc.

## PoSSUM Class 1602 Schedule

	9/30/2016			10/1/2016			10/2/2016		
	PoSSUM 1602 (9/30 - 10/5)								
	Event	Location	Leader	Event	Location	Leader	Event	Location	Leader
8:00				Spacesuit Operations and History	Classroom	Moiseev	Introduction to the Mesosphere	Classroom	Reimuller
9:00				PoSSUMCam Ops	Classroom	Wampler	Principles of Remote Sensing	Classroom	Fritts
10:00				Transport to SAMI Facility	I-95	N/A	Noctilucent Clouds and Scattering	Classroom	Reimuller
11:00				Concepts of Hypoxic effects on Spaceflight Crews	SAMI	Buza	Solar Mechanics as applied to PoSSUM	Classroom	Reimuller
12:00				LUNCH	SAMI	N/A	LUNCH	Cafeteria	N/A
13:00				High-Altitude Simulation and Slow-Onset Hypoxia Effects	SAMI	Buza	Observing Geometry during Suborbital Flight	Classroom	Reimuller
14:00	PoSSUMSim Operations and Practice	SSFS	Nguyen						
15:00									
16:00									
17:00	Reception	COA Atrium		DINNER	El Ambio Cubano	N/A	DINNER	TBD	N/A
18:00	KEYNOTE TALK	Classroom	Bechtle						
19:00									
20:00				Transport to Embry-Riddle	I-95	N/A	Spacesuit Safety Protocols	Hotel Conf. Room	Wampler and Rice



## PoSSUM Class 1602 Schedule

	10/3/2016			10/4/2016			10/5/2016		
	Event	Location	Leader	Event	Location	Leader	Event	Location	Leader
8:00	Spacesuit Operations	COA 305		Spacesuit Operations	COA 305		Aerospace Physiology for Spaceflight Crews	Classroom	Seedhouse
9:00	Simulator Operations	SSFS		Simulator Operations	SSFS		Spacecraft Life Support Systems	Classroom	Seedhouse
10:00	CRM	SSFS		CRM	SSFS		Evaluation	Classroom	Lundeen
11:00	High-G Flight	Flight Ops		High-G Flight	Flight Ops		Film: Sprites	Classroom	Lundeen
12:00	LUNCH	Cafeteria	N/A	LUNCH	Cafeteria	N/A	LUNCH	Cafeteria	N/A
13:00	Spacesuit Operations	COA 305		Spacesuit Operations	COA 305		Remedial & Extra Flights (as needed)	Classroom/ Flight Ops	Various
14:00	Simulator Operations	SSFS		Simulator Operations	SSFS				
15:00	CRM	SSFS		CRM	SSFS				
16:00	High-G Flight	Flight Ops		High-G Flight	Flight Ops		GRADUATION	Classroom	Reimuller
17:00									
18:00	DINNER	TBD	N/A	DINNER	TBD	N/A			
19:00									
20:00	Guest lecture	Hotel Conf. Room	TBD	Guest lecture	Hotel Conf. Room	TBD			

# PoSSUM Class 1602 Personnel

## PoSSUM Management

Dr. Jason Reimuller  
Dr. Dave Fritts  
Mr. Chris Lundeen

Executive Director  
Chief Scientist  
Program Coordinator

## PoSSUM Science Leads

Dr. Gary Thomas  
Dr. Mike Taylor  
Dr. Steve Mitchell  
Dr. Gerald Lehmacher  
Dr. Zoltan Sternovsky  
Dr. Kathy Mandt

PMC Science Lead  
Infrared Imagery Lead  
LiDAR Systems Lead  
PMC Temperatures Lead  
Particle Detection Lead  
Atmospheric Sampling Lead

## PoSSUM Instructors

Dr. Paul Buza  
Mr. Nikolay Moiseev  
Dr. Erik Seedhouse  
Mrs. Patty Wagstaff  
Mr. Van Wampler  
Cpt. Tim Plunkett  
Mr. Brian Norris  
Mr. Virgil Calejesan  
Mr. Parker Rice

PoSSUM Instructor  
PoSSUM Instructor  
PoSSUM Instructor  
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PoSSUM Instructor  
PoSSUM Instructor  
PoSSUM Instructor

## Embry-Riddle Simulation

Dr. Erik Seedhouse  
Mr. Christopher Nguyen

ERAU Simulation Manager  
ERAU Simulation Technician

# PoSSUM Class 1602 Sponsoring Organizations



## Sundog Software

Sundog Software creates 3D oceans, skies, volumetric clouds, and weather effects for games and simulators worldwide. Sundog's SilverLining(tm) and Triton(tm) software development kits enable graphics developers to add realistic environmental effects to outdoor virtual worlds with a few lines of code.



## CinemaRaven

Founded by Van Wampler and Parker Rice, CinemaRaven is an advanced video production company located in Boulder. For more information, visit their website at [cinemaraven.com](http://cinemaraven.com).

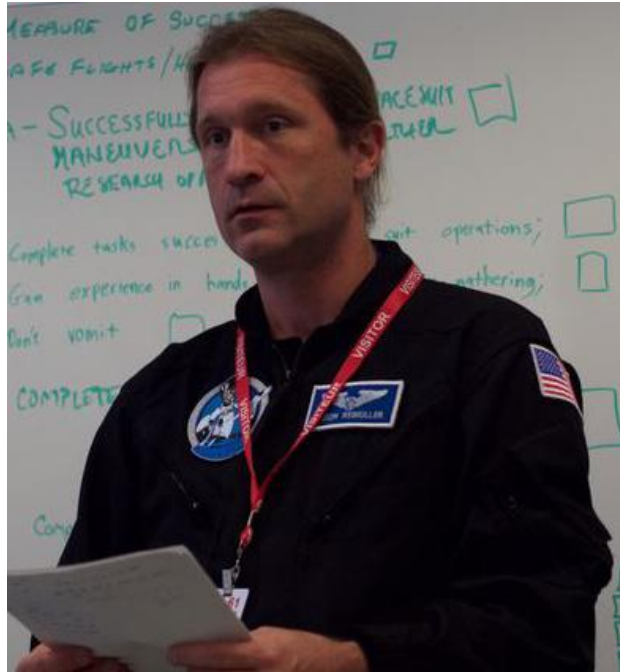


## Embry-Riddle Aeronautical University

Embry-Riddle Aeronautical University, the world's largest, fully accredited university specializing in aviation and aerospace, is a nonprofit, independent institution offering more than 70 baccalaureate, master's and Ph.D. degree programs in its colleges of Arts & Sciences, Aviation, Business, Engineering and Security & Intelligence.



### Dr. Jason Reimuller, Ph.D.



**Dr. Jason Reimuller** is the Executive Director of Project PoSSUM (Polar Suborbital Science in the Upper Mesosphere) aeronomy research and education program and also serves as Co-I of the PMC-Turbo experiment and the PoSSUM Microgravity Spacesuit Evaluation program. In addition, Jason works as a commercial research pilot and flight test engineer with GATS, Inc., is a NAUI SCUBA Divemaster, and is the author of "Spacecraft Egress and Rescue Operations."

Jason served for six years as a systems engineer and project manager for NASA's Constellation Program, leading studies on launch aborts, launch commit criteria, landing conditions, post-landing and emergency crew egress trades, and propulsion options. Jason also led a NASA and NSF-funded flight research campaign to study noctilucent cloud time evolution, structure, and dynamics in Northern Canada as lead investigator and pilot-in-command, then further applied his background in airborne remote sensing to conduct research in glaciology to better understand the dynamic changes of the Greenlandic Ice Sheet as part of NASA's Operation ICE Bridge. Jason has been a Commissioned Officer of the US Air Force and a spacecraft flight director for Space Systems Loral.

Jason holds a Ph.D. in Aerospace Engineering Sciences from the University of Colorado in Boulder. He also holds an M.S. degree in Physics from San Francisco State University, an M.S. degree in Aviation Systems from the University of Tennessee, an M.S. Degree in Aerospace Engineering from the University of Colorado, and a B.S. degree in Aerospace Engineering from the Florida Institute of Technology.



## Dr. Dave Fritts, Ph.D.



**Dr. Dave Fritts** has worked in a number of areas of atmospheric dynamics extending from the stable boundary layer (SBL) into the thermosphere, acquiring broad experience with theoretical, modeling, and experimental activities. He has guided a number of experimental programs, including rocket campaigns in Alaska, Norway, Sweden, and Brazil, radar measurements on six continents, and multi-instrument field programs. He has installed MF or meteor radars at Hawaii, McMurdo, Rothera, Rarotonga, Tierra del Fuego (TdF), and King George Island (KGI), participated in the planning of the ALOMAR lidar/radar observatory in northern Norway, and suggested the formation and structure of the NSF-funded Consortium of Resonance and Rayleigh Lidars (CRRL) within which he serves as PI for the ALOMAR sodium lidar. Dave also helped design and was an Interdisciplinary Scientist with the NASA TIMED satellite mission studying middle atmospheric dynamics.

Dr. Fritts has organized and/or coordinated several large, international field programs addressing atmospheric dynamics (MAC-EPSILON, CADRE, MacWAVE, SpreadFEx, SpreadFEx-2, CASES-99), performed or guided the major studies of gravity wave instability dynamics to date, and employed various modeling technologies to develop a new-generation turbulence forecasting methodology intended for government and commercial (i.e., airline) applications. Dr. Fritts has also been a founder, manager, and senior research scientist at Northwest Research Associates in Boulder, CO. Recently, Dave is also a co-founder of Space & Weather Technologies, Inc., promoting commercial opportunities for two revolutionary imaging systems that would re-define capabilities for two key atmospheric measurements.

Dr. Fritts holds a Ph.D. and an M.S. degree in physics from the University of Illinois and a B.A. in physics from Carleton College. He has been a professor of physics at the University of Alaska, Fairbanks and a research professor of electrical and computer engineering at the University of Colorado at Boulder. He has over 200 publications; listed among top 1/2% of cited researchers by ISIhighlycited.com.



### Chris Lundeen



**Chris Lundeen** serves as program coordinator for Project PoSSUM's educational programs. Chris has a BS degree in recreation resource management and an AS in network programming. He spent the last five years as the maintenance manager of the Neets Bay salmon hatchery in remote Southeast Alaska, where thinking outside the box was a daily necessity.

Chris is certified as a simulator technician for PoSSUM's simulation facilities and is completing his qualifications as a certified spacesuit technician. Chris is an avid climber with accents in Yosemite, the Cascades, Denali, and Pico de Orizaba. His adventuresome spirit also extends to the sea as a master diver, boat captain, and surfer. He recently captained a sailboat thru the inside passage from Alaska to Seattle.



### Dr. Paul Buza, Ph.D.



**Dr. Paul W. Buza** D.O. F.A.C.N, is board certified in Neurology and specializes in Clinical Hyperbaric Medicine, Cellular Biology, Diving Medicine and Aerospace Physiology. Dr. Buza founded SAMI in July 1999. The primary goal was to establish an advanced clinical hyperbaric and diving medicine program for the east central coast of Florida using a unique hyperbaric/hypobaric chamber. In 2001, the chamber went on line for hypobaric operations for research and training for the aviation community, and in 2002 NASA approved the facility as a triage center for support operations related to the Shuttle Launch Program. Since that time, SAMI has provided over 45,000 patient treatments for the area hospitals and has trained over 3000 pilots in the high altitude chamber for hypoxia training. In addition, SAMI has provided a platform for research related to clinical medicine and the aerospace industry.





### Patty Wagstaff



To **Patty Wagstaff**, the sky represents adventure, freedom and challenge. A six-time member of the US Aerobatic Team, Patty has won the gold, silver and bronze medals in Olympic-level international aerobatic competition and is the first woman to win the title of US National Aerobatic champion and one of the few people to win it three times.

Patty one of the world's top airshow pilots, flies thrilling, low-level aerobatic demonstrations before millions of people each year. Her breathtaking performances give airshow spectators a front-row seat view of the precision and complexity of modern, unlimited hard-core aerobatics. Her smooth aggressive style sets the standard for performers the world over.

Patty is a six-time recipient of the "First Lady of Aerobatics" Betty Skelton Award. In July 2004, Patty was inducted into the National Aviation Hall of Fame and was the recipient of the National Air and Space Museum's Award for Current Achievement in 1994. Having received many awards for her flying, she is particularly proud of receiving the Airshow industry's most prestigious award, the "Sword of Excellence", and the "Bill Barber Award for Showmanship". Recently she was awarded a Lifetime Achievement Award from the Air Force Association. In March, 1994, her airplane, the Goodrich Extra 260, went on display in the Smithsonian National Air & Space Museum in Washington DC. Patty's airplane is displayed in the Pioneers of Flight Gallery.

Patty has trained with the Russian Aerobatic Team and has flown Airshows and competitions in such exotic places as South America, Russia, Europe, Mexico and Iceland. She is a member of the Screen Actors Guild, Motion Picture Pilots Association, United Stuntwomen's Association, working as a stunt pilot and aerial coordinator for the film and television industry. Today, Patty owns the "Patty Wagstaff Aerobatic School" in St. Augustine, Florida, located at Southeast Aero, the U.S. Distributor for the Extra Aircraft and she continues to fly airshows around the world.



### Dr. Erik Seedhouse, Ph.D.



**Dr. Erik Seedhouse** is an aerospace/life sciences scientist and Assistant Professor in the Applied Aviation Sciences Department at ERAU, where he teaches life support systems in the Space Studies Program. After completing his first degree in Sports Science at Northumbria University the author joined the legendary 2nd Battalion the Parachute Regiment, the world's most elite airborne regiment. During his time in the 'Para's' Erik spent six months in Belize, where he was trained in the art of jungle warfare and conducted several border patrols along the Belize-Guatemala border. Later, he spent several months learning the intricacies of desert warfare on the Akamas Range in Cyprus. He made more than thirty jumps from a Hercules C130 aircraft, performed more than two hundred abseils from a helicopter and fired more light anti-tank weapons than he cares to remember!

Upon returning to the world of academia, Erik embarked upon a Master's degree in Medical Science at Sheffield University and then completed his Ph.D. at the German Space Agency's Institute for Space Medicine. In 1999, he started his post-doctoral studies at Simon Fraser University. While living in Vancouver, Erik gained his pilot's license, started climbing mountains and took up sky-diving to relax in his spare time. In 2005 he worked as an astronaut training consultant for Bigelow Aerospace in Las Vegas and wrote 'Tourists in Space', a training manual - of sorts - for spaceflight participants. He is a Fellow of the British Interplanetary Society and a member of the Aerospace Medical Association. In 2009 he was one of the final thirty candidates of the Canadian Space Agency's Astronaut Recruitment Campaign. Erik currently works as manned spaceflight consultant and author (he has written 12 books).

In addition to being an accomplished scientist, Erik is a world-class triathlete and scuba diver. In 1997, GQ magazine nominated him as the 'Fittest Man in the World'.



### Nikolay Moiseev and Virgil Calejesan



**Mr. Nikolay Moiseev** was trained at the Moscow Aviation Institute, and graduated with a M.S. in Life Support Systems Engineering 1986. He began work at Zvezda, Russia's space suit provider, in 1986, and worked there for 20 years. Mr. Moiseev's suit designs have flown on Mir, Buran, and ISS, and he has worked with both the ESA and NASA on advanced EVA designs. Mr. Moiseev is a co-founder of FFD and has been working in the commercial space industry for the last 7 years.

**Mr. Virgil Calejesan** joined Final Frontier Design in 2013 with a diverse background in product development and user experience through guest services, events, and higher-education. Virgil manages on-site operations and led development of FFD's space suit training curriculum. In studio, he also handles FFD's marketing and digital presence, space suit operations, and all aspects of FFD computing. Mr. Calejesan has participated in a variety of simulated, in-flight and hypobaric chamber tests of FFD suits. He holds a Bachelor's in English from Yale University and a Master's in Industrial Design from Pratt Institute.



### Brian Norris and Captain Tim Plunkett



**Mr. Brian Norris** spent 24 years working full-time in the airshow industry as the Operations Coordinator, Narrator and Support Pilot for one of the top solo performers in North America. In that time he earned is Single & Multi-Engine Land, Single-Engine Sea, Instrument- Airplane and Glider Ratings. In addition, he is a CFI, CFII and Multi-Engine Instructor as well as an A&P mechanic with an Inspection Authorization. Since earning his Private Pilot's License in 1992 he has accumulated 10,000 hours of flying time in a wide variety of aircraft ranging from the J-3 Cub to Warbirds to the Cessna Citation jet. He now lives in the Spruce Creek Fly-In community in Port Orange, FL with his wife Devan where they own Norris Aeroworks, a company that provides maintenance for aerobatic aircraft, pilot services, flight instruction and airshow consulting, narration and airboss services. Brian graduated from Embry-Riddle Aeronautical University in 2002 with a B.S. degree in Professional Aeronautics and a minor in Aviation Safety.

**Captain Tim Plunkett** was an Air Force Pilot, Instructor, and Evaluator who flew the T-37, T38, T39 and the B52 during his military career. He then became an International Airline Captain for one of the world's largest airline flying the Boeing 727,737,757,767,767ER, the MD11 and the L1011 where he retired as an International Check Airman Instructor and Evaluator. He was also a competition aerobatic pilot flying the Pitts biplane and past President of the Miami IAC as well as an Aerobatic Judge. He is also a glider pilot, a helicopter pilot and an air show pilot. He was a Test pilot as well as an Aerodynamics professor at a major aeronautical university. He holds a US Patent for a Jet engine design modification. He now spends his time flight testing other aircraft while building and flying WW1 aircraft such as The Fokker Triplane, Sopwith Camel, Fokker DVII, Albatross and the SE5A. Captain Plunkett has accumulated over 30,000 flying hours in numerous types of flying machines. Captain Plunkett holds an ATP, SEL, MEL, CFI,CFII, CFMEI, glider and rotorcraft FAA ratings with five jet type ratings.



### Van Wampler and Parker Rice



**Mr. Van Wampler** is a PoSSUM spacesuit technician and instrumentation specialist. Van founded CinemaRaven in 2011 after graduating from University of Colorado Boulder with a BFA in Film Studies. He's been shooting films for years, and loves every aspect of filmmaking. Van is experienced in directing, lighting, editing, mixing audio... anything he needs to do to make projects look and sound great! He also writes the musical score for many of CinemaRaven's projects. Van has had award winning films play in festivals coast-to-coast.

**Mr. Parker Rice** is a PoSSUM spacesuit technician and instrumentation specialist. In addition to Parker's work with PoSSUM, he leads CinemaRaven's still photography department. He's also an excellent camera operator, director of photography, and editor. Many of his projects have gone viral, getting millions of views in mere minutes. His work has been displayed in galleries across the state of Colorado.





## PoSSUM Science Leads

### Dr. Gary Thomas, PMC Science Lead



**Professor Gary Thomas** has been involved in Polar Mesospheric Cloud (PMC) research since 1981, when PMC were detected by the Ultraviolet Spectrometer on the SME spacecraft. (The term PMC was coined in the paper by Thomas, 1984.) Since then he has authored or co-authored over 80 papers on PMC and related subjects, and supervised two graduate students in this area. From 1986 to 2008, he served as Chair of the International Working Group on Noctilucent Clouds (now the Working Group on Layered Phenomena in the Mesopause Region). He served as Chair of the AstroGeophysics Department at the University of Colorado (CU) in 1982-83; Associate Editor of the Journal of Geophysical Research, September 10, 1992 to December 31, 1995; Secretary of the International Commission on the Meteorology of the Middle Atmosphere, 1987-1995; and Interim Director of LASP from 1992 to 1994. He has taught at CU in the areas of meteorology, astronomy, aeronomy, statistical physics, and radiative transfer. His 1999 textbook on Radiative Transfer in the Atmosphere and Ocean is still in use in graduate classes throughout the world. He is currently a Senior Research Associate at LASP, a Co-Investigator on the NASA Small Explorer Satellite mission (the Aeronomy Of Ice in the Mesosphere, AIM), and co-chair of the CAWSES-II Project 3 PMC/NLC altitude, frequency and brightness changes related to changes in dynamics and chemical composition. Professor Thomas has been a member of the Laboratory for Atmospheric and Space Physics (LASP) since 1967.

### Dr. Steven Mitchell, LiDAR Instrumentation



**Dr. Steven Mitchell** received his B.S. degree in Mechanical Engineering from the University of Maryland at College Park in 2005, and his M.S. and Ph.D. degrees in Aerospace Engineering Sciences from the University of Colorado at Boulder in 2009 and 2013, respectively. His thesis research was on high-resolution depth measurement of remote semitransparent media through development of novel LiDAR technologies. He holds the patent on the seminal LiDAR technology enabling remote measurement of extremely shallow media depths through polarization analyses of transmitted and received optical signals. In his current role as LiDAR systems engineer, Steve has led the development of multiple LiDAR instrumentation efforts for measurements including surface topography, water depth, and wind velocities. His primary interest is instrument development for high-altitude platforms, with successful deployment of LiDAR sensors onboard aircraft including NASA's ER-2 and Global Hawk airborne science platforms.



### **Dr. Gerald Lehmacher, Mesospheric Temperatures Lead**



**Dr. Gerald Lehmacher** received his M.S. and Ph.D. in physics from the University of Bonn, Germany. His thesis research was on mass spectrometry for a cometary mission and on sounding rocket measurements in the mesosphere and lower thermosphere. His positions were National Research Council Resident Research Associate at NASA Goddard Space Flight Center; Research Scientist at the University of Wuppertal, Germany, working on the Cryogenic Infrared Spectrometers and Telescopes space shuttle missions; and Research Associate at Western Kentucky University involving astronomy students in small atmospheric and space missions. Since 2002, he has served as faculty in the Department of Physics and Astronomy at Clemson University, working primarily on upper atmospheric turbulence using sounding rockets and the giant Jicamarca radar array in Peru. A memorable highlight was his involvement with the Helium Abundance Detector of the Galileo Jupiter Probe mission.

### **Dr. Michael Taylor, Infrared Imagery Lead**



**Dr. Michael Taylor** is a specialist in optical remote sensing measurements of atmospheric optical emissions at the Center for Atmospheric and Space Sciences and (CASS) Utah State University, Logan, Utah. He has developed several high-performance imaging systems utilizing the airglow emissions to investigate upper atmospheric dynamics and temperature structure. These instruments have been used to study a broad range of atmospheric phenomena including gravity waves, tides, polar mesospheric clouds, equatorial and mid-latitude F region dynamics, upper atmosphere lightning, meteor ablation and satellite re-entry signatures. His group is actively involved in collaborative LiDAR, radar, imaging and temperature mapping programs at low, mid-latitudes with ongoing measurements programs in Chile, Norway, and Antarctica. He is a Co-Investigator on the NASA Aeronomy of Ice in the Mesosphere (AIM) mission designed to study polar mesospheric clouds (NASA Group Achievement Award 2008), and Director of the USU Bear Lake Observatory (BLO), Utah. As a professor in Utah State's Physics Department, his graduate and undergraduate students are involved in all aspects of these research programs which have resulted in 5 Ph.D.'s, 6 M.S.'s and over 135 collaborative publications to date. Dr. Taylor holds a Ph.D. in Atmospheric Physics from Southampton University, U.K., 1986, an M.Sc. in Electronics from Southampton University, U.K., 1977, and a B.Sc. with honors in Physics from Southampton University, U.K., 1974.

### **Dr. Zoltan Sternovsky, Aerosol Detection Lead**



**Dr. Zoltan Sternovsky** is an assistant professor of Aerospace Engineering Sciences at the University of Colorado in Boulder, Colorado, and a research scientist at the Laboratory for Atmospheric and Space Physics, focusing on aerosols and dusty plasmas. Dr. Sternovsky holds a Ph.D. and an M.S. degree in physics from Charles University in Prague, Czech Republic. His dissertation focused on the elementary processes associated with dusty plasmas. He is a recipient of the 2011 Young Scientist Award from the Union of Pure and Applied Physics (IUPAP), noted for "pioneering contribution to the study of charged dust particle dynamics in laboratory and space plasmas."

## PoSSUM Partner Organizations

### Integrated Spaceflight Services



GATS, Inc.

Located in Boulder, Colorado, Integrated Spaceflight Services (ISS) develops, tests, integrates, and operates scientific payloads onboard airborne and spaceborne platforms. ISS is the research and education partner of Swiss Space Systems (S3) Zero-G flights in America, operating an Airbus microgravity aircraft, and is the managing and integration partner of Project PoSSUM. ISS also offers complete space program development services and is the exclusive purchasing agent of the Ecuadorian Space Agency in North America.



GATS, Inc., is an aerospace company founded in 1986 by Larry L. Gordley, the President and CEO, to support atmospheric remote sensing projects, including all phases of project life cycle, from concept development to data dissemination and research efforts. GATS has expertise in software development, web-based systems, satellite instrument operations, atmospheric radiative transfer calculations, and project management that can serve a wide variety of applications. GATS currently participates in several major remote sensing projects. Collaborations include NASA, Science Systems and Applications Inc. (SSAI), Ball Aerospace, National Center Atmospheric Research (NCAR), Applied Research Laboratory (APL) at Johns Hopkins University, Hampton University, and Space Dynamics Laboratory (SDL) at Utah State University. The company's calibration and performance analysis software, radiative transfer packages, flight operations utilities, and web-based project and data management systems are some of the most efficient and accurate in the business.

### NASA Flight Opportunities Program



The NASA Flight Opportunities Program intends to mature to flight readiness status crosscutting technologies that advance multiple future space missions. It provides frequent flight opportunities to demonstrate and develop technology payloads on both parabolic aircraft and suborbital reusable launch vehicles for reduced gravity or near-space flights. Flight Opportunities is part of the Space Technology Program within NASA's Office of the Chief Technologist and is managed at NASA's Dryden Flight Research Center in Edwards, California. NASA's Ames Research Center in Moffett Field, California, manages the payload activities for the program. The March 2011 NASA press release announcing the suborbital flight opportunity is available at <http://www.nasa.gov/centers/ames/news/releases/2012/12-28AR.txt>.

### Embry Riddle Aeronautical University



Embry-Riddle Aeronautical University, the world's largest, fully accredited university specializing in aviation and aerospace, is a nonprofit, independent institution offering more than 70 baccalaureate, master's and Ph.D. degree programs in its colleges of Arts & Sciences, Aviation, Business, Engineering and Security & Intelligence. Embry-Riddle educates students at residential campuses in Daytona Beach, Fla., and Prescott, Ariz., through the Worldwide Campus with more than 150 locations in the United States, Europe, Asia and the Middle East, and through online programs. The university is a major research center, seeking solutions to real-world problems in partnership with the aerospace industry, other universities and government agencies.

## Southern AeroMedical Institute



The Southern AeroMedical Institute (SAMI) addresses a wide diversity of applications from clinical medicine to advanced high-altitude physiological training. Founded in 1999, SAMI manages a state-of-the-art Hyperbaric/Hypobaric Chamber and has now provided over 45,000 patient treatments and trained over 3,000 pilots in the high-altitude chamber. SAMI is the home of "Scenario Based Physiological

Training" where over 2,500 pilots have undergone specialized training with the successful integration of flight simulators within the chamber to achieve the most realistic training available today. Depending upon your needs please take the time to explore the many diverse resources the SAMI has available to offer.

## Space Science Institute



The Space Science Institute (SSI) is a nonprofit, public benefit corporation formed in 1992. SSI's purpose is to create and maintain an environment where scientific research and education programs can flourish in an integrated fashion. SSI has five major branches: Research, Flight Operations, Education, Business Operations, and Information Systems and Technology (IST). SSI's research program encompasses the following areas: space physics, earth science, planetary science, and astrophysics. The flight operations branch manages the Cassini spacecraft's visible camera instrument and provides spectacular images of Saturn and its moons and rings to the public. SSI's education program includes developing traveling exhibits and professional development workshops for scientists and educators, education planning for the research community, and developing instructional materials. The business operations area strives to create an efficient working environment. It provides the necessary infrastructure that allows the organization to carry out its day-to-day tasks and meet its regulatory and contractual obligations. And finally, the IST branch is responsible for keeping our computers running, protecting the Institute from virus attacks, and providing a variety of education services.

## Laboratory for Atmospheric and Space Physics



The Laboratory for Atmospheric and Space Physics (LASP) is a full-cycle space institute, combining all aspects of space exploration through expertise in science, engineering, mission operations, and scientific data analysis. LASP is an institute at the University of Colorado at Boulder. LASP began in 1948, a decade before NASA,

to develop a stabilized platform for instruments launched aboard sub-orbital rockets. LASP addresses key questions in solar influences, atmospheric science, planetary and space physics. LASP focuses on the study of Earth's atmosphere, the sun, and the solar system. LASP is the world's only research institute to have sent instruments to all eight planets and Pluto.

## University of Colorado Department of Aerospace Engineering Sciences



Located in Boulder, Colorado, the University of Colorado's Aerospace Engineering Sciences department is home to 36 tenure-track, research, and instructional faculty, over 250 graduate students and more than 400 undergraduates. Our vibrant community of engineers and scientists tackle challenges in aerospace technology and science, focusing on Astrodynamics & Satellite Navigation Systems, Vehicle Systems, Bioastronautics, Structures & Material Systems, and Remote Sensing, Earth & Space Sciences.

## Department of Meteorology at Stockholm University



The Department of Meteorology at Stockholm University conducts a broad research program ranging from the Earth's oceans to the upper atmosphere. Activities include experimental, theoretical and modeling studies of atmospheric and oceanic processes, with particular attention devoted to effects on the global climate. Field research makes use of satellites, rockets, balloons, aircraft, ships as well as ground-based observations. Numerical investigations are undertaken with process models, weather-forecast models, as well as climate models from regional to global scales. The Atmospheric Physics group at the

Department of Meteorology is involved in a number of satellite, rocket, ground-based and modeling projects concerning the Earth's stratosphere and mesosphere. Major focus is on the coupling between atmospheric regions and the understanding of underlying dynamical, microphysical, radiative and chemical interactions. Since 1990 a major focus of the group has been the development and operation of the Swedish-led Odin satellite, launched in 2001. The Atmospheric Physics group is also active in international sounding rocket programs, in close collaboration with scientific groups in Germany, Norway, and the USA.

## Leibniz-Institute for Atmospheric Physics



The Leibniz-Institute of Atmospheric Physics e.V. is located at the University of Rostock (IAP). The Institute was founded in 1992 and is a member of the research association Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (WGL). The institute is located near the Baltic Sea resort Kühlungsborn and owns a separate site on the island

Rügen, close to Juliusruh. In addition, IAP is a major partner of the ALOMAR observatory in northern Norway. A total of 65 persons are employed at IAP including 10 – 15 Ph.D. students. The Leibniz-Institute is one of the main German centers for Middle Atmosphere research and operates active cooperations with several international research organizations. The most important scientific topics at IAP are 1) investigation of the mesosphere, 2) atmospheric coupling, and 3) trends in the middle atmosphere.

## Clemson University Department of Physics



The Department of Physics and Astronomy at Clemson University has 25 faculty and 66 graduate students (2012) conducting research in the areas of Astrophysics, Atmospheric and Space Physics, Biophysics, Condensed Matter, Atomic Physics, and Foundations of

Quantum Theory. It is housed in the four-story Kinard Laboratory, which includes a fully equipped machine shop and a state-of-the-art planetarium. Campus computing facilities are spearheaded by the 15,000+ core high-performance Palmetto cluster. Research facilities include an electron beam ion trap facility, a scanning tunneling and other powerful microscopes, laboratories for the creation and processing of thermoelectrical and diverse nanomaterials, and access to ground-based and space telescopes.

## Silicon Valley Space Center



Humanity is emerging from the cradle of the Earth, and creating a market of suppliers and users of space products and services, fueled by innovative technologists and entrepreneurs. A healthy commercial space industry needs entrepreneurial companies that target a wide range of revenue levels. New entrepreneurial space companies will fill existing and now unimagined economic niches. The entrepreneurial environment of Silicon Valley can empower the development of such companies in a growing commercial space industry. The Silicon Valley Space Center integrates the innovative and entrepreneurial practices of Silicon Valley into the burgeoning NewSpace industry. This includes the

Valley's practices for business acceleration, incubation, and angel-level funding. The SVSC enables entrepreneurial start-up or early-stage companies to commercialize products or service concepts for space, and helps entrepreneurs identify niches in NewSpace markets. SVSC incorporates the Valley's richness of technology, business, entrepreneurial finance, and educational leadership.





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## SCIENTIST-ASTRONAUT CANDIDATE EMERALD AINGE



**Emerald Ainge** is an aerospace engineer at Pioneer Astronautics in Colorado, where her current project is the design of high performance, green-propellant spacecraft thrusters for a NASA research grant. She holds a Bachelor's degree in Aerospace Engineering from MIT and an M.S. in Aeronautics and Astronautics Engineering from Purdue University. Her thesis focus was the development of interplanetary propulsion thrusters. After Purdue she worked at SpaceX on the Merlin Vacuum (MVacD) engine and on developmental space engines. Several of her designs are currently in use on commercial missions to the ISS.

Emerald pursues intensive research projects in remote areas of the world where she can work as part of a crew. In 2009, she flew on a Zero-G flight as part of the Mars Gravity Biosatellite team, where they studied gravity's effects on mice. That same year she traveled to the Sinai Peninsula in Egypt for desert conservation research. In 2010, she traveled to the Alps for harsh conditions training and psychological evaluation for remote missions. In 2011, she traveled to Antarctica, where she worked as the resident engineer inside a survival home without electricity, heat, or running water. She completed geological research by climbing glaciers, taking magnetic measurements, and exploring the environment. In addition to her professional work, Emerald is certified in open water SCUBA diving, American Sailing Association (ASA) blue-water sailing, and is currently working toward fluency in Japanese.



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SCIENTIST-ASTRONAUT CANDIDATE DR. TIAGO BRITO



**Tiago Brito's** professional career started in 2001 as a geologist. Tiago currently works with Teixeira Duarte SA, the biggest Portuguese company in construction. Tiago had the opportunity and honor to participate in various international projects, such as:

- The Kerrada dam in Algeria: Worked as the responsible for the geotechnical consolidation of the foundation of the dam
- Marina Luanda in Angola: responsible for the elaboration of a proposal for the construction of the Marina in Luanda-Angola
- Tunnel Baralt in Venezuela: Responsible for the geotechnical study of the area of the tunnel construction as well as project manager for the part of the project related with the slope stability of the highway.

Tiago's increased interest in the development of alternative forms of energy and in the study of climate research led him to Project PoSSUM, which he strongly considers a unique opportunity to acquire knowledge related to the aforementioned areas through different and innovative types of training while working in a multi-disciplinary team.

Tiago holds a bachelor in Geology with specialization in geotechnical science from the University in Lisbon, while for the completion of my thesis I participated to the creation of the geotechnical map of Lisbon.





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## SCIENTIST-ASTRONAUT CANDIDATE KAREN BRUN



On July 20, 1969, everything changed for **Karen B Brun** as she fixated on the grainy television live coverage of the moon landing. At the time, just a child growing up on the island of Trinidad and Tobago, embracing this new-found passion could have only remained a fantasy seeing at the time she had never travelled more than 50 miles from her birthplace, much less travel on an aircraft. Years later, she took that first airplane ride, which brought her to a new life and opportunities in the United States.

Pursuing her passion, Karen served in the United States Air Force, specializing in Aviation Operations, which earned her a position as a C-5 Galaxy Flight Engineer. She also earned three associate degrees from the Community College of the Air Force and a Bachelor of Science in Applied Science and Technology from Thomas Edison State University. She is currently a graduate student in the Unmanned Systems - Space Operations Program at Embry Riddle Aeronautical University.

Karen also holds Federal Aviation Administration (FAA) licenses and ratings which includes – Instrument Rated Private Pilot; Aircraft Dispatcher; Airframe and Power Plant, and Flight Engineer (Turbojet). As an instrument rated private pilot, she was selected for an FAA-sponsored study to fly simulations using enhanced weather models to help industry experts identify possible root causes for weather-related general aviation accidents.

Karen credits opportunities such as RockOn, a NASA-sponsored program, where she learned how to build a sounding rocket payload utilizing an Arduino platform, which was then launched onboard a Terrier-Improved Orion sounding rocket at the Wallops Flight Facility. She hopes to inspire generations of learners about aviation and space exploration, and how they can become a part of it by becoming involved in STEM programs early. Passion overcomes setbacks ...just stay the course because there is no timeline, only perseverance.



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SCIENTIST-ASTRONAUT CANDIDATE

ROSSANA OCHANA DA CUNHA ROMERO FERNANDES



**Rossana Ochana da Cunha Romero Fernandes** is a student at Embry-Riddle Aeronautical University where she is pursuing a PhD in Aerospace Engineering. She graduated Summa Cum Laude with a Bachelor of Science in Aerospace Engineering, concentration in Astronautics, and a minor in Computer Science from Embry-Riddle Aeronautical University (ERAU). She later earned a Master of Science in Aerospace Engineering with distinction from the same institution. Rossana's master thesis involved the vibration analysis of composite wing boxes with arbitrarily shaped spars and ribs. As a graduate research assistant, her research interests include areas such as computational structural mechanics, structural dynamics and design optimization. Her research at Embry-Riddle earned her the ERAU Outstanding Aerospace Engineering Graduate Academic Achievement Award in Spring 2015. Rossana has tutored math and has been a tutor and teaching assistant for computer programming in the past. Currently, she enjoys being a graduate teaching assistant for the Aerospace Engineering Department. She is also a member of several honors societies, such as ERAU Honors Program, Tau Beta Pi and Sigma Gamma Tau.

Rossana's passion for science, aviation and space exploration and her determination to become a successful woman aerospace professional has been one of the main motivations in her career. She hopes her research and career can contribute to science and technology and can inspire young women to pursue their dreams overcoming the adversities with integrity, determination and love.



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SCIENTIST-ASTRONAUT CANDIDATE RENEE GARIFI



**Renee Garifi** is an experienced microgravity payload analyst and current flight controller for the International Space Station program with a background in space bioscience, astrobiology, astronomy, space biophysics and human spaceflight. Earlier this year, she served as Commander for Crew 162 of the Mars Desert Research Station, representing her graduate school, The International Space University, during a two-week isolation mission simulating conditions on the Martian surface and conducting planetary analog research. Renee is also a founding member of the International Space Station for the Nobel Peace Prize Initiative. As she develops her knowledge of space systems professionally and academically, her future goals include working on the next space station program after ISS; either in orbit around the Earth, Moon or Mars. She is currently pursuing a second Master of Science degree in Space Systems and hopes to extend this topic to a future Ph.D. research degree. She enjoys challenging herself by competing in triathlons and serves as a NASA Emeritus Docent at the US Space and Rocket Center in Huntsville, Alabama.



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SCIENTIST-ASTRONAUT CANDIDATE HADY GASSABIAN



**Hady Ghassabian** was born in Perugia, Italy. He soon started to be interested in space and science in general and dreamed to become an astronaut.

Currently he is doing his research as an aerospace engineer at the German Space Agency, DLR Institute of Space Systems, on bio-regenerative life support systems in order to make manned missions to Mars a reality. His focus is on space mission architectures, resupply systems and system engineering.

Hady is involved also in the 'Space Exploration Project Group', a division of the Space Generation Advisory Council, a group that works according to the global exploration roadmap and try to establish an international network of space enthusiast and decision makers in order to make space exploration more affordable.

He is also an inventor and in his spare time, he likes to create new stuff. This way he keeps his mind working on new things and let his creativity flow. His inventions have brought him recognition at an international level.

Hady is proud to be a 'Kendo-ka', a Japanese martial art practitioner and enjoys watching exciting basketball matches.

At the end, we can say that he is love with nature and never refuses a nice cup of traditional tea.



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SCIENTIST-ASTRONAUT CANDIDATE AVISHEK GHOSH



**Avishek Ghosh**, a young space enthusiast, was born in a village called Jiarah in India, 50 km far from the city Kolkata, West Bengal. After graduating in Physics from India, he decided to further pursue Masters in Space Studies (MSS) at International Space University (ISU), France. As part of his master's program, he got an opportunity to work at NASA Ames Research Center, as a program researcher, during spring of June 2015. His research area is focused on applications and strategies to imply the composition of the base material and the working principles of the additive manufacturing (3DPrinting) process that would be useful and economical for building space habitats and vehicles on the lunar surface using indigenous materials.

During his career, he witnessed the benefits of intercultural and interdisciplinary exchange. Being surrounded by such an environment encouraged him to accelerate the development of his research work at interacting with delegates from various organizations around the world. He is fascinated by space exploration and wants to become an Astronaut, in his own words, "The enthusiasm and passion for Space has gradually grown up in me since my childhood" He have been part of various Space related activities and study programs which have always been encouraging for me. According to him, "Space exploration is challenging, but it's worth pursuing the dreams with passion".

While travelling through many countries and continents during his academic and professional career, he realized the importance of Space for humankind." Avishek believes that, we are still not reached to the people who not aware of the importance of Space technology and its advantages in our daily life. The fact is, we can transform our lives through promoting space education and creating awareness in our society. An initiative for outreach program is important to reunite people, which also focus exclusively to the arena of space science and technology. For that reason, there has to be an organized platform availing broad access to people to learn and explore more about Space education even space enthusiasts can express their talent and passion inventively.



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SCIENTIST-ASTRONAUT CANDIDATE ALEXANDER HORVATH



**Alex Horvath** grew up in a town called Burke near Washington, D.C. From a very young age, Alex was interested in vehicles, particularly cars and planes. He could recognize the individual models and he knew that he wanted to do something in aerospace. In high school, Alex had the opportunity to work at the National Air and Space Museum in Washington, D.C. which opened his eyes to some fascinating things about space. He was intrigued with learning about how humans could live and work in space, such a hostile environment. Alex subsequently decided to enroll in the newly created Commercial Space Operations program at Embry-Riddle Aeronautical University to learn more about spaceflight and is working towards obtaining his private pilot's license and he wants to eventually get his commercial license. Alex is interested in human factors, space medicine, space safety, spacecraft systems, ECLSS systems, spacesuit operations and training, which is why he am doing this fantastic course!





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## SCIENTIST-ASTRONAUT CANDIDATE DR. DIANNE HOWARD



**Professor Dr. Diane Howard** is Assistant Professor in the Commercial Space Operations program at Embry-Riddle Aeronautical University in Daytona Beach, Florida USA. She is responsible for curriculum development and teaching space law and policy courses that are core to the program. Diane first became involved in space initiatives in 2004, participating in citizen lobbying efforts to facilitate the passing of the Commercial Space Law Amendments Act of 2004, a critical piece of US legislation that has made possible the development of innovative technologies and a burgeoning commercial space transportation industry.

Dr. Howard has retained her interest in commercial space issues. After working as a staff attorney in the Florida Appellate courts for a number of years, she took the decision to specialize in space law and attended McGill University's Institute of Air and Space Law. Her LLM thesis centered upon private space law issues and her doctoral work focused upon effective spaceport regulation.

Diane serves as Executive Secretary of the International Institute of Space Law and participates in numerous legal projects, both domestically (within the US) and internationally. She works with COMSTAC Working Groups when invited. The US Department of State named her a private sector advisor and subject matter expert in Expert Group D of the UN COPUOS STSC Long Term Sustainability of Space Activities Working Group, hoping to soon conclude its work. Dr. Howard was legal lead for the International Association for the Advancement of Space Safety Suborbital Safety (IAASS) Technical Committee, which recently finalized its guidelines. She continues to publish her research and speaks at space conferences and events throughout the world. In addition to the IISL and the IAASS, Diane is a member of the AIAA, the American Society of International Law, and the Florida Bar.



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SCIENTIST-ASTRONAUT CANDIDATE PRANIT PATIL



**Pranita Patil** is a scientist, technologist and researcher by profession. He is a member of Athena Platform for PSI System NASA and researching on Space explorations applications such Silica gel and special alloy. He is a member of European Patent Organization since 2015. He is also advising on Osmotic Power which are pressure restarted osmosis and reverse electrodialysis. Pranita loves astronomy and a member of skywatcher community. He likes singing, cooking and bike riding. On the family He is married and has a 7 month old daughter.



