AIAA ALBUQUERQUE

DECEMBER 2020

Shaping the Future of Aerospace

THE FLIGHT PLAN

The Newsletter of AIAA Albuquerque Section
The American Institute of Aeronautics and Astronautics

DECEMBER 2020 SECTION MEETING: MODELING AND SIMULATION OF COVID-19 SPREADING AS AEROSOL TRANSPORT IN A CLOSED ENVIRONMENT: CLASSROOM AS AN EXAMPLE.

Presenter. Mohamed Abuhegazy
Organization Ph. D. candidate, UNM Mechanical Engineering

Abstract A clear understanding of aerosol transport in different environments is crucial to find physics-informed measures for COVID-19 spreading mitigation. The objective of our study, is to numerically investigate the aerosol transport and surface deposition in a realistic classroom environment as an example of a closed area using Computational Fluid Dynamics (CFD) simulations. An instructor and nine students were placed in a 9 m by 9 m classroom, 2.4 m apart, following the social distance recommendations. A real situation of the room ventilation was applied by considering the classroom air conditioning according to ASHRAE 62.1 ventilation standards. Four different parameters including the particle size, aerosol source location, presence of sneeze guards in front of students, and the window state open vs. closed were studied. It is found that a significant fraction (24 – 50%) of particles smaller than 15 μm exit the classroom through the return diffusers of the air conditioning system within 15 minutes. This highlights the importance of effective filtration and sterilization systems within air conditioners. Sneeze guards are found to reduce the aerosol transmission of the 1 μm particles from the source to others by ~92%. By opening windows, the particle exit fraction can be increased by ~38% and aerosol deposition on people in the room is reduced.

Continued on page 2

Bio Mr. Abuhegazy obtained his M.S. degree in Mechanical Engineering from Menofia University, Egypt in 2016 and his B.S.degree in Mechanical Engineering from the same university in 2013. He has conducted research in various areas including Wind Energy, Multi-phase Flow, and Fire Dynamics. He co-authored journal articles and conference presentations. Currently, he works with Prof. Svetlana Poroseva in the ME Department at UNM on studying the mixing layer flows.

When: Dec 17, 2020 (Thursday) 5:45 – 6:00 Virtual meet and greet
Where: On-line via Zoom 6:00 ~ 7:00 Presentation & Discussion

Join Zoom Meeting
https://aiaa.zoom.us/j/99432933248

Meeting ID: 994 3293 3248

Click Here to RSVP
https://docs.google.com/forms/d/1T8z2aAe_WIRsqoNVZl2iKleXjwtDPPE07VXuIuNhhCM/viewform

INSIDE THIS ISSUE:

NEXT MEETING:
January:
25 January – Presenter – TBD

CALENDAR

Local Section Events

Next General meeting 17 December 2020

Virtual Meeting Via Zoom

Start 6:00 pm
End 7:30 pm

Upcoming U.S. Launches

2 Dec Falcon 9 • Space X CRS 21
Dec Falcon 9• NROL-108
Dec Delta 4 Heavy• NROL-82
Dec Falcon 9 • Turksat 5A
4th Qtr Electron • STP-27RM
Jan Atlas 5 • CST-100 Starliner OFT 2
Jan Falcon 9 • Transporter 1
Jan Falcon 9 • WorldView Legion 1&2
1 Feb Antares • NG-15
Feb Atlas 5 • STP-3
Mar Falcon 9 • Space X CRS 22
Mar Minotaur 1• NROL-111
30 Mar Falcon 9 • Crew 2

National AIAA Events

Student Virtual Career Fair (Postponed)
15 DECEMBER 2020 1200 - 1500 (EASTERN STANDARD TIME)

International Student Conference
10 JANUARY - 12 JANUARY 2021

To the Moon with Dynetics: The Importance of Lunar Exploration and Utilization
15 SEPTEMBER 2020 1300 - 1430 (EASTERN DAYLIGHT TIME)

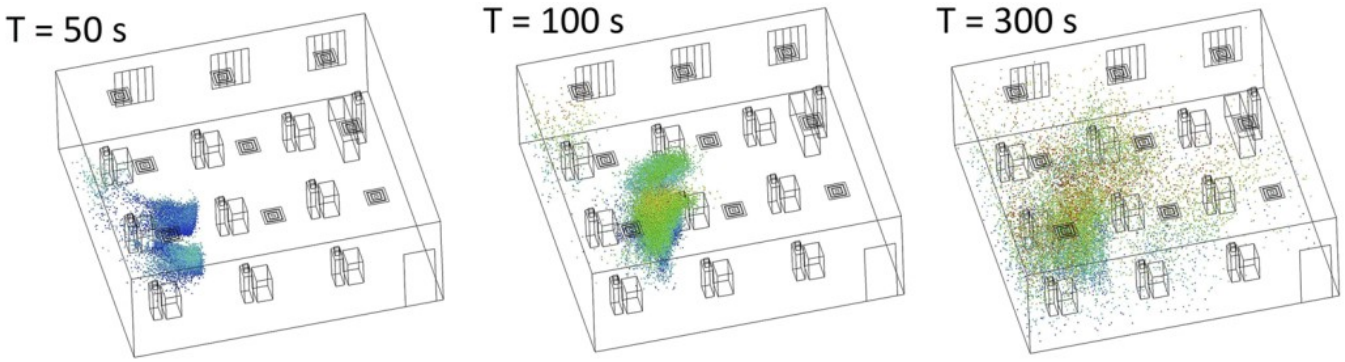
2021 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum)
11 JANUARY - 15 JANUARY 2021

Professional Virtual Career Fair
26 JANUARY 2021 1500 - 1800 (EASTERN STANDARD TIME)

31st AAS/AIAA Space Flight Mechanics Meeting
31 JANUARY - 4 FEBRUARY 2021

Conrad Challenge - 2021 Virtual Innovation Summit
1 FEBRUARY 2021

DECEMBER 2020 SECTION MEETING: (CONTINUED)



One micron particle spread in a classroom at 50 to 300 seconds

THE ZIA INITIATIVE

By Dr. Paul M. Delgado Vice Chair – AIAA Albuquerque

I, like many of my colleagues in the aerospace industry, can trace my fascination with space all the way back to childhood. Be it the Apollo Program or the Space Shuttle, Star Trek or Star Wars, I've always had a deeply held fascination with space exploration. For me, it was the amazement that space flight wasn't just something that happened in movies, but in real life. The fact that it was not only amazing, but also "tangible" gave me the impression that it was within my reach.

Growing up in the barrios of East L.A., I was surrounded by other kids that were as equally (if not more so) fascinated by the notion of space travel as well. Yet among those friends and classmates I had as a child, I was the only one who made it all the way into the aerospace industry. It is tempting to dismiss this observation and ascribe it to a sort of "natural process" of changing interests over time.

Yet even for someone like me who works in the industry, it was not easy holding on to the dream of working in space flight. I often remember asking my elementary school teachers how things like rockets work, and never really getting a satisfying answer. Back before the internet, it wasn't easy to learn about spaceflight on your own. What few resources existed to learn it were scarce and far too advanced for casual learners, much less for young learners. Even today, with the internet and YouTube, it can still be difficult put all the pieces of spaceflight together in one cohesive narrative, much less a narrative accessible to an elementary school kid.

Ever since I've become a professional in the aerospace industry, I've made it a personal goal to make spaceflight education accessible to a much wider audience. Over the course of multiple years, I've developed entire courses focused on introducing kids throughout New Mexico to the whole process of spaceflight, from rocket propulsion and aerodynamics, to orbital mechanics and reentry thermodynamics. On the surface, many of these topics seem far too advanced for even a high schooler. Yet these courses have been tailored to suit audiences as young as preschool. Moreover, the courses have been met with great success and positive feedback, particularly from students in under-represented minority communities around the Albuquerque area.

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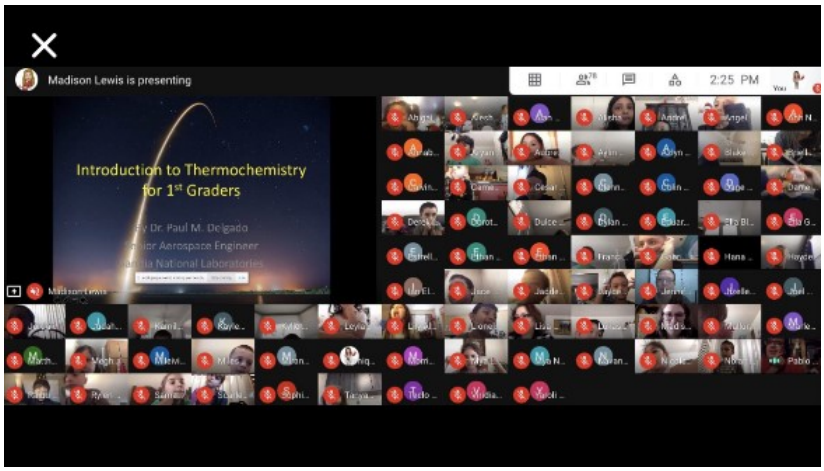
THE ZIA INITIATIVE– CONTINUED



Examples of spaceflight couses designed for elementary & middle school kids as part of the ZIA Initiative, including propulsion, aerodynamics, thermodynamics, and orbital mechanics.

(Continued from page 3)

While these courses have been largely successful, many questions remain. Do these efforts have a lasting impact? In what ways does exposure to such education at an early age affect retention, college preparedness, graduation, etc…? To the best of my understanding, no one has ever attempted to incorporate aerospace engineering education systematically at the public-school level, much less at younger grade levels. It is still very much an open question how best to incorporate it within existing school frameworks and curricula.

To this end, AIAA Albuquerque has begun an initiative to explore and address these issues. The Zia Initiative, as it has come to be known, is an effort of our local AIAA section whose mission is to transform and improve public education in New Mexico through expanded access and exposure to aerospace engineering education and training.

(Continued on page 5)

THE ZIA INITIATIVE– CONTINUED

(Continued from page 4)

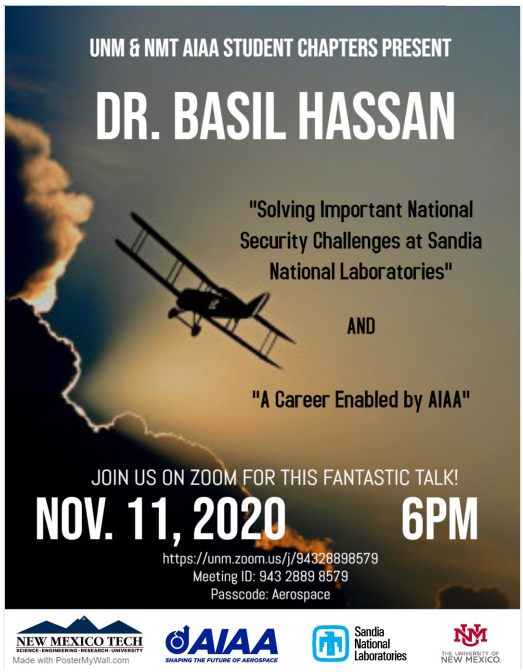
The initiative includes efforts to:

- Design a first-of-its-kind curriculum tailored around aerospace engineering from Kindergarten to 12th grade in the public school system.
- Deliver a multi-year curriculum designed around different aerospace engineering applications, designed to reinforce basic engineering principles and skills at age-appropriate levels
- Research the effects of integrating aerospace education on student outcomes
- Train a workforce capable of supporting and expanding the aerospace and defense industry in New Mexico
- Build a consortium of educators, researchers, and subject matter experts capable of refining the curriculum and disseminating it more broadly throughout New Mexico
- Expand public awareness & pride in New Mexico's historic and current role as leader in aerospace & defense
- Foster a culture that promotes both education and the aerospace / defense industry in New Mexico

The goals of the initiative are broad and long term and will require significant efforts not only of the AIAA organization, but also industry, government, and academic partners. For further information on the Zia Initiative and how to participate in it, please contact the Vice Chair of the AIAA Albuquerque Section, Dr. Paul M. Delgado (dr.paul.m.delgado@gmail.com).

AIAA PRESIDENT SPEAKS TO UNM & NMT STUDENT BRANCHES

By Jeremy A. Holder Chairman – UNM Student Branch



On 11 November 2020 the University of New Mexico (UNM) and New Mexico Tech (NM Tech) student branches of the American Institute of Aeronautics and Astronautics (AIAA) conducted a collaborative speaker meeting to great success. This was the first speaker meeting of the fall semester for UNM AIAA and the first meeting for the newly formed NM Tech AIAA branch. Dr. Basil Hassan, the current President of AIAA and the Director of the Chief Research Office at Sandia National Laboratories, was gracious enough to talk to both branches. Dr. Hassan's talk focused on the history and the current thrusts of Sandia National Laboratories, as well, his journey with AIAA and what an important role that has played in his career. Twenty-five plus students attended the meeting from both groups and Dr. Hassan's presentation gave new attendees insight into what benefits may be gained by being a part of this esteemed organization.

ALBUQUERQUE SECTION MEETING 24 SEPTEMBER

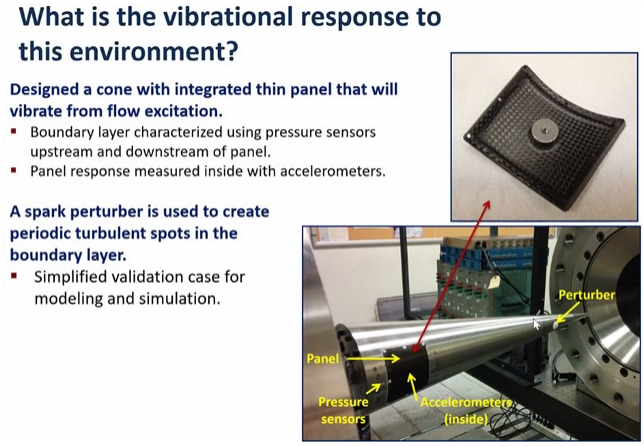
Experimental Studies of Fluid-Structure Interactions in High-Speed Flow

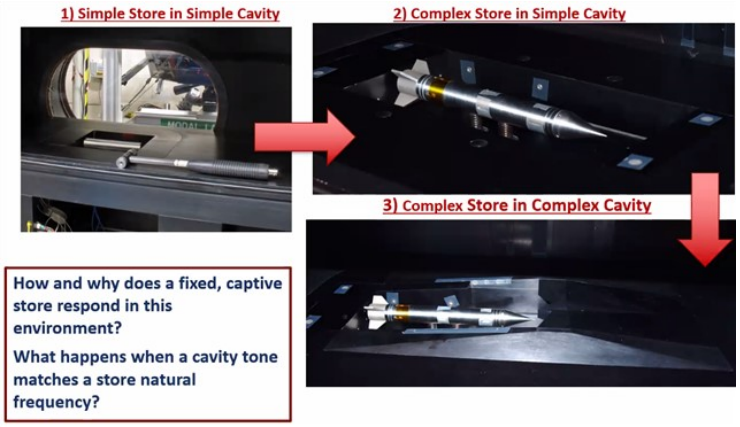
Katya Casper, PhD, Sandia National Laboratories

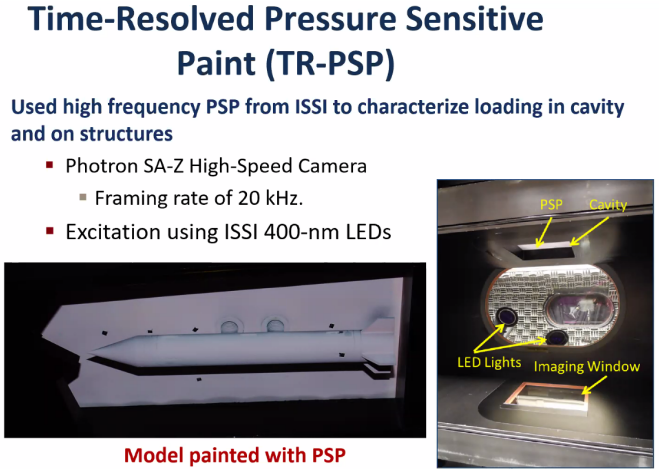
Dr. Katya Casper, a principal member of the technical staff at Sandia National Laboratories in Albuquerque, develops, conducts, and manages wind tunnel experiments in support of Sandia's programs. Her work centers on high-speed experimental fluid dynamics, with a focus in hypersonic boundary-layer transition, hypersonic fluid-structure interactions, as well as fluid-structure interactions in subsonic/supersonic cavity flows.

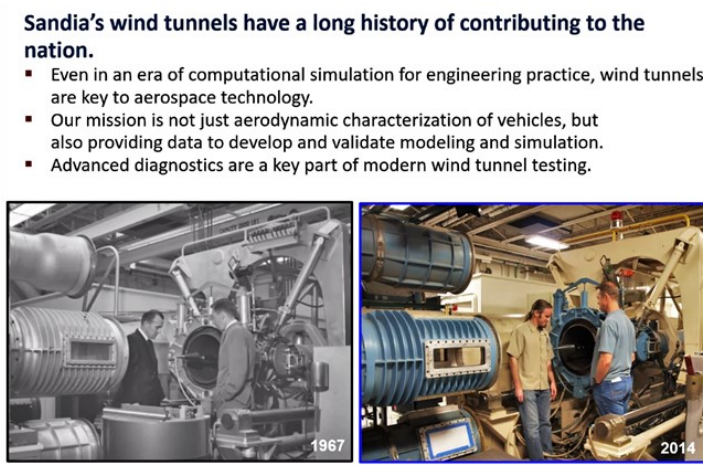
Sandia National Laboratories is responsible for predicting the vibrational response of many structures to high speed flow. This talk gave an overview of experimental efforts aimed at better understanding these fluid-structure interactions. During atmospheric reentry, hypersonic vehicles are subjected to high levels of boundary-layer pressure fluctuations that can cause vibration of internal components. Experiments were conducted to correlate the unsteady loading from turbulent spots in the transitional hypersonic boundary layer to the dominant vibrational response of a thin panel.

Experiments have also been conducted to better understand fluid-structure interactions in subsonic and supersonic cavity flows. Work focused on determining if the resonant tones of these cavities can drive a large vibration of internal structures when matching a structural natural frequency. This talk also covered the use of pressure-sensitive paint (PSP) to capture both the fluid loading and structural response with both temporal and spatial resolution.









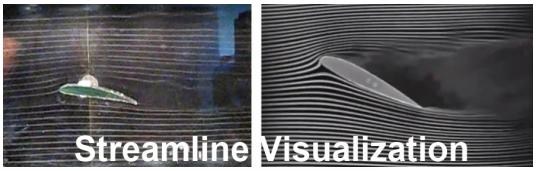
The major change seems to be the switch from suits to blue jeans.

ALBUQUERQUE SECTION MEETING 16 OCTOBER

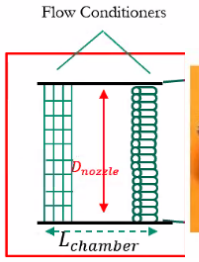
Low Speed Wind Tunnel Design and The Zia Initiative

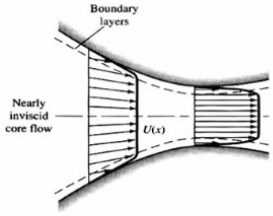
Dr. Paul Delgado, Sandia National Laboratories

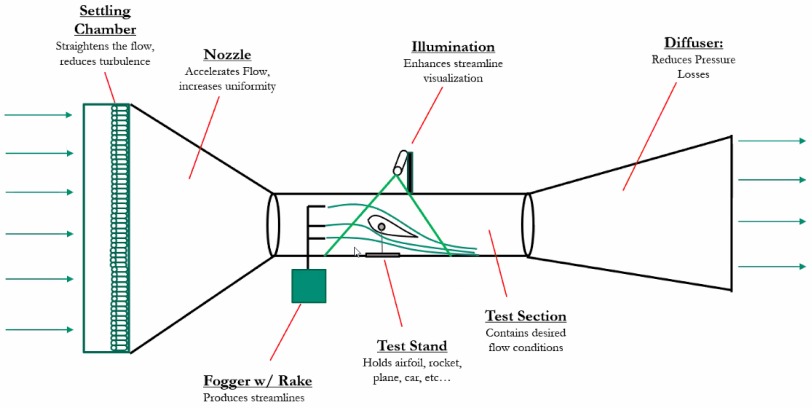
Our section Vice Chairman, Dr. Paul M. Delgado is a Senior Member of the Technical Staff at Sandia National Laboratories' Aerosciences Department, specializing in Hypersonics, Thermal Ablation, and Planetary Reentry. He is also a member of the AIAA Weapon Systems Effectiveness Technical Committee, and moderator of the Computational Science Stack Exchange. Paul also actively participates in STEM K-12 outreach with Air Force Research Laboratories and Sandia National Laboratories, developing and teaching courses in spaceflight to underrepresented minority students at the elementary and middle school levels. The Zia Initiative is a pilot program designed to expand access to aerospace engineering education within the greater New Mexico K-12 public school system. Paul presented a design for a portable, low-speed, subsonic wind tunnel and its role within the Zia Initiative. In his talk, he explored the trade-offs in complexity, performance and cost for streamline visualization.

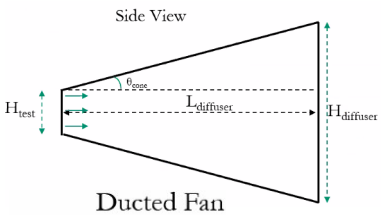


The tunnel should be small enough for easy portability for school and STEM event presentations. Dr. Delgado discussed criteria for designing various components depicted here:

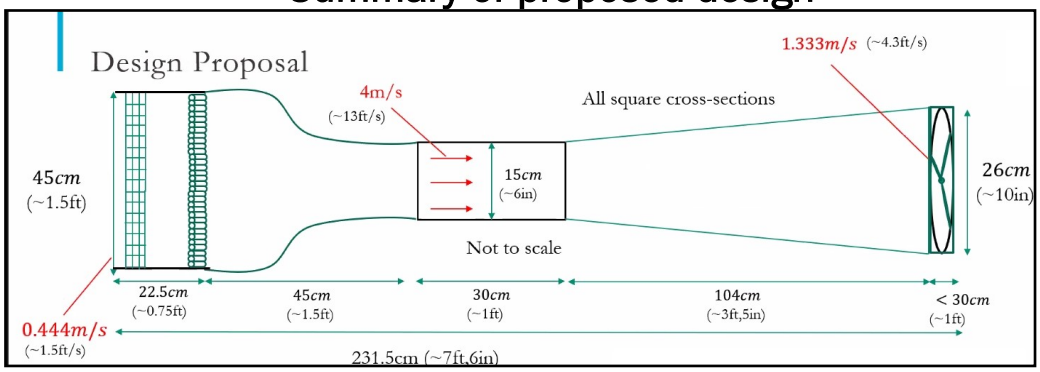








Summary of proposed design

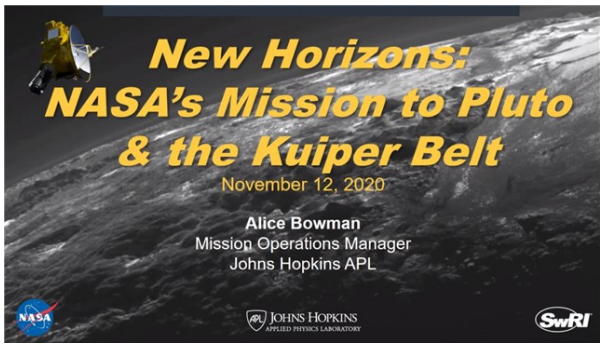


ALBUQUERQUE SECTION MEETING 12 NOVEMBER

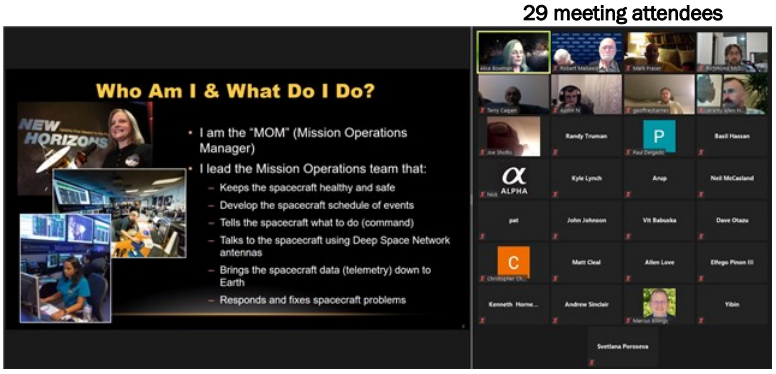
Mission to Pluto

Alice Bowman, JHU Applied Physics Laboratory , AIAA Distinguished Lecturer

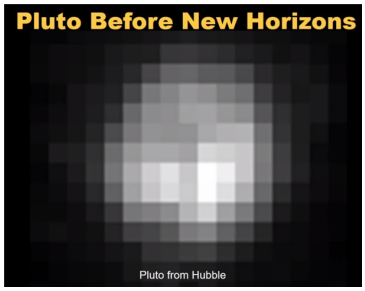
Alice Bowman presented her Distinguished Lecture titled, "Mission to Pluto". Ms. Bowman is a member of the Principal Professional Staff at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland. She is the Space Mission Operations Group supervisor and the NASA New Horizons Mission Operations Manager (MOM). She spoke about the many challenges of designing a mission and building a spacecraft to make a fly-by survey of Pluto and the Kuiper Belt object MU69. After Pluto was discovered in 1930 by Clyde Tombaugh it was considered to be the 9th planet of our solar system although its orbit was different from that of the other 8 planets. These days numerous other objects have been discovered in the trans-Neptunian region that we call the Kuiper Belt, so It is now believed that Pluto was just the first of these to be discovered. The New Horizons mission was to visit two of these objects.



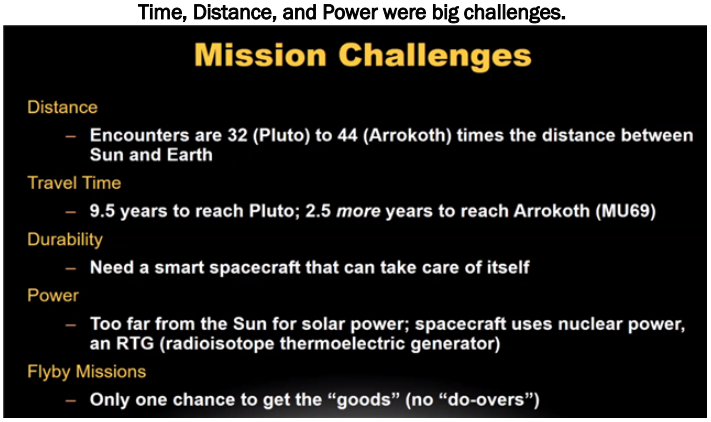
29 meeting attendees



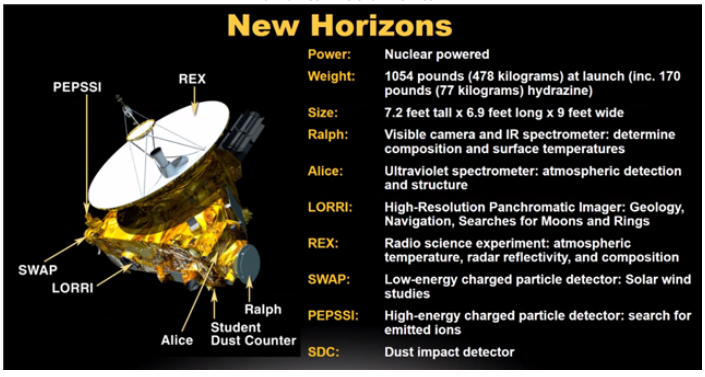
Hubble gave us the best previous view of Pluto, but now much has been revealed.



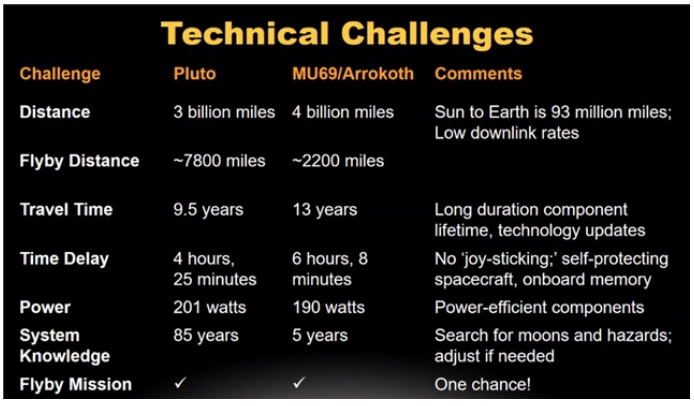
Time, Distance, and Power were big challenges.



Radioisotope Thermal Generator was necessary to power the spacecraft and its instruments.



Communication time to Pluto was over 4 hours and over 6 hours to MU69.

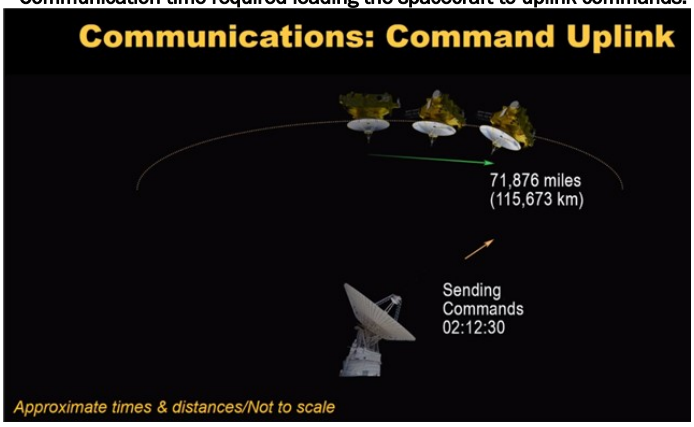


Challenge	Pluto	MU69/Arrokoth	Comments
Distance	3 billion miles	4 billion miles	Sun to Earth is 93 million miles; Low downlink rates
Flyby Distance	~7800 miles	~2200 miles	
Travel Time	9.5 years	13 years	Long duration component lifetime, technology updates
Time Delay	4 hours, 25 minutes	6 hours, 8 minutes	No 'joy-sticking;' self-protecting spacecraft, onboard memory
Power	201 watts	190 watts	Power-efficient components
System Knowledge	85 years	5 years	Search for moons and hazards; adjust if needed
Flyby Mission	✓	✓	One chance!

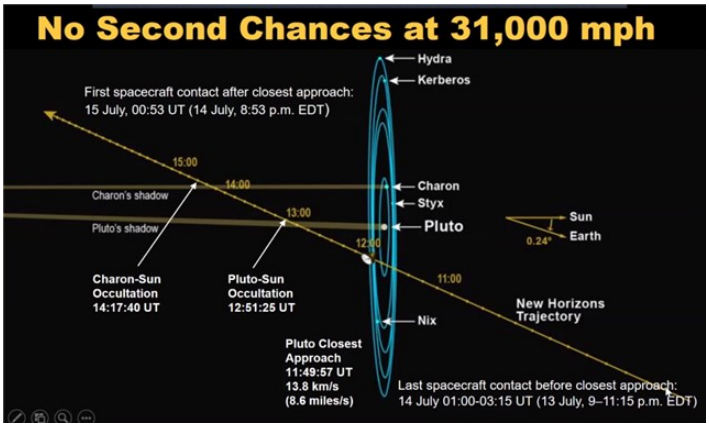
ALBUQUERQUE SECTION MEETING 12 NOVEMBER

Mission to Pluto (Continued)

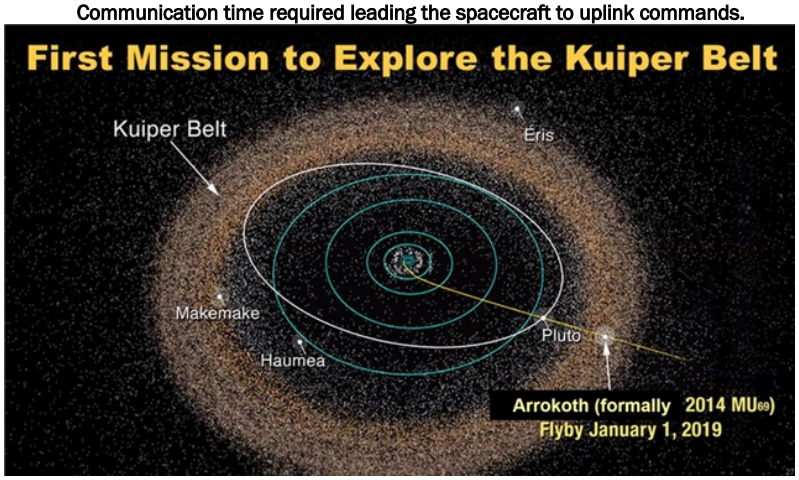
Communication time required leading the spacecraft to uplink commands.



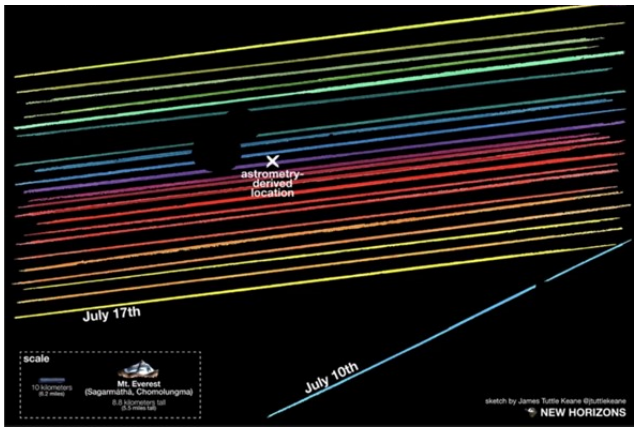
Navigation was very accurate.



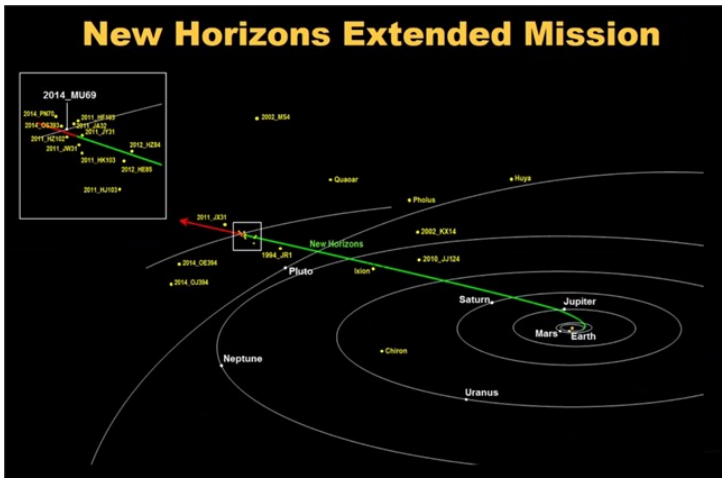
Communication time required leading the spacecraft to uplink commands.



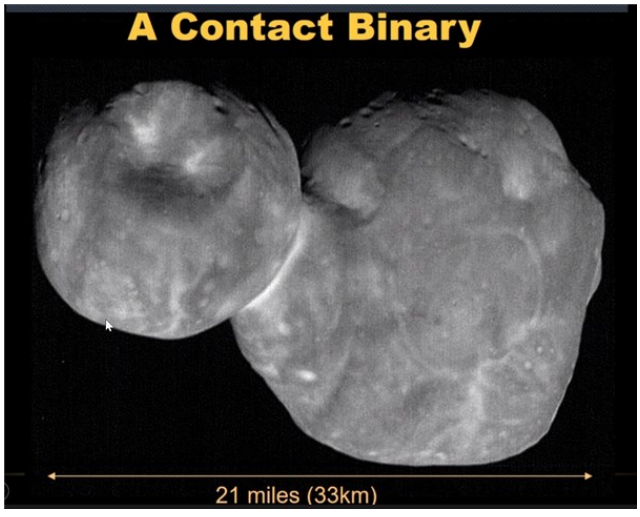
Ground-based star-occultation observations in Argentina revealed that MU69 seemed to have an unusual shape.



The New Horizons extended mission will make observations of at least 5 other Kuiper Belt objects.



New Horizons showed that MU69 is a contact binary object . It was temporarily named Ultima Thule, and later the official name "Arrokoth".



STUDENT BRANCH NEWS

2021 REGIONAL STUDENT CONFERENCE INFORMATION

Michael Lagana University Programs Manager
American Institute of Aeronautics and Astronautics, Reston VA

4 September 2020

The AIAA Regional Student Conference season begins NOW! Yesterday, we launched our abstract solicitation for this upcoming student conference season, and we couldn't be more excited to see what our student members have been up to.

If you are unfamiliar with this program, student members submit their papers via our online system (abstracts and then final manuscripts). The papers go through a **technical** judging process, where they receive one set of scores from technical judges and then student present at their regional conferences for an **oral** score based on their presentation. The two scores are then combined to determine our 1st, 2nd, and 3rd place winners in each category.

1st Place winners get $500 (total for the team) + a trip to the 2022 AIAA SciTech Forum to present at the International Student Paper Conference.
2nd Place winners get $300 (total for the team)
3rd Place winners get $250 (total for the team)

The categories are the following:
Undergraduate (max of 2 student authors and 1 faculty advisor)
Masters (max of 2 student authors and 1 faculty advisor [no Ph.D. students])
Team (between 3-10 student authors and 1 faculty advisor - all students should be undergraduates)

For 2021, we opened our solicitations 2 months earlier than normal to give our students extra time to submit heir abstracts, given the changing environment, with due dates being in late winter.

There are no limits on what topic you can submit to the call for papers. These competitions are open-topic, as long as it relates to aerospace engineering and your paper fits into the formatting restrictions, you are good to go! Check out more information, review the rules and deadlines here:

AIAA Student Conferences Call for Papers

Want to go straight to the submission site? Click here!

If you have any questions, please contact me at michaell@aiaa.org. I am happy to help!

AIAA SCHOLARSHIPS AND GRADUATE AWARDS

By Robert Malseed—Treasurer

Undergraduate Scholarships
SCHOLARSHIP NAME & AWARD AMOUNT

Daedalus 88 Scholarship: $10,000*

**Note: Applicants should call out their entrepreneurial spirit by describing their leadership of a student-initiated, hands-on multidisciplinary aerospace engineering project. Applicants must be willing to make a presentation, at a site that is mutually agreeable, on the student-led project in which they participated.*

David and Catherine Thompson Space Technology Scholarship: $10,000
Vicki and George Muellner Scholarship for Aerospace Engineering: $5,000
Wernher von Braun Scholarship: $5,000
Liquid Propulsion Scholarship: $2,500

Digital Avionics Scholarships
Cary Spitzer Digital Avionics Scholarship: $2,000
Dr. Amy R. Pritchett Digital Avionics Scholarship: $2,000
Dr. James Rankin Digital Avionics Scholarship: $2,000
Ellis F. Hitt Digital Avionics Scholarship: $2,000

Space Transportation Scholarship: $1,500
Leatrice Gregory Pendray Scholarship: $1,250*

**Note: This scholarship is available to female applicants only.*

Rocky Mountain Section Scholarship: $500

Graduate Awards
SCHOLARSHIP NAME & AWARD AMOUNT

Neil Armstrong Graduate Award: $5,000
Orville and Wilbur Wright Graduate Award (x2): $5,000
Dr. Hassan A. Hassan Graduate Award in Aerospace Engineering (x2): $5,000
Luis de Florez Graduate Award: $3,500
Guidance, Navigation and Control Graduate Award: $2,500
John Leland Atwood Graduate Award: $1,250
Martin Summerfield Propellants and Combustion Graduate Award: $1,250
Gordon C. Oates Air Breathing Propulsion Graduate Award: $1,000
William T. Piper, Sr. General Aviation Systems Graduate Award: $1,500 ($1,000 award, plus $500 stipend, to attend the AIAA AVIATION Forum)

Applications accepted from 01 October to 31 January

Details may be found at:

https://www.aiaa.org/get-involved/students-educators/scholarships-graduate-awards

AERONAUTICS R&D POLICY PLATFORM PAPER

For over a century, aeronautics research and development (R&D) has been a vital part of the foundation of U.S. economic prosperity and is a critical asset for maintaining our national security and defense. The aviation industry could not be more important to our nation's economic engine and our interconnectedness to the world. Aeronautics-related R&D is the foundation upon which this healthy industry has been built.

Contributions include dramatically improved aviation safety, defense force modernization, development of cutting-edge manufacturing processes and materials, significantly reduced environmental impact of aircraft, and, now, the creation of a dynamic aviation start-up ecosystem. Continued long-term federal investments have helped create, foster, and sustain a vibrant aviation industry and the need for ongoing support of the industry is even more vital considering the significant impacts of the coronavirus pandemic.

KEY POINTS

The United States must continue to ensure the viability of the civil aviation industry in the near term with sustained bipartisan policies, programs, and investment to allow for the stabilization and potential future growth of the industry during these unprecedented times. Despite a growing deficit and budget constraints, continued consistent federal investment in aeronautics R&D, as outlined in NASA's Strategic Implementation Plan, is essential to compete with international competitors like China and the European Union. The continuity of policies and programs that are meeting their objectives and adding value to the nation's technological advancement, scientific knowledge, and strategic security is necessary to maintain "constancy of purpose" in both civil aviation and national defense. This includes robust government support of basic research that is often the source of technological breakthroughs fueling America's engine of innovation.

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American Institute of Aeronautics and Astronautics
12700 Sunrise Valley Drive, Suite 200, Reston, VA 20191-5807 I 703.264.7500 I aiaa.org

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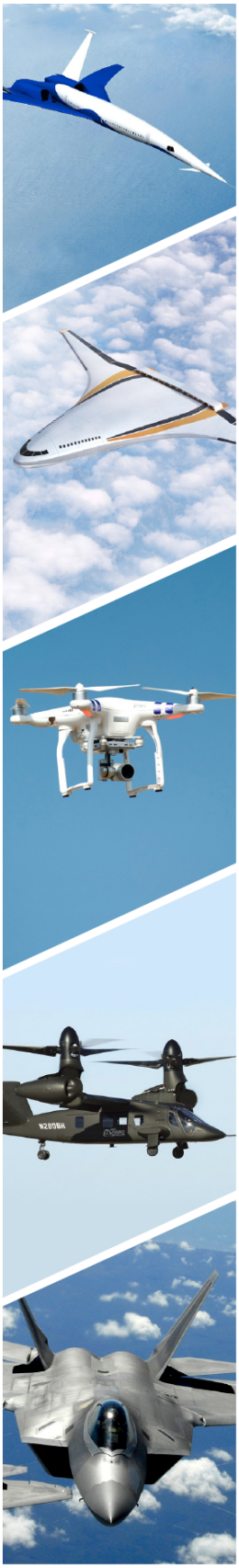

The commercial aviation market is projected to recover from the coronavirus pandemic and grow in the coming years. The U.S. economy stands to gain significantly from a growing market that is realized through emerging technologies. Ensuring U.S. preeminence will require continued congressional support, as well as increased funding for robust, long-term federal civil aeronautics research and technology initiatives. Government-funded R&D at the DOD, the FAA, and NASA has enabled the development of advanced engines, materials, aerodynamics, and systems to address the expansion of global operations. Research conducted at these federal agencies has developed multiple world-class technologies that enabled significant fuel savings, new materials, reduced noise and emissions, and the NextGen Air Traffic System.

These investments in aeronautics have made civil aviation safer, air travel affordable for most Americans, and significantly reduced the environmental impact of aircraft by reducing community noise and emissions. Excitement in the civil aviation industry is at a generational high with the advent of technologies in autonomous systems, low boom supersonics, alternative fuels, and air traffic control systems. New products and companies created from these technologies will fuel economic prosperity in the U.S. economy by connecting people, cultures, and businesses, as well as supporting the necessary infrastructure of companies working on equipment and vehicle maintenance, repair, and overhaul.

Beyond these technologies, there are substantial areas of research that need investment to ensure the United States remains a world leader in aeronautics. The future of aeronautics requires research funding for federal agencies to study supersonic and hypersonic flight, environmental sustainability, new materials, noise reductions, advanced propulsion systems, UAS, and the further development of Next Generation air traffic management technologies. Also, while the federal government has recognized the importance of a healthy aeronautics industry with financial support provided in the CARES Act to deal with the short-term impacts of the pandemic, additional aid is needed.

ADVANCEMENTS AND NEW TECHNOLOGIES

AIAA has identified several key advancements in aeronautics and civil aviation that must be addressed to safeguard ongoing U.S. leadership. Efforts in these areas are vital to ensure innovation in this high-tech sector, continued stabilization and growth for our nation's economic prosperity, and that that we maintain our national security and defense.

- ***Focus on Reducing Carbon Emissions*** – The use of ultra-efficient commercial air vehicles and emerging capabilities, such as electric and hybrid-electric propulsion systems and renewable alternate aviation fuels, will enable the U.S. industry to cultivate emerging markets and to stay competitive in existing markets. Continuing research is needed in areas like advanced composite materials for strong, lightweight aircraft structures and electric propulsion for the next generation of single aisle transport.
- ***Supersonic Flight*** – While current FAA restrictions prevent civil aircraft from operating at supersonic speeds over land, companies continue to propose and develop supersonic platforms for commercial applications of high-speed transit. In addition, propulsion and materials research is being performed to address the unique environmental challenges of providing safe, reliable structures and engines that are economical to operate and maintain.
- ***Hypersonics*** – Research related to heat exchangers, engines, and high-temperature materials is needed to make this technology viable for military payloads, so the United States does not fall behind work being performed by Russia and China. Robust and highly integration control systems for hypersonic and supersonic technologies are necessary and would help other aspects of aviation.
- ***UAS*** – As the aerospace and defense industry's UAS capabilities evolve and mature, more commercial applications and technology advances are realized. With the advent of drone delivery services and the use of first responder drones for wildfires and aerial surveillance, there is significant pressure to invest in the maturation of UAS technology and policy to keep up with its accelerating pace.
- ***Advanced Air Mobility*** – NASA has launched an Advanced Air Mobility national campaign to help emerging aviation markets safely develop an air transportation system that moves people and cargo between places not previously served or underserved by aviation. The U.S. Air Force has developed Agility Prime to accelerate the commercial market for these new air vehicles. Additionally, there is a need for defense force modernization incorporating the developing technologies to meet future national security threats.

VIRGIN GALACTIC NEWS

By Robert Malseed—Treasurer (From SpaceNews.com)

— Virgin Galactic is postponing a test flight of its SpaceShipTwo suborbital vehicle that was scheduled for late November after the state of New Mexico reinstated a stay-at-home order in response to a surge of COVID-19 cases.

Virgin Galactic had planned to perform a powered test flight of SpaceShipTwo from Spaceport America in New Mexico between Nov. 19 and 23. The flight would have been the first powered test flight of the vehicle since February 2019 and the first ever from Spaceport America, where the company will commercially operate the vehicle.

That test flight is on hold after New Mexico Gov. Michelle Lujan Grisham announced a "reset" of the state's pandemic restrictions Nov. 13 after a sharp increase in cases of the disease in the state. That includes reinstituting a stay-at-home order starting Nov. 16 through at least Nov. 30. The state had a similar order in place in the spring during the onset of the pandemic, closing nonessential businesses.

"We had hoped targeted crackdowns, limited hours of operation and amplified messaging and enforcement would make the difference and slow the spread and relieve our hospitals," Lujan Grisham said in a statement about the new order. "The public health data make clear, however, that more aggressive restrictions are not only warranted but essential if we are to prevent mass casualties."

Virgin Galactic, in a Nov. 16 statement, said it was rescheduling the SpaceShipTwo test because of that order as it limits activities in the state after consultation with officials there.

"With the health and safety of our team members in mind, and in accordance with the recent direction from the New Mexico Department of Health, we will be minimizing our New Mexico operations to the greatest degree possible," Michael Colglazier, chief executive of Virgin Galactic, said in a statement. "While these new restrictions cause us to adjust our flight schedule, we take this pause in stride and will be prepared to resume our preflight procedures and announce a new test flight window as soon as we can."

The company didn't announce when a new flight might take place. Before this latest delay, Virgin Galactic said that this test flight, with two pilots on board, would be followed by another in the first quarter of 2021 with two pilots and four company employees board, then another late in the first quarter that will carry company founder Richard Branson.

Virgin Galactic blamed some delays in the flight test program this year on the pandemic. Colglazier, in a Nov. 5 earnings call, cited "scheduling and cost inefficiencies" because of the pandemic that pushed back completion of the next SpaceShipTwo vehicle at its Mojave, California, factory. "As you might imagine, building spaceships during a pandemic is materially less efficient than normal," he said.

(Continued on page 15)

VIRGIN GALACTIC NEWS—CONTINUED

By Robert Malseed—Treasurer

Many aerospace companies have been able to continue operations despite stay-at-home orders during the pandemic, citing federal classification as essential businesses. Those companies, though, often paused or slowed down activities during the onset of the pandemic as they enacted new processes to incorporate practices like social distancing.

CONGRATULATE OUR NEW ASSOCIATE FELLOWS

By AIAA National

September 28, 2020 – Reston, Va. – The American Institute of Aeronautics and Astronautics (AIAA) is pleased to announce its Class of 2021 Associate Fellows.

"I am extremely excited for and proud of each member of the Class of 2021 Associate Fellows," said AIAA President Basil Hassan. "These individuals exemplify passion and dedication to advancing the aerospace profession and were selected because of their significant and lasting contributions to the field."

"The AIAA Associate Fellows personify the innovation that drives our industry forward," said Dan Dumbacher, AIAA executive director. "The Class of 2021 Associate Fellows, representing industry, academia, and government, embodies the commitment, dedication, and ingenuity that are crucial for devising the best solutions to the complex questions raised in aerospace science. AIAA and the aerospace industry tremendously appreciate the long hours of dedication to society and the industry. We also recognize the families, friends, and colleagues that support the Associate Fellows helping drive our industry forward."

The grade of Associate Fellow recognizes individuals "who have accomplished or been in charge of important engineering or scientific work, or who have done original work of outstanding merit, or who have otherwise made outstanding contributions to the arts, sciences, or technology of aeronautics or astronautics." To be selected as an Associate Fellow an individual must be an AIAA Senior Member in good standing, with at least twelve years professional experience, and be recommended by a minimum of three current Associate Fellows.

Congratulations to the following Albuquerque Section members:

Eleni Sims	The Aerospace Corporation
Brenton Taft	Air Force Research Laboratory
Justin Wagner	Sandia National Laboratories

Application now open!
>> Select sites only

Deadline: January 12, 2021

TODAY! Application is now open for multiple AFRL sites, including Kirtland AFB, NM, and AMOS, HI. Start your application now for these sites, and stay tuned for Eglin AFB, FL, and Rome Labs, NY, application updates coming soon.
https://afrlscholars.usra.edu/students

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-processed for a ***Secret Security Clearance***, making them competitive on the job market

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Frequently Asked Questions...

Questions about housing, the security clearance process, available topics, or maybe something else? We may have already answered it on our FAQ page!
https://afrlscholars.usra.edu/faq/

You can also check out the responses from past Q&A live events. Follow @AFRLScholars on Twitter and search **#AskAFRLScholars** to learn more!

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Over the years, the **Honors and Awards Program** has celebrated thousands of the best and brightest for their outstanding achievements in aerospace. We take great pride in honoring dedicated individuals for their technical contributions, literary excellence, and service to AIAA.

Please consider nominating someone who deserves recognition for their contributions to the aerospace industry. Nomination forms and endorsement letters must be submitted to AIAA Honors and Awards by **1 February 2021.**

Technical Excellence Awards

Aerospace Power Systems Award
Air Breathing Propulsion Award
Energy Systems Award
Haley Space Flight Award
Hypersonic Systems and Technologies Award
Propellants & Combustion Award
Space Automation & Robotics Award
Space Operations & Support Award
Space Systems Award
von Braun Award for Excellence in Space Program Management Award
Wyld Propulsion Award

Award Nomination Form

Premier Awards

Daniel Guggenheim Medal

Award Nomination Form

Lectureships

Dryden Lectureship in Research Award
Durand Lectureship for Public Service Award

Award Nomination Form

CHUCK YEAGER, TEST PILOT WHO BROKE THE SOUND BARRIER, IS DEAD AT 97

From the New York Times

1948

2012

Chuck Yeager, the most famous test pilot of his generation who was the first to break the sound barrier, and, thanks to Tom Wolfe, came to personify the death-defying aviator who possessed the elusive yet unmistakable "right stuff," died on 7 December at a hospital in Los Angeles. He was 97.

General Yeager came out of the West Virginia hills with only a high school education and the first time he went up in a plane, he was sick to his stomach. But he became a fighter ace in World War II, shooting down five German planes in a single day and 13 over all. in March 1944, on his eighth mission, he was shot down over France by a German fighter plane and parachuted into woods with leg and head wounds. But he was hidden by members of the French underground, made it to neutral Spain by climbing the snowy Pyrenees, carrying a severely wounded flier with him, and returned to his base in England.

In the decade that followed, he helped usher in the age of military jets and spaceflight. He flew more than 150 military aircraft, logging more than 10,000 hours in the air.

His signal achievement came on Oct. 14, 1947, when he climbed out of a B-29 bomber as it ascended over California's Mojave Desert from what was then known as Muroc Air Force Base, and entered the cockpit of an orange, bullet-shaped, rocket-powered experimental plane attached to the bomb bay.

An Air Force captain at the time, he zoomed off in the plane, a Bell Aircraft X-1, at an altitude of 23,000 feet, and when he reached about 43,000 feet above the desert, history's first sonic boom reverberated across the floor of the dry lake beds. He had reached a speed of 700 miles an hour, breaking the sound barrier and dispelling the long-held fear that any plane flying at or beyond the speed of sound would be torn apart by shock waves.

OCT, NOV, DEC IN AIR & SPACE HISTORY

OCTOBER 2020

75 Years Ago - 1945

October 15: Operation Clitterhouse, V-2 launched from Cuxhaven, Germany, by British.

60 Years Ago - 1960

October 4: Courier I-B orbited Aboard Thor Ablestar rocket, 1:50 p.m., EDT, Cape Canaveral, Fla.

55 Years Ago - 1965

October 14: OGO (Orbiting Geophysical Observatory)-2 orbited Aboard Thor rocket., 6:13 a.m., PST, Vandenberg AFB, CA.

October 25: Agena target vehicle for Gemini 6 exploded at launch. Manned Gemini flight postponed. Mission redirected to rendezvous mission with Gemini 7 scheduled for December 1965 launch date, Cape Canaveral, Fla.

50 Years Ago - 1970

October 14: First X-24A supersonic flight, John A. Manke, pilot, Dryden Flight Research Facility (DFRF), CA.

October 25: Zond 8 Launch (USSR Moon Flyby)

45 Years Ago - 1975

October 6: Explorer 54 (AE-D) orbited aboard Delta, 5:00 a.m., EDT, Vandenberg AFB.

October 16: GOES-A (SMS-C) orbited by NASA for NOAA aboard Delta, 6:40 p.m., EDT. GOES-A is the first in a series of weather satellites.

October 22: Venera 9, Venus Landing (Soviet Venus Orbiter/Lander)

October 25: Venera 10, Venus Landing

40 Years Ago - 1980

October 30: FleetSatCom 4 launched, 10:54 p.m., EST, Cape Canaveral, Fla.

35 Years Ago - 1985

October 3: STS-5IJ (Space Shuttle *Atlantis)* launched with DoD payload. Crew: Karol J. Bobko, Ronald J. Grabe, Robert A. Stewart, David C. Hilmers and William A. Pailes. First flight for Atlantis. Launched from KSC, 11:15 a.m., EDT Atlantis landed Edwards AFB, CA, October 7, 10:00 a.m., PDT.

Mission Duration: four days, one hour and 45 minutes.

October 30: STS-61A (Space Shuttle *Challenger)* launched from KSC at 12:00 noon, EST with Spacelab D-1 in cargo bay and GLOMR satellite. Crew: Henry W. Hartsfield, Steve R. Nagel, Bonnie J. Dunbar, James F. Buchli, Guion S. Bluford, Ernst Messerschmid (West Germany), Reinhard Furrer (West Germany) and Wubbo J. Ockels (Netherlands). Landed at Edwards AFB, CA, November 6 at 9:45 a.m., PST. Mission duration seven days and 45 minutes.

30 Years Ago - 1990

October 6: STS-41 (Space Shuttle *Discovery)* launched from KSC 7:47 a.m., EDT with Ulysses solar spacecraft aboard. Crew: Richard N. Richards, Robert O. Cabana, William M. Shepherd, Bruce E. Melnick, and Thomas Akers. Landed at Edwards AFB, CA, Octo-

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ber 10 at 6:57 a.m., PDT. Mission Duration: Four days, two hours and ten minutes.

25 Years Ago – 1995

October 20: STS-73 (Space Shuttle *Columbia)* launched from KSC at 9:53 a.m. EDT. Crew: Kenneth D. Bowersox, Kent V. Rominger, Kathryn C. Thornton, Catherine G. Coleman, Michael E. Lopez-Alegria, Fred W. Leslie, and Albert Sacco, Jr. USML-1 payload. Second United States Microgravity Laboratory (USML-2) Spacelab mission. Landed: November 5 at 6:45 a.m., EST at KSC. Mission Duration: 15 days, 21 hours, 53 minutes.

20 Years Ago – 2000

October 9: High Energy Transient Explorer (HETE 2), an American astrophysical research spacecraft was launched at 05:38 UTC from over Kwajalein Missile Range in the Marshall Islands by a Pegasus rocket released from an L-1011 cargo aircraft that flew out of Vandenberg AFB.

October 11: STS-92 (Space Shuttle *Discovery)* launched from KSC at 7:17 p.m., EDT. Crew: Brian Duffy, Pamela A. Melroy, Koichi Wakata (Japan), Leroy Chiao, Peter J.K. Wisoff, Michael Lopez-Alegria, and William S. McArthur. ISS assembly mission 3A with Z1 Integrated Truss Segment and Pressurized Mating Adapter 3. Landed: October 24 at 4:59 p.m., EDT, Edwards Air Force Base. Mission Duration: 12 days, 21 hours, 42 minutes.

15 Years Ago – 2005

October 12: Shenzhou 6 (meaning Divine Ship), a People's Republic of China (PRC) spacecraft, was launched by a Long March 2F rocket from Jiuquan in northwest China. It carried two Chinese astronauts Fèi Jùnlóng and Niè Hǎishèng in the re-entry capsule, also named as Shenzhou 6, to orbit around for about five days.

10 Years Ago – 2010

October 1: Chang'e 2, a Chinese lunar satellite mission, launched from Xichang at 10:59 UTC on a Long March 3C rocket. It is designed to observe the Moon for at least six months, but carries enough fuel to operate much longer. Similar to how the Lunar Reconnaissance Orbiter (LRO) was used to detect spots for future manned missions to the Moon, the Chinese spacecraft will map candidate landing sites for the next mission in China's lunar program.

October 7: Soyuz-TMA 1M, launched from Baikonur at 23:10 UTC by a Soyuz FG rocket carrying one NASA astronaut (Scott Kelly) and two Russian Cosmonauts (Oleg Skripochka and Alexander Kaleri) to the International Space Station (ISS) where they joined their colleagues boosting the lab's crew size to six. Soyuz-TMA 1M introduced new improvements to the veteran vehicle, featuring new guidance, navigation, control and data processing systems, along with an improved cooling device for the vehicle's electronics. The spacecraft features a variety of avionics and computer upgrades that allows the vehicle to be less operator intensive.

5 Years Ago – 2015

October 2: Hollywood and NASA science and technology came to audiences around the world with the U.S. premier of the film,"The Martian." The agency collaborated on this journey to Mars film with 20th Century Fox Entertainment, providing guidance on production design and technical consultants.

NOVEMBER 2020

85 Years Ago - 1935

November 11: Captains Stevens and Anderson, U.S. Army Air Corps, reached an altitude of 14 miles (74,000 feet) in stratospheric balloon Explorer II; take-off was at Rapid City, SD, and landing eight hours and 12 minutes later 340 miles away near Aurora, NE.

65 Years Ago - 1955

November 18: First powered flight of Bell X-2, piloted by Lt. Col. Frank Everest, Edwards AFB, CA.

60 Years Ago - 1960

OCT, NOV, DEC IN AIR & SPACE HISTORY

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November 3: Explorer 8 launched by Juno II, 12:23 a.m., EST, Cape Canaveral, Fla.

November 8: Little Joe V failed, 10:18 a.m., EST, Wallops Flight Facility (WFF), VA.

November 21: Mercury-Redstone (MR-1) failed, 8:00 a.m., Cape Canaveral, Fla.

November 23: Tiros 2 launched by Thor Delta, 6:13 a.m., EST, Vandenberg AFB, CA.

55 Years Ago - 1965

November 6: GEOS 1 (Explorer 29) orbited by a Delta, 1:39 p.m., EST, Cape Canaveral, Fla.

November16: Venera 3 crash-landed on Venus and became first spacecraft to reach another planet.

November 18: Explorer 30 (Solar Explorer A) launched by a Scout, 11:48 p.m., EST, Wallops Flight Facility (WFF), VA.

November 26: Asterix 1 Launch (France's 1st Satellite). First satellite to be launched by a nation other than the US and the USSR with the use of its own launch vehicle (Diamant A from Hammaguir, Algeria).

November 29: Explorer 31, a small ionospheric observatory, was launched by Thor-Agena B from Vandenberg AFB, CA, 11:48 p.m., EST.

50 Years Ago - 1970

November 9: OFO 1 (Orbiting Frog Otolith) launched by a Scout. 1:00 a.m., EST, Wallops Flight Facility (WFF).

November 10: Luna 17 launched by a Proton K rocket from Baikonur. It landed on the moon 7 days later in the Sea of Rains. The first Moon rover, Lunokhod 1, was then deployed and remote-controlled by a 5-man team from Earth. The rover traveled over the lunar surface for 11 months, transmitted photos and analyzed soil samples.

November 25: First M2-F2 powered flight, William H. Dana pilot, Dryden Flight Research Facility (DFRF), CA.

November 30: OAO-B failed to orbit, launched by Atlas-Centaur, 5:40 p.m., EST, Cape Canaveral, Fla.

45 Years Ago - 1975

November 19: Explorer 55 launched (AE-E) by a Delta, 9:06 p.m., EST, Cape Canaveral, Fla.

November 26: China 4, a military photo surveillance satellite, was the People's Republic's first retrievable satellite. It was launched on a CZ-2 (Long March) from Shuang Cheng-Tzu, Peoples Republic of China.

November 26: Last flight of the lifting body program, Thomas C. McMurtry, pilot, Dryden Flight Research Facility (DFRF).

40 Years Ago – 1980

November 12: Voyager 1, Saturn Flyby 78,000 miles above the cloud tops. Voyager sent back spectacular photos and discovered new moons.

November 16: SBS-I launched, 5:49 p.m., EST, Cape Canaveral, Fla.

35 Years Ago - 1985

November 26: STS-61B (Space Shuttle *Atlantis),* launched 7:29 p.m., EST from KSC. Crew: Brewster H. Shaw, Bryan D. O'Connor, Mary L. Cleave, Sherwood C. Spring, Jerry L. Ross, Rudolfo Neri Vela (First Mexican citizen in space), and Charles D. Walter. From shuttle cargo bay the crew launched Morelos-B, Aussat-2, and Satcom KU-2. Atlantis landed at EAFB, CA. Dec. 3, 1:33:49 p.m., PST. Mission Duration: six days, 22 hours, and 54 minutes.

30 Years Ago - 1990

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November 15: STS-38 (Space Shuttle *Atlantis),* launched from KSC, 6:48 p.m., EST. Crew: Richard O. Covey, Frank L. Culbertson, Jr., Charles "Sam" Gemar, Robert C. Springer and Carl J. Meade. Crew launched a classified Department of Defense payload. Landed at KSC, November 20, 4:43 p.m., EST. Mission Duration: 117 hours, and 54 minutes.

25 Years Ago – 1995

November 4: RADARSAT-1 launched by a Delta 2 from Vandenberg at 6:22 a.m. PST.

November 12: STS-74 (Space Shuttle *Atlantis),* launched from KSC, 7:30 a.m., EST. Crew: Kenneth D. Cameron, James D. Halsell, Jerry L. Ross, William S. McArthur, Jr. and Chris A. Hadfield. Second Shuttle-Mir flight. Brought the Russian Docking Module. Landed at KSC, November 20 at 12:01 p.m., EST. Mission Duration: 8 days, 4 hours, and 31minutes.

20 Years Ago – 2000

November 2: The International Space Station became occupied with the arrival of the Expedition One crew consisting of William M. Shepherd (commander), Yuri Gidzenko, and Sergei K.Krikalev aboard the Soyuz TM-31 launched on Oct.31 from Baikonur. The Expedition One mission lasted 136 days and the ISS has been continuously operated by successive crews since then.

November 21: EO 1 (Earth Observing mission 1), the first spacecraft in the American New Millennium Program (NMP) was launched by a Delta 2 rocket from Vandenberg AFB at 13:24 UTC.

November 30: STS 97 (Space Shuttle *Endeavour),* launched from KSC, 10:06 p.m. EST. Crew: Brent Jett, Michael J. Bloomfield, Joseph R. I. Tanner, Carlos Noriega, and Marc Garneau (Canada). ISS Assembly Flight 4A. Landed at KSC, Dec. 11, 2000 at 6:04 p.m. EST. Mission Duration: 10 days, and 19 hours, and 57 minutes.

15 Years Ago – 2005

November 9: Venus Express, an ESA planetary mission was launched by a Soyuz-Fregat rocket from Baikonur, designed to monitor the atmosphere of Venus.

10 Years Ago – 2010

November 4: NASA's EPOXI spacecraft successfully flew past comet Hartley 2, providing unprecedented images and giving scientists new information about the comet's volume and material erupting from its surface.

November 14: SkyTerra 1, a commercial communication satellite, was launched from Baikonur at 17:29 UTC by a Proton rocket with a Breeze M upper stage. SkyTerra 1 will join traditional terrestrial cell networks to shape a fourth-generation, or 4G, wireless system designed to reach nearly every American by the end of 2016. It carries a 22-m diameter L-band antenna, the largest commercial antenna reflector ever built.

November 20: FAST 1, also known as USA 222, was launched from Kodiak at 01:25 UTC by a Minotaur 4 rocket. Built by students at the University of Texas, Austin, FAST 1 is also called FASTRAC (Formation Autonomy Spacecraft with Thrust, Relnav, Attitude and Crosslink) and consists of two satellites launched together for formation flying and testing of a GPS navigation experiment. FASTSAT-HSV01 (Fast Affordable Science and Technology Satellite), a NASA microsatellite also known as USA 220, was launched from Kodiak on the same launch vehicle as FAST 1 to test a Threat Detection System and a Miniature Star Tracker for the US Air Force Research Laboratory. STPSAT 2, also known as USA 217, a technology demonstration for the USAF Space Test Program, was launched with the two payloads described above. Finally, O/OREOS (Organism/Organic Exposure to Orbital Stresses), a NASA nanosatellite also known as USA 219, carried a three unit CubeSat carrying two biological experiments.

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DECEMBER 2020

90 Years Ago - 1930

December 30: A rocket launched by Dr. Robert H. Goddard in New Mexico reached an altitude of 2,000 feet and a speed of 500 mph.

75 Years Ago - 1945

December 10: Fifty-five German specialists arrived at Fort Bliss, TX, and White Sands Proving Grounds, NM, where they were joined by seven specialists headed by Dr. Wernher von Braun.

60 Years Ago – 1960

December 1: Sputnik 6 launch from Baikonur; unsuccessful reentry.

(Carried Two Dogs: Pchelka & Mushka).

December 4: Explorer S-56 failed to orbit, 4:14 p.m., EST, WFF, VA. Scout launcher. It was the first attempt to place a satellite in orbit using an all-solid propellant launch vehicle and the first orbital attempt made from NASA's Wallops Island facility.

December 7: Discoverer 18 (CORONA Mission 9012)launched by Thor Agena, 3:21 p.m., EST, Vandenberg AFB, CA.

December 15: Atlas Able 5B / Pioneer 31 / Pioneer Z, lunar satellite exploded on launch, 4:11 a.m., EST, Cape Canaveral, Fla.

December 15: Echo 1 commemorative stamp issued, Washington, D.C.

December 19: MR-1A suborbital flight, 11:15 a.m., EST, Cape Canaveral, Fla. The first Mercury-Redstone capsule.

December 20: Discoverer 19 orbited by Thor, 3:37 a.m., EST, Vandenberg AFB, CA. Though part of the CORONA program, Discoverer 19 did not carry a film capsule. It was orbited as a test for the Midas missile-detection system.

55 Years Ago - 1965

December 4: Gemini Titan 7 launched by Titan 2, 2:30 p.m., EST, Cape Canaveral, Fla. Astronauts Frank Borman and James A. Lovell, Jr. on a 14-day mission.

December 6: French 1 (FR 1) launched by Scout, 4:06 p.m., EST, Vandenberg AFB, CA.

December 15: Gemini Titan 6 launched by Titan 2, 8:37 a.m., EST, Cape Canaveral, Fla. Astronauts Walter M. Schirra, Jr. and Thomas P. Stafford; rendezvous mission with GT-7.

December 16: Pioneer 6 launched by Thor Delta, 2:31 a.m., EST, Cape Canaveral, Fla.

50 Years Ago - 1970

December 11: NOAA 1 launched by Thor Delta, (ITOS-A), 6:35 a.m., EST, Cape Canaveral, Fla.

December 12: Explorer 42 (Uhuru, SAS-A) Launched by Scout B, 5:54 a.m., San Marco facility, Kenya.

45 Years Ago – 1975

December 5: DAD launched by Scout. Failed to orbit, 7:35 p.m., PST, Vandenberg AFB, CA.

December 16: China 5 (aka Mao 5). Part of JSSW (Ji Shu Shiyan Weixing or "Technical Test Satellite") series orbited by Feng Bao 1 (Storm) rocket from Shuang Cheng-Tzu.

40 Years Ago - 1980

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(Continued from page 23)

December 6: Intelsat 5 F-2 orbited by Atlas-Centaur, 6:31 p.m., EST, Cape Canaveral, Fla.

30 Years Ago - 1990

December 2: STS-35 (Space Shuttle *Columbia)* launched from KSC, 1:49 a.m., EST. Crew: Vance D. Brand, Guy S. Gardner, Jeffrey A. Hoffman, John M. "Mike" Lounge, Robert A. R. Parker, Samuel T. Durrance and Ronald A. Parise. Carried ASTRO-1 telescopes for ultraviolet and X-ray astronomy in cargo bay. Landed at Edwards AFB, CA, December 11, 12:54 a.m., EST. Mission Duration: eight days, 23 hours, and five minutes.

December 17: The Advisory Committee on the Future of the U.S. Space Program report (aka the Augustine Report because it was chaired by Norman Augustine, chief executive office of Martin Marietta) submitted to NASA delineating the need for a balanced space program within a tightly constrained budget.

25 Years Ago - 1995

December 2: Joint ESA-NASA launch of Solar and Heliospheric Observatory (SOHO) from Cape Canaveral Air Station by an Atlas 2AS rocket. It carried three American and nine European instruments to observe the Sun and its corona.

December 7: Galileo released probe into Jupiter's atmosphere.

20 Years Ago – 2000

December 28: Galileo probe performs flyby of Jupiter's moon, Ganymede. December 30: Cassini probe performs flyby of Jupiter.

15 Years Ago – 2005

December 28: GIOVE-A (Galileo In-Orbit Validation Element), a European (ESA) navigational satellite, was launched by a Soyuz-Fregat rocket from Baikonur at 05:19 UTC. It is the first member of a planned fleet of 30 Galileo satellites to operate independent of the American GPS and the Russian GLONASS fleets.

10 Years Ago – 2010

December 6: At 1:31 a.m. EST, NASA for the first time successfully ejected a nanosatellite from a free-flying microsatellite. NanoSail-D ejected from the Fast, Affordable, Science and Technology Satellite, FASTSAT, demonstrating the capability to deploy a small cubesat payload from an autonomous microsatellite in space.

December 8: Dragon C1 launched from Cape Canaveral at 15:43 UTC on a Falcon 9 rocket. The spacecraft conducted a series of demonstrations in orbit as part of NASA's Commercial Orbital Transportation Services (COTS) program in support of the International Space Station. This was the first time a commercial organization has recovered a spacecraft from orbit.

December 15: Soyuz-TMA 20 launched from Baikonur at 19:09 UTC. Crew: a Russian cosmonaut (Dmitry Kondratyev), an Italian astronaut (Paolo Nespoli), and a NASA astronaut (Catherine Coleman). Docked with the International Space Station (ISS) at the Mini Research Module-1 (MRM-1) Nadir port on December 17, 2010 at 20:11 UTC.

December 15: On the 3,340th day since its arrival in October 2001, Mars Odyssey orbiter passed the Martian career longevity record set by Mars Global Surveyor.

5 Years Ago – 2015

December 3: LISA Pathfinder, originally named SMART 2 (one of ESA's Small Missions for Application Research and Technology), launched at 04:04:00 UTC by a Vega Launch vehicle from Kourou, French Guiana. It is a mission to demonstrate in orbit the technologies for LISA, the ESA/NASA Laser Interferometry Satellite Antenna gravitational wave observatory. The basic principle of LISA is to measure the changes in distance between freely floating 'test masses', literally, small gold blocks held in place by carefully controlled electrostatic fields.

December 15: Soyuz TMA-19M launched from Baikonur at 11:03:00 UTC by a Soyuz FG launch vehicle. Crew: Tim Kopra, Yuri Malenchenko, and Tim Peake. (ISS Expedition 46).

IMAGE OF THE QUARTER

OSIRIS-Rex Touches Asteroid Bennu

Captured on Oct. 20 during the OSIRIS-REx mission's Touch-And-Go (TAG) sample collection event, this image shows the SamCam imager's field of view at the moment the NASA spacecraft touched down on asteroid Bennu's surface. The sampling event brought the spacecraft all the way down to sample site Nightingale, and the team on Earth received confirmation of successful touchdown at 6:08 p.m. EDT. Preliminary data show the sampling head touched Bennu's surface for approximately 6 seconds, after which the spacecraft performed a back-away burn.

PARTING THOUGHTS

"For whatever reason, I didn't succumb to the stereotype that science wasn't for girls. I got encouragement from my parents. I never ran into a teacher or a counselor who told me that science was for boys. A lot of my friends did."

— Sally Ride

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AIAA Albuquerque Section
American Institute of Aeronautics & Astronautics
PO BOX 20818
Albuquerque, NM 87154-0818

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