AIAA ALBUQUERQUE

DECEMBER 2021

SHAPING THE FUTURE OF AEROSPACE

THE FLIGHT PLAN

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

DECEMBER 2021 SECTION MEETING: HYPERSONIC AEROTHERMAL ANALYSIS—PAST, PRESENT, AND FUTURE

Presenter ; *Dr. Paul M. Delgado, Chairman*

Abstract: Modern computational platforms allow for complex 3D reentry phenomena to be resolved an coupled manner. However, Sandia National Laboratories has maintained the capacity to model and analyze such hypersonic aerothermal phenomena computationally since the 1960's. The purpose of this talk is to provide a historical perspective on the development and progression of the "state-of-the-art" in hypersonic aerothermal modeling & simulation tools with the aim of providing insights into modern and future development efforts .

Speaker Bio: Dr. Paul M. Delgado is a Senior Member of the Technical Staff in the Aerosciences Department (Org 1515) at Sandia National Laboratories. Paul is a former NSF Fellow at the University of Texas at El Paso (PhD Computational Science, M.S. Computational Science) and a graduate of the University of New Mexico (M.S. Applied Mathematics, B.S. Mathematics & Spanish). He has worked at NASA Ames Research Center, Los Alamos National Laboratories, National Energy Technology Laboratories, Leidos, and Ball Aerospace. Paul is a subject matter expert in Hypersonic CFD and Thermal Ablation, Principal Investigator of the SPARC Multi-Fidelity Toolkit and a System Aero Lead at Sandia National Laboratories. He is also the Chair of the AIAA Albuquerque Section and is a member of the AIAA Thermophysics Technical Committee.

When: Dec 16 2021 (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/94045272381

Meeting ID: 940 4527 2381

Click Here to RSVP

https://docs.google.com/forms/d/1T8z2aAe_WIRsqoNVZI2iKIeXjwtDPPE07VXuluNhhCM/viewform

INSIDE THIS ISSUE:

CALENDAR

Local Section Events

Next General meeting 16 December 2021

Virtual Meeting Via Zoom

Meet & Greet 5:45 pm
Presentation Start 6:00 pm
Presentation End 7:00 pm

Upcoming U.S. Launches

TBD Falcon 9 • Starlink 2-3
Dec 18/19 Falcon 9 • Turksat 5B
Dec 21 Falcon 9 • SpaceX CRS 24
Early 2022 Falcon 9 • CSG 2
Jan Falcon 9 • Transporter 3
Jan Atlas 5 • USSF 8 (GSSAP 5&6)
Early 2022 Falcon Heavy • USSF 44
Early 2022 Starship • Orbital Test Flight
NET Feb 12 SLS • Artemis 1
Feb 19 Antares • NG-17
Feb 21 Falcon 9 • Axiom Mission 1
Mar 1 Atlas 5 • GOES-T
NET Mar Falcon 9 • WorldView Legion 1&2
2nd Qtr Falcon Heavy • USSF 52

National AIAA Events

2022 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum)
3 JANUARY - 7 JANUARY 2022

AIAA Mid-Atlantic Professional Section Young Professionals, Students, and Educators (YPSE) Conference
3 FEBRUARY - 4 FEBRUARY 2022

2022 IEEE Aerospace Conference
5 MARCH - 12 MARCH 2022

2022 Region IV Student Conference
1 APRIL - 2 APRIL 2022
San Antonio, Texas, USA

2022 AIAA Defense and Security Forum (AIAA DEFENSE Forum)
19 APRIL - 21 APRIL 2022

2022 Aerospace Spotlight Awards Gala

ALBUQUERQUE SECTION OFFICER NEEDED

By Robert A. Malseed, Treasurer

Your Albuquerque Section needs you to serve on the section Council. Our **Communications** position is currently vacant. (It would be nice to return to monthly newsletters.)

"The Communications Officer shall be responsible for the Section publication activities including, but not limited to, the periodic preparation and distribution of the Section newsletter and any other print or social media required to support Section activities."

WE WANT YOU!

YOUNG PROFESSIONALS CORNER

AIAA's mission is to help aerospace professionals succeed. For young professionals embarking on a career, we strive to provide information and assistance to members on finding positions, networking opportunities,

Local Career Fairs

In need of assistance reviewing a resume before a fair? Let us help! Reach out to Kyle Lynch (klynch@sandia.gov) for resume help.

UNM

- Thurs, Feb 10th, 11am-2pm, Virtual Fair
- Wed, Apr 13th, 11am-2pm, In-Person Fair
- More information, including invitation links and guides, at: https://career.unm.edu/events-workshops/career-fairs.html

New Mexico State

- Tue-Wed Feb 1-2, 9am-2pm, In-person
- Wed Mar 2nd, 9am-2pm, In-person
- More information, including invitation links and pre-fair workshops, at: https://oel.nmsu.edu/career-fairs/career-fairs-future-dates/

New Mexico Tech

- Mon, Jan 31st, 11am-2pm, Virtual Fair
- Tue, Feb 1st, 9:30am-2:30pm, In-Person Fair
- More information, including invitation links and pre-fair workshops, at: https://nmt.edu/studentaffairs/careerservices/careerfair.php

By Kyle Lynch, Young Professionals Officer

Upcoming Events at AIAA SciTech

The AIAA SciTech Forum is coming up soon from Jan 3-7th in San Diego. If you're planning to attend, take advantage of these on-site events:

- Sun Jan 2nd: "Meet the Employers" event, 4pm-6pm
- Sun Jan 2nd: Student Welcome Mixer, 630pm-730pm
- Mon Jan 3rd: Speed Mentoring, 230pm-430pm

Upcoming Local Events

- *Trivia with AIAA* - Last Wednesday of every Month, 6 pm, Boxing Bear Brewery on Tramway. Look for the AIAA sign or contact Kyle Lynch at 505-318-8092.
- *AFRL Maker Hub Tour* - Thursday, Jan 20th, 5 pm at Kirtland AFB Maker Hub. Note: This requires Kirtland Base Access.
- Have an idea for a networking or learning event you'd like to see or have AIAA sponsor? Contact Kyle Lynch (klynch@sandia.gov)

Learning Resources

Did you know AIAA has a vast catalog of online, on-demand courses for continuing education? In spring 2022, courses on UAV design, Python programming, space systems engineering, and more are on offer.

Visit https://aiaa.mycrowdwisdom.com/diweb/catalog for more information.

HONORS AND AWARDS NEWS OF SECTION MEMBERS

By Stephen Seiffert—Honors and Awards Officer

11 October 2021 AIAA Announcement of 2022 Associate Fellows

AIAA national recently announced the membership awards of Associate Fellow for 2022, for Region IV – South Central, AIAA Albuquerque Section. Associate Fellows are distinguished as having accomplished or been in charge of important engineering and scientific work; having done original work of outstanding merit, or have otherwise made outstanding contributions to the arts, sciences, and technologies affiliated with aeronautics or astronautics, consistent with the interests and goals of AIAA nationally. The Albuquerque Section's new 2022 Associate Fellow awardees are:

Dr. Katya M. Casper, Sandia National Laboratories, for her exceptional contributions to the understanding of hypersonic environments and response, impacts to programs of national importance, extensive collaboration, and mentorship in the Aerospace field.

Jonathan Christensen, Sandia National Laboratories, for his outstanding contributions to critical national security programs in the areas of applied aerodynamics, flight mechanics, flight safety, and project management

Micah Howard, Sandia National Laboratories, for his notable achievements in aerothermodynamics, demonstrated by breadth of leadership in research, development, application and advisory roles, with primary emphasis on national security related programs.

Dr. Julie J. Parish, Sandia National Laboratories, for her pioneering contributions in the areas of robust navigation, guidance and control, and for her outstanding leadership in the field of Aerospace Engineering.

Ross Wagnild, Sandia National Laboratories, for his exceptional achievements in the research, development, and application of hypersonic aerodynamics, including impactful research into hypersonic boundary layer transition.

Our congratulations, from the Albuquerque Section AIAA, upon selection your awards as AIAA 2022 Associate Fellows. The Associate Fellow member recognition is indeed an individual accomplishment, both professionally and personally.

HONORS AND AWARDS NEWS OF SECTION MEMBERS

By Robert A. Malseed—Treasurer

Congratulations to these Albuquerque Section Members

American Nuclear Society Reactor Technology Award

Mohamed El-Genk, a Distinguished and Regents' Professor in the Department of Nuclear Engineering at The University of New Mexico, has received the 2021 American Nuclear Society Reactor Technology Award.

This national award recognizes individuals who have made original and outstanding contributions to the advancement in the areas of design and safety in reactor technology. El Genk was recognized for "extraordinary contributions towards advancing space and micro reactor technologies."

The award will be presented during the ANS Winter Meeting and Technology Expo, which will be held in Washington, D.C., on Dec. 1.

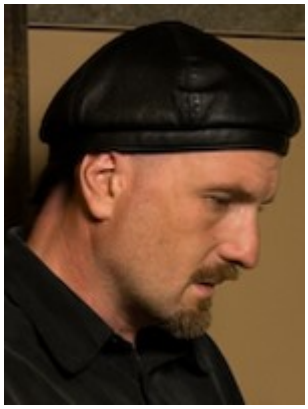
"This is for my students and members of the research staff at the UNM Institute for Space and Nuclear Power Studies over the years," El-Genk said. "It would not have been possible without their dedication, innovation and hard work. It has been a challenging and enjoyable journey, indeed."

El-Genk received his bachelor's and master's degrees in nuclear engineering from the University of Alexandria in Egypt and spent many years in industry before pursuing a Ph.D. in nuclear engineering at UNM, where he received his degree in 1978. He founded the Institute for Space and Nuclear Power Studies, and national and internationally-recognized research center within the School of Engineering and served. He has served as its director since 1984.

His primary research interests include space nuclear power; nuclear thermal propulsion; reactor thermal hydraulics and safety; nuclear fuel and high temperature materials; design and analysis of advanced, small modular reactors and microreactors; molecular dynamics simulation of irradiation effects on materials; simulation and modeling; boiling and two-phase flow experiments and heat transfer; and cybersecurity of nuclear power plants.

El-Genk has received numerous national and international awards and honors throughout his career. He is a fellow of the American Nuclear Society, the American Society of Mechanical Engineers, the American Institute of Chemical Engineers, and the International Association for the Advancement of Space Safety and an associate fellow of the American Institute of Aeronautics and Astronautics.

Regents Professor in UNM School of Engineering



The School of Engineering has selected Peter Vorobieff, professor in the Department of Mechanical Engineering, as the new Regents' Professor .

His term will run from 2021 and conclude in 2024

ALBUQUERQUE SECTION VISIT TO THE UNM ME DEPARTMENT

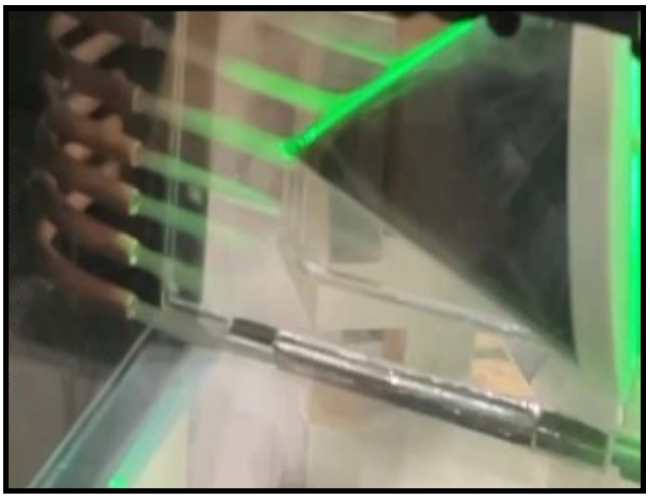
By Svetlana Poroseva, Kegan Reynolds, Paul Delgado, and Ben Urioste

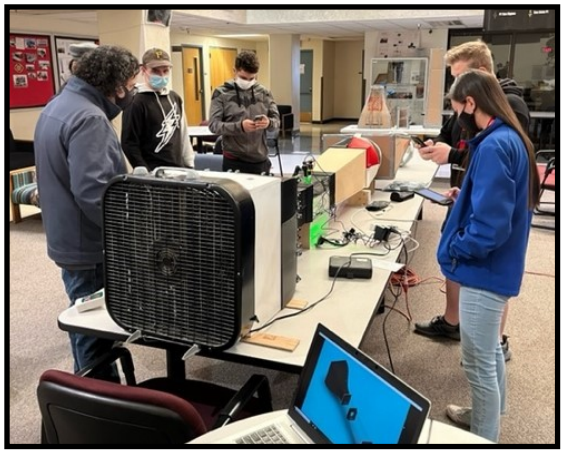
On November 18, 2021, the AIAA Albuquerque Section and the AIAA UNM Student Branch organized the AIAA Albuquerque Section visit to the UNM Department of Mechanical Engineering and presented there the AIAA low-speed wind tunnel and the DreamFlyer flight simulator. The wind tunnel was constructed by the team of AIAA UNM and NM Tech students under the advisement of Dr. Paul Delgado from the Sandia National Labs in the challenging pandemic time. During the event on November 18, the section was represented by Paul Delgado and Ben Urioste and about 12 UNM students attended the event. The purpose of the event was to provide the hands-on-experience for the students. All smiles on their faces as they brought out a cardboard model for the wind tunnel. The officers of the Student Branch set up the wind tunnel software. It took some time to get the fans in synch with the fog machine. The team then began testing the airflow of a 3D printed wing that they intend to use on their competition RC plane in the coming months. Other students were photographing the progression of the fog over the wind representing the airflow. It was fascinating. What was truly amazing was how each member proposed ideas on how to alter their plane design in order to achieve the best possible outcome. Making and testing the flight simulator was also a lot of fun, with students bringing ideas on how to update the simulator for future uses. Overall, events like that are very helpful in supporting students' interest in aviation and aerospace-relevant research and also providing students an opportunity to network directly with AIAA Professional members . We would also like to thank the UNM ME Administrator Janine Pacheco for her help during the event!

DREAMFLYER AND WIND TUNNEL AT UNM

Continued

Low-speed wind tunnel





DreamFlyer

AIR FORCE RESEARCH LABORATORY
Space Vehicles & Directed Energy Public Affairs
Air Force Materiel Command
Oct 30, 2021| #2021-049

U.S. AIR FORCE

News Release

AFRL partners with UNM for new Directed Energy Center

KIRTLAND AFB, New Mexico (AFRL) -- The Air Force Research Laboratory's (AFRL) Directed Energy Directorate is partnering with The University of New Mexico (UNM) to establish a center for directed energy studies, a congressionally-funded endeavor.

The Directed Energy Center will be based at UNM and jointly managed by UNM's School of Engineering and UNM's Center for High Technology Materials (CHTM).

AFRL is recognized as the nation's center of excellence for the development of directed energy technologies and will oversee the founding of the center as well as the research taking place at UNM.

"We are extremely pleased to partner with UNM and to grow New Mexico's experts in the field of directed energy," said Dr. Kelly Hammett, director of the AFRL Directed Energy Directorate. "Our nation will be better equipped to move forward in this critical technology as a result of this partnership."

Directed energy technologies in development at AFRL include lasers and high-power electromagnetics directed toward a target to achieve a desired result, with applications in a variety of areas that are vital to national security.

"One of the important aspects of using DE weapons systems is that they are much less costly than traditional kinetic systems and result in less collateral damage," Hammett said. "We lead the world in these systems, but developing a robust pipeline of experts in the field is critical to maintaining our advantage."

Senior researchers, postdoctoral scholars, and graduate students will advance the modeling, design, and fabrication of fiber lasers and amplifiers to more than one kilowatt for conventional designs and near kilowatt for radiation-balanced and unconventional wavelengths. The center will create a hub of expertise in high-power, fiber laser research, and the fiber draw tower at the center will create the highest-quality fibers for high-power laser operation at various wavelengths.

Edl Schamiloglu, Distinguished Professor in the Department of Electrical and Computer Engineering at UNM, will lead the Directed Energy Center. He has led UNM's research efforts in microwaves and high-

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power electronics for the last few decades and also serves as associate dean for research and innovation in the School of Engineering. Ganesh Balakrishnan, professor in the Department of Electrical and Computer Engineering, will serve as associate director of the center.

"The Directed Energy Center will make UNM one of only a handful of universities in the country with a center dedicated to that type of research and the only one that has expertise in both lasers and microwaves," he said. "Having the partnership of AFRL scientists and engineers will mean our students and faculty will have access to the highest level of expertise and world-class facilities."

Arash Mafi, professor of physics at UNM and director of the Center for High Technology Materials at the time the proposal was submitted, is principal investigator, and Schamiloglu and Balakrishnan are co-PIs on the recent $2.4 million, four-year cooperative agreement through AFRL called, "Directed Energy Center for Lasers and Microwaves."

The center will eventually be located in a new facility in the planning stages in UNM's south campus S&T park, which is expected to be operational by 2025.

About AFRL

The Air Force Research Laboratory (AFRL) is the primary scientific research and development center for the Department of the Air Force. AFRL plays an integral role in leading the discovery, development, and integration of affordable warfighting technologies for our air, space, and cyberspace forces. With a workforce of more than 11,500 across nine technology areas and 40 operations across the globe, AFRL provides a diverse portfolio of science and technology ranging from fundamental to advanced research and technology development. For more information, visit: www.afresearchlab.com.

About UNM, CHTM and the School of Engineering

The University of New Mexico (UNM) was founded in 1889 and is New Mexico's flagship institution. It is the only R1 university in the state, which is a designation by the Carnegie Classification of Institutions of Higher Education reserved for doctoral universities with very high levels of research activity. The Center for High Technology Materials (CHTM) one of 10 University-level research centers at UNM and is focused on photonics, microelectronics, nanoscale materials and devices, and their applications. The School of Engineering, founded in 1906, is comprised of six academic departments and is a major economic driver of the University and the state, generating $34.9 million in research expenditures in FY 2021. For more information, visit: www.unm.edu.

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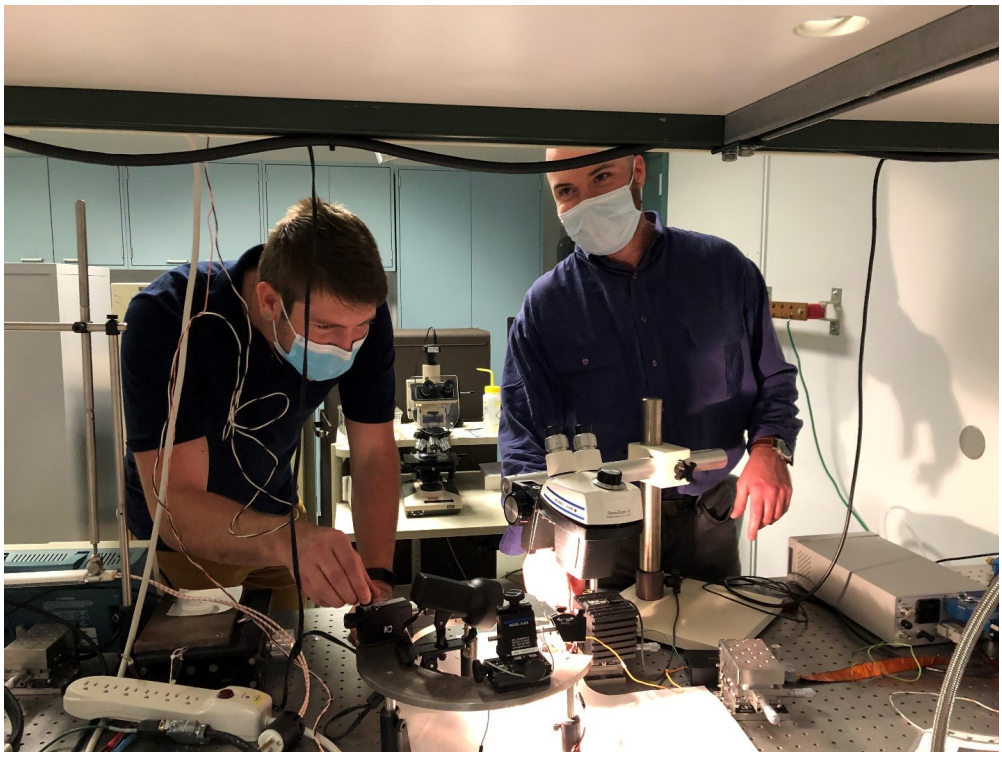
Ph.D student Khandakar Nusrat Islam (left), and Master of Science degree graduate, Braulio Martinez (right) at work in the UNM Pulsed Power, Beams and Microwaves Laboratory. (UNM Courtesy Photo)



Graduate students Alex Newell (left) and Kevin Reilly (right) characterizing a semiconductor diode laser. (UNM Courtesy Photo)

NEW FREE AIAA HIGH SCHOOL MEMBERSHIP NEW

Our section currently has eight members in the new High School Student grade.

By Robert Malseed—Treasurer

SECTION COUNCIL MEMBERS FOR 2021-2022

Robert A. Malseed, Treasurer

In April the Albuquerque Section elected officers for the 2021 - 2022 year. Other council members are remaining in their previous positions.

Chair	Paul Delgado	Membership	Erin Pettyjohn	Career Enhancement	Andrea Loper
Vice Chair	Reid Shaeffer	Honors & Awards	Stev Seiffert	Young Professionals	Kyle Lynch
Secretary	Terry Caipen	Public Policy	Mark Fraser	UNM Branch Advisor	Svetlana Poroseva
Treasurer	Robert Malseed	Corporate Liaison	Neil McCasland	NMT Branch Advisor	Mostafa Hassanalian
Communications	**VACANT**	Education	Humberto Silva III		
Programs	Nick Morley	STEM K-12	Elfego Pinon III		

OCT, NOV, DEC IN AIR & SPACE HISTORY

OCTOBER 2021

115 Years Ago -- 1906

October 2: Space popularizer and science writer Willy Ley. Born, Berlin, Germany.

80 Years Ago -- 1941

October 6: Redstone Arsenal activated, Huntsville, AL.

75 Years Ago -- 1946

October 24: First motion pictures taken of Earth from a V2 rocket.

60 Years Ago -- 1961

October 11: X-15 flown to more than 40 miles into space, 217,000 feet, and a speed of 3,647 miles per hour, pilot was Major Robert White, Edwards Air Force Base (EAFB), CA.

October 13: Midas 4 launched by an Atlas. Also carried Project West Ford payload, Vandenberg AFB, CA.

October 25: Mississippi Test Facility established in Hancock County, Miss. to test the Saturn launch vehicles. Renamed Stennis Space Center after Mississippi Senator John Stennis in May 1988.

October 27: Saturn I (SA-1) suborbital flight. Launched to an altitude of 84.8 miles, 214.7 miles downrange, 10:06 a.m., EST, Cape Canaveral, Fla. First test of the newly developed Saturn booster.

55 Years Ago -- 1966

October 2: ESSA 3 launched by Thor Delta, 6:39 a.m., EDT, Vandenberg AFB, CA.

October 22: Luna 12 (Lunik 12) launch (USSR Moon Orbiter) launched by Modified SS-6 (Sapwood) or Molniya.

October 26: Atlas Centaur 9 launched, 6:12 a.m., EST, Cape Canaveral, Fla. It carried a Surveyor model that was injected into simulated lunar transfer orbit.

October 26: Intelsat 2 F-1 (Intelsat II-A) launched by a Delta, 6:05 p.m., EST, Cape Canaveral, Fla. A COMSAT Corporation commercial communications satellite.

50 Years Ago -- 1971

October 21 : ITOS-B launched by a Thor Delta, 4:32 a.m., PDT, Vandenberg AFB, CA. Launch vehicle failure.

October 28: Prospero launched, (Great Britain's first) Woomera Test Range, Australia. Launch vehicle a UK Black Arrow.

45 Years Ago – 1976

October 12: First flight of Sikorsky S-72 Rotor Systems Research Aircraft (RSRA), a joint NASA/Army project.

October 14: Marisat 3 launched by a Delta, 16:44 p.m., EDT, Cape Canaveral, Fla.

October 14: Soyuz 23 launched, Baikonur, USSR. Cosmonauts: Vyacheslav D. Zudov and Valeri I. Rozhdesvensky. Failed to dock with Salyut-5.

40 Years Ago -- 1981

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JUL, AUG, SEP IN AIR & SPACE HISTORY

(Continued from page 12)

October 6: SME (Solar Mesosphere Explorer) launched by Delta, 4:27 a.m., PDT, Vandenberg AFB, CA. (UOSAT) (Oscar 9) dual payload with SME.

October 30: Venera 13 Launch (USSR Venus Lander/Flyby Mission) by Proton K from Baikonur.

35 Years Ago – 1986

October 15: NASA launched the Black Brant sounding rocket to analyze the ionosphere during a solar mission. The rocket completed a second solar mission on October 22.

30 Years Ago -- 1991

October 29: Galileo probe flyby of Asteroid Gaspra.

25 Years Ago -- 1996

October 24: Molniya-3-48 communications satellite launched by Molniya-M from Plesetsk, Russia at 11:37:00 UTC, which used a three-channel repeater to support domestic and international communication.

20 Years Ago – 2001

October 21: Soyuz TM-33 launched. The second “taxi” flight to the International Space Station (ISS) by a Soyuz-U rocket from Baikonur at 08:59 UTC. It carried two Russian and one French astronaut: Victor M. Afanasyez, Konstantin M. Kozeev, and Claudie Haigneré, bringing a “fresh” Soyuz crew to the ISS. It docked with the ISS at 10:00 UTC on October 23. This new crew spent eight days on the ISS, and returned on the older Soyuz TM-32 at 03:59 UTC on October 31.

October 24: Mars Odyssey reached Mars.

15 Years Ago – 2006

October 26: The Solar Terrestrial Relations Observatory consisting of STEREO-A and STEREO-B, two identical heliospheric craft, were launched by a Delta 2 rocket from Cape Canaveral at 8:52 pm EDT. STEREO-A orbits the Sun ahead of the Earth, and STEREO-B orbits behind the Earth in order to image the Sun and its emissions stereographically. The spacecraft predict whether a Coronal Mass Ejection (CME) is heading toward the Earth.

10 Years Ago – 2011

October 23: the German ROentgen SATellite ROSAT re-entered Earth's atmosphere.

October 28: NPP (National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project), launched from Vandenberg AFB at 05:48 EDT by a Delta rocket. NPP is a joint effort between the National Aeronautics Space Administration (NASA) and the NPOESS Integrated Program Office (IPO). NPP is an Earth-observing satellite designed to collect data critical to improving short-term weather forecasts and increase understanding of long-term climate change.

5 Years Ago – 2016

October 19: Soyuz MS-02 spacecraft launched at 08:05:00 UTC by a Soyuz FG launch vehicle from Tyuratam (Baikonur Cosmodrome), Kazakhstan. Crew: Cosmonauts Sergey Ryzhikov, Andrei Borisenko, and astronaut R. Shane Kimbrough. (ISS Expedition 49).

NOVEMBER 2021

60 Years Ago – 1961

November 15: Transit IV-B launched by Thor Ablestar, 5:25 p.m.. EST, Cape Canaveral, Fla.

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JUL, AUG, SEP IN AIR & SPACE HISTORY

(Continued from page 13)

November 16: Discoverer 35 launched by Thor Agena, 4:23 p.m., EST, Vandenberg AFB, CA.

November 18: Ranger 2 launched by Atlas Agena, 3:12 a.m., EST, Cape Canaveral, Fla.

November 21: The Air Force launched a Titan ICBM from Cape Canaveral carrying a target nose cone to be used in Nike-Zeus antimissile-missile tests. This was the first Titan ICBM to be fired from Cape Canaveral by a military crew.

November 28: The prime contract was awarded to North American Aviation for the development and construction of the Apollo spacecraft.

November 29: Enos, a 37.5 pound five-year-old male chimpanzee, sent aloft at 1:28 PM from Cape Canaveral in a capsule atop a Mercury-Atlas 5 rocket,10:07 a.m., EST, Cape Canaveral, Fla.

55 Years Ago – 1966

November 6: Lunar Orbiter 2 launched by Atlas Agena, 6:21 p.m., EST, Cape Canaveral, Fla. Photographed lunar landing sites from lunar orbit.

November 11: The last Gemini flight, *Gemini XII* (GTA-12), was launched on 2:08 p.m., EST, Cape Canaveral, Fla. During this mission, American astronauts James A. Lovell, Jr. and Edwin E. “Buzz” Aldrin, Jr. completed three EVAs and a docking with an Agena target vehicle.

50 Years Ago – 1971

November 13: Mariner 9 becomes first spacecraft to orbit another planet – Mars. Transmitted 6,876 pictures. Launched May 30, 1971.

November 15: Explorer 45 (Explorer S-Cubed A) launched by a Scout, 12:52 a.m. EST, San Marco Range, Kenya .

40 Years Ago – 1981

November 4: Venera 14 launched (USSR Venus Lander/Flyby) by Proton K from Baikonur.

November 12: STS-2 (Space Shuttle *Columbia)* launched, 10:10 a.m., EST, KSC. Crew: Joe H. Engle and Richard H. Truly. Landed November 14 at 1:23 p.m., PST, Edwards Air Force Base (EAFB), CA. Mission Duration: 2 days, 6 hours, 13 minutes.

November 19: RCA-Satcom 3-R launched by a Delta, 8:37 p.m., EST, Cape Canaveral, Fla.

35 Years Ago -- 1986

November 13: Polar Beacon and Research satellite aka Polar Bear launched. BEAR is an acronym for Beacon Experiment and Auroral Research. It was part of the Air Force STP P87-1 mission. Launched by a Scout, Vandenberg AFB, CA. at 4:23 p.m. PST. It was used to study communication interference caused by solar flares and aurora activity in support of the military.

30 Years Ago – 1991

November 24: STS-44 (Space Shuttle *Atlantis)* launched 6:44 p.m. EST, KSC. Crew: Frederick D. Gregory, Terence T. “Tom” Henricks, James S. Voss, Story F. Musgrave, Thomas J. Hennan, and Mario Runco. Deployed the third Defense Support Program satellite. Landed Dec. 2, 5:34 p.m., EST, Edwards Air Force Base (EAFB), CA. Mission Duration: 6 days, 22 hours, 51 minutes.

November 28: First in series of improved Block 5D-2 satellites in the Defense Meteorological Satellite Program, launched by Atlas E from the Vandenberg AFB, CA.

25 Years Ago – 1996

November 4: Galileo probe, Flyby of Callisto.

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JUL, AUG, SEP IN AIR & SPACE HISTORY

(Continued from page 14)

November 7: Mars Global Surveyor launched by Delta 2 from Cape Canaveral, Fla. Arrived at Mars on 12 September 1997 (UTC). First successful U.S. mission to arrive at Mars since the Viking landers in 1976. Contact lost November 2006.

November 19: STS-80 (Space Shuttle *Columbia)* launched 2:55 p.m. EST, KSC. Crew: Kenneth D. Cockrell, Kent V. Rominger, Tamara E. Jernigan, Thomas D. Jones, and F. Story Musgrave. Deployed German-built Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph-Shuttle Pallet Satellite II (ORFEUS-SPAS II) and Wake Shield Facility (WSF). Landed December 7, 6:49 a.m. EST, KSC. Mission Duration: 17 days, 15 hours, 53 minutes.

20 Years Ago – 2001

November 27: DirecTV-4S, a geosynchronous communications spacecraft that provides 300 local TV channels to 41 metropolitan communities, was launched by an Ariane 44LP rocket from Kourou at 00:35.

15 Years Ago – 2006

November 17: Navstar 59, also known as USA 192, as GPS 2RM F-3, and as GPS 2R-16, an American navigational satellite in the GPS fleet, was launched by a Delta 2 rocket from Cape Canaveral at 19:12 UTC.

10 Years Ago – 2011

November 8: Phobos-Grunt (alternatively Fobos-Grunt) was a Russian mission designed to land on the Martian moon Phobos and return a sample to Earth. The primary scientific objective was to analyze the sample on Earth to understand the origin and reconstruct the history of Phobos. It was launched at 2016 UT on a Zenit 2SB41.1 rocket from the Baikonur Cosmodrome in Kazakhstan into an elliptical Earth orbit. The plan was to use a Fregat upper stage to carry Phobos-Grunt and Yinghuo-1 on an eleven month cruise to Mars. However, the later firings never occured and the spacecraft remained in Earth orbit. The orbit of Phobos-Grunt decayed until it entered the Earth's atmosphere on January 15, 2012. About 450 pounds of the probe likely crashed into the Pacific Ocean.

November 14: Soyuz-TMA 22 was launched from Baikonur at 10:11 UT by a Soyuz launch vehicle. Crew: NASA astronaut Dan Burbank; and Russian cosmonauts Anton Shkaplerov and Anatoly Ivanishin. The craft docked with the ISS Poisk module on 16 November 2011 at 05:24 UT. This is the final flight of a Soyuz-TMA capsule. Future missions will be flown by a TMA-M spacecraft, the newer digital Soyuz spacecraft.

November 26: The Mars Science Laboratory (MSL), nicknamed Curiosity, is a large rover launched at 15:02 UT (10:02 a.m. EST) from Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida.with the objective of exploring the Martian environment as a former or current habitat for life.

5 Years Ago – 2016

November 17: Soyuz MS-03 spacecraft launched at 20:20:00 UTC by a Soyuz FG launch vehicle from Tyuratam (Baikonur Cosmodrome), Kazakhstan. Crew: Oleg Novitsky, Thomas Pesquet, and Peggy Whitson. (Expedition 50). Peggy Whitson set NASA record for cumulative time in space- 665 days.

November 19: The Geostationary Operational Environmental Satellite-R Series (GOES-R), the next generation of geostationary weather satellites, launched at 23:42:00 UTC by an Atlas V launch vehicle from Cape Canaveral.

DECEMBER 2021

450 Years Ago – 1571

December 27: Astronomer Johannes Kepler born.

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120 Years Ago – 1906

December 30: Sergey Korolev born, Zhitomir, Ukraine USSR.

75 Years Ago -- 1946

December 9: Bell X-1 first powered flight.

December 17: First night firing in the U.S. of a V-2. Missile No. 17 launched from the White Sands Missile Range, NM.

60 Years Ago – 1961

December 12: Discoverer 36 launched from Vandenberg Air Force Base in California with special payload, OSCAR 1. It was Amateur Radio's first satellite and the world's first piggyback satellite.

55 Years Ago – 1966

December 7: ATS 1 launched by Atlas Agena, 9:12 p.m., EST, Cape Canaveral, Fla.

December 14: Biosatellite 1 launched by Delta, 2:20 p.m., EST, Cape Canaveral, Fla.

December 22: First HL-10 glide flight, Bruce Peterson pilot, DFRF, CA.

50 Years Ago – 1971

December 2: USSR Mars 3 lands on Mars, launched May 28, 1971. First unmanned landing on Mars.

December 19: Intelsat 4 F-3 launched by Atlas Centaur, 8:10 p.m., EST, Cape Canaveral, Fla.

40 Years Ago – 1981

December 15: Intelsat 5D F-3 launched by Atlas Centaur, 6:35 p.m., EST, Cape Canaveral, Fla.

35 Years Ago -- 1986

December 4: Fleetsatcom 7 launched by Atlas G Centaur, 9:30 p.m., EST, Cape Canaveral, Fla.

25 Years Ago – 1996

December 4: Mars Pathfinder launched aboard a Delta II 7925 launch vehicle from Cape Canaveral Air Station. Landed on Mars on July 4, 1997.

December 24: Bion 11 launched from Plesetsk cosmodrome by a Soyuz-U rocket at 13:50 UTC. It carried a capsule housing two monkeys and several newts, snails, beetles, fruit flies, and small plants to study their responses and behaviors under microgravity.

20 Years Ago – 2001

December 5: STS-108 (Space Shuttle *Endeavour)* launched 5:19 p.m. EST, KSC. Crew: Dominic L. Gorie, Mark E. Kelly, Linda M. Godwin, and Daniel M. Tani. 12th Space Shuttle flight to the International Space Station (ISS). Carried an Italian cargo module, the Raffaello Multi-Purpose Logistics Module (MPLM), that was attached to the Unity module of the ISS. Also Expedition 3 & 4 crews exchange. Landed December 17 at 12:55 p.m., EST, KSC. Mission Duration: 11 days, 19 hours, 36 minutes.

December 7: TIMED (Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics) ionospheric research satellite launched by a Delta 2 rocket from Vandenberg AFB at 15:07 UTC.

December 7: Jason 1, an American-French (NASA-CNES) oceanographic satellite was launched by a Delta 2 rocket from Vandenberg AFB 15:07 UTC to supplement and extend the TOPEX/Poseidon mission results by monitoring the sea surface level and wave heights.

December 16: STARSHINE 2, a US high school educational microsatellite was deployed from STS-108. It was built with the partici-

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pation of 25,000 students in 26 countries and very similar to the STARSHINE 3 that was launched in September 2001.

December 21: Sean O'Keefe takes office as tenth NASA Administrator.

15 Years Ago – 2006

December 10: STS-116 (Space Shuttle *Discovery)* launched 8:47 p.m. EST, KSC. Crew: William A. Oefelein, Joan E. Higginbotham, Mark L. Polansky, Robert L. Curbeam, Nicholas J.M. Patrick, Sunita L. Williams, and the European Space Agency's Christer Fuglesang (Sweden). International Space Station Flight 12A.1. Rewired the International Space Station's power system, paving the way for further construction. Landed December 22 at 5:32 p.m.EST, KSC. Mission Duration: 12 days, 20 hours, 45 minutes.

December 10: Dr. John C. Mather, an astronomer at NASA's Goddard Space Flight Center received the 2006 Nobel Prize for Physics, awarded by the Royal Swedish Academy of Sciences. Mather shares the prize with George F. Smoot of the University of California for their collaborative work on understanding the Big Bang. The two scientists lead the Cosmic Background Explorer satellite mission.

December 16: GeneSat 1, a NASA-Ames nanosatellite, was launched by a Minotaur rocket from Wallops Island in Virginia at 7:00 am EST. The 10 kg craft carries E. Coli bacteria to monitor the effect of space radiation by protein-sensing optical instruments.

10 Years Ago – 2011

December 21: Soyuz-TMA 3M, the first of the Russian Soyuz TMA-M series spacecraft, launched from Baikonur at 01:16 UT by a Soyuz launch vehicle. Crew: ESA astronaut André Kuipers, cosmonaut Oleg

Kononenko, and NASA astronaut Don Pettit. It successfully docked with the International Space Station's (ISS) Mini Research Module-1 (MRM-1) "Rassvet" Nadir docking port at 15:19 UT on December 23.

5 Years Ago – 2016

December 1: "Hidden Figures," premiered at the Virginia Air and Space Center in Hampton, VA. The film portrays Katherine Johnson, the African American mathematician, physicist, and space scientist, who calculated flight trajectories for John Glenn's first orbital flight in 1962.

December 8: John H. Glenn, Jr. died.

December 9: HTV-6, An unmanned cargo spacecraft launched to resupply the International Space Station, launched at 13:26:00 UTC by an H-2B launch vehicle from Tanegashima, Japan.

December 15: Cyclone Global Navigation Satellite System (CYGNSS) launched at 13:37:00 UTC by a Pegasus XL launch vehicle from Cape Canaveral The CYGNSS mission uses eight micro-satellites to measure wind speeds over Earth's oceans, increasing the ability of scientists to understand and predict hurricanes. Each satellite will take information based on the signals from four GPS satellites.

IMAGES OF THE QUARTER

James Webb Space telescope getting ready for launch

NASA, along with the Canadian Space Agency and the European Space Agency, started working on the telescope back in 1996, several years after Hubble launched. Whereas Hubble was designed to observe the universe in mostly visible and ultraviolet light, Webb was built to soak up the infrared, looking deeper into the cosmos to reveal even more glittering galaxies. Program managers expected the Next Generation Space Telescope, as it was known then, to cost about $500 million and launch in 2007, but over the years, the design grew far more complex than anyone had anticipated. Whole new technologies were invented specifically for the project, and they had to be tested and perfected and then tested again. The Webb telescope finally arrived at its launch site on the northeastern coast of South America—near the equator, where Earth's spin will give the payload an extra boost—in October of this year. Barring any more surprises, the observatory is scheduled to blast off on the morning of December 22. "It's just nerve-racking," Caitlin Casey, an astronomer at the University of Texas at Austin, told me. "You don't want it to launch yet if it's not absolutely safe. At the same time, you just want it to go, because you know what a powerful tool it'll be." Casey and her colleagues have received the biggest chunk of observing time in Webb's first year of operations, and will study thousands of the earliest galaxies in the universe, too faint for any current telescopes to spot now. And the rocket launch to space isn't even the most stressful move. After Webb leaves the launchpad, it will take about a month to travel to its final destination, 1 million miles from Earth. On the way there, JWST must deploy itself piece by piece. The observatory is too big to fit into any existing launch vehicles, so it will leave folded up and then unfurl in space, like a flower blooming in spring, revealing its shiny, gold-covered mirrors to the universe.

PARTING THOUGHTS

"I would rather have questions that can't be answered than answers that can't be questioned."
- Richard Feynman

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