



AVIATION FORUM

25–29 June 2018
Hyatt Regency Atlanta,
Atlanta, Georgia

Upcoming Events

June 25-29, 2018

AVIATION Forum and Exposition
Hyatt Regency Atlanta, Atlanta, GA
[AVIATION Link](#)

September 17-19, 2018

AIAA Space Forum
Hyatt Regency Orlando, Orlando, FL
[SPACE Link](#)

September 21, 2018

*AIAA-RM 7th Annual Technical
Symposium*
Metropolitan State University, Denver,
CO
[ATS Link](#)

Note from the Chair

By Kay Sears, *Lockheed Martin*

AIAA Rocky Mountain Section,

As I wrap up my term as Chair for RMS, I want to express my sincere appreciation for the dedication and service of the section officers and council members. It has been an amazing experience to be part of team of volunteers who are enthusiastic about our mission and willing to give their time and effort toward furthering our goals of celebrating aerospace ingenuity and collaboration.

Hopefully you enjoyed the program line-up this past year. A few highlights include the Trajectories 2017 networking event, the 6th Annual Technical Symposium at MSU Denver, the Honors and Awards Banquet with guest speaker Lt. Col Hamilton, achieving the largest Colorado delegation at the Congressional Visitors Day, and most recently the Young Professionals event featuring Dr. Darden and the movie Hidden Figures.

In addition to these great networking and career expanding events, RMS also touched students and teachers from across our region to ignite a passion for aerospace and develop the next generation of leaders in our industry. This was accomplished through speaker series, university and school events and even mentoring opportunities that developed through AIAA memberships. As I hand the baton over to the new Chair, please join me in thanking this dedicated team of volunteers and in wishing Rusty good luck in his term.

Best,
Kay

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SECTION OFFICERS

Elected

Section Chairman	Dr. Rusty Powell
Chairman Elect	Dr. Merri Sanchez
Secretary	Kevin Mortensen
Treasurer	Dr. Taylor Lilly
Vice Chairman – North CO	John Marcantonio
Vice Chairman – South CO	Dr. Todd Nathaniel
Vice Chairman – MN	Erik Eliassen
Vice Chairman – WY	Mark Kettles

Committees

Fellow-At-Large	Gene Dionne
Member-At-Large	Pam Burke
Education and STEM	Brandon Walls
Honors and Awards	Stacey DeFore
Membership	Marshall Lee
Newsletter Editor	Adrian Nagle
Public Policy	Tracy Copp
Pre-College Outreach	OPEN
Programs	Chris Zeller
Technical Committee Liaison	OPEN
Webmaster	John Grace
Young Professionals	Brandon Tortorelli

We Need You!!

If you are interested in increasing your participation in AIAA Rocky Mountain Section, we need your help with positions in any of the committees. If you have an interest, please contact: Kevin Mortensen – kevin.mortensen@baesystems.com

Another RMS AIAA Member Highlighted in AIAA Member Spotlight

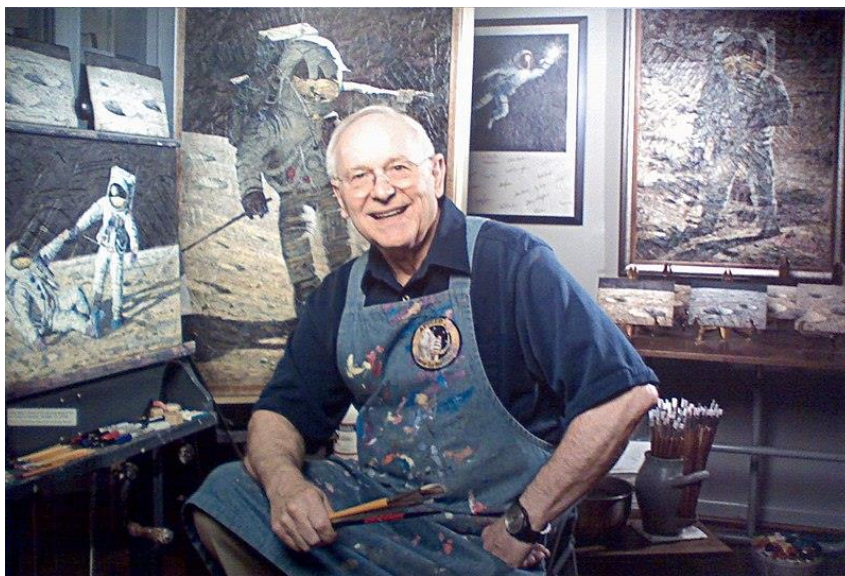
Like the last newsletter, another AIAA RMS Member is highlighted in the Member Spotlight. A professor at the United States Air Force Academy, Dr. Martiqua Post was on the road to an engineering career when using multiplication flashcards with her godfather. The article mentions Dr. Post's membership starting in 2001 and the credit she gives her AIAA membership for connecting her to her current position at USAFA. This spotlight also mentions "Post is enthusiastic about her students pursuing careers in aerospace engineering, joining AIAA, and presenting at AIAA forums." Read more at the [Member Spotlight for May 2018](#).

Remembrances of Alan Bean - an extraordinary, ordinary man

Louis Ramon, *Lockheed Martin (retired)*

I lost a good friend yesterday [May 26, 2018], Capt. Alan Bean. Alan was a pilot, an engineer, an astronaut, an artist, and, above all, a gentleman. He was the fourth human being to walk on the moon and the commander of the second Skylab space station mission where he and his crew spent 59 days in space.

I first met Alan as he was training for his Apollo 12 mission in late 1968. Later I spent quite a bit of time with him developing experiments and training for his Skylab mission. We travelled together after his Apollo lunar landing. We often talked about and agreed that we were just ordinary people (as ordinary as an engineer can be) who had the opportunity to participate in some very unique and special activities. We had the great good fortune to be in the right places at the right times, and, most of



Credit: Matthew G. Bisanz

all, were surrounded by and part of a truly extraordinary team. Alan was very much influenced by the man who trained him as a fighter pilot, encouraged him to become an astronaut and, later, was his commander on Apollo 12, Pete Conrad. Pete taught Al what was important about working with people and teams during their preparation for Apollo 12. Alan practiced that throughout the rest of his life and passed that wisdom down to me (among others, I'm sure). Now that Alan is gone, I will try, more than ever, to practice what he taught me. The number one rule in working with people and being on a team is to truly recognize and appreciate what they, as individuals, bring to the team. The other thing to realize is that, by working together as a team, a bunch of ordinary people can accomplish

truly extraordinary things. Things that, as individuals, we might think was impossible. Alan often said that the Apollo, Skylab and the entire human space program were "impossible dreams" that

we, as part of a team, were able to make come true.

There are three moments that I had with Alan that I will remember for as long as I live. The first was in the early 1970's when

we were training for his Skylab mission at Martin Marietta (now Lockheed Martin) in Denver. This was the last day of our training activities on the simulator in Denver where we had the astronauts of all of the astronauts who were going to man the Skylab space station together for the last time. The good folks at Martin Marietta had a “family day” in which they invited all the members of the Skylab Maneuvering Unit experiment team to bring their families to see the astronauts train and then to have lunch with them in the Executive Dining Room. They arranged the seating at luncheon such that one Astronaut was seated each table. I was sitting at the table with Alan. During the conversations, someone at our table asked what it was like to be on the moon. Alan started the reply by simply saying, “When I was there...”. He said it without any bravado, but simply as a statement of fact. At that point the whole room grew quiet with the realization that only a dozen people in the entire history of mankind could start a sentence with those words.

The second moment I remember about Alan was one time when on one of the milestone anniversaries of the first lunar landing, NASA had an open house for families that highlighted a round table discussion in the auditorium of all of the astronauts who had walked on the moon. After the panel discussion, as the crowd was leaving the auditorium, there was a big jam up of people moving toward the exits. I was there with my son, Noah. As we were inching toward the exit, Alan came by, going in the opposite direction. He saw me and stopped. After saying “Hi” to me,

he bent down and said to Noah that he really appreciated working with me and that I played a very significant part in him being able to go to the moon and have a successful Skylab mission. That he took the time to stop and talk to my son really pointed out his approach to working and appreciating people.

The last special memory was not in being with Alan, but in encouraging and arranging for Cindy, my wife, to meet with him. I visited with Alan several times in his home and studio. We often talked about his approach to his art. He said that each day, he asks himself “How can I be a better artist today than I was yesterday?” On one occasion, I mentioned that I was glad he had published prints of some of his paintings. He said he would save an Artist’s Proof of his first published print for me. Years passed, maybe a decade, when Cindy, who was doing some free-lance writing, asked me what I would like for my birthday. I told her that I would like a print of that particular painting. I knew that particular print was sold out commercially, but what I really wanted was for her to meet this extraordinary person. I had her phone Alan, and, much to my surprise, he had saved and Artist’s Proof after all these years. She had to go to his place to pick it up. They talked about him inscribing the print appropriately. After conferring with him, on a second visit, she brought the print home, but more importantly, she brought back the memories of spending two afternoon’s with this very special man.

One lasting memory or lesson from Alan was that, after being on the moon and in

space for 59 days aboard the Skylab space station, he came to believe that little blue planet orbiting in the vastness of the Universe is, truly, the Garden of Eden. He often said that after he returned from space, he never complained about the weather, or being in line at the post office, or any of the things that frustrate us about being alive here on this planet because he recognized that out of the whole universe, we were blessed to be alive here in the

Garden of Eden.

Alan Bean, was the most extraordinary, ordinary man I have ever met. Thank you, Alan Bean for being a friend and a mentor. You will be missed and remembered. God Speed!!!

Thank you,

Lou R



Vulcan Rocket Promises More Flexibility by ULA

Adrian Nagle, *Ball Aerospace*

The April Speakers Program was held at United Launch Alliance, April 4 in Centennial. The event was attended by 35 AIAA members and rocket enthusiasts. Mark Peller, Vice President Major Development, provided an enthusiastic talk about the ULA Vulcan rocket development to provide more flexibility and an updated launch system to remain competitive in the expanding launch services market. ULA was formed in 2006 by combining the nation's two major US launch providers, Boeing's Delta and Lockheed Martin's Atlas rocket systems to share resources in the two Air Force Evolved Expendible Launch Vehicles (EELV) and bring cost effective launch options. Mr. Peller demonstrated the long, successful, and reliable Atlas and Delta experience is used to create the Vulcan launch system. The Delta and Atlas rockets have launched over 100 successful

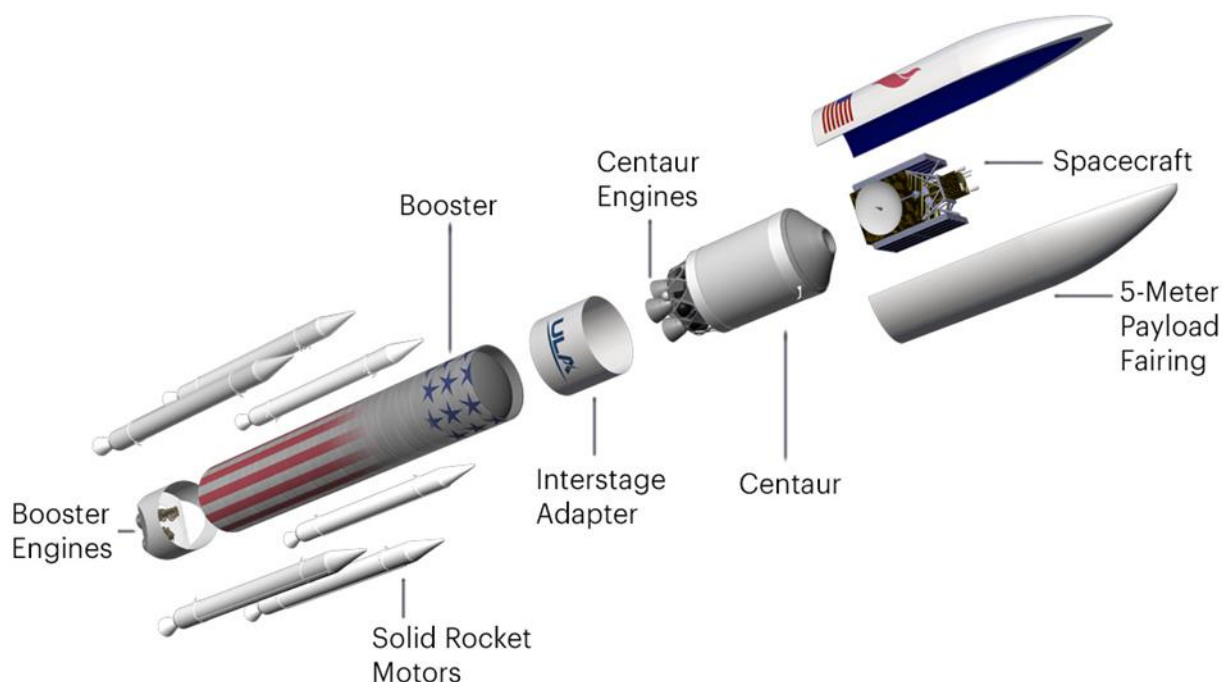
launches in the EELV program. These launches have occurred within 2 weeks of promised launch dates. The new Vulcan rocket development is divided into three steps (mass to LEO): Step 1, 25 t (2020), Step 2, 35 t (2023), and Step 3, Enhanced system (2023). By 2024, reuse aspects are expected to be part of the system.

The Vulcan system is the embodiment of the ULA partnership as the first vehicle developed under the ULA paradigm. As such, it is composed of components from both Atlas and Delta heritage. The vehicle is a two stage rocket with a pair of domestically developed main engines, BE-4 from Blue Origins or the Aerojet Rocketdyne AR-1 engine for the first stage. The BE-4 engine has been tested twice (Oct., 2017 and Mar. 2018). The AR-1 continues to be in development. Both are designed from the start to be reusable. The BE-4 provides 555,000 lb thrust using liquified natural gas. The entire rocket is 5.4 m in diameter to match current payloads. The Vulcan rocket can have up to six solid rocket boosters (SRBs).

Future payloads includes the Boeing CST-100 Starliner crewed capsule, NASA cargo and crew missions, and scientific, commercial and Department of Defense payloads.

unsafe operations in the Vulcan rocket design.

The audience's enthusiasm for rockets was evident based on the questions asked. The Vulcan system is expected to have a human



The upper stage is an evolved Centaur rocket.

The Vulcan rocket is developed with four teams working concurrently in 10 week cycles to keep the designs aligned. The four participating teams include the Payload Accommodations, Centaur Upper Stage, Tank Assembly and Aft Compartment. Because of ULA's long term experience with launch systems, teams from their operational rockets systems from disciplines such as Design Technicians, Supervisors, Inspectors, and Procurement are involved routinely to provide input to avoid requiring difficult or

rating in early 2020 decade. Reusability was also discussed. ULA has emphasized safety, reliability, and performance to orbit and will include re-useability in later versions. The engines are already designed with re-useability in mind.

As with all Speaker Program events, snacks and drinks were provided. There are always discussions and members meeting other members. It is exciting as engineers to have technical discussions with other engineers in other organizations and programs. I encourage any member to attend the next speaker program.

AIAA Honors and Awards Banquet Honors Local Members

Taylor Lilly, *Lockheed Martin*

Every year, AIAA Rocky Mountain Section, organizes a dinner to celebrate the accomplishments and leadership of local AIAA members, welcome the new council members, and learn and discover through a special speaker.

This year, the event was hosted at The Falls Event Center in Littleton, CO and catered by Rocky Mountain Catering. Approximately 50 registered and attended on a beautiful spring evening in full view of the mountains on one side and the Denver skyline on the other.

Honors and Awards Committee Chair, Taylor Lilly, and AIAA RMS Chairman, Kay Sears, handed out the RMS annual awards: K-12 Educator of the Year, College Educator of the Year, Young Engineer of the Year, and Engineer of the Year. Taylor presented the awards in such a way that illustrated how our careers progress in industry and how important AIAA RMS members affect their co-workers and community in Colorado, Wyoming, and Montana.



This year, AIAA RMS was happy to honor Charles Sprague of Wheat Ridge High School in Wheat Ridge as K-12 Educator of the Year because “if you visit Wheat Ridge High School STEM Lab today, you will see a very busy place full of energized and engaged students ... learning STEM skills, teaming skills, communication and presentation skills, and all-around life skills.” Dr. Todd Nathaniel of the United States Air Force Academy was honored as College Educator of the Year for teaching “the 2-semester capstone course, organizing it like a small aerospace company (, and) building a 170 kg, \$34M satellite with 6 payloads for the Air Force Research Lab.” Christopher Allison of Sierra Nevada Corporation was honored as the Young Engineer of the Year for coordinating “all licensing and approvals that are needed in place for both launch and reentry of the spacecraft and ... landing site coordination for potential reentry sites around the world. ” And Michael Drews of Lockheed Martin Space Special Programs was honored as Engineer of the Year for his role as “LMC Enterprise Integration lead for Zeta, a \$300M/yr wholly-owned subsidiary of LM, reporting in to LM via Special Programs.”

Class of 2018 AIAA Associate Fellows for the Rocky Mountain Section were also recognized by name for their recent elevation within the institute: Arnold A. Barnes III, William P. Crisler, Taylor C. Lilly, Chris C McCormick, William C. Jackson, Gretchen M. Lindsay, Angela Suplisson, Bernard F. Kutter , Gary L. Wentz, Jr., John G. Reed , Mark E. Peller, Melissa Sampson, and Jay McMahon.

The evening was completed by an exciting and “grounded” talk by Lt Col Tucker “Cinco” Hamilton, an Experimental Fighter Test Pilot for the United States Air Force. Cinco started his Air Force career as an operational F-15C pilot. He served as the Chief Instructor for 200+ aircrew and accumulated over 400 combat hours directly supporting ground forces. After his operational time, he attended the USAF Test Pilot School (TPS) where he flew 30 different aircraft, wrote 38 technical reports, and took part in the first Automatic Air Collision Avoidance System testing. He is currently at Edwards AFB, CA where he flies the F-35 as the Commander of F-35 Developmental Test.

As with all AIAA RMS events, there was opportunity to meet other AIAA members, share experiences, build new relationships, and learn about new endeavors I hope to

share some of those endeavors in next year’s newsletters.



College Educator of the Year winner Todd Nathaniel



Young Engineer of the Year winner, Christopher Allison

2018 RMS Awards

K-12 Educator of the Year Award: Charles Sprague

College Educator of the Year Award: Dr. Todd Nathaniel

Young Engineer of the Year Award: Christopher Allison

Engineer of the Year Award: Michael Drews

Strong Interest Brings Crowds to Young Professional Movie Event

Brandon Tortorelli, *Lockheed Martin*

The Rocky Mountain Section of AIAA hosted an exciting Young Professionals networking event at the Alamo Drafthouse movie theater in Littleton, CO on the evening of May 10, 2018. The event consisted of food, drinks, networking, and a presentation by guest speaker Dr. Christine Darden. We then finished the evening with a screening of the film *Hidden Figures*, based on the book in which Dr. Darden is featured.

The evening began with some networking time during which professionals, students, and average citizens of all ages intermingled and bonded over their shared interest in Aeronautics and Astronautics. The Rocky Mountain Section Young Professionals Chair, Brandon Tortorelli, then gave some brief remarks thanking the various sponsors and urging everyone to learn more about the benefits of being an active member of AIAA and the other sponsoring organizations.

One of those sponsoring organizations was the Mines Aerospace Interest Group (MAIG), which operates under the Colorado School of Mines Alumni Association. MAIG works to expand the Colorado School of Mines' brand in Aerospace through connecting Mines alumni who are working, studying, and/or interested in the aerospace industry. MAIG encourages its members to stay connected with the

university and with fellow alumni in the aerospace field to support Mines aerospace, STEM, and the industry in all forms.

The other sponsoring organizations included Lockheed Martin Space Systems Company, along with a few of its Employee Resource Groups (ERGs). The ERGs represented that evening were the African American Council for Excellence (AACE), the Hispanic Organization for Leadership and Awareness (HOLA), and the Lockheed Martin Leadership Association (LMLA). All these groups consist of hard-working individuals who donate much of their free time to promote diversity, inclusion, and leadership development not only in the Lockheed Martin workplace, but also throughout the communities of our entire aerospace workforce.

The keynote address was given by Dr. Christine Darden, a career mathematician, aeronautical engineer, and NASA researcher featured in the *Hidden Figures* book. She began her talk by pointing out that she is an AIAA Lifetime Associate Fellow affiliated with the Hampton Roads Section in Virginia. Dr. Darden then flashed back to her childhood to discuss the events that first got her interested in aeronautics and aerospace, such as the launch of Sputnik in 1957 when she was a 15-year-old student.

After discussing her own path through high school and college, as well as the extreme cultural changes that were occurring during that time, Dr. Darden ventured into her own journey as a Young Professional entering the workforce. She talked about the inspirational women from the *Hidden*

Figures film, many of whom she met and worked with later in life. With her theme being “On Their Shoulders,” Dr. Darden emphasized how Dorothy Vaughan, Katherine Johnson, and Mary Jackson paved the way for women like her to get through the door and be successful within the industry. However, the path was still not clear-cut for Dr. Darden, who had to work as a human computer – below her collegiate qualifications – for several years before confronting her supervisor and finally being transferred to an engineering job in 1973.

The second half of Dr. Darden’s presentation described some of her various roles and projects at NASA during her nearly 40-year career. She especially emphasized her work on the science of sonic booms, where she played an important role in making advances on sonic boom

minimization for supersonic aircraft. She then finished her presentation by answering some questions from the audience, many of which inquired more deeply about her personal struggles being one of the first African American women to work in the industry. Dr. Darden’s words were honest, insightful, and often coupled with a clever wit that seemed to touch and inspire everyone in the audience, regardless of age or profession.

After Dr. Darden’s presentation, we wrapped up the event by watching the film *Hidden Figures*. The Alamo Drafthouse added extra enjoyment to the movie theater experience since attendants could order food and drinks directly to their seats. Of course, the film was even more exciting than usual since a real life *Hidden Figure* was in the room watching with us!



Dr. Darden (center) together with AIAA RMS Chair Kay Sears (right) and Ms. Sear’s fiancé Bill Hood (left).

Busy Spring for Educational Outreach!

Sue Janssen, *ULA retired*

AIAA RMS members supported many educational outreach activities from the western slope to the Front Range and on the eastern plains.

The “Good Vibrations” workshop at SWE’s GESTEM on 18 May was a “resounding” success again. Brendan Coyne, Karolyn Evans, Jane Mattson, Carolyn Overmyer, Alison Petruska, Lenny Demchak and Sue Janssen presented a 50 minute workshop that introduced 7th grade girls to concepts in sound and vibration through a skit, demonstrations and experiments. The capstone of the workshop was to “engineer” a wind chime in a C major chord. Hopefully, the 90 participants will remember at least one factor (e.g. mass, stiffness, geometry, material) that determines the natural frequency of vibration of the chime tubes.



AIAA RMS participated in the “STEM Expo” in Edwards Colorado on 6 April. Jay Lindell of the Colorado Office of Economic Development and International Trade coordinated the event to introduce about 350 students at Battle Mountain High School to technology careers. Lenny Demchak, Adrian Nagle, Rhonda Ahrens and Sue Janssen spoke with student and educators about aerospace careers and AIAA membership. Adrian had a thermal experiment, Rhonda brought some electrical connectors for satellites and we had some cool models to encourage discussion. We had lots of questions and made contacts with educators in the Vail valley. After the event volunteers have filled requests for classroom speakers, help with a high altitude balloon project, and career information. For more information about the event, go to <https://www.vaildaily.com/news/stem-expo-shows-local-students-the-path-to-lucrative-tech-careers/>.

This was the second year the Rocky Mountain Section sponsored a student essay contest for 7th and 8th graders. Students were invited to submit an original essay about the impact of astronauts on our society, our country and international partnerships.

We received entries from STEM School at Highlands Ranch, Legacy Academy in Elizabeth, Longs Peak Middle School in Longmont, and Manitou Springs Middle School. Twenty members volunteered to review the entries and select the winning essays: Lt Col Michael Anderson, Andrew Campbell, Jesse Chuhta, Natia Crosley,



AIAA at Expo Event with (LtoR) Sue Janssen, Lenny Demchak, Rhonda Ahrens, Adrian Nagle

Stella Fang, Heidi Hallowell, Gary Herbella, Mitchell Hobish, Sue Janssen, Matthew Lehmitz, Lt Col Barrett McCann, Adrian Nagle, Russell, Rowland, Katie Schneider, Nicole Sinnott, Kirsten Strandjord, Philip Walker, John Niehues, Jeff Smith, and Rick Sturdevant.

The criteria included originality of ideas presented, soundness of logic used to develop ideas, realism of ideas presented, and quality of composition, clarity of expression, grammar and spelling and use of references.

More than one judge commented on the high quality of the essays and how enjoyable they were to read. The winners were presented with a certificate and a monetary award. All authors received posters donated by Lockheed Martin Space Systems. The first place essays were forwarded to the national level contest organized by the Space Systems TC. Enjoy reading the winning essays starting on the page 15!

Colorado Science Fair

AIAA contact for the CSSF:

Sam Bartlett, Colorado Engineering Council and CSSF Board of Directors

AIAA Judges for this event:

Clark Mikkelsen, Ryan Pendleton, John Janczy, Eric Johnson

Colorado State Science Fair Winners (place, Title, category, student):

Junior Division

1st - **Starring Materials**, *Earth and Space Sciences*, Morgan Cragin

2nd - **Up Up and Away**, *Physics*, Kjersti Moritz

Senior Division

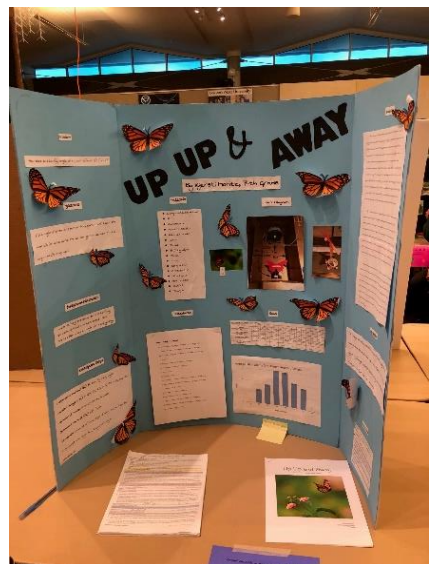
1st - **Suppression of Aeroelastic Instabilities in HR Wing Structures Using Principal Component Analysis**, *Engineering*, Krithik Ramesh

2nd - **Stampede Arm II**, *Engineering*, Chase Cromwell

Colorado Science Fair

Mark Kettles, *Dish Network*

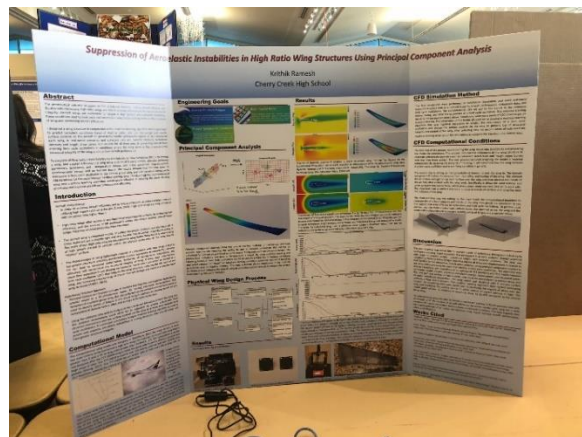
The Colorado State Science Fair exceeds expectations every year, demonstrating the highest level of student dedication to excellence as they all go above and beyond with their respective project efforts! Sam Bartlett (Colorado Engineering Council and CSSF Board Member) has consistently



supported the involvement of AIAA in the state science fair and his efforts to give these students every opportunity

for success are truly appreciated.

We offered 4 AIAA Prizes for exceptional projects in aerospace and astronautics related areas of focus. Each of the 4 students received a certificate recognizing their successful achievements, a Junior



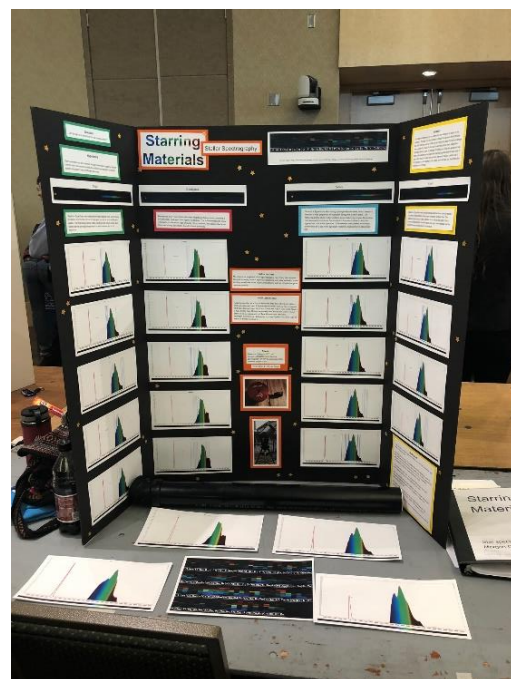
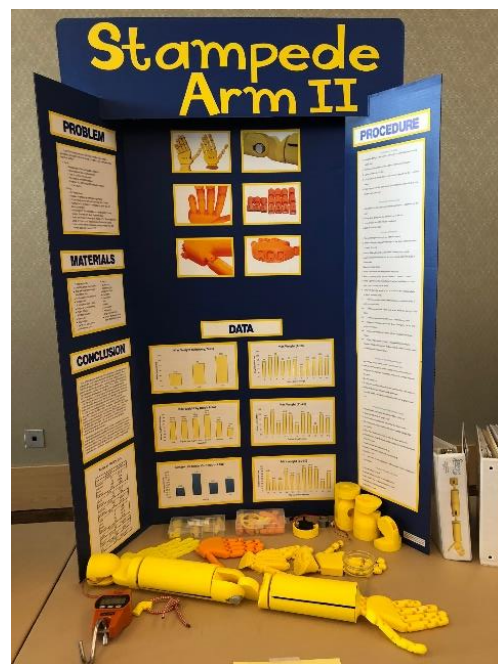
membership to AIAA for one year, and an inventor's Arduino kit to help support further exploration.

All 4 of our respective judges are returning AIAA supporters of the fair this year. Their dedication to excellence while

providing a strong guiding force for each student that they interviewed was unparalleled. As these judges brought their questions to each of the students, they were received with welcome contemplation and thought provoked determination found in each student reply.

Eric Johnson, one of the AIAA Judges, "It would be nice to think that our efforts contributed in some small way to some young person's success, benefiting him or herself and future society as a whole."

See side bar on prior page.

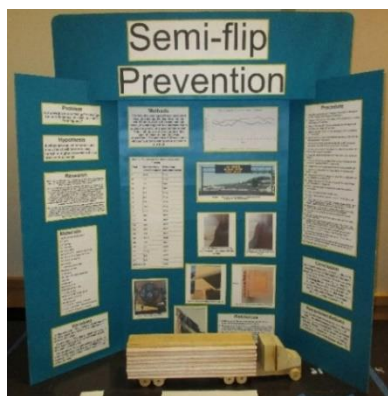


Wyoming State Fair

Mark Kettles, *Dish Network*

The Wyoming State Science Fair has been growing every year and continues to demonstrate exceptional innovation within student projects! Erin Stoesz, WSSF Director, has expressed a genuine appreciation for the involvement of AIAA over the years, "We are so grateful!"

We offered 4 AIAA Prizes for exceptional projects in aerospace and astronautics related areas of focus. Each of the 4 students received a certificate recognizing

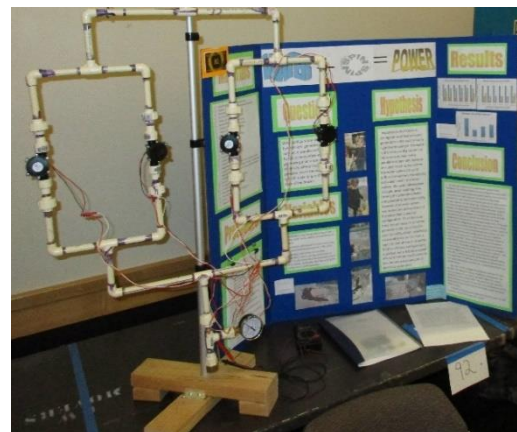


their successful achievements, a Junior membership to AIAA for one year, and an inventor's Arduino kit to help support

further exploration.

Dr. Michael Stoellinger (Wyoming State University, Professor) and his graduate students

have also played an integral part in judging the AIAA Prize over the past few years, and we can't thank them enough for their dedication to the students and the AIAA efforts to support these brilliant young minds.



Wyoming Science Fair

Contact: Erin Stoesz

AIAA Judges for this event:

Dr. Michael Stoellinger (University of Wyoming Prof), Clint Dunn (Graduate Student), Rajib Roy (Graduate Student), Sue Janssen (AIAA support), Mark Kettles (AIAA support)

Wyoming State Science Fair Winners (place, Title, category, student):

Junior Division

1st - **Semi Flip Prevention**, *Engineering*, Ashton Ford

2nd - **Water + Spin = Power**, *Engineering*, Rueben McGuire

Senior Division

1st - **Click and Go: Object Tracking Through Alternate Color Spaces and Open Computer Vision**, *Robotics*, Joshua Arulsamy

2nd - **Polarization to Prevent Snow Blindness**, *Engineering*, Nicholas Primanis-Erickson

First Place 8th Grade

Student: Victor

Teacher: Colin Rickman

School: Longs Peak Middle School

What it Takes to Reach for the Stars

What does it truly take to become an astronaut? And how does becoming an astronaut impact everyone else? An astronaut is someone who is trained and prepared for spaceflight and space exploration. Becoming an astronaut has been a childhood dream for me ever since I can remember. I was fascinated by the vastness and beauty of space. Space has inspired me to explore, learn, and take an extra step in everything I do. Astronauts need a degree in a STEM field, professional experience, and the ability to pass NASA's astronaut physical; astronauts need these three things to help with the future of the U.S., international partnerships, and NASA's research.

The U.S.A. and NASA have a lot planned for astronauts in the future. In the future, NASA plans to send humans to Mars via the Space Launch System. The Space Launch System will hopefully launch astronauts to Mars and beyond to help the U.S. and the world to learn more about our solar system. NASA is also working on new designs on experimental aircraft; they are transforming aviation with new technologies that will improve efficiency, noise reduction, and safety. Next, the U.S. and NASA also plan to explore and understand more about the planet we live on by bringing technology, science, and global observations together. By doing this we will hopefully understand more about Earth's resource and global warming problems. "NASA brings together technology, science, and unique global observations to provide societal benefits and strengthen our country" (NASA.gov). NASA believes that the combination of technology, science, and global observations could help us better understand our planet. Both NASA and the U.S. hope for a greater future that involves benefits to all people and a better world.

Astronauts can help with international partnerships with the International Space Station (ISS). The first piece of the International Space Station was launched on November 20th, 1998. After the first piece more and more pieces of the International Space Station started to come together. In 2011 the International Space Station was complete. However, Controlling the International Space Station requires a lot of support which is managed on earth by international partnerships involved in the program. It is difficult to operate the International Space Station because each partner has to be responsible to operate the hardware it provides. Meaning that teamwork and communication are very important between partners. "[T]he ISS continues to be assembled in orbit. It has been visited by astronauts from 18 different countries- and counting" (NASA.gov). The International Space Station has brought together many countries and their astronauts to research, study, and collect information about space to share with the world.

Even though it might be difficult to operate the International Space Station the outcome of the hardship pays off. This is true when training, engineering, and development brings international partnerships together in one giant project.

Astronauts can help impact NASA with its biological research on the human body. Astronauts can be studied to collect more information about space radiation. Space radiation can damage your central nervous system, increase your risk of cancer and reduced motor functions. Also, due to the habitats of the space station, microbes can be easily transferred from person to person resulting in an increased in allergies, illnesses, and diseases. Next, not only do the effects of space affect the astronaut's physical wellness, the effects of space can also affect the astronauts' mental wellness too. NASA has learned that behavioral issues develop over time among people who are crammed in small spaces over long periods of time. "Scott Kelly was the first American to spend nearly a year in space...Science takes time, and researchers are eagerly analyzing results of the mission to see how much more the body changes after a year in space"(NASA.org). For astronaut Scott Kelly to last almost a year in space he needed to be fit. This is why astronauts need to pass NASA's physical because scientist and researchers on earth can study the effects of space on the human body. A lot of information can be gathered from astronauts to study more about the effects of space and how we can use that information to learn to combat the effects.

In order for astronauts to help the future of the U.S., international partnerships and NASA, astronauts need to have a bachelor's degree in a STEM field, 3 years of professional experience, and the ability to pass NASA's physical. It takes the ability to bring international partnerships together, to push the U.S. forward, and to help with research and study of the unknown to truly become an astronaut. Because of how Space, NASA, and astronauts have inspired my life to always go an extra step, I hope that someday I can inspire others to do the same.

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Second Place 8th Grade

Student: Jaxen

Teacher: Jennifer Jones

School: Manitou Springs Middle School

Astronaut J. R. Reilly

When the space program started on October 4, 1957 the astronauts were referred to have “The Right Stuff” by Tom Wolfe. This means that they were the most qualified for the job however, our definition of the right stuff has changed over the years from Mercury 7 pilots to doctors, engineers, and scientists. We also have nine countries going into space from many different regions and ethnicities. These nine countries span from the United States to Russia but, they both focus on one goal to explore and expand our knowledge and technology.

The prompt of this essay was to write and describe the role of astronauts and their impact but I find it easier to talk about one astronaut. This one astronaut is Doctor J. R. Reilly. He flew on three space shuttle missions the STS-89, STS-104 and STS-117. He got his PhD in geosciences in 1995 from the University of Texas in Dallas. However, I’ve had the pleasure working with him on my eagle project for the Air Force’s Space 200 course, an aerospace course using desktop satellites.

Throughout J. R. Reilly’s astronaut career he totaled 517 hours in space and 16.5 hours of those were spacewalks. He visited the ISS on STS-104 and STS-117 and Mir STS-89. The STS-89 was J. R. Reilly’s first space flight, it was a transfer flight to bring up payloads like an advanced X-Ray detector to the Russian MIR space station to bring David Wolf home after four months and replace him with astronaut Andrew Thomas. During STS-104 in 2001 the crew rendezvoused with ISS (still under construction at that time). Over the course of three spacewalks Dr. Reilly helped to install the Quest airlock, a pressurized flight element consisting of two cylindrical chambers attached end-to-end by a connecting bulkhead and hatch. This airlock is the primary air lock for the ISS. It was designed to host spacewalks with US Extravehicular Mobility Units spacesuits and the Russian Orlan space suits. On STS-117 the main goal was to deliver the second starboard truss segment and a set of solar arrays to power it. During that mission Dr. Reilly’s team did 4 space walks for routine maintenance. Overall, during all of Dr. Reilly some spaceflights he made significant contributions to international space station, and the Mir space station. His contributions have had a lasting effect.

In addition to his international contributions, Dr. Reilly has made many contributions to the US, specifically US department of defense. Dr. Reilly was also an officer in the US Navy reserve serving on USS Eisenhower, USS George Philip, and the USS Oriole. After leaving NASA, Dr. Reilly eventually ended up at the national security space institute (NSSI) at Peterson Air Force Base Colorado Springs, Colorado. At NSSI, He is responsible for curriculum development and

training department of defense personnel in space mission operations. It is in this capacity I first met Dr. Reilly. One of the courses he is responsible for is called space 200 (SP200) over 500 Air Force, Army, Navy, and international officers take this course each year to help them become better space professionals. As part of SP200, students participate in a laboratory experience where they get to integrate, test, and operate a desktop 3U CubeSat.

For my Eagle Scout project I built and designed Space Operation Chambers (SpOC's) with Dr. Reilly's help. The Space Operations Chambers provide a simulated on orbit scenario for students to get a feel for how real world space operations works. Also being inside the box students have to use telemetry to determine their orientation. With Dr. Reilly's help we completed the boxes in September 2017 and they have already been integrated and students are using them currently.

In recognition of his vast accomplishments and diverse background, especially in the field of geology, Dr. Reilly was just recently been nominated by President Trump to serve as the Director of the U.S. Geological Survey. He is currently undergoing Senate Confirmation.

By their examples and heroic actions, astronauts inspire many people around the world in many different places and for many different reasons. Dr. J. R. Reilly like many others like him have made immeasurable contributions to NASA, our country, education, and the world. Dr. Reilly has personally inspired me to pursue a career in space. After high school I hope to attend the US Air Force Academy pursue an education in astronautical engineering. One day I hope to eventually make my own contributions to the space community and inspire a future generation to explore.

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First Place 7th Grade

Student: LiAn

Teacher: Leah Sakdol

School: STEM School Highlands Ranch

Astronauts and Space

Imagine a world where we didn't even know we were on a planet, or even a universe existed- imagine that we only had far-fetched, hard-to-believe theories. That would be our world without space exploration and research by agencies such as NASA. You see, space exploration plays an exponential role in today's world. Without the findings and information agencies like NASA present to us, we would not be as technologically advanced as we are today. However, you cannot have space exploration without the hard-working, headstrong astronaut. Today, we cannot thank astronauts enough for all the work they have done for us in the past and what they will do for us in the future, such as helping us observe the wonders of space better, helping us research how being in space affects our bodies, and aiding us in innovating navigating and travelling in space.

To begin with, all astronauts are sent into space for a reason, and that usually leads up to observing space more. As we all know, we already know a bit about space- but it's never enough. Even though we know a lot about space, we only are familiar with about 4% of the universe's composition. As an article on the website Space.com says, "All the stars, planets and galaxies that can be seen today make up just 4% of the universe. The other 96 percent is made of stuff astronomers can't see, detect or even comprehend" (Moskowitz, 2011). Yet each day, step by step, astronauts aid us in trying to find out what the rest of the universe is made of. Evidently, it's pretty clear that astronauts play an extremely important role when it comes to understanding space. Astronauts are to observe space and its factors, and we're getting closer and closer to discovering something unbelievable every second that passes by. Altogether, if astronauts did not study space, no one would, and we'd be falling way behind whatever alien species that may be out there to get us someday.

Equally as important, astronauts also are like the guinea pigs in researching things like how going to space affects the body. For example, as the article about the twin space travel experiment on NASA's websites says, "NASA astronaut Scott Kelly returned home last March after nearly one year in space living on the International Space Station. His identical twin brother, Mark, remained on Earth" (Gushanas, 2017). When Scott Kelly returned to Earth, the twins had DNA tests and they found astounding results. Basically, these results were that Scott's RNA was expressed widely differently than his twin's- which people called the "space gene". Of course, these astronauts will be kept safe and happy as they are experimented on. The sole purpose of these experiments is that we can learn more about how space affects the

body in detail- we wouldn't want to ruin such a precious and delicate thing. All in all, we've done a number of experiments with space already, and we're bound to do more in the future, which will further aid us in learning more about the complexion that is space.

Last but not least, astronauts also guide us with improving and innovating in space navigation and space travel. Now, becoming an astronaut is no easy feat- it doesn't just happen with the push of a button. No, one must meet countless requirements and know certain things and pass several physical tests to be even applicable to be an astronaut. According to an article on Space.com, "After graduating, many astronauts are not assigned to a flight for years. They will back up other astronauts in orbit through serving as a "CapCom" in Mission Control, doing simulated spacewalks in NASA's Neutral Buoyancy Laboratory and picking up more skills they will need for their time in orbit. They spend time not only at NASA, but also international partners with training facilities (such as Canada, to learn how to operate the station's robotic arm.) All astronauts also must maintain flight proficiency on T-38 aircraft, flying a certain number of hours per month" (Howell, 2017). This quote states that it is more than just difficult to even get to the point where you get to fly an aircraft as an astronaut- and it requires immense amounts of training. Obviously, we all know that having a first-hand experience with something can give you an impression on what it's really like, and you can provide constructive criticism better that way. I imagine it is the same with astronauts- they will guide people in improving flight experiences, controls, navigation, and all that whatnot to help us take a leap forward in space travel. Clearly, astronauts serve a great role in helping us innovate in the engineering of spacecraft and space travel.

In conclusion, astronauts are more than just important to our society today, and will also be more than just important in the future. Astronauts deserve all of our respect and appreciation, because they are guiding us to a better world that bursts of knowledge. They are honorable by all because they observe space for those who don't get a chance to, aid us in learning more about how space affects bodies down to the tiniest details, and they help us in improving space travel and navigation. Astronauts truly are not represented enough as higher, respectable figures in our society today.

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Second Place 7th Grade

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A Peek into Space - Contributions of Astronauts in Society

In our society, astronauts are similar to a “trend” as their jobs are exciting and unique. Astronauts get to explore the world from a view most individuals never get to experience, but that doesn’t mean the job is all fun and games. In fact, astronauts take on a lot to become successful, while also providing a lot of information toward people across the globe as it becomes necessary. They are practically risking their lives to tell the world about future possibilities, such as life on another planet, threats to the Earth, and so on. Just think about it: Astronauts make the decision to be crammed on a spaceship—hopefully one that won’t explode, run out of oxygen, or crash—so that they can examine what types of features the universe beholds for society’s benefit! That is a lot of pressure to take on! As an overview, astronauts play a big role by having a large impact on NASA, they are changing the possible future for everyone, and they have an impact on international partnerships.

My first point is that astronauts provide a lot to NASA and their research. Primarily, the current space team, and previous ones, have made a lot of news on NASA’s website as well as other websites concerning space information. From articles about space memories like the one titled “John Young Remembered as Gemini, Apollo, Space Shuttle Astronaut” to inspirational articles like the one titled “NASA, American Girl Inspire Next Generation of Space Explorers,” to even the most simple of articles, NASA has received it all from astronauts within their own stations. Likewise, the current space team stirs up a lot of excitement and frames a friendly attitude around NASA as a whole. The space team posts individual updates, reminders, shout-outs and other information that makes the public feel as though they are interacting with NASA’s alibis in person. Additionally, the astronauts train future generations of people who want to be in their spots eventually. There are many people with the dream of contributing STEM-based skills to society through space adventures, and it is very fortunate that we have professionals willing to give people a chance. Essentially, the NASA space team gives a lot to NASA and the world as a whole, and people should feel very lucky that we have come across this.

To follow up with the last point, NASA is changing the future. The NASA base alone is making history already, and will continue to do so in the coming years. An example of this would be the Mars Rovers inspecting, well, Mars of course! NASA is monitoring these rovers which are signaling conditions of Mars so we know what to expect. This tells us whether the opportunity is available to at some point move a fraction of the population to a new environment, in order to prevent the possibility of overpopulating to the point of disaster. Another example of a

previously conducted mission that went down in history, was the Apollo Mission. The Apollo Mission was a trip to the Moon, which resulted in bringing back celestial objects contained there. Putting Neil Armstrong on the moon to see how it would turn out wasn't enough to provide us with much information. After the Apollo Mission, scientists were able to examine products from the Moon which gave us a better understanding of what the Moon is necessary for, what the conditions were at the time, etc. Overall, NASA has and probably will continue to change the possibilities for humans, while giving people something fascinating to talk about and we can all thank their recruits for their services so far.

To proceed into my final point, astronauts have a large impact on international partnerships. As illustrated on the NASA website, they have already partnered with headquarters found in the U.S.A, Russia, Canada, Japan, Europe, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. Those are a lot of countries that NASA has found the time to collaborate with despite all the other concepts they have to worry about. Subsequently, the ISS (International Space Station Program) brings all these headquarters together. International flight crews, multiple launch vehicles, globally distributed launch operations, training, engineering, and development facilities, communications networks, and the international scientific research community (try and say that 5 times fast!) all have relations with one another which is brought out thanks to NASA and other organizations. All of these relations can, no doubt, be traced back to the popularity and influence that astronauts have. After all, they represent each of these organizations!

Summing this up, astronauts clearly contribute a lot toward organizations and society as a whole. Astronauts bring lots of important information to the "table." At the times we are feeling bad about a proposed mission astronauts jump in and put us at ease by confirming that everything will turn out okay. Just think: When has an astronaut ever let us down after promising something? Never that I know of, at the very least. Astronauts really have done it all. It takes a lot of knowledge to be qualified and feel comfortable to put your life at stake while in space. Engineering, science, technology and mathematics are all required to understand even the basics of space missions and other related tasks. On a whim, my school, STEM, is preparing each individual student for careers like these, because the next generation needs to be taught to teach themselves and to prepare for jobs that require real-world skills. Astronauts acquire far from enough people to make significant changes, therefore schools need to incorporate training that gives their students what they need to become qualified enough to actually solve problems that haven't been resolved yet as not many people know how to do so. As Roger Lewin had once said, "Too often we give children answers to remember rather than problems to solve," (Jones, 2017).

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