

ORBITER NEWS

News, announcements, and more.

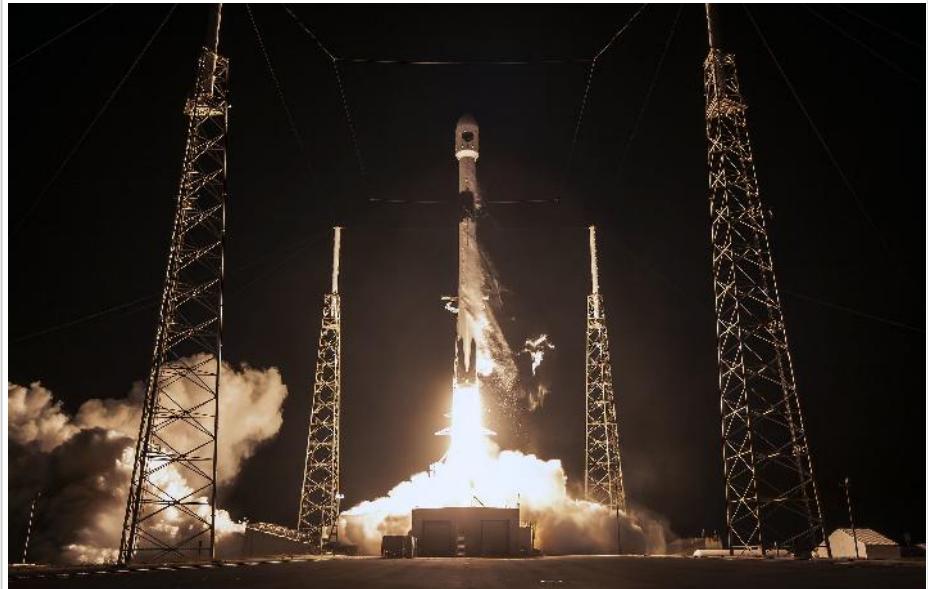
SpaceX's Falcon 9 Delivers GPS III-4 to Orbit

November 18, 2020

The Aerospace Corporation successfully supported a national security space launch remotely for the fourth time since COVID-19 conditions. Aerospace personnel used a highly distributed remote STARS capability to support the SpaceX Falcon 9 F9-098 mission that lifted off from SLC-40 at Cape Canaveral Air Force Station on November 5 at 6:24 PM EST and successfully separated the GPS III-4 spacecraft into a medium earth transfer orbit.

Built by Lockheed Martin, GPS III-4 is the fourth satellite to be deployed in the third-generation Global Positioning System. GPS III satellites provide three times greater accuracy and greatly enhanced anti-jamming capability relative to their predecessors.

The F9-098 mission utilized a Falcon 9 Upgrade Block 5 vehicle to launch the GPS III-4 spacecraft. The F9-098 first stage booster and fairing were first-use items, and this was the second National Security Space Launch (NSSL) mission to include recovery of the first stage booster, which successfully landed on a downrange drone ship. What was unique about this booster recovery is that Space Force plans to reuse this booster (a first for NSSL) for the GPS III-5 mission during the summer of 2021. Aerospace has been at



The SpaceX Falcon 9 F9-098 launch at Cape Canaveral Air Force Station on November 5 marked the fourth mission supported by Aerospace's remote STARS capability. [Photo credit: SpaceX]

the forefront in defining standards and criteria for reuse and our team is actively engaged in reuse non-recurring design validation (NRDV).



*Space Force plans to reuse the booster from the GPS III-4 launch for the GPS III-5 mission during the summer of 2021, a first for NSSL.
[Photo credit: SpaceX]*

Although this mission was almost identical to the GPS III-3 mission that launched on June 30, the vehicle that launched on November 5 required significant efforts by the team to clear an earlier launch attempt anomaly and re-verify our requirements. The first GPS III-4 launch attempt on October 3 was scrubbed at approximately T-3 sec due to an engine anomaly that triggered an automatic abort to protect engine hardware. That led to a month-long joint anomaly investigation between SpaceX, Space Force, Aerospace and NASA with the team concluding that the most probable cause was material blocking a relief valve in the engine's gas generator, which powers the Merlin 1D engine turbo pumps.

I am extremely proud of the work performed by our team in the weeks preceding launch, having active involvement in developing and adjudicating the fault tree, performing pedigrees of additional hardware, monitoring additional testing, performing independent analyses, and working closely with SpaceX on the mission (and fleet) corrective actions which paved the way for the successful launch on November 5.

The significant achievements of the team were highlighted by Space Force and Aerospace leadership. The team received kudos for their outstanding work demonstrating resilience by working long hours to mitigate the anomaly, emerging issues, and launching during the pandemic – maintaining technical excellence and dedication to mission success.

Written by Akhil Gujral, General Manager of Launch Systems Division

NASA Commercial Crew Program Kicks off Spaceflight Renaissance

November 13, 2020

After a successful prelude with [the Demo-2 mission in May](#), NASA and its ensemble of partners will officially raise the curtain on the Commercial Crew Program with the launch of Crew-1 this week. (**Update:** The Crew Dragon spacecraft "Resilience" successfully launched atop a SpaceX Falcon 9 rocket at 7:27 pm ET on Sunday from NASA's Kennedy Space Center in Florida and is now en route to the International Space Station.)



The program's inaugural crewed operational mission will send four astronauts to the International Space Station via SpaceX's Crew Dragon Capsule and Falcon 9 launch vehicle. Their journey could be the first step in opening space to countless others.

During the Crew-1 mission, NASA astronauts Michael Hopkins, Victor Glover, Shannon Walker and Soichi Noguchi of the Japan Aerospace Exploration Agency will live and work aboard the station until spring 2021, conducting scientific and maintenance activities.

Broadening the Spectrum

As much a business model breakthrough as a technical marvel, CCP will utilize private companies to ferry crews to and from the ISS, putting the U.S. on a path toward safe, reliable and cost-effective human space transportation.

Continuous work on the ISS over two decades has advanced scientific knowledge and demonstrated technologies essential to reaching the moon and beyond. CCP could accelerate this development, spurring economic growth in space services and opening low Earth orbit to more companies, nations and scientific endeavors.

"The primary purpose is to find a more cost efficient, yet safe way to get our astronauts up to the ISS," said Jon Cowart, Systems Director at Aerospace's Human Exploration and Space Flight Division for Kennedy Space Center. "Once NASA has certified that capability for their use, it frees up SpaceX to offer that same service on the open market."



A SpaceX Falcon 9 rocket with the company's Crew Dragon spacecraft onboard is seen on the launch pad at Launch Complex 39A before being raised into a vertical position, Monday, Nov. 9, 2020, at NASA's Kennedy Space Center in Florida. Photo Credit: (NASA/Joel Kowsky)

Though SpaceX and Boeing are the program's main launch providers, commercial contracting will enable NASA to seed other companies, such as Blue Origin and Sierra Nevada Corporation. This competitive model drives down cost, while nurturing novel approaches to the challenges of spaceflight.

"Having different minds from all of these organizations really broadens the spectrum of people that are going to be focusing on these problems," said Kelly Donnenwirth, a Senior Member of Technical Staff at Aerospace. "Competition drives a lot of new ways of doing things that we might not have thought of."

Less Disposable, More Sustainable

Key to the program's economic viability will be the reuse of spacecraft. Saturday's launch will utilize a vehicle fresh out of the factory, but both the first stage and capsule will be recovered for reuse in a future mission.

Though the Space Shuttle program operated with a partially reusable launch system, Cowart believes CCP could go all the way.

"This is radically different than the Shuttle. The fact that SpaceX has landed boosters successfully 60 times and reused 30 times is a good start to a database to show if this thing is working. Once they figured out how to land safely that very first time, they've only had one instance of a technical issue that prevented a successful landing," he said. "Originally, when SpaceX bid on the contract, there was no reuse on the rocket and no reuse on the Dragon capsule. Now it's official. Now SpaceX and NASA are looking into complete reuse of the capsule and booster."

Beyond the economic benefit, reuse could bring a new level of sustainability to space activity.

"It makes spaceflight more affordable in the sense that it's less disposable and that's something people are very conscious of," Donnenwirth said. "Because of the state of the world right now, if we can minimize the impact from an environmental perspective, that's something everyone is on board with."



A SpaceX Falcon 9 rocket with the company's Crew Dragon spacecraft onboard is seen as it is rolled out of the horizontal integration facility at Launch Complex 39A as preparations continue for the Crew-1 mission, Monday, Nov. 9, 2020, at NASA's Kennedy Space Center in Florida. Photo Credit: (NASA/Joel Kowsky)

Trusted Partner Through the Mission Life Cycle

With four lives and an international partnership at stake for Crew-1, NASA must balance the speed and innovation of its commercial collaborators with a prudent approach to risk management. Aerospace supports the full program life cycle from the assembly line to the splashdown of the capsule, providing independent technical analysis to identify and mitigate issues before they arise.

"From cradle to reuse, we're looking at different points in the process where there might be potential risk," said Ivor Bulathsinghala, a Senior Project Leader at Aerospace. "We're on the factory floor auditing various points in the build process from the subcomponent level, such as looking at the way a valve gets built up, to larger components like an engine, where these valves get installed and integrated into booster."



The crew for Crew-1. From left: NASA astronauts Shannon Walker, Victor Glover and Michael Hopkins, along with Soichi Noguchi of the Japan Aerospace Exploration Agency (JAXA). Photo credit: NASA/James Blair

As CCP evolves, Aerospace will continue to support NASA and its partners, drawing from six decades of work with military, civil and commercial space programs.

"We're able to leverage knowledge, independent assessments and other experience to help multiple government customers," said Aerospace Senior Project Leader Amy Misakonis. "We're like a wheel. We get insight from different spokes that we're able to leverage with organizations across the space enterprise."

While SpaceX was first to the launchpad, CCP will rely on the co-innovation of multiple commercial providers. Aerospace is uniquely positioned to provide value as a convener and catalyst of this process.

"We support Boeing the same way we support SpaceX. They're just on a different timeframe," Misakonis said. "More and more, our team is getting involved with the other players as well. We're out there to help everyone be successful because when they succeed, NASA succeeds."

A New Realm of Prospects

While improving access to the ISS represents a milestone in its own right, CCP lays the foundation for human spaceflight activity beyond low Earth orbit. Leveraging private industry for core spaceflight capabilities could accelerate NASA's progress in reaching the moon and Mars.

"If you're going to run a marathon, you're not going to just run 26 miles on race day. You have to work your way up," Donnenwirth said. "If we can perfect the process of getting to low Earth orbit, we have more time to focus on what we need to do to get beyond the ISS. There are different trajectories and distances that

will require more thought because they're not things that we currently deal with. Having commercial partners come in and handle the baseline capabilities will help us get there faster."

CCP could be the first step toward making space travel truly ubiquitous – a game-changing development for humanity. Saturday's launch represents a critical inflection point on this journey, opening up a new realm of prospects, both known and yet-to-be-conceived.

Cowart anticipates that increased frequency and capacity of human spaceflight will soon allow for scientists to visit the ISS and conduct extended experimentation in microgravity. Though astronauts carry out numerous studies aboard the station on behalf of Earth-bound investigators, Cowart says that the ability for scientists to modify their experiments in real-time will unlock new levels of discovery. Further in the future, CCP could bring once-outlandish ideas, from space tourism to lunar colonies, closer to reality. Donnenwirth suggests that, with the help of rockets, intercontinental travel could one day be reduced to a few hours.

Such concepts would only become viable if space travel became as seamless as air travel, but Donnenwirth isn't ruling anything out.

"It's like asking the Wright brothers what flight will look like," she said. "We can't fathom how much it will change. The possibilities are endless and it's up to our imagination where we want to take it."

*This article has been **published on Aerospace.org**.*

Aerospace Employees Exceed Giving Goal in DEI Matching Donation Campaign

November 23, 2020

Aerospace employees across the company contributed to a variety of charities in support of diversity, equity and inclusion (DEI) organizations during the company's first-ever Matching Donation campaign in September.

Through the month of September, more than 450 employees donated \$103,346 through AeroCares, which the corporation matched \$100K for a total of \$203,346. Aerospace



employees contributed in one month what they typically contribute through AeroCares in a year. The program resulted from the collaboration between Aerospace's Office of General Counsel, Corporate Social Responsibility, Employee Resource Groups (ERG), the Aerospace Committee for Equality Community liaisons across multiple sites, and DEI leadership.

"This corporate effort demonstrated the positive impact that can be made when we support the community organizations where many of us are volunteering our time," said Marty Whelan, Senior Vice President for Defense Systems Group. "I was thrilled to be able to use the match to support organizations where I already invest my time: the Tragedy Assistance Program for Survivors (TAPS), New Direction for Veterans in West Los Angeles and the Campagna Center in Alexandria, Virginia."

The matching campaign was one of the earliest initiatives introduced by the Aerospace Committee for Equality (ACE), which has developed 34 DEI actions across 6 focus areas. The 6 focus areas are: Recruiting, Retention, Representation, Education and Training, K-12 STEM and Community Outreach. The integrated corporate DEI strategy is intended to foster a diverse and inclusive workforce where people bring their best selves to work and to create the best solutions for our customers.

"We have a long-standing corporate commitment to meet our employees where they work and live. The matching program is one program that supports that connection," said Sabrina Steele, Executive Director of Corporate Affairs and Communications and executive champion for the ACE Community Outreach Committee. "We learned a lot during this successful first campaign, and I look forward engaging with employees to build on those lessons as we deepen our support of them and their communities."

The biggest impact made was to Aerospace's AeroScholars/Dr. Wanda M. Austin STEM Scholarship. The Scholarship was named after Aerospace's former president and CEO for her dedication to STEM education support, and offers scholarships, grants, and teacher education programs. The ACE Community Liaisons are exploring efforts to expand the Aero/Scholars program, including the addition of college fellowships for first-generation college students and an expansion of the scholarship to other locations.

By authoring a series of profile features on The Orbiter, leaders from Aerospace's ERGs and DEI Office also helped to spotlight causes for employees to consider supporting through the Matching Donation campaign. The spotlight pieces highlighted a broad range of organizations in Aerospace locations that are helping under-represented communities, providing early STEM education, or promoting equal opportunities.

Principal Director Rachel Morford shared her personal commitment to SWE, Society of Women Engineers in a spotlight story for the employee match program. "For me, SWE has been a source of inspiration and growth," said Morford. "I've learned from mentors who come from a variety of industries. I've developed a global network of friends who are all just as passionate as I am about making a difference and helping others in STEM. I've been a coach and a teacher, paying forward the opportunities that I gained through SWE as I've been involved in the organization."

"The engagement in our efforts this year is consistent with the high level of involvement we have in our Employee Resource Groups and employee volunteers in our corporate social responsibility efforts. Aerospace employees love to give back," said Via Van Liew, Director of Workplace Inclusion at the Aerospace Corporation.

We have seen a nationwide outpouring of generosity from Aerospace employees this year, along with many productive conversations on ways to build upon our efforts to give back. As we look forward to 2021, the team is exploring how best to engage employees in future donation campaigns, and has received feedback from all levels on causes and plans.

Aerospace Pays Tribute to Our Veterans

November 11, 2020



The Aerospace Military Veterans (AMV) hosted its Annual Veterans Day Tribute yesterday to honor all those who have served in the United States Armed Forces. In fact, about 15 percent of the company's workforce is comprised of military veterans and active members. With today being Veterans Day, it is important to take the opportunity to express gratitude and appreciation to colleagues, friends or family for their service to our nation. Aerospace Cares and AMV are providing multiple opportunities to say thank you, celebrate, and even give back to our veterans, which you can read about [here](#).

Due to the current telework environment as part of the COVID-19 safety guidelines, AMV shifted the format for this year's event to a virtual panel, focusing on the topic of "Veterans Transitioning from Military to Civilian Workforce: Understanding the Mission Perspective".

The guest speakers for the panel were Dr. Eva Jenkins, Systems Director in Office of the Director of National Intelligence; Abraham Gonzalez-Silva, Information Assurance Specialist with Special Programs Security; Miguel Mercado, Security Director of Special Access Programs; and Justin Neglia, Information Assurance Specialist with Special Programs Security. Jay Santee, Vice President of the Defense Systems Group, provided the opening remarks while Jon Shields, Project Engineer with Acquisition Programs moderated the event.

"The whole reason we have this panel is to have a personal and intimate look at Veterans Day and what it means for our folks in Aerospace," said Chuck Allen, Associate Director in Cyber Options and Resilience Department and AMV President. "We intentionally put our shields down a little bit because we're one family, the Aerospace family, so we just wanted to share some thoughts and perspectives with you out there about what it means, not only to be at Aerospace but also a veteran."

Tough Times Don't Last; Tough People Do

A focal point of discussion for the panelists involved sharing their personal experiences on transitioning from active duty to civilian life. While their individual paths varied, a consistent theme was how their time in the military shaped them for success.

"Being part of Army staff and learning the military's way of problem solving, briefing and making reports—all that has really helped me perform in an office setting," said 1st LT. Gonzalez-Silva. "Not to mention on top of that, all the general military traits you pick up along the way, things like discipline, time management, teamwork, leadership, working under pressure and patience... Lastly, and it's really significant to me, I learned that I'm far more resilient than I ever knew. I can't put a price on those experiences."

But the return home is not always an easy road. Mercado, whose promising career in the Marines ended prematurely, shared his powerful story about how sometimes the hardest challenges are the ones that nobody else sees.

"I was very young when I retired. I was 33 years old, and you can imagine having your resume saying you're a retired Marine," he said. "I had a lot of people wondering what was wrong with me. I had felt I lost my sense of mission. That transition was very difficult for me, but I received a lot of help. That was the biggest



Miguel Mercado with Iraqi police forces in Ramadi. (Photo courtesy of Miguel Mercado)



Abraham Gonzalez-Silva, who was activated by the National Guard earlier this year to support the COVID-19 response, explains to Sabrina Silva of Good Day Sacramento the unit's mission at the Sacramento Food Bank. (Photo courtesy of Abraham Gonzalez-Silva)

thing that made the change in my life—those three simple words: I need help. I was retired for combat-related injuries. I had stuff that was visible and stuff that was invisible, but I felt that the invisible was what was going to get me, and that was PTSD. I suffer from very, very severe PTSD to this day. It's only gotten worse with time. The difference is I've learned to deal with it, and I've learned the power of those three simple words: I need help."

Fortunately, through programs like the Intelligence Community Wounded Warrior Project (ICWWP), the National Character Leadership Symposium (NCLS) and with support from his Aerospace colleagues like those in AMV, Mercado eventually found his path to thrive.

Veterans Within the Aerospace Family

The panelists also discussed their experience here at Aerospace, and how identifying parallels in terms of similar collaborative, mission-oriented cultures and supporting the customer helped to make their transition smoother.

"Certainly, in a position as a colonel or a general you take on a lot of responsibility and it rests on your shoulders. The buck stops here. But you also have to realize you have amazing resources of very talented people that are doing their absolutely best, which makes your mission so much easier," said Jenkins, who retired from Air Force at the rank of Colonel. "That's something that I can see we do with Aerospace. We have a team, we have larger teams, we have organizations, and we're all really working toward one goal, and that is supporting our nation in the world of aerospace. It's just a great place to be, and I think the transition was much smoother and much easier coming into an organization like this than it would've been somewhere else."

For those still in active service, such as for the National Guard or the reserves, their support network within Aerospace does not stop even when they've been activated. 1st LT Neglia, who is currently deployed as an Army Reservist in a Central Command Combat Zone, talked about the support he received from his team and throughout the company.



Justin Neglia in uniform. He is currently deployed in a Central Command Combat Zone. (Photo Credit: Justin Neglia)



shirt every week. There are all sorts of little things like that that Aerospace does that are relatively small but make a huge impact."



Dr. Eva Jenkins (left) with Aerospace Senior Vice President Tanya Pemberton, General Harold "Buck" Adams, USAF (Ret.) and Aerospace Project Engineer Jon Shields at AMV's 2019 Veterans Day event. (Photo credit:

"There are tools that Aerospace has helped build that I need to do my job on a daily basis. So, Aerospace in that sense has already been a cornerstone of being successful in our counterterrorism mission overseas. I can see that firsthand. I want people to know that the work they're doing matters and it's very, very helpful," Neglia said. "There are also a lot of little things that Aerospace does that are incredibly helpful, especially when it comes to reminding me of home. There's that mental aspect of being apart from everyone I know and everyone I love for long periods of time. Aerospace went out of their way to send me a care package while I was out here. I wear my Aerospace T-

Unlocking Quantum Key Distribution for Space Asset Cybersecurity

November 04, 2020

A key aspect in outpacing the threat is the need to strengthen the cybersecurity of space assets to ensure the integrity of communication. To stay ahead in the encryption arms race, Aerospace is exploring ways these systems can leverage the laws of physics to remain provably secure.

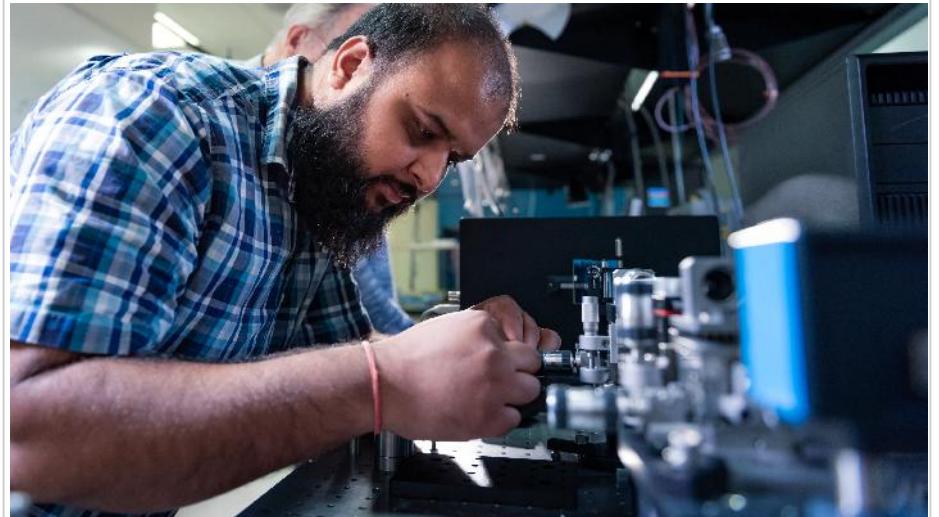
Using an emerging technique called quantum key distribution (QKD), satellite networks could potentially prevent the interception of sensitive data, such as for those used for orbital maneuvering or in military communications for the warfighter.

Aerospace is developing a proof of concept of QKD for space systems while also investigating its regulatory and market implications. A new report from Aerospace's Center for Space Policy and Strategy (CSPS) titled Challenges and Opportunities in Space-Based Quantum Key Distribution details the benefits of this new paradigm, as well as the actions required for its mainstream adoption.

A Self-Destructing Code

Unlike traditional encryption, quantum information systems use a unit called a qubit (quantum bit), which possesses the properties of a self-destructing code. The information carried by a qubit is encoded in a quantum state, representing multiple combinations of 1s and 0s simultaneously.

Due to its fragile nature, measuring this state alters it, and any information about its initial state prior to the measurement is lost. Thus, the receiver would immediately know if there had been an eavesdropper.



Dr. Uttam Paudel is among the team of scientists and engineers at Aerospace leading the effort to better understand and harness the potential of quantum communication technologies.



Currently, qubits are used in ground networks to generate cryptographic keys that cannot be copied now or cracked in the future. Aerospace is exploring ways to deploy QKD in space.

Hands-On Perspective

Although other research institutions are examining pieces of space-based QKD, such as the formation of qubits, Aerospace has constructed “a true soup-to-nuts experiment” to validate the full process, said Dr. Joseph Touch, a Senior Distributed Systems Architect in Aerospace’s Information Systems and Cyber Division. Touch and Aerospace Technology Strategist Lori Gordon co-authored the recent CSPS report on QKD.

“To do this work in earnest, you need boots on the grounds – hands on the hardware,” Touch said. “Our theoretical partners are impressed with our implementation experience, and they come to us when they need that hands-on perspective.”

Unlike other experiments of its kind, the project utilizes commercial off-the-shelf (COTS) parts, which will make future systems cost-effective, especially at the scale of large satellite constellations planned for low Earth orbit.

“We have an end-to-end QKD test bed in our lab that allows us to understand how these structures would work at a system level and the cost components to get the job done,” said Dr. Andrew Mollner, a Senior Project Leader in the Photonics Technology Department. “It allows us to really poke at it from a system level and understand what it would take to get to a space system.”

A Matter of Trust

Concurrently, Aerospace’s CSPS is examining the policy actions required for widespread adoption of QKD aboard satellites. The center’s work reveals a complex web of government and industry standards organizations – most unrelated to space – that must reach a consensus on the reliability of QKD for broader cybersecurity.

From a funding perspective, QKD must compete with higher-profile efforts such as quantum computing for a slice of investment and priority on the national research agenda. Progress has been relatively slow, and the U.S. stands at a crossroads, Gordon explained.

“But momentum has been building,” Gordon said. “Recently Congress, urged by several scientific societies and as well as growing quantum competition from global players, invested \$1.2 billion for quantum research. Only \$3 million went toward quantum key distribution. Yet around that time, China launched a satellite demonstrating QKD over a ground system. All of this sets up the need to understand the implications and viability of QKD.”

The paper finds that formal standards for QKD, driven collaboratively by private and public sector stakeholders, will be critical for greater adoption and investment. Until then, uncertainty will hinder further development.

"You can't launch it if you can't trust it," Touch said. "We have a huge chasm between lab testing and trusted use in national security, particularly for space payloads. Right now, nobody can have full confidence in QKD."

Aerospace is working to bridge this divide, leveraging quantum expertise and its unique vantage point in the space enterprise. Ultimately, the team's objective technical guidance will help shape the future of secure communications.

"The goal," Paudel said, "is to be gaining enough hands-on knowledge so we can advise the government as they're investing more heavily so they're making wise decisions."

*Read the full article [**Unlocking Quantum Key Distribution for Space Asset Cybersecurity**](#) on Aerospace.org. Be sure to also read the Value Vignette Quantum Communication—Aerospace Is Leading the Development of "Spooky Action at a Distance" Technology for Space published earlier this year.*

Is the Future of Work Already Here?

November 02, 2020



Aerospace President and CEO Steve Isakowitz joined leaders from the philanthropic, nonprofit and education worlds to discuss the future of work.

The future of work is approaching faster than ever, with disruptions from COVID-19 accelerating existing trends around where and how people do their jobs. At the same time, that disruption has spotlighted and deepened existing inequities around access to good jobs and high-quality educations.

A recent panel at the Milken Institute's 2020 Global Conference, which featured Aerospace President and CEO Steve Isakowitz, dove into these issues, exploring what steps companies, non-profits and higher-education institutions can play in shaping a "new normal" that provides economic mobility while producing the high-skilled workforce needed in today's world.

"The Future of Work is Here" panel was moderated by Jane Oates, president of the nonprofit WorkingNation, and in addition to Isakowitz featured panelists Eloy Ortiz Oakley, Chancellor of California Community Colleges; Vivienne Ming, co-founder and executive chair of the think tank Soco Labs, and Sarita Gupta, director of the Ford Foundation's Future of Work(ers) program.

Their wide-ranging discussion touched on everything from how artificial intelligence will impact the future of work to how the lack of broadband internet access acts as a barrier to education and job opportunities for people from low-income and under-resourced communities.

Isakowitz spoke about the lessons Aerospace learned in responding to the COVID-19 pandemic and the new opportunities those experiences will open up in the future. He also talked about the importance of building an innovative workforce that values different perspectives and experiences, and the role companies can play in promoting STEM education for students of all ages.

"There are things we're learning in this COVID environment that we should capture and keep," Isakowitz said. "A lot of it boils down to workplace flexibility, which I think really opens up the possibilities of the future of work."

To view the full presentation, click [here](#). The video begins with an interview with Secretary of Labor Eugene Scalia, and the full panel discussion begins at the 19:40 mark.

November 2020 Obituaries

November 01, 2020

Sincere sympathy is extended to the families of:

- **Meggan Anderson**, office of technical support, hired April 2, 1984, retired Feb. 1, 1991, died Oct. 1, 2020
- **Jack Avrin**, member of technical staff, hired Aug. 13, 1971, retired June 1, 1989, died Oct. 2, 2020
- **James Beggs**, member of administrative staff, hired March 5, 1961, retired Nov. 1, 1989, died Aug. 21, 2020
- **Wesley Boulanger**, member of technical staff, hired Sept. 2, 1965, retired March 1, 1998, died Aug. 29, 2020
- **James Bradley**, office of technical support, hired Nov. 6, 1961, retired Oct. 1, 1993, died Sept. 17, 2020
- **Sheng Chu**, member of technical staff, hired Oct. 17, 1960, retired April 1, 1985, died Oct. 22, 2020
- **Jeanne Kirschner**, member of administrative staff, hired Nov. 7, 1960, retired Jan. 1, 2000, died Sept. 7, 2020
- **Eugene Levin**, member of technical staff, hired Oct. 18, 1960, retired May 1, 1985, died Oct. 7, 2020

To notify Aerospace of a death and have it included in the Orbiter, please contact People Operations at (310) 336-5107.

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