Pulse

VOLUME 35 | December 2021

The Autonomy Factor: Future Vertical Lift

Partnering for greater producibility

Expanding cross-functional opportunities across Engineering and Operations

Assessing wildfire risk

Using today's technology to assess fire danger tomorrow

BAE SYSTEMS

The Beacon

Total innovation for the future

By **Dave Logan,** vice president and general manager of C4ISR Systems[1]
With **Casey Kennett,** Communications

Courage. Creativity. Adaptability. These are just a few of the behaviors that embody the "T" in Electronic Systems' HEAT strategy. Technology Disruption means leading the pace of total innovation in our markets. We push the limits of what is possible, giving our customers an edge and our employees a chance to change the world. I think of Technology Disruption as a key enabler for our customers. By creating and employing advanced technology, our customers can evolve their missions' concept of operations and tactics, giving them a significant advantage over our nation's adversaries.

A few years ago, the term "innovation velocity" was introduced in our organization to aptly describe the speed and direction of Technology Disruption. Oftentimes people mistake speed for progress, when really, speed and direction generate velocity. Together, these allow us to differentiate ourselves from the competition.

It is this difference that makes us unique, and why the solutions our employees develop disrupt the marketplace and solve our customers' greatest challenges. I see it everywhere; whether it's embracing novel technology, or the healthy curiosity with which our employees work with customers to effectively address their missions. I see it in the partnerships we make with our colleagues in FAST Labs™ and the flow of advanced technology into our products. It's the mission-level view that spans the many offerings within Electronic Systems to deliver our customers full spectrum solutions. Most importantly, I see it in the manner in which we engage with our customers. We approach them with a sincere desire to understand their mission, for the ultimate benefit of the warfighter.

We have teams within BAE Systems that, through a combination of hard work, keen intellect, and talent, have become national assets. Every day our customers face increasingly dangerous environments, and we share in their missions by finding solutions to their hardest problems. Our own mission, We Protect Those Who Protect Us®, is a call to service – an opportunity to use the skills residing within our teams for the good of our country and its allies. We take both missions – ours and theirs – to heart, so that every warfighter has a better chance of coming home safely. That is at the core of Technology Disruption, and why innovation velocity is so important to our enterprise.

[1] Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance Systems

Take me home!

Every issue of *Pulse* magazine is fully approved for public release. Feel free to share with family and friends.

Inside this Edition:

Electronic Systems' *Pulse* Volume 35 focuses on how BAE Systems is helping the U.S. Army outpace tomorrow's threats under the Future Vertical Lift program, and demonstrating the "art of the possible" with autonomous solutions.

Managing Editor: Lauren Leedberg
Editor-in-Chief: Kelly Hussey
Cover Image: Justin Bogart
Layout Designers: Justin Bogart · Nancy Green · Kris Jackson · Dave JanTausch · Hailee Knadle · Drew Laskowski · Tim Mattson · Marissa Rattee · Nathan Gams
Photography: Vinnie Ardizoni · Christine Tilley

If you have a story idea or suggestion for the magazine, please contact Managing Editor Lauren Leedberg.
Email: lauren.leedberg@baesystems.com.

For more information on Electronic Systems, contact Nicole Gable, Manager, Media Relations.
Email: nicole.gable@baesystems.com

Follow BAE Systems on social media.

You can follow BAE Systems' social media sites below:
facebook.com/baesystemsinc
twitter.com/baesystemsinc
flickr.com/baesystemsinc
linkedin.com/company/bae-systems
@baesystemsinc

Explore available digital formats:
www.baesystems.com/pulse

Disclaimer

The publishers, authors and printers cannot accept liability for any errors or omissions. *Electronic Systems Pulse* is produced by BAE Systems corporate and business unit internal communications teams.

Managing Editor, Lauren Leedberg. Please send any comments and feedback to Communications.es@baesystems.com or leave a message on (607) 770 3783. Email: lauren.leedberg@baesystems.com

Articles or opinions expressed in this publication may not reflect company policy. All rights reserved. On no account may any part of this publication be reproduced in any form without the written permission of the copyright holder, application for which should be made to communications.es@baesystems.com.

Designed and produced by BAE Systems Electronic Systems Creative Services http//www.baesystems.com/es © BAE Systems 2021

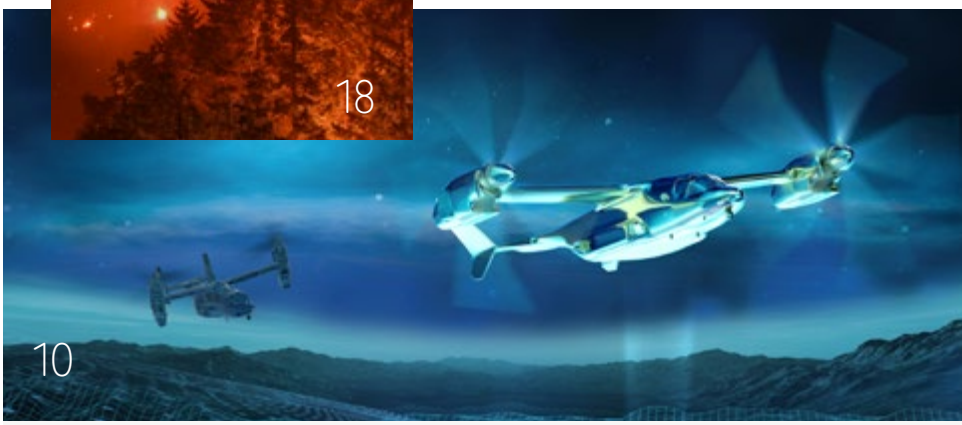
© BAE Systems Information and Electronic Systems Integration Inc., BAE Systems Controls Inc., BAE Systems (Operations) Ltd. 2021 All rights reserved

Contents

Employee Spotlight

Tech Corner

Note: Images that do not depict social distancing were taken prior to COVID-19 guidelines.



Features

Departments

On the cover:

BAE Systems develops autonomous solutions for Future Vertical Lift.

Compass Call: 40 Years of Innovation

New technologies, expanded mission

By Chelsey Campbell, Communications

The best defense is a good offense. It's more than just an age-old saying, but a proactive and effective strategy that has been proven time and again by the Compass Call program.

Compass Call is an airborne tactical electronic attack weapon system that disrupts enemy command and control communications, radars, and navigation systems to restrict adversary battlespace coordination. BAE Systems serves as the prime mission system integrator, leading engineering, integration, and testing for all mission system equipment. In 1981, the Compass Call EC-130H aircraft took its first flight. Four decades later, it not only soars and protects the skies, but is mission-ready for the future battlespace.

Today, BAE Systems is working with the U.S. Air Force, L3Harris Technologies, and Gulfstream to convert the advanced Compass Call mission equipment from the EC-130H aircraft to the EC-37B aircraft, a special-mission Gulfstream G550 that meets current U.S. Air Force requirements and is expected to field in 2024. This "cross-deck" initiative is intended to significantly improve mission effectiveness by enabling the Air Force to disrupt future enemy command and control capabilities in hostile environments more effectively.

Reflecting on 40 years

This 40th anniversary is a time for celebration and reflection. For decades, the technology has outpaced the threat. This innovation would not be possible without the people behind the technology – those who have supported the various lifecycles of the program, some since its inception. "Compass Call is a national asset," shared Duane Beaulieu, the product line technical director and chief architect for Compass Call, who has supported the program for more than 20 years. "It's a versatile and adaptable weapon system that has performed a critical mission for 40 years. We are proud to design, produce, test, deliver, sustain, and update the capabilities faster than ever before, supporting the program's history and future. It's a great challenge and reward to bring forward new capabilities to help our customers dominate the electromagnetic spectrum."

Matt McQuaid, technical director and chief engineer for the EC-37B effort, reflects on the impact of the anniversary. "The longevity of Compass Call, and BAE Systems' continued leading role in the solution, speaks to the technology's relevance in terms of fulfilling a customer need, as well as our ability to consistently deliver the best product on time. We haven't lost that drive for 40 years, and it will only grow stronger over the next 40."

Communication, culture, and collaboration

In order to support a longstanding program like Compass Call, it's as much about communication and teamwork as it is about technology. "There's a real sense of collaboration to deliver this high-performing solution," said Aparna Anbalagan, a software lead supporting the program. "We are doing development and production concurrently – executing and innovating at the same time. It's a continuous effort to strive toward zero defects, which our customers depend on. To do that, we all have a 'one team' mindset. From program office to systems engineering, hardware engineering, operations, and beyond – we all work toward our single, unified mission."

With 20 years on the program, Antonio Ayala, program manager and sustainment efforts lead, believes it's all about the team's culture. "We

have great relationships with our customers and end users that really drive us to give them that advantage in the battlespace." Ayala's previous experience with the U.S. Air Force has given him an even greater appreciation for maintaining the aircraft. "From having a hands-on experience as an aircraft maintainer, to flying the aircraft as a test engineer, to now working on contractor logistics and sustainment, it creates a holistic view of how everything works and how the operator will be using it. We've kept this aircraft flying by working collaboratively with the customer on a regular basis."

Erin Dobe, a program manager leading the production effort, echoed her team members' sentiments. "Compass Call is a program that people want to stay with and support for years, if not their entire career. It speaks to our mission and the opportunity employees have to make a difference for our warfighters." Dobe believes the program's success is thanks to the team's strong sense of mission and ongoing communication with the customer. "It's about more than dates and numbers and dollars. It's really about giving the customer what they need and remembering why you are there and who you are supporting."

Looking to the future

Innovation becomes reality at the crossroads of technology and agility. Both will be critical as the team advances its cross-deck initiative to transition and update the electronic warfare suite from the Compass Call EC-130H to the new EC-37B. It's about rapid development and deployment, with a focus on open mission systems and a software-defined radio architecture to ensure upgrades and rapid tech insertion. Another area of emphasis is decreasing operator workload and improving user experience for operators as their environment becomes more complex. Project Engineering Manager Shabnam Smith, who has been leading the program's development efforts for 10 years, shared that, "We're transitioning from this era of unique hardware sets required for certain functions, to a future state with pools of common tuners and processors with multi-function capability. It's truly a revolutionary change to be a part of. We're drawing in some exceptional talent, because we have some complex problems in front of us that require a creative mindset shift."

"Next-generation technology and talent are central to this program's success," said Russ Bardsley, RF transmitter lead who dedicates a majority of his time to mentoring young professionals. "The diversity of talent as well as the ability to effectively transfer knowledge across the generations is why Compass Call has been such a viable and vital solution for decades. The team's forward-looking mindset and commitment to develop both people and product is the winning solution."

This 40th anniversary marks a new chapter for the Compass Call program. With the EC-37B and the superior capabilities it will bring, the team is well positioned to support the mission for the next 40 years.

What's it like to be mentored by our leaders? It's impossible for every one of us to sit down with members of our leadership team, so we're conducting virtual mentoring sessions with them to pass along wisdom and lessons from the people who have ascended to Electronic Systems' highest level positions.

In this session, we talk with Jay Herther, vice president of Business Winning, about why it's important to keep a solid work ethic, always put people first, and maintain a curiosity for learning – at all stages of life.

A virtual mentoring session with Jay Herther

By **Kelly Hussey**, Communications

What did you want to be when you were a child?

I wanted to be an entrepreneur like my dad. He started his own company in the 1970s and is in the Space Pioneer Hall of Fame. I was captivated by this idea of starting from the ground up. I never ended up starting my own company, but thanks to the culture we have at BAE Systems that welcomes forward, intrapreneurial thinking, I've had many opportunities to create new initiatives and groups.

One example of this was being a part of the team that started the Business Winning organization a decade ago this past October, and seeing it grow, thrive, and transform into the robust entity it is today. Another key moment was in the late 1990s when I had the opportunity to help launch a Leadership Breakfast Club. Out of those meetings came the 9/80 work week and the mission we know today: We Protect Those Who Protect Us.® The possibilities are endless when diverse, passionate people come together and share their ideas.

Tell us a little about your career journey. Why did you choose to pursue Business Development?

After obtaining electrical and aeronautical engineering degrees, I landed my first role at a major aerospace and defense company. I enjoyed the technology, but over time I realized I wanted to lead my own team. I sought an opportunity to lead a small group of engineers, and enjoyed the people management aspect of it. As my career progressed, I also discovered a love of intense competition, so I was always looking for opportunities that combined both of these elements.

At one point I held a position in program management. It made me realize that my skill set and passion were more aligned with being a capture team leader. After spending some time as a PM, I decided I wanted to pivot my career journey and pursue one of the largest captures our company had ever bid – F-35 Electronic Warfare – which led me to where I am today.

My advice is to seek out new experiences and try out various roles, as it allows for self-discovery. What are you good at and want to master? And equally important, what are you most passionate about? If you can find what drives you and make a career out of it, you'll never work a day in your life.

What is an important lesson – either personally or professionally – you'd like to share?

I have learned that relentless persistence (also known as GRIT: Guts, Resilience, Initiative, and Tenacity) is more important to success than IQ. I always viewed initial failures as a chance to double down on my efforts and try again, which has made all the difference.

When I was 10 years old, I tried out for Little League baseball and did not make the team. The coach's advice was to work harder and train in the off season, which is exactly what I did. While I was never the MVP, I made the team the next year, and my dedication resulted in significant improvement. This experience taught me that all leaders will have setbacks, and learning to rebound quickly is key to success.

I understand you mentor others. Why is this important to you?

At any one time I have about a dozen mentees I work with regularly. It's such a thrill to help those who are earlier on in their careers and to see them thrive and succeed. Becoming an expert at anything takes 10,000 hours. If I'm able to impart some of my knowledge or advice to another person to lift them up and contribute to their professional or personal growth, that is so rewarding to me.

And, it's always a two-way street. My mentees ask me probing questions that I never thought to consider before, or took for granted. Their intellectual curiosity helps challenge my own beliefs and makes me think differently.

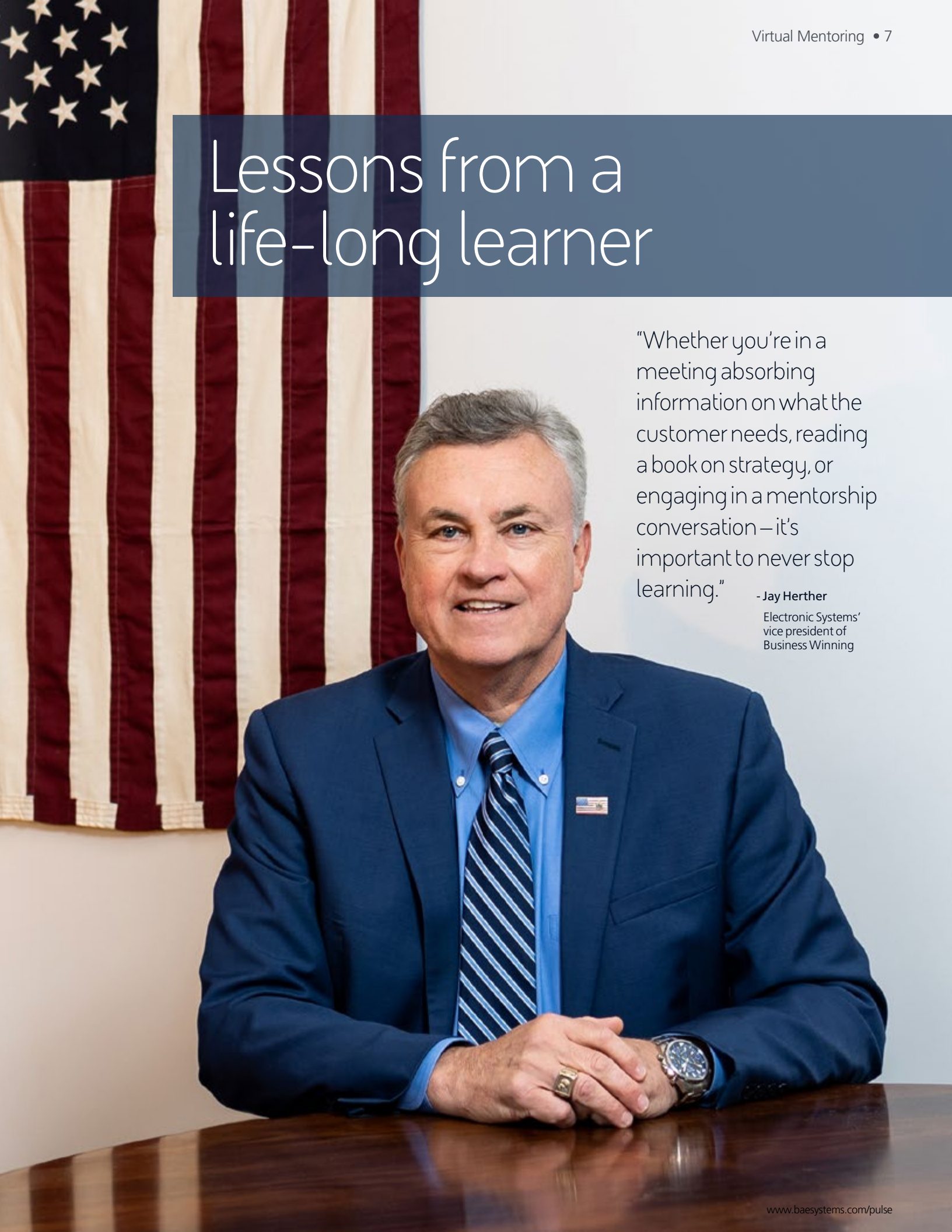
What do you like to do in your free time?

I spend as much time with my family as possible. I love boating and being out on the water with my wife, daughter, son-in-law, and two grandsons. I also like playing, coaching, and watching basketball – the ultimate team sport. I coached my daughter for years when she was growing up and now we watch as many Celtics games together as possible. My Business Winning team's mantra is Family First, and I try to live by example daily.

I am also a voracious reader of business books. Growing up, I didn't read very often, and when I was in engineering school, most of my time was spent on equations. Today I try to read at least 50 books a year on topics like strategy, marketing, presentations, and leadership to expand my thinking and apply new techniques. I also write books, articles, and blogs, so I continue to learn and share with others. Whether you're in a meeting absorbing information on what the customer needs, reading a book on strategy, or engaging in a mentorship conversation – it's important to never stop learning.

BAE Systems employees, if you would like to learn more about Business Winning specifically, visit the function's internal OneSpace page.

Lessons from a life-long learner



"Whether you're in a meeting absorbing information on what the customer needs, reading a book on strategy, or engaging in a mentorship conversation – it's important to never stop learning."

- Jay Herther

Electronic Systems' vice president of Business Winning

Making a Difference at a Distance

How virtual volunteering brings employees together to support their communities

By Hannah Wilson, Community Investment

Honoring our warfighters, no matter the location

For children with deployed parents, having something as simple as a teddy bear to squeeze can make a world of difference. That is why nearly 700 BAE Systems employees participated in virtual volunteering activities during this year's Remember.Honor.Support. campaign. Every May, this internal program honors our veterans, military families and children, and active duty service members during National Military Appreciation Month.

Jenny Poisson, director for space systems business development at BAE Systems, brought her personal experience as a parent, veteran, and military spouse to her volunteer activity. She and her daughter assembled teddy bears – known as Battalion Buddies – for Operation Gratitude, an organization that supports military service members, veterans, and their families. As part of the event, BAE Systems employees gathered by video conference to learn about Operation Gratitude while filling the bears' bodies with stuffing. The goal was to create a comforting object for children with military parents away from home.

"It is hard having a loved one deployed. Your 'normal' is disrupted, you worry about their safety. A piece of you is missing and there is a constant ache in your heart," said Poisson. "As a spouse it's difficult, as a child even more so; they do not have the coping mechanisms to deal with all of the emotions. Sometimes they just need to hug and cry into a bear."

Larissa Heimer, a program manager for Navigation & Sensor Systems in Cedar Rapids, Iowa, gathered her colleagues to assemble Battalion Buddies as a virtual team building event. "If you can find ways to support organizations virtually, take advantage," said Heimer. "Many organizations have struggled over the past year to keep up with the needs of the people they serve."

While employees also had the option to build the bears on their own schedule, the family-friendly virtual gathering allowed employees to share their personal experiences with colleagues and explain why the activity was meaningful to them. In addition to building Battalion Buddies, employees could participate in Remember. Honor. Support. by making paracord bracelets, creating outdoor expedition packages, or assembling care packages – all from the comfort of their homes.

Pivoting to virtual volunteering

Like many nonprofits with traditionally in-person volunteer events, FIRST® Robotics experienced competition cancellations during the 2020-2021 season due to the COVID-19 pandemic. BAE Systems helped FIRST pivot to provide new activities to keep participants safe and volunteers engaged.

Michael Pownell, a hardware design engineering manager at BAE Systems and long-time FIRST volunteer in Cedar Rapids, did not want the absence of in-person competitions to reduce his involvement with the program. After 22 years of participation, most recently as a mentor and coach to local robotics teams, Pownell switched gears to be a virtual judge for the inaugural FIRST Innovation Challenge.

"The virtual Innovation Challenge created an opportunity to engage with teams outside our regional areas and in some cases with teams in other countries," said Pownell. "It was inspiring to hear the teams' ideas and see how passionate and proud they were when describing the journey of taking their project from idea to prototype."

BAE SYSTEMS EMPLOYEE JENNY POISSON AND HER DAUGHTER ALEXIS WITH THEIR COMPLETED VOLUNTEER PROJECT.

The Virtual Advantage: Connection and community

Virtual Volunteering expands the definition of community by removing geographic barriers. Poisson can participate in more volunteer activities because she only has to go as far as her desk or kitchen table to impact people across the country.

"I work full-time in a role with a lot of responsibility, and I have two children and a husband who is currently deployed," said Poisson. "It can be tough to make time in an already packed schedule."

As the way we work continues to evolve, virtual volunteering is here to stay. This new method of volunteering has brought numerous opportunities for creativity, connection, and community.

Employees like Pownell and Poisson will continue to hop on video conferencing platforms to volunteer whenever they can. "It was fun to be in a social environment with some of my co-workers, and to virtually meet new people from different sites," said Poisson. "It was also nice to see some young helpers pitching in as families of employees joined to volunteer. Experiences like these contribute to a work environment where we can build a positive culture outside of our day jobs."

To learn more about Community Investment visit **www.baesystems.com/EScommunity**

Partnering for greater producibility

By **Barbara Driscoll and Tim Palmer**, Communications

ABDUL AULAKH, PREVIOUS EOPP PARTICIPANT

When our employees grow, our organization grows. One of the most effective ways for individuals to expand their careers is to gain firsthand experience in how BAE Systems both designs and manufactures products.

The Engineering-Operations Partnership Program enables employees from the two functions to spend up to 18 months in a job rotation to do just this – and improve our processes along the way. These experiences allow engineers to see how their designs are actually used to build products, while giving our manufacturers the opportunity to understand the design process.

"There are many, many decisions and actions we take in Engineering that have a profound impact on Operations' ability to effectively manufacture our designs," said systems engineer and 2016 EOPP alumna Isabel Farrell. "Engineers who are focused on creating cutting-edge technology are not always thinking about aspects of producibility, like simplifying parts lists, or orienting parts of a module to make it easier to assemble."

EOPP participants get a unique, hands-on, immersive learning experience. The program broadens their understanding of the opportunities and challenges that each function faces, and grows the communication between them. This enhanced understanding enables BAE Systems to improve quality, reduce cost, and increase producibility of our products.

"Successfully designing and building quality products for our warfighters requires a close, collaborative relationship between our functions," said Deputy Discipline Director for U.S. Defense Hardware Engineering John Prokopik. "The EOPP provides participants the opportunity to work across their respective organizations and apply new knowledge to their day-to-day activities."

Farrell said that it helped her to see the full picture. "It was so valuable to work on the manufacturing floor with the operators. Building, running tests in the labs, and talking with dozens of people every day as we moved products through the factory gave me a different perspective on executing projects that I had started on the other side of the fence in Engineering," she said.

BRITTANY JENNINGS, EOPP PARTICIPANT

As part of his rotation as a process engineer in Operations, hardware engineer Abdul Aulakh had the opportunity to improve the process for manufacturing modules in one of Electronic Systems' passive/active electronic warfare systems.

"A lot of time when I was engineering, I would create change orders or redesigns and move on to the next task, without seeing the full impact of my actions. But now I know the true value of how it impacts Operations, and how much effort it takes to implement these changes," said Aulakh. "I gained awareness on many levels, even things like being more clear and concise in how I write design change orders for the operators."

There are currently 21 employees involved in the program at sites in New Hampshire, New York, New Jersey, Virginia, and Texas. The program is open to all employees in participating functions; however, most participants are early- to mid-career and have an engineering, software, or science degree.

"We recently expanded the program to four new sites," said hardware engineering manager and EOPP program lead, Emily Mitchell. "We would love to be able to open this experience to all of the qualified candidates who apply, so I would encourage all managers to look at how they might be able to incorporate an EOPP rotation into their work."

Expanding cross-functional opportunities

The program was launched in 2013 for engineers seeking Operations experience, and Operations employees soon began taking part as opportunities arose. This year, the program actively recruited its first group of Operations employees to rotate into Engineering.

Ken Carpenter, business area operations director for FAST Labs™ and Operations' representative for EOPP, explained, "We were looking for a rotational program to develop Operations' technical experts, and leveraging the EOPP made perfect sense. There was no point reinventing the wheel when we had the ideal rotational program already in place."

Process engineer Brittany Jennings began her rotation with the mechanical engineering team in September 2021. She explained that working within Engineering has given her a much greater appreciation of the design process, and she has in turn been able to pass on her experience of the Operations manufacturing process to her new colleagues.

"I'm able to bring the perspective of someone who has faced some of the Engineering-specific challenges related to parts and documentation," said Jennings. This has allowed her to help the Engineering team understand the importance of building these considerations into the design process.

"EOPP gives me the chance to understand the product realization process holistically – not only the manufacturing side – and I look forward to using my experience in manufacturing to help the Engineering team in their development of the products," Jennings said.

The program has also placed employees from the Quality function on rotation in Engineering and Operations, as interested candidates come forward.

"As far as I'm concerned, any opportunity to build synergies between our functions and cross-pollinate ideas is a good one," said Carpenter. "At the end of the day, this program is all about building stronger cross-functional relationships, developing a better understanding of our design processes, and rounding out the skillsets of some of our best people. This can only benefit the business as we strive to achieve operational excellence."

The Autonomy Factor: Integrated Solutions for Future Vertical Lift

By **Carrie Connors** and **Megan McKeon**, Communications

As our nation's threats and enemies change, so does the battlespace. The U.S. Army has been specifically looking at what mission engagement will look like as our defensive focus and presence evolves.

A paradigm shift

Future Vertical Lift is the solution to upgrade their fleet in the face of evolving threats, and as battlespaces shift to increasingly complex, contested, and communication-denied battlespace presented by near-peer adversaries. This new environment presents the Army with a difficult new mission. In order to make manned rotary wing platforms more lethal and survivable, they need to detect, identify, locate, and disintegrate highly mobile threats from low altitude. FVL is a result of the broader concept of Joint All-Domain Operations, which integrates planning and execution of a mission across air, land, sea, cyberspace, and space domains.

FVL mission requirements emphasize platforms and technologies that optimize maneuverability, endurance, lethality, and survivability – increasing operational reach and effectiveness. While there are several lines of effort to the Army's FVL program, the two platform priorities for modernization upgrades are a Future Attack Reconnaissance Aircraft, a revolutionary light aircraft for use in contested, complex operational environments; and a Future Long-Range Assault Aircraft, a combat assault aircraft with revolutionary advances in maneuverability, agility, reach, survivability, and sustainment to operate in a highly contested battlefield.

Autonomous systems are an area of special interest for the FVL program. By creating an automated system to offload the cognitive burden of pilots while enabling them to command teams of unmanned aircraft, mission effectiveness and survivability are significantly improved. Autonomy must enable operators to intuitively use unmanned systems to provide the added standoff needed for survivability, while simultaneously enhancing the ability to degrade the enemy threat. Building on our heritage and leveraging mature technology to address these new challenges, the autonomy software programs that BAE Systems has been developing are coming to maturity at the perfect time to give FVL a competitive edge.

The BAE Systems advantage

BAE Systems is leveraging mature, mission critical technology across our portfolio to deliver transformational survivability and overall mission effectiveness. Because of this, our approach is a low-risk mission system solution that uses a modular open architecture system approach to software that allows new capabilities to be rapidly integrated at the pace of technology, not at the pace of acquisition.

Graham Ward, director of FVL strategy for BAE Systems' Electronic Systems sector, emphasizes that, "The lessons learned from older programs have given us knowledge and experience to solve some key problems that FVL may face. Our solution draws next-generation expertise from across Electronic Systems, including cutting edge capabilities in communications, sensor fusion, autonomy, electronic surveillance, electronic countermeasures, flight controls, and navigation."

BAE Systems is working with the Army to demonstrate the art of the possible, where aircraft act in concert with unmanned aerial vehicles to support the next set of capabilities needed for vertical lift missions. This strategy pulls together systems from several business areas for one integrated solution that is adjustable, easy to use, and quick to market with an open architecture approach to software and more autonomous functions.

From operator of one, to manager of many

With the volume of threats that FVL crews are expected to face, the cognitive burden will be heavy. The sheer number of sensors already on the battlefield can provide enough information to drown an operator in data. Autonomy technologies will play a key role in reducing that burden for humans, while simultaneously providing them with actionable information that increases survivability and delivers overmatch capabilities.

For nearly two decades BAE Systems has developed trusted autonomy technologies that are the building blocks for true manned-unmanned teaming operations. "In the same way that unmanned systems are meant to relieve humans from tedious or dangerous activities, autonomy software relieves human operators from mentally taxing tasks," said Damon McGurgan, technology development manager in BAE Systems' FAST Labs™ R&D organization. "This technology can fuse and correlate massive amounts of data across systems, missions, and domains to create what is called a 'common operating picture' for the human."

"Our algorithms will enable unmanned vehicles, and many other sensors across missions and domains, to be the 'eyes and ears' for the human operator, delivering a clear picture of what's going on around them at every moment," continues McGurgan. This software will be a force multiplier when it comes to increasing FVL aircrews' situational awareness in the battlespace.

Similarly, autonomy software helps aircrews conduct mission planning and mission control not just for manned aircraft, but for the many unmanned systems that are teamed with it. By providing mission-planning options in seconds – rather than the hours or days it may take a human – autonomy offers the ability to adjust the plan on-the-fly, even within the course of a mission.

Autonomy capabilities will enable operators to execute at unparalleled speeds, forcing adversaries to make critical decisions, tradeoffs, and wagers as they must quickly react to the maneuvers of the U.S. Army. As a result, the advantages of this technology could be revolutionary, and even life-saving, for an FVL fleet in a highly contested environment.

As a trusted supporter of our military, BAE Systems is ready to apply its expertise to help our warfighters outpace tomorrow's threats, and come home safely at the end of their mission.

A Vision to Decarbonize Fleets: US' First Hydrogen Powered Ferry

By **Carol Gorenflo**, Communications

Every day, BAE Systems employees are persevering, taking a leap, and breaking new ground to shape a better tomorrow. It inspires us when we have the opportunity to partner with other companies with a similar mindset. Side by side, we are accepting the environmental challenge and ensuring future generations thrive on this earth.

SWITCH Maritime is an organization that is willing to go into unchartered territory for the right reasons. This U.S. maritime investment company is set to construct North America's first commercial fleet of zero-emissions maritime vessels. They teamed up with ship builder All American Marine and multiple technology partners, including BAE Systems, and built SWITCH's flagship zero-carbon vessel. Named the *Sea Change*, it is a 75-passenger ferry powered by hydrogen fuel cells. The *Sea Change* was launched in the fall of 2021 and is currently awaiting operational trial approvals.

When introducing advanced technologies into a new market, there are many hurdles to overcome. SWITCH boldly signed up for the task of ensuring marine vessels begin moving away from diesel engine power and advance toward renewable electricity. The company sought to engage experienced partners to help them achieve this vision.

Ship builder All American Marine and electric propulsion provider BAE Systems had previously worked together to bring *Enhydra*, the largest hybrid electric propulsion passenger ferry in the U.S., to the market. On the heels of this successful project, it only made sense for the two to work together again – this time collaborating with another forward-thinking innovator to build the first commercial hydrogen fuel cell powered passenger ferry.

Employing a knowledgeable partner like BAE Systems, with more than two decades of experience integrating hydrogen fuel cell propulsion, lowers project risk and ensures success. Collaborating with transit industry partners, the company helped lead transit operations into zero emission propulsion and is responsible for powering 26 transit buses with proven fuel cell electric technology. Now, it is transferring that know-how and expertise to commercialize hydrogen fuel cell vessels.

Both BAE Systems and SWITCH Maritime share a vision to progress the net zero initiative and ensure our air and waterways are preserved for the future with clean propulsion. Elias Van Sickle, director of operations and commercial development at SWITCH Maritime explained, "We have a window of opportunity to replace aging maritime fleets with zero-carbon options, and that shift can start to take place with technology available today." SWITCH plans to make zero-carbon vessels more accessible to operators by offering capital efficient access to zero-carbon vessels, along with supporting clean fuel supply chains. They hope to work with vessel operators of all types to accelerate their progression toward future-proofed, zero-emissions vessels.

> "We have a window of opportunity to replace aging maritime fleets with zero-carbon options, and that shift can start to take place with technology available today."

Peter Brooks, business development director at BAE Systems, is passionate about bringing zero emission solutions to fleet operators. "BAE Systems' electric drive technology will power both low and zero emission vessels using electric hybrid, battery electric, and fuel cell electric solutions," says Brooks. He emphasizes that transit fleet operators transitioning to zero emission propulsion at their own pace, and our product offerings reflect this personalized journey.

Together, BAE Systems, SWITCH Maritime, and All American Marine are demonstrating a fearless pursuit of green vessels and the proliferation of clean ships. After completing operational sea trials, the *Sea Change* will soon commence commercial operation in California's San Francisco Bay area.

This innovation may be a first of its kind, but it's definitely not the last. BAE Systems remains committed to developing proven, low and zero emission propulsion solutions to support a cleaner, more sustainable world for generations to come.

Controls business flies underwater on **Dreadnought**

By **Dan Palmer,** Communications

For decades, BAE Systems has led the way on a range of controls for some of the most iconic aircraft in the world. From automatic flight controls for Concorde, to fly-by-wire systems for the Boeing 777, to fast jet active inceptor systems for F-35, the technology has continually developed to meet the needs of customers.

The aerospace industry has always been at the core of our Rochester, UK, site's manufacturing capabilities, with the site also specializing in visual technology such as head-up displays, helmet mounted displays, and augmented reality glasses.

Now though, BAE Systems' expertise in aerospace technology and flight controls is seeing the company dive under the waves and on board the UK's next generation submarine: Dreadnought.

In a new innovation, engineering teams are adapting controls that are usually used in fly-by-wire aircraft and applying them in a marine environment. Where electronic systems would usually control the movement of aircraft, engineers are developing electronics that control the heading, pitch, depth, and buoyancy of the Dreadnought class among other critical elements with added safety benefits.

That means that the new active vehicle control management system will oversee all major aspects of the submarine's maneuvering capability to the highest levels of safety and reliability, similar to existing systems on modern air transport platforms.

To develop this technology, engineers in Rochester worked closely with colleagues across the company's Maritime and Air sectors to develop a world-class system as part of our Active Vehicle Control One-Team.

Director for Maritime Controls Jon Tucker shared, "With more than 50 years of avionics experience, we already have a great understanding of how to develop complex control systems for hi-tech platforms. However, taking our technology underwater brings exciting new challenges and we are proud to support the Dreadnought program and play an important part in our national security effort."

More than 130 highly skilled engineers are working on the project, making it the biggest development program taking place in Rochester right now. But the innovation isn't going to stop there when it comes to the maritime business. Engineers are continuing to develop the technology with a vision to expand its applications to other underwater and surface vessels.

This work marks a shift in direction for the business, and highlights the way in which BAE Systems is able to continually innovate and adapt to meet the evolving needs of the warfighter.

Totowa, NJ facility

The **HEAT** is building in New Jersey

By **Laura Goodwin, Casey Kennett, and Lauren Leedberg,** Communications

Wayne, NJ facility

Composed of two sites in Wayne and Totowa, the New Jersey Business Center has long-standing ties to the aerospace and defense industry. Employees at the NJBC conduct important work across BAE Systems' Electronic Combat Solutions and C4ISRS[1] business areas.

C4ISRS' communications products span airborne, maritime, and ground communications applications in high frequency spectrums. The goal is to provide modernized communication products and services in support of critical tactical missions.

Within the ECS business, the small form factor products being developed in New Jersey leverage the benefits across BAE Systems' suite of EW Systems to provide sensors that offer critical capabilities, including passive threat detection and situational awareness; precision direction finding and geo-location; and mission system integration with full life-cycle support, ensuring our warfighters return home safely.

[1] Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance Systems

Human Capital

Long-term employee John Cunha at the NJBC

Nearly 800 dedicated employees call the NJBC their home site. Whether working in one of the office spaces, engineering labs, or manufacturing floors, all play an important role in bringing our missions – We Protect Those Who Protect Us® and We Innovate For Those Who Move The World™ – to life.

One such employee is John Cunha, who has worked at the NJBC for nearly 37 years. In his current role as the manufacturing manager, he is responsible for assembly, inspection, and testing, as well as production engineering and environmental testing. He has remained at BAE Systems and this specific site for decades because of his deep connection with our mission to serve the warfighter, and the ability to stay close to his New Jersey roots. Cunha has also taken advantage of the opportunity to grow his skills through various roles and work with talented, dedicated individuals along the way. Teamwork is key in his position, as he collaborates with a diverse group of employees across the site to meet delivery objectives. This strong sense of teamwork is felt by many across the business center. Cunha shares that, "Everyone is part of the team. We are all pulling in the same direction and putting in hard work to achieve our end goals. It feels like a second family."

External Focus

Located in close proximity to many interesting destinations, local employees have plenty of options for activities in their off time. Within a 45 minute driving radius, heading east brings them to New York City for a night on the town, north to a ski day in Mountain Creek, and west to beautiful, peaceful farmland.

NJBC employees volunteering at Eva's Village

In addition to taking advantage of the local area, giving back to the community is of utmost importance to NJBC employees. The site has a longstanding partnership with non-profit Eva's Village, a comprehensive behavioral health and social service organization. They aim to provide support and care for those who are experiencing poverty, homelessness, and hunger. From running school supply drives to helping cook and serve some of the 400+ nutritious to-go lunches and breakfasts Eva's Kitchen offers, NJBC employees are passionate about volunteering their time to help this worthy cause, along with others in the area.

Fun Facts

- Nori Restaurant in Wayne, New Jersey, was featured on the popular TV show, "The Sopranos."
- New Jersey locals eat "heros," as opposed to "grinders," "hoagies," or "subs."
- There is a fiery debate across the state on whether a locally available pork meat product should be referred to as Taylor ham or pork roll. The product in question is made of processed pork mixed with a variety of spices, sugar, and salt.
- Taylor ham (or pork roll), egg, and cheese sandwiches are a New Jersey classic.
- There are over 200 celebrities from New Jersey, including Buzz Aldrin, Peter Dinklage, Bruce Springsteen, and Meryl Streep.

Achieving Operational Excellence

Despite the effects of the pandemic, NJBC employees working on C4ISRS' Integrated Communication Solutions product line rallied together to find ways to maintain their output. Thanks to their hard work, dedication, and streamlined processes, they were able to successfully and seamlessly ramp up production for Multifunctional Information Distribution System Joint Tactical Radio System. Their excellence is further shown through the delivery of our 2,000th Multifunctional Information Distribution System Joint Tactical Radio Systems terminal in early spring 2021, maintaining the site's status as a leader in Link 16 products.

Employees at work at the New Jersey Business Center

Employees at the NJBC are also responsible for the ECS ALR-56 Radar Warning Receiver family of products. By locating those who oversee the development, production, and post production support sustainment activities in one place, it streamlines efficiencies, reduces cycle time, and provides proactive product support to our customers throughout the entire life cycle. Thanks to this innovative approach, and despite the challenges of the pandemic, the teams continue to meet operational milestones. This includes the ALR-56M team recently passing all government testing on our upgraded system, and delivering upgrade kits to international customers. In addition, the ALR-56C team received a contract to upgrade the radar warning capabilities of the fleet from analog to digital technology, which will lead to production of more than 300 systems' worth of upgrades to support the field, with the contract extending well into the 2026 timeframe.

Technology Disruption

This business center plays a key role in Electronic Systems' growth strategy to lead the pace of total innovation in our markets. Currently the site is home to a number of key programs that push the limits of innovation.

On the Electronic Combat Solutions side, these programs include our Long Range Anti-Ship Missile Radio Frequency Sensor, which is a precision-guided anti-ship missile designed to give warfighters the ability to strike high-value targets from a long range while avoiding counter-fire. Its semi-autonomous guidance and target cueing reduces reliance on intelligence, surveillance and reconnaissance platforms, networking links, and GPS navigation. Anticipating the need for increased capability to counter future threats, work is also done here on our next-generation EW sensor, a miniaturized sensor, which retains more than 90 percent of the current LRASM software baseline, but offers expanded capabilities to meet future threats.

Additionally, the NJBC provides C4ISRS' wideband communications for intelligence, surveillance, and reconnaissance systems and exportable wideband networking radios for foreign communication systems. This plays a key role in our field-proven solutions, enhancing situational awareness and providing a tactical battlefield advantage,

Long Range Anti-Ship Missile Radio Frequency Sensor is a key program worked on at this site

with more than 10,000 fielded systems to our Department of Defense and coalition forces across 45 nations. Employees working in the C4ISRS business area in New Jersey also produce Doppler navigation systems. These provide accurate, independent, jam-resistant navigation in friendly and hostile environments, and in military operation situations where global positioning system interference is likely.

Co-location of these teams in New Jersey allows them to collaborate and leverage technology innovations to further advance our products for the warfighter.

Assessing wildfire risk

By **Casey Kennett** and **Shelby Cohen,** Communications

Teaming up for the Environment

While searching for a virtual community service project to complete during the pandemic, Science National Honor Society students at Eaglecrest High School in Colorado became concerned about the threats posed by unhealthy vegetation and drought conditions in their state. They worked with BAE Systems' Geospatial eXploitation Products™ team to embark on a STEM project using the company's SOCET GXP® software to assess and predict the likelihood of wildfires in the forests of the Rocky Mountains. The students shared their report with government agencies in the state, with the hope that it will be used to help prevent future disasters and raise awareness of potential risks in regions vulnerable to wildfires.

The GXP® product ecosystem informs effective decision-making for all major military branches and many civilian organizations, ranging from critical infrastructure groups to federal, state, and local governments. SOCET GXP, an advanced geospatial intelligence software solution, uses satellite and aerial imagery to identify and analyze features on the ground. Image analysis, advanced photogrammetric techniques, remote sensing, and observation workflows are seamlessly combined in this advanced geospatial intelligence software solution. These capabilities can be used to enhance maps, support defense agencies and first responders, coordinate regional operations, and build geospatial-intelligence reports.

"The students also leveraged image streaming capabilities from GXP Xplorer® for their research, which works in tandem with SOCET GXP, on a virtual desktop," said Kurt de Venecia, director of product development for SOCET GXP at BAE Systems.

GXP Xplorer software can manage and access virtually any type of data files including images, terrain, features, maps, charts, and videos. De Venecia continued, "Using GXP Xplorer to supplement SOCET GXP with data management and search functionality streamlined the workflow, allowing the students to focus on data interpretation and analysis."

Identifying high risk areas

Working with both their academic advisors and BAE Systems engineers, Eaglecrest's students leveraged SOCET GXP primarily as an imagery analysis tool to deploy combinations of visible and near-infrared bands to gauge vegetation health. To calculate the percentage of unhealthy vegetation in the project area, they correlated area measurements and geographic location in a single data table. The students then exported the data into other software tools for visual comparative analyses and to assess trends in the data produced.

SOCET GXP provides terrain analytics, allowing analysts to create products such as terrain shaded reliefs, slope maps, aspect maps, and line of sight. While the students didn't generate terrain within the software, they used this functionality to analyze the terrain, using readily available public sources of imagery. The analysis included slope aspect maps correlated with vegetation analysis to identify how terrain affects forest health.

SOCET GXP's feature analysis capability identifies adverse conditions such as rough terrain, dense vegetation, or impacted infrastructure, while accurately pinpointing operational or evacuation routes. The Eaglecrest students, collaborating with our engineers, used feature extraction to collect polygons on the imagery, denoting vegetation under duress. They then merged the polygons together with the software, creating a continuous data set over the region of interest. They also used SOCET GXP's remote sensing ability, specifically multispectral analysis, to investigate vegetation in the area of interest. All of this technical work gave the student insight into the engineering process and how advanced technology tools are used in the real world.

"The whole experience was fascinating because it provided a glimpse into real applications of technologies and how, using remote sensing, I can impact the world," said Eaglecrest senior William Zhang.

Using today's technology to assess fire danger tomorrow

At the completion of this phase, the students used SOCET GXP to develop a customized report on the data they found. The students' findings were significant, showing extreme drought conditions along with substantial tree loss from infestation and disease. These conditions continue to threaten forested areas in Southern and Eastern Colorado following fires in 2020.

"Future wildfire risks remain high due to continued drought conditions along with abundant fuel sources of dead and diseased trees," said de Venecia. And as wildfires continue to plague the western United States, tools like SOCET GXP can bolster the prediction and prevention of such destruction, leading to better environmental outcomes and the preservation of habitats and property.

The students created two reports to share their findings, in the hope of preventing future devastation by raising awareness of potential risk in vulnerable wildfire areas.

Eaglecrest High students created a presentation of their findings from using SOCET GXP software to predict wildfire activity in their community.

From data to action

"This project is crucial because it increased awareness through hands-on participation, allowing us to better resolve issues as a community," Zhang said.

The students' work was accepted and published in the 2021 Esri User Conference Map Gallery, which was virtually attended by thousands of people around the world.

"It is the responsibility of all members of a community to understand the causes and consequences of wildfire. The honors students at Eaglecrest High School completed excellent research and analysis of this data and reported it in a way that is interactive and easy for the public to relate to and understand," said Krystal Steward, administrative manager of Grand Lake Fire Department in Colorado.

Beyond forest fires

The Eaglecrest students' project is not the only non-military application for GXP software. BAE Systems' GXP suite of advanced geospatial products inform effective decision making and ensure a safer world, and its users make all the difference.

For more than 40 years, BAE Systems has been a trusted supplier of imagery, geospatial products, and services to the defense and intelligence communities, and commercial markets. But now, those products are being used in a variety of imaginative ways including the assessment of climate change, assistance to first responders, and staging of pandemic relief.

These humanitarian missions underscore the impact that advanced technology can make in everyday lives, and the benefit of next generation geospatial intelligence to all people.

Energizing the future of flight

baesystems-ps.com

We are applying four decades of experience and know-how in energy management, power conversion and controls to enable the electrification of aircraft. Our offerings are modular, scalable, and adaptable for regional and business jets, urban air mobility, and military applications.

BAE SYSTEMS

Copyright © 2020 BAE Systems.