

CYBERSECU ISSUE

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HOW DO YOU GET TO BE THE LEADER OF THE OTHER 49?



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A Head Start ARIZONA POSITIONED TO BATTLE THE CYBER THREAT



FRANK J. GRIMMELMANN



hen it comes to cybersecurity, the reality is apparent every time you turn on the TV: We have individual victories but we're certainly

not winning the war. What we need to do is to change that paradigm and build capacities. The risks are real. Our response to those threats is a set of choices.

In Arizona, we have emerged as a national leader in the areas of talent development, effective cyber intelligence, secure operations and joint response. We have accomplished this through truly impressive cross-sector collaboration by federal agencies, businesses, state and local governments, higher education, and non-profits. For proof, look on the educational side, where the students and volunteers down at the Arizona Cyber Warfare Range have created a successful public-private lab environment that teaches while also contributing to economic development. Look at how area organizations have created shared workforce development programs that raise the bar for the Valley's seasoned technical professionals, helping them integrate threat intelligence into daily operations at our businesses and governments. Look at how these

efforts collectively help attract and retain top cybersecurity professionals in Arizona.

Even if it does indeed take a generation to create the next cadre of cyber warriors for our nation, Arizona already has begun battling the cyber threat because we are positioned to do so—and because we must. Arizona benefits from an innovative view of cybersecurity, as well as a culture of collaboration between the private and public sectors, law enforcement, and educational institutions-definitely much greater than you see throughout the United States. Additionally, in being proactive, we have been focusing for years on something that has only recently emerged as a major topic of nationwide discussion. Being early to the cause, Arizona's cybersecurity community is executing on initiatives that other regions are only now beginning to understand and discuss.

Capitalizing and building on Arizona's advantages is a rare opportunity. From our citizens to our small businesses to our major corporations, there is shared interest in protecting our stakeholders along with the ability to center part of the cybersecurity industry in Arizona. Our community is actively involved in direct defense of the critical systems in the state. Our state's alliances are integrated across sectors, support unprecedented private and public law enforcement collaboration, and allow joint response when members are targeted. Our cybersecurity professionals serve the country through our engagement and national activities, such as information sharing, intelligence analysis programs, and contributing to standards development created under presidential executive order. Indeed, one moonshot we are helping to develop is a flexible framework that would allow protected sharing of cyber intelligence among all organizations throughout the United States.

By working nationally and internationally, we are able to create a collaborative umbrella that gives us the opportunities to strengthen defenses for the state of Arizona and the nation. The reality is that people must think beyond the boundaries of their organizations and sectors to be secure. Compromises of Sony, Target, the federal government and others show us all that the disparate and evolving risks we face require shared action. Those that approach cybersecurity with narrow minds will be the ones most violated.

A crucial endeavor for the non-profit Arizona Cyber Threat Response Alliance (ACTRA) is empowering its member organizations to protect the intellectual property of our businesses, industries and government entities. It is a fact that some of the technologies developed in Arizona, if compromised, will provide other countries with unearned economic and military advantages, putting the future opportunities of our children at risk! However, a key emphasis for ACTRA's alliance activities is maintaining focus on 300-plus companies and organizations in the state that have been identified by the U.S. Department of Homeland Security as critical infrastructure/key resources. This means these entities are identified as having such importance that if they were incapacitated or compromised, our way of life—from turning on the lights and having water to banking and daily operations for businesses—would be affected.

It's everybody's responsibility to be aware of the issues related to cyber threats. Admittedly, it is a challenge to get the resources to respond to what seems to be an arcane and technical topic. This is particularly so for Arizona's small and medium-sized businesses because of natural resource constraints. Because of that, ACTRA works with infrastructure and service providers who support those businesses in order to try to shore up the defenses of an essential part of our communities. They are not alone and our small and medium-sized businesses cannot afford to wait until a cyber event impacts them to act.

The fact is that Arizona's success on the cybersecurity front begins with each and every person recognizing the power of individual action, as well as his or her power in changing the equation and paradigm. We are only as strong as our weakest point. Unless we look at a unified solution that includes small and medium-sized business, ultimately we are not in the position to have the strongest defense. We all need to be part of that equation. Engage today and make a difference. Changing the outcome begins with you!

FRANK J. GRIMMELMANN is president & CEO/intelligence liaison officer of the Arizona Cyber Threat Response Alliance, which is independent of but closely affiliated with the FBI's Arizona InfraGard Program. He also is a member of the Arizona Counterterrorism Information Center Executive Board and chair of the National Information Sharing and Analysis Organization's ISAO Creation Workgroup. Close+up: Focusing on Significant Topics Affecting Technology



"The very technologies that empower us to do great good can also be used by adversaries to inflict great harm." -President Barack Obama

hen it comes to developing game plans for defending against cyber threats, one word from the president's observation stands out: us. The only way to win the war against a new type of enemy is to do it together. That level of cooperation is even more noteworthy when you consider it is signaling an erosion of the long-standing barriers between the private and public sectors.

A prime example is Sierra Vista as the city has formed partnerships with the private sector—in this case, defense contractors, people with ties to adjacent Fort Huachuca and members of academia—to trade notes as they craft an economic development plan based on cybersecurity. "We started looking around to form the strategy for the city and where would our target markets be," says Simone McFarland, the city economic development manager. "Obviously, we have a lot of cybersecurity happening already," referring to the activities at the fort.

To gain more insight about the potential, Rainey & Associates of Peoria was hired to do an analysis. The findings jumped off the page: "While there is fierce national competition in the cybersecurity space, the study found that there are immediate opportunities for public-private-academic partnerships in Sierra Vista. With the right partners, Sierra Vista can support targeted initiatives and bring the credibility and traction necessary for an appropriately scaled cybersecurity technology cluster development."

While eight areas of focus were recommended, McFarland says three have made their way to the front burner:

- Workforce development A multi-pronged approach already is underway. The new Cyber Operations program launches in the fall semester at The University of Arizona

 South campus based in Sierra Vista.
 Students who earn the Bachelor of Applied Science will wrap up the last two years of their coursework at UA after completing the first two years through Cochise College, which already has a program in Sierra Vista. In addition, Advanced Business Learning will begin offering certificated classes in August in the city, McFarland says.
- Research and development UA's Defense and Security Research Institute has expressed interest in working with Sierra Vista to have R&D work occur in Sierra Vista, McFarland says.
- Bringing in new companies and business development – Advanced Business Learning will be one of the first businesses coming in that focuses on cybersecurity, she says.

When considering cybersecurity, a bulk of the money is getting spent in defense, McFarland says. To add to the mix, the city is trying to expand its network into commercial areas. "So we'll end up with some kind of defense cluster along with commercial cluster in the end," she says.

There already are targets for growth. McFarland says the alliance needs to build up the technical side plus the workforce side, which means more educators will be needed. Since these employees will need places to live, at some point brokers and real estate developers will need to be part of the conversation, she says. So far, the cooperation is "unbelievable," says McFarland, who expresses surprise over the progress in less than a year. "I think the main reason why is that we look at potential everywhere. You might call them 'frenemies'—they're competition to each other and the next time they're working together on contracts—so when we look at how do we partner, we look at the win-win."

She adds: "To accomplish whatever the goal is that you want to do in economic development, you need a variety of partners all working on different aspects. And when you bring them all together and then they all understand the goal and they have a vision that everybody buys into, it just makes everything happen together."

To reach common goals, there indeed is a great deal of information sharing that needs to occur. That is at the heart of the Cybersecurity Information Sharing Act (CISA) that Obama signed into law late last year. The intent of the law is to drive information sharing on cyber threats within the private sector and between the private sector and the government. Separately, the Department of Homeland Security's has been working on the National Protection and Programs Directorate (NPPD) that includes having cyber professionals find ways of expanding the cybersecurity insurance market's ability to address the new type of risk.

This public policy activity comes at a time when the insurance industry is experiencing a growth spurt. For example, global insurer Marsh experienced a 27 percent customer increase in 2015 compared to the previous year, with a 32 percent annual hike reported in 2014 and a 21 percent jump in 2013. And it wasn't just large companies and municipalities buying coverage. Jodi Clever, a Phoenix-based senior vice president for Marsh speaking from her earlier experience as a broker, says even smaller technology companies are proactive on their cyber protection. "They tended to be more sophisticated than other smaller companies when it came to that risk," she says.

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RISKY BUSINESS

Dealing with cybersecurity's talent shortage BY CHRIS BOWEN

Information security is one of the fastest growing occupations in the nation today, projected by the U.S. Bureau of Labor Statistics to grow 18 percent by 2024. Not surprisingly, there is a worldwide shortage of experienced cybersecurity professionals. At least one widely cited report places the figure at more than a million unfilled positions while also noting the gap won't be solved simply by stepping up the number of cybersecurity college graduates. It's a complex field that takes years to obtain the kind of comprehensive knowledge needed to prevent ever-evolving cybercrime attempts. So where can this kind of talent be found today—in abundant enough numbers to stay ahead of cybercriminals?

COVETED CREDENTIALS

Rather than trying to build and manage security internally, many organizations are entrusting their data to cloud providers. A cloud provider is a company that offers some component of cloud computing—typically, Infrastructure as a Service (IaaS), Software as a Service (SaaS) or Platform as a Service (PaaS)—to other businesses or individuals. To be competitive, cloud providers must have solutions for rapid deployment, seemingly infinite scalability and feature-rich agility.

While most public cloud providers, such as Amazon Web Services (AWS) and Azure, focus on foundational services, they rely on partners (i.e., managed cloud service providers) to serve the needs of customers who demand industry-specific solutions that meet rigorous regulatory, security and privacy standards. Healthcare and life sciences are just two examples. Cloud managed service providers are staffed with senior professionals with a wealth of knowledge, thanks to continuous immersion and training in all things related to the needs of the industry they serve, such as security, privacy, regulatory compliance and specific workloads. The level of professional expertise can span from manager to director to C-Suite executives but almost all members of the managed cloud service provider's security team will have a decade or more of experience in IT security and privacy.

CRUCIAL CONSIDERATIONS

Even as an organization weighs the benefits of the cloud for its own workloads, understanding its security risks and mitigation plans is crucial. Applying strategies used successfully from a legacy system will not necessarily transfer to a cloud strategy. The healthcare industry in particular has an acute talent shortage in security, and working with patient health data in a public cloud requires a very specific, ever-evolving knowledge set; it's not something that can easily be picked up from a lunchtime webinar. At a minimum, it calls for deep experience in complying with HIPAA standards for security at the physical, technical and administrative levels.

With the advent of public clouds, expertise is required in using tools developed specifically for managing security in these environments. AWS, for example, offers DIY tools like CloudTrail for log monitoring—just one of the security tasks mandated by HIPAA. Obviously, these tools take time to learn, use and automate, with HIPAA itself a constant endeavor. Many organizations would rather use their IT resources for innovation, not continuous security.

SILVER LINING

The good news is organizations don't need an internal team of security experts to breach-proof their IT assets. A certified AWS or Azure cloud partner can step in with services that include:

- Application security
- Identity and access management
- Configuration management for operating systems, networks and firewalls
- Client-side and server-side data encryption
- Network traffic protection
- Log management
- Monitoring and alerting

CONTINUOUS VIGILANCE

Hackers always are looking for vulnerabilities in an organization's network. A cloud services partner with an exclusive focus on protecting valuable data will deny them any opportunity to find one. The value of this partner's constant monitoring of the entire network infrastructure for any breach attempt cannot be overstated. Judging by the frequently long stretches of time between a breach and its discovery, many organizations are unable to keep up with this sort of vigilant surveillance—which includes maintaining a continuous watch over which employees enter the network and when.

As we look to the future, it becomes clear that cyberattacks will continue to diversify in methods and complexity going forward. That's why so many organizations are hiring chief information security officers or outsourcing the role—and shifting the risk— to their cloud services partner.

CHRIS BOWEN is chief privacy and security officer and founder of ClearDATA. He is one of the nation's leading experts on patient privacy and security, and manages the risks and business challenges faced by healthcare organizations, with a specific focus on cyber threats, privacy violations, security incidents, social engineering attempts and data breaches.



GENERATION C

Competition can offer gateway to cyber professions

s Ross Lampert recalls, the CyberPatriot program offered a way to support a component of the Air Force Association's mission by supporting aerospace education. The result also has been something more down to earth: new career options for young people.

The year was 2010 and Lampert was serving as president of the Association's Cochise Chapter based in Sierra Vista. He recognized aerospace education for K-12 education was the equivalent of learning about science, technology, engineering and math—more commonly known as STEM. Lampert also saw an opportunity for students to learn through CyperPatriot, the National Youth Cyber Education Program.

At the program's core is the National Youth Cyber Defense Competition, which puts teams of high school and middle school students in simulations of managing the network of a small company. "CyberPatriot most definitely is not a spectator event," says Mark Goldie, Open Division CyberPatriot coach at Buena High School in Sierra Vista. "It's a puzzle to competitors, fitting the pieces together to secure a system."

Buena High School was the connection that helped Lampert launch the program for the chapter. His pursuit occurred in time for CyberPatriot III, referring to the third year of the completion. It also was the first year that the program was opened to cadet programs outside Air Force Junior Reserve Officers' Training Corps (ROTC) and Civil Air Patrol. "I knew Buena High School had an Army JROTC program," Lampert says of the fresh opportunity.

In addition, Dr. Hal Thomas, a former chapter president and one of the chapter's executive committee members, was on the Sierra Vista Unified School District board. Thomas saw the opportunity CyberPatriot provided and "encouraged" Buena High School's principal to get involved, says Lampert, who now is the chapter's CyberPatriot advocate.

Teams compete for top CyberPatriot honors within their states and regions. The best in the nation travel to Baltimore for the National Finals Competition, where they can earn scholarships and national recognition.

In that first year for Buena High School, it entered a team of five competitors, Goldie says. The next year the school was represented in the national finals, Lampert says, placing second in the All-Service Division—which was for all the cadet programs involved, including Navy and Marine Corps JROTC.

In the most recent season of competition, Buena finished first in both Open and All service divisions for Arizona and third nationally in the Army All Service Division. Such success has nothing to do with luck. "I think the student motivation comes from our demand for them to excel at anything they attempt," says JROTC Instructor Anthony Teeters. "Additionally, we are very stringent on our practice sessions."

Looking to next year, there were 21 teams registered for all of Arizona by mid-May.

The competition and preparation also clear a pathway to real life. As Goldie talked with local employers about finding jobs for students, he kept hearing students with certificates in areas such as network security could find work after high school. "As promised, local industry has hired high school aged students," Goldie says, with possibly a few more hires this summer.

Arizona Commerce Authority

DESERT DEFENSE

Arizona cybersecurity expertise safeguards against digital attacks

he drive up to the walled compound in southeast Mesa is the first clue that this is no ordinary government complex. "How can I help you?" the voice says over the intercom at the gate. After being buzzed in, a security guard approaches before the car is even parked.

A walk across the asphalt lot of this 6.5acre complex reveals a series of tan, 1960s- and '70s-era block buildings. If this scene resembles a Cold War military complex, well, that's because it is. This is the site of the former U.S. Air Force Research Laboratory at Williams Air Force Base (now Phoenix-Mesa Gateway Airport). Though built for Cold War training purposes, this site is now tailor-made to confront 21st Century cyber challenges. AZLabs, as it is now known, is the epicenter in Arizona and beyond for security and defense research in a one-of-a-kind facility that maintains U.S. Department of Defense (DoD) security protocols.

It's just one example of how Arizona is making a name for itself in the cybersecurity

world, where a growing army of smart, talented professionals work every day to prevent digital attacks.

The Arizona Commerce Authority estimates there are at least 50 companies with cybersecurity operations in Arizona, in addition to Arizona's three public universities—as well as Embry-Riddle Aeronautical University—doing important research in the sector and training thousands of students each year to enter the workforce.

Tina Slankas, the city of Phoenix's





cybersecurity coordinator, is bullish about Arizona's cybersecurity future. "We are on the cusp of being a hotbed for cybersecurity," says Slankas, who worked on a team that helped prepare the Greater Phoenix region for cyber threats before and during the 2015 Super Bowl in Glendale. "We have a broad and deep market here. Most people want to stay here because there are great jobs and great opportunities to learn and advance in the cybersecurity world."

Meanwhile, inside the walls at AZLabs, nearly 30 companies and organizations perform research and training for the most complex challenges and cyber threats that companies and governments face today. Most of these are private-sector firms doing work for the end client being the U.S. federal government.

AZLabs is the result of a unique partnership between the City of Mesa, which owns the site, and Alion Science and Technology, which operates the site. It's authorized under a U.S. Air Force "Base Realignment and Closure" (BRAC) agreement to maintain the site as a security-wrapped set of buildings designed to attract and maintain high-level industry, academic, private-sector and government talent. The site's private communications network, for example, exceeds the capacity of most small towns.

There are about \$120 million worth of active government contracts happening within these walls. The complex is about 70 percent occupied, with expectations that it will be fully occupied within 18 months.

Other key players involved in the success of the site are the public-private Arizona Cyber Threat Response Alliance (ACTRA) and the all-volunteer Arizona Cyber Warfare Range. Together, they represent a national model for how public and private interests can combine in a way to develop the best cybersecurity protocols. "It's a fundamental transformation, but most importantly, it delivers results. You have Arizona at the forefront of innovation and cybersecurity," says Brett Scott, a co-founder of the Arizona Cyber Warfare Range. "But instead of just innovating, results are being delivered that are transformative—and the country has now recognized what is being done through ACTRA and the Cyber Warfare Range—and enabled by AZLabs and Alion. None of this could operate independently of each other."

Lest you think Scott is exaggerating about Arizona's status as an emerging leader in cybersecurity, just look at the results of last year's Cyber Guard 2015, the largest government-run cybersecurity exercise in the U.S. It's known as the "Super Bowl" of cyber events. Out of 22 state-assembled teams, Arizona swept the competition, with a preponderance of team members crediting AZLabs and the Cyber Warfare Range.

The real estate slogan of "location, location, location" also holds some truth in cyber defense and classified research. Dane Mullenix, the vice president of Alion and director of AZLabs, says this effort would not have been possible without the proximity to Phoenix-Mesa Gateway Airport and the Polytechnic campus at Arizona State University.

"There are just a handful of places on the planet where you have a university polytechnic campus along with both commercial and industrial access, near military training ranges, near a major city, and this incredible, high-tech lab tucked right in the middle of it," says Mullenix, a retired Air Force officer and former Pentagon employee. "It doesn't exist anywhere else in the country."

Inside the Cyber Warfare Range stand long rows of black computer servers. In its simplest

66 You have Arizona at the forefront of innovation and cybersecurity.

- Brett Scott, co-founder of the Arizona Cyber Warfare Range

form, this is a place that lets you learn by actually hacking instead of learning by simulations or theory. They teach how to hack, how to fend off hackers and then how to perform forensics on the results.

It's a place, for example, where a company might send an IT director to learn the "offensive" side of the business. The best way to learn how to defend a company's system is by teaching them how to think like the enemy, Scott says.

Mullenix describes it as training for one of the most treacherous and highly complicated problems that exists today across all sectors of business, government and national security. In 2014, the FBI's Internet Crime Complaint Center received nearly 270,000 complaints with reported losses of more than \$800 million.

"This is one of those rare examples where the good guys have successfully turned the tables on the bad guys," Mullenix says of the Cyber Warfare Range. "Instead of letting somebody, like for example ISIS, use borrowed 21st century technology to drag us back to the 12th century, here are the good guys borrowing that same technology on a voluntary basis and countering those kinds of threats."

Message from the Governor

Just A Start Employment options on the upswing for security experts



echnology has substantially changed our lives.

As governor, I can engage with tens of thousands of Arizonans in a matter of seconds by simply using my smartphone and a social media platform. As residents, we can get college degrees and do our jobs entirely online. And businesses increasingly rely on e-commerce and innovative mobile apps to be successful.

The opportunities are endless.

These technologies also present challenges unique to our place in the 21st century: Cybersecurity has emerged as one of the most important fields that exists to protect us from digital attacks across all sectors of business, government and in our personal lives.

I'm proud to report Arizona is a growing epicenter for cyber solutions in the private and public sectors. This includes military research at places like Fort Huachuca, cybersecurity operations at dozens of Arizona companies, as well as coalitions like the Arizona Cyber Threat Response Alliance, which serves as a hub for cyber information-sharing with partners from industry, academia, law enforcement and intelligence.

We're also leading in academic research. Our universities, such as Arizona State University's SEF-COM (Security Engineering for Future Computing), University of Arizona's Artificial Intelligence Laboratory and Embry-Riddle Aeronautical University's Cyber Security Lab all have established themselves as leaders in cybersecurity and defense research in the U.S. Cybersecurity enrollment at those schools plus Northern Arizona University exceeds 5,000 students a year.

Additionally, the state's private-sector is excelling in its cybersecurity efforts. Arizona Commerce Authority (ACA) estimates there are at least 50 companies with cybersecurity operations in Arizona.



GOV. DOUG DUCEY

Those include Arizona-headquartered companies like Insight, Avnet, Go Daddy, Apollo Education, Freeport McMoRan and LifeLock, just to name a few.

This emerging industry offers a variety of career choices, everything from "firewall jockeys" and forensic auditors to military intelligence researchers and those who write digital policy for a company's human resources department. Our computer and technology industry workforce, in which most cybersecurity jobs are included, has grown substantially over the past five years. That workforce now exceeds 80,000 positions.

These are some of the most technically challenging and high-paying jobs in Arizona. People want to stay here because there are great jobs and great opportunities to learn, advance and innovate in the cybersecurity world. The best part: the chance to work in a rapidly changing, competitive field whose story is just beginning to take shape.

A 2015 report, "Job Market Intelligence: Cybersecurity Jobs, 2015," ranked Arizona No. 15 in the country for total job postings in the sector. And the future looks promising. Phoenix-area job postings increased 101 percent between 2010-14, compared to 91 percent nationally.

In these pages, you'll read about Arizona's growing ecosystem of talented companies and organizations all working together to protect us from digital attacks. There are a number of factors propelling the Grand Canyon State as a leader in data security.

And we are just getting started!

Douglan . A. Juccey

FIGHTING FRAUD

WRITING BY × PAUL TUMARKIN New line of defense for online businesses

euro-ID, a science and software company with technology that flags suspicious responses on web-based

forms and questions, is leveraging patented technology from The University of Arizona to help businesses and organizations to significantly minimize online fraud.

The technology was developed by Joe Valacich, professor in the UA Eller College of Management's Department of Management Information Systems, and Jeff Jenkins, assistant professor in the Marriott School of Management's Information Systems Department at Brigham Young University.

Neuro-ID's software identifies suspicious behaviors that may indicate fraud, malicious behavior and intent by analyzing how a person answers questions when using a standard computer, tablet or smartphone. The software also identifies atypical interaction patterns from a person's typing, touch or mouse movements. The approach is fast, accurate and scalable.

Customers are using the technology to better identify suspicious responses in a broad range of contexts. The company is engaging with customers from the financial services, insurance, healthcare and other commercial sectors, as well as various public sectors that include both the state and federal governments.

"Our technology 'lets the data do the talking,' providing a common and unbiased approach for gaining insight about how a person answers riskrelevant questions," Valacich explains. "An example of a risk-relevant question might be a health insurance company asking a potential customer if he smokes or airport security asking if a passenger has restricted items before boarding a flight."

Questions are scored instantly and can scale to any number of users. Literally, millions of data fields



Michael Byrd, Joe Valacich, Roger Girard and Rod Dunmyre gather around Jeff Jenkins and Gerard Hranek. All are members of the Neuro-ID team.

per minute can be captured, analyzed and reported. Currently, no one technology definitively detects a lie but Neuro-ID is effective at detecting suspicious responses. The company is constantly improving the software in order to help organizations better manage risk and prioritize investigative resources.

In addition to signing up customers, Neuro-ID is also expanding its team with the addition of Greg Dawson, a former partner at PricewaterhouseCoopers and director at Gartner who is now directing accounts in the public sector.

CEO Roger Girard is excited about the company's potential. "Neuro-ID has traction and is rapidly evolving into a successful business," he says. "Our customers see tremendous value in our products and the incredible team we've put in place to lead the company."

Given the widespread and growing need for such technology, Rod Dunmyre, senior vice president of business development, also projects rapid growth for the company. "We're already engaging blue-chip companies from a broad range of industries, far beyond our initial planning" he says. "Our technology is a horizontal play truly a platform that can be utilized in virtually any industry, including retail, travel, education, advertising and any other context where people may be reluctant to provide a candid response."

PAUL TUMARKIN is the marketing & communications manager of Tech Launch Arizona.



inding solutions to technological challenges has become more complex, and achieving progress often demands collaboration by sizable teams of experts

with diverse and highly specialized kinds of knowledge.

Such "team science," as it's called, has yielded advances that could never have been accomplished by a lone researcher. But merely assembling groups of qualified scientists and engineers is no guarantee of success, says Arizona State University professor and psychologist Nancy Cooke.

The problem is recognized by the National Science Foundation, which asked the National Academies of Science, Engineering and Medicine to assemble experts to seek ways to improve the effectiveness of research teams. The 13-member Committee on the Science of Team Science was led by Cooke, chair of the human systems engineering program in the Ira A. Fulton Schools of Engineering at Arizona State University.

The committee's report, "Enhancing the Effectiveness of Team Science," emphasizes that successful research collaborations hinge not just on a high level of research expertise but also on planning, management, organizational and communications skills—and leadership that can instill a shared sense of purpose. See the report brief at http://fullcircle.asu.edu/wp-content/ uploads/2016/01/Team-Science-Report-Brief.pdf.

Relationship building is the foundation of successful collaborations, says Nadya Bliss, director of ASU's Global Security Initiative. She spent a decade at the Massachusetts Institute of Technology Lincoln Laboratory, a Department of Defense Research and Development Laboratory, where she led the Computing and Analytics Group, overseeing about 35 physicists, mathematicians, electrical engineers and computer scientists.

FINDING THE FORMULA WRITING BY × JOE KULLMAN Good team chemistry is challenge for researchers

> Bliss is now in charge of developing and leading security-related research for ASU's Global Security Initiative. The work involves collaborations among researchers in multiple branches of science and engineering, as well as sociology, political science, business, law, ethics, public policy and education.

"You have to embrace the complexity when you have interconnected teams of people coming at problems from different spheres of knowledge," Bliss says. "Some people think you just bring a bunch of brilliant people together and the magic just happens. But that doesn't just happen."

What makes it work, Bliss says "is to really understand what drives people. Most people really want to achieve something important that makes the world a better place, so you have to articulate a broad vision of your goals that everyone can buy into."

In May, a national Science of Team Science Conference in Phoenix explored the challenges of collaborative research. It's critical that both the research community and public policy leaders grasp the importance of doing what is necessary to ensure effective team science, Cooke says. "When projects come up short of expectations, it's a big problem," she says, "because we don't want to waste valuable time and effort, or our research funding."

JOE KULLMAN is the science writer for the Ira A. Fulton Schools of Engineering at Arizona State University.

A HIGHER LEVEL

UAVs offers alternative for tracking smaller wildlife

ildlife biologists and ecologists are datastarved because current technologies for tracking small animals are time intensive

and produce low sample sizes, says Paul Flikkema, professor of electrical engineering. For example, Carol Chambers, a Northern Arizona University forestry professor and wildlife biologist, has spent years tracking bats. After a small radio transmitter is glued to a bat and it flies away, the researchers track the transmitter's signal, which can mean carrying antennas through rugged terrain.

W

Enter the unmanned aerial vehicle (UAV).

NAU researchers have been awarded a National Science Foundation grant to develop an unmanned aerial vehicle to find animals in the wild that are carrying tiny transmitting tags. The technology has potential to vastly improve the ability to track small wildlife.

"It could make our work more efficient because people won't have to drive around for days searching for transmitters, often hiking long distances and up to the tops of hills and mountains to find bat roosts," says Chambers, who primarily works to protect maternity bat roost habitats.

"Better and faster is what we are shooting for," says Michael Shafer, assistant professor of mechanical engineering, who is named on the NSF grant with Flikkema and Chambers. "We will help these wildlife trackers do their jobs and improve information gathering. Instead of using hand or polemounted antennas, we will put them on a UAV that can go up hundreds of feet and leverage the threedimensional flight capabilities to more easily locate the radio tag signals."

NAU's drone technology capabilities for tracking wildlife will turn the UAV into a virtual pole that can fly hundreds of feet in the air and replace or augment handheld poles currently used to pick up radio tag signals.

Wildlife biologists have an easier time studying larger animals because they use GPS-enabled tags. Those sensors are usually too heavy for bats, birds and other small animals, which need small, specialized radio-transmitting tags.

"We are developing a new UAV that is not available anywhere commercially," says Flikkema. "We think the technology is a great synthesis of a mobile platform with sophisticated electronics and software that together can help find and track small animals."

The NSF grant of \$601,896 is applied to instrument development for biological research. Instead of funding new science, NSF is funding NAU's new tool development with the goal of quick distribution to the scientific community.

Phases for the three-year NSF grant include:

- Year one: Developing the engineering and core technologies.
- Year two: Testing technology and getting the documentation. At the end of the grant cycle, users will be able to download instructions to build their own UAVs.
- Year three: Working with scientists at Cornell University to ensure individuals can effectively replicate and use the technology.



WRITING BY × STEVE YOZWIAK Genomic technologies track origin of valley fever plus future outbreaks

y using the latest in genomic analysis technologies, scientists at the Translational Genomics Research Institute (TGen) have tracked the likely origins and dispersal of the fungus that causes valley fever.

In a story that spans 2 million years and includes the effects of glaciation and the pre-historic movements of animal hosts, the study sets the stage for tracking future outbreaks of this potentially deadly dust-bound disease as it spreads across arid regions of North and South America.

Valley fever is an infection caused by the microscopic fungus Coccidioides, which lives in desert soils and typically enters the body through the lungs. An estimated 150,000 Americans are infected annually by valley fever and as many as 500 die each year.

"The combination of whole genome sequencing and advanced statistical analysis provides for an understanding of the possible ancestry and dispersal pathways of this fungus," says Dr. David Engelthaler, director of programs and operations for TGen's Pathogen Genomics Division (TGen North), and the study's lead author.

Nearly 60 percent of infected people—and other mammals, especially dogs—develop no significant symptoms from exposure to valley fever. However, some infected patients develop highly debilitating symptoms, such as cough, fever and fatigue. These symptoms are similar to other respiratory diseases caused by bacteria or virus, and often lead to delayed diagnoses and inappropriate treatment. Very severe valley fever can require lifelong treatment with antifungal drugs and even death.

VALLEY FEVER EVOLVED IN THE SONORAN DESERT

There are two distinct species of the fungus Coccidioides that cause valley fever: C. posadasii, the oldest species, which originated in the Sonoran Desert of southern Arizona and northern Mexico; and C. immitis, which is the species found in California's Central Valley, as well as parts of southern California and Baja Mexico.

Using the genetic data derived from 86 Coccidioides genomes, the study published April 26 in the scientific journal mBio estimates that C. posadasii diverged, forming Arizona and non-Arizona subpopulations, between 820,000 and 2 million years ago.

The Arizona subtype today is found throughout central and southern Arizona. Within Arizona, TGen researchers identified multiple distinct genetic groups originating in the Tucson region—one of which also includes all the Phoenix isolates, where the largest concentrations of valley fever occur.

The study's authors also estimate the fungus spread to Mexico and Texas as many as 675,000 years ago, to South America about 527,000 years ago, and to Guatemala in Central America less than 190,000 years ago.

VALLEY FEVER SPREADS TO NEW AREAS

The geographic range of the fungus is expanding. New clusters of C. immitis have been identified in eastern Washington state, which likely emerged from California. Valley fever also is also known to occur in Argentina, Paraguay, Brazil and Honduras.

The previous dispersal of this pathogen is attributed in large part to major animal migrations during the last several hundred thousand years. Besides humans, highly susceptible mammals include dogs and other canids; rodents; and llamas, armadillos and bats in South America. The cause of the more recent expansion to Washington remains uncertain.

STEVE YOZWIAK is the senior science writer for the Translational Genomics Research Institute (TGen). Connect at www.tgen.org.

SPEED OF BUSINESS

writing by × ken quartermain, jr. A three-pronged approach to economic success

he No. 1 driver for industry today is talent. Every day, 10,000 baby boomers are retiring while 10,000 students are dropping out of high school. We are simply not keeping pace with current demand, let alone the impending labor demand tsunami expected over the next 10 years.

Gov. Doug Ducey last year asked Science Foundation Arizona (SFAz) to do an independent, comprehensive review of Arizona's workforce training and identification infrastructure to determine challenges and make recommendations to centralize, connect, leverage and focus our efforts, and make Arizona the top state in the nation in identifying and training talent for industry through real, market-driven reforms. We found:

- Employers cannot find the available talent to grow their businesses and skilled workers cannot find the businesses that offer high paying, high demand jobs. Adult learners in the community college system may be one online class or certification away from having the package of skills these employers desperately need but cannot find a source to identify these employers or the skill sets needed to become qualified for these high paying jobs. Community college completion rates suffer as a result.
- Students throughout Arizona's K-12, community college and public university system struggle to understand the relevance of their education, and how best to match their hopes, dreams and passions with rewarding careers. Based on current data, only 18 percent of our high school freshmen will complete a two- or four-year degree within the next decade.

Although these scenarios seem bleak, they actually represent gigantic opportunities. SFAz has recommended to the governor a solution with three phases: **AZ-VETFORCE –** Match one of the nation's largest populations of men and women who will soon exit military service with employers seeking highly trained talent. Through a technology-driven platform, vets will be paired with employers in minutes by bridging the gap between talent needs and veteran-based talent solutions. More than 10,000 military job codes have been translated into skill sets demanded by private firms. Veterans who run into difficulties finding a job or find they are "underemployed" will use these translation tools to secure the right job in the right industry at the right salary.

AZ-TALENTFORCE – Work with Arizona's community college system, the largest in the U.S., to develop career paths for adult learners who will serve as a pipeline for the top 100 high demand careers—covering industries in IT, healthcare, advanced manufacturing, construction, energy and transportation. Industry leaders will work with SFAz to map out the skill sets they need. The platform then will produce a roadmap for community college adult learners to identify gaps in the necessary skill sets and the fastest way classes, associate degrees or certifications—to qualify for these high paying careers.

AZ-FUTUREFORCE – The platform will work with Arizona's middle and high school kids to help them decide what future they want then map the steps necessary to achieve their dreams. Beta tests conducted in two states with some of the nation's lowest performing school districts showed remarkable results in increased graduation rates and decreased dropout rates.

Our goal is to connect all those people and processes to make them more powerful and set Arizona up, as our governor has charged, "to operate at the speed of business."

KEN QUARTERMAIN, JR. is vice president & director of the Arizona STEM Network at Science Foundation Arizona.

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Close+up: NO US VS. THEM continued from page 007

As the future of cyber risk is shaped on Capitol Hill, someone with a front row seat to the action affecting cyber risk is Matthew McCabe, a senior vice president with the Marsh Cyber Center of Excellence whose earlier career stops included the Bush administration and the House of Representatives. McCabe views the NPPD as an information-sharing initiative based on cyber incidents and using them to build a repository, with the Department of Homeland Security serving as a convener among both companies and their insurers. "I don't necessarily think that initiative needs to happen for this industry to continue to grow but I also do recognize that if there is more data available to our clients, better data makes better decisions," he says.

For anyone fearing NPPD may establish government mandates, McCabe doesn't believe

that to be the case. "I think the department sees this as purely a voluntary effort on the part of private sector companies collaborating, which is a good thing." Still, NPPD may face some obstacles in coming about because CISA already has been enacted, he says.

Even the industry isn't immune from the risks. Insurance companies and insurance brokers withstand cyber threats just like any other company, McCabe says. He credits the Financial Services Information Sharing and Analysis Center as a leader in establishing information sharing protocols. While many insurance entities—whether brokers or carriers—already are engaging in robust information sharing, it is uneven. "The challenge for us nationally is to bring everybody up to a high level of information sharing," McCabe says.

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