



14th Annual Verification and Validation Summit - 2019

“Resilience – 360”

Event Record

The 14th Annual Verification & Validation (V&V) Summit was held at the Sheraton Atlantic City Convention Center Hotel September 25-26, 2019, with 239 in attendance. There were 22 speakers from FAA, Air Force Research Laboratory, United States Air Force (USAF), Rowan University, Boeing-NeXt, US DOT Volpe Center and private industry who addressed this year’s theme, “Resilience – 360,” that focused on fostering resilient services, systems, personnel, organizations, leaders, and practices. Topics addressed V&V and resilience across many domains and from varying operating perspectives.

The presentations and discussions addressed critical topics that included:

- drones
- autonomous vehicles
- futuristic air travel
- human factors
- emerging technologies
- future of the NAS
- traffic management
- cloud computing
- personal resiliency
- machine learning and artificial intelligence
- resilient engineering
- evolutionary design
- rapid acquisition
- aviation new entrants
- configuration management
- change and risk management
- building workforce resiliency
- generational factors of resiliency
- sustainment of the NAS

To provide additional insight and understanding of resilience, the following videos were presented: *Latest thinking on Organizational Resilience, George Washington: Lessons in Leadership, and Seven Principles for Building Resilience in Social-Ecological Systems*. The Summit featured interactive display booths including the FAA NAS Animated Storyboard, Big Data Analytics Working Group (DAWG) and ATO Runway Safety.

The V&V Summit was planned, conducted, and facilitated by the FAA V&V Strategies and Practices Branch under the direction of the Branch Manager, John Frederick. The V&V Summit coordinator was Wanda Lopez-LaBarbera. The 22 distinguished speakers at the summit addressed the following topics:

- John Frederick – FAA, Manager, V&V Strategies and Practices Branch, welcomed the audience to the 14th Annual V&V Summit and provided an overview of V&V. He established context for why we need resilience in a Volatile, Uncertain, Complex, Ambiguous (VUCA) world. Resilience is adapting to change, keeping an open mind, learning, applying lessons learned, anticipating, innovating, and making connections.
- Shelley Yak – FAA, Director, William J. Hughes Technical Center, greeted the assembly and emphasized the “big picture” or the holistic resilient approach for people and organizations.

Change ushers in ideas, and opportunities. We should embrace change to innovate and recognize new opportunities to transform our technologies and culture. This V&V Summit will provide us the perspectives, understanding, and methods to manage change with resiliency.

- Keynote Speaker: Melchor J. Antuñano, M.D., M.S. – FAA, Director, Civil Aerospace Medical Institute, AAM-3 Mike Monroney Aeronautical Center. Mr. Antuñano presented *New Developments in Aerospace Transportation Vehicles* to showcase how a myriad of new vehicles in the not-too-distant future will require a full resilient infrastructure of NAS stakeholders, services, and systems to accommodate them. His talk also illustrated how technology's capacity and performance can far exceed human abilities with the human as the weak link in the system.
- The *Blue Skies Initiative: What's Next after NextGen* panel consisted of Gene Hayman (Moderator), CACI International, Inc., Vice President, FAA Account Executive; George Emilio, Serco North America; James H. Washington, JJW & Associates; and Rebecca Guy, FAA, Deputy Director, Air Traffic Systems. Panel discussion focused on NextGen looking ahead to see the emerging technologies and the impacts to the NAS. Keeping personnel trained as the technology changes is a challenge. The discussion surfaced critical resiliency questions for NextGen concepts and beyond: Are service agreements the way to address the demands? How do we get capabilities out early while maintaining a resilient NAS? How do we ensure rigor, data availability, and data transferability? As artificial intelligence becomes viable, how do we certify it? How should we explicitly address resiliency in the Safety Management System of the NAS?
- Kerianne Hobbs – Aerospace Engineer, Air Force Research Laboratory, Autonomous Control Branch, gave a technically deep presentation entitled *Run Time Assurance for Resilient Autonomy* that exposed the audience to Air Force Research Laboratory's V&V approach. In training autonomous systems, the prime directive is "do no harm" followed by "do not interfere," then "prevent collisions." Autonomous systems can take over for the pilot, but the V&V must be methodical to establish effective rules for engaging autonomy and performing autonomous functions. Hobbs proposes that the quality loop of Plan, Do, Check, Act may be adapted as a "Foresight" loop of "Foresight, Insight, Oversight, and Hindsight."
- Praveen Raju – FAA, Technology Development & Prototyping Division, ANG-C5, discussed leading the FAA's program for Unmanned Aircraft System (UAS) Traffic Management [UTM]. The FAA has focused on UTM to address UAS new entrant technology. To do so, the Division is working with local and state governments to carve out airspace access routes. There are many considerations for regulating low-altitude flight, especially as privately-owned airborne craft not classified are used. UTM is focused on the implementation of deconfliction services, data analysis, and reuse of NAS data to ensure safety and resiliency.
- Lieutenant Colonel Mark A. Massaro – United States Air Force, Division Chief, Air Force Test and Evaluation Policy, Programs, and Resources Division, discussed *Tailoring Test for Rapid Acquisition*. The USAF is using Rapid Acquisition to get projects done in less than 5 years. This relies on rapid learning and agile teams matrixed from across the organization (get people out of silos). Testing is early and iterative, and design takes testability into account. It was stressed that rapid should not equal reckless. Rapid acquisitions rely on rapid learning.

- Matthew Monaco – Noblis, Director of Aerospace Mission Solutions discussed *Ensuring Resiliency in Autonomous Systems through V&V*. The focus of autonomous systems is to shift from human-in-the loop to human on (validation, supervisory, monitoring) or around (verification, compliance) the loop. Using nondeterministic systems and Artificial Intelligence (AI) are possible ways to replace the human. An important constraint is that the AI cannot explain how it learned what it learned, making assurance difficult. The focus must be on V&Ving data and the requirements for the system.
- Jon Schleifer – FAA, Chief of Staff, William J. Hughes Technical Center, ANG-E002 discussed *Descendants from Tun Tavern* as an enduring example of discipline, tradition, sacrifice, and life-long resiliency for the common good. M²+P=360 (mentally, morally, and physically every day). Individual resolve leads to group resolve in the Marines. He told the tale of Lt. Col. Deal’s resiliency in the Marines as the first woman naval aviator and the distinguished history of the Montford Point Marines as the African-American platoon called to combat in WWII. He concluded with an invitation to those in service to recite the oath of office. The Tun Tavern was the birthplace of the Marine Corps in Philadelphia, PA; its namesake restaurant and brew pub is located in the Sheraton Hotel where the Summit took place.
- Dr. Nidhal Bouaynaya – Rowan University, Associate Dean for Research & Graduate Studies Professor, Electrical and Computer Engineering, spoke *On the Resiliency of Machine Learning Systems*. Machines may learn in one of three ways: Supervised, Unsupervised, and Reinforcement. She played a video demonstrating intelligent agent machine learning and showed photos that might be used to train AI. While AI/machine learning has amazing success in many applications, it is not yet very resilient; it is particularly susceptible to attack, and is challenged regarding lifelong learning. When noise (like graffiti on a stop sign) is introduced, sensor certainty in identifying an object is reduced. When “smart noise” is used, it poses a digital threat to confuse a sensor. Dr. Bouaynaya noted some of her promising research to analyze the certainty metrics rather than the accuracy metrics to signal potential use of smart noise.
- A. Larry Gurule – CMPIC, LLC and i-infusion, Inc., President, discussed *NAS CM Orchestrating Resilience Across the FAA*. Industry uses security to decrease system vulnerability and “DevOps” to optimize activities between development and operations when building a system. We are in the 4th Industrial Age with a fusion of Cyber and Physical systems. Critical CM needs a process and innovation platform. Resilience is not optional. Stressed resilience requires connectivity and discipline. Resilient CM should address needs, truth, trust and traceability.
- Natesh Manikoth – FAA, Chief Data Officer, AIT-001, discussed *Resilience – An Architectural Viewpoint*. He spoke about resiliency of NAS systems by presenting an analogy and lessons learned from architectural design. NAS resiliency and the existence of a resiliency index provides a means of measuring a system’s preparedness. Mr. Manikoth referred to the book *How Buildings Learn* by Stewart Brand. There are best practices and lessons to be applied to our aviation systems from Brand’s architectural lessons of evolutionary design of buildings. Resiliency required layered and continuous learning. The fast layer promotes innovation. The

slow layer promotes stability. For NAS subsystems truly to be resilient, designers, developers, and maintainers of the NAS must acknowledge and anticipate change impacts to systems.

- Jon R. Damush – Boeing-NeXt, Senior Director, New Business Ventures, discussed *A Vision on How Mobility Will Evolve*. Boeing is managing resiliency of the marketplace by standing up a separate line of business and investing in nascent business ideas to think differently and embrace the disruption of new technologies and entrants to aviation/aerospace. Mass transit and road infrastructure do not have the capability to expand to traffic demands. Jon compared aviation to time machines. We fly to save time. Our challenge is to find different/better ways to move people. Businesses and organizations can become slow and congested, just like air traffic. They can rigidly impose structures for the necessary purposes of security, safety, and risk management, but these also hinder innovation. Innovative organizations interrupt their own practices and rules to investigate pathways to growth.
- Ann M. McDonald – U.S. DOT Volpe Center, Program Analyst, Aviation Systems Engineering Division and Jennafer Miller – PMP, Evans Incorporated, Senior Consultant discussed *Resilience and Requirements Management in the PMO*. They gave an overview of a Japanese concept called Ikigai (reason for being/purpose/quality of one’s life) and led an exercise stressing that resiliency in an organization comes from the network as a whole. Change is inevitable, but one may find harmony in the balanced intersection of the four arenas of “What you’re good at,” “What you love,” “What you get paid for,” and “What the world needs” => Ikigai. The group exercise asked attendees to match playing cards to form a team holding a royal flush and then to discuss elements of organizational resilience affixed to the back of each card. If a person/organization can be resilient, they must have Ikigai; these concepts are dependent on one another.
- Richard Abbott – Objectstream Inc., Director of Safety discussed *Resilience Engineering – Managing Safety in Complex Systems*. The transitive property as it relates to Cause and Effect in Accidents tells us that all accidents have effects; all effects have a cause; therefore all accidents have a cause that can be prevented. Traditional safety management focuses on minimizing what can go wrong. Managing safety in the 21st century focuses on learning what goes right and doing more of that. Resilience Engineering helps an organization assess, develop, monitor, and continuously improve their resilient performance potentials.
- Sonceré W. Woodford – FAA, PMO, En Route & Oceanic Second Level Engineering, AJM-256, Test Functional Manager, discussed *Resiliency in a Maintenance Organization*. She shared the various Second-Level Engineering support and Program Management functions the branch performs to support the NAS 24/7/365. The organization uses Field Automation Support Teams as the eyes, ears, and voices of the EnRoute and Oceanic domains to continuously maintain legacy systems. To ensure resiliency, they use tabletop exercises to glean solutions to operational and maintenance issues.
- Peter D’Amico – FAA, Computer Engineer, ANG-E5A, and Cuong Nguyen, FAA, Computer Scientist, ANG-E5A, discussed *Resiliency of the FAA Workforce* regarding what motivates the latest generations of our workforce (millennial, Gen-Z, iGen). They think differently and have a different perspective than the “baby boomers” or Gen-X that followed the baby boomers. The speakers discussed survey and research data on trending attitudes and business practices relating

to millennials, Gen-Zs, and iGens. In general, statistics indicate they have less patience for typical “pay your dues” progression and are motivated significantly by 1) perception: feeling like they are making a difference, 2) connection: feeling part of a bigger team, and 3) trust: feeling supported and mentored. Gen-Z employees need recognition and continuous feedback as well. To be a resilient workforce, as these new generations become the largest employed segment in the next 10-15 years, the FAA must consider these workforce needs.

The speakers at this year’s Summit addressed “Resiliency” by stressing adaptability, mitigation of risk, and innovation. The audience may have the following takeaways:

1. Resilience is critical in a VUCA world: Volatile, Uncertain, Complex, Ambiguous.
2. Resiliency is the ability to: bounce back and recover from a disturbance, cope with setbacks, keep going in the face of adversity, adapt to change, thrive and not just survive, innovation from adversity, and bounce forward.
3. To increase resilience we must: learn from the past, optimize connections, anticipate change, take risks, use risk-based thinking, and establish rules (checks and balances). Nothing produces resilience like connections.
4. With today’s air transportation system, safety through resilient practices must be continually assured and cannot be compromised.
5. Resilient Engineering focuses not just on system recovery. It strives to build things right from the beginning. The goal is to innovate and optimize for greater effectiveness and minimized impacts, disruption, and required recovery actions.

All FAA participants (who attended both days) at this year’s V&V Summit received FAA eLearning Management System (eLMS) credits (course #FAA30020006). V&V Summit feedback forms were collected at the end of each day and will be assessed to improve future summits. The 14th Annual V&V Summit presentations, final agenda, video links, and pictures are stored on the Web at:

http://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/v&vsummit/v&vsummits.html.