

# CHANGE CREATOR

Gregg Leone believes the global aviation sector must seize today's opportunity to collaboratively improve safety

Ben Sampson



Undeniably, Covid-19 has disrupted aviation. But every crisis provides opportunity, and Gregg Leone, vice president and director of the Center for Advanced Aviation System Development at MITRE, is a man on a mission.

Leone simply wants to improve ATC's safety and efficiency. It is decades long work in progress – he has worked at MITRE, a private, not-for-profit US R&D company since 1983.

His zeal for making the industry work better together is infectious and extends beyond borders. Even considering the challenges posed by Covid-19, he firmly believes that the present provides an excellent opportunity for improving ATC in terms of operations and safety.

## Leading by example

MITRE runs several FFRDCs (federally funded research and development centers) in the areas of aviation, defence, healthcare, homeland security, treasury, veterans affairs, and cybersecurity, supporting government agencies and private industry.

The Center for Advanced Aviation System Development (CAASD) at MITRE works on behalf of the US Federal Aviation Administration (FAA). CAASD provides technical capabilities in systems engineering, mathematics, and computer science and supports initiatives such as the FAA's modernization program called NextGen. The closest equivalent in Europe is probably aviation research agencies such as Germany's DLR, the Netherlands' NLR, or the UK's ATI.

The purpose of FFRDCs, including CAASD, is to solve technical and operational problems where “off the shelf” commercial solutions are not available. “Our job is to build things that solve our sponsors' mission-focused problems. We do this by evaluating state-of-the-art technologies and prototyping operational solutions. We then transfer these prototypes to our sponsor or industry to support what they do best, which is commercialize it, build it, and run it,” says Leone.

What really sets FFRDCs apart is their freedom from conflicts of interest—they

don't profit from the government's decisions. By law, FFRDCs can't manufacture products, compete with industry, or work for commercial companies.

These restrictions mean government and industry can provide FFRDCs with sensitive or proprietary information without fear of improper use or disclosure. This allows FFRDCs to help their sponsors acquire the right technology, objectively assess business processes, and integrate complex systems.

“Aviation is an environment that requires high levels of safety with multiple partners.

“It feels like almost anyone can say no to an operational change or new technologies. Getting to yes on a new system or operational change requires building consensus from the beginning of a program, and that means involving communities, trade unions, governments, neighboring states and bodies, as well as relevant international organizations.”

Building consensus is a difficult task in aviation, and MITRE spends as much time managing relationships with stakeholders as it does developing new technical solutions.

The organization's approach to building consensus breaks it down into three dimensions: What is it? Why should I care? And: Why should I believe you? Communicating these aspects of any operational change or technology project requires not just discussion with partners, but also the provision of definitive proof through modeling, simulation, and data, believes Leone.

“We work hard to stay current with what industry is developing, figure out how to use it, and separate the hype from the reality,” he says. “Then the FAA encourages us to take what we have learned or built to improve operational safety and efficiency and promote it internationally. When we are overseas, we want to understand what others' solutions look like too, so that we can import them back to the US and then study them.”

## Distributed decision-making

According to Leone, the FAA's modernization program NextGen has made great progress in upgrading most of the US

National Airspace System's (NAS) core functions – data management, communications, navigation, and surveillance. Many improvements are in place and have delivered benefits in efficiency, predictability, capacity, and access.

However, he is quick to stress that this does not mean job done for CAASD.

Over the past few years, the R&D center has been working with the FAA on the next step for modernizing the NAS. Fundamentally, this will involve evolving the NAS's current “command and control” operation and aviation-specific infrastructure into a distributed one that takes advantage of industry technologies and broadens the improvements in efficiency and capacity beyond those observed with NextGen. One main aim is overall system resiliency. The recent pandemic demonstrated very effectively the need for resiliency in ATC infrastructure.

There are other reasons to move toward a more distributed approach to ATC systems. In the future, the aviation industry wants to introduce more and more varied air vehicles, such as eVTOL aircraft and unmanned drones. It also wants to commercialize space more. This means more launches and high-altitude persistent platforms for applications such as communications. It also means much more diversity in operations in areas that are already very congested.

This has clear implications for the NAS. “We have to move to a more collaborative structure – with a set of connected systems and aircraft sharing information,” says Leone. “When things are purposefully and securely connected to each other, it promotes a natural resiliency in the system.”

Leone believes the basic function of ATC is to provide what he called “perfect” communications, navigation, surveillance, and flight flow information at the levels of performance required by any situation or environment. That situation could be bad weather with low visibility, a GPS outage, or an airspace above a city with thousands of drones and air taxis.

“The future is going to require heavy data and information flow; connectivity between aircraft, the ground, and each other; and



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### GREGG LEONE CV

Gregg A. Leone is vice president and director of the Center for Advanced Aviation System Development at The MITRE Corporation in Virginia. He leads MITRE's domestic and international civil aviation, aerospace, and transportation strategy efforts and works closely with the Federal Aviation Administration and the global aviation community on next-generation transformation and integration. He joined MITRE in 1983.

highly resilient infrastructure for communication, navigation, surveillance, and flight flow," he says.

"Our economies are increasingly dependent on aviation, so you can't have massive disruptions."

The main lesson learned from Covid-19 is that ATC systems and capabilities must be able to manage through disruption. So, if an ANSP goes down, a neighboring FIR or someone else needs to accommodate their service. "The technology can do it; it's mainly a political problem that stops these arrangements," Leone says.

"In the US we do not have a lot of different ANSPs, and it is a very large airspace. The FAA is very good at collaborating with airlines and at managing disruption, whether it's facilities outages due to Covid or bad weather."

### Next level safety

Until now, traditional safety analysis has allowed the NAS to develop a sort of baked-in resiliency. But the "next level of safety," as Leone puts it, requires more than diagnostic and descriptive analysis — it requires just-in-time predictive analytics that furnish knowledge about a future in time to influence that future. The next generation of predictive analytics will ensure the time horizons needed to affect an advantageous outcome consider who is responsible for mitigating the risk, as each decision-maker will have different data-related needs.

In the US, the Aviation Safety Information Analysis and Sharing (ASIAS) program has helped industry stakeholders understand and proactively address risks of adverse events in their operations. Established in 2007, ASIAS is a public-private partnership between industry stakeholders, the FAA, and The MITRE Corporation. ASIAS stakeholders consist of a broad range of organizations conducting domestic operations and enables the sharing and analysis of safety-related air carrier data in a de-identified and protected manner for aggregate level analyses. These analyses focus on "what" and "why," rather than "who," which is critical to building trust among stakeholders.

Aviation remains one of the safest modes of transportation, and continually improving aviation safety is a global issue, so expanding ASIAS to include international operators and data sets is paramount to capturing the last mile in aviation safety. Leone remarks, "I want this to work globally through common integrated data exchanges. An aircraft accident anywhere in the world is a

safety problem for everyone in the world. To get to the next level of safety we must lift up everyone. We need to get better at sharing data."

ICAO is the main vehicle for international collaboration in aviation, and Leone is a passionate champion of the organization. "We need to recognize that ICAO has enabled a harmonized system over the last 75 years. Let's work together to further speed up global harmonization, share new capabilities, and best practices and accomplish the next level of safety as an integrated global partnership."

### International collaboration

The criticism that ATC is slow to change is often heard, perhaps more so within the sector itself than outside of it. Drones, eVTOLs, and more commercial operations above 60,000ft all present amazing economic opportunities, but some are asking if ANSPs and ATC systems are adequately prepared for them.

Leone says that "just-in-time change" will see these new technologies introduced safely, but that global regulators need courage to take prudent risks.

"In Europe and the US, we have regulators that are always out in front and assess risk through formal safety case analysis — they can build data and information to prove safety cases. If we are going to push these things out globally, we must teach other regulators how to manage risks using safety data and cases," says Leone.

"Continuous improvement in system and operational safety takes the focused efforts of governments and ANSPs around the

world to target investment in new R&D. Since aviation is global, my dream has always been to build integrated R&D centers in key parts of the world that work together to solve new aviation challenges."

To that end, MITRE worked with the Civil Aviation Authority of Singapore (CAAS) to open an R&D center in Singapore in 2014 to serve the Asia Pacific region.

MITRE Asia Pacific Singapore (MAPS) features a human-in-the-loop laboratory for developing and testing new systems, and Asia-specific modeling and simulation and data collection capabilities. The way the center works is modeled on the close relationship MITRE has with the FAA in the US.

One of the key tasks the organization has helped CAAS with so far is leveraging the most capacity possible with a third runway at Changi Airport, which is expected to be operational by the mid-2020s. Three runways pose operational challenges, with three aircraft being able to arrive and depart at the same time. "The only other airports that runs triples are in the US, and we worked with the FAA to ensure they are run safely," says Leone.

They have also jointly developed a departure sequencing tool that incorporates wake separation requirements, so departures can use the same runway. MAPS is also working internationally and with ICAO on a concept called flight and flow collaboration environment (FF-ICE). "It enables information exchange between different ANSPs so they can collaborate in a better way and industry can build systems that are connectable," says Leone.

In addition, the Singapore R&D center is working on changes to ICAO Standard Annex 14 for obstacle limitation standards around airports.

### Connectivity and consensus

MITRE has a long list of technological achievements in ATC, from TCAS and User Request Evaluation Tool (conflict probe) in the US, to procedure design tools. But most important to Leone is the organization's capability to build new technologies and consensus simultaneously.

"I've been in ATC for almost 40 years because it's an exciting place to be. The industry is a global sport and the people in it are open, sharing, and collaborative — it's an incredible community.

"Our capability as a convener and technology developer is unique. We work in partnership with the ATC community, using data to show what we are doing works." ❖