



THE NEED FOR NAVAID MODERNIZATION

Aging navigation aids need to be modernized or they risk affecting ATM safety

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According to the International Air Travel Index, aviation is showing solid signs of recovery from the effects of the Covid-19 pandemic. The revenue passenger kilometers indicator for international travel increased 289.9% in March 2022 compared to March 2021. The recovery is attributed to the opening of borders between countries now willing to receive air travelers whose travel was restricted during the pandemic.

But there is another hurdle the ATM community needs to address – the age of ground-based navigation aids (NAVAIDs). With GPS resiliency being challenged around the world, ground-based navigation aids are more important than ever for the safety of our airspace. In the USA, much of the FAA's NAVAID infrastructure has outlived its design life by more than 50% and concerns are growing for its safety, sustainability, and maintainability.

The advent of satellite-based navigation had a huge impact on US aviation after the FAA first introduced it in Instrument Flight Rules operations in 1994. GPS is now the primary means of navigation for most aircraft, although many still rely on traditional ground-based aids such as distance measuring equipment (DME), Very

High Frequency Omni-directional Range (VOR), tactical air navigation (TACAN) and instrument landing system (ILS). “The US airspace is unique,” adds Kenneth Cleveland, Selex's vice president of sales and marketing. “We have the busiest commercial and general aviation airspace in the world. Many aircraft rely on ground-based systems as a primary means of navigation.

“With hundreds of airports in remote locations across the United States, maintaining the ground-based navigation infrastructure is critical to flight safety.”

NAVAID modernization

NAVAIDs such as VOR, DME, TACAN, ILS and other such equipment serve as the primary navigation system for many airports. They also provide backup navigation at airports that use satellite-based navigation guidance such as GPS, which can suffer service outages.

It's time to put a plan in place for the immediate maintenance and modernization of ground-based NAVAID systems in the USA to keep passengers safe and realize the economic benefits of the latest technologies.

Aging ground-based navigation infrastructure is a threat to safety and efficiency in the National Airspace System

(NAS). It is crucial that the modernization and replacement of aging navigation infrastructure be accelerated. The FAA's business case states that DME, VOR and TACAN are primary navigation instruments and were designed for a 20-year service life. Today, 85% are operating at 50% beyond this lifespan. That means 55% of DMEs, 95% of VORs, and 100% of TACANs used by the FAA that are more than 30 years old, without an immediate plan for modernization.

“Aging electronic systems cannot be sustained indefinitely, and comprehensive rapid modernization is required now! These systems are critical to safety and are aging, just like bridges and roads, and are vital not only for safety but for growing our economy in the US and around the world,” says Bill Colligan, general manager of the Selex ES, Air Traffic Management Division.

“ANSPs all around the world need to prioritize landing and navigational aids in their infrastructure budgets.”

Further, the existing NAVAIDs in the USA do not meet the FAA's own most recently published safety standards.

Resiliency and over-reliance

ICAO issued a notice in August 2020 to member states to strengthen



Left: Ground-based NAVAIDs help ensure the safe, fast and efficient flow of air traffic, the security of people and goods, and the effective exchange of information between operators

Top right: Distance measuring equipment provides slant range information to aircraft for en route and precision approach and landing applications

Right: VHF omni-directional range (VOR) provides azimuth information for en route navigation and approach services



communications, navigation, and surveillance (CNS) systems resilience and mitigate interference to global navigation satellite systems (GNSS). The notice strongly suggested it was critical for member nations to strengthen CNS system resiliency to mitigate the interference to GPS.

While GPS-based navigation is highly accurate and economical, some believe that aviation has become overly reliant on GPS. Satellite navigation is vulnerable to disruption and outages. Even small and inexpensive spoofing and jamming devices used by truck drivers to conceal their location from employers have been known to cause major issues for pilots.

More destructive attacks are also becoming commonplace. In the past five years, more than 10,000 incidents of GPS interference have been linked to China and Russia. GPS is an easy target and interference can cause big issues globally, where like in the USA, aviation and economies are so closely tied.

Fortunately, the USA has a strong back-up navigation system in its ground-based NAVAIDs, thousands of which are in place across the states. "With the increased amount of GPS jamming interference throughout the world, the ground-based systems are now in

the forefront of safely navigating planes to and from airports," says Terry Thomas, vice president of programs at Selex.

Even if every airspace in the world transitioned to GPS as their primary, reliable NAVAIDs will remain critical to air travel safety for the foreseeable future.

The FAA manages many challenges due to the vast size and complexity of its US airspace. And, legitimately, the pandemic and global political conflicts have compounded their hardships, widespread staff shortages, and high fuel costs. But aging NAVAID equipment and their effect on global air travel safety was a concern before the pandemic began.

For instance, the FAA is working on a plan to modernize the NAS into a performance-based system that uses existing VOR technology, and removes the oldest VORs from service. That plan, which is called VOR MON is not scheduled to be complete until 2030 at the earliest. Even if The FAA can stick to that timeline, the VORs that are already operating well beyond their end-of-life window will be another ten years old.

It's time for the industry to work with the FAA on a plan designed to improve the integrity and modernization of USA

ground-based infrastructure urgently before equipment failure causes a catastrophe.

Upgrade benefits

Modern ground-based NAVAIDs offer many advantages over their predecessors, such as reduced power consumption compared to legacy systems. Today's VORTAC, a combination of VOR and TACAN technologies, is nearly seven times more energy efficient than the ten to thirty-year-old systems in service.

If every VORTAC in the NAS operating beyond its service life was replaced, it will save the equivalent energy usage of a small town. With our world focused on sustainability, the efficiency of modern NAVAIDs alone should be enough to motivate the FAA to implement NAVAID infrastructure renovations now.

"Advanced ground-based NAVAIDs are available right now, but the manufacturers and airports cannot install the equipment until it goes through the FAA's certification process," says Colligan.

"In addition to reduced power consumption through the use of modern electronics and electrically scanned antennas, fuel savings can be achieved through the use of DME-DME technology."



“DME-DME is used in support of PBN [Performance-Based Navigation] operations, allowing aircraft to fly fuel efficient arrivals and departures in a GPS denied environment,” says Kevin Sivits, Selex’s chief technical officer.

Aircraft can fly much more fuel-efficient arrivals and departures using the newest DME-DME technology. And let’s not overlook the job creation and ensuing economic boost inherent in an initiative focused on air navigation maintenance and modernization.

So what is preventing the modernization of US ground-based NAVAIDS? Many countries worldwide operate with reliable, well-maintained NAVAID systems and many are working towards modernization. Key practices include replacing NAVAID technologies every fifteen to twenty years in order to keep up with advancements and innovations in electronics. Some focus on interoperability to gain efficiencies with air and ground systems.

Another proven practice for many countries is to successfully run privatized air traffic organizations designed to cut out bureaucratic hindrances to efficient operations. They are able to certify and bring new technologies to their airspace in a cost effective manner. They do this with quicker product certifications which allow new products to hit the market much faster, including air traffic management systems. Australia, the UK, Germany, Belgium, and Canada have all privatized their ANSPs to reduce costs and increase efficiencies while maintaining the highest of safety standards.

Learning about the successful practices of other countries is a great place to start when trying to foster the acceleration of the FAA’s NAVAID modernization plan. This could

Top left: Tactical air navigation (TACAN) is used to provide azimuth information to military aircraft and slant range information to military and civilian aircraft

Top right & right: An instrument landing system (ILS) is a precision runway approach that provides pilots with both vertical and horizontal guidance



look like a global awareness campaign to change the public’s pro-GPS mindset to a “safety and security” mindset, that includes both GPS and the system resiliency offered by ground-based NAVAIDS. ANSPs could also lobby their governments to increase funding toward maintenance and modernization. Equipment manufacturers can also partner with ANSPs to create streamlined testing and certification processes designed to keep navigation systems in optimal order without delays.

ANSPs around the world are challenged with aging infrastructure. Some equipment in use is 40 years old and arguably approaching the realm of irresponsibility when it comes to safety. It may be only a matter of time before ground-based NAVAID equipment is no longer dependable, whether

used as a primary system or a backup to GPS resiliency.

While the FAA in the USA is an easy example for shedding light on the aging ground-based NAVAID equipment in service and the potential dangers they represent to air travel, they are not alone in the misprioritization of this issue. Aging ground-based NAVAIDS is a global issue, and requires global action. It is time for ANSPs to fully address their role in the health decline of ground-based NAVAIDS. With the help of aviation stakeholders, equipment manufacturers, and other ANSPs, private or government-run, air navigation service providers can build a safer, more efficient, modern and resilient air traffic system to support increasing global air traffic demands. ❖