

The National Airspace System

A Systematic Resilience Evaluation

What?

What is the National Airspace System?

The United States National Air Space System is the combination of aircraft, airports, sensors, navigation facilities, people, and processes that enable people and cargo to move across the country.

Components of the National Airspace System

- **Ground Control:** Manages aircraft on the tarmac and taxiways.
- **Tower Control:** Manages aircraft on the runways and in the air around the airport.
- **Approach Control:** Manages aircraft in the airspace around the airport.
- **Center Control:** Manages aircraft in the airspace between airports.

So What?

**Can the National
Airspace System be
disrupted?**

The Threat

Could an adversary, such as a domestic terrorist, disrupt the Air Route Traffic Control Centers and meaningfully disrupt national air travel?

In Short: No

Slightly Longer: **It's a highly resilient system, with characteristics dating back to the advent of flight, that would be difficult to disrupt locally, but is built to retain and recover from disruptions quickly as a core function.**

Resilience Comes in 4 Forms

- **Resistance:** The system's ability to stop a threat from occurring.
- **Retention:** The system's ability to continue operating in spite of an active threat.
- **Recovery:** The system's ability to return to operation after experiencing a threat.
- **Resurgence:** The system's ability to improve after facing a threat.

Resistance Characteristics

Many of the Centers can resist physical threats due to their positioning within the physical security perimeter of major international airports.

Recovery Characteristics

The system is distributed, airport by airport, region by region, so an aircraft could reach out to a previous or upcoming center if it lost access to its regional Center.

Retention Characteristics

Early flight procedures were built with the concept of failures, especially of radios, and a lack of redundancy, so significant effort has gone into the retention of capability considering failures. Pilots undertake

Resurgence Characteristics

Even with significant resilience via resistance, recovery, and retention, catastrophic failures happen. Air traffic is subject to investigations by both the National Transportation Safety Board and Federal Aviation

Now What?

The ARTCC System is very good, but there are opportunities for improvements.

Resistance

Recommendations

- Improve Physical Security: There are a wide variety of levels of physical security based on visual assessment (as detailed data about security is tightly controlled and not publicly available).

Retention Recommendations

- **Retention Exercise Tabletop:** Tabletops are a low-effort, low-risk, but often illuminating approach to gaining an understanding, especially in situations where there is limited real-world data on base decisions.
- **Retention Simulation Exercise:** The best way to test further is real-world simulation. This comes with significant risk, as even temporarily removing an ARTCC could impact air travel across the country and world, but without fully understanding the impacts, it's impossible to fully understand the ability of the system to retain.

Recovery Recommendations

- **Downtime and Recovery Tabletop & Simulation Exercises:** As part of Retention tabletop and simulation exercises, modeling recovery is a logical extension. Simulating this would provide a wide variety of lessons learned.
- **Disaster Recovery Planning:** While an ARTCC going offline would be catastrophic, having plans to enable adjacent ARTCCs to formally, for a period in the event of a physical attack, take over responsibility would be a low-cost (though high effort if implemented) approach to enable recovery quickly. Building and testing processes for doing this would greatly benefit the ability to recover quickly.

Resurgence Recommendations:

- None. The NAS as a whole, and ARTCCs specifically, come under the jurisdiction of both the FAA and NTSB and, as a result, have extensive processes in place to learn from actual incidents.

In Summary

The National Airspace System is Resilient

- It is built to withstand and recover from disruptions, and has a long history of doing so.
- It can be improved by taking a systematic approach and now is the ideal time with the release of NextGen.