

Frequentis' Integration Challenge: ARINC 424 and AIXM

When Austrian systems engineering firm **Frequentis** found itself facing an impossible problem translating air navigation data across formats, they turned to **Spatial DNA** to build their own Rosetta Stone.

BACKGROUND

Spatial DNA tackles complex technical problems with location data and systems. In a project with Frequentis, the company solved a decades-old bottleneck in the airline industry.

As commercial flight grew in popularity and aviation systems became more complex, airport authorities faced increasing pressure to standardize the storage and exchange of navigational data. To address this, a global standard was established in the 1970s: **ARINC 424**. Its importance rose with Honeywell's introduction of the Flight Management System (FMS), which became standard equipment on B757 and B767 aircraft in 1982.

ARINC 424 is a text-based format that encodes a vast amount of data about the world's airports, flight routes, waypoints, runways, heliports, and navigational aids—all in a rigid, 132-character structure.

Yet not all stakeholders—whether national or private—use ARINC 424 consistently across their systems. Given the format's complexity, individual implementations often differ in units, codes, fields, and languages. These differences become a problem when attempting to transfer data between systems.

THE PROBLEM

Compiling and managing navigational data is difficult on its own. But translating that data—frequently updated, multidimensional, and drawn from disparate sources—into and out of incompatible systems while ensuring accuracy and consistency

was impossible.

That changed in 2019 when Frequentis turned to Spatial DNA.

While Spatial DNA now serves a wide range of sectors, its roots are in navigation.

“Aviation and navigational data are one of Spatial DNA’s core capabilities.”

– Todd Lewis, CEO of SpatialDNA

CEO **Todd Lewis** began his career in **Geomatics**, and the company’s first five years were spent working closely with **NAV CANADA**.

Frequentis had two clients—**Air Navigation Service Providers (ANSPs)** in Central Europe and the Middle East—who needed to convert data between **ARINC 424**, **AIXM 5.1**, and **AIXM 4.5**.

According to **Francesco Saraceni**, Technical Solutions Manager at Frequentis, the challenge was not limited to the format itself:

“Every country was really trying to keep their own national settings or their own national practice,”

— *Francesco Saraceni, Technical Solutions Manager, Frequentis*

These inconsistencies made each integration complex and unpredictable:

“A lot of time and a lot of money was invested on the development of every project because nobody was able to estimate the time needed.”

Saraceni had long envisioned a

centralized, project-independent solution. But progress only came when **Kerstin Honeder**, a Data Analyst and Domain Expert, introduced Frequentis to Spatial DNA.

From the outset, Spatial DNA’s engineers knew the project would be transformative:

“Even though these standards talk about the same things—airports, interfaces—they’re so different that bringing them together is a real challenge.”

— *Neil Hellas, Director, Solutions Delivery, Spatial DNA*

Lewis elaborated on the core technical challenge:

“There is an approach to how current geographic data is captured in ARINC 424 called a path terminator approach. You can think of it like orienteering with a compass. You go to this point, then take this heading over to the next point. You are not actually given precise coordinates. But when you’re trying to convert that into a system that does need to know the geographic



coordinates for each data point, there's a lot of interpretation of what those things are, what they mean, and how to define them when you're going into a system that needs actual latitude and longitude coordinates."

THE SPATIAL DNA SOLUTION

The solution requires data experts—not just developers or aviation specialists. Spatial DNA's team needed to understand two fundamentally different data models and map one to the other. It was a massive task that demanded a deep understanding of data structure, translation logic, and validation.

"We had to determine the formats and rules for each system, recreate the environments, and identify how each data element in one system maps to the other. Only then could we develop translation rules."

— Todd Lewis

"The design phase took several months," added Hellas, "and building and testing the conversion services took several more."

THE RESULT

Ultimately, Spatial DNA delivered a simple, powerful solution using Safe Software's **FME Platform**.

"It was set up basically as a service," explained Hellas. "Someone could just upload a file, and then a couple of minutes later they get the resulting file."

The impact was immediate.

"It was a great experience to work on this brilliant idea that had initially been dismissed," said Saraceni, "and the engineered solution was exactly what we were looking for."

"Spatial DNA's expertise in data structures was really, really important and was actually one of the reasons we decided to work together."

— Kerstin Honeder, Data Analyst, Frequentis

WHY IT MATTERS

In aviation, time matters—and data updates are frequent. As Hellas explains:

"The global standard for aviation data is that it changes every four weeks.



There are new airspace routes, sometimes airports close or open..."

Without automation, organizations risk using outdated or incomplete data: that it changes every four weeks. There are new airspace routes, sometimes airports close or open..."

Without automation, organizations risk using outdated or incomplete data:

"In an ideal world, every Aviation Authority gets all their data updated every four weeks. But if they do not have a way to quickly change the data from one format to another, they may end up using old data."

Thanks to Spatial DNA's solution, data that once took days or weeks to reformat is now **converted and validated in minutes**. The team has since extended its ARINC 424 connector into a full **Data-as-a-Service** platform: the **Aviation Data Engine (ADE)**. ADE can ingest and output ARINC 424 into any **AIXM** or **GIS-based format**, using FTP, email, or web service APIs.