Cruising Through the Skies with Confidence

How Real-time Big Data Exploitation Leads to Optimized Operations for the Aviation Industry

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Commercial airspace is busier every year. In 2017 alone, 36.8 million flights were operated worldwide. Air travel is projected to double or even triple by 2025. Congestion in the air traffic network is a growing problem, with increasing relevance for airlines' costs as well as airspace safety. At the same time, competition between airlines is becoming fiercer, and they are working harder than ever to save money while still ensuring the safety of their passengers.

Today's challenges not only affect airlines, but also national air navigation service providers and regulators such as the European Organization for the Safety of Air Navigation (EUROCONTROL) and the Federal Aviation Administration (FAA). Not only are more and more airplanes populating the airspace – the same applies for unmanned aviation vehicles (UAVs), including drones. In the United States alone, the FAA projects the small-model hobbyist UAV fleet to more than double by 2022. The commercial, small, non-model UAV fleet is set to grow even more.

Optimized operations can provide answers to many of the top concerns in the aviation industry, including weather hazards, noise and air pollution, air traffic congestion, and airport safety. In order for decision makers to have the necessary insight to conduct this optimization, they need tools that can fulfill a number of prerequisites, such as: connecting to multiple types of data, visualizing data in different dimensions, and having the algorithms in place to execute necessary calculations.

Big Data is in the Air

A big data revolution is taking place in the aviation industry.

According to Forbes, annual data generation in aviation should reach 98 million terabytes by 2026. The newest generation aircraft by then will be generating between five and eight terabytes of data per flight, up to 80 times what older planes generate today.

Real-time sensor information generated by aircrafts, such as speed and fuel consumption, are not the only industry-critical data types. Weather data, traffic surveillance information, safety reports, flight plans, noise and pollution measurements, and satellite photos are all examples of the myriad of data categories necessary to monitor for ensuring the most efficient operations.

However, solely collecting and storing more data will not simplify the operations of aviation industry professionals because data is only useful when it is used to generate insight. Instead, that data must be collected, visualized, *and* analyzed in order for its full potential to be realized.

Connecting to Hundreds of Data Types

The first step to successfully utilizing data is connecting to it. In order to build an accurate solution, connecting to data in its native format is key. Software that requires preprocessing or converting data into a predefined format can cause users to lose valuable information and jeopardize precision. Preprocessing data also increases the volume of it, in addition to being a time-consuming action, which is especially unfavorable in a fast-paced industry such as aviation. Furthermore, if the preprocessing time exceeds the time until new data arrives, any results derived from the data are immediately outdated.

Luciad Portfolio technology from Hexagon's Geospatial division enables users to load many types of data into desktop, mobile, and browser solutions, derived from multiple sources such as databases, web services, cloud services, and even real-time sensors. Founded in 1999 by engineers from the European Aeronautic Defense and Space Company (now Airbus) and NATO, Luciad (now part of Hexagon's Geospatial division) specifically developed technology to handle and display real-time air tracks.

The portfolio also supports hundreds of formats relevant to the aviation industry, including:

- ASTERIX standard for the exchange of ATM surveillance

- ASDI format for near-real-time air traffic data provided by the FAA

- Digital NOTAMs (Notice to Airmen)

- Complex airspaces delivered as AIXM 5.1 or ARINC data

- Weather and environmental data like OGC NetCDF, GRIB, and WXXM

Luciad Portfolio technology is also well-suited for use in building SWIM-enabled applications.

Visualizing A Smart Digital Reality in Real Time

Once all the data is accessible, the next step is to visualize different data sources together in order to obtain a common operational picture. When working with dynamic data, it is important for users to have multiple views of the data. In Luciad Portfolio solutions, a traditional 2D view with live data can instantly be switched to a 3D view. Vertical views are also available, which are a convenient way to visualize the height of a flight related to possible obstacles. The views provided by these solutions remain responsive, even with massive amounts of data loading and updating dynamically.

Even virtual and augmented reality are available in the Luciad Portfolio software, which can be used, for instance, to visualize airport data in cases of poor visibility to retain safety in all situations.

Additionally, an important aspect of visualization is styling. Styling includes labeling the data and ranges from simple icons to 3D models or status-dependent styling, where objects are represented differently according to speed. It is crucial that the correct styling is applied and that it follows guidelines such as those set by the International Civil Aviation Organization (ICAO), especially in an industry where real-time information is a necessity. For that reason, Luciad Portfolio technology automatically positions styling labels so there is no overlap, even in real time.

Analyzing Information on the Fly for Smart Decision Making

When visualizing big data in the aviation industry, it is vital that the user is able to interactively explore the data. Visual analytics can be defined as representing data in such a way that relevant information becomes visually clear to the human observer. It includes tools such as time sliders that allow the user to replay and search through data fluently. Visual analytics in aviation can, for instance, show the impact of an airspace reservation on the surrounding traffic as intersections with flight plans that are calculated on the fly while the user is defining the spatial and temporal dimensions of the airspace directly on the map.

Additionally, Luciad Portfolio technology offers calculations to visualize high density (congestion) or to calculate shortest routes and movement time so assets can navigate optimally. For example, the pilot of a taxiing airplane who knows the gate will not be available until five minutes later can slow down to save fuel or let another plane pass to optimize the flow of traffic. Aircraft refueling trucks and buses can also arrive together with the airplane so they can start working immediately.

Moreover, users can analyze the placement of sensors to have the best coverage and overview by using line-of-sight calculations available in Luciad Portfolio software. The software's algorithm can spot blind areas from the control tower, providing invaluable insight prior to an airport deciding to build new infrastructure.

Lastly, the benefits of analytics extend to the interior of an airport as well. Heatmaps, for instance, can provide additional insight to airport staff, allowing them to detect bottlenecks, or points of congestion inside the airport, which can lead to long lines in areas such as check-in or boarding. Knowing where these areas occur provides necessary information for conveniently rerouting foot traffic to best provide quick and efficient customer service.

Real-World Applications of Luciad Portfolio Solutions

Many Hexagon customers have successfully applied Luciad Portfolio capabilities to their aviation operations to increase optimization in many areas.

Lufthansa Systems is applying all of the above principles of data connectivity, visualization, and analytics to their operations. With Luciad Portfolio software, dispatchers can react to storm predictions to alert pilots who would otherwise be taken by surprise. Supported by the dispatcher and hours ahead of landing, pilots can make minor adjustments to correct their course. They arrive with minimum delay at the destination airport as soon as possible after the storm.

Lufthansa Systems uses Luciad technology to map aircraft positions and georeferenced data to support decisions during flight time

EUROCONTROL used Luciad Portfolio products to develop a Surveillance Analysis Support System for Air Traffic Control Centers (SASS-C) for users to visualize and graphically analyze massive amounts of surveillance data (20-30 million records). The system enables the theoretical calculation of surveillance infrastructure performance, probability of message reception, calculation of environmental interference, and position measurement accuracy, which aids in determining placement of new systems.

EUROCONTROL SASS-C surveillance analysis

Unifly developed an innovative drone management platform with Luciad Portfolio technology that allows drone users to safely plan and fly UAVs in today's commercial airspace. The real-time position of a drone operation is shared into the aviation system. This makes it possible for air traffic controllers and pilots to intervene if a dangerous situation arises, such as a possible collision.
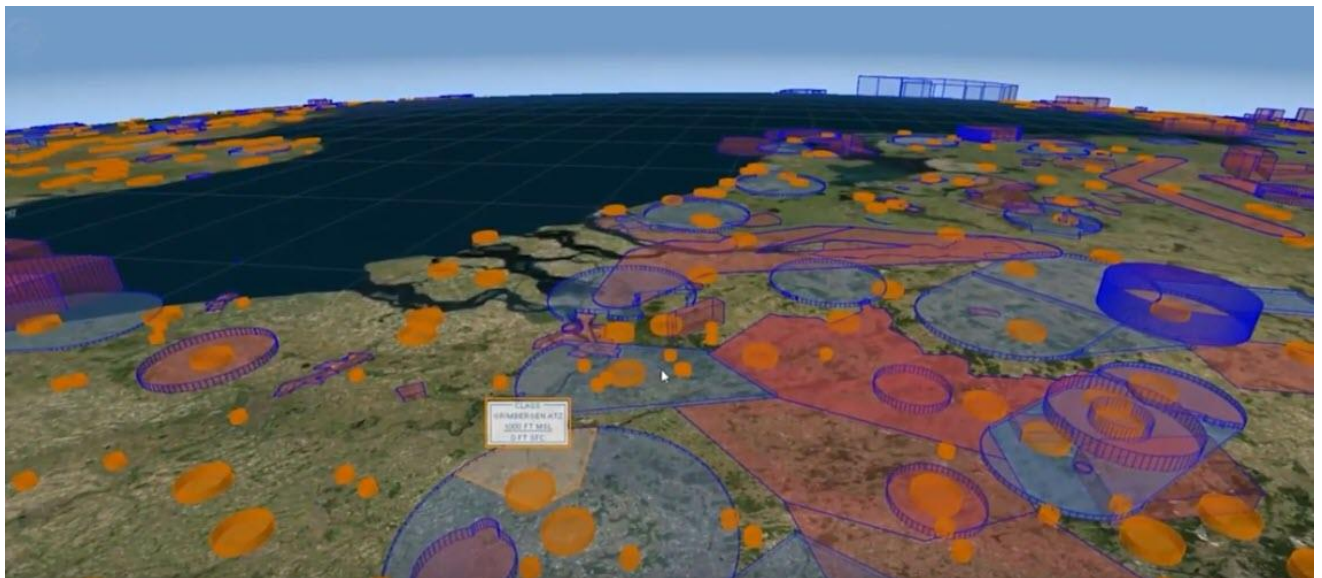
Unifly platform facilitates integration of drones into the manned aviation system

RETINA, an award-winning Research and Development project collaborated on by (then) Luciad, EUROCONTROL, University of Bologna, ENAV, and the ATM Research, Development, and Innovation Reference Center (CRIDA), used Luciad Portfolio technology to support augmented reality in control towers. The project supports the realization of advanced control towers that are no longer limited by the human eye, providing a head-up view of the airport regardless of visibility conditions and reducing head-down time.
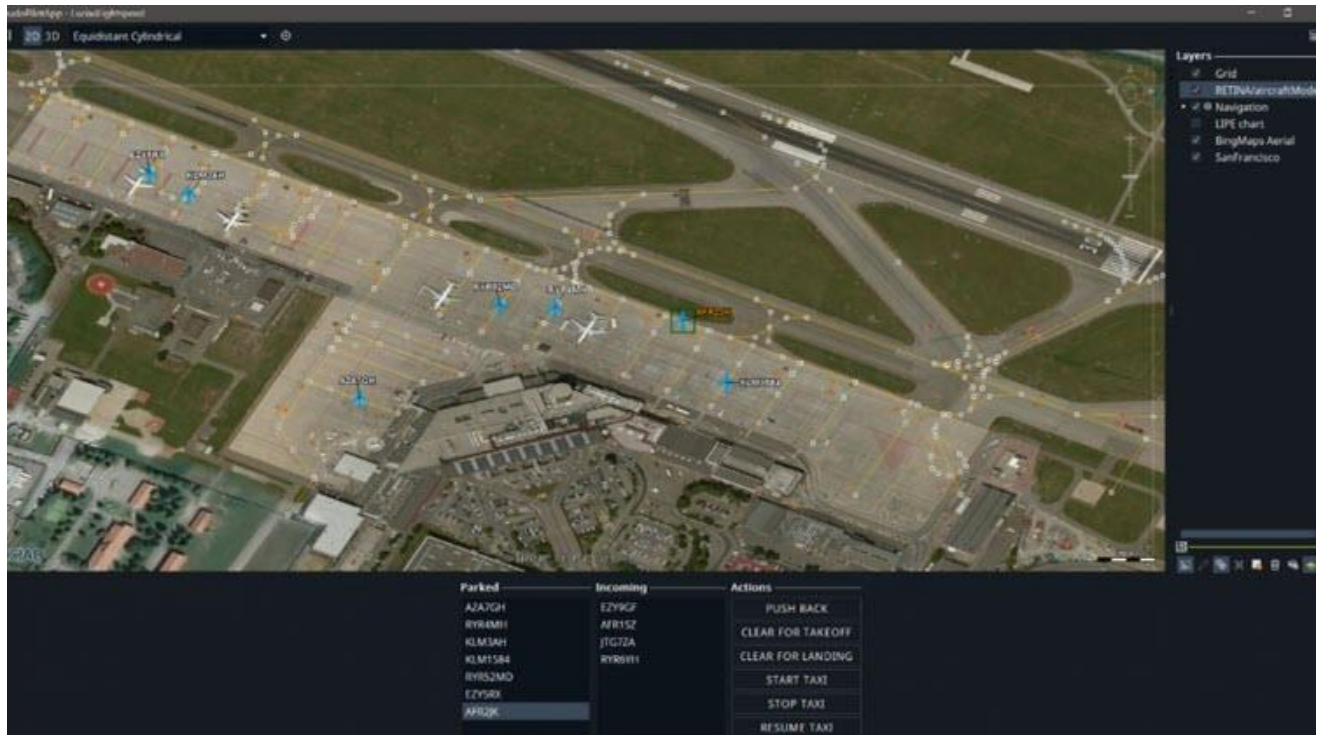
RETINA air traffic control tower simulation

Contact Us

To learn more about Hexagon's solutions and how they aid aviation organizations worldwide in optimizing their daily operations, contact us at https://go.hexagongeospatial.com/contact-us-today.

About Hexagon

Hexagon is a global leader in digital solutions that create Autonomous Connected Ecosystems (ACE). Our industry-specific solutions create Smart Digital Realities™ that improve productivity and quality across manufacturing, infrastructure, safety and mobility applications.

Hexagon's Geospatial division creates solutions that visualize location intelligence. From the desktop to the browser to the edge, we create ACE that bridge the divide between the geospatial and the operational worlds.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 20,000 employees in 50 countries and net sales of approximately 4.3bn EUR. Learn more at **hexagon.com** and follow us @HexagonAB.

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