# Connected Aviation

A digitalization and automation journey
powered by private cellular connectivity

# In this report

Aviation is a big, diverse industry, with players ranging from airports and airlines to ground handlers; maintenance, repair and overhaul providers; governments; and retail. As travel demands grow, aviation must transform to remain stable and profitable in the coming years. Companies are exploring various avenues of digitization to optimize operations, improve customer experience, increase throughput and diversify their portfolios, all enabled by connectivity such as private 5G.

This report provides insights into use cases that can help the industry improve air-side operations and showcases private 5G networks as the futureproof solution to enable various applications across airlines and airport operators around the world.
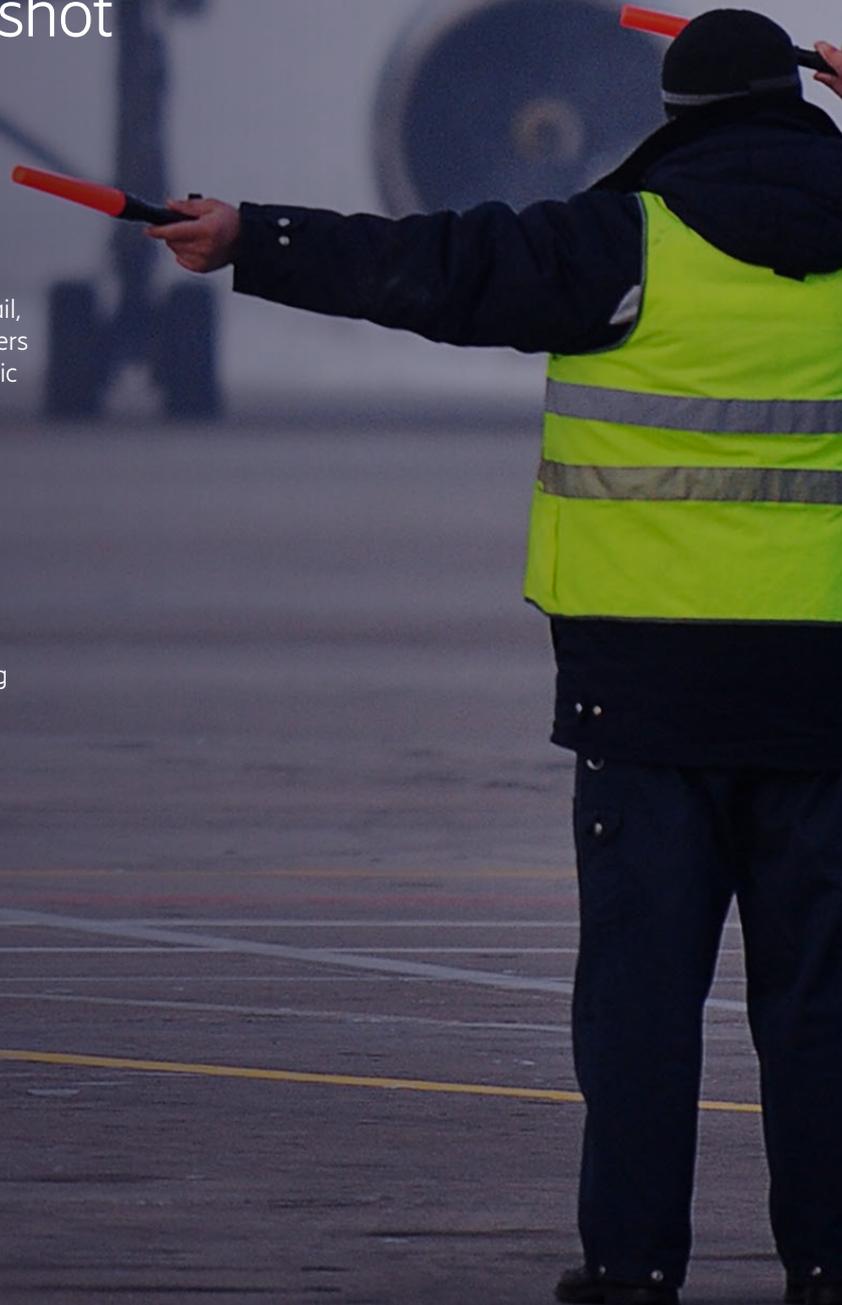
# Know your destination
## — Aviation industry snapshot

Aviation is a key industry on which much of the global economy depends. It enables connections between people, cultures and businesses across continents, allowing local communities and businesses to access global markets. All the many stakeholders who make up this industry — such as airports, airlines, ground handlers, governmental bodies, retail, aircraft and MRO (maintenance, repair and overhaul) providers — together contribute $2.7 trillion to the global gross domestic product. The industry is an essential component of the U.N. 2030 Agenda for Sustainable Development.

As the world enters a new era of digital technologies and wireless communications, aviation is embracing connected aircraft solutions and aviation intelligence. Aviation players across the aviation ecosystem have been at the forefront of technological innovation, researching and developing disruptive, ground-breaking technologies. And far from working alone or in silos, ecosystem players are collaborating to overcome the barriers to growth.

"Successful collaboration and cooperation between ANSPs, airspace users, airports, regulators, manufacturing industry, and regional and global organizations are paramount for the sound development of air transport."

**— IATA**

## Know your destination

The sectors growth requires stability and profitability. The COVID-19 pandemic had an enormous impact on the industry. From 2019 to 2021, passenger volume dropped 50%, airline revenue dropped 45% and airport revenues dropped by 54.6%. However, there are strong signs of recovery. In 2021, the number of passengers that flew on US airlines grew 83% from 2020, and while that's still below pre-pandemic levels, it nevertheless shows strong growth, especially considering that the COVID-19 vaccine wasn't widely available initially. And from January 1, 2022 to March 12, 2022, the cumulative number of passengers was 93% higher than it was over the same period in 2021.

Structural problems continue to pose significant challenges leading to several growth barriers. Turnaround time delays cost up to $33 billion or 10% of U.S. aviation industry revenue. Operational inefficiency is causing airports' total cost per passenger to rise, while return on invested capital and airline net profit margins are declining. Additionally, the demand for maintenance, repair, and operation (MRO) technicians is increasing, with an expected need for 630,000 additional labour-intensive personnel by 2030. Finally, the industry carbon emissions footprint continues to grow 2% annually.

| Key growth barriers | |
|---|---|
| **Turnaround delay** | Turnaround delay affects on-time-departure-time performance (OTP). For example, it could cost **$33 billion around 10%** of US aviation industry revenue. |
| **Financial sustainability** | Operational inefficiency drives an increase in operational cost. Airport **total cost per passenger (USD14.1) is increasing** while industry return on invested capital (6.6%) and Airlines Net profit margin (3.1%) **is declining year-on-year.** |
| **High-cost MRO** | Demand for maintenance, repair and overhaul (MRO) labor is increasing. The projected additional required demand is **630K MRO technicians by 2030**, due to increase in the global fleet by 40 percent results in more MRO cost. |
| **Customer experience** | Passengers want more control, and less waiting time. It is estimated that **1% increase in customer satisfaction** led to **1.5% increase of non-aeronautical revenue**, as compared to 0.7% due to 1% increases in passenger traffic. |
| **Safety and security** | COVID-19 imposes the need to control safety measures not only for passengers but also for employees along with **managing and maintaining security protocols, screening and operations.** |
| **Environment protection** | CO2 emission increases by **2% per year.** Industry aims to reduce carbon footprints from utilities (Airport) and fuel burn (Airlines). |

**Figure 1:** Aviation Industry Challenges
Source: Ericsson consulting

## Know your destination

The industry is transforming to align with the needs of the era and become future-ready to meet the growing demand after the recovery phase. Aviation players across the eco system have been at the forefront of technological innovation, researching and developing disruptive, ground-breaking tec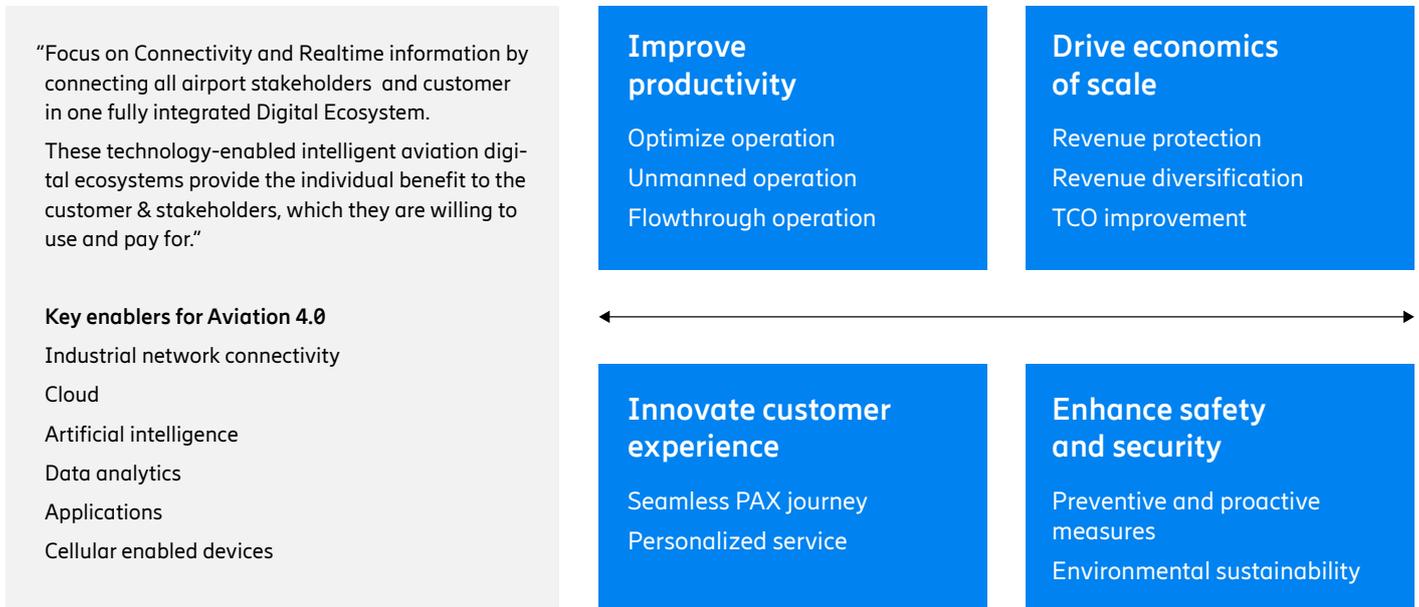hnology. There are many motivations for this drive-in technological advancement. Not only do more efficient operations, enhancing experience, drives economics. They also have positive environmental impact through reduced fuel use and associated emissions which lower fuel costs in the long term, leading to more affordable air travel.

| Ecosystem players are uniting with partners to deploy use cases to address key growth barriers | | | |
|---|---|---|---|
| Ecosystem players | Partners | Use cases | Key growth barriers |
| AIRFRANCE / GROUPE ADP | Ericsson Hub One | Push to talk – voice, video, data; Luggage tracking; Aircraft telematics data offload | Turnaround delay; High-cost MRO; Financial sustainability; Customer experience |
| AVIAPARTNER  Rotterdam The Hague Airport | VANDERLANDE | Autonomous baggage dolly | Financial sustainability; Environment protection |
| BRITISH AIRWAYS  Heathrow Making every journey better | AURRIGO | AGV-baggage handling | Turnaround delay; Financial sustainability; Environment protection |
| YOUR LONDON AIRPORT Gatwick | Pointr | AR wayfinding | Customer experience |
| GTAA  Toronto Pearson | IBM | Potable water system management; Elevator and escalator management; Baggage system management | Financial sustainability; Customer experience |
| FINNAIR  LOS ANGELES AIRPORT | vision-box | Facial biometric for boarding | Financial sustainability; Safety & Security |
| JFKIAT  JFK JOHN F. KENNEDY INTERNATIONAL AIRPORT | ASSAIA | Turnaround control | Safety & Security; Turnaround delay |
| sats  CHANGI airport group | VUZIX View the Future  eon reality | AR assisted baggage and cargo loading | Turnaround delay; Safety and Security; Customer experience |

**Figure 2:** Aviation industry market moves
Source: Ericsson consulting

## Aviation 4.0 Vision...

... and its key pillars

"Focus on Connectivity and Realtime information by connecting all airport stakeholders and customer in one fully integrated Digital Ecosystem.

These technology-enabled intelligent aviation digital ecosystems provide the individual benefit to the customer & stakeholders, which they are willing to use and pay for."

**Key enablers for Aviation 4.0**

Industrial network connectivity

Cloud

Artificial intelligence

Data analytics

Applications

Cellular enabled devices

### Improve productivity

Optimize operation

Unmanned operation

Flowthrough operation

### Drive economics of scale

Revenue protection

Revenue diversification

TCO improvement

### Innovate customer experience

Seamless PAX journey

Personalized service

### Enhance safety and security

Preventive and proactive measures

Environmental sustainability

"With passenger demand forecast to double by 2035 to 7.2 billion air travelers, we are preparing to handle more passengers, aircraft and airfreight," said Mr. Alex Hungate, who was then President and Chief Executive Officer, SATS, the chief ground-handling and in-flight catering service provider for Singapore's Changi Airport, in a 2017 statement. "SATS is embracing technology to handle these volume increases in an innovative, sustainable way. By introducing augmented reality to our ground handling operations, we are improving services for airlines, passengers and airfreight shippers."

There are many motivations for this drive for technological advancement, not the least of which is it enables more efficient operations and a better passenger experience. Across the globe a strong uptake in demand for cellular industrial networks, like private 4G and 5G networks, is observed to unlock the potential of digitalization of airside operations. Technological advancement drives better overall economics for the industry, reduces fuel use and associated carbon emissions, and makes air travel more affordable for consumers. For example, airlines can significantly reduce fuel costs — a large portion of their overall costs — through the use of an Industrial IoT platform with rerouting capability and preventive maintenance alarms.

While aviation players are undergoing various digital transformations, they are frequently done in piecemeal fashion. To maximize value from this transformation journey, they need to align the aviation 4.0 vision with the use of real-time data from connected devices and the four key pillars for digital transformation:

- Improving productivity
- Driving economies of scale
- Innovating to improve the passenger experience
- Enhancing safety and security

## Know your destination

The aviation sector is a large, interdependent ecosystem, with many different players, all of whom depend on others as part of an interconnected process. The key performance indicators (KPI) of one player are linked to the KPIs of others.

For instance, the art of airport operations comes together during the turnaround of the aircraft at the airside operations side of the journey. The ground handler reports on cargo and baggage handling time. If they are unable to load a plane in time, the effect is that the airline cannot meet its OPT KPI. Overall the airport could suffer from decreased average turnaround time. Having insights and control over the complete chain of collaborating parties through digitalization is key in terms of maximizing capacity and efficiency.

> "The best use of an aircraft is when it is flying passengers or freight, hence airlines - in collaboration with airports - are trying to minimize the time spent on the ground."
>
> — Henri Tallon,
> Business Unit Manager Telecom, HubOne

| Aviation ecosystem players | Activities |
|---|---|
| **Airport authorities** Government, Premise owner and operator, Police | • Operation orchestration and oversight of an airport or group of airports<br>• Arrange funds for investment<br>• Construct, modify and manage airport infrastructure<br>• Security and Immigration |
| **Operational partners** Ground Handler, Aircraft MRO, Aircraft Services Facility and Parking Management, Traffic control | • Ownership of Cabin, PAX, Catering, & Ramp services and field operations<br>• Repair, service, or inspection of an aircraft or aircraft component<br>• Prevent collisions, organize and expedite the flow of air traffic |
| **Tenants** Airlines, Aircargo, Retail outlets, Taxi | • Provides air transport services for PAX and freight<br>• Duty free stores, shop and dine facility<br>• Taxi services to PAX |



**Figure 3:** Aviation Eco-system
Source: Ericsson consulting

The turnaround process on the airside takes the center stage, as any improvement will have a ripple effect on key KPIs across the ecosystem. It's clear that on occasion neither the airport, nor the airlines, have sufficient means to measure turn-around activities. The longer an aircraft spends on the ground, the fewer routes it can fly. Quick turnarounds are equally crucial for the airport and for airline partners, which is why it is important to invest in new technology that supports improvements of both the safety as well as efficiency of operations.
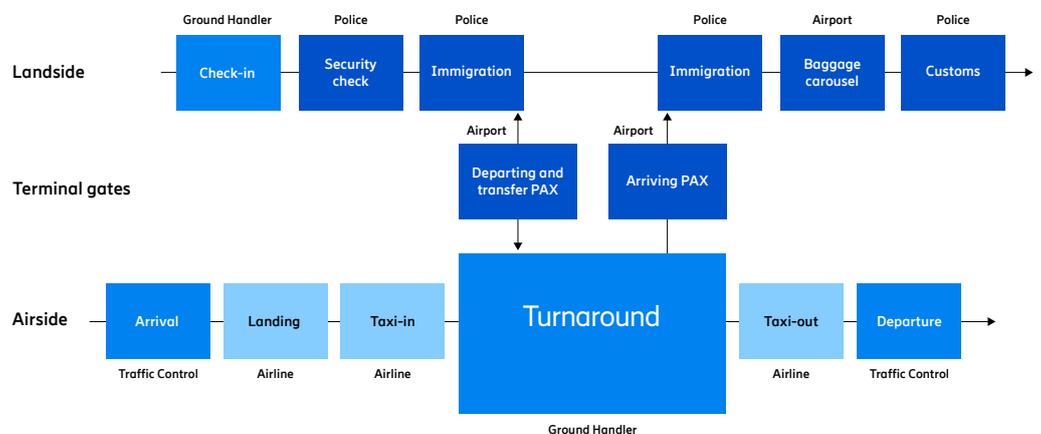


**Figure 4:** E2E Passenger Flow and responsible eco-system players
Source: Ericsson consulting
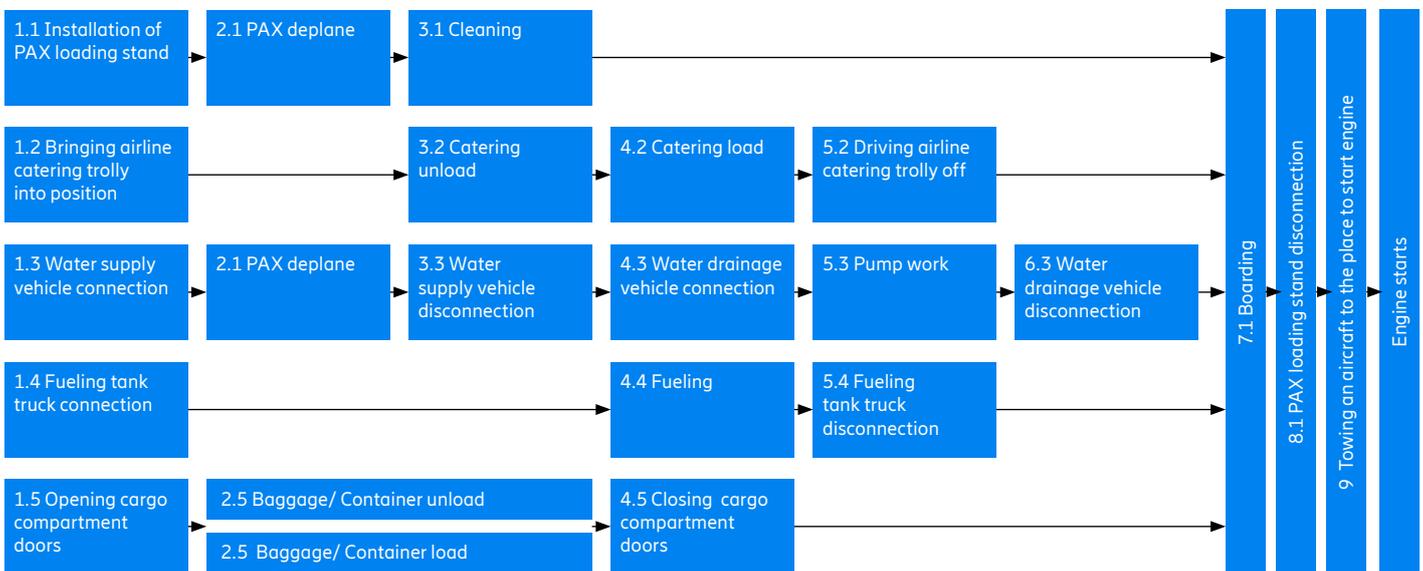
# Airside turnaround process

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.1 Installation of PAX loading stand | 2.1 PAX deplane | 3.1 Cleaning | | | | | 7.1 Boarding | 8.1 PAX loading stand disconnection | 9 Towing an aircraft to the place to start engine · Engine starts |
| 1.2 Bringing airline catering trolly into position | | 3.2 Catering unload | 4.2 Catering load | 5.2 Driving airline catering trolly off | | | | | |
| 1.3 Water supply vehicle connection | 2.1 PAX deplane | 3.3 Water supply vehicle disconnection | 4.3 Water drainage vehicle connection | 5.3 Pump work | 6.3 Water drainage vehicle disconnection | | | | |
| 1.4 Fueling tank truck connection | | | 4.4 Fueling | 5.4 Fueling tank truck disconnection | | | | | |
| 1.5 Opening cargo compartment doors | 2.5 Baggage/ Container unload / 2.5 Baggage/ Container load | | 4.5 Closing cargo compartment doors | | | | | | |

**Figure 7:** Airside turnaround process
Source: : [Ericsson Consulting](#)

# Plan your itinerary
## — Key Connected Aviation applications

There are a plethora of use-cases, to unlock the full potential of Aviation 4.0 and to strengthen the digitization journey of Aviation players across landside, terminal, airside. The failure of critical operations can have a large business impact on these players. Thus, private networks with high reliability and low latency are needed to ensure every aspect of the aviation ecosystem runs smoothly.

This chapter specifically focuses on how aviation 4.0 use cases can improve turnaround operations in this vast ecosystem.

"[With Terminal 5] the scale of our operations will double." said Lee Seow Hiang, CEO at CAG. "Customer expectations will get more intense and technology will continue to transform our operations and the way we work."

**— Lee Seow Hiang,
CEO at CAG**

## Plan your itinerary

Turnaround time is critical for Airside operations. Ericsson envisions use-cases to improve it and could be strategically implemented over the period. Use cases are analyzed on two matrices: ease of implementation and business potential. Four use cases were identified with the highest scores on these two dimensions, which could be implemented in one year. We will look at each in detail, but briefly, they are:

- Connected Assets
- Integrated real-time communication
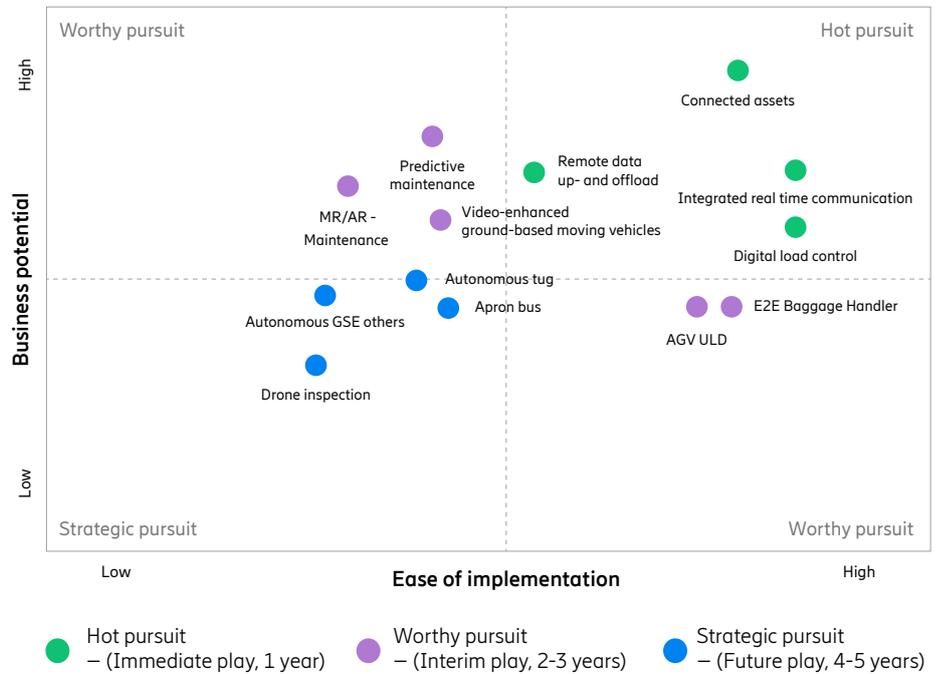- Digital load control
- Remote data up- and offload



**Figure 5:** Aviation 4.0 Use-cases prioritization matrix. Source: Ericsson Consulting

| | Current situation | Use case | Impact |
|---|---|---|---|
| **Connected assets** | Difficult to establish controls over coordination of airport services due to reliance on manual routines and checks. | Tracking and monitoring of personnel and moveable assets. | • Higher productivity<br>• Improved safety and security |
| **Integrated real-time communication** | Legacy systems are costly to maintain and can no longer support the increased data and video communication needs of airport staff in various operational processes. | Push-to-X over a cellular network that integrates voice, video and data. | • Economies of scale<br>• Higher productivity<br>• Stronger safety and security |
| **Digital load control** | Unloading and loading baggage to and from planes is a labor-intensive process that directly affects the on time performance (OTP) of flights. | AR-assisted tally and loading of baggage and cargo onto aircraft. | • Economies of scale Higher productivity<br>• Stronger safety and security |
| **Remote data up- and offload** | Reliance on flight data recorders to transmit safety monitoring data for safety and operational analysis is slow and cumbersome. | Flight telematics data transfer directly to airport operations centers and aircraft manufacturers. | • Higher productivity<br>• Stronger safety and security |

**Figure 6:** Hot Pursuit Use-cases, Source: Ericsson Consulting
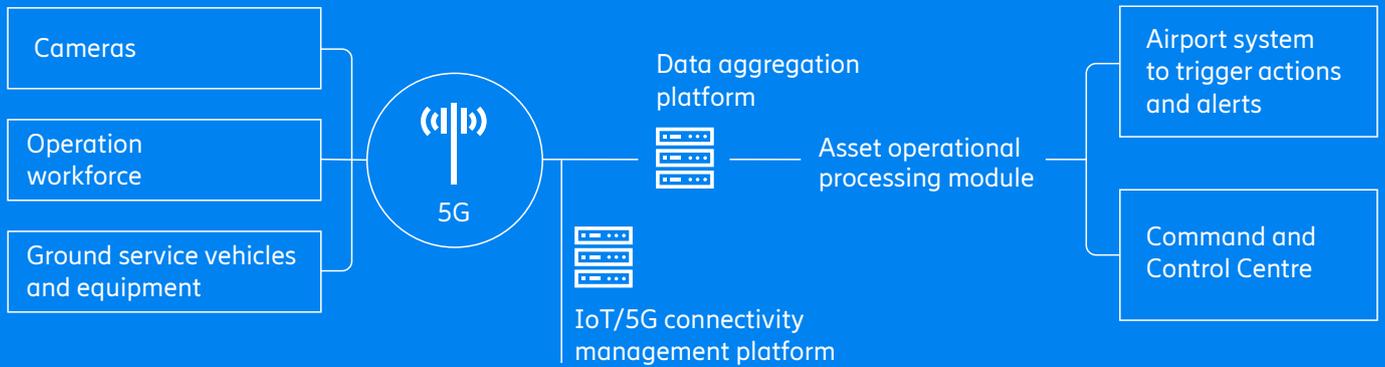
## Connected assets

Connected assets enable real-time scheduling and dynamic assignment to the closest work or asset to solve an issue promptly. Additionally, they increase the utilization of assets and the productivity of personnel by optimizing operations with less running time. Finally, they increase security for airport workers through detection and anticipation of problems with alarm triggering.

To enable relevant applications, aviation ecosystem players need to deploy sensors on physical assets and personnel enabled by reliable connectivity so they can collect and transmit all relevant data. It also requires an optimization module to apply rules and policies.

Private 4G/5G networks provide high bandwidth and capacity which improve the performance, availability and reliability of a large amount of co-existing applications. Fast data download and high-performance data lake storage enable real-time as well as batch processing. Sensors capture usage and location data from airport operations location-based services and then transmit the data wirelessly to gateways. The gathered data is then combined with location details in a dedicated server for timely analysis to provide insights that enable unbiased, data-driven decision making.

**Self Check-in**

| Technical Requirement | |
| --- | --- |
| Service reliability | Medium—high |
| Security | Medium |
| UE battery life | High |
| Latency | Low—medium |
| Mobility | Low—medium |
| Connection density | Low—medium |
| Data rate | Low—medium |
| Position accuracy | High |

**Benefit levers**

- Real time scheduling
- Increase asset utilization
- Increased security and reliability
- Optimize delays

Real-time
data transfer

5G

Connected
workers

PTX/MC
PTX Services

Airport operations
center
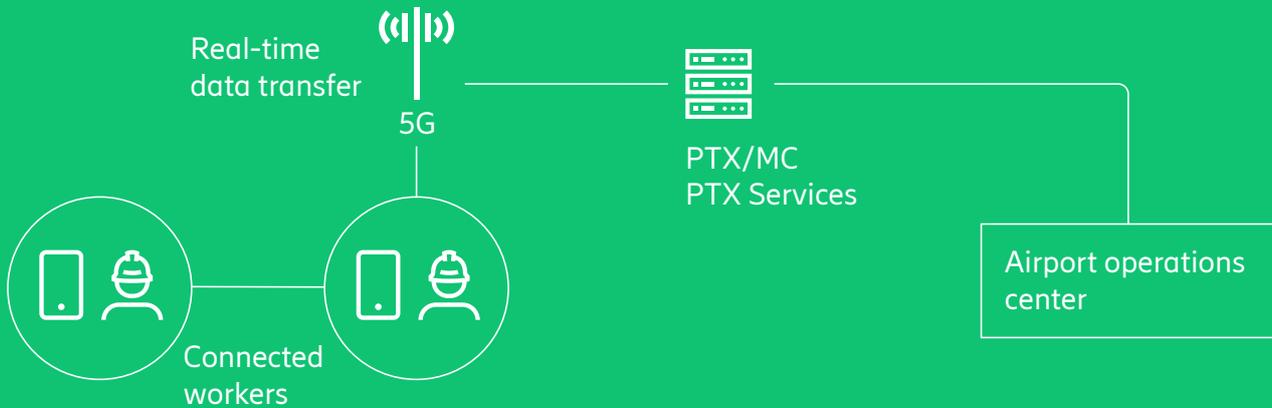
## Integrated real-time communication

During aircraft maintenance, ramp services and turnaround processes, ground handlers, aircraft teams and the operations center needs to exchange information constantly. Even amidst loud aircraft engines. Often, legacy networks are deployed that are TETRA or P25 based that support Push-to-talk functions. Such networks are parallel to cellular and Wi-Fi networks. But the cost for both multiple networks and multiple ruggedized devices is expensive. Also, workers often must carry multiple devices, which can be cumbersome. Additionally, there is typically only support for voice, without the capability for data and video over land or private mobile radio.

Real-time communication based on cellular networks enable the airport

value chain to use voice, as well as video and data, to optimize operations and better manage safety and security. This mission-critical communication will, temporarily, require interworking of coexisting professional mobile radio (PMR) narrowband and broadband LTE/5G networks with hybrid devices or gateways before full migration. The network must also provide guaranteed quality of service (QoS) based on tenant requirements such as ground services, security teams and safety teams.

Ultimately, the aviation industry gains increased operational efficiency, fewer delays and higher coordination, all while cutting the total cost of ownership (TCO) for critical networks in half. Additionally, stakeholders will enjoy stronger network security and reliability with 20% to 40% performance gains for operations.

### Self Check-in

| Technical Requirement | |
|---|---|
| Service reliability | High |
| Security | High |
| UE battery life | Low |
| Latency | Medium–high |
| Mobility | Low–medium |
| Connection density | Low–medium |
| Data rate | Low–medium |
| Position accuracy | Medium–high |

**Benefit levers**

- Increase operational efficiency, reduce delays
- Lower operational costs
- Increased security and reliability

## Digital load control

Currently, (un)loading an airplane after its arrival at the gate and preparing it for departure is a complex and time-intensive process that requires coordination from a wide array of interdependent aviation stakeholders. Digital load control enables scanning of baggage and containers with real-time loading instructions and updates that significantly reduce turnaround time. Enhanced oversight of the loading process enables greater flexibility in labor management across the ecosystem, and a more effective loading process enables airlines to reduce fuel burn and fuel costs.

Cargo loading for instance requires 5G-enabled augmented reality (AR)

glasses that can instantly show the wearer details such as weight, loading sequence and the allocated position of cargo and baggage in the aircraft. Cargo containers and baggage must be equipped with sensors to enable location determination and tracking. Real-time analytics and artificial intelligence (AI) platform are required to analyze data so it can be provided quickly to loading personnel, and the command center must also be able to access real-time visuals and information.

Private 5G networks provide the bandwidth, capacity and low latency required to enable real-time transmission of rich data such as video.
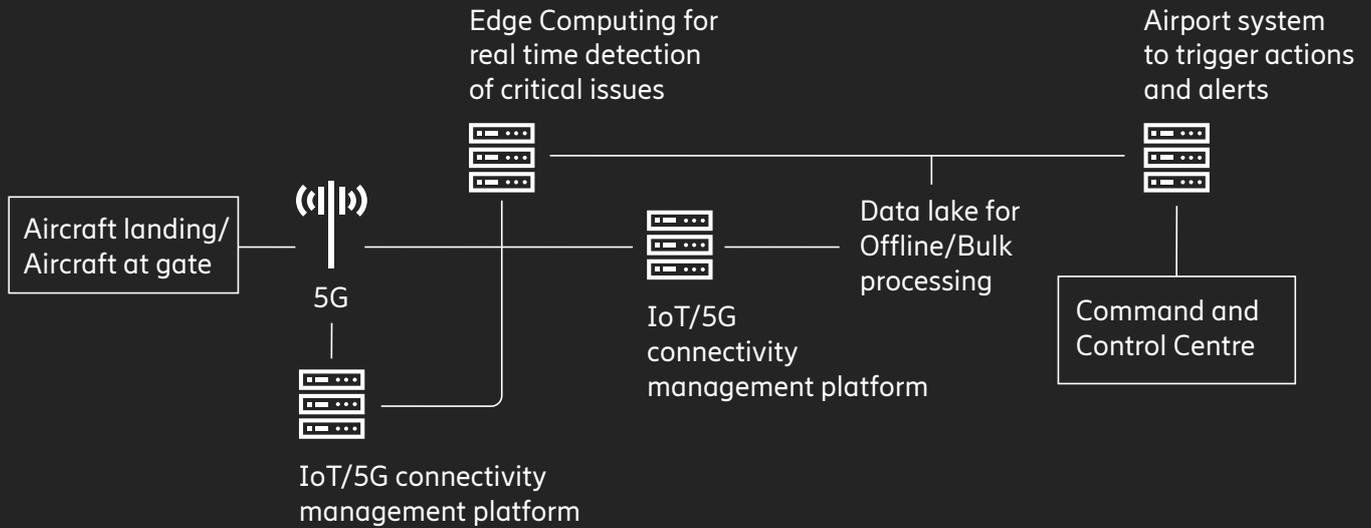
## Self Check-in

### Technical Requirement

| | |
|---|---|
| Service reliability | Medium |
| Security | High |
| UE battery life | Medium |
| Latency | Low–medium |
| Mobility | Low |
| Connection density | Low–medium |
| Data rate | Low–medium |
| Position accuracy | High |

**Benefit levers**
- Reduction in turnaround time
- Operational efficiency
- Fuel efficiency

Edge Computing for
real time detection
of critical issues

Airport system
to trigger actions
and alerts

Aircraft landing/
Aircraft at gate

5G

IoT/5G
connectivity
management platform

Data lake for
Offline/Bulk
processing

Command and
Control Centre

IoT/5G connectivity
management platform

## Remote data up- and offload

Efficient flight data transfer is critical to provide reliable data for aircraft predictive mechanisms and airport operations optimizations, but that's currently very challenging to accomplish. Each flight needs to offload anywhere from 500 GB to 1 TB of data related to sensors, direction, entertainment and more. Transferring such a large amount of data is often slow and can delay turnaround time, especially if there are network or connectivity issues.

A full 5G infrastructure can enable the fast exchange of all data. Mobile edge-computing close to the aircraft can detect critical issues that need immediate attention. Bulk data can be stored in specified data lakes for analysis, and data can also be shared with aircraft manufacturers for predictive maintenance.

To enable this application, aircrafts are equipped with cellular connections to enable efficient data transfer, and connections must be reliable to ensure the quality of service and have low latency to ensure safety.

Private 5G networks provide the bandwidth, capacity and low latency required to enable real-time transmission of rich data.

Once enabled, airlines can extract data quickly and reliably from the airplane to retrain data models. The fast download of data enables optimization of ground operations and faster decision making. Plus, it strengthens safety by enabling the identification of key issues through rapid analysis and fast data transfer that must be immediately addressed.

### Self Check-in

| Technical Requirement | |
|---|---|
| Service reliability | Medium–high |
| Security | High |
| UE battery life | Medium–high |
| Latency | Medium–high |
| Mobility | Low–medium |
| Connection density | Low–medium |
| Data rate | Medium |
| Position accuracy | Medium–high |

**Benefit levers**
- Optimization of operation
- Faster decision making
- Improved turnaround

# Take off for Connected Aviation

## — Technology outlook with 5G connectivity

For all applications to achieve their full combined, they need connectivity that only a 5G wireless network can provide. 5G is designed for mobility with security built in from the start. It provides predictable high-performance under load, with low latency and high reliability.

5G's advantages over legacy mobility technologies are clear. Land mobile radio, for instance, can provide voice, data and video communications, but the data piece provides just 9.6k / second data throughput, which is nowhere near fast enough for the kind of rich data and video these use cases require. Plus, the device ecosystem is not well developed. Finally, these systems are aging and operating costs are high.

Cabled networks can provide extremely high speeds with excellent predictability, but they lack flexibility and are difficult to adjust and scale when operations change and connectivity is required in new locations. Mobility is not supported, causing significant drawbacks for devices and applications used in both indoor and outdoor environments.

Wi-Fi cannot provide the stability of performance these use cases require. Interference issues occur as Wi-Fi operates in an unlicensed spectrum. They also do not perform well in combined indoor-outdoor use cases, because pervasive outdoor coverage is difficult to achieve.

"Leveraging 5G for speed and data density will enable better monitoring and analysis of assets in and around the airport."

— Gilles Bloch-Morhange,
SITA vice president of communication and data exchange

Take off for Connected Aviation

# Scale of connectivity needs at airports

The world's largest airports are essentially small cities, and their private networks serve an area similar to those served by a national operator or a regional MNO (mobile network operator). Paris Charles de Gaulle Airport, for example, spans 32 square miles, which is larger than the island of Elafonisos in Greece. Its networks support hundreds of tenant companies, tens of thousands of employees and millions of passengers who pass through it each year, along with large numbers of vehicles and IoT devices.

The connectivity needs of these airports often result in private wireless networks in different sections of the airfield, from the passenger terminal and maintenance hangers to hotels and car-rental facilities.

Cellular enables high-speed, reliable mobile connectivity that enables convergence with existing technologies that are fundamental for Aviation 4.0 use-cases. It can support the technical requirements for these use cases based on the use-case features and maturity, which can differ substantially. For example, AR-enabled use-cases such as digital load control require less than 10 milliseconds of latency while the connected asset use case can sometimes sustain even high latency, depending upon the specific service provided.
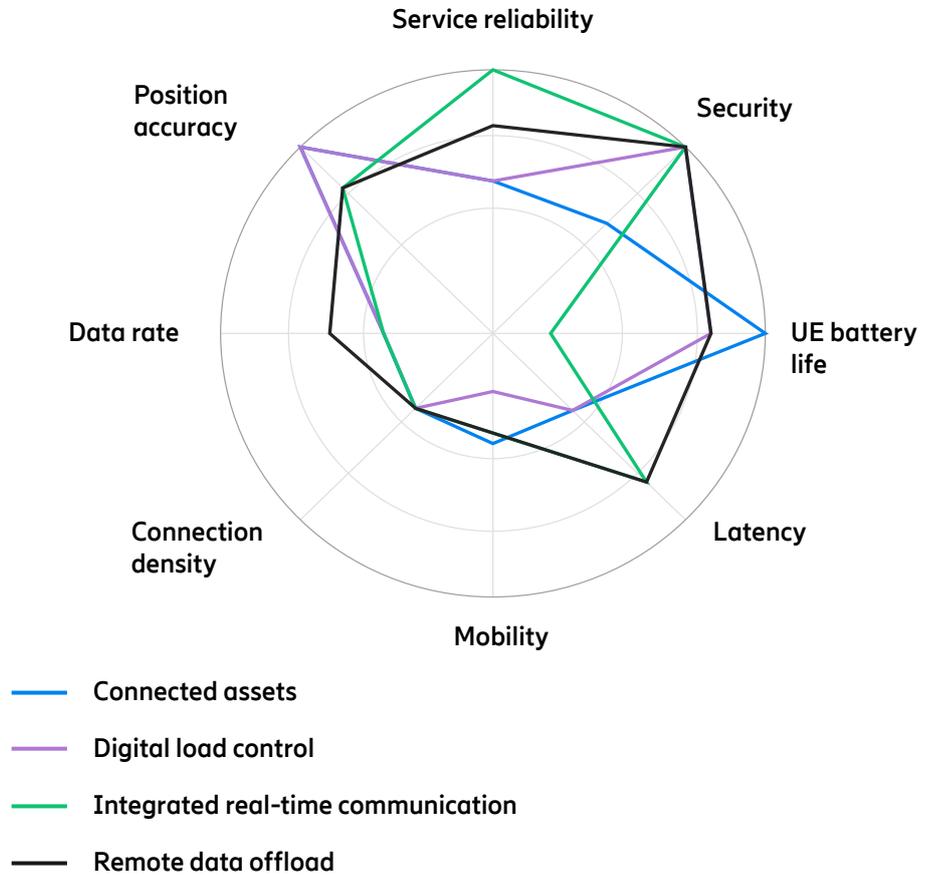


— Connected assets
— Digital load control
— Integrated real-time communication
— Remote data offload

**Figure 8:** Technical requirement for Use-cases, Source: 3GPP

It governs the fact that airports need to update legacy critical communications systems such as terrestrial trunked radios (TETRA) to more-capable LTE or 5G equivalents to enable data, video and other applications. Additionally, airports need networks with a bias toward data uplink rather than downlink, especially when it comes to HD video and other security systems, which may require separate frequencies to the public networks. Additionally, the network needs to accommodate a mix of up- and download traffic, while providing 100% coverage of the airport environment, both indoors and outdoors up to the perimeter fence.

"Already by being able to digitalize the aircraft release process, enabled by our private cellular network, we have seen double digit efficiency increase with clear ROI."

**— Henri Tallon,
Business Unit Manager Telecom,
HubOne**

# Future Proof Mobile Private Network

There are various ways for a cellular network to be deployed in an aviation environment: hybrid, integrated private network or future-proof private network. Use case requirements are very stringent, however, so as aviation stakeholders plan for new use cases, the network model may need to evolve.

An integrated private network for a smaller airport would take advantage of public multi-edge access compute to enable edge capability, while a larger operation could upgrade to an isolated private network. This environment would enable use cases with mid-throughput and lag such as automated guided vehicles and remote operations for end-to-end baggage handling.

Finally, a future-proofed private network would employ advanced slicing and edge capabilities on a private network. This would, in the long run, enable

operations that require high throughput and low lag, such as cloud robotics and 8K streaming for drone inspection of assets.

To enable the digitization journey cost-effectively, an airport operator might start their cellular journey by connecting operational assets via network slicing services over a public network. Experienced airport hubs could opt for a hybrid or fully isolated non-public network intended for operational use. As they continue their journey and plan for use cases with more demanding network requirements, they could strengthen it by combining the greater speeds and lower latencies of 5G networks with specialized hardware that allows for real-time communication of crucial information across ecosystems.

Hybrid networks leverage operator expertise and provide a wide range of spectrum portfolio. They enable high data isolation, security, privacy and further service level agreement (SLA) customization including availability and

reliability. Plus, they are interoperable with a public network for wide area service. On-site edge computing gateways enable very low-latency and fully localized processing and data storage, while edge computing on the mobile network operator edge and a network slice enables low latency and local storage/ processing.

Dedicated Private network also known as Isolated non-public network as per 3GPP, on the other hand, provide dedicated resources which enables high security and privacy, along with access to a broad range of spectrum options from operators. It provides full control over design, timeline, SLAs and operations. Aviation stakeholders can outsource some or all of the design and management of the network to mobile network operators, system integrators or choose to build the competence in house.
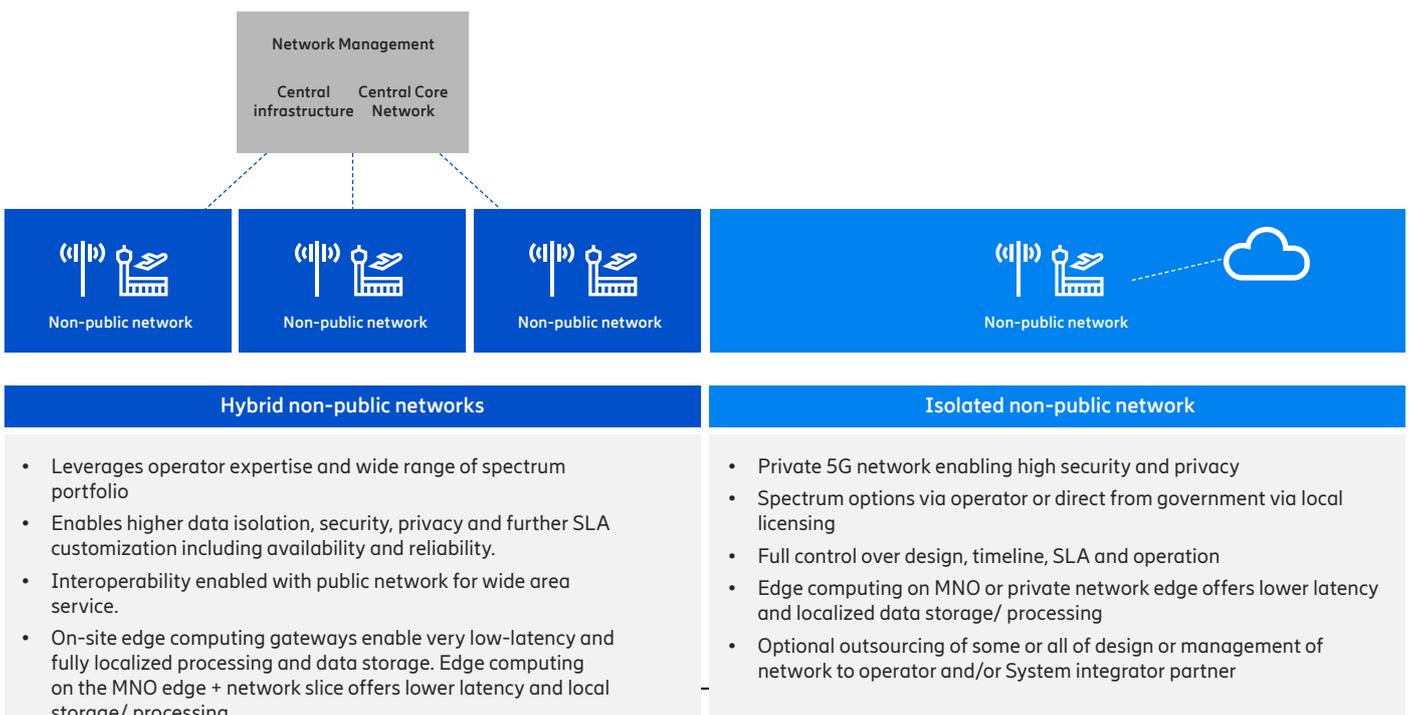


**Figure 9:** Private Network Deployment Option,
Source: Ericsson BTEB

# Security

Security must be robust due to the high level of threats airports face on a regular basis. The European Aviation Safety Agency (EASA) estimates that an average of 1,000 attacks occur per month on aviation systems, including:

- Distributed denial of service (DDoS)

- Malicious software

- Tampering with the operational technology system

- Network attacks

- Authorization breaches

- Social attacks

Any aviation network must provide message integrity, message and source authentication and access control, all of which 5G can address. 5G provides user plane integrity protection; 5G-AKA, EAP-AKA, EAP-TLS mutual authentication; and network slicing closed access groups.

In the long run, due to high security and for better control, airport hubs will likely opt for isolated non-public networks. High-performance, 5G dedicated private networks provide security, flexibility and control for turnaround operations optimization.

# Get ready for landing
## — Ecosystem enablement

The Ericsson Private 5G ecosystem can help aviation stakeholders to modernize connectivity and enable advanced use cases that optimize operations, increase efficiency, reduce costs, improve the passenger experience and harden security. This market-leading open ecosystem specializes in providing 5G and technology leadership.

## Get ready for landing

Ericsson provides connectivity infrastructure and services such as integration, customer support and managed services, as well as value-added features. Ericsson's device and software vendor partners provide chipset integration, pre-integration and testing, along with the provision of applications, solutions and tools. Operators provide applications, devices, support spectrum and value-added features on top of Ericsson's products and services. System integrators provide full integration work for devices, applications and services. Additionally, they can consult for digitalization and connectivity integration as well as an expansion path.

**Market leading ecosystem**

- Leading partners across device and hardware, professional services and independent software vendors.
- Enabling end-to-end enterprise solutions for use cases creating business value.
- Leverage partner and Ericsson insights and experience for successful engagement.

**Open ecosystem**

- Open non-proprietary ecosystem for best-in-class enterprise solutions.
- Modular approach, choosing the right partners and technical solutions for use-cases.
- Worldwide reach through Ericsson and partner presence.

**5G and technology leadership**

- Collaborate with the 5G leader to evolve and scale for futureproof solutions.
- Ericsson and partner technology expertise to design and test industry solutions.
- Open API for ease of integration and ecosystem collaboration.

**Devices and hardware**

- Machinery OEMs and companies are providing chipsets, modules, gateways, sensors and IT infrastructure that enable cellular connectivity.

**Software and applications**

- Application developers, independent software vendors (ISVs) and hyperscale cloud providers developing and selling offerings that reside in any of the IT layers of the enterprise.

**Professional services**

- System integrators, business advisors and test houses with offerings and services for installing and running a network.

**Figure 10:** Ericsson Private 5G ecosystem
Sources: ericsson.com/en/industry4-0/partners
ericsson.com/en/internet-of-things/platform/iot-ecosystem

Using a proven methodology, Ericsson and its ecosystem partners support customers in their aviation 4.0 journey with:

| | |
|---|---|
| **Service strategy** | Develop a service roadmap comprising of prioritized use cases, technical requirements and value quantification for the aviation sector in alignment with enterprise strategy. |
| **Business case identification** | Conduct network dimensioning and create e2e business model — benefits vs. cost. |
| **Go-to-market planning and execution** | Define the go-to-market strategy — value proposition, value chain role, ecosystem and partner strategy — for prioritized use-cases and enable business execution. |
| **Proof of concept enablement** | Design and execute PoCs for enterprise use cases comprising activities such as PoC project management, partner facilitation, outcome definition and evaluation. |

**Figure 10:** Aviation 4.0 Strategy approach
Source: Ericsson Consulting

# Connected Aviation experience

Ericsson and its partners have worked with several aviation stakeholders as key partners to enable their Aviation 4.0 journey.

"The deployment of this professional mobile network will strengthen the performance and accelerate the digitalization of the 120,000 professionals daily at our Parisian airports and pave in the best way the resumption of air traffic."

**— Edward Arkwright, Executive Director General of Groupe ADP and President of Hub One**

## Groupe ADP and Air France

For Groupe ADP, three of their flagship airports are in Paris:

- Airport Charles de Gaulle: The largest of the three and Paris' main airport.

- Paris Orly: Second largest airport, located south of Paris.

- Paris le Bourget: An extension that's exclusively for business or large private jet traffic.

Together they rank among the 10 largest airports in the world. From a purely operational standpoint, HubONE, IT and telecommunications subsidiary of Groupe ADP, operates these three airports as if they were a single entity.

Air France has a large presence at these airports and, in the summer of 2020, the airline and Group ADP chose Ericsson to deploy a private 4G/5G network to connect more than 120,000 people who work at the three Paris airports. Additionally, about 1,000 tenanted companies also do business there on a daily basis.

The new mobile network provides fast, reliable connectivity across all outdoor spaces at the airports, as well as indoors across all public and reserved areas for professionals working at the terminals. As a result, aviation stakeholders at these airports enjoy ubiquitous high-performance connectivity that complies with all the security requirements of France's National Agency for Security of Information Systems. With everyone connected and communicating, the airport and its stakeholders can significantly enhance operations without degrading the customer or employee experience or compromising safety.

"First, there were too many obsolete technologies for radio networks — such as TETRA and DECT for voice — or technologies with limitations in industrial environment — such as Wi-Fi for data - which were in use prior to building the 4G/5G solution with Ericsson. Additionally, the coexistence of all these distinct technologies were prone to operational complexity and in some case interferences which made them increasingly difficult and expensive to maintain, resulting in a diminishing return."

**— Henri Tallon,
Business Unit Manager Telecom,
HubOne**

Source: www.ericsson.com/en/news/2020/7/
ericsson-private-network-to-serve-paris-airports

At Charles de Gaulle over a 24-hour period, 120 thousand full-time employees worked at the airport along with roughly 350,000 passengers daily pre-COVID. The workers included police, army, secret service, ground handling, engineers, airline companies, hospitals and electrical plants to provide the airport with electricity. All of these stakeholders were demanding more from their devices and broader range of applications. They required access to large amounts of bandwidth to digitalize their operations. For example, before takeoff, each aircraft has one person responsible for conducting about 120 checks before the plane can leave the gate. This checklist is handed over to the aircraft captain when done and the captain takes over responsibility. These 120 checks are handed over to around 20 different roles around the aircraft. These checks were previously made with pen and paper, but are now digitalized.

Wireless connectivity is essential for all personnel working in the airport, but it must not interfere with the communications used by aircrafts and control towers, and there was the potential for a lot of interference.

HubOne consolidated obsolete networks into a modern private cellular network that it operates. With a unified private cellular network, all personnel use a PDA (personal digital assistant) to validate and conduct checks. The process is fully digitalized and handover to the aircraft captain is automated. Due to lower error rates, better monitoring and better fluidity of the aircraft, Charles de Gaulle is already seeing operational efficiency returns from this example application.
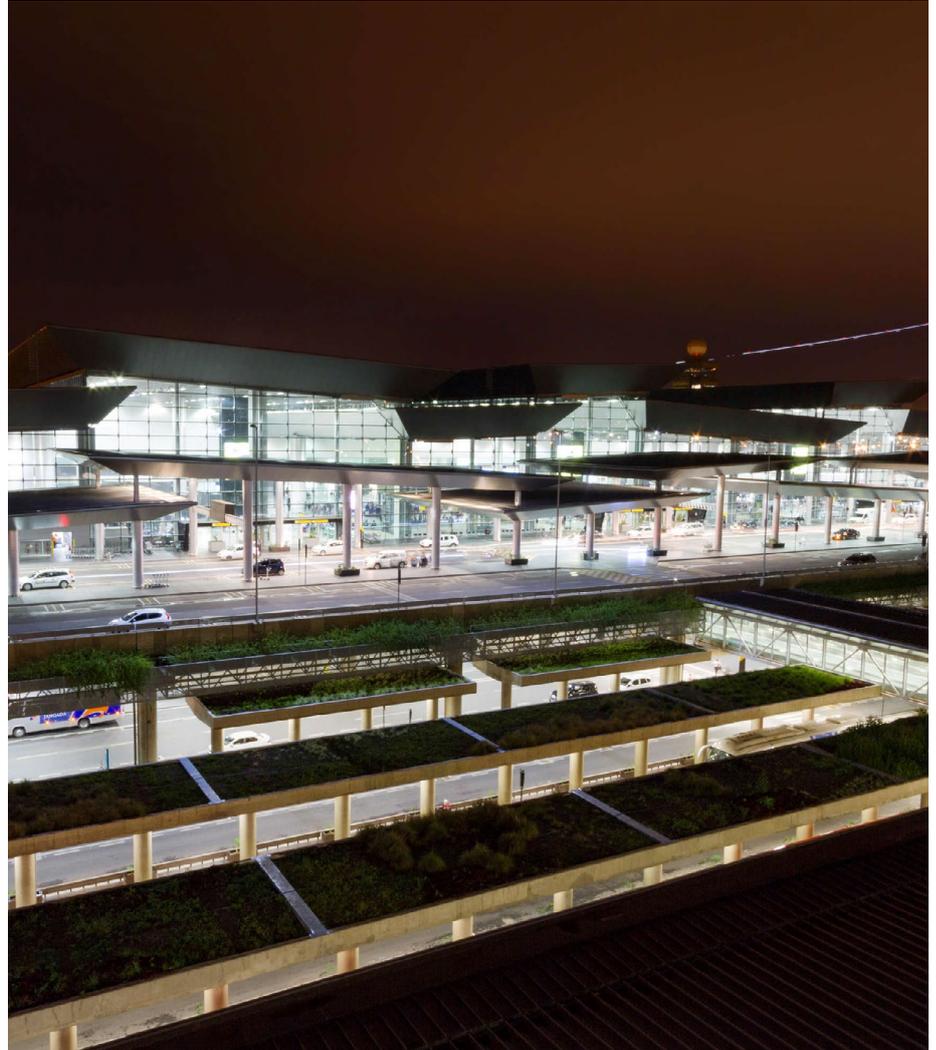
# Airbus

Airbus is working with Ericsson to provide a secure connectivity solution that will increase aircraft production and validation efficiency. Specifically, the solution supports aeronautical engineering and final assembly line production by providing secure onsite data transfer between engineering teams and device connection on site with NB-IoT (narrowband IoT).

This secure solution from Ericsson features a 4G private network that is 5G-ready and includes a robust and redundant core network connected to radio solutions running on mid-band 700 MHz, 2600MHz TDD. 5G millimeter wave has been tested throughout 2021 as Airbus looks to Ericsson for future-proofed solutions.

The Ericsson private LTE core network is being deployed at the Toulouse city site. A key feature of private networks is the ability to securely transfer data between different engineering teams located on the site, as well as the connection of devices within Airbus plants and sites through a NB-IoT connectivity solution.

Åsa Tamsons, head of Business Area Technologies and New Businesses at Ericsson says: "Ericsson's 5G-ready private networks accelerate aerospace innovation and enable the secure transfer of data between different onsite engineering teams and connected devices within Airbus plants and sites. We're proud to be the Airbus supplier for this 4G/5G private network venture and are pleased that the project is now close to live."

Source: https://www.ericsson.com/en/news/2021/4/airbus-private-cellular-network

## stc, Saudi Arabia

Saudi Arabia's 28 airports served more than 103 million passengers in 2019, and it expects that number to grow to 195 million by 2030. To accommodate this growth, Saudi Arabia plans to build five new airports before the end of the decade.

But growth is just one of the aviation challenges Saudi Arabia faces. They need to increase the security of borders, assets and personnel; improve passenger satisfaction; reduce baggage loss; reduce operations costs; and reduce delays. Building on the foundation of a modern wireless 4G/5G network from

Ericsson and its aviation ecosystem partners, Saudi Arabia has an ambitious plan to create smart airports that provide:

- Connected operations: Real-time analytics and connected assets will help workers reduce turnaround time.

- Integrated real-time communication: Saudi Arabia wants to move beyond land mobile radio to provide real-time mission-critical data, voice and video to stakeholders.

- Autonomous vehicles: These will enable autonomous control of large portions of airport operations.

Source: Industry Talk - 5G4B Airport Podcast - Ericsson

# Final call

Aviation faces significant challenges to growth, customer satisfaction, operational efficiency and security, all of which can be addressed through Aviation 4.0 use cases. But making these use cases a reality requires a network that can meet the stringent demands of a modern airport. These mini-cities need high throughput, low latency, reliability and strong security, all of which cellular solutions can provide. Facilitated by (private) 5G[2], it will be enabled by even better performance and security.

Aviation 4.0 is not a far-off goal. Connected aviation stakeholders can prioritize use-cases to optimize airside operations now, enabled by a single private 5G network. Airports will likely want to operate their own private 5G networks to gain more control and stronger security. In various operational models, they can take advantage of resources and network slices powerful enough to deploy early win use cases.

Aviation 4.0 is not just the future — it can be an airport's[3] present through the help of Ericsson and its ecosystem partners.

[2] ericsson.com/en/dedicated-networks
[3] ericsson.com/en/industries/airports

# Abbreviations

| | | | | |
|---|---|---|---|---|
| AI | Artificial Intelligence | | MNO | Mobile network operator |
| AR | Augmented reality | | MRO | Maintenance, repair and overhaul |
| ATM | Air traffic management | | MS | Millisecond |
| CSP | Communications service provider | | NB-IoT | Narrowband IoT |
| DDoS | Distributed denial of service | | OTP | On-time performance |
| DECT | Digital enhanced cordless communications | | PAX | Airline passengers |
| E2E | End-to-end | | PMR | Professional mobile radio |
| EASA | European Aviation Safety Agency | | PDA | Personal digital assistant |
| HD | High definition | | PoC | Proof of concept |
| IoT | Internet of Things | | QoS | Quality of service |
| KPI | Key performance indicators | | ROI | Return on investment |
| LAN | Local area network | | SLA | Service level agreement |
| LMR | Land mobile radio | | TCO | Total cost of ownership |
| MEC | Multi-edge access compute | | TETRA | Terrestrial trunked radios |
| ML | Machine learning | | ULD | Unit load device |

If you'd like
to know more,
we'd love to talk.

Get in touch at:

www.ericsson.com/en/dedicated-networks

www.ericsson.com/en/industries/airports