



Advanced Air Mobility

Position Paper

As a global leader in aerospace, mobility and digital security,

Thales has been working on UAM systems and ATM/UTM solutions for many years.

With this unique positioning, we develop solutions for the eVTOL and the drones market with an incremental approach to help safe, reliable and efficient piloted and unmanned operations.

Introduction

Over the next 10 to 15 years, the emergence of Advanced Aerial Mobility (AAM) will revolutionize the aviation industry and how people and things move around the world with the implementation of highly automated and collaborative systems. The services offered by the AAM will include passenger transport (city taxi, airport shuttle, intercity mobility, etc.), freight, parcel and mail transport, and will operate in urban, regional and interregional areas, and even on an international scale.

AAM is a developing aviation capability, driven by the emergence of new technologies, such as small UAS (Unmanned Aerial Systems) and eVTOL (electric vertical take-off and landing aircraft), and digital platforms characterized by automation, artificial intelligence and a collaborative cloud environment. As such, AAM presents complex and unique challenges in terms of infrastructure, operating concepts, regulations and certification, and of course acceptability.

Thales' mission is to build a future we can all trust. We're committed to improving quality of life through efficient, fluid, safe and equitable access to aviation services, bringing us all closer together while minimizing carbon footprints. Our expertise in avionics, navigation aids, air traffic control, UTM, automated traffic management, air surveillance and communications infrastructure, as well as digital ecosystems and control centers, puts us at the forefront of the AAM evolution.

In this white paper, we discuss the catalysts in making AAM a reality.



Aircraft systems for AAM

Safe flight path

Calculating and adjusting the position of the aircraft's control surfaces and managing engine thrust, the fly-by-wire system is a critical element of flight safety.

Drawing on a **40-years experience in flight controls** for aviation and more **12,000 aircraft equipped**, Thales has developed a new generation of control systems especially for eVTOLs: **Thales' FlytRise**. Thales flight controls will equip SkyDrive and Airbus City Next Gen.

This "super computer" is setting the benchmark for the next generation of highly critical computing technologies, capable of hosting several functions beyond traditional flight controls hence optimizing aircraft architecture in terms of simplicity, cost and weight, meanwhile providing superior flight safety.

These capabilities will allow aircraft manufacturers introducing new functions such as Autopilot, Navigation or some Surveillance functions.

Superior sensors

eVTOL require high performance sensors to precisely and safely guide their flights.

Thales Air Data (ADU) solution inherits from more than 20 years' experience of in-house development and series production of MEMS pressure sensors and millions of flight hours in regional air transportation, military aircraft and helicopters. It offers the lowest Size, Weight and Power ratio (SWaP) on the market together with a unique performance at low speed and no need for calibration during the life of the aircraft. The system comprises the computer and the probes.

While more than 50,000 air data units have been delivered for conventional aircraft, Thales's recognized product range has reached Urban Air Mobility, notably with the selection for Embraer EVE's eVTOL aircraft.



40 years experience in flight controls



12M aircraft equipped



UAM

Paving the way to autonomous flights through drones

Fully automated flights will be the tipping point for the Urban Air Mobility market to reach its full potential.

To design the technological solutions required for these flight while enabling safe and secure long elongation drones operation, Thales has developed, the UAS100, a lightweight drone capable of flying more than 100 km from its base. The drone is equipped with a hybrid propulsion system, allowing for discretion, limited environmental impact and resilience to failures. It incorporates avionics that combines the safety of certified aeronautical solutions with the lightness and compactness required for a drone.

The UAS100's ability to meet safety and certification requirements opens up a wide range of surveillance, detection and warning applications, both civilian and governmental:



- **SURVEILLANCE**

Natural Environment Observation, Coast Guard, border patrol



- **DETECTION**

Inspection of linear infrastructures (electricity or gas networks, railroads, etc.)



- **ALERT**

Traffic, major events

Its system architecture benefits from the entire ScaleFlyt equipment portfolio to secure drone operations at scale.

UAV equipment for safe operations

For the drone market, Thales has developed a full range of solutions under the brand name ScaleFlyt, among which:

- **ScaleFlyt Remote ID** "virtual licence plate" for drones. This small receiver weighing just 70 grams uses 5G to LTE-M cellular networks to accurately track, identify and monitor the status of each air vehicle in flight.
- **ScaleFlyt Antijamming** system to protect the UAV for intentional or non-intentional GPS/GNSS jamming threats
- **ScaleFlyt Geocaging** solution to allow drone operations in restricted flight areas with a highly reliable flight control solution

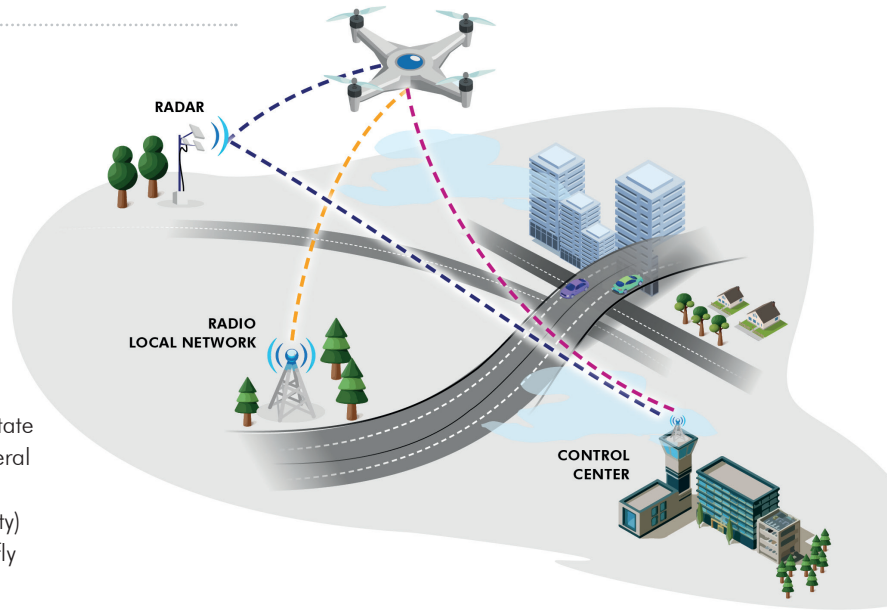


Infrastructure & Vertiports

High-value commercial AAM use cases – think package deliveries, passenger transport, freight – will take place in urban, regional, and remote areas with varying levels of connectivity. Investments in physical and virtual aviation infrastructure ensure the safety and airworthiness of AAM operations across a diversity of operating environments.

Consider Vantis. Vantis is an innovative system of AAM-enabling technologies that makes it simple and economical to perform safe, repeatable, and scalable commercial UAS operations. Vantis is developed and implemented by the Northern Plains UAS Test Site (NPUASTS), a North Dakota state agency, with Thales and in close collaboration with the Federal Aviation Administration (FAA). Vantis combines distributed physical (surveillance and command-and-control connectivity) and virtual cloud infrastructure to enable UAS operators to fly BVLOS within designated airspace service volumes.

Thales is deploying communications and surveillance infrastructure in phases across the state. This infrastructure is supported by a Mission and Network Operations Center (MNOC) that uses the State of North Dakota's fiber optic telecommunications network along with robust digital services



deployed on cloud-based infrastructure to support operational resilience. Among the various infrastructure components required for the deployment of AAM operations at scale, the adaptation of airports in the short term and the implementation of vertiports in the slightly longer term are essential.

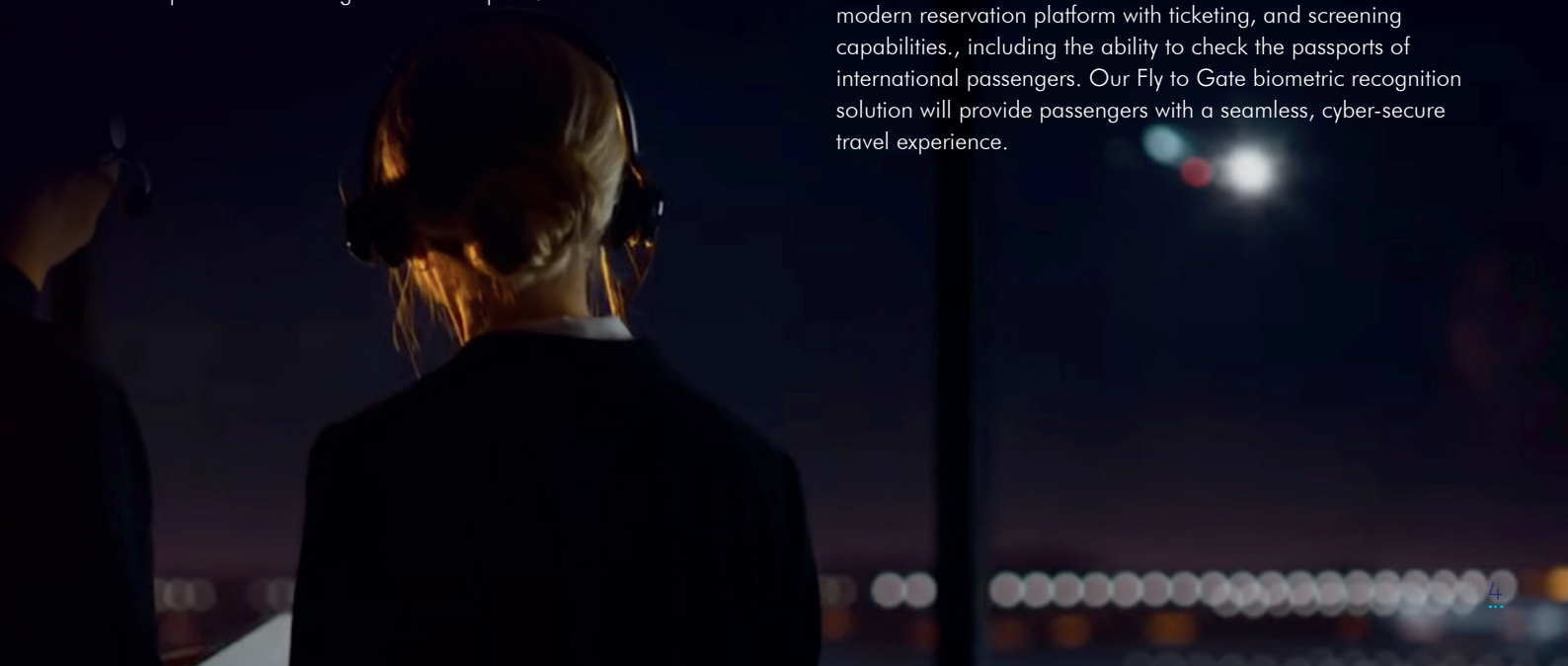
Vertiports must be able to handle the take-off, landing, maintenance and recharging of a high volume of mixed AAM vehicles, and to integrate them into urban and suburban transport networks (close to airports, city centers and mobility hubs, in general).

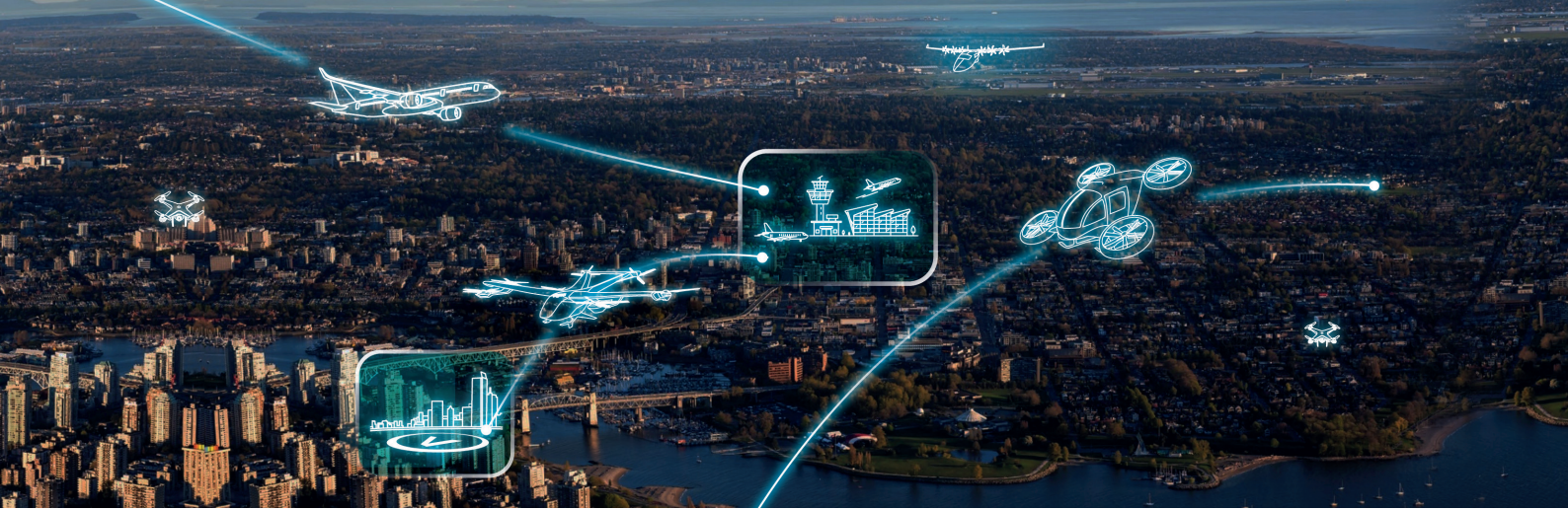
Vertiports require the integration of artificial intelligence (and possibly quantum computing at a more mature stage) to coordinate movements of many autonomous vehicles simultaneously. Our advanced air traffic management solutions, our research and advances in the integration of quantum computing into our products, and our expertise in AMAN/DMAN technologies, as demonstrated by our MAESTRO ATM system, make Thales a key player in the development and management of vertiports.

Vertiports also require robust communication networks, navigation aids with advanced precision for autonomous flights, and high-speed recharging stations capable of absorbing a large flow of traffic. As a systems integrator, we are evaluating technologies to provide high end solutions.

Perhaps most importantly, vertiports must consider a broader urban strategy with urban planners and local communities to ensure social acceptance and usability (including demand, noise management, future mobility schema). Strong market penetration will require a dense network of connected infrastructure, strategically located in cities and mobility hubs.

Lastly, to absorb large passenger flows and ensure flexible, efficient, and instantaneous mobility, vertiports require a modern reservation platform with ticketing, and screening capabilities, including the ability to check the passports of international passengers. Our Fly to Gate biometric recognition solution will provide passengers with a seamless, cyber-secure travel experience.





Airspace management

AAM is only part of an ongoing transformation of the way airspace is managed more broadly. Macroeconomic trends in aviation threaten to upset and overwhelm today's ATM systems, causing disruptions of service and creating new safety risks. These include dynamic and distributed traffic; new entrants; new performance profiles; and demands for increased flexibility among airspace users.

The airspace management system of the future requires the integration of technologies for demand capacity balancing – think flow management for vertiports – as well as dynamic airspace “sectorization” that considers weather, wind, and other conditions at different altitudes and times of day. Emerging technologies like AI, machine learning, big data analytics, cloud, and identity and access management will be incorporated to augment the human-in-the-loop capacity. Zero-trust environments ensure regulated and authenticated access to physical and virtual infrastructure, data, and services.

Thales is evolving our airspace management approach by transforming existing CNS/ATM infrastructure with cloud-native technologies while maintaining strict industry standards for safety and security. This enables a flexible, modular capability made up of physical and virtual infrastructure to meet the needs of diversity of vehicles in dynamic operating environments.

For example, Thales' OpenSky Platform enables airspace management stakeholders to adopt cloud infrastructure while remaining aviation-grade, cyber-secured, and safety certifiable. OpenSky Platform is built on KAST (Kubernetes Analytics and Service sTack) with a built-in data analytics engine that makes it possible to leverage big data securely for performance, efficiency, collaboration, product development, and insights across the organization.

Vantis is an example of foundational AAM capabilities that can apply more broadly to airspace systems around the world. Vantis is the first to receive approval through the FAA's Near-Term Approval Process (NTAP). This recognition underlines Vantis's advanced capabilities, its robust safety features, and its alignment with the FAA's stringent criteria to ensure efficient UAS operations up to 400 feet.

AAM also introduces new airspace management challenges, like autonomy; pilotless aircraft; dynamic operations and ad hoc flights; “smart” demand management; precision navigation; cybersecurity and anti-spoofing; c2 loss link mitigations; emergency management; and format and data exchange standards for ATM-UTM integration. Thales participates in global industry and standards groups in developing innovative solutions for these challenges.

Conclusion

At Thales, we believe in a global aviation system that serves a growing diversity of users, safely and efficiently. That's why we have been working for over a decade envisioning AAM solutions that facilitate electronic flight and avionics systems, innovative physical and virtual infrastructure networks, a dynamic airspace management capability, and a modern, cybersecured passenger experience.

By combining modern technology credentials with deep subject-matter expertise and a system-of-systems integration approach, Thales is uniquely positioned to usher in the ATM system of the future.



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