THE MIND *of the* MACHINE

For decades Flight Management Systems (FMS) have helped reduce pilot workload, improve fuel efficiency and increase flight safety. Now, a new generation of connected FMS is bringing further benefits to the cockpit, as *Alex Preston* discovers

Illustration by Phil Couzens

Since their integration into the flight deck in the early 1980s, Flight Management Systems (FMS) have helped lead a step-change in aviation safety and improvements in operational performance.

Put succinctly, an FMS provides the primary navigation, flight planning, optimised route determination and enroute guidance for an aircraft.

Several companies have been at the forefront of FMS development. Thales has been making FMS for over four decades, with different products dedicated to different market segments. It is embedded on ATR 42 and 72 aircraft as well as the Airbus A320 family.

According to Marc Duval-Destin, VP strategy, Flight Avionics, regional operators know that Thales' FMS guarantees precise navigation computation and precise trajectory control in all phases of the flight. "For instance," a spokesperson states, "on bad weather conditions, the LPV (Localiser Performance with Vertical Guidance) and RNP-AR (Required Navigation Performance-Authorisation Required) approach capabilities allow for a precise and safe arrival to the airport when no Instrument Landing System (ILS) is available. The very intuitive interactions help to reduce crew workload in critical phases of the flight."

The Universal Avionics' FMS is built on more than 30 years of growth and innovation, evolving from the original UNS-1, the first FMS introduced in 1982 and certified at its time. Its latest-generation, SBAS-enabled WAAS FMS family includes the UNS-1Ew, UNS-1Lw and UNS-1Fw models, each offering unique configurations and integrations to meet the needs of customers.

As Dror Yahav, Universal Avionics CEO explains, the Universal FMS meets regional requirements for FANS 1/A+ (a direct data link communication that includes message latency monitoring between the pilot and the air traffic controller) and ADS-B (Automatic dependent surveillance – broadcast) while unlocking next-gen capabilities for LPV and Data Comm, allowing operators to save time and fly preferred airspace.

"Data recording and post-flight analysis provided by our 25-hour Kapture CVR/FDR can be coupled with our connected applications as well as FMS recordings, to support in-depth flight data monitoring, enable fuel savings and optimisations," Yahav, himself a qualified commercial airline pilot, says.

AIRBUS SUPPORT

Honeywell has been supplying FMS since Airbus' first A300 went into service. In mid-2022, the airframer selected Honeywell's FMS for the A320 amongst other models. Mike Harshberger, director, Offering Management – Avionics at Honeywell explains that the new FMS combines multiple current FMS offerings for Airbus into one single solution for their A320, A330 and A350 platforms. "Importantly, the new FMS hardware is 15 times more capable than current hardware and enables a path to future enhancements without hardware changes," he claims, adding, "this win will extend our 35-year partnership [with Airbus] well into the future. Honeywell is still ▶

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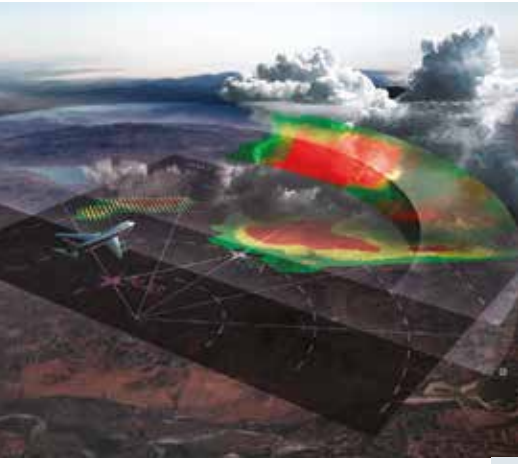
1 Equipment is constantly checked and updated **2** Honeywell's IntuVue weather radar system maps out conditions for pilots **3** Honeywell's IntuVue radar hardware

"FOR A SAFETY AND RESILIENCE REASON, HARDWARE OF AVIONICS IS EVOLVING SLOWLY"



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on track for end of 2026 for forward and retrofit."

PureFlyt is the latest generation of FMS, dedicated to air transport and more generally to "high altitude/high speed civil operations" from Thales. The first entry into service will be in 2026 on Airbus aircraft, with Duval-Destin confirming that "for the retrofit market, Airbus is working to define the associated schedule and give the opportunity to our airline customers to harmonise their fleet".

Airbus has selected Thales' FMS for its new generation of A320 aircraft. Duval-Destin explains, "This new flight management system, which is based on the PureFlyt product, has been adapted to meet the specific requirements of Airbus. This next generation FMS will bring at the entry into service new features for greener and more economical flights like Continuous Descent Approach, Flight Criteria, more tools for what-if scenarios and a cyber-secured connectivity to the open world."

But being connected to the open world surely invites cybersecurity threats and raises the need for cyber resiliency? The answers to such questions have already been pre-empted into the design of the latest generation of FMS, as the manufactures are keen to emphasise.

"For a safety and resilience reason, hardware of avionics is evolving slowly," says Duval-Destin. "It is not evolving as fast as the software. For that concern, connected FMS can be an answer. The true purpose of the FMS is to compute a safe, understandable and flyable trajectory from a given flight plan and to ensure the aircraft guidance along it.

"How the flight plan is defined or optimised can be delegated to other equipment, inside or outside the avionics. Using the computing power of the open world for flight plan preparation or optimisation and then injecting it in the avionics in a very few pilot actions is now possible and it will answer to the need of rapid software changes and continuous increase of computing power need."

Historically, the FMS was not connected to the open world, so there was no such need for cybersecurity. But, says Thales, "With this new generation of connected FMS, it is critical to ensure data coming from the open world is safe and compliant to expectations. To achieve that, there are a limited and verified number of data injections which are allowed from the FMS perspective. If received data are is compliant, the FMS will simply reject it. Additionally, this data is entering into the FMS only after passing successfully through a cyber-secured gateway. Thanks to a very strong experience in cybersecurity, we are proud to also provide to Airbus this cyber-secured gateway which will be embedded in their aircraft."

Earlier last year, Universal Avionics successfully completed testing to ▶

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1 Flight Management Systems have undergone significant evolutions since they were first certified and installed in the cockpit in the mid-1980s. (Airbus) **2** Research continues to reduce pilot workload

"USING AN IPAD AS A COMPLEMENT TO THE UNIVERSAL FMS UNLOCKS POSSIBILITIES FOR THE FUTURE"

meet cybersecurity requirements for its Connected Avionics Solution. The Connected FMS's layered security implementation ensures interactions are always secure, says Yahav. "For example, a QR code is required as a multi-factor authentication mechanism to sync flight plans between FlightPartner and the FMS, preventing unauthorised access.

"Using an iPad as a complement to the Universal FMS unlocks endless possibilities for the future in terms of computation power and software development. As mobile devices and tablet apps continue to expand, so does the opportunity for our Universal FMS to grow with it," he states.

Recent certifications have further established Universal's Connected FMS connectivity upgrade, iPad applications and two-way Wi-Fi interactions that enable seamless database updates and smart flight planning on the go. The FlightPartner and FlightReview apps provide real-time weather updates and extensive flight data for an additional layer of safety and information to support proactive decision-making. They integrate with the operator's existing flight planning to streamline the pilot workflow.

In parallel, says Yahav, Universal is developing the i-FMS, a software-based version of the FMS hosted on 3rd party hardware. The i-FMS incorporates connectivity features and is designed for advanced human-machine interfaces, supporting augmented reality with the company's wearable head-up displays and advanced control features. "Picture an advanced interface with augmented reality, voice recognition and gesture recognition," he says.

Harshberger says that Honeywell's Connected FMS has been designed in conjunction with the Honeywell Cyber Security Organisation and are collaborating with aircraft OEMs to ensure secure connectivity solutions are in place.

Honeywell's FMS integrates with almost every other avionics application/system within an airplane, including but not limited to datalink, GNSS, fuel monitoring, air data computers, thrust management computers, etc. The new FMS, reveals Harshberger, is being developed to build upon millions of hours of Honeywell's FMS legacy, with enhanced modularity, advanced functionality and a multi-core processing platform.

Universal Avionics is continuing research and development for its software-based iFMS and Connected FMS applications to improve workflows for operators.

Ongoing expansion of FlightPartner and FlightReview applications also includes partnerships to offer new packages for Universal FMS users such as Aircraft Performance, which integrates take-off and engine-out calculations, obstacle analysis, landing factors and more.

"With these software enhancements for our Connected FMS, we can connect what's next for customers," avers Yahav.

The top priority for Thales is to certify PureFlyt. "In addition to the open world connectivity, we are continuously working on how to reduce pilot workload," says Duval-Destin. "At Paris Le Bourget last year, we presented the future of flight avionics with Smart Assistants.

"We strongly believe that the FMS must be at the centre of it to help the pilot by continuously displaying the right information at the right time, proposing different and adapted suggestions regarding the current situation and finally being able to manage automatically a greater number of scenarios during the flight," he concluded.

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