AIRBUS A350 & A GENERATIONAL

Avionics Magazine brings you an in-depth look at the technological capabilities, performance parameters, development and industry expectations for the commercial aviation industry's two most advanced platforms currently in service, the Airbus A350 and the Boeing 787.

by Woodrow Bellamy III and Juliet Van Wagenen

BOEING 787: LEAP IN AVIONICS

The Airbus A350 and the Boeing 787 are the two most technologically advanced commercial airliners in the aviation industry today. What's always difficult to measure about aircraft technologically and in terms of avionics capabilities is that aircraft take up to 10 years to develop, flight test, and eventually mass produce. So while the 787 originally entered service in 2011, it's Integrated Modular Avionics (IMA) architecture, touchscreen display technology and fly by wire style was actually based on technological schema and concepts that Boeing engineers developed in the early to mid 2000s. Similarly, although the A350 entered service just last year with Qatar Airways, it's technology was actually first discussed in this publication in 2009, and now as A350 operators prepare to finally operate the wide body on more challenging routes, and long intercontinental cross-oceanic flights, the industry can start assess its performance, ability to communicate with ground automation systems and its overall flight operational and technological power over the next few years.

Juliet Van Wagenen
is the assistant editor for *Avionics Magazine*.

AIRBUS A350

by Woodrow Bellamy III

The Airbus A350 has now been in service for more than a year, although the French airframe manufacturer has been flight testing since 2012 and is based on an avionics architecture that was first discussed by Airbus in the 2007 timeframe, and is borrowed from the A380. However, Finnair Chief Operating Officer Ville Iho says the airline is excited and has been preparing to operate the A350 for several years, and was involved in the design and development of the aircraft so nothing about it is new for Finnair pilots or mechanics, other than the fact that they have not yet operated the aircraft live.

"We actively participated in the design of the aircraft. We had our own internal technical services representative working with Airbus on the design prototype for several years," says Iho.

Finnair was one of several airlines to take advantage of the new Airbus "Airline Office," a new concept launched in Toulouse where airline customers carry out in-depth work on the A350 prior to delivery giving Airbus engineers in-sight on real-life operations, such as Finnair's plans to use the A350 extensively on routes to Asia. This allowed Finnair to gain a clear understanding of the A350's ability to communicate the airline maintenance crew via the Aircraft Communications Assessing and Reporting System (ACARS), Wi-Fi, sideband satellite communications or cellular networks.

The A350 at Airbus' 2015 Dubai Airshow static exhibition area. Photo courtesy of Airbus.

Airbus estimates that the A350's No-Fault Found (NFF) removal rate will be reduced by 50 percent compared to the A380. Additionally, as compared to the process of accessing the independent maintenance features of the A330 through a Multi-Purpose Control Display Unit (MCDU), all of the A350's digitized maintenance features can be accessed through an Onboard Maintenance Terminal (OMT).

"Whereas the A380's IMA manages 23 functions for avionics, landing gear, fuel, brakes and pneumatics, the A350's IMA manages more than 40 functions, including new ones such as the oxygen system, full cabin pressurization system and fire detection. The resulting benefits are reduced maintenance and less weight. The A350's IMA will replace multiple separate LRUs with around 50 percent fewer standard computers and Line Replaceable Units (LRUs). The IMA runs on a 100 megabits per second network based on the Avionics Full-Duplex Switched (AFDX) Ethernet standard, already employed in the A380," says Raphael Lafourgue, an aircraft operations manager at Airbus.

"We are able to carry a full range of cargo and passengers to more destinations than we have been able to do with the traditional aircraft. But that's one aspect, the better range; then it is a faster aircraft which saves time. We have calculated that ... we will be shaving 15-20 minutes off [several routes] of which is a significant benefit," says Iho. "The A350 also flies at slightly higher altitudes when compared to the A330s and 40s, which is an asset as well because in certain weather conditions it makes the flight much smoother and enables routing that wouldn't be possible if you have storms or poor weather along your routes. It has quite a scope of possibilities when you are doing your routing ... Our strategy currently is focusing on reaching Asian markets. We are carrying full passengers and cargo to Asian destinations and some of the destinations are only accessible with the A350."

The A350 is also the first commercial air transport platform to feature a Satellite-Based Augmentation System (SBAS) as part of its standard navigation systems. AVS

BOEING 787

By Juliet Van Wagenen

United Airlines, British Airways, American Airlines and Virgin Atlantic: these are just a few of the nearly 60 airlines signed on as operators for Boeing's promising 787 Dreamliner. Airlines across world have begun incorporating Boeing's Dreamliner into their fleet to cut down on fuel use and CO2 emissions while modernizing avionic systems alongside cockpit and cabin design. The aircraft was developed to be 20 to 30 percent more fuel efficient than the 767 .

Aside from the highly publicized fuel savings, the airframer has sought to incorporate new technologies into the flight deck and enable performance-based approaches while maintaining a significant amount of commonality with other Boeing aircraft, according to Rich Horigan, director of 787 systems at Boeing. "The 787 integrates triple-redundant Flight Management Systems (FMS) with dual GPS receivers and makes the integrated approach navigation information available on the dual Head Up Displays (HUDs). This allows the airplane to reliably perform RNP procedures which, in turn, increases the efficiency of the airplane by reducing overall fuel use and thus emissions," Horigan says.

The 787 also features large multifunction displays, which provide a picture of the FMS' calculated vertical flight profile. The FMS supports RNP 0.1 procedures as well as fixed radius turns on airways, constant descent arrivals and integrated speed management for approach /missed approach to further increase operational efficiency. Horigan believes it is the RNP 0.1 capability that separates the 787 from other airplanes in the world. With the RNP 0.1 capability, "the 787 can fly point-to-point to or from any runway without engaging ground navigation aids," Horigan explains, noting that the aircraft can support these RNP 0.1 procedures with autopilot or flight director engaged. "The 787's Earth Reference System, High Step 2 capability and GPS coasting performance allow the airplane to support high-fidelity takeoff and landing procedures with very high reliability and for periods of up to 20 minutes without GPS availability," he adds.

The Dreamliner is also the first Boeing airplane to operate with a common core system, which functions as the center of the airplane's computers, networks and other interfacing systems as well as existing avionics technology and hardware that have been "repackaged" into integrated systems. Airlines such as Virgin Atlantic have also sought to take advantage of the 787's e-Enabling infrastructure to improve maintenance and flight operations. Nearly 146,000 parameters of flight data can be collected from the 787, a hefty amount of data that requires operators large and small to prepare to manage the enormous influx being constantly transmitted from the aircraft.

"The 787 produces, on average, about 30 to 45 Mb on a nine-hour flight. This includes, primarily, data from the aircraft conditioning monitoring function and crew information system," explains Horigan. "The 787 central maintenance application contains sophisticated algorithms that continuously collect health data on the various systems and components and that determines the correct actionable task."

With so many parameters available, the amount of data can skyrocket but, if managed appropriately, the data can help airlines such as Virgin Atlantic to improve operations. During flight, the e-Enabling infrastructure sends aircraft health data automatically via the ACARS. This in-flight data gives the live condition of the 787's avionics systems to Virgin's Integrated Operational Control Center (IOCC) throughout all phases of flight. avs

First Boeing 787-9 Dreamliner features new Boeing livery. Photo courtesy of Boeing