The size and scope of flightdeck data transmissions is beginning to increase as higher capacity connectivity systems become available. The amount of data airlines will have and the way airline departments operate will be transformed when the appropriate applications are developed.

The real time transfer of operations data during flight

Flightdeck transmissions in real time have been limited to connectivity channels with low data transmission rates, which has made it expensive to send large volumes of data while in flight. The high cost has limited transmissions to categories and messages that are relatively small. New generation connectivity systems with high data transmission rates and other technological changes are now allowing larger volumes of data to be transmitted from the flightdeck at relatively low cost. This is changing airlines' operating constraints.

Flightdeck transmissions

Flightdeck transmissions fall into four categories. The first of these are air traffic service (ATS) messages. These are all safety-related voice or data transmissions. They are confined to communication between flightcrews and air traffic control (ATC) and other ATSs. Their importance in relation to safety means that they have to be transmitted through secure connectivity channels.

The legacy channels approved for ATS messages are high frequency (HF) and very high frequency (VHF) radio, and L-band satellite communication (satcom) channels. None of these systems is attenuated by water droplets or other weather-related phenomenon. L-band satcom channels are provided by Iridium and Inmarsat.

Data messages through these channels have been confined to aircraft communications and addressing system (ACARS) messages. The portion of ATS messages that are data transmissions is increasing, and will continue to rise as more flightdeck communications with ATC are performed via controller-pilot datalink channels (CPDLC) messages.

ATS messages also include communications such as air terminal information service (ATIS) messages, departure clearances, and flight level changes.

The main disadvantage of these three main types of connectivity systems is that ACARS messages over VHF and HF channels are limited to relatively low transmission rates. The original standard of ACARS messages, referred to as plain old ACARS (POA) messages, has a transmission rate of 2.4 kilo bits per second (Kbps) over VHF, HF and L-band satcom. Digital ACARS messages, including CPDLC, over VHF have a transmission rate of 31.5Kbps.

L-band over Iridium and Inmarsat was originally used for the future air navigation system (FANS), whereby communication by pilots to ATC was conducted via CPDLC when operating trans-oceanic flights.

The other three categories of flightdeck messages are: airline operational communication (AOC); airline administration communication (AAC); and air passenger communication (APC) messages and transmissions.

AOC messages and transmissions can be categorised as data sent from the aircraft to its airline's operations department. These include the small volume departure and arrival time communications, as well as the larger volume messages that include: transmission of flight plans; loadsheet information and data; engine health monitoring (EHM) data; aircraft health monitoring (AHM) data; some flight operations quality assurance (FOQA) data; maintenance operations quality assurance (MOQA) data; and central maintenance computer (CMC) fault codes and messages.

The large volumes of AHM, EHM, FOQA and MOQA data are stored on the quick access recorder (QAR), and downloaded when the aircraft is on the ground.

Other large volume AOC messages include uploads and downloads to electronic flightbags (EFBs), downloads from electronic technical logs (ETLs), and graphical text weather services (GTWS) data. GTWS data are relatively small in volume, and are used to provide weather (Wx) information that is in text form only. It can, therefore, provide Wx information to the flight management system (FMS), but can also be used on an EFB. GTWS data are limited in volume because of the legacy connectivity systems available, and the high cost of sending large volumes of information. In most cases, GTWS data are uploaded when the aircraft is on the ground.

AAC messages include crew rosters, passenger manifests, and loadsheet and chart database uploads. APC messages are mainly limited to news and other items of interest to passengers.

Data volumes

The size of standard ATS voice and data communications has not increased significantly. Transmissions that have experienced a significant increase in the number being sent, as well as in the size of the transmission, are most categories of AOC messages, and some AAC messages.

The AOC messages that have grown in number and size are AHM, EHM, FOQA and MOQA messages. Modern generation aircraft monitor a larger number of parameters that fall into these four criteria. The volume of data is thus significantly higher compared to older generation, legacy aircraft types. It is estimated that new generation aircraft

The main requirements from airlines to send larger quantities of data in flight are for more ATS messages; a larger volume of QAR and health monitoring data; and a larger volume of AOC data, that includes digital weather graphics.

types now generate as much as 5.5 mega bytes (MB) per hour, and in some cases as much as 8.0MB per hour. "The quantity of data generated can thus equal at least 200MB per month for older types, and up to 2 giga bytes (GB) per month for new generation aircraft," says Willie Cecil, director of business development for wireless and data automation at Teledyne Controls.

Some of the parameters in the AHM and EHM categories have to be transmitted in real-time from the aircraft, in particular exceedences relating to engine vibration and temperature. These are required as soon as possible after occurrence, so they are sent in real-time from the flightdeck. It is also necessary to send some data from a small number of parameters that are categorised as FOQA or MOQA in real-time.

Other messages that have to be sent in real-time from the flightdeck are CMC fault codes, and transmissions of pilot reports from the ETL. This is especially the case with defects that are not reported by the CMC.

The messages that are transmitted in real-time are relatively small in size, and have not contributed to a significant increase in data being sent. Their number and size mean that legacy flightdeck connectivity systems have sufficient capacity to avoid an excessive increase in data transmission costs.

Most EHM and AHM parameters do not have to be transmitted in real-time. The same applies to FOQA and MOQA data, because most parameters are processed and analysed post-flight.

These data are downloaded from older aircraft types through magneto-optical disks. The QAR units on later aircraft types had removable sold disks and cards. Aircraft from the mid and late 1990s had a data acquisition unit (DAU), with an integrated QAR function, and QAR data was removed using the solid disks.

The latest generation aircraft types have a integrated modular avionics (IMA) architecture. Boeing uses an on-board network server (ONS), while Airbus has its Flysmart with Airbus system. These IMA systems had in-built QAR functionality.

In the case of both generations of aircraft, a system to easily transfer the data to a ground-based system for processing and analysis is required. The two options for this data transfer are WiFi and cellular wireless data downloading systems.

A WiFi system requires the aircraft to be fitted with a terminal wireless lan unit (TWLU). This will be interfaced with the QAR. Examples of TWLU are Teledyne Controls's aircraft wireless lan unit (AWLU), and TWLUs manufactured by Miltope, Honeywell and Rockwell Collins.

Examples of cellular units are a generation of Teledyne's AWLU, Miltope's cTWLU, and Rockwell Collins's terminal ground cellular unit (TGCU).

A generation of Teledyne Controls' AWLU provides combined WiFi and cellular connectivity. Teledyne Controls also provides combined QAR and cellular wireless connectivity functionality with its Wireless GroundLink (WGL) unit.

High-volume transmissions

There are advantages to a larger number of AHM, EHM, FOQA and MOQA parameters, and, therefore, more data, being transmitted in real-time. Airline operations, maintenance control, line maintenance, and maintenance and engineering departments could all use applications that transmit large volumes of data from these categories for predictive and preventative maintenance. More specifically, data relating to aircraft and engine parameters before and after the exceedences are recorded can also be used while the aircraft is in the air to assist in analysing the cause of faults. "One product we have in development is an application that will capture warnings generated by the engine indicating and crew alerting system (EICAS) on the aircraft," says Paul Mallasch, senior director of aviation and technology development at i-Jet Technologies. "If the airline receives exceedence data, then the application can optionally request related AHM and EHM data for one hour before and after the exceedence occurred is transmitted during the flight if necessary. While this request temporarily increases the volume of data sent in real-time, it will provide the necessary information to the relative airline departments to help them analyse the cause of the exceedence. We are building interfaces with maintenance and engineering, line maintenance, maintenance control, and flight operations systems that are already used by airlines."

As the availability of diagnostic and analytical applications to process a larger number of select health monitoring and operations data parameters increases, so does demand for sending a larger volume of flightdeck tranmissions in real-time.

The need to send higher volumes of data and larger in-flight transmissions has also been stimulated by other requirements from airlines. The use of EFBs by airlines is increasing. Current systems of operation are based on flight plans being transmitted in electronic format to the FMS. Electronic flight plans include information on waypoints, wind speed and direction at each waypoint, profiles for the climb cruise and descent phases of the flight, estimated passenger numbers and payload, other relevant weight data, and estimated fuel required. Flight plans are generated several hours

The Inmarsat SBB system has been trialled on Hawaiian Airlines's trans-Pacific operations in the process of sending and receiving CPDLC messages.

before departure. A lot of the information used is therefore based on assumptions, including: Wx at various points during the flight, and estimated payloads, weights and fuel requirements.

The electronic flightplan can then be transferred to the EFB for use by various applications. These are aided by receiving updated and accurate parameters used in the flight plan just before departure.

These include using updated payload and fuel information to acquire more accurate weights, and updated Wx data and information. This allows pilots to use various applications to optimise the flightplan with respect to the vertical profile of the cruise phase, and top of the descent point and the descent phase profile. Applications also allow the profile of the climb phase to be optimised, but these require accurate weight data.

In addition to more exact flightplan data and information, there are other EFB-hosted applications that optimise the lateral and vertical profiles of the cruise phase, that is, the waypoints and track flown, and flight level or altitude and speed flown. These not only need more accurate weight and other data, but also the frequent feed of Wx data at each waypoint. Accurate wind speed and direction information for several FLs at each waypoint allow the flight's vertical profile to be optimised. Such a process can save about 1% of cruise burn.

The frequent transmission of detailed Wx data for each waypoint generates a higher volume of data than legacy generation flightplans. Moreover, the detailed Wx data for several FLs at each waypoint may be larger than the FMS's capacity. Forecast wind speed and direction data are updated every six hours, but detailed Wx data can be sent to the aircraft every 15 minutes.

In addition to frequent and regular Wx data being transmitted to the aircraft to allow more precise flightplan optimisation, a big requirement from airlines is graphical Wx information. "This would be superimposed on the lateral profile of a flightplan on the EFB," says Cecil at Teledyne Controls. "The Wx information provided by the weather radar in the aircraft's nose is limited, and is only useful for flying around storm clouds. The actual weather data received are through ACARS channels, and this is used by the FMS as part of the flightplan calculation." Long-haul flights may have up to 100 waypoints, so not all the information in a flightplan can be loaded prior to departure. Information can thus be sent to the aircraft for segments of the flight as it progresses.

"A flightdeck connectivity system with a higher data transfer rate would make it possible to have real-time Wx graphics on the flightdeck and EFB all through the flight. This would be for the entire remaining distance. It would allow crews to make decisions about changes to lateral tracks, due to deterioration of the Wx along the flight track, in advance as well as decisions with respect to diversion and alternate airfields," says Cecil. "Graphic Wx for the entire route length would increase the crews' chance of being given a new lateral track from ATC."

Panasonic subsidiary Panasonic Weather Solutions is providing the world's most advanced global weather forecasting platform, a product called Panasonic Global 4D Weather. This has weather prediction capability, and includes an industry-leading global weather model. It uses Panasonic's atmospheric datasets. These include detailed weather data in the four dimensions of longitude, latitude, altitude and time. It also utilises data assimilation capability. The system is intended to provide more accurate Wx information and data to aid in the lateral profile optimisation of flight plans.

A further requirement with respect to AOC transmissions is sending detailed data on tracking requirements, which overlaps the need to send health monitoring and QAR data to airline departments. This will require a high data transmission download capacity.

Some AAC transmissions would become economic to transmit in real-time if high-capacity connectivity channels were available. The two main categories are live credit card transactions for in-flight shopping, and passenger manifests. A live link for credit card approval in flight would prevent the credit card fraud that is possible with manual transactions. While internet browsing and other passenger activities use existing connectivity channels for the passenger cabin, AAC messages such as credit card transactions require a secure link.

Enhanced connectivity

As described, a main constraint of sending ATS messages from the flightdeck is that they must be transmitted over a secure connectivity channel. The legacy options for this are analogue and digital versions of VHF and HF radio links, and L-band satcom, that have low transmission rates of 2.4Kbps and 31.5Kbps These limit the amount of data that can be sent economically in flight.

Inmarsat SBB

In addition to the ATG systems and the K-band satcom systems, connectivity systems with high data transmission rates have been developed for sending and receiving ATS messages. The first of these is Inmarsat's swiftbroadband (SBB) L-band satellite system. Despite using an L-band radio wave, it uses an I.P. protocol to achieve higher data transmission rates of 432-480Kbps, so it cannot be used for ATS messages in pure form. The SBB has, therefore, been modified to make it possible to send ACARS messages over the satcom I.P. link by encapsulating them in I.P. packets on the aircraft. Once received on the ground, the I.P. packets are opened and the ACARS message is extracted and passed to the SITA or ARINC networks for the usual remaining transmission of the ACARS message to the recipient. The encapsulation system, therefore, bypasses the limited data transmission rate of the legacy ACARS transmission systems.

"The main benefit is that the system is a satcom programme that will use I.P. over SBB for use on the flightdeck. It will consequently achieve faster transmission rates for ATS messages," says Robert Keys, pre-sales engineer at Cobham. "The first category or group of ATS transmissions will be CPDLC messages for use in trans-oceanic operations. We have an agreement with Inmarsat to evaluate the system together, and the aim is to have the system certified for ACARS ATS transmissions from the flightdeck. As part of this process we have developed an ACARS gateway for the I.P. tranmissions, and have also been working with ARINC and SITA to channel the messages into their networks once they have been received on the ground.

"The evaluation started with Hawaiian Airlines, and included its transpacific operations from Hawaii to the Asia Pacific and the US," continues Keys. "The evaluation has involved using the system on eight aircraft. The process for getting the system certified to carry ATS messages requires providing a large enough quantity of data to support adequate performance of reliable communications over the SBB link to the Performance Operations Aviation Rulemaking Committee (PARC), which is a sub-committee of the Federal Aviation Administration (FAA). The FAA creates the performance criteria required for the system to be certified.

"The evaluation started in March 2015 and is continuing," adds Keys. "PARC will also probably require an evaluation of a similar amount of data from transatlantic operations, so we will evaluate the system with a major cargo carrier's transatlantic flights starting in February 2016. The evaluation has involved sending FANS CPDLC messages and automatic dependent surveillance (ADS) transmissions. The results so far have been phenomenal. While our target is to send about 75,000 messages, the criteria is that the messages have a latency time from the FMS to ATC of no more than 180 seconds. The system has in fact averaged a latency time of 5.6 seconds during the evaluation. We can expect certification of the system in mid-2016. The high speed of the transmissions is due to the system's overall capability."

Included in SBB's ATS functionality will be position reports required by ICAO's flight tracking initiative.

The SBB system can later be evaluated for other operational transmissions. These will include large volume AOC messages that currently cannot be sent via ACARS because of the related cost. "The FAA has an initiative called system-wide information management (SWIM)," says Keys. "The objective of SWIM is to supply several or all categories of operational data and hold them in a single location for airlines. This will include Wx information, flight data, such as plans and departure clearances, and notices to airmen (NOTAM). This source will basically be used by flightcrews in flight planning and during operations, so the SBB system will be used to transmit these data as encapsulated ACARS messages for AOC purposes. The information can be used on the FMS or EFB."

Many EFBs are based on commercial off-the-shelf (COTS) devices that operate on I.P. protocol. iPads do not, however, have connection ports, and so will only be able to connect to the SBB system via a WiFi signal and receiver on the flightdeck. The WiFi receiver would need to be connected to the aircraft's avionics or its server. Other EFB hardware devices with connection ports could be interfaced

Lufthansa will be one of the first European airlines to equip its short-haul fleet with the new EAN system. EAN is a combination of ATG, S-band satellites, and Ka-band satellites for use over the airspace of the 28 EU countries and will provide data transmission rates to the aircraft of 75Mbps.

with the aircraft's avionics and the SBB system via an aircraft interface device (AID). Such connectivity would make it possible for the EFB to receive a larger volume of data and information, including graphical weather.

"Another potential use of SBB is downloading passenger manifests to the ground," continues Keys. "It is currently expensive to do this via conventional ACARS channels. Another main example of a potential use for SBB is uploading Wx graphics data to the EFB."

The current evaluation of the SBB system, however, is only for the service of FANS transmissions. The current satcom system has been modified to provide an ACARS gateway link. While this system can encapsulate the ACARS messages in I.P. packets, Cobham has also developed an Aviator 'S for Safety' avionics unit to provide the SBB system with additional features, including data segregation. Keys explains that the avionics unit will allow separate ATS and AOC messages to be simultaneously transmitted via the system, and segregation of the data for each type of message.

An alternative to Inmarsat SBB is Iridium NEXT. This will replace classic Iridium, and Iridium NEXT will have a data transmission rate of 1.5Mbps. It is expected that it will be used for advanced flightdeck communications. It will first work on ARINC protocols, but may later transfer to I.P.

I.P. connectivity systems

Several connectivity systems have been developed for use in the passenger cabin. These are all I.P.-based systems that deliver data transmission rates that are required for passenger activities in the cabin, such as internet browsing.

The two main types of cabin connectivity systems are Ku-band and Ka-band satcom, the latter being based on a later generation of satellites. The advantage that these K-band satcom systems have is higher data transmission rates of 1-2Mbps for the first generation of Ku-band, up to 30Mbps for the high throughput variants of the latest Ku-band satellites, and 12Mbps to the aircraft with Inmarsat's Ka-band Global Xpress service.

Gogo has launched a high transmission rate Ku-band system called 2Ku-band. This uses a phased array antenna and collects the transmission in a proprietary way. It has a data download rate of 70Mbps.

Other high data rate cabin connectivity systems are the air-to-ground (ATG) system provided by Gogo for overland operations in North America. The original ATG system has a transmission rate to the aircraft of about 3Mbps, while the second-generation system ATG4 has a transmission rate of about 10Mbps.

As an equivalent system to ATG in North America, Inmarsat is launching its European Aviation Network (EAN) together with Deutsche Telekom and Lufthansa Systems. EAN will provide a combination of an ATG connectivity system from ground-based transmitters, located across the 28 countries of the European Union, S-band satellites, and Inmarsat's Ka-band satellites. The data transmission rate from the ATG transmitters is expected to be 75Mbps in each sector of the ATG transmitter's three cells.

These higher transmission rate connectivity services are based on K- and S-band transmissions, but all provide an I.P. link. Although these transmissions have higher data rates, their radio waves are all subject to attenuation by water droplets, so they can never be approved for transmission of ATS messages. This alone does not present airlines with a particular issue, since ATS messages and transmissions are small in size. A larger number of non-ATS transmissions and quantity of data could, therefore, be sent in real-time from the flightdeck, however, if the satcom and ATG S- and K-band cabin connectivity systems could be used for AOC and AAC transmissions.

There are several main concerns over the use of these I.P. connectivity systems for flightdeck transmissions. The biggest of these is the possibility of the flightdeck being hacked from the ground via the cabin connectivity system. "There are security concerns, but these only relate to the hacking of QAR data. The issues of hacking have been overstated. Airlines have been using passenger connectivity systems to send operational data for about two years, and there has been an escalation in the number of airlines using passenger connectivity to send operational data over the past six months," says Andrew Kemmetmueller, vice president of connected aircraft at Gogo. "In fact, satcom and ATG systems can be used by the passenger cabin and the flightdeck simultaneously.

"The process for an airline to start using cabin connectivity channels does not require certification from the FAA or the European Aviation Safety Agency (EASA)," continues Kemmetmueller. "The airline in fact requires operational approval from its regulatory authority, which involves the airline providing operational proof over a six-month period. The airline, therefore, has to do a side-by-side transmission of the same data simultaneously through both connectivity channels. One will be the use of a TWLU unit, such as Teledyne Controls' WGL unit, and the other will be an I.P. system the airline is seeking to get approval for, such as the ATG or a satcom system. It is relatively simple to achieve this approval because a new type of data is being sent over an existing connectivity stream. The approval process is harder when the connectivity stream is being replaced for existing data.

"Gogo now has airlines that are transmitting QAR data over several types of I.P. link. This is a relatively recent development, and some carriers consider this to be an operational advantage," continues Kemmetmueller. "The transition from a POA ACARS system with a transmission rate of 2.4Kbps to an I.P., L-band link with a much higher transmission rate, will have a massive impact on how airlines can operate, for example, using predictive maintenance. Airlines in North America started with the ATG system, and some have transitioned to Ku-band. Some will start using 2Ku-band when it goes into service."

Other solutions are coming available. Teledyne Controls has installed WGL and WGL Comm units on about 10,000 jetliners, more than half the global fleet. Other aircraft are equipped with TWLU avionics that have similar on-ground connectivity functionality. Meanwhile, Panasonic has the largest market share of aircraft equipped with its X-Connect Ku-band satcom systems. The two companies also have a lot of common customers. "We have, therefore, formed a joint venture with Panasonic to offer a combined on-ground and satcom high bandwidth I.P. data transmission package. The idea is to send QAR data in real-time using the Ku-band link," says Cecil. "This will only be worth doing, however, if somebody is going to use the AOC data in real-time, or the transmission of the data is just as cheap with this new system as it is with current connectivity pipes."

Bill Baumgarten, business development manager for aircraft data management at UTC Aerospace Systems comments that there is not yet a solution that can stream the entire set of QAR data in real-time. "This is leading to a demand for select parameters to be sent in flight," says Baumgarten. "UTC Aerospace has projects to connect cabin satcom systems with the flightdeck for non-ATS transmissions. These should be available by the end of 2016."

More maintenance and engineering departments are finding it useful to receive FOQA and QAR data in real-time. The data can be used to troubleshoot technical problems, since it will be much more detailed than the information that gets sent via ACARS. It will allow a drill-down analysis, and deeper analysis of AHM and EHM data. This can be up to 100 engine parameters. This can reveal detailed information about an engine's operational behaviour. It can even lead to improvement in an engine's design.

"Another function of enhanced in-flight connectivity will be to upload and download larger quantities of data to the EFB and ETL," continues Cecil. "We are now examining what QAR data could be sent in real-time or is worth sending in flight. This is just the first stage. The airline needs to have all the other steps of the data processing, analysis and applications to use the data in place. Our philosophy is to get an airframe or engine manufacturer to trial the system on an aircraft."

Higher data transmission rate connectivity systems for the flightdeck will come available over the next few years. This will allow frequently updated graphical weather data to be sent to the EFB, and transmissions such as ACARS messages to be sent from the EFB.

Another application developed by Teledyne is the ability to transmit ACARS messages over I.P. to get a faster and more efficient service. "This service will start with on-ground ACARS transmissions via the WGL unit," says Cecil. "It will later upgrade to in-flight transmissions when we link the WGL unit, which is interfaced with the avionics, to the X-Connect system. These will, therefore, be non-ATS flightdeck messages. The system would be suitable for EFB uploads and downloads, and will include live graphic Wx map updates as the flight progresses.

"A further development will be to interface the WGL unit with our AID device, which will then interface a standalone EFB with the WGL and X-Connect system," continues Cecil. "This will allow EFB applications to be connected to the internet, the flightdeck printer, data from avionic units such as the FMS, and the ACARS generating unit."

While it is already possible to make high volume flightdeck transmissions in flight, this is only the first of several stages to form a complete process. "The systems and applications in the various airline departments need to process, analyse and utilise the QAR and health monitoring data," says Cecil. "The problem is that most of these applications do not exist, because transmitting these data has only become available relatively recently."

i-Jet Technologies has developed a data management platform to acquire, organise, hold and process QAR and health-monitoring data that is agnostic to the hardware it is operated on and the connectivity links through which data message are transmitted. "The preferred connectivity link is an I.P. channel, and the data management platform communicates over the I.P. link," says Mallasch at i-Jet Technologies. "The data platform comprises two primary parts, one on the aircraft and a centralised server on the ground that sends and receives data from the aircraft. The platform normalises and organises aircraft data by decoding it into common engineering units. The airborne part of the platform runs on an airborne server, and can optionally interact with applications running on the EFB or server, or an EFB browser to view the i-Jet applications that communicate with the data management platform."

The ground platform element receives the data from each aircraft in an operator's fleet via the I.P. connectivity link. The aircraft can stream selected data to the ground platform, and can take advantage of any I.P. link available on the aircraft.

"The data that the platform will accept and process are the aircraft's QAR data, as well as any data that are available to the AID, or any interfaces with avionic databases," continues Mallasch. "The platform on the aircraft can be configured to choose which data to send to the ground. The platform can also specify if the data must be stored on the aircraft until an inexpensive communications link becomes available at any particular point in the flight. This could be a WiFi or cellular signal when the aircraft reaches the ground, for example.

"Airlines may be interested in receiving operational parameter exceedences or detailed health-monitoring data," continues Mallasch. "Our aim is for the platform to be flexible, so that it can be tailored to the airline's individual requirements. It can also be configured to dynamically increase the number of QAR and health-monitoring parameters if a cheaper connectivity channel becomes available. Different departments in the airline can specify what data they require. The connectivity links that the platform can utilise are on-ground cellular and WiFi signals, various levels of satcom system, and even possibly Gogo's ATG/ATG4 system. We are currently testing the system in flight trials that will use a cabin satcom system as the connectivity channel. The data are first normalised on the aircraft platform so that they can then be interfaced with a standalone EFB. The trial airline has EFBs and an airborne server installed on the sub-fleet on which the system is being tested. First, the system will be tested for the transfer of the data to the ground, and the ground platform. The platform software will then be loaded in April 2016. The software requires an airborne computer to operate, and this can be the avionics server unit.

"The ground platform is interfaced with the FOQA data processing system, and other applications and systems used by airline departments," continues Mallasch. "We are also building interfaces with existing maintenance and engineering, line maintenance, maintenance control, and flight operations systems that are already used by airlines."

Summary

The technology to transfer larger quantities of ATS, AOC and AAC data and information is already available to airlines. While a small number of airlines are already putting these systems in place, the additional applications and systems to process and utilise the data to its highest level are still under development. More improvements will become available over the coming years, and these have the potential to transform not only how airlines operate, but also their levels of efficiency. AC