



Harnessing the power
of aviation's information age

**Rockwell
Collins**

Building trust every day



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Introduction: Harnessing the power of aviation's information age



Jeff Standerski
*Senior vice president,
Information Management
Services*

The aviation industry is in the midst of a new information age. By 2030, the number of active air transport and business aircraft is expected to grow to nearly 85,000 – with 80 percent of those equipped with new information-enabled systems. Beyond the aircraft, cutting-edge innovations are creating faster and more secure air and ground networks and more streamlined airline and airport operations.

These developments are making a seamless, secure and integrated aviation ecosphere a reality.

At Rockwell Collins, we've been working to meet and exceed the needs and possibilities we see ahead in the information age. That has required investments in a robust portfolio of systems and services, from our information-enabled avionics and cabin systems to our global communications networks and services and airport information solutions. And it's leading us down exciting new paths, developing applications and services that leverage that global portfolio to bring new value to our customers by improving safety, maintenance, flight operations and more.



Kent Statler
*Executive vice president and
chief operating officer,
Commercial Systems*

We also have a vision for the future of our industry, powered by the seamless and secure flow of information:

- › Intuitive, information-enabled flight decks and aircraft that use data from on-board and external sources to provide new levels of analysis and awareness for pilots, airlines and manufacturers
- › Cabin solutions that change the paradigm from passenger entertainment to passenger engagement while helping airlines achieve their goals
- › Airport operations that streamline passenger processing, increase efficiencies and enhance revenue
- › A robust and flexible network that pairs bandwidth to manage information across the aviation ecosphere with the necessary security to keep our passengers and our airspace safe
- › A future airspace that leverages the flow of shared information to address the congestion of today with a new model of aircraft and airspace management

Rockwell Collins: An information management pioneer

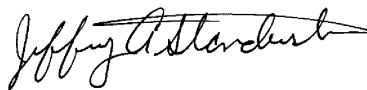
Rockwell Collins has long been an industry leader in information management technologies, from innovative situational awareness solutions in the Boeing 787 flight deck to the information management on-board solution connecting the new Airbus A350 XWB. And our Pro Line Fusion® integrated avionics system – originally developed for business aviation and now on regional platforms including the Bombardier *CSeries* and the Mitsubishi Regional Jet, and even rotary-wing and military aircraft – gathers and delivers the right information at the right time to enhance effective decision making.

In 2013, Rockwell Collins took the next step in its information management vision by acquiring ARINC, a leader in global air-to-ground and ground-to-ground networks. Today, with a growing portfolio that includes both networks and the avionics, cabin and airport solutions that leverage those networks, Rockwell Collins is uniquely positioned to develop information management solutions for airlines and business aircraft operators that integrate cutting-edge hardware, software and connectivity – all from a single provider.

In this e-book, we've asked experts from across our company to build on this vision, exploring how our industry can best harness the power of aviation's information age from a variety of perspectives.

We're excited to share their thoughts with you in order to begin a broader conversation about how we can all work together to harness the power of aviation's information age. ♦

– Jeff and Kent



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Networks: Four principles for tomorrow's information flow



Yun Chong

Vice president, Commercial Aviation Solutions, Information Management Services



Alexis Hickox

Senior director, Strategic Development, Information Management Services

The lifeblood of aviation's information age is information itself: the massive volume of data carrying everything from passenger reservations to critical flight instructions to maintenance records. To ensure that information is accessible across the entire aviation community, our industry requires a network that is secure, reliable and resilient.

As we think about the future of Rockwell Collins' global network, we've identified four key principles that will help the industry achieve maximum benefit from the network today and identify how best to invest in tomorrow.

Principle 1:

Match the right data to the right channel

The global aviation network is composed of numerous communications conduits, both airborne and ground based. The challenge is to match the right data to the right channel in order to maximize efficiency and minimize cost.

For instance, on a single transoceanic flight, pilots may send data to air traffic control via VHF (very high frequency) when over land soon after takeoff, while later, the crew might receive updated weather information through HF (high frequency), and engine operating parameters might be transmitted automatically to an airline maintenance base via Iridium satellites. All while an executive in business class is remotely editing a presentation via SwiftBroadband.

The route that each of these messages takes is driven by cost, availability and security. Safety service data-link messages sent over land masses are best suited to an ultra-secure connection like VHF. Over oceans and polar routes, HF is the most reliable alternative for continuous contact, with global satellite constellations like Iridium and Inmarsat's Classic Aero also options.



These channels continue to evolve. Next-generation digital VHF is an essential component in the FAA's NextGen® initiative. Called VHF data link (VDL), it is more robust, faster and has higher capacity than its analog counterpart. This new technology signals a transition from a voice-reliant air traffic control system to a digital model designed to exchange text messages between ground-based controllers, the flight deck and other aircraft. Likewise, HF ground stations are transitioning to digital technology and data communications. The voiceless system will enhance safety, increase efficiency and reduce pilot-controller workload.

The next generation of ACARS (Aircraft Communications Addressing and Reporting System), called ACARS over IP, is designed to utilize higher-speed broadband channels, allowing support of the iPad® and other smart devices. This creates the opportunity to connect Internet-enabled devices to cockpit avionics in order to efficiently update navigation databases and transfer flight plans. In June 2015, Rockwell Collins announced that it is working with the FAA and Hawaiian Airlines to evaluate the use of Inmarsat's SwiftBroadband to transfer ACARS data messages for safety services, as well as electronic flight bag updates and airline operations communications.

These advancing technologies and applications signal an important evolution in the global network. As an industry, we will need to continue to calculate the proper balance of security, bandwidth, efficiency and cost to stay connected in every phase of flight.

“We will need to balance security, bandwidth, efficiency and cost to stay connected in every phase of flight.”

Principle 2:**Interoperability matters**

Today's aviation ecosystem – from aircraft and airlines to airports and agencies – is built upon myriad systems of different complexities and ages. And whether they're used to control passenger flow at an airport, manage flight delays through airport operations or maintain security and border data delivery, each system can utilize different protocols and transport mechanisms.

This makes interoperability between systems and applications – as well as the secure transmission of operational and business-critical messages – an essential component of networks, today and in the future. Regardless of the message format, network protocol or access technology that each aviation partner uses, the network must seamlessly facilitate communication with airlines and aviation partners. All this must be done with a focus on availability, reliability and data integrity.

Principle 3:**Make the best use of data**

Consider that a single Boeing 787 Dreamliner on a single round-trip international flight generates a terabyte of data. The sheer volume is enormous, and it will only continue to grow as new communications technologies, greater transmission speeds and increasing demands for information develop. Making the best use of data means finding new ways to enhance its value and delivering it to the right people at the right time.

For example, ACARS is useful for far more than merely position reporting. The system can transmit a constant stream of performance data, including reports on engines and components that will yield significant maintenance, time- and cost-saving advantages.

It also can be used for positioning assistance. The tragic loss of MH370 last year reinforced that even in this age of rapidly advancing technology, we could still lose track of an airliner. In response, Rockwell Collins and others introduced solutions that tap into a variety of data sources to locate aircraft. Rockwell Collins' ARINC MultiLink™ flight tracking services combine ACARS, ADS-B and -C, high-frequency data link and other data resources to reliably monitor the location of an aircraft anywhere in the world.

Data can also improve efficiencies, which impact customer satisfaction – and the bottom line. Consider the challenge of matching airport ground systems and staff with the variability of air travel. If a plane lands before ground staff is ready for it, passengers and crew are stuck waiting on the tarmac; if it shows up late, then staff sits idle, driving up costs. By delivering and integrating ACARS and IATA messaging data into airport systems and applications to dynamically manage these assets, airports and airlines can achieve significant cost savings.

Principle 4:

Peace of mind is paramount

As systems become increasingly interconnected, interdependent cyber security has become a growing concern in civil aviation. Network security threats are diverse and persistent; a large part of the data that traverses private aviation networks is sensitive and relates to passengers' reservations.

In this environment, security is essential. Today, private aviation networks like those from Rockwell Collins are outfitted with multiple firewalls and security mechanisms to ensure that the security of critical communications is airtight, and that policies and protections align with IATA security rules and mandates.

As we explore new channels of communication to meet the needs of the information age, we must ensure that they can support those same levels of security at every moment of transmission.

But peace of mind goes beyond ensuring messages are protected at every point of transmission – it's also about ensuring the information arrives at its intended destination in a timely manner. Even as our industry embraces new technology like ACARS over IP and standardized, web-based applications like XML Web Services, we believe the curation of message delivery is a critical component of information management – knowing exactly where a message is at any given moment, and if something goes wrong, where that error occurred and what backups are available to ensure the message arrives at its destination.

Conclusion

In aviation's information age, an ever-increasing volume of data streams across the sky and around the earth. Developing faster ways to transmit, store, process and access that information – leveraging the latest ground- and satellite-based communications technologies – will be necessary to ensure our industry can take full advantage of the opportunities ahead. ♦

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Flight Deck: A new phase in information management for flight crews



Linda Peyton
*Senior director, Avionics
Products Engineering,
Commercial Systems*

In today's world, instant access to information is expected in our daily lives – and the cockpit should be no different.

Tablets and electronic flight bags (EFBs) are commonplace, replacing massive suitcases of paper carried on board to reduce weight and make it faster and easier to access and input flight-critical information.

The next step? Combining these information-enabling devices with a new generation of connectivity options in the air and on the ground.

For flight crews, this means the ability to get a more complete weather picture created by inputs from on-board weather radar systems, dispatchers and even other aircraft. Other capabilities include flight plan and technical logs, uploaded in real time, as well as new flight and crew recordkeeping tools to instantly share data with back-office operations for better management of human assets.

So how do we get there? By continuing to build on the pieces we have in place. Let's take a closer look at the interfaces, information and connectivity pieces associated with the flight deck of today – and where that can take us in the future.



Simon Tudge
*Senior director, Strategy
and Business Development,
Information Management
Services*

The evolving human-machine interface

Today's new flight decks – with graphic, all-digital, large-screen, multifunction displays – look nothing like the hodgepodge of electromechanical, single function gauges that still exists on older aircraft. In fact, these “glass cockpits” are much like the computers we use in our office environments. In smaller aircraft, some of these displays are even touch-screen, like on Rockwell Collins' Pro Line Fusion integrated avionics systems.

The evolution to these more intuitive human-machine interfaces didn't occur just because of the latest technology – they were developed with a purpose. Through human factors research, we strive to deliver ever-increasing amounts of information in ways that will best suit the pilot's attention, workload and decision making.

This human factors research is what led to the development of the head-up display (HUD). Placed in the pilot's line of sight, the transparent HUD allows pilots to keep eyes forward while still having access to essential flight information during some of the most critical moments of flight.

And this isn't all. Other human-machine interface methods such as multi-touch, voice and gesture control are under exploration, as well as emerging display technologies like 3D and OLEDs.



Going beyond the black box

As we know in our own lives, the quality of the work we do is only as good as the information we get. And the quality of the information that pilots have access to – whether it's communication, navigation or surveillance data – must be of the highest integrity. We've made unbelievable strides in this area, but the advent of new technologies makes the future even more exciting.

Today, the information that's fed into the cockpit traditionally comes from hidden "black boxes" on board the aircraft. These brains of the plane are actively processing data about their respective functions and delivering them to the pilots. That information is increasingly being gathered from sources beyond the black box – including

sensors positioned on the outside of the aircraft. In the future, this information will be streamed in from sources on the ground or even from other aircraft.

Two great examples of how new sources of information are being harnessed and displayed in the flight deck are enhanced vision systems (EVS) and synthetic vision systems (SVS), each of which greatly increases situational awareness.

These technologies have created new ways to display information so that pilots can overcome weather and reduced visibility issues. EVS integrates infrared images so pilots can literally see the runway environment, aircraft on the ground and moving vehicles through darkness and

fog. And making the picture even better, SVS creates computer-generated images of the world around – airport detail and surrounding terrain in real time, so the pilot is always flying on a clear day. As valuable as EVS and SVS are to pilots in a head-down position, the benefit grows markedly when they are depicted on a head-up display (HUD). Today, Rockwell Collins is combining both EVS and SVS into a combined vision system to create a single “best” view of the outside world – a view that could even be augmented by additional imaging sources in the future.

Now imagine the possibilities that exist if we can leverage new sources of information beyond the aircraft and new connectivity pipelines to create an even more complete picture – and even enhance airline back-office operations.

“Information-enabled flight decks can bring new rigor to back-office assessments of FOQA and MOQA data.”

For example, information-enabled flight decks can also bring new rigor to back-office assessments of Flight Operations and Maintenance Operations Quality Assurance (FOQA and MOQA) data, resulting in efficiencies and cost savings. FOQA data –

automatically downloaded at the end of a flight to airline operations via Wi-Fi® or AeroMACS – can help identify performance trends that can be used to improve approach and landing safety. Similarly, maintenance data is sent to operators on the ground in essentially real time, allowing maintenance crews to be ready to repair immediately to help ensure dispatch reliability and reduced unplanned aircraft-on-ground issues.

Securing flight decks in the information age

The advent of the information-enabled flight deck – passing data between on-board systems as well as with air traffic control and airlines below – brings remarkable potential for efficiency and safety improvements. But as recent media discussions have highlighted, these benefits are accompanied by sincere concerns for data integrity and security.

Clearly, avionics and cabin solutions manufacturers place the highest priority on security of these systems, and Rockwell Collins is a leader in providing secure information management solutions to our markets. Primary areas of focus include building in high levels of redundancy, managing the separation of passenger systems from flight-critical systems, and developing and implementing enhanced security features.

We are also collaborating with industry regulators, customers and suppliers to develop new standards and cyber policies to assure the highest levels of protection. And at Rockwell Collins, our commercial avionics teams work hand-in-hand with colleagues in our Government Systems business who develop mission-critical, military-grade security protocols for warfighters and even heads of state. These collaborations help engineers identify and adopt the most secure yet flexible solutions to the critical issue of information security in flight.

Conclusion

In today's data-infused world, there is remarkable potential for information-enabled and connected avionics to ease pilots' workflow, enhance decision making and help crews and airlines better manage their resources. By building upon the designs of today, while embracing new ways to intuitively deliver the right information at the right time, we can ultimately gain enhancements in functionality, safety and efficiency for pilots, airlines and the entire aviation community. ♦

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Cabin: Engaging and empowering passengers beyond IFEC



Richard Nordstrom
*Senior director, Global
Marketing, Cabin Solutions*

Look around the boarding gate at any airport. Judging by the number of earbuds, charging ports and mobile devices in use, there is no denying that today's travelers are multitaskers. In fact, today nearly 90 percent of all passengers travel with at least one personal electronic device (PED), and the number of passengers carrying multiple Internet-enabled PEDs for talk, text, streaming video and listening to music – often at the same time – continues to surge.

Creating effective cabin solutions in this new information age calls for our industry to look at the world differently, finding new ways to meet customer needs while protecting and even enhancing the bottom line. Airlines, manufacturers and service providers are actively exploring, developing, enhancing and implementing the tools and technologies that address passengers' needs today and their desires for tomorrow.

A new paradigm: passenger engagement

In this environment, our current industry term, in-flight entertainment (IFE), is woefully inadequate to describe what the passengers of 2015 want to do on their journey. While IFEC – with the “C” standing for connectivity – is a step in the right direction, we really should be thinking about a whole new term: passenger engagement.

Passengers are engaged with their mobile devices from the time they leave home to the moment the airlines close the aircraft door. And they're seeking and even expecting to link their earth-bound connection with their flying experience.

For instance, consider the plethora of things you may see a single passenger do while in flight: A game or two on their smartphone. Maybe a movie, or an episode of “NCIS” on the iPad. A little work on a presentation or spreadsheets and some email or messaging with the office on their laptop. A chapter of the latest John Grisham novel while listening to some music. Not to mention thinking about the next airline connection or how to most quickly get to ground transportation.



What can we do to curate cabin solutions that engage each passenger throughout his or her experience? The answer to that question offers an engineering challenge with great opportunities to meet today's and tomorrow's expectations:

- Games, movies, music and even digital books can be made accessible to personal devices from centralized servers on board, some free and some monetized. All of those consumption choices are recorded in passengers' personal preferences – stored online and on their devices – so they don't have to start over every time. It's not hard to even imagine the capability to start watching a movie on one flight and finish it up on the next leg.
- But entertainment is only the start: Personalizing the passenger's experience from frequent flier data and previous selections makes for an Amazon/Google-style relationship, leveraging up-to-date information to bring great value to the passenger and the opportunity for the airline to enhance the service capability. Passengers can order drinks or indicate meal or snack preferences via a smart app. Or, if the passengers prefer, they can simply expect that flight attendants will know their drink and meal preferences, improving efficiency and customer satisfaction. Duty-free orders and shopping can be completed instantly thanks to on-board credit card authorization. Even their window shade or reading light preferences can be stored to ensure a highly tailored experience.

- › While airlines today usually charge for high-speed connectivity, we will see airlines be more willing to look at connectivity as a free service, to build loyalty and enhance revenue as a result of the almost unlimited things connectivity can bring to the passenger while in flight.
- › The experience of travel is one of unknowns and uncertainties. Since we will know passengers' travel plans from home to hotel, we can help them along the journey to reduce travel stress and make flying an easier experience for all. Whether it's providing directions on the quickest way to their next leg through a busy airport; tracking their baggage in real time throughout the trip; providing up-to-the-minute weather forecasts; or serving up coupons and travel advice custom-selected for their final destination.

“With GX, passengers will be able to remain in constant touch with the world below.”

Delivering on the promise of high-speed connectivity

In this 24/7 connected world, the outcry for constant connectivity has gone from a shout to an uproar. Passengers are looking for the ability to move their totally connected digital life from home and office to the airport and the aircraft cabin.

Today, I believe we've hit a tipping point in the business case for connectivity on an ever-growing number of aircraft. Even as the demand for high-speed connectivity soars, costs are plummeting, technological capability is skyrocketing and hardware size and weight are shrinking. These advancements not only make the traditional cost-benefit analysis a must for long-haul twin-aisle carriers, but are also making it more alluring for short-haul, single-aisle jets as well.

With next-generation connectivity, more passengers surf the Internet, send and receive email and use social networking and text messaging on mobile devices. Additionally, anything that is traditionally paper-based can be transmitted while in flight, creating efficiencies through more on-time flights through faster gate turns, while enhancing value to passengers through personalization.

We are seeing exciting new movement forward. Companies including Inmarsat, Iridium and industry newcomer OneWeb are offering higher speeds and larger bandwidth. Inmarsat's latest-generation Global Xpress (GX) constellation is designed specifically for the fast-moving mobile aircraft environment. With GX, passengers will be able to remain in constant touch with the world below, surfing the Web, updating Facebook or checking email at speeds previously unimaginable.

Getting a broader pipe to the aircraft is only part of the battle. The next step is the “final inch”: having an on-board wireless routing system that reliably and consistently delivers that high-speed connectivity to a wide variety of devices and possibly hundreds of passengers. Innovations from a company recently acquired by Rockwell Collins have broken that barrier, and planeloads of passengers will quickly be able to experience something much more akin to home performance levels, even at 40,000 feet.

Flexible solutions for flexible situations

At the core of every cabin solution are some key tenets: reliability, performance, ease of use and content management. But beyond those core elements, the needs of each airline are nearly as diverse as those of the passengers they serve. They can run the gamut from cabin solutions driven by a desire to generate additional revenue, to the desire to create brand loyalty through an extraordinary customer engagement experience. Having a business model flexible enough to address airlines’ needs – wherever they are on that spectrum – will be essential to ensuring airlines and passengers each achieve their desires.

The business case for the information age

Today’s cabin experience has evolved from a relatively passive entertainment experience to one of passenger engagement. To ensure passenger satisfaction and loyalty, we must meet their higher expectations – while also ensuring that airlines achieve their goals. The advent of new connectivity technology, advanced wireless cabin networks and applications that “listen to the market” will be a win-win for passengers and airlines alike. By working in close partnership between airlines, manufacturers and even passengers themselves, we can continue to develop the richer, more engaging experiences that will meet and exceed those expectations, and position airlines and the entire industry for success. ♦

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Airports: The airport of tomorrow

The information age is quickly transforming aviation, touching every aspect of air travel from point of departure to ultimate destination. But nowhere will the change in passenger experience be as profound as at the airport itself. The airport of tomorrow will be a very new and exciting experience. In fact, it may well become one of the more pleasing parts of the journey, rather than one of the most maligned.



Chris Forrest
*Vice president,
Global Airports, Information
Management Services*

A seamless progression

Tomorrow's travel experience will inevitably begin the moment you make your reservation. Your booking details and associated information will travel over a protected private network, security hardened to meet demanding TSA requirements. Once you arrive at the airport, the traditional bottlenecks associated with transitioning – from the curbside through check in, and then through security to the airline departure gate – will quickly disappear. Inside the airport, you will have choices of how to check in: at a self-service electronic kiosk, traditional desk-based check-in, automated self-bag drop station or even opt-in auto check-in when entering the terminal. If you have bags to check, self-tagging stations will allow you to efficiently manage your luggage. Regardless of where you check-in, your identity sensors will confirm you're the owner, even if you have no bags and go straight to security. Your boarding pass, identification and

biometrics will allow you total control of your passage through the airport, all the way through aircraft boarding.

"Pipe dream" you say? Actually, we are nearly there.

The boon of biometrics

The key to this automated travel vision is biometrics – which can come in the form of iris scan, fingerprint, facial recognition and a number of other forms. The technology is poised to eliminate the largest air travel holdups in check-in, bag drop, security and boarding. Through these systems, we can remove the most time-consuming element of that airport journey: human interaction. Conventional wisdom worries that without the human element, security is negatively impacted. But the reality is actually the exact opposite. With 1.8 million passengers screened in the United States each day – and millions more worldwide – there is a constant and real danger of human error. With biometrics in every phase of the process, however, airports gain tireless sentinels that remain equally vigilant with passengers from inbound flights as they are for outbound travelers. For example, on inbound international flights, much of the passenger verification process can be completed even before the aircraft lands, so as soon as the landing gear touches down and the cell phones come out, many passengers

will be met with a message instructing them to go straight through fast track customs, rather than waiting for an agent.

Integration and wireless innovations

Airports today are asking for fully integrated, end-to-end solutions that include these self-service systems. This data-driven approach allows airports to reallocate resources, leading to lower costs, greater efficiency and a greatly enhanced passenger experience.

And advances in wireless technology mean these advancements often no longer require miles and miles of cables and expensive and time-consuming renovations. When harnessed to an extensive smart network within the airport and unified with a secure global network, wireless technology can enable new frontiers in mobility and geolocation. For example, using inexpensive, off-the-shelf wireless beacon technology and a simple

smart phone application, an airline can send individual or group messages to inform only targeted passengers of relevant gate changes, or ground handlers can be apprised of an impending thunderstorm. In fact, these systems can identify the closest ground handler to secure vehicles nearby. Whole systems of perimeter cameras can be controlled wirelessly without the cost of physical cabling, and airports can create geo-fencing to keep specific assets in particular areas, warn ramp drivers about their speed or immediately direct fuel trucks or other services to any aircraft.

Best of all, this integrated technology can be deployed in a modular fashion, allowing airports to choose a la carte from an extensive menu depending on need and budget. In addition, innovations in secure and reliable cloud technology open up new possibilities for shared service models in place of local infrastructure, making the technology more efficient and cost effective, even for the smallest airports.



Baggage and flight information breakthroughs

The airport environment will become much more interactive and more customizable, transforming a destination often viewed with mild dread into a relaxed and even enjoyable experience.

For instance, the baggage handling experience will see one of the biggest changes during the next five to 10 years. With self-service bag tagging and bag drops, if you've already checked in prior to airport arrival, you can go straight to a self-service bag drop station, scan your boarding pass and ID and, after instant biometric confirmation, print out your own bag tag and place the bag on the conveyor belt yourself. Even more enticing, this automation can allow you to move these processes away from the airport to the rental car center or a multimodal hub; while there are still agents involved, we are seeing ongoing experiments with this model at Hong Kong International Airport.

The next evolutionary step involves the conundrum of connecting flights. "Where do I go when I get off the plane? Where is the gate? How long will it take to get there?" Flight information, which is normally relegated to a fixed, terminal-based monitor, can be sent seamlessly to the aircraft in-flight entertainment system or passengers' mobile device. Upon landing, dynamic way-finding will make it even easier to navigate toward the next departure gate, a restaurant, concession or any other airport facility and show the walk time needed. And, rather than searching for a restaurant or waiting for a table, passengers can use the app to make a timely reservation so the table is ready when they arrive.

"Passengers can use a seamlessly connected app to make a reservation so the table is ready when they arrive."

Efficiency through dynamic resource allocation

The stop-and-go nature of airport operations means that all too often, large sections of valuable real estate remain unused during lulls in schedules, wasting time and resources. But innovations in technology offer new ways to more effectively share these facilities:

- **Check-in desks** – Check-in desks will have a similar transformation. Instead of having an abundance of frequently unused space, it's possible to have common use facilities where each airline's branding will display prominently as needed. Check-in software is customized, so agents only need to touch a specific airline icon and the screen will reflect their own airline system.

- **Wireless check-in** – In addition to the efficiency of common check-in facilities, it's possible to take agents completely away from check-in desks. Roving agents using wireless tablet computers could go from bottleneck to bottleneck, checking passengers through more quickly during weather or mechanical delays. In fact, systems like these are now operating in more than 100 airports globally, and the numbers continue to increase.
- **Dynamic gate allocation** – All too often, travelers share stories of touching down 20 minutes ahead of schedule, but then finding themselves still stranded on the tarmac because there is no gate available. So, instead of having dedicated gates that may be used infrequently, the airport of tomorrow will boast dynamic gate allocation that allows a gate to be used for one airline at 10 a.m. and then a completely different airline 30 minutes later. Within the airport, signage and branding will change automatically to accommodate the particular airline, maximizing use of available assets and gates much more efficiently.

Conclusion

Research tells us that passenger satisfaction can have a significant impact on customers' spending choices, and today many airport experiences don't necessarily meet all passenger expectations. But passenger processing technologies – those already in the marketplace and those on the near horizon – hold great promise to leverage greater systems integration, mobile technology and smart devices for greater efficiency, lower operating costs and a transformative passenger experience.

After all, once you breeze through an airport – through check-in, bag drop and security – with a smartphone and a smile because you instantly know your flight is on schedule, how to get to the gate and even which coffee shop is offering the best deal along the way, there will be no turning back. ♦

Airspace: Using information to move from control to management



Richard Heinrich
*Director of Strategic
Initiatives, Commercial
Systems*

Today our skies are busier than ever, with more flight operations and more passengers and cargo generating more revenue throughout the global economy. More than 3 billion passengers take to the air annually, and the International Air Transport Association forecasts long-term average annual passenger traffic will grow five percent annually.

To address this unprecedented expansion, we are in the midst of a complete transformation in the global airspace structure, driven by timely access to critical information. We are moving from our historical standard – one of air traffic control – to a more flexible and efficient standard, air traffic management. This paradigm shift can yield improved safety, efficiency, environmental responsibility and customer satisfaction. And it all relies on the exponential growth in our industry's ability to rapidly access, disseminate and interpret a vastly intensified flow of quality data – reliably, resiliently and securely.

Moving from control to management

Today, air traffic control is based on the idea of prediction. In this model – which has been the status quo for generations – aircraft position is interpolated via a combination of ground-based radar, procedures and human interaction. To facilitate this system, pilots and controllers exchange requests and responses within a rule-based structure, with all actions resting in the hands of the controller – the equivalent of “Mother, may I?”.

This rigid model can quickly create aviation's butterfly effect, with small changes rippling through the system to cause major delays: a possibility of a storm in one city results in a handful of canceled flights to ensure aircraft and crew can operate somewhere else. But those cancellations often begin to spread, meaning that by the end of a day, flights might be delayed or canceled at multiple airports across the nation and even beyond. Moreover, while pilots and controllers operate with one set of data, flight dispatch has different information.

But a new model offers new possibilities. In an air traffic management model, the paradigm shifts to one of management: The controller no longer holds singular control, but instead manages automated processes for a more optimized result. In this model, airlines, airports, air traffic managers, dispatch, pilots and transportation security have seamless access to

the same information at the same time, removing ambiguity via a process called Collaborative Decision Making.

For instance, consider weather information, one of the critical information elements affecting safe and timely operation of the airspace. With reliable, resilient and secure connections, we can merge space-based weather observations, ground radar, airborne weather radar and weather data derived from sensors aboard commercial airliners into a near-real-time blended picture. This intensely vivid weather picture – retrieved from a common storage environment – can significantly improve weather forecasts, enhancing safety and improving decision making.



Enhancing security through rich information

Access to such a rich and varied stream of data can also make the data and decision making more secure. Consider the heightened difficulty for those who would attempt to compromise the information within a system: That information – gleaned from a multiplicity of sources – is now changing in near real time, making it less vulnerable to tampering. And there is also operational security, afforded by all decision makers having access to that common information.

But that's only the start. Adaptive, multi-layer security will also ensure that the information and the decision-making processes are robust. Communication exchanges, surveillance data processing, airspace operations, collaborative decision making, etc., will all bring their unique methods of consuming that information to improve the protection envelope while minimizing the impact of system overhead.

Optimizing for the benefit of all

Think about the verbiage we use to talk about advanced airspace operations: “Optimized Profile Climb.” “Optimized Profile Descent.” “Optimized Flight Profile.” This optimization comes from not thinking of our aviation ecosystem as a fragmented series of ground systems, airborne systems, planning tools, etc., but as a true “system of systems,” with aircraft, flight operations and the back office all acting as nodes on a greater network, assessing the impact of any decision on a single user and everyone.

As my colleague, Chris Forrest, mentions in the Airports section of this e-book, the availability of real-time information – shared among all the players – can result in real efficiencies for passengers and airlines by allowing gates to be assigned more dynamically. This can also mean less ground time between flights and, perhaps, even additional stages per day. In fact, the net result could quickly become the equivalent of purchasing another aircraft – without any associated cost or overhead.

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But there's also great benefit to the system as a whole: Improved routings will reduce fuel consumption, which will decrease emissions and improve the environmental footprint. Passengers will benefit from improvements in on-time departures and arrivals. And airlines will benefit through improved asset utilization and enhanced system performance.

And in the future, information will allow a distributed system to essentially “heal” itself if there's a system fault, before those faults cause serious issues. By mining the data for trends, we can begin to better predict failures before they happen, leading to better decisions earlier, and improved report and overall safety. In fact, we can already see tantalizing possibilities of this today. Many of today's congested airports utilize Flight Interval Management, a process where controllers and flight crews share information to dynamically manage and optimize spacing during arrivals, like beads on a string.

How do we get from here to there?

Although these improvements in efficiency will ultimately pay for themselves, will implementation be hindered by stringent certification requirements or other challenges?

As I mentioned, we see enticing possibilities even in today's airspace environment. Regulators are already responding with new certification philosophies using a risk-based certification process that carefully evaluates safety benefits. For example, small general aviation aircraft are gaining unprecedented advantage from tablet devices that bring a wealth of information to the cockpit, including real-time traffic and weather data. The improved situational awareness and enhanced safety gained by assessing traffic and avoiding intense weather or icing conditions is far more beneficial than restricting it through brittle regulation.

There is no question: We are on the cusp of a new day – one where information enables enhanced operations, improves system efficiency and ensures that every flight operation is safer than yesterday. Most important, it means greater efficiency and cost savings for the end user and an enhanced quality experience for the passenger. ♦

➤ Join the conversation about aviation's information age on our [LinkedIn page](#).

Conclusion: The power lies ahead

Aviation's information age is upon us, and the potential to transform the industry is tremendous, from streamlining the journey of a single passenger through an airport to more efficiently managing a whole airspace of flights every day.

To accomplish this transformation, information management – seamless, optimized and secure – is essential. That doesn't mean simply raw data, but actionable information, analysis and applications, delivered at the right time to the right resources.

Rockwell Collins is investing in the elements to help our industry take on that challenge. But even with a portfolio that reaches across the aviation ecosphere, we recognize that harnessing the power of aviation's information age requires the understanding and input of all the communities involved, from airlines and pilots to airports to agencies and even passengers and partners.

We hope this e-book serves as the first step in facilitating a larger discussion around these topics and our industry's future. We welcome the opportunity to continue the conversation.

Building trust every day.

Rockwell Collins delivers smart communication and aviation electronic solutions to customers worldwide. Backed by a global network of service and support, we stand committed to putting technology and practical innovation to work for you whenever and wherever you need us. In this way, working together, we build trust. Every day.

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