CPDLC—A NEW DIMENSION IN AIR TRAFFIC CONTROL

The Federal Aviation Administration (FAA) will be one of ARINC's largest data link customers under its Controller-Pilot Data Link Communications (CPDLC) Program. A key element

**John Burks
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in the next dimension of air traffic control, CPDLC enables the exchange of air traffic control (ATC) information and instructions over a digital air-to-ground communication link. Communications are displayed as text messages on controller and pilot displays with less delay, interference, and confusion than current voice transmissions.

ARINC is the world leader in developing and deploying VHF Digital Link (VDL) Mode 2 that, in conjunction with the Aeronautical Telecommunication Network (ATN), enables the use of data link for ATC communications in continental U.S. airspace. Recognizing the importance of CPDLC, ARINC partnered with the FAA, American Airlines, and Rockwell Collins to take the first step toward full CPDLC service in one Air Route Traffic Control Center (ARTCC)—Build 1. Deployment to all 20 continental ARTCCs—Build 1A—will follow. Although the program did suffer setbacks after September 11, it is back on track. CPDLC service is scheduled to begin in the Miami ARTCC later this year, and Build 1A in December 2005.

During the last year, ARINC completed initial ATN software development and deployed an ATN/VDLM2 network in Florida. We also conducted extensive ground and flight testing with the FAA, Rockwell Collins, and American Airlines. FAA ATC data link processors, controller displays, the ARINC VDLM2 network, and Rockwell Collins avionics have been thoroughly tested. ARINC supported over 10 weeks of flight testing in the Miami area, usually between midnight and dawn, with ARINC engineers working both in the test aircraft and the network operations center. Although the testing was taxing for the entire team, it allowed us to identify and resolve any problems—prior to operational service—that could have scuttled the program.

Other ARINC customers have also begun VDL and CPDLC conversion. In addition to American Airlines, Continental is flying with VDL equipment, and Delta will begin testing and conversion in late 2002. FedEx, the Air Force, and others are also planning for Build 1 participation. ARINC is working with all its airline partners to provide a better understanding of the benefits of VDLM2 and CPDLC and to help them with technical efforts necessary for upgrading. CPDLC is a critical element in the Free Flight concept and ushers in a new dimension in air traffic control. ●

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CUSTOMER ARTICLE

CPDLC OPERATIONAL TESTING AND TRIALS

It seems that routine operational use of a new digital data link has been "right around the corner" for some time. Using ATN over VDLM2, air traffic controllers and pilots will be able to exchange routine instructions, requests, and replies using data link instead of voice. Among the anticipated benefits, one of the first will be some much needed relief on voice frequencies in high-density traffic areas.

**Frank Cheshire
CPDLC Project
Coordinator,
American Airlines**

**Andy Fry
Flight Operations
Technical Lead
and CPDLC
Project Manager,
American Airlines**

It will also provide suitably equipped airlines with improved aeronautical operational control (AOC) by accelerating ACARS to digital transmission rates. The good news is that after years of preparation and development, the time is indeed upon us.

Last summer American Airlines participated in the data link flight trials in Europe, known as PETAL IIe. Earlier this year we started preliminary testing with Miami Center—testing that will lead to routine use of ATN over VDLM2 in Miami Center airspace as part of the FAA CPDLC Build 1 program. In addition to the B767s used in PETAL IIe, American will

DATA LINK: THE UNIVERSAL LANGUAGE

John Belcher
President and
Chief Executive Officer,
ARINC

ARINC has a proud heritage in aviation since our founding in 1929. We were first with an air/ground data messaging system (ACARS, deployed in 1978) and, a little over two decades later, first with a digital data link AOA and ATN solution, VDLM2. As President and COO since September 1997 and CEO as of May 2002, I am honored to be associated with the name ARINC. As our positioning statement says, we are proud to be "The World Leader in Transportation Communications and Systems Engineering."

ARINC's global air/ground communications service, deployed in conjunction with our partners, now has 780 ACARS ground stations. Together, our VHF ACARS, HF data link, and SATCOM services provide total global communications coverage. In addition, 73 ground stations are now operational on VDLM2.

VDLM2, our major capital investment, is currently in an operational phase. The first commercial flight using VDLM2 took place December 13, 2001—an American B757-200 flying from Tulsa to New York. This past March, an FAA test aircraft exchanged more than 100 routine air traffic control messages with its ground controller—without using voice contact. We are extremely excited about VDLM2, as its use for additional AOA applications and routine ATC messaging will dramatically reduce voice communications and frequency congestion and, as new applications are implemented using the expanded bandwidth, will reduce airline and CAA operating costs as well.

Over the past month, I have had the opportunity to meet with our Asian, European, and Middle Eastern partners at our customer meetings in Bangkok and Barcelona. I prefer to use the word partners, as our approach is to be an integral partner with the 95 air carriers around the world now using ARINC air/ground data communications. We recognize that we are a fundamental part of their operations and must ensure the highest levels of quality and systems availability.

We hold our company responsible for meeting or exceeding six major quality goals to ensure high availability and back this up by tying the goals to employee bonuses. In 2001, we attained 114.4% of our corporate quality goals. For example, outages at the top 39 critical airports totaled less than 6 minutes in 2001. For the first five months of 2002, we have continued with no outages.

ARINC's global presence continues to expand. Our European headquarters, under Managing Director Graham Lake, opened only two years ago in Crawley, United Kingdom. That office has grown substantially this year, and we are extending our reach in Europe with new facilities in Munich and Milan. We now have staff in Switzerland, France, Spain, Belgium, Italy, Russia, Finland, Germany, and the Netherlands, as well as offices in Beirut, Cairo, and Jeddah to support the Middle East and Africa. In Asia, along with our existing offices in Bangkok and Beijing, we have just opened a new facility in Tokyo and are adding one in Hong Kong. In addition to maintaining a physical presence near our customers, we provide truly global customer service through our ARINC Call Center, which helps our customers 24 hours a day, 7 days a week, in 140 languages.

After the September 11 tragedy, we in the aviation community have a greater responsibility to use technology to help our customers reduce operating costs by offering increasingly competitive and low-cost solutions. We can do so by making better use of existing systems and increasing revenue through innovative customer service. ARINC recognizes the need to form close relationships, speak the same language, share the same culture, and be located in the same time zones—and as you can see, we are taking action to do all of this and more. We look forward to a successful year working with our global partners. ●

ACARS: ALASKA AIRLINES IMPLEMENTATION

In late 1998, Alaska Airlines made the decision to equip our fleet with ACARS. Today, 91 of our aircraft are ACARS-equipped, and we are moving toward our goal of 97 aircraft.

Joellyn DeRonghe
ACARS Project
Manager,
Alaska Airlines

The requirement for an alternative method of communication—because of radio congestion and the need to track OOOI times more accurately—provided the justification for installing ACARS. Implementation consisted of four major components: a service provider, an equipment supplier, an installation plan, and ground messaging software. Selecting a service provider and equipment was easy: ARINC's commitment and experience in supporting a carrier's data link implementation, together with its focus on quality of service, were key. Addressing the other two components was more difficult.

Developing the installation plan—which included certification and activation of the system—was extremely challenging. Since it was necessary to have the aircraft open to lay the wiring, we needed to install ACARS during heavy checks so as to minimize costs. Our goal was to accomplish complete installation by 2001—a schedule that seemed aggressive when having to rely on heavy checks only. Luckily we were also working on other engineering projects, which allowed us to run a modification line to install ACARS at the same time. Although we didn't meet our original goal of 2001, we still feel a great sense of accomplishment with only six aircraft left to complete.

After many months of research, we determined that it would be to our benefit to develop the ground messaging software in-house. Our Information & Communi-

ARINC EUROPEAN CUSTOMER MEETING — BARCELONA, JUNE 12-13, 2002

This year saw the fifth ARINC regional customer meeting for Europe, which has thus far taken us and our customers to London, Dublin, Copenhagen, and now Barcelona, Spain. "Improving the Bottom Line" was the theme of this year's meeting, reflecting the common need of our customers and partners to constantly monitor and make their operations as cost-efficient as practicable.

Ben Griffin
Manager,
Aviation Services,
ARINC

Close to 100 people attended the conference. Perhaps just as encouraging as seeing familiar faces was meeting first-time attendees—a testament to the growth ARINC has enjoyed in the region over the past 12 months.

This year, ARINC gave presentations on our major aviation-related business areas—airports systems, networks, and air/ground communications—and demonstrated the interaction and synergies between them. The first morning was filled with informative tutorials from these areas. Each tutorial provided an introduction to the services offered in each business area and how they can be effectively applied to reducing costs in the real-world environment.

Following the tutorials, the meeting was formally launched by John Belcher, ARINC's President and CEO, who welcomed the attendees and talked about ARINC's European operations. The opening afternoon was focused on ARINC's IT expertise, supported with input from our valued customer British Airways, our partner BT, and industry fulcrum IATA. All of the speakers offered valuable insights into how their organizations are improving the bottom line—either as a customer or as a supplier offering solutions in today's market.

The second day of the meeting featured updates on our airports systems and GLOBALink businesses. ARINC has enjoyed significant success in both of these areas in the past 12 months, including MUSE® wins at Munich and Milan and a major air/ground win with Virgin Atlantic Airways. Informative talks were provided by representatives of Manchester Airport and Virgin Atlantic—again stressing the pressures they face in improving costs and how ARINC has worked in partnership with them to reduce costs and improve productivity.

In addition to the sessions presented in the main auditorium, ARINC provided demonstrations of equipment and services throughout the two days.

Based on the favorable comments received from attendees, the theme of "Improving the Bottom Line" captured the current mood of the industry, and the ability to incorporate this theme throughout all areas of the aviation business was very much appreciated. We hope that 2003 will see more interaction, more new faces, and more success. ●

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cation Services (ICS) started from scratch to develop software that would integrate ACARS with the existing tools used by our dispatchers and operations agents. The original requirement was to process OOOI times only, but that changed as we discovered the operational benefits we could gain from many of the other applications currently available. We also began using ACARS as a vehicle for sending information from other ICS-developed programs directly to the flight crews. For example, we uplink load closeout information to the crews during preflight, eliminating the radio call from Operations with final weight and balance information. Weather requests, in-range messages with automated reply of arrival gate information, D-ATIS information, and other miscellaneous reports are just some of the other applications that we currently use ACARS for.

In an increasingly complex flight operations environment, controlling and reducing costs while improving safety and operational capabilities is a major challenge. ACARS is definitely part of the solution. With that in mind, we look forward to many new developments and applications to come. ●

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ARINC ASIAN CUSTOMER MEETING — BANGKOK, MAY 21-23, 2002

ARINC, AEROTHAI, and ADCC held the fourth Asia Aviation Customer Meeting in May at the AEROTHAI facility in Bangkok, Thailand. This was the most successful meeting in terms of attendance, with 156 participants. The meeting provided a wide array of topics relevant to the Asia-Pacific region, especially from outside speakers who gave their unique view of the issues at hand. We provided up-to-date information on current and future products and services from ARINC and our strategic partners in Asia.

Heament Kurian
Senior Program
Manager,
GLOBALink/Asia,
ARINC

Both evenings were also filled with outstanding events, exposing all of us to Thai cuisine, culture, and hospitality. We intend to build on the success of this meeting and continue to host interesting and informative conferences for our customers.

New Installations

Expansion in Asia continues. We have installed the second ground station in Hong Kong, which, coupled with the existing ground station at Victoria Peak, provides excellent coverage. Coverage is further improved with our ground station in Macau. With the Hong Kong installation, the number of ground stations in the ADCC network stands at 79.

We have finalized our expansion plans for the Asia-Pacific region and are excited at the prospect of expanding our network and providing the level of service that our customers have come to expect.

D-ATIS expansion in the region continues to accelerate through the AEROTHAI C-ATIS development. Currently, seven of the major airports in Thailand, including BKK, CNX, and HKT, are operational. Testing of the first of 10 D-ATIS sites in China will start shortly in Beijing. ●

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HFDL

GLOBALink/HFDL

HFDL Ground System Operation

In past issues of *The Global Link,* reference has been made to technology currently used by the HFDL system, called adaptive frequency management. This technique has been described as a method for managing the various high frequencies currently used by the system. But what exactly is adaptive frequency management?

HFDL Alphabet Soup

The HFDL ground system does not operate like any other data link system. Unlike both VHF and satellite systems, which operate on the same frequency 24 hours per day, the HFDL system must continually change frequencies to maximize coverage and ensure highly reliable long-range communications. Currently, there are over 120 HF frequencies licensed for HFDL use worldwide. But how does each HFDL ground station (HGS) know which frequency to operate on and when?

The answer lies in a bit of HFDL "alphabet soup" — ARINC uses HSTs and AFTs to operate the system. The HFDL system table, or HST, is a list of all the HFDL 120-plus frequencies licensed to the HFDL system. This list is modified only several times per year, when frequencies are added to or deleted from the system. The HST is prepared by HFDL engineers in Annapolis, Maryland, who send it via land lines to the HGS.

When an aircraft logs on to an HFDL ground station, the HF data radio (HFDR) compares its version of the HST in its memory with the version broadcast from the HGS. If no version exists, or if the version numbers differ, the HFDR will request that the most current version be uplinked to the HFDR, where it will be stored and used during normal operation.

The active frequency table, or AFT, is a list of instructions that tell the HGS on which frequencies to operate and when to change to those frequencies. The AFT is derived from a combination of real-time ionospheric monitoring, polar and geomagnetic observational data, and HF propagation programs. The AFT is generated weekly and is sent to each HGS. If atmospheric disturbances are predicted, the AFT can be updated more frequently in order to provide optimal HFDL coverage.

This behind-the-scenes work ensures that the HFDL system always operates at an optimal level. HFDL coverage is maximized to provide customers with a highly reliable long-range data link service.

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VHF

GLOBALink/VHF

The value derived from any data link program is a direct result of a successful implementation plan as well as ongoing support to meet changing requirements. ARINC satisfies our customers' needs in both areas.

Key to the team's success is the knowledge and experience of all members in the details of the data link system, including connectivity, network operation, message formatting, and host processing.

ARINC's GLOBALink implementation team, headed by Peter Wright, provides the information and focus new data link users need to see immediate benefits from their investment. The team has successfully helped new users develop and manage a successful implementation plan—from defining the avionics messages and menus to developing a functioning end system that allows the airline to process the messages received from the aircraft. The team also coordinates end-to-end testing and provides audit monitoring to make sure the aircraft and ground end systems communicate effectively.

Once a GLOBALink customer is successfully transmitting and processing messages, ARINC continues to provide support. Technical support is available through our ARINC Operations Center 24 hours a day, 7 days a week. Our experienced analytical support team, led by Carolyn Bray, can help identify the root cause of any issue—many times by reviewing audit data to determine if the source of the problem is message processing, coverage, or avionics. We also recommend solutions and monitor progress. From usage statistics maintained for each airline, ARINC can provide individualized reports to help indicate trending or other functions. Finally, the ARINC GLOBALink customer web site is a useful tool that provides up-to-date coverage maps, station lists, and other information about the service and the data link industry in general.

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IFC

GLOBALink/InFlight Communications

Swift64 — High-Speed Data

ARINC first announced at WAEA last year its support for Inmarsat's Swift64 service, which incorporates both high-speed (up to 64 kbps) aeronautical mobile integrated services digital network (ISDN) and mobile packet data services (MPDS). The circuit-mode service is currently being offered with MPDS to follow shortly, once market prices are established and avionics development is finalized. This new technology currently operates using the Aero-H (high gain) antenna and is offered as an upgrade or a stand-alone service, maximizing an aircraft's upgrade path.

Inmarsat 2002 Aeronautical Conference

The annual Inmarsat Aeronautical User's Forum was held June 10-12 in Montreal, Canada. ARINC participated in industry panel discussions, and Inmarsat's new Swift64 service offering was a main topic of conversation. This conference presented valuable opportunities to discuss aircraft and avionics manufacturers, service providers, and product/technology evolution paths. Airline safety, security, and operational issues were also addressed.

Short Messaging Service (SMS) Offering

ARINC, in cooperation with Matsushita Avionics Systems and Tenzing Communications, is currently developing text message solutions for aircraft passengers to communicate reliably with the ground while en route. SMS aeronautical service will allow commercial air travelers to type data messages in mobile telephones and transmit them via satellite to ground-based destinations—efficiently and cost-effectively.

New Customers

Virgin Atlantic Airways and Cathay Pacific Airways have signed fleetwide, multiyear agreements with ARINC for the provision of satellite services beginning this quarter. The two carriers will use voice and data link communications, including multiple new in-flight entertainment system applications, such as SMS.

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AOM

Airport Operations Management

European Initiatives Take Flight

EUROCONTROL, the European multinational air traffic control agency, has established an Airport Operations and Information Management Task Force to advance the understanding and consistent implementation of collaborative decision support tools at airports throughout Europe.

The Task Force has been established to improve "gate to gate" flow of traffic in recognition that a large percentage of flight delays in Europe occur while aircraft are on the ground and often arise from complex turnaround management processes and procedures.

ARINC's AOM team has been addressing these issues in partnership with its customers in the United States and its European colleagues, and has become an active participant in the EUROCONTROL Task Force. As part of that Task Force, ARINC has shared our experiences with EUROCONTROL in detail. In addition, we have presented a comprehensive description of one of our products, AirportOpsAdvisor, which introduces data link to airside operations—a feasible solution to the issues raised. ARINC has hosted visits from our European colleagues, allowing them to see AirportOpsAdvisor in action and assess the positive impact on user workload and frequency congestion.

Meanwhile, the EUROCONTROL Collaborative Decision Making (CDM) Task Force has defined three levels of CDM implementation that take into account the specifics of European ATC operations—in particular the need for management of departure slots and planned taxi times, the reduction of frequency congestion, and the overall definition of the CDM turnaround process.

In parallel, a number of CDM initiatives have begun in collaboration with EUROCONTROL at airports across Europe.

We are optimistic that 2003 will see the first implementation of the ARINC AirportOpsAdvisor capabilities outside the United States, at some of the busier hubs across Europe, yielding quantifiable improvements in gate-to-gate flight management for all airport stakeholders.

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F Y I

Milestones of flight that occurred in July:

1919: First use of an aircraft to track and arrest a speeding motorist

1940: Introduction of the Boeing Stratoliner, the first airliner with a pressurized cabin; aircraft can now fly up to 20,000 feet

1949: First flight of the first commercial jet aircraft, de Havilland Comet

1969: First landing of man on the moon

source: www.firstflightnc.com

ATS
Air Traffic Services

Oceanic Clearance Processing (OCP) II

ARINC, in conjunction with NAV CANADA, successfully fielded a significant enhancement to the existing Oceanic Clearance Delivery (OCD) service. This enhancement, often referred to as OCP II, takes us beyond the standard ARINC 620 offering and allows us to offer the OCD service to those aircraft equipped with ARINC 622/623-type avionics. In short, OCP II will improve the OCD service by:

- Converting all clearances from the Gander Automated Air Traffic System (GAATS) to the appropriate format—ARINC 620 or 622/623—depending on the target airline's preferred configuration
- Converting all readbacks to the GAATS format before delivery to GAATS
- Storing all aircraft clearance requests on the OCD server until the clearance is received from GAATS
- Storing all GAATS clearances on the OCD server until the corresponding aircraft clearance request is received

Airlines will now have access to this service regardless of their service provider or data link media—VHF, HF, or SATCOM.

OpCenter

OpCenter is a web-based interface that allows users to easily and inexpensively manage their air-to-ground and ground-to-ground data link messages.

A more flexible implementation of Predeparture Clearance (PDC) hosting has just been introduced for OpCenter. With this added functionality, OpCenter can now accept a PDC request in any user format, match it to an existing clearance, and deliver that clearance to the aircraft. This new capability will allow more customers to use OpCenter for their PDC hosting, including those who do not use OpCenter to manage their data link messages.

Those customers whose current messaging host does not have PDC hosting can sign up for OpCenter exclusively for PDC hosting. In addition, OpCenter enables a customer to participate in PDC without even being a data link customer, since OpCenter can forward a clearance to an airport printer.

Our customers continue to find new and interesting ways to use OpCenter. Airlines have used it to provide message-handling support during scheduled host outages. Avionics vendors have used it to support development and testing of their products. And Air Force dispatchers use it to support their daily activities. OpCenter is a versatile and amazing product.

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ACRONYMS

ACARS – Aircraft Communications Addressing and Reporting System

ADCC – Aviation Data Communication Corporation

AOA – ACARS Over AVLC

AOM – Airport Operations Management

ARTCC – Air Route Traffic Control Center

ATC – Air Traffic Control

ATIS – Automatic Terminal Information Service

ATM – Air Traffic Management

ATN – Aeronautical Telecommunication Network

ATS – Air Traffic Services

AVLC – Aviation VHF Link Control

CAA – Civil Aviation Authority

C-ATIS – Computerized-Automatic Terminal Information Service

CNS – Communications, Navigation, and Surveillance

CPDLC – Controller-Pilot Data Link Communications

D-ATIS – Digital Automatic Terminal Information Service

FAA – Federal Aviation Administration

HF – High Frequency

HFDL – High Frequency Data Link

IATA – International Air Transport Association

IT – Information Technology

NAS – National Airspace System

OOOI – Out, Off, On, In

PETAL IIe – Preliminary EUROCONTROL Test of Air/Ground Data Link II (extended)

QNH – Quasi-nonhydrostatic

RTCA – Radio Technical Commission for Aeronautics

SATCOM – Satellite Communication

VDL – Very High Frequency Digital Link

VDLM2 – VDL Mode 2

VHF – Very High Frequency

WAEA – World Airline Entertainment Association

THE USE OF TRACKER MESSAGES IN CATEGORY A ACARS NETWORKS

**Steve Leger
Director,
Avionics Test
and Evaluation,
ARINC**

Many customers frequently ask about the purpose of tracker messages: "What are tracker messages?" "How are tracker messages used?" This article provides answers to those questions.

Description and Purpose of Tracker Messages

Tracker messages are VHF ACARS downlinks that are sent automatically at fixed intervals, typically 10 minutes. These messages allow the service provider to dynamically track aircraft during flight. In most cases, the avionics use a Q0-labeled Link Test as a tracker message. The Link Test message does not contain any useful application text; therefore, it does not result in a delivery message to the airline customer. Some customers prefer a user-defined tracker message with a message label other than Q0. The message may include additional information such as geographic position or altitude within the message text. These user-defined messages certainly would be delivered to the airline host computer.

As mentioned, tracker messages are used for flight following. Each time a downlink message is received from an aircraft, the ARINC ACARS Central Processor System (CPS) is updated with the three best remote ground stations (RGSs) that received the downlink message. When ARINC receives an uplink message from the airline computer, it first consults a table in CPS to determine which stations are most likely in contact with the aircraft. It tries these stations for message delivery. If no downlink activity has been heard from the aircraft in 11 minutes, the CPS system returns the uplink back to the originator as undeliverable.

For aircraft in flight, the CPS holds the RGS station information as active for only 11 minutes. After that time, the station information is deleted because an en route aircraft will usually have moved on to a different set of stations. When an aircraft uses 10-minute tracker messages, CPS is continuously refreshed with new RGS information and always knows where to deliver an uplink message.

If an airline sends uplink messages only after they have been specifically requested by a downlink from the aircraft, then tracker messages may not be needed. This is because the preceding downlink request automatically updates the ground network with aircraft location information. An uplink message that was not first requested by the aircraft (by downlink) is referred to as an "unsolicited uplink." For unsolicited uplinks, CPS knowledge of the best RGSs is essential to successful delivery of the message. In practice, almost all airlines send some unsolicited uplinks and depend on the service provider to know what RGSs are in communication with the aircraft.

Category B Networks and Tracker Messages

In a Category B network, the traditional tracker message is considered optional because the tracker message function is covered elsewhere in the air/ground protocol. This would lead some to believe that a Category B network operates more efficiently by not using traditional trackers.

In a Category B network, aircraft must monitor all the stations available and then select a single station to establish a connection to the ground. During the connection process, the first action of the avionics is to send a Link Test to establish a connection with the RGS. This Link Test has a format that is identical to the Category A tracker message. Once the connection is established, messages to the aircraft are handled by this single RGS.

With Category B, the aircraft can only connect to one RGS at a time; therefore, during flight the avionics must change RGS connections and repeat the connection process every few minutes. As a result, while the traditional tracker function is not needed, Link Test messages are still transmitted at frequencies that are at least the same or greater than those used in a Category A network.

Summary

Tracker messages allow ARINC's Category A VHF network to track an aircraft during flight and allow us to make the best RGS selections for message delivery. Tracker messages do not decrease the network efficiency and are recommended for customers that send unsolicited uplink messages. Many avionics systems allow an airline to enable tracker messages as a maintenance or configuration item. As always, please contact us if you'd like further information or assistance in enabling tracker messages in your aircraft. ●

CPDLC OPERATIONAL TESTING AND TRIALS (CONTINUED)

use B757s for this first stage of what will eventually become a nationally deployed ATN/VDLM2 system. Just as we did in PETAL IIe, for Build 1 we will use a new Rockwell Collins VHF radio and communications management unit (CMU) and the ARINC VDLM2 ground network to communicate.

Our experience with PETAL and the preliminary work with Miami Center have been very favorable. As with almost any new technology, the trials and testing program has enabled us to find ways to improve system performance and operational characteristics. A good indication of its effectiveness in taking some of the load off of voice communications is the enthusiasm the air traffic controllers at Miami Center have for getting it in place and operational.

As the name implies, Build 1 is just the start. As the technology matures and automation increasingly becomes a part of CNS/ATM, data link will become a key "enabler" to help tie it all together. American Airlines looks forward to being part of Build 1 and future ATC data link programs. ●

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TAKEOFF DATA CALCULATION (TODC) OVER ACARS

Scandinavian Airlines started implementation of a fleetwide ACARS capability in 1995. The principal motivation was to provide real-time, end-to-end communications between our aircraft and ground IT systems and other functions at all times. In the years since then, we've been busy developing and introducing a broad spectrum of ACARS applications, making use of the capabilities that ACARS has brought us.

Björn Syrén
Datalink Program Manager,
Flight Operations,
Scandinavian Airlines

The applications in use today focus on supporting flight operations, operations control, ground handling, and maintenance activities. We have actively promoted and supported ACARS-based ATS applications such as ATIS, departure clearance, and oceanic clearance. And we're not finished yet—far from it.

One of the most successful applications so far has been Takeoff Data Calculation (TODC). Before every takeoff, a performance calculation or check must be conducted to ensure that a safe takeoff can be made within regulated performance margins. This calculation must take into account aircraft technical and environmental parameters, including:

- Aircraft type and version
- Engine type and thrust rating
- Actual takeoff weight of the aircraft
- Status of aircraft systems that affect performance, such as wing and engine anti-ice, brakes, and reversers
- Actual airport, takeoff position, runway length and slope, obstacles during climbout, and other related information
- Meteorological conditions (wind, temperature, QNH*)

*QNH is the more common method of setting the altimeter to compensate for changes in barometric pressure. The pilot receives information from the airfield and adjusts the altimeter accordingly, and the altimeter reads airfield elevation at touchdown.

- Runway contamination, such as water, slush, and ice

Together, these parameters result in the correct flap settings and takeoff speeds for the actual takeoff weight. If the aircraft is, in fact, not using the maximum possible takeoff weight, then engine thrust can be reduced to save wear on the engines.

The traditional way for pilots to obtain takeoff performance data was through paper tables (gross weight charts) carried on board. The performance data in these charts had to be simplified and conservative to fit into a manageable paper format. As a consequence, the payloads and thrust settings obtained from these tables did not take advantage of the actual performance of the aircraft.

Computerizing the TODC calculations and using a sophisticated aircraft performance program allows much more precise calculations to be made. The net effect is that it enables higher payloads and reduced engine operating costs. The improvements can be significant.

One option is to make TODC calculations using a laptop in the cockpit. This was not an attractive solution to SAS because of the logistical issues involved in supporting a relatively large fleet (180+ airplanes). Databases need to be updated regularly, and the performance program may need unscheduled updates. In addition, we would have to deal with batteries and power supplies as well as broken or lost laptops.

SAS chose instead to implement TODC calculations via ACARS. This made it possible to use a powerful ground TODC application that is centralized, automated, and capable of supporting the entire aircraft fleet with advanced takeoff performance calculations. It brought many advantages compared with the laptop computer solution. Updates to the airport database and performance program are quick and instantly available to the entire fleet, and logistical issues are avoided.

Some pilots were initially skeptical of the capability of ACARS to
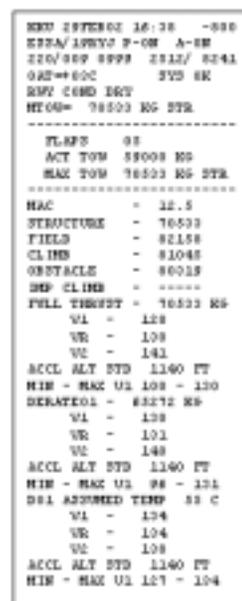
deliver the TODC information reliably and with acceptable delivery times. They were proved wrong. The typical end-to-end TODC transaction as seen from the cockpit is 15 to 25 seconds, which is operationally acceptable and compares favorably with other solutions. Reliability has been excellent and is not an issue today.

In the aircraft, we introduced an ACARS TODC request function where the pilot enters the input data for the calculation. The downlink is sent to the ground TODC application, the calculation and optimization are made, and the uplink response is sent back to the cockpit, where it can be printed if desired. If conditions change, a new calculation can be made easily. The TODC output also gives the pilot a shortlist of alternative runways and takeoff positions that are possible under the circumstances.

ACARS TODC is currently in service for our Boeing 737NG, Boeing 767, and Airbus A321 fleets. It will be introduced in the Airbus A340 and A330, Boeing MD-80, and Dash-8-Q400 fleets during 2002. ●

Example ACARS TODC Request Screen (above, left) and Example ACARS TODC Printout (above, right)

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Orlando, FL
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SPOTLIGHT ON VICTOR J. NAGOWSKI

The phrase VDL Mode 2 has been buzzing around the industry incessantly over the past year and justifiably so, as VDLM2 will be the critical link to advancing the future of air/ground data link communications. Victor Nagowski has firsthand experience with VDLM2.

As ARINC Senior Director, Advanced Communications, Vic leads the team that will help evolve data link communications. His team's goals with regard to VDLM2 are to support the FAA's CPDLC program with deployment and operation of VDLM2 in the Miami ARTCC, support airline customers in transitioning to VDLM2, and identify and capture new business opportunities. Vic welcomes these goals because he realizes the importance of taking ACARS to the next level.

"Although at one time ACARS was the ultimate in communications, it does have performance constraints and limited capacity," said Vic. "VDLM2 provides over 10 times the capacity of ACARS and has been developed according to international standards."

VDLM2 has been designed to support the operational needs of the airlines and the more stringent performance requirements of the FAA. "The FAA CPDLC Build 1 program will move routine en route voice communications services to data link to allow more efficient use of the airspace. The CPDLC partnership, including American Airlines, Rockwell Collins, the FAA, and ARINC, just completed the technical evaluation of the system and is entering into the operational evaluation phase. Initial daily use is scheduled for September 30, 2002."

American and Delta have committed aircraft in support of the Build 1 program; Continental and Federal Express are expected to join the CPDLC partnership soon. The CPDLC partners have agreed to operate and maintain their respective parts until the FAA CPDLC Build 1A program is fielded, starting in December 2005. Build 1A will provide additional services to the aviation community and will be deployed nationwide. The use of CPDLC is expected to provide substantial improvements in aviation efficiency.

In addition to deployment of the VDLM2 network in the United States, Vic's team is working with AVICOM Japan, Ltd., to install VDLM2 technology at 10 Japanese airports. Japan's service provider for civil aviation communications, AVICOM operates an ACARS-similar network at 50 airports. AVICOM's VDLM2 system will complement that network. ARINC is continuing to pursue other opportunities for the sale of VDLM2 systems, as well as other air/ground communications technologies.

Vic began his ARINC career in April 1979 as an engineer focusing on air-to-ground and ground-to-ground communications. After working his way up the ranks of the engineering program, Vic moved into program management. As a senior director, he is recognized as a valuable asset and leader in the VDLM2 program. When he's not concentrating on VDLM2, Vic enjoys fishing, traveling, gardening, and golfing.

Vic holds a BS degree in electrical engineering from New York State University and an MBA from Alabama A&M University. ●

Victor J. Nagowski
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CUSTOMER ARTICLE

CPDLC IN EUROPE—LINK 2000+ PROGRAM UPDATE

At its May 2002 meeting, the LINK 2000+ Programme Steering Group adopted EUROCAE Document ED-110 as its baseline for en route implementations up to 2007.

Alex Wandels
Programme Manager,
EUROCONTROL

LINK 2000+ partners are committed to implementing en route data link services covering transfer of communications between sectors and centers requesting and issuing ATC clearances and the ATC microphone check.

This decision ensures that FAA and EUROCONTROL CPDLC implementations cover the same services and are based on the same interoperability, safety, and performance requirements (produced by RTCA and EUROCAE). It provides a larger potential market for ATC systems, avionics, and aircraft manufacturers and focuses on the implementation of data link services.

In Europe we now see commitment to or concrete plans for en route CPDLC implementation over ATN/VDLM2 in Italy, Austria, Switzerland, Spain, Germany, and France between now and 2007—this in addition to the already existing Maastricht implementation, which largely resulted from the PETAL trials. It is true to say that some of these plans and commitments are more stable than others, but globally we can expect a similar number of en route centers providing data link services in Europe as in the United States by 2007.

Data link is alive and growing, and this message has been understood by European airlines. The LINK 2000+ Programme's discussions with Lufthansa, KLM, Iberia, Air France, and Alitalia to recruit them as pioneer airlines look promising. ●

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