COLLINS HIGH-SPEED DATA

Enabling The Global Office

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The ability to effectively communicate has long been a primary factor in determining the success of a leader. As advancements in technology enhanced our ability to communicate, those who demonstrated the foresight to leverage that technology enjoyed a distinct competitive advantage. The introduction of computer networks, for example, enabled a tremendous increase in productivity, as individuals were able to share information via e-mail.

The Internet links together computer networks around the world, providing access to greater amounts of information than ever before thought possible. Most recently, the use of wireless communications has allowed unprecedented mobility in communications, allowing us to communicate and access information from nearly anywhere on earth.

MAKING THE GLOBAL OFFICE A REALITY

Now, Rockwell Collins has made it possible to extend to the aircraft the same capabilities we've come to rely on in the office, providing today's business aircraft passengers the tools needed to maintain their competitive edge.

This Global Office capability is enabled by an advanced, integrated high-speed data system, including satellite communications, a high-speed transceiver and digital Local area network (LAN) and server technology. This robust, end-to-end solution makes it possible for business aircraft passengers to access corporate e-mail and browse the Internet in real-time-in addition to the traditional SATCOM functions of sending and receiving phone calls and faxes-all while flying Mach 0.85 at 35,000 feet.

Rockwell Collins makes the global office a reality, offering business aircraft passengers the same capabilities in the air that they enjoy on the ground.

COLLINS HIGH-SPEED DATA: THE TOTAL SOLUTION

To power the Global Office, Rockwell Collins leverages the same satellite communication technology developed for land mobile applications. The Collins HST-900 High-speed Transceiver is a small (2MCU), lightweight (8.5 lb.) unit that integrates with the Collins SAT-906 SATCOM. The system takes advantage of Inmarsat's Aero-H/H+ and Swift64 data services to provide 64 kBPS bi-directional voice/data communication-fast enough to support corporate e-mail access and Internet browsing.

Consisting of a satellite data unit (SDU), radio frequency unit (RFU) and a high-power amplifier (HPA), the Collins SAT-906 system interfaces with ARINC 741-approved Aero-H/H+ antennas. Offering basic voice and data communications (up to 10.5 kBPS), this system enables phone and fax communications to the cabin and supports data communications to and from the flight deck. With over 1000 systems in operation, the SAT-906 is both proven and highly reliable, offering constant communication with ground-based networks, even when traveling over the ocean.

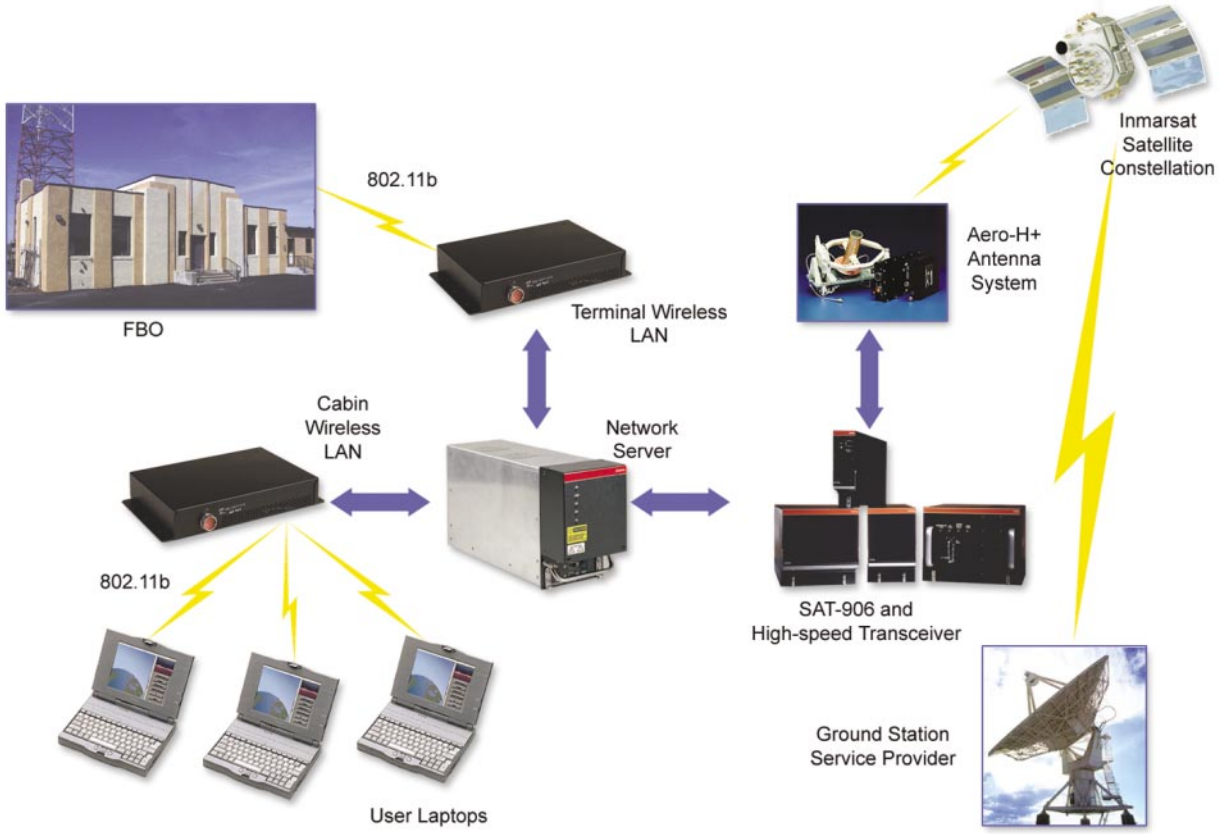
The HST-900 connects to the SAT-906 via the SDU and HPA. The HPA operates at a robust output of 60 watts, allowing it to simultaneously operate high-speed data and traditional Aero services without the addition of another HPA or the suspension of certain Aero services. The system supports multiple interfaces, including RS-232, ISDN and Ethernet, to meet the needs of a variety of operating configurations.

Collins HST-900 (top) and SAT-906

Additional components of the system include an optional network server that supports multiple-user environments. The 4MCU server contains a 30 GB hard drive, enabling users to store information on the local Intranet and cached Internet content to be stored on board the aircraft. This reduces the need to transmit and receive off the aircraft, reducing operational communications costs.

The Collins wireless LAN supports intra-cabin data communications, allowing passengers to connect with the server from anywhere in the aircraft. The wireless network uses a small, lightweight antenna mounted inside the cabin instead of hard-wiring the network server to the aircraft seats. Laptops must be configured with a commercially available wireless LAN card supporting the IEEE 802.11b standard.

When using e-mail and Internet applications, data is sent from the laptop, through the wireless LAN, to the on-board server. The server interfaces via an Ethernet connection to the HST-900 and SAT-906, which transmits the data to a participating Internet service provider via the Inmarsat satellite system. The process in reversed when information is being received.



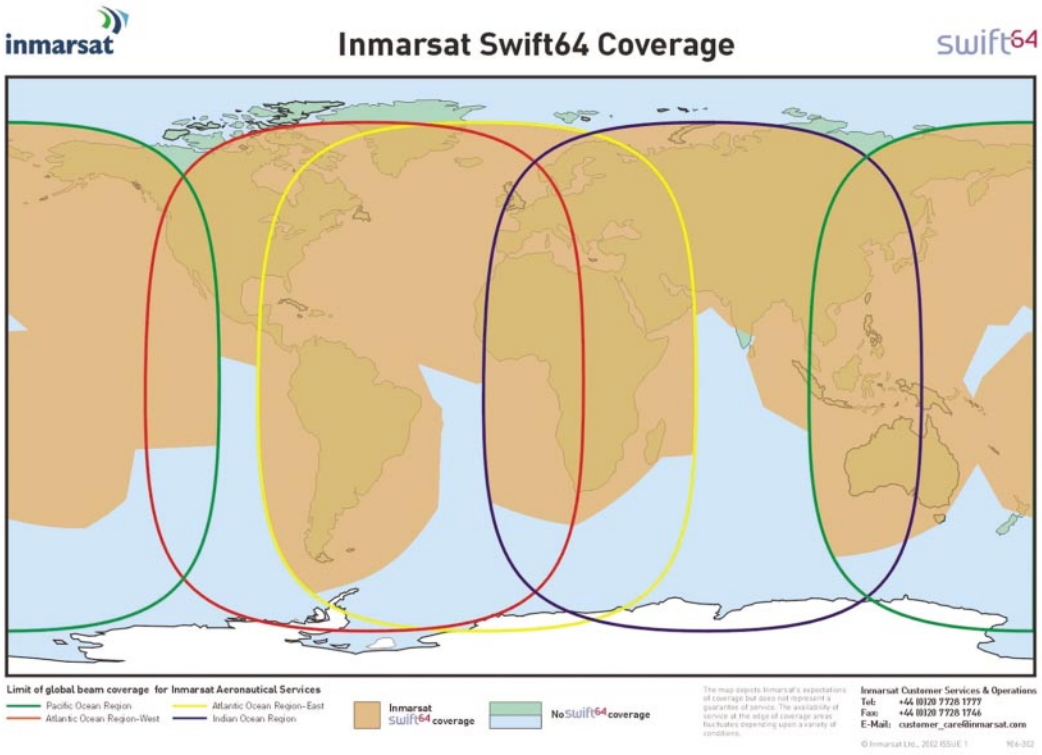
The Collins Global Office consists of the SAT-906, HST-900 and an optional server and wireless LAN.

COMMUNICATION PROTOCOLS

Inmarsat offers two communication methods within the Swift64 service: circuit mode-also known as Integrated Subscriber Digital Network (ISDN)-and packet mode, or Mobile Packet Data Service (MPDS).

A circuit mode connection is analogous to a typical phone call, where the user is constantly connected with the ground. In this mode, Inmarsat bills users on a per-minute basis, and each high-speed data channel is assigned its own unique frequency. In contrast to this, packet mode service can be compared to a party line, where multiple users share the same channel. This is a more effective use of the available bandwidth since, in most applications, data is transmitted in bursts rather than a constant stream.

In packet mode, although the user is connected continuously, Inmarsat charges users only for the amount of data actually sent rather than the time connected, providing a more cost-effective alternative for simple e-mail and small file exchange, and light Internet browsing. For video conferencing and large file transfers, it would likely be more cost effective for users to use circuit mode. In order to provide the most flexibility for operators, the HST-900 has been designed to support either mode of operation.



The Collins high-speed data solution takes advantage of Inmarsat's Aero-H/H+ and new Swift64 data communications services. These services are provided by four geostationary satellites, each of which provides global beam coverage and spot beam coverage (as indicated above), to cover a large majority of all potential air routes.

SINGLE VS. DUAL CHANNEL CONNECTIVITY

The Collins HST-900 offers a single high-speed data channel utilizing the Swift64 service. Every device accessing the Swift64 service will offer the same basic data rate – 64 kBPS per channel. While adding a second channel to the system doubles the total throughput to the aircraft, it does nothing to enhance the performance for a single user. This can perhaps be best understood using the following analogy.

Imagine a single car driving down a highway with a speed limit of 64 mph. Adding an additional lane to the highway will not enable the car to travel any faster; the car is still limited to 64 mph by the speed limit. Only if many cars are travelling on the highway will a single car experience an improvement in speed if a second lane is added – thereby alleviating a traffic jam.

Similarly, adding a second high-speed data channel will not result in an improved Internet browsing experience for a given individual. Only if the high-speed data channel becomes clogged with e-mail and Internet traffic will a user benefit by the addition of a second high-speed data channel. This situation is quite unlikely to occur on a business aircraft using an ISDN channel, however. For example, a 10 kBPS e-mail with 20% protocol overhead will only take 1.5 seconds to transmit at 64 kBPS, requiring only a small portion of the system's overall capacity.

Furthermore, in the MPDS mode of operation, multiple channels actually share the same frequency. In other words, adding a second MPDS channel to an existing MPDS channel may, at best, result in a user getting a slightly higher priority to access the Inmarsat system.

FUTURE GROWTH

Rockwell Collins is exploring multiple opportunities to increase the channel data rate and total throughput to 128 kBPS and beyond. Potential advancements include:

- Adding additional Swift64 high-speed data channels for increased capacity
- Employing advanced data compression techniques for more effective use of the available bandwidth
- Applying variable rate coding to enable increased data rates
- Using higher frequency bands to allow more information to be transferred per channel

In addition, Inmarsat's next-generation of satellites will dramatically increase the speed of a single high-speed data channel to transmit and receive up to 432 kBPS. The first launch is scheduled for October 2003, with operational availability anticipated by 2005.

Because the architecture of Rockwell Collins' system was designed with future Inmarsat technology enhancements in mind, the HST-900 can be easily upgraded to take advantage of this new technology without affecting basic SATCOM performance.

CONCLUSION

At home and at work, there is a demand for high-speed data connections. When business aircraft passengers and crew "plug in" at 35,000 feet, their expectations are no different. Rockwell Collins brings aircraft a high-speed data solution while preserving the integrity of existing systems. All while clearing a path for the insertion of still higher data speeds, as they become available.

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