High Speed Data

BY TONY BAILEY

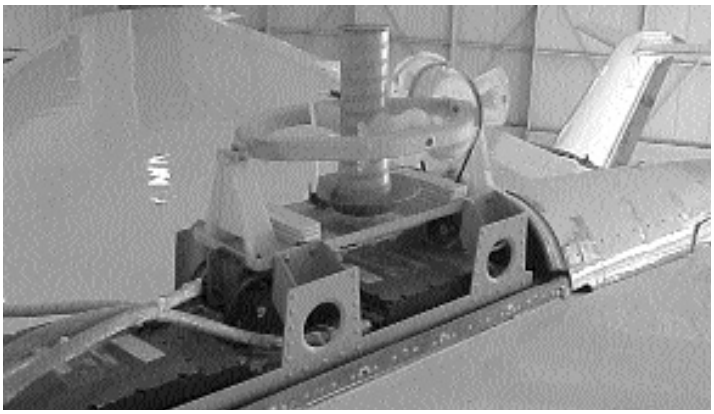
Aircraft communications has taken a twist towards technology that seems to be in every magazine and on the tip of every operator's tongue. *High Speed Data* is the latest aircraft system that is a mix between entertainment and operational necessity. But what is it really? What can it do?

Avionics technicians have always been faced with the latest and greatest changes in electronics and the high speed data craze is pushing technicians into the IT environment. No longer will it be enough just to know how to troubleshoot autopilot or navigational systems. Computer savvy will be the next leap in the avionics field. To understand high speed data, you must first understand what it does and what the lingo is.

The development of airborne e-mail and internet was made possible by the introduction of the Swift64 High Speed Data service by INMARSAT. This service allows aircraft connections to the internet at 64 kilobits per second (kb/s), commonly referred to as a "channel" or "mode." This is comparable to a dial-up connection which is approximately a 20-times increase in data rate from current data transmissions from aircraft.

Swift64 is the portal to worldwide access of the satellites of INMARSAT, a global mobile communications company. Swift64 allows high-speed data transfers, e-mail and internet access to aircraft for the first time while maintaining secure, reliable data communications at speeds of up to 64 kb/s per channel. For air travelers almost anywhere, this means quick and easy access to e-mail, the Internet and company networks.

INMARSAT Swift64 is nothing more than the "tube" that connects the aircraft HSD to the satellite and operators must subscribe for service through a service provider. The service providers act like a phone company or Internet Service Providers (ISP) on the ground, providing connectivity, billing and other related services just like your home service. Currently, there are two types of data service—Mobile Euro-ISDN and Internet Protocol (IP), which is based on Mobile Packet Data Service (MPDS)—globally available to aircraft in flight. The Euro-ISDN is a high performance connection that charges per minute of connectivity, while the MPDS version charges customers for only the data used, it is tab-



EMS Technologies AMT-50G Antenna

Racal DBS-2100 Antenna and a Raycal 8182-1G Antenna

Rockwell Collins HST-900 High Speed Transceiver

ulated based on megabit (Mb/s) usage.

INMARSAT has four third-generation satellites in orbit operating at locations above the earth in strategic coordinates. These satellites currently provide several different types of SATCOM service, which are described below. It is the configuration of the SATCOM equipment installed in the aircraft that determines which service that can be accessed.

Aero L: Low-speed (600 bits/second) real-time data communications used primarily for aircraft air traffic control and general administrative purposes. The Aero L service is used as a low-gain backup to the Aero H or Aero H+ services.

Aero I: Intermediate-gain capable of exploiting the higher power available from the Inmarsat-3 satellites. The Aero I allows aircraft flying within the satellite beam coverage to receive multi-channel voice, fax and circuit mode data services.

Aero H: Provides channel rates up to 10.5 kb/s, supporting multi-channel voice, fax, and data communications services anywhere in the global beam for passengers and operations, administrative and safety services applications.

Aero H+: A deviation of the Aero H service that uses the higher power of the Inmarsat-3 satellites when operating within beam coverage area. When operating outside the beam coverage areas, the terminal operates using the global beam as a standard Aero H system. Aero H+ supports the same services as Aero H does.

Swift64: 64 kb/s mobile Integrated Services Digital Network (ISDN) and MPDS allows for the support of the full range of ISDN compatible communications and internet connectivity.

High speed data is just another enhancement to the worldwide SATCOM system which was designed to assist voice, fax and data communications virtually anywhere in the world except for the extreme polar regions. In addition to the worldwide communications reach, the SATCOM system provides significant improvements over conventional long-range communications systems by providing better connectivity, transmission quality, reliability and traffic capacity.

As the technology keeps moving forward, avionics manufacturers are promoting 128 kb/s performance. However, INMARSAT channels are limited to 64 kb/s. In order to get 128, manufacturers have "combined" two channels of 64 kb/s transmission to get 128. Often called the "combined mode," the aircraft connects through two channels to the satellite, which sends the two independent channels to a ground station where the data is received.

EMS Technologies, Rockwell Collins and Honeywell are the only North American providers of high speed data at this time. EMS Technologies manufactures their own components as well as the components for Rockwell Collins. Honeywell has partnered up with Thales, a European manufacturer for their components. EMS Technologies has the only system currently operating in the "combined" 128k mode, but Rockwell Collins and Honeywell expect to offer the 128 solution by late 2003 or early 2004. EMS Technologies has also recently announced the introduction of

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Terms and Definitions

TERM	DEFINITION
SATCOM	Satellite Communications System
COTS	Commercial, Off-The-Shelf
HSD	High Speed Data Unit
HST	High Speed Transciever
SDU	Satellite Data Unit
HPA	High Power Amplifier
BST	Beam Steering Unit
ISP	Internet Service Provider
kb/s	Kilobits Per Second
IP	Internet Protocol
MPDS	Mobile Packet Data Service
INMARSAT	International Maritime Satellite Organization
Forward ID	Identification Number
ISDN	Integrated Services Digital Network
AERO	Aeronautical Terrestrial Network Global Earth Network
IT	Information Technology
RFU	Radio Frequency Unit
LES	Land Earth Station

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the "X" Box allowing operators to add on modules capable of an additional 64k data stream per module.

The heart of the high speed data system comes from the SATCOM transceiver, which interfaces the SATCOM system with high speed data capabilities. When faced with a customer having problems connecting to the internet, determining if they have good SATCOM connection is a key element to troubleshooting. Different manufacturers of high speed data equipment utilize different techniques for troubleshooting system operation. EMS Technologies, for example, allows system troubleshooting through a HyperTerminal connection to a lap top or PC. The troubleshooting menu gives access to determine a magnitude of malfunctions and perform a series of tests including Beam Steering Unit operation (BST), measured transmit coax cable loss, Forward ID, Terrestrial Network, inverse video, AERO receiver calibration, force spot beam selection, and numerous other maintenance utilities and indicators.

Of course, troubleshooting at this level requires special training and familiarity. For the avionics technician seeing the system for the first time, troubleshooting is limited to the basics, but here are a few steps you can take to isolate or correct a minor malfunction:

Log-on request fails: Check for an open cable, secure mounting of the transceiver, and/or an HPA fault.

Unit does not receive: Verify the forward ID, ensure the account is current, check the forward ID strapping.

Unit is not transmitting: Check for an open cable, check RF power output, ensure the transceiver is properly mounted.

Call Failure: Check the account status with the Service Provider.

Log-on is successful, but fails to complete the call: Contact the service provider and verify the account is active, check all cables and connections, Dial #33 to contact the LES (Land Earth Station) operator and ask them to place an incoming call to the unit.

Calls do not complete and connection is not established: Wait five minutes and call again, Dial #33 to contact the LES operator and ask them to verify channel congestion.

Reference EMS Technologies HSD Installation and Maintenance Manual Document Number EMS-MN-1110-10113/A and Rockwell Collins SATCOM-906 Satellite Communications System Installation Manual P/N 523-0078263-003116.

Beyond these basic checks, troubleshooting requires expertise and experience to get the system to communicate. However, the units from all of the manufacturers are highly reliable and most problems can be easily solved. Just like your connection from home, most problems form when the connection to the service provider is rejected. A quick verification of the account status could save you from a huge headache.

The other operational checks are standard for any SATCOM system. As the high speed data system can be installed as a stand-alone, the basic components are the HSD (high speed data unit) or HST (high speed transceiver), RFU (radio frequency unit), SDU (satellite data unit), and the HPA (high power amplifier) connected to a SATCOM antenna. Of course different manufacturers utilize different terminology for like or similar components, but the basic function of the components are the same. If utilizing the system in a dual SATCOM/ high speed data role, the current systems interface almost seamlessly and can be considered plug-and-play in most instances.

The introduction of high speed data for aircraft has opened the door to numerous other items being introduced that are considered COTS (commercial, off-the-shelf) by the FAA and should be carefully examined before placing them in an aircraft. FAA Order 8110.42 and 14 CFR Part 21 section 21.303 cover the approval of materials, parts and processes. Routers and wireless components that you would use at home or work are very enticing for company IT people to bring on the aircraft and are significantly cheaper than airborne certified components. While the manufacturers of high speed data components have done extensive and thorough testing of airborne equipment, COTS items have no DO-160 or DO-178 testing to ensure compatibility with the airborne environment. DO-160 (RTCA/DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment) testing and certification is the standard used to verify that equipment has been tested to a level of safety that is acceptable for aircraft use. Software used in aircraft electronics equipment also must be tested in accordance with RTCA/DO-178B for safety and compatibility with other airborne equipment. Fire, EMI transmissions, compatibility and implosion testing is essential to safety. Just because the COTS items are cheap doesn't mean they should be installed in the aircraft, no matter how tempting it is. COTS items are also a source of major headaches. Configuring a router can be a troublesome process that I am not sure anyone understands completely.

Those are the basics for high speed data. The future probably holds data transfer rates at lightning speeds and robots to configure the whole thing. Until then, avionics technicians are again forced to learn a new trade in the IT business. Pocket protectors and glasses optional. ❑