



INTELSAT[®]
General Corporation



INTEROPERABILITY VIA SATELLITE:
Breaking Communications Barriers

Lessons Learned – Essentials for Communication

At no point in our history has the need for effective communications been more crucial. The 2001 terrorist attacks demonstrated that even the most sophisticated communications infrastructure is vulnerable to being temporarily immobilized. Further, the devastation of the communications infrastructure in the aftermath of the 2005 Gulf Coast hurricanes proved how very dependent we, as a nation, are on phone, data and video communications.

Whether they are responding to a natural or man-made disaster, our heroic law enforcement, fire and emergency medical units are the first responders on the scene. They are followed shortly thereafter by emergency managers, state and local officials, the American Red Cross and other support organizations whose job it is to provide for the public safety, food and comfort needs of the affected population.

When lives are at stake, it is essential that “first responders” be able to communicate immediately not only among themselves, but also with their leadership through respective command and operational centers.

Communications Interoperability

After any major disaster affecting life and property, communications needs and requirements can be defined in three broad categories:

- 1. First Responders:** Public Safety and public health professionals from local Cities, Counties, Urban Areas and States, and the disaster recovery teams who respond immediately to conduct search and rescue, situational assessment and provide immediate medical care and restoration of order.
- 2. Disaster Recovery and Relief:** Emergency Managers from State, Urban Area, Other local areas, as well as Federal representatives (FEMA), the American Red Cross and other officials ensuring public safety and providing food, water and shelter to the affected population.
- 3. Operational Continuity:** A more prolonged disaster recovery and relief effort, extending to welfare, reconstruction and public health and many other Federal/ State/Local jurisdictions.

In each case, communications interoperability is essential for these immediate and ongoing coordination and risk management efforts.

Vulnerability of Terrestrial Communications Infrastructure

Land Mobile Radio (LMR) is generally the most common communication system used by first responders and the National Guard. Effective when it comes to local communications, LMRs have limited reach to the “outside” world.

Land mobile radios from various agencies often operate on different frequencies, leading to difficulties coordinating between teams of first responders during a disaster. This was evident in the immediate aftermath of the Sept. 11, 2001, attacks on the World Trade Center in New York, and is still a problem today.

Local and regional communications that rely on the Public Switched Telephone Network (PSTN) and terrestrial infrastructure (line-of-sight to repeaters or towers) are vulnerable to disruption in the event of a significant disaster. Hurricanes, earthquakes, floods or explosions can destroy connections to the PSTN and leave first responders without means of communicating to the outside world when it is most essential.

The Satellite Solution

The commercial satellite industry provides a critical component to the nation’s communications network infrastructure and ensures interoperability of immediate and ongoing emergency response communications.

Commercial satellites provide critical voice and data services to millions of consumers on a daily basis, including the public safety and military communities. Of equal importance is the redundancy that commercial satellites provide to the nation’s communications assets. This redundancy extends to the wireless and wireline terrestrial infrastructure. In times of disaster and emergency, often the only reliable, and many times the only available, communications networks are satellite-based.

Commercial satellite networks are completely independent of the regional infrastructure. They can be relied upon in any emergency or disaster. Satellites provide immediate voice and data connectivity when the critical infrastructure of the public switched telephone network is damaged. They can provide gateway services for voice (VoIP), data and video WiFi and local cellular phone service, connecting these services directly to the Internet and unaffected portions of the PSTN.

By providing connectivity to the PSTN and the Internet, commercial satellites are an essential component to achieving the goal of immediate global communications interoperability.

In October 2006, this conclusion was borne out by one of the findings of the Hurricane Katrina Task Force report¹, which stated in part: “response operations were impeded because of a lack of adequate satellite communications capability.” Without incorporating satellites into emergency communications network planning, the report concluded that America will continue to have significant communications failures resulting in the loss of lives.



Instant satellite connectivity - anytime, anywhere, with Intelsat General's mobile satellite service.

Intelsat General - A Vital Partner for Achieving Homeland Security Preparedness Goals

Many Federal, state and local emergency response providers already provide for commercial satellite services in their emergency communication plans. However, a host of others have yet to plan or provide for adequate satellite capability in their disaster planning. This is the case, despite a finding by the Federal Communications Commission² that: "the incorporation of commercial satellite services into either a private public safety or commercial interoperable network that also includes terrestrial wireless systems would help to ensure that effective communication services are available to emergency response providers."

Intelsat General Corporation is part of the Intelsat Limited group of companies. It is a provider of satellite communications products and services for all U.S. Federal, State and Local government and NATO military end-user applications, commercial companies and private users. Additionally, Intelsat General (IGC) serves the global communications requirements of the U.S. Federal Government and NATO, primarily for U.S. embassies and deployed armed forces overseas.

Intelsat General's communications applications include voice, data, Internet, video, videoconferencing and distance learning. The Company is ideally suited to serve the emergency preparedness and ongoing communications needs and requirements of the first responder community.

Federal Emergency Preparedness Planning REQUIREMENTS

As we learned from Hurricane Katrina, satellites provide the only interoperable solution in the aftermath of a disaster and should be considered essential to emergency and communications preparedness.

As part of the National Preparedness Goal (NPG), states are required to be prepared for 15 different terrorist attack or national disaster scenarios by developing or enhancing 37 critical target capabilities. Satellite communications serves as an important enabler to significantly enhance a number of these critical target capabilities.

Homeland Security Grant Program

The FY 2007 Homeland Security Grant Program (HSGP) provides an excellent vehicle for state and local governments to upgrade their communications capability levels. A brief summary of the grant type and the corresponding Intelsat General service appears below:

Grant Type	Intelsat General Solution	NPG Supported Elements or Other Directives
State Homeland Security Program (SHSP)	<ul style="list-style-type: none"> • Mobile Satellite Services (MSS) • BGAN/GAN • Iridium 	Satellite can offer communications solutions in the absence of permanent communications infrastructure to support NPG capabilities during some identified scenarios: critical resource logistics and distribution, emergency operations center management, firefighting operations support, interoperable communications, on-site incident management, public safety and security response.
Urban Areas Security Initiative (UASI) Program	<ul style="list-style-type: none"> • GlobalStar • Intelsat Network Broadband Solution (Fixed Satellite Services based VSAT) 	Satellite solutions will aid the response and recovery preparedness efforts against terrorism and other hazards. Satellite solutions may be the only reliable method of communications during terrorist attack and natural disaster. Supports NPG capabilities as identified above.
Law Enforcement Terrorism Prevention Program (LETPP)		Satellite solutions will act as an enabler to ensure that required communications exist to allow the fusion centers to operate even during a disaster or terrestrial communications infrastructure failure.

"Satellite Data Services" including satellite equipment and satellite services/space segment are listed in FY2006 Authorized Equipment List for HSGP.

Intelsat General Satellite Solutions

Satellite services can generally be classified into two groups: Fixed Satellite Services (FSS) and Mobile Satellite Services (MSS). Both FSS and MSS solutions are vital during emergency response and disaster recovery, yet they have different characteristics as shown in the table below. While Broadband Global Area Network (BGAN) service is classified as an MSS, BGAN has data rates exceeding 450 kbps in some cases.

Type	Data Rates	Typical Terminal Size	Typical Set-Up Time	Suitable Applications	Typical Cost
FSS-Based VSAT	~ Duplex 1.5 Mbps	1.2-meter dish with RF equipment and modem (>100 pounds).	From several minutes to a few hours.	Continuity of Operations (COOP) command center communications, any applications requiring high-speed communications.	Terminal: ~\$15k. Auto-Acquire terminal begins at around \$40k. Service: depends on several factors, although ~\$9k to \$12k per month for dedicated connectivity. Shared services are more economical.
BGAN	~ 500 kbps	As small as a laptop computer (a few pounds).	Typically less than 5 minutes.	Small scale COOP and command center communications – perhaps the initial line of communications after disaster prior to FSS VSAT set up in some cases.	Terminal: ~\$2k (~\$17k for “on-the-move” terminal). Service: under \$1 per minute for voice; several dollars per MB for data.
Traditional MSS GAN Iridium GlobalStar	Up to 64 kbps for data; <10 kbps for voice/fax.	Handset plus handheld terminal (~15 pounds).	Typically less than 2 minutes.	First responder voice communications in absence of cell phones; low speed data as necessary.	Terminal: ~\$2-4k. Service: \$6 per minute for data; \$1+ per minute for voice.

Typically, traditional MSS and BGAN are more mobile than VSATs although VSATs can offer higher throughputs (shown above). BGAN also supports “on-the-move” terminals providing connectivity of over 400 kbps for vehicles traveling up to 100 MPH and over 600 MPH for aeronautical units.

Satellite Communications and Interoperability Breakthrough

Land mobile radio (LMR) and other terrestrial communications systems can be connected to a satellite communications system through the use of an interconnect device.

Once such device is the Raytheon ACU-T™ Tactical Interconnect System, or radio gateway (right). The ACU-T can be rapidly configured and deployed to meet almost any interoperability application involving radios and telephones, connecting them immediately and seamlessly to the PSTN and Internet. Because of this multi-application interconnect capability the ACU-T gateway represents an interoperability breakthrough for emergency communications.

The Raytheon ACU-T gateway can interconnect up to 5 devices. It can simultaneously cross-connect different radio networks, connect radio networks to telephone systems (or SATCOM systems) or interconnect Radio Over Internet Protocol/Voice Over Internet Protocol (RoIP/VoIP) communications.

The ACU-T is completely scalable and field-configurable to meet any customer and application requirement. It provides three different methods of operation for system redundancy and is neither computer nor network dependant for its operation. It provides tactical packaging for the proven ACU-1000 modular interoperability system. With much the same functionality as the ACU-1000, the ACU-T is

ACU-T™ Tactical Interoperability



a small rugged unit suitable for tactical or vehicular use and rapid deployment. Weighing less than eight pounds, the ACU-T incorporates a drip proof top cover; quick connect/disconnect CPC connectors for radio interfacing; and a keypad, speaker, and handset for local control and monitoring.

In March 2007, Intelsat General and Raytheon successfully tested and demonstrated the BGAN capabilities with the ACU-T. In addition to testing voice applications through the ACU-T, the demonstration included the capability of the BGAN to provide streaming IP and data messages on the same terminal, achieving significantly higher data rates than any previous tests.

Mobile Satellite Solutions

Through its Mobile Satellite Service (MSS), Intelsat General provides a full spectrum of mobile telecommunications services for commercial and government customers worldwide. Intelsat General specializes in providing mobile satellite communications to customers on the move who require quick response, secure, and highly reliable voice and data services via mobile terminals. These services provide end-to-end connections for all calls. This includes communications among MSS users and between MSS and Public Switched Telephone Network (PSTN) and cellular users via satellite gateway earth stations.

Intelsat General provides the following mobile satellite services appropriate for use in the United States:

- Inmarsat: All services, including BGAN
- Iridium
- Thuraya
- Mobile Ku-band
- GSM

Intelsat General has seasoned engineering and implementation staff with extensive MSS experience and commitment to customer satisfaction. In addition to the services provided above, Intelsat General also provides other mobile services, including international cellular and voice, data, telex, fax, and position and status reporting for vehicles and for land, mobile, airborne, or maritime customers.

Our mobile satellite services can support emergency, disaster, or continuity of operations in areas of the world where communications are extremely difficult or impossible by any other means. Services are also available for temporary or fixed operations.

Intelsat General provides airtime via any available ground station, and equipment from reliable, tested equipment manufacturers. We provide our customers with worldwide coverage for the following services:

Inmarsat: Broadband Global Access Network (BGAN) Service

The Inmarsat satellite network is the most popular, reliable, and stable mobile satellite communications system available. Inmarsat terminals vary greatly in size and weight (left), ranging from 1.5 pounds to hundreds of pounds for shipboard units. The Inmarsat network has multiple ground earth station operators and manufacturers of Inmarsat-capable equipment.

Inmarsat's BGAN service provides both circuit switched and IP data services.

- The circuit switched services provide 2-way full duplex 4.0kbps voice, 64kbps ISDN, and 3.1 kHz audio communications.
- The IP data services are divided into two service classes: Background and Streaming.

- The Background IP class provides shared 2-way communications at transmission speeds of up to 492kbps.
- The Streaming class operates 2-way full duplex at transmit speeds of 32, 64, 128, and 256kbps, depending on the type of terminal. Terminal equipment is extremely lightweight, portable, and easy to operate. Note that terminal position is transmitted when the terminal attaches to the network.

Inmarsat currently has two Satellite Access Stations (SAS), located respectively in Fucino, Italy and in Burum, The Netherlands. These two stations share duties in the Indian and Atlantic Ocean Regions.



Inmarsat BGAN End-to-End Connectivity

Connectivity for mobile-to-mobile circuit switched calls is offered via a double hop to the SAS and back to the destination terminal. Connectivity for mobile to fixed wireline users is via the satellite to the SAS and then to the PSTN or ISDN circuit switched networks to the end user. Connectivity for fixed wireline users to mobile users is via the PSTN or ISDN to the SAS, to the satellite, and to the mobile terminal. Connectivity for IP services is from the terminal to the satellite, to the SAS, and to the Internet.

FSS-Based VSAT Solutions

Intelsat General supports the following services, suitable for multi-site applications, using Intelsat's Network Broadband Service based on iDirect technology:

- Internet and Intranet access with virtual private network (VPN) and web browsing
- E-mail
- Voice over IP (VOIP) telephony
- File transfer
- Video conferencing



BGAN Explorer 300 and Explorer 500 Terminals.

These applications run on Intelsat's Network Broadband Service with additional hardware and software. They are platform independent and run on single channel per carrier (SCPC) satellite solution configured for IP traffic. For services involving only a few sites, SCPC services augmented by Intelsat's teleports services may be more economical depending on the user requirements.

Intelsat Network Broadband Service

Intelsat General's GlobalConnexSM (GXS) Network Broadband Service allows Government and other users to deliver direct Internet and broadband services to their end users via satellite. GlobalConnex is based on iDirect technology. All the participating sites in the network deploy iDirect terminals and are connected to an Intelsat General hub in a star configuration. The service leverages Intelsat General's infrastructure comprising satellites, teleports, points of presence (POP), and a terrestrial network that interconnects the ground infrastructure.

GlobalConnex has features and controls that allow it to be easily configured to deliver required Quality of Service (QoS) and other traffic-engineered solutions. It also provides TCP and web acceleration in both directions. Other service features include optional 3-DES link encryption, local DNS cache on the remote, dynamic and static IP routing, and virtual local area networks (VLANs). The service also supports mobile communications.

As a 2-way broadband solution, all out-bound GlobalConnex traffic (from hub to remotes) is broadcast over one outroute Time Delay Multiple Access (TDMA) carrier while all the in-bound traffic (from remotes to hub) is routed over one or more inroute carriers using D-TDMA (Deterministic-TDMA) in a shared mode. The platform supports an outbound carrier up to 20Mbps in size and inbound carriers of up to 4.5Mbps.

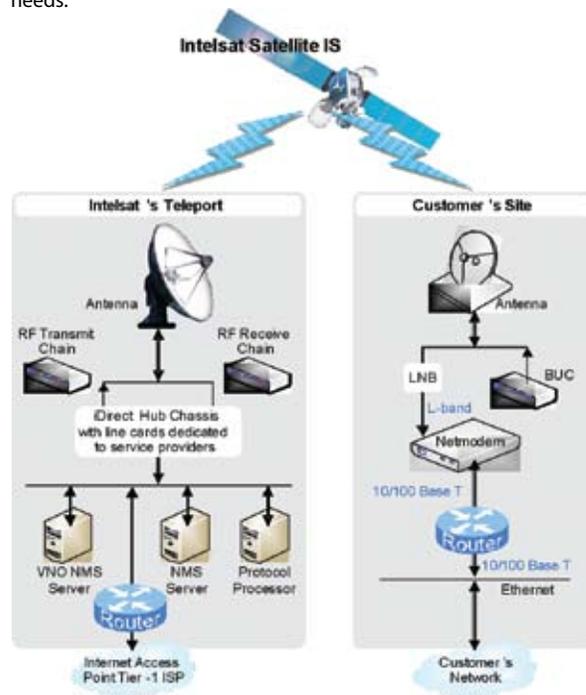
GlobalConnex employs an iDirect hub located at an Intelsat General teleport and iDirect remotes at end-user locations. The hub consists of iDirect hub chassis, multiple (up to 20) line cards, redundant Protocol Processors, and Network Management System. Each line card can support one outroute, one inroute, or a combination of both. The highly scalable iDirect hub can support up to five different networks operating on five different satellites from one hub chassis. The NMS server allows configuration and supervision of the hub and all the remote terminals. Each remote terminal receives the outroute carrier and transmits on one of the assigned inroute carriers in a TDMA access mode. The hub is connected to Intelsat General's multi-homed Tier-1 IP backbone. The platform also supports IP backhaul to customer's IP backbone provider on a case-by-case basis.

Intelsat General's network broadband service is fully scalable; additional bandwidth can be provided as the number of customer premise terminals (CPT) on the

network grows. With this service, Government, first responders and other users can offer multiple service classes (up to four) to their end users. A class of service is defined by a Committed Information Rate (CIR), a Burstable Information Rate (BIR), and the sharing ratio that applies to the traffic of the sites belonging to this class of service.

Intelsat General Service Options

Intelsat General offers two variants of its broadband service, Intelsat Managed (IM) and Virtual Network Operator (VNO). Customers can choose the service option that best fits their needs.



Under the Intelsat Managed option Intelsat General provides the hub equipment and manages the network. We set up support commissioning of the remote sites including configuration of QoS profile and CIR/BIR, per the customer's requirements. Customers can view their network through a remote read-only access to Intelsat General's Network Management System (NMS).

With the VNO option, Intelsat General provides hub equipment while customers manage and monitor their own network. They are responsible for setting up and configuring the remote sites including QoS profile and CIR/BIR. We facilitate this process by providing our customers with a dedicated NMS server at the Intelsat General teleport with a remote write access.

The VNO option requires the customer to be trained on VNO operation and to be VNO certified by iDirect.

Customers can launch their broadband service using this platform by signing up for a minimum aggregate bandwidth of 1Mbps and establishing a Level 1 helpdesk for their end users.

With this product, the customer needs only pay a one-time setup fee (which is significantly lower than buying a complete hub), and the monthly service charges for contracted aggregate bandwidth.

Network Broadband Disaster Response Solution

Combining a transportable (“flyaway” terminal and attached iDirect modem) with Intelsat’s Network Broadband Service, Intelsat General can instantaneously provide Internet and intranet connectivity, file transfers, e-mails, and telephony service in a disaster area to support emergency relief and recovery efforts.

Vehicle mounted flyaway terminals (right) can be used to access Network Broadband Services while “on-the-pause.”

Required Equipment and Services include:

- Network Broadband Service
- Flyaway terminal with iDirect modem
- Electric generator
- Installation, setup, and configuration services
- Customer Provided: PC, VoIP handset, router (if needed), video camera

Lessons are still being learned from recent natural and manmade disasters. However, it is clear that state, local and Federal agencies must plan for continuity of operations. These solutions must be pre-deployed and available through auto-redundancy switches or manual set-up for rapid restoration. This involves a quick-deployment or fixed VSAT network for point-to-point or point-to-multipoint connections, plus a service that provides burstable IP voice, data and video data efficiently and cost-effectively.

Mobile Command Centers (MCC)

Intelsat General has three large mobile communication centers available for deployment. Each MCC consists of a bus with a trailer attached, shown below. We can integrate satellite products and services into any customer’s mobile command center to meet specific communications requirements.

Features of the MCC include:

- 40-foot and 53-foot self-contained vehicles.
- Up to 24 individual stations, each with a telephone jack, an Ethernet port, and an electrical outlet
- A satellite antenna and associated RF and IF equipment.
- VoIP telephones, wireless IP telephones, and both wired and wireless Ethernet access for laptops.



Emergency Response/Continuity of Operations (ER/COOP)

Government agencies are required to have a plan and resources in place to enhance existing communication capabilities and reestablish communications in times of natural or man-made disasters. Events such as Hurricanes Katrina and Rita were two recent examples where a rapid deployment capability of communications is essential. Intelsat General combined forces with MCI and Verizon Business to respond in these two disasters. We have since expanded this relationship to provide a comprehensive package of ER/COOP services.

Intelsat General can deploy a number of solutions depending on the requirement. These premier offerings range from the Mobile Command Center (MCC) - or “Big Blue” - to fully-managed two-way broadband solutions that supply the additional bandwidth needed by disaster recovery and relief organizations. Our goal is to provide terrestrial and space services for instant satellite communications wherever and whenever they are needed.

- Ports with PCs attached as well as ports available for personal PC attachment.
- Residents or communities may use the MCC to make local, long distance, and international calls, as well as access the Internet and send or receive faxes.
- Completely self-sufficient, with portable generators providing electricity for lights, heating and cooling. If needed, the generator can hand off power for external emergency lighting, equipment power, etc.
- Provides worldwide communications via satellite technology to local and long distance switches in Texas.
- Equipped with two satellite televisions—one flat-screen and one regular.
- When not serving a community, the MCCs and teams of employees who maintain them are based in Richardson, Texas. An MCC can typically reach either coast within 24 hours.



Business Communication Van #1 and #2

The Business Communications Van #1 and #2 are trailers, each of which is part of an 18-wheel rig.

Features:

- Self-contained vehicles.
- Equipped with up to 24 individual stations, each with a telephone jack, an Ethernet port, and an electrical outlet.
- Equipped with a satellite antenna and associated RF and IF equipment.
- VoIP telephones, wireless IP telephones, and both wired and wireless Ethernet access for laptops.
- Ports with PCs attached as well as ports available for personal PC attachment.
- Residents/community may make local, long distance, and international calls, as well as access the Internet and send or receive faxes.
- Completely self-sufficient, with portable generators providing electricity for lights, heating and cooling. If needed, the generator can hand off power for external emergency lighting, equipment power, etc.
- Provides worldwide communications via satellite technology to local and long distance switches.
- When not serving a community, the vans and the team of employees who maintain them are based in Richardson, TX. The vans can typically reach either coast within 24 hours.

Medium-Size Site Restoration

In addition to its large communication vehicles, Intelsat General offers small mobile trailers (left) that provide a mobile office environment for displaced local or state agencies or first responders. This mobile communication solution serves as a remote extension for an Agency's LAN.

Features:

- 6' x 8' trailers with auto-deploy antennas (auto-deploy antennas automatically locate the proper satellite and transponder without the need of a satellite engineer or satellite trained personnel).
- Trailers can be equipped for an indoor 1-2 man workstation and/or an outdoor tent work environment using tables, etc. for computers, phones and/or video equipment.



- Trailers can be wired for computers and/or VOIP connections along with the associated VOIP phone systems.
- Trailers can be deployed, set-up and moved very quickly, typically within 4 hours after arrival onsite.

Deployable and Auto-Acquire VSAT systems

Intelsat General carries a fleet of flyaway terminals for low- to high-bandwidth data links. These self-contained units are packed in hard cases that can be transported via commercial airlines. These flyaway terminals can be deployed within a few hours and setup on-site by a satellite technician within thirty minutes to four hours after arriving on-site.

Features:

- Professionally integrated and pre-tested 1.2-meter VSAT antenna system and associated outdoor RF equipment, cabling, indoor unit (satellite modem).
- Rugged shipping container.
- Ethernet switch for non-collision data traffic within the LAN.
- Logistics and customer support.

Options include:

- VoIP phone systems and wiring.
- Routers/switches.
- Video equipment.
- Power Generators and UPS Systems

Summary

FCC Chairman Kevin J. Martin, in a recent report to Congress², concluded that: "recent disasters such as Hurricane Katrina have highlighted the ability of satellite services to continue operating when existing terrestrial infrastructure is non-existent or has been degraded or destroyed."

The integration of satellite communications capabilities, both MSS and FSS, into emergency response and disaster recovery network must be provided to achieve the National Preparedness Goal and execute the State Homeland Security Strategies.

Intelsat General can provide these satellite services, which can be integrated into the network to help prevent and respond to terror and disaster events in all conditions.



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¹U.S. Representative Gene Taylor (MS-04) Chairman, Hurricane Katrina Task Force, and U.S. Representative Charlie Melancon (LA-03), Vice-Chairman, Hurricane Katrina Task Force: Katrina and Beyond: Recommendations for Legislative Action (Hurricane Katrina Task Force, October 2006, p. 12.)

²Kevin J. Martin, Chairman of FCC, "Report to Congress: On the Study to Assess Short-Term and Long-Term Needs of the Electromagnetic Spectrum for Federal, State and Local Emergency Response Providers" (Federal Communications Commission, December 19, 2005, p. 22.)