Homeland Security
Science and Technology

TechNote

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercially available equipment and systems, and develops knowledge products that provide relevant equipment information to the emergency responder community.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?" These knowledge products are shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities.

This TechNote was prepared for the SAVER Program by the National Urban Security Technology Laboratory.

NUSTL

For more information on this and other technologies, contact the SAVER Program by e-mail or visit the SAVER website.

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Satellite Mobile Phones

Satellite mobile phones utilize satellites to communicate with landline, cellular, or other satellite phones in most regions of the world. Responders use satellite mobile phones for emergency communications in order to coordinate response and recovery efforts in remote areas, where there are no landline or cellular telephone networks, or in areas where existing networks are damaged or overloaded during a natural disaster (e.g., severe weather or earthquake) or a man-made incident, including potential chemical, biological, radiological, nuclear, or explosive events. Satellite mobile phones can help maintain command and control functions during an emergency when existing communications networks are not functioning. These phones are designed to be relatively rugged and simple to operate, but are more expensive than cell phones to buy and use.

How Satellite Mobile Phones Work

Satellite mobile phones are handsets that use satellites to communicate with landline, cellular, or other satellite phones. The satellite receives the information signal, voice or text, from the sending phone and transmits it back to earth to a receiving satellite phone. An omnidirectional or directional antenna in the mobile phone is used for both transmitting and receiving signals. Satellite phones generally require line-of-sight with the sky to receive a signal for service. As a result, satellite phones do not work well indoors, although operation might be acceptable if the phone is positioned near a window. Mobile phones using satellite phone systems can provide communications to ships, vehicles, planes, other ground-based phones, and command centers (Figure 1).

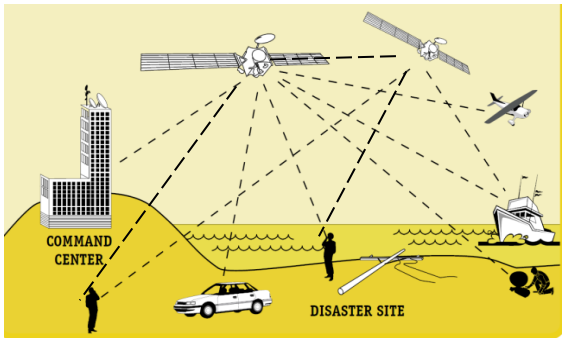

Figure 1. Satellite Communications

Photo courtesy of Satellite Industry Association

Satellite phone systems use geosynchronous equatorial orbit (GEO) or low Earth orbit (LEO) satellites. GEO satellites orbit about 36,000 kilometers (22,400 miles) above the earth's equator, remain in fixed positions in the sky, and can provide near-continuous global coverage with only a few satellites. They have a latitude limitation of approximately 70 degrees north of the equator to 70 degrees south of the equator. GEO satellite phone systems may introduce a noticeable delay while making a phone call or using data services due to the long signal transmission distances. LEO satellites orbit the earth at much lower altitudes between 780 kilometers (480 miles) and 1,500 kilometers (930 miles).

Because their orbits are not geosynchronous, LEO satellites move with respect to the ground. At least one satellite must have line-of-sight to every coverage area at all times. Depending on the positions of both the satellite and the user's phone, a pass of an individual LEO satellite will typically provide 4 to 15 minutes of coverage; thus, a network comprising as many as 60 satellites is required to maintain continuous coverage. LEO satellites need less powerful amplifiers for successful transmission than GEO satellites. However, LEO data transmission speeds are much slower than speeds of GEO systems.

Applications and Phone Selection Guidelines

Satellite mobile phones have been increasingly used by responders as a backup to land-based communications systems during natural disasters or man-made events. Emergency response organizations use handheld satellite phones primarily for voice communications, but e-mail, text messaging using Short Message Service (SMS), and Internet capabilities are available. Handheld satellite phones, especially models that use LEO satellites, are now smaller and lighter than older models, making them convenient to carry and use. Phones that connect to GEO satellites require more power and are usually larger in size. Some satellite phones replicate the functionalities of cellular phones, including global positioning systems (GPS), and Bluetooth and Wi-Fi, which permit the use of a remote headset and wireless connection to a computer for data access.

The largest satellite network phone operators providing voice and data services are Iridium, Globalstar, Thuraya, and Inmarsat. All provide widespread service around the globe except for Thuraya, which does not serve North or South America. Iridium and Globalstar use LEO satellites; Thuraya and Inmarsat use GEO satellites.

Most models of satellite mobile phones cost between $400 and $1,000 although some models are more expensive (Figure 2). Use charges are costly compared with land-based cell phones; charges of $1/minute or more are typical. Receiving calls that originated on a landline can be more expensive. Rates can be much higher when calling a phone in another provider's network. Some vendors offer dual-mode phones, which are compatible with regular cell phone networks and route communications through them by default. If cellular communications fail, the dual-mode phone automatically switches to satellite mode.

Selection of a satellite mobile phone depends on a number of factors, including:

- Geographic coverage requirements – global or regional
- Economics – handset cost and operating charges (e.g., annual fees, in-network and out-of-network call charges)
- Capabilities – voice quality, e-mail, SMS, GPS, Internet, and phone tracking
- Design and features – size, weight, display, antenna, ruggedness, Wi-Fi, and Bluetooth.

A comprehensive review of satellite communications for emergency resonders can be found in the reference.

(a) (b)

Figure 2. Satellite Mobile Phones: (a) Inmarsat IsatPhone 2 and (b) Iridium Extreme 9575

Photo courtesy of Groundcontrol.com

Reference

A Review of Satellite Communications and Complementary Approaches to Support Distributed Disaster Response. First Responder Group. U.S. Department of Homeland Security, Science and Technology, prepared by Massachusetts Institute of Technology, Lincoln Laboratory, December 2013. http://www.firstresponder.gov/TechnologyDocuments/A%20Review%20of%20Satellite%20Communications%201-15-14.pdf