Satellite Phone

A **satellite** , **satellite phone**, or **satphone** is a type of mobile phone that connects to orbiting satellites instead of terrestrial cell sites. Depending on the architecture of a particular system, coverage may include the entire Earth, or only specific regions.

Satellite phone (Inmarsat)

The mobile equipment, also known as a terminal, varies widely. Early satellite phone handsets had a size and weight comparable to that of a late 1980s or early 1990s mobile phone, but usually with a large retractable antenna. More recent satellite phones are similar in size to a regular mobile phone while some prototype satellite phones have no distinguishable difference from an ordinary smartphones. Satphones are popular on expeditions into remote areas where terrestrial cellular service is unavailable.

A fixed installation, such as used shipboard, may include large, rugged, rack-mounted electronics, and a steerable microwave antenna on the mast that automatically tracks the overhead satellites. Satellite phones have notoriously poor reception indoors, though it may be possible to get a consistent signal near a window or in the top floor of a building if the roof is sufficiently thin. The phones have connectors for external antennas that are often installed in vehicles and buildings. Some systems also allow for the use of repeaters, much like terrestrial mobile phone systems.

In some countries ruled by oppressive regimes such as Burma possession of a satellite phone can be illegal as their signals will usually bypass local telecoms systems hindering censorship and wiretapping attempts.

Satellite phone networks

Geosynchronous services

Some satellite phones use satellites in geosynchronous orbit. These systems can maintain near-continuous global coverage with only three or four satellites, reducing the launch costs. However the satellites used for these systems are very heavy (approx. 5000kg) and therefore very expensive to build and launch. The satellites sit at an altitude of about 22,000 miles (35,000 km) and therefore a noticeable delay is present while making a phone call or using data services. The amount of bandwidth available on these systems is substantially higher than that of LEO systems, all three active systems provide portable satellite internet using laptop-sized terminals with speeds ranging from 60 kbits to 512 kbits.

Another disadvantage of geostationary satellite systems is that in many areas, even where a large amount of open sky is present, the line of sight between the phone and the satellite is broken by obstacles such as steep hills and forest and the user will need to find higher ground before being able to use the phone. This is not the case with Low Earth Orbit (LEO) services - even if the signal is blocked by an obstacle one can wait a few minutes until another satellite passes overhead.

- **ACeS** - This small regional operator provides voice and data services in East Asia using a single satellite.

- **Inmarsat** - The oldest satellite phone operator, founded in 1979 it originally provided large fixed installations intended for use on ships but has only recently started to enter the market of hand-held phones in a joint venture with ACeS. The company operates eleven satellites with another planned for launch in 2008. Coverage is available on most of the earth's surface except polar regions.

- **Thuraya** - A system based in the UAE which until recently operated a single satellite. Two satellites are currently in active service providing coverage to the most of Eurasia, Africa and Australia with some degree of coverage overlap between the two satellites

- **MSAT / Mobile Satellite Ventures** - An American satellite phone company which uses equipment similar to INMARSAT but plans to launch a service using hand-held devices similar to Thuraya in the Americas

Low Earth orbit

LEO telephones utilizes LEO (low Earth orbit) satellite technology. The advantages include providing worldwide wireless coverage with no gaps. LEO satellites orbit the earth at high speed, low altitude orbits with an orbital time of 70–90 minutes, an altitude of 640 to 1120 kilometres (400 to 700 miles), and provide coverage cells. Since the satellites are not geosynchronous, they must fly complete orbits and thus further guarantee complete coverage over every area by at least one satellite at all times.

Two such systems, both based in the United States started up in the late 1990s but soon went into bankruptcy after they failed to gain the number of subscribers required to fund the large satellite launch costs. They are now operated by new owners who bought the assets for a fraction of their original cost and are now both planning to launch replacement constellations supporting higher

bandwidth. Data speeds for current networks are between 2200 bit/s and 9600 bit/s using a satellite handset.

- **Globalstar** - A network covering most of the world's landmass using 44 active satellites however many areas are left without coverage due to the fact that a satellite must be in range of an earth station. Satellites fly in an inclined orbit of 52 degrees and therefore polar regions are not covered either. The network went into limited commercial service at the end of 1999.

- **Iridium** - A network operating 66 satellites in a polar orbit that claims coverage everywhere on the earth's surface. Commercial service started in November 1998 and fell into bankruptcy soon after. Notably radio cross-links are used between satellites in order to relay data to the nearest satellite with a connection to an earth station.

Tracking

LEO systems have the ability to track a mobile unit's location using doppler shift calculations from the satellite however these can be inaccurate by tens of kilometers. On Iridium some hardware the coordinates can be extracted using AT commands while recent Globalstar handsets will display them on the screen

Proposed systems

- **ICO Satellite Management -** A satellite phone company which has launched a single geosynchronous satellite which is not yet in active service.

- **Teledesic** - An ill-fated company backed by Microsoft which planned to provide broadband internet using a network of 840 LEO satellites, it ended up launching only one test satellite.

- **Terrestar** - Proposed satellite phone system for North America

- **Ellipso** - Start up that entered a partnership with ICO

One-way services

Some satellite phone networks provide a one-way paging channel to alert users in poor coverage areas of an incoming call. When the alert is received on the satellite phone it must be taken to an area with better coverage before the call can be accepted.

Globalstar provides a one-way data uplink service, typically used for asset tracking.

Iridium operates a one-way pager service as well as the call alert feature.

Cost of a satellite phone

Satphones on display

While it is possible to obtain old handsets for the Thuraya, Iridium, and Globalstar networks for approximately $200, the newest handsets are still quite expensive. The iconic Iridium 9505A, although released in 2001, still sells for well over $1,000 new. Since satellite phones are purpose-built for one particular network and cannot be switched to other networks, the price of handsets varies with the performance of the network. If a satellite phone provider encounters trouble with its network the handset prices will fall, then increase once new satellites are launched. Similarly, handset prices will increase when calling rates are reduced.

Among the most expensive satellite phones are BGAN terminals, often costing several thousand dollars. However these satphones provide broadband Internet as well as voice communications. Satellite phones are sometimes subsidised by the provider if one signs a post-paid contract but subsidies are usually only a few hundred dollars or less.

Since most satellite phones are built under license or the manufacturing of handsets is contracted out to OEM's, operators have a large influence over the selling price. Satellite networks operate under proprietary closed standards, making it difficult for manufacturers to independently make their own handsets.

Virtual country codes

Satellite phones are usually issued with numbers in a special country calling code.

Inmarsat satellite phones are issued with codes +870 through +874. In the past these codes have been allocated to different satellites but the codes +871 to +874 are due to be phased out at the end of 2008 leaving Inmarsat users with the same country code regardless of which satellite their terminal is registered with.

Low earth orbit systems including some of the defunct ones have been allocated number ranges in the International Telecommunications Union's Global Mobile Satellite System virtual country code +881. Iridium satellite phones are issued with codes +881 6 and +881 7. Globalstar, although allocated +881 8 and +881 9 use U.S. telephone numbers except for service resellers located in Brazil which use the +881 range.

Smaller regional satellite phone networks are allocated numbers in the +882 code designated for "international networks" which is not used exclusively for satellite phone networks.

Calling cost

The cost of making calls from a satellite phone varies from around $0.15 to $2 per minute, while calling them from landlines and regular mobile phones is extremely expensive. Rates from landlines and mobile phones range from $3 to $14 per minute with Iridium and INMARSAT being some of the most expensive networks to call. The receiver of the call pays nothing, unless they are being called via a special reverse-charge service. Making calls between different satellite phone networks is also notoriously expensive with calling rates of up to $15 per minute.

Calls from satellite phones to landlines are usually around $.80 to $1.50 per minute unless special offers are used. Such promotions are usually bound to a particular geographic area where traffic is low. Globalstar is currently offering unlimited calling plans until 2010 - something almost unheard of with satellite phones but their current network is highly unreliable and could be out of service sometime in 2008..

All satellite phone networks have pre-paid plans, with vouchers ranging from $10 to $5000.

Use in disaster response

Most mobile telephone networks operate close to capacity during normal times and large spikes in call volumes caused by widespread emergencies often overload the system just when it is needed the most. Examples reported in the media where this have occurred include the attacks of 9/11/2001, the Hawaiian earthquake, the 2003 Northeast blackouts, Hurricane Katrina, and the 2007 Minnesota bridge collapse.

Also, terrestrial cell antennas and networks can be damaged by natural disasters. Satellite telephony can avoid this problem and be critical in natural disaster communications. Satellite phone networks themselves are prone to congestion as satellites and spot beams cover a very large area with relatively few voice channels.