THE IRIDIUM SATELLITE (ISS)

Abstract :

The credentials part of the paper lies in the applications part where the applications of ISS as an alert system for EARTHQUAKE and TSUNAMI like natural disasters with which the casualties can be drastically reduced.Iridium is a satellite based wireless personal communication network designed to permit a wide range of mobile telephone services including voice, data, networking, facsimile, geo-location , fax capabilities and paging. The iridium project , which sounds like something out of star wars , has its main objective to allow handheld mobiles to be used from anywhere on the planet , with the call being routed directly from handset to handset via one or more of the satellites. With complete coverage of Earth's oceans ,airways and polar regions, Iridium delivers essential services to users who need communications access to and from remote areas. This paper unleashes the system facts such as network coverage , satellite constellation of ISS system and its operation along with advantages and applications also the innovative application of ISS as TSUNAMI ,EARTHQUAKE alert system.

Key Words: *Satellite,Wireless.*

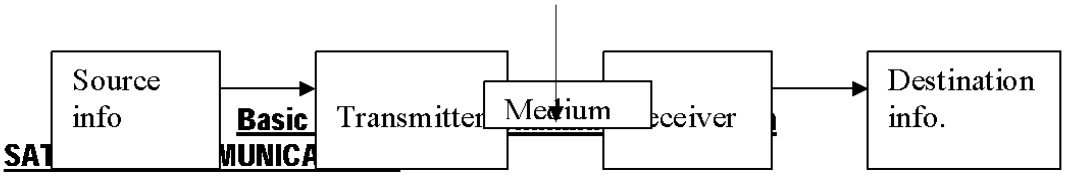
Conclusion:

COMMERCIAL POINT OF VIEW :

Availability of services and early subscriber take up will be the key to survival for the operators. Lower infrastructure costs will further help in early break even and profitability for network operators. Equipment

Introduction :

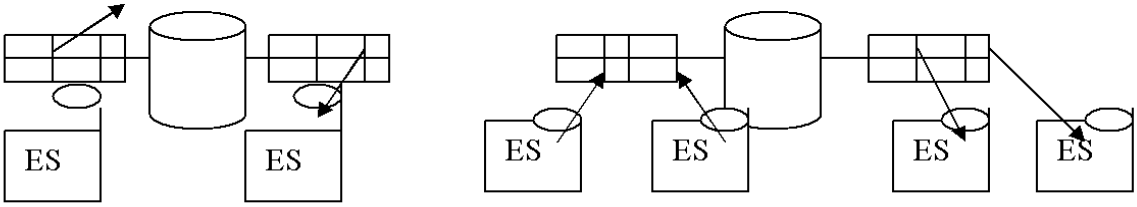
The fundamental purpose of an electronic communication system is to transfer information from one place to another. Thus , electronic communications can be summarized as the transmission , reception ,and processing of information between two or more locations.



A satellite communication system consists of one or more satellite space vehicles (transponder). A ground based station to control the operation and a user network of earth stations that provides the interface facilities for transmission and reception of terrestrial communications traffic through the satellite system. In essence , a communication satellite is a microwave repeater in the sky that consists of a diverse combination of amplifier , receiver ,transmitter ,filter, mux , demux and so on. A satellite communication system with single channel satellite transponder can communicate with one transmitter and receiver i.e; each earth station can communicate with only one other earth station. To overcome this disadvantage multiple channel satellite transponders are used. For multiple channel system, multiple carriers are used and multiple accessing format is established.

Personal Communication Satellite System :

Mobile satellite system (**MSS)** provides the vehicle for a new generation of wireless telephone services called personal communications satellite system (**PCSS).** PCSS is the mother of iridium satellite system.. MSS satellites are , in essence ,radio repeaters in the sky and their usefulness for mobile communications depends on several factors such as the space vehicle altitude , orbital pattern , and several other factors. Satellite communication systems have traditionally provided narrowband and wideband voice , data, video, facsimile , and net communicating via high altitude , geosynchronous earth orbit (GEO) and satellites. personal communication satellite services , however ,use low earth orbit (LEO) and medium earth orbit (MEO) satellites that communicate directly with small , low power mobile telephone units. PCCS telephones will be able to make or receive calls at anytime , anywhere in the world. ES – Earth station



History Behind Its Name :

The system is called iridium after the element on the periodic table with the atomic number 77, because iridium's original design called for 77 satellites. The final design, however, requires only 66 satellites.

Operation :

The 66-vehicle LEO inter-linked satellite constellation an track the location of a subscriber's telephone handset, determine the best routing through a network of ground-based gateways and inter-satellite links, establish the best path for he telephone call, Initiate all the necessary connection, and terminate the call upon completion. The unique feature of iridium satellite system is its cross-links. With this two-way global communications is possible even when the destination subscriber's location is unknown to the caller.

The Iridium System is a satellite-based,wireless personal communications network to permit a wide range of mobile telephone services including voice, data, networking, facsimile, and paging, Virtually any destination anywhere on earth allowing telecommunication anywhere, any time, and any place. Each satellite is cross-linked to four other satellites; two satellites in the same orbital plane and two in an adjacent plane to relay digital information around the globe. The cross-link antennas point towards the closest spacecraft orbiting in the same plane and the two adjacent co-rotating planes. Feeder link antennas relay information to then terrestrial gateways and the system control segment located at earth stations.

Iridium Satellite Constellation :

The Iridium system comprises three principal components – the satellite network, the ground network and the Iridium subscriber products including phones and pagers. Voice and data calls are relayed from one satellite to another until they reach the satellite above the Iridium Subscriber Unit (handset) and the signal is relayed back to Earth.

The Iridium constellation consists of 66 operational satellites and 14 spares orbiting in a constellation of six polar planes. Each plane has 11 mission satellites performing as nodes in the telephony network. The 14 additional satellites orbit as spares ready to replace any unserviceable satellite.

Iridium USES 66 operational satellites configured at a mean elevation of 420 miles above earth in six nearly polar orbital times of 100 min 28 sec. This allows iridium to cover the entire surface area of earth and whenever one satellite goes out of view of a subscriber a different one replaces it. The satellites are placed appropriately in north south directions forming co-rotating planes up one side of earth, across the poles, and down the other side. The first and last planes rotate in opposite directions, creating a virtual beam. The co-rotating planes are separated by 31.6 digress and the beam planes are 22 degrees apart.

Global Coverage Of Iss :

Each satellite is equipped with 3 L-band antennas forming a honeycomb pattern that consists of 48 individual spot beams with a total of 1628 cells aimed directly below the satellite. As the satellite moves in its orbit, the footprints move across earth's surface and subscriber signals are switched from one beam to the next or from one satellite to the next in a handoff process. When satellites approach the north or South Pole, their footprints converge and the beams overlap. Outer beams are then turned off to eliminate this overlap and conserve power on the spacecraft. Each cell has 174 full duplex voice channels for a total of 283,272 channels worldwide. The satellites are in a near-polar orbit at an altitude of 485 miles (780 km). They circle the earth once every 100m minutes traveling at a rage of 16,832 mph. This constellation ensures that every rgion on the globe is covered by at least one satellite at all times

Iridium System Architecture :

The iridium uses GSM-based telephony architecture to provide a digitally switched telephone network and global roaming feature is designed into the system. Each subscriber is assigned a personal phone number and will receive only one bill, no matter in what country or area they use the telephone. System Architecture

The Iridium Satellite System is the only provider of truly global, truly mobile satellite voice and data solutions with complete coverage of the Earth (including oceans, airways and Polar regions). Through a constellation of 66 low-earth orbiting (LEO) satellites operated by Boeing, Iridium

delivers essential communications services to and from remote areas where terrestrial communications are not available. The service is ideally suited for industrial applications such as heavy construction, defense/military, emergency services, maritime, mining, forestry, oil and gas and aviation. Iridium currently provides services to the United States Department of Defense and launched commercial service in March 2001.

The IRIDIUM system is a satellite-based Personal Communication Services (PCS), or Mobile Satellite Services (MSS) system, supporting global, wireless digital communications. IRIDIUM provides voice, messaging and data services to mobile subscribers using handheld user terminals. Iridium Satellite launched commercial global satellite communications

services on March 28, 2001 with enhanced products and services. Service enhancements include improved voice quality and simplified pricing plans. Soon after launch, Iridium expanded the service portfolio to include data services. Please see the Product & Services pages for details. Iridium Satellite LLC is focused on providing affordable, dependable, long-term global communications solutions.

System Layout :

The ground network is comprised of the System Control Segment and telephony gateways used to connect into the terrestrial telephone system.

It provides global operational support and control services for the satellite constellation, delivers satellite-tracking data to the gateways, and performs the termination control function of messaging services. The System Control Segment consists of three main components – 4Telemetry Tracking and Control sites, the Operational Support Network, and the Satellite Network Operation Center. The primary linkage between the System Control Segment, the satellites, and the gateways is via K-Band feeder links and cross-links throughout the satellite constellation. Subscriber telephone sets used in the iridium system transmit and receive L-band frequencies and utilize both frequency and time division multiplexing to make the most efficient use of a limited frequency spectrum. Other communications links used in iridium include EHF and SHF bands between satellites for telemetry, command, and control, as well as routing digital voice packets to and from gateways.

Iridium gateways are prime examples of advances in satellite infrastructures that are responsible for the delivery of a host of new satellite services. The purpose of the gateways is to support and maintain roaming subscribers as well as to interconnect iridium subscribers to the public switched telephone network. Gateway functions include the following :

1. Set up and maintain basic and supplementary telephony services.

◊ Using satellite cross links is the unique key to the iridium system and the primary differentiation between iridium and the traditional satellite bent pipe system where all transmissions follow a path from earth to satellite to earth.

◊ Iridium is the first mobile satellite to incorporate sophisticated, onboard digital processing on each satellite.

◊ Entire global coverage by a single wireless network system.

◊ Only provider of truly global voice and data solutions.

◊ With this system the subscriber will never listen a message called “OUT OF COVERAGE AREA”.

This list provides just a few of absolutely inexhaustible list of comparisons.

◊ Less reliance on wire-line networks

◊ Continuous talk time

◊ Fewer outages

◊ Don’t need to be in the same footprint as the gateway

Advantages:

- Satellite cross-link

- Digital network
- Global paging
- GSM platform based
- Global coverage
- Continuous talktime
- Higher reliability

Disadvantages :

- High risk associated with designing, building, and launching satellites.
- High cost for the terrestrial-based networking and interface infrastructure.
- Low power, dual mode transceivers are more cumbersome and expensive.

Applications :

- Fixed cellular telephone service.
- Complementary and back up telephone service in fields of :
  - Retail
  - Manufacturing
  - Military
  - Government
  - Transportation
  - Insurance
  - Finance

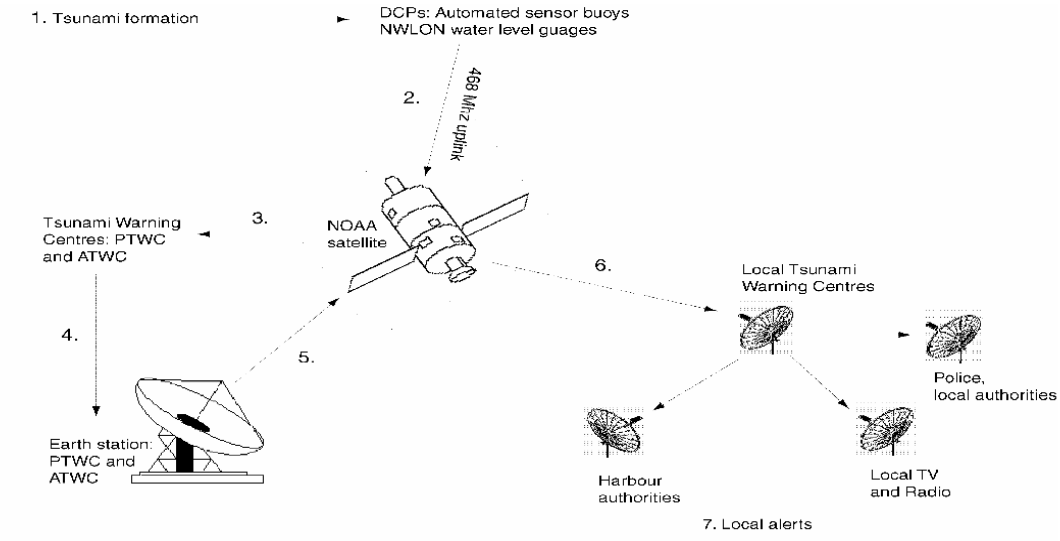
Forthcoming Application :

Earthquake And Tsunami Alert Through Iss :

Earthquakes and Tsunamis strike without warning. The resulting damage can be minimized and lives can be saved if the people living in the earth quake-probe area are already prepared to survive the strike. This requires a warning before the strong ground motion from the earthquake arrives. Such a warning system is possible because the energy wave released at the epicenter travels slower (at 3.5 to 8km/s) than light.The warning signal from the earthquake or tsunami epicenter can be transmitted to different places using the satellite communication network, fiber-optics network, pager service, cell phone service or a combination of these. The satellite based wireless network such as ISS is idle if system has to cover a large continent like ASIA.For EARTHQUAKE, TSUNAMI-prone countries like Indonesia, Japan seismic alert system using the ISS network spread throughout the earth is proposed here. This system does not try to find the epicenter or the fault line caused by the earthquake.

Principle :

Energy waves released travel slower than light waves. It simply monitors the earth vibrations and generates alert signal when the level of earth vibrations crosses a threshold. Thus the disaster is predicted with greater ease and early



Tsunami Alert System Using Iss:

Communicating The Danger :

This GSM-based ISS alert system monitors the earth vibration using a strong motion accelerometer at the earthquake-prone area and broadcasts an alert message to tows and villages through the cell phone network existing throughout the state. Here wireless mobile phones (ISS phones) are used as transmitter and receivers.

The communication system for earthquake alert comprises an earthquake Sensor and interface unit, decision system and alert-dissemination network.

After receiving alert, a middle-aged person takes 30 to 40 seconds to godown the stairs from fifth floor and 65 to 80 seconds from tenth floor. If it takes a minimum of 10 seconds to damage a poorly structured house, this 10 seconds too can be consider for going to safer place. If we consider these points, giving earthquake alert before the actual occurrence of earthquake can minimize casualties. Time to alert is critical. But in generating the alert quickly, there are possibilities of false alarm. In the system proposed here, an attempt has been made to reduce the possibility of false alarm. still, the system needs to be simulated and validated putting into practice.