

Cutting Edge Engineering for Modern Geospatial Systems

Rear Admiral Dr. S Kulshrestha, retd

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“The technology would become so pervasive that it becomes a part of you — it will be built in your glasses, on your phone and in your ears.” Michael T Jones, Google.

“The Archaeological Survey of India has tied up with Google to put 100 major Indian monuments and sites on its immersive visual walkthroughs”



Church of St. Cajetan, Goa

Taj Mahal, Agra

Sanchi Stupa, Madhya Pradesh

Stone Chariot, Hampi, Karnataka

Geospatial technology or Geomatics, includes surveying, geographic information systems (GIS), global navigation satellite system (GNSS), mapping, remote sensing, photogrammetry, and geodesy.

Applications: security and intelligence, automated mapping, environmental management, telecommunication, business, utilities, precision farming, video surveillance cameras, and RFID tags.

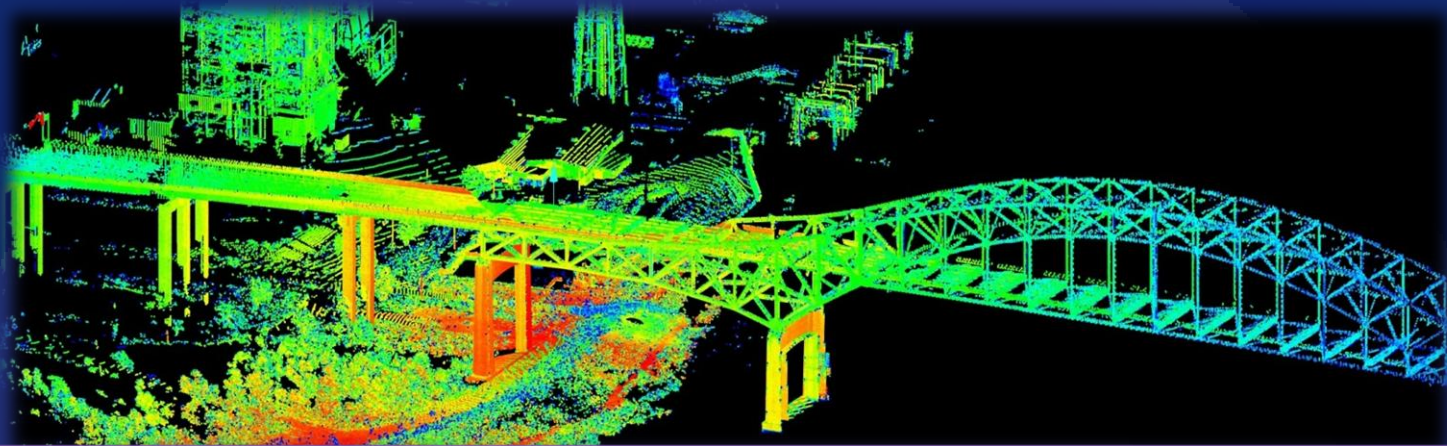
Interlinkages with Communication and Information Technologies.



OrbView3 data, USGS free landsat archive, Global Land Cover Facility (GLCF) , Microsoft Virtual Earth & Google Earth, are free of cost.

With launch of GeoEye-2 in 2016 images of a resolution of 31cm would be commercially available. The imaging sensor is by ITT Exelis, and the satellite by DigitalGlobe .

GeoEye-2, GeoEye-1 and IKONOS, would boost applications like 3D visualization, disaster management, feature extraction & analysis, and infrastructure management.



LIDAR (Light Detection and Ranging) collects 3-dimensional point clouds of the Earth's surface.

Applications: high-resolution topographic mapping & 3-dimensional surface modeling, infrastructure & biomass studies.

Airborne LIDAR uses a laser scanner with up to 400,000 pulses of light per second.

Each data point is recorded with precise horizontal position, vertical elevation, and other attribute values.

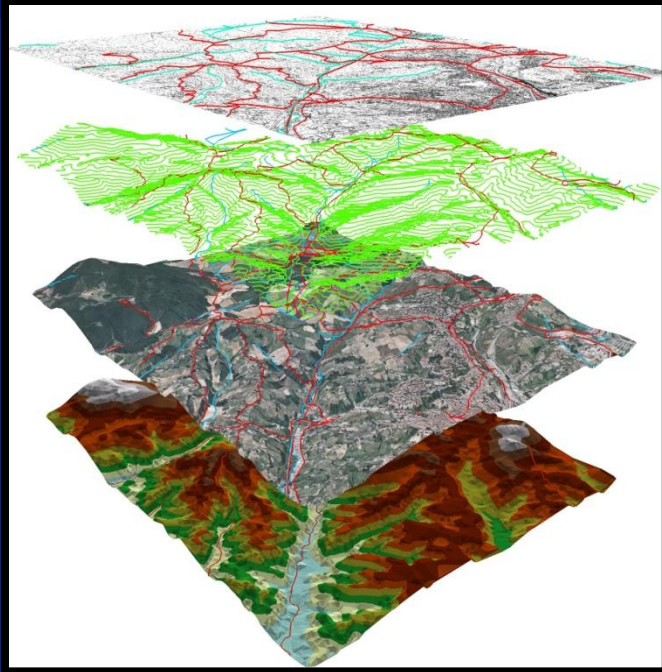


GIS has evolved from desktop to distributed GIS. It is evolving from mobile GIS to web GIS and now onto cloud GIS.

Nepal Earthquake

The Micro Mapper's CrisisMaps were live and publicly available. The Humanitarian UAV Network was also activated to coordinate UAV teams. UAV pilots produced high-resolution imagery, oblique imagery, and 3D point clouds. DigitalGlobe, Planet Labs and Sky Box shared their satellite imagery with CrisisMappers, HOT and others in the Digital Humanitarian Network.

Core Disciplines of GIS



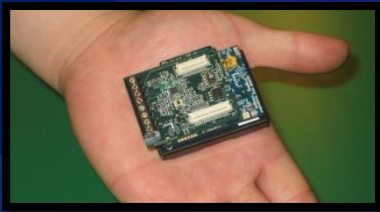
Geography - provides methods of analysis and ways to consider and solve geographical problems;

Cartography - production and study of maps and charts;

Statistics - most of the data are represented as numbers, and queries and analysis rely on statistical techniques;

Databases and data structures - are critical to the storage and manipulation of geographic information.

Programming – aim of analysis task, and series of actions required



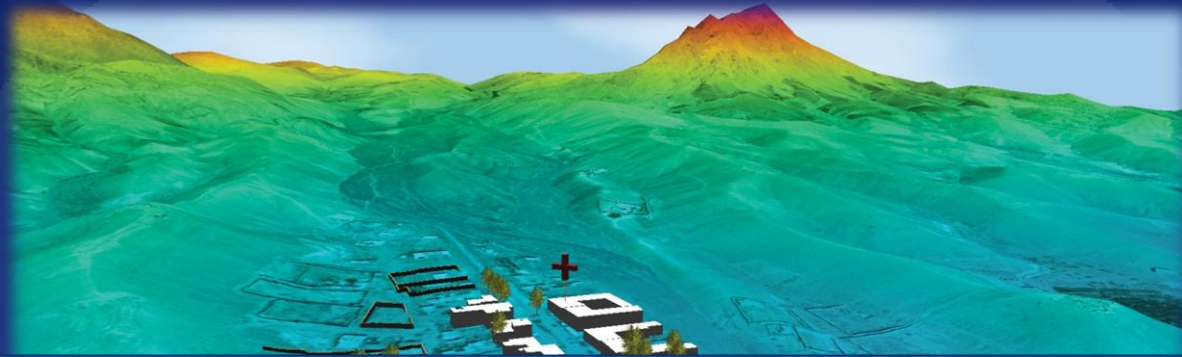
Wireless Sensor Networks



-Availability of wireless communication networks; low-power, short-range radio-based communication networks; miniaturized computing and storage platforms running on battery power; micro sensors and novel sensor materials and real time data delivery have enabled development of intelligent and adaptive sensor platforms. These can be operated as a collaborative-networked system.

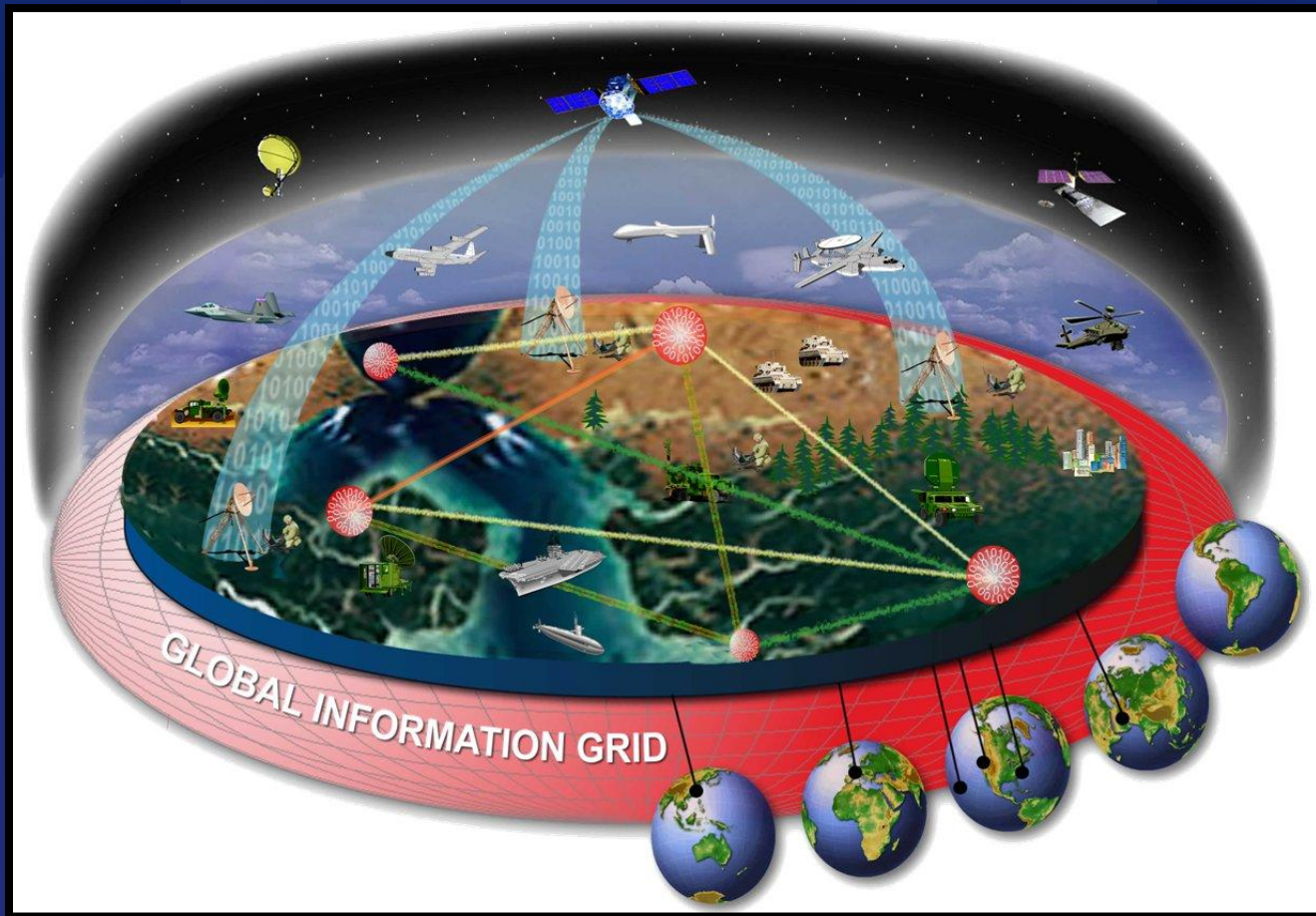
-Wireless sensor networks (WSN) are a group of MEMS devices running on batteries with short-range communication links. They are un-tethered and have very small processing power. Each may have many micro sensors ("pixie dust").

-Work on standardized sensor service interfaces is underway to create a web of real-time sensors that are accessible and sharable in a uniform way. Commercialization of such GSNs is being undertaken by Dust Networks ("Smart Dust"). A software system called TinyOS has been developed which has a very low memory footprint, and is available as open source software.



GEOINT

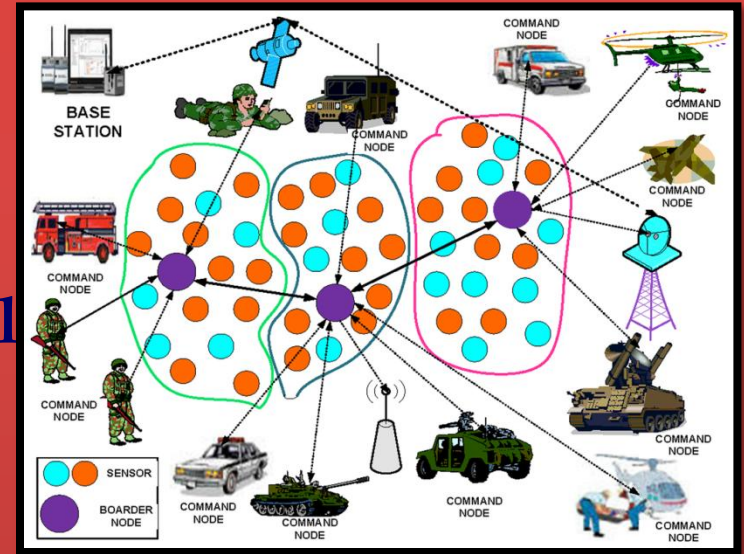
- GIS is a critical component of the Geospatial intelligence.
- GEOINT is intelligence about the human activity derived from the exploitation and analysis of imagery and geospatial information.
- GEOINT describes, assesses, and visually depicts physical features and geographically referenced activities.
- It can be defined as, data, information, and knowledge gathered about adversaries that can be referenced to a particular location on, above, or below the earth's surface.



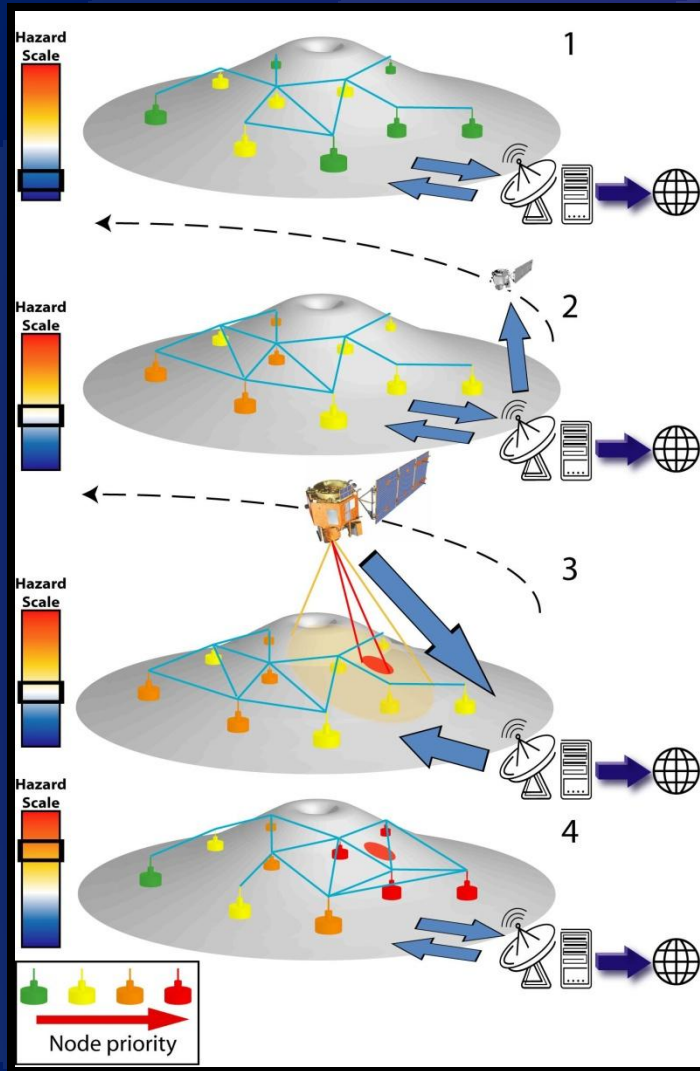
'Situational awareness' comprises tasking, collection, processing, exploitation, and dissemination. Smart, and networked combat systems are pushing the military to adopt commercially available emerging technologies.

Major issues faced by the military

- Availability of ever-increasing Volumes of sensor data from integral sources like UAV's.
- The screens and software tools do Not have interoperability.
- Due to security considerations, ISR data from different sources is stored in different locations with varying access levels.
- Single network domain providing access to data at multiple levels of security classification is not available.
- Some companies in this field are Modus Operandi, Palantir Technologies, SAP's Hana platform, Oracle, Teradata, Leidos, and SYNTASA.



Current Research



-GIS is rapidly moving towards an overarching use through applications such as Location-Based Services (LBS).

-Mobile devices allow obtaining of geographical information at any location in real time but their size limits the amount of information.

-Research focus on the concept of 'Sensor Web'.

-Sensor Web is based upon the sensor web enablement (SWE) initiative.



“The fact that now any individual using the Web can produce a map, publish it, and potentially reach an audience of millions is truly groundbreaking,”
Ed Parsons, Google.

**Thank
You,
Jai Hind!**

