Satellite Asset Tracking (SAT) of Ships/Containers/Vehicles/ Wagons/Aircraft and SCADA (M2M)

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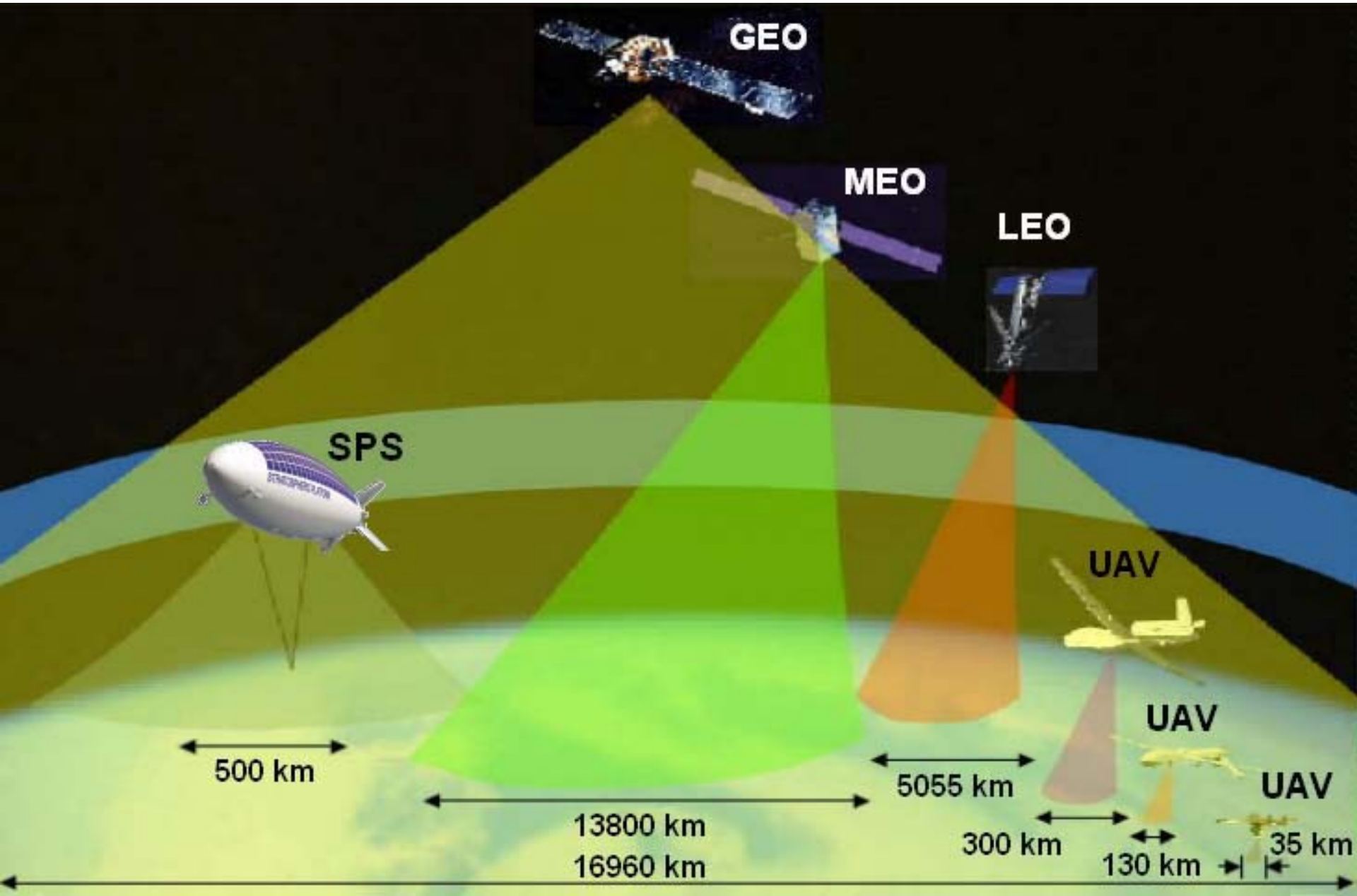
Space Platforms useful for Mobile Tracking

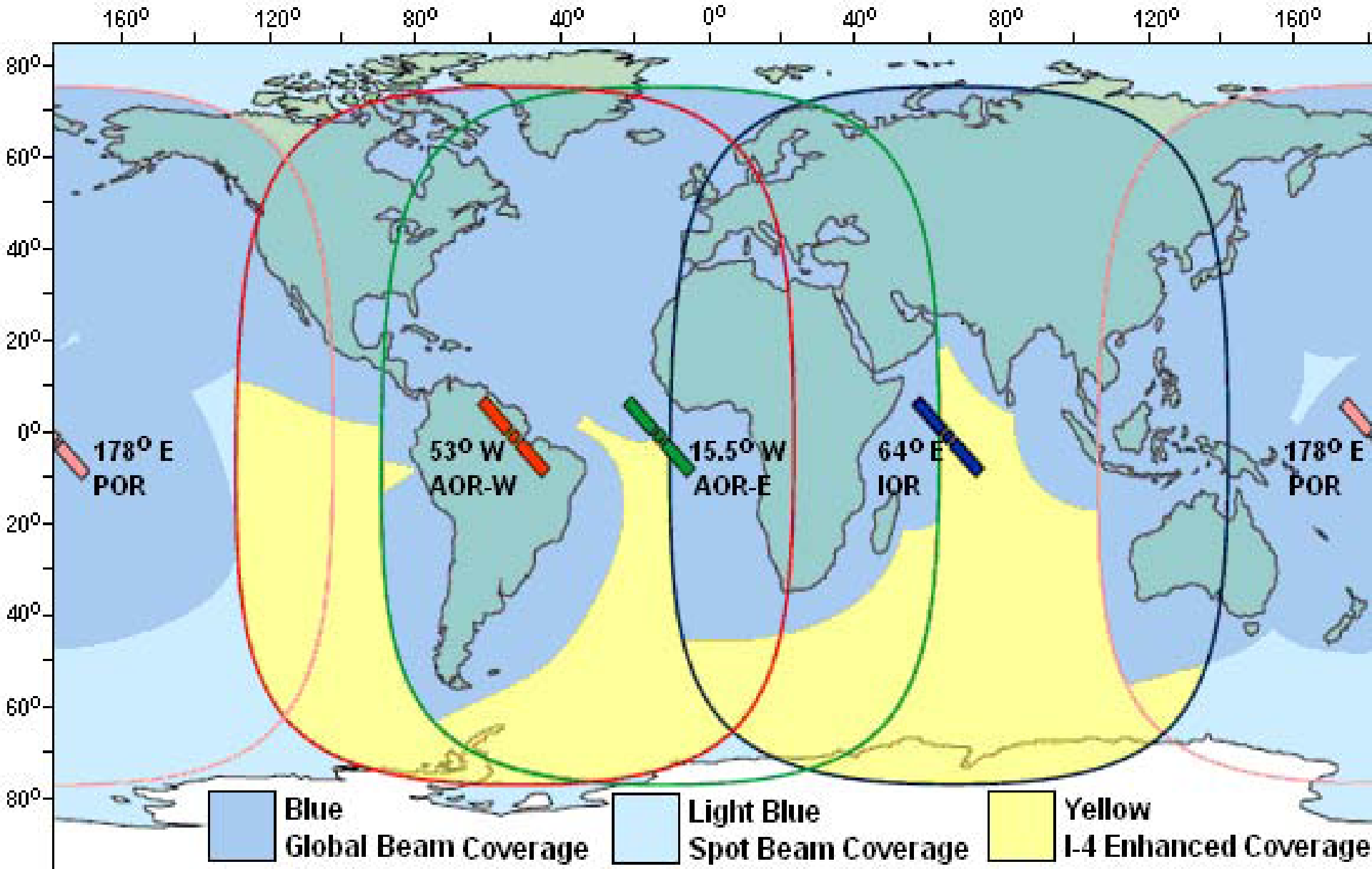


SATELLITE OPERATORS

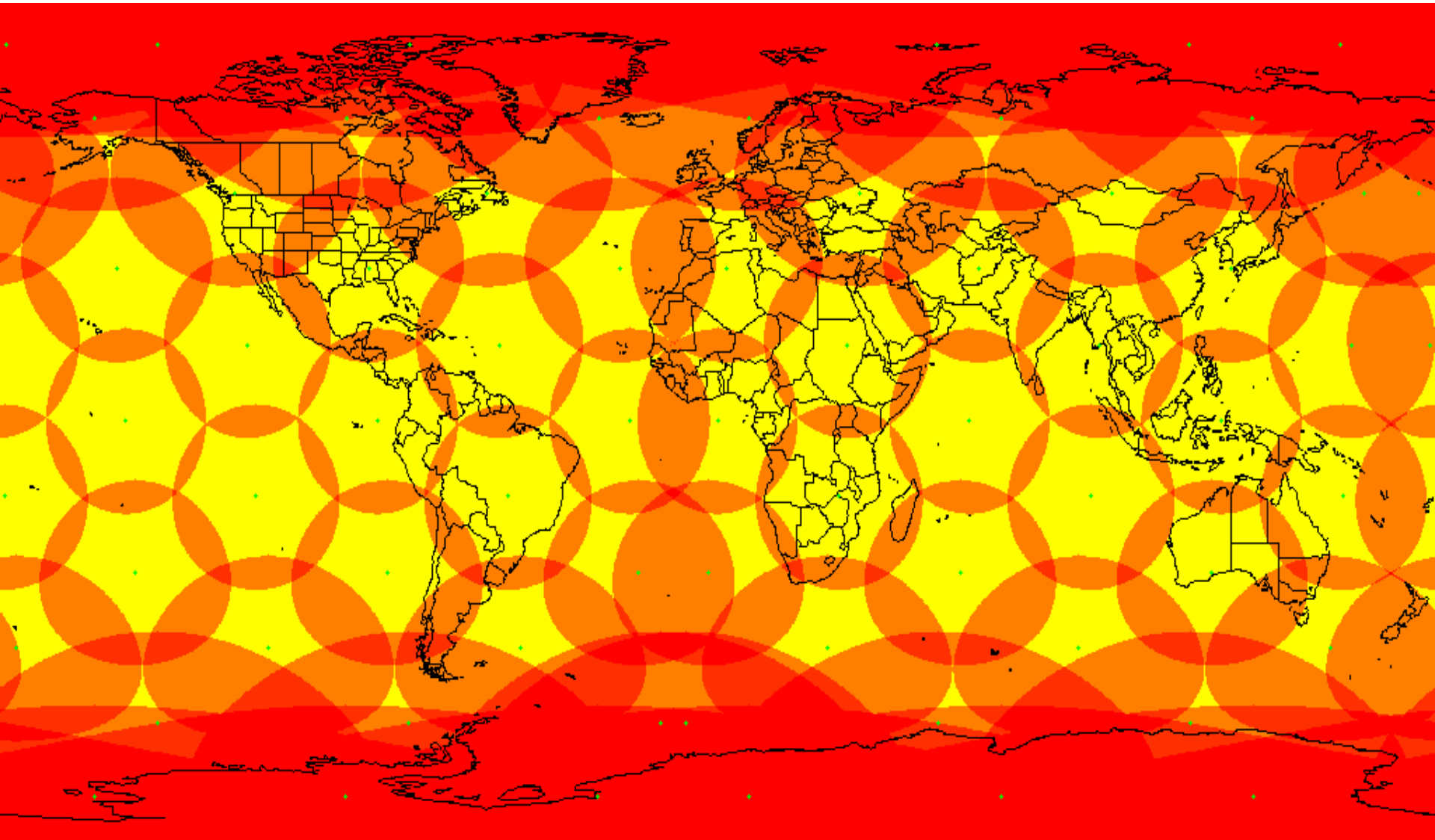
Current Satellite Constellations Suitable for SAT:

1. Inmarsat GEO
2. Iridium Big LEO
3. Globalstar Big LEO
4. Orbcomm Little LEO

INMARSAT COVERAGE MAP

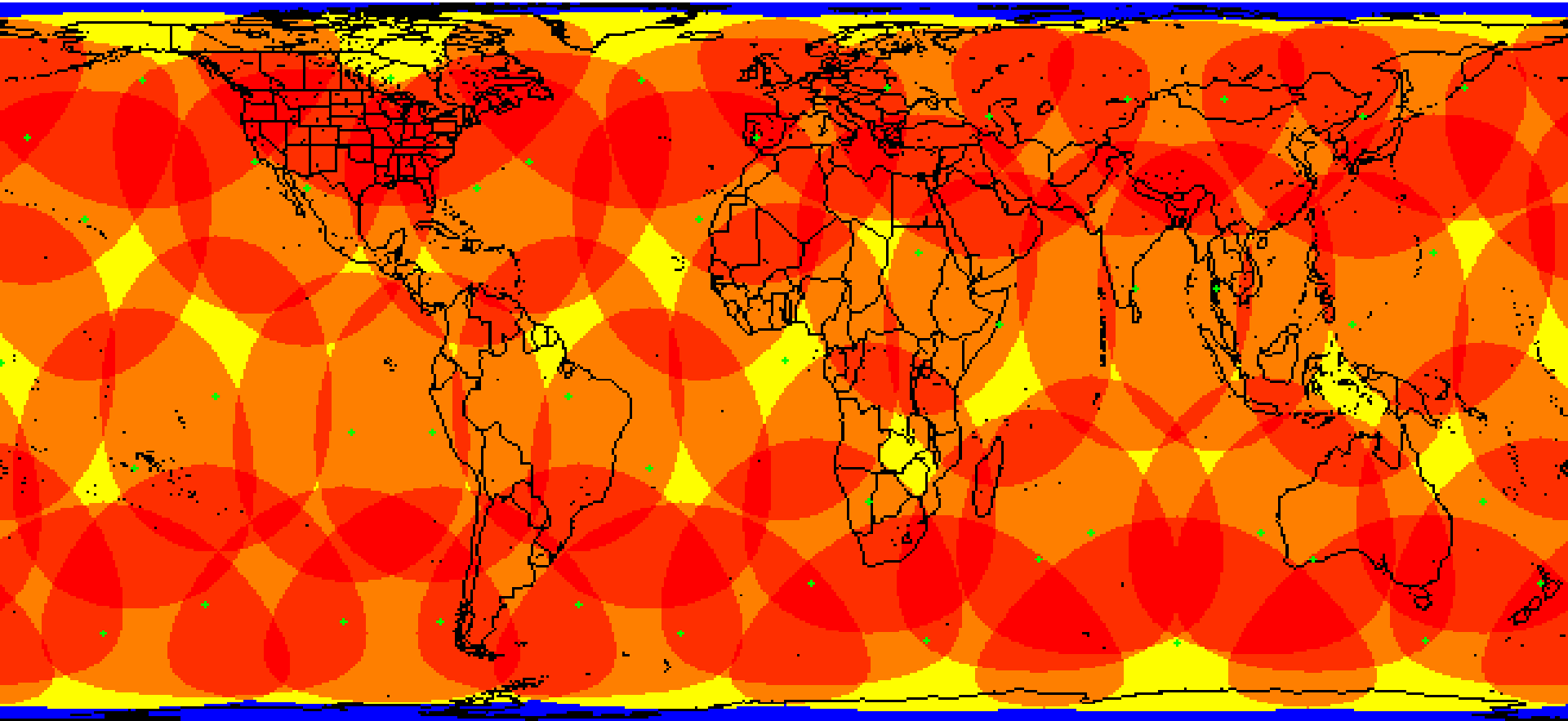


Iridium Coverage Map with 66 Big LEO Satellites

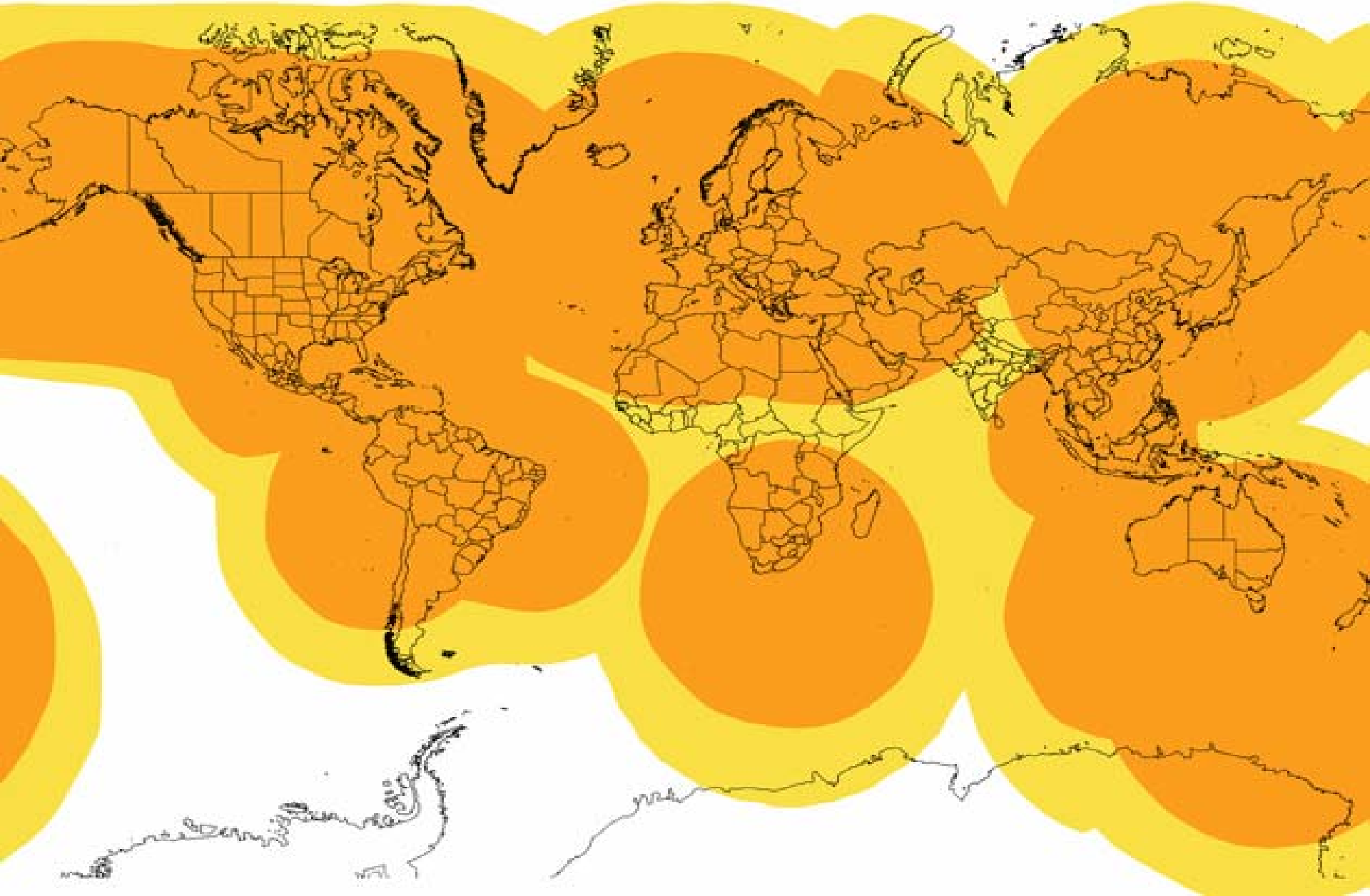


Globalstar Coverage Map with 48 Big LEO Satellites

(Since 2014 Globalstar is covering South Africa)

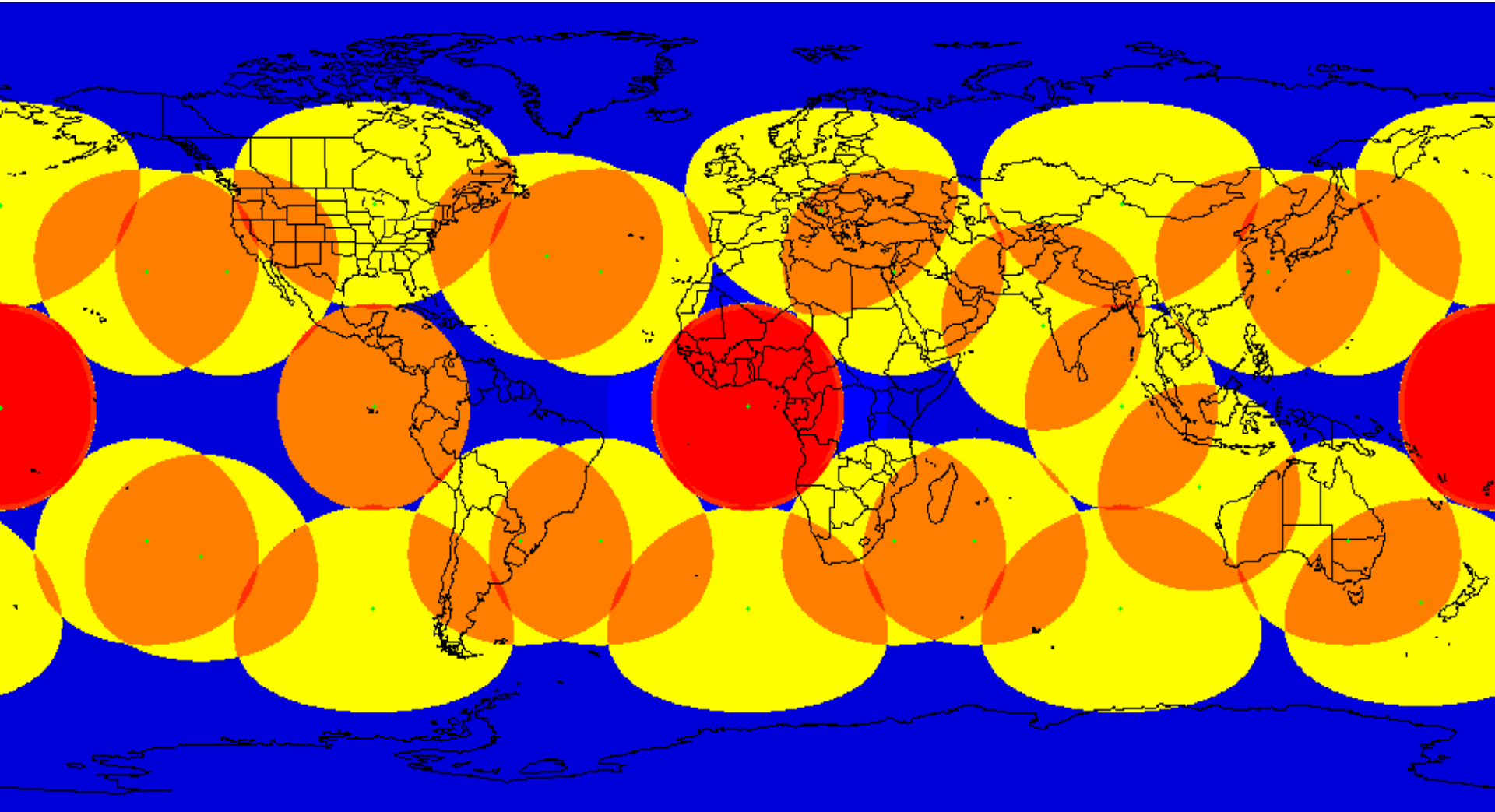


Globalstar Coverage Map for Simplex Data by GES

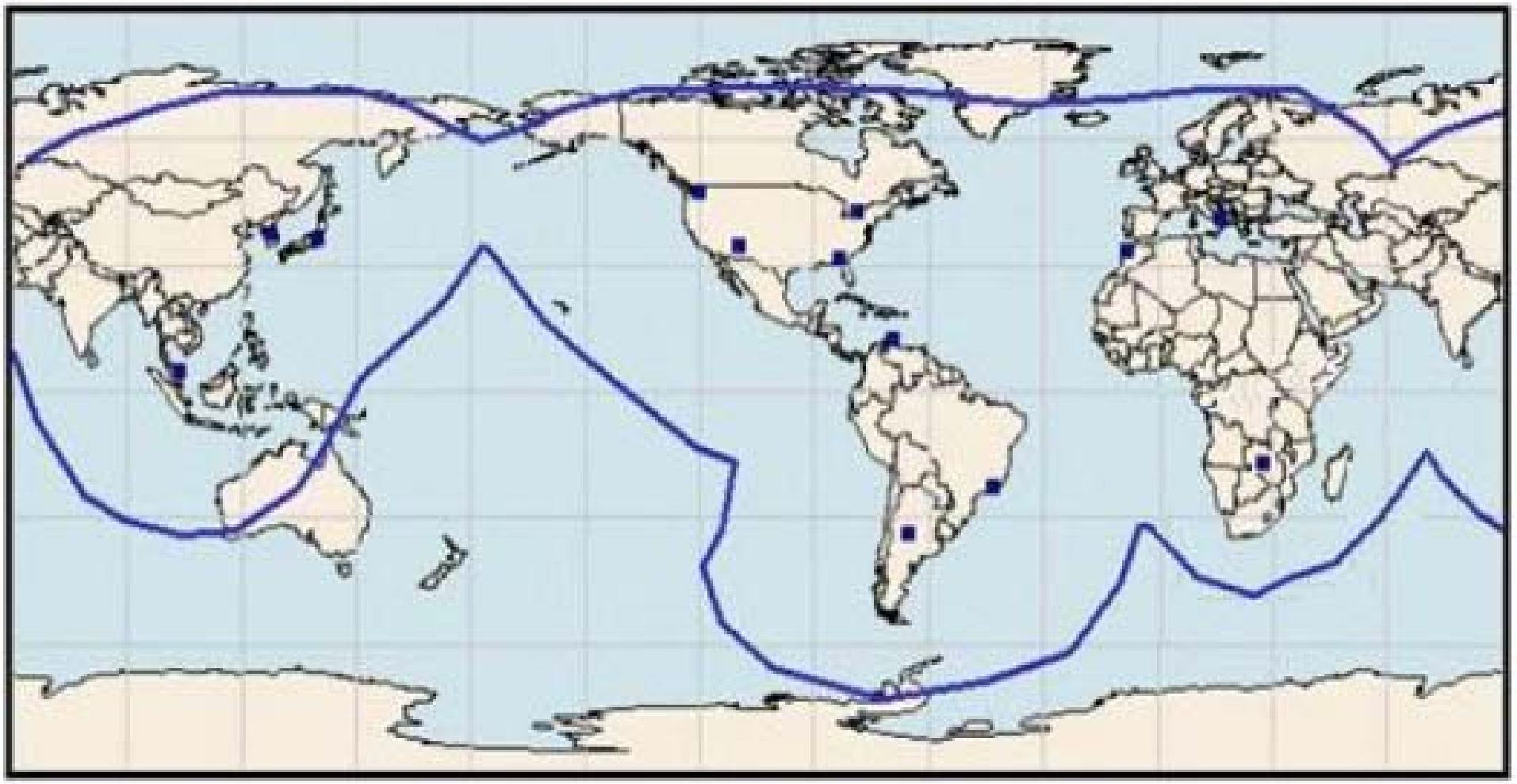


Orbcomm Coverage Map with 36 Little LEO Satellites

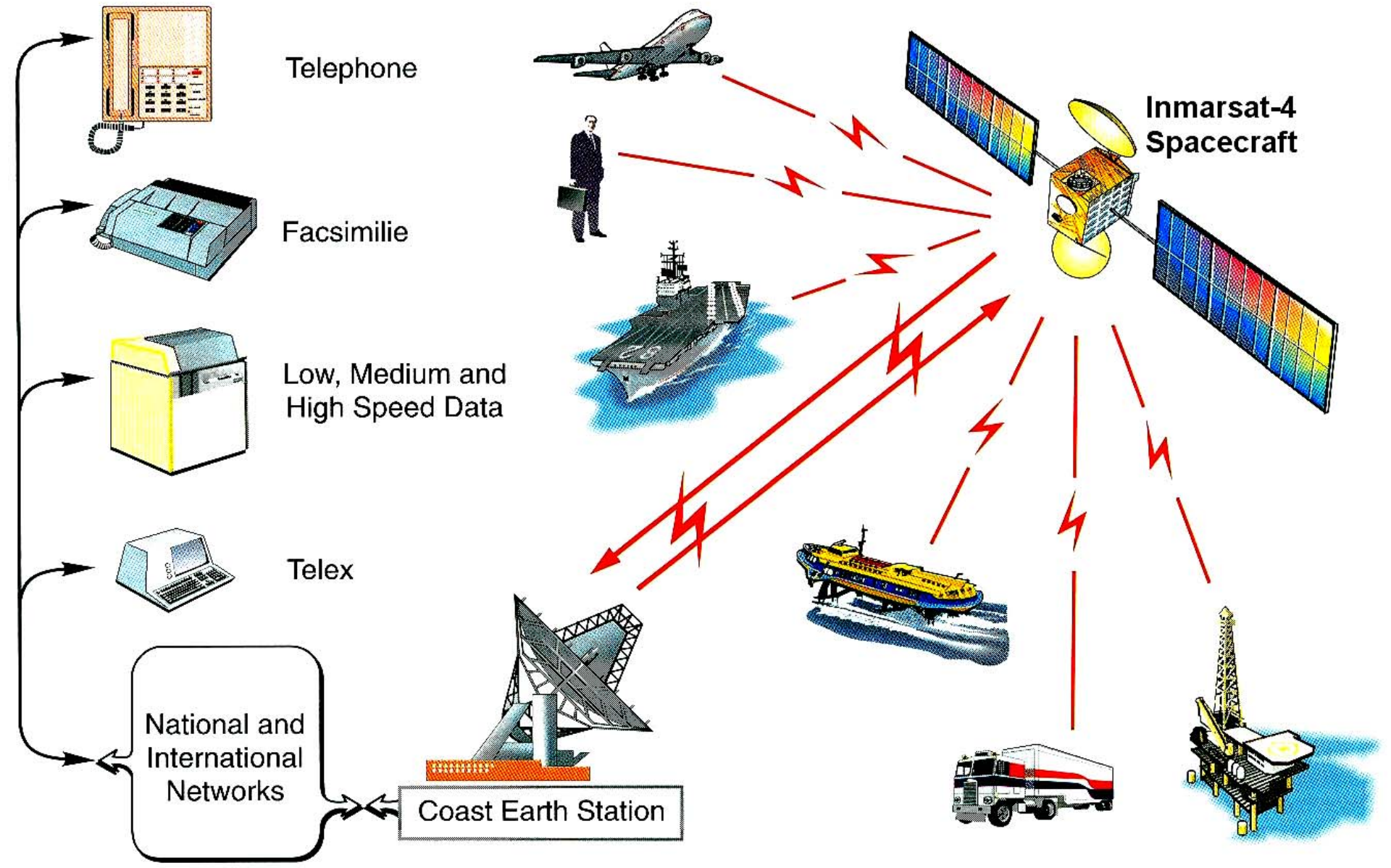
(Since 2012 Orbcomm is covering South Africa)



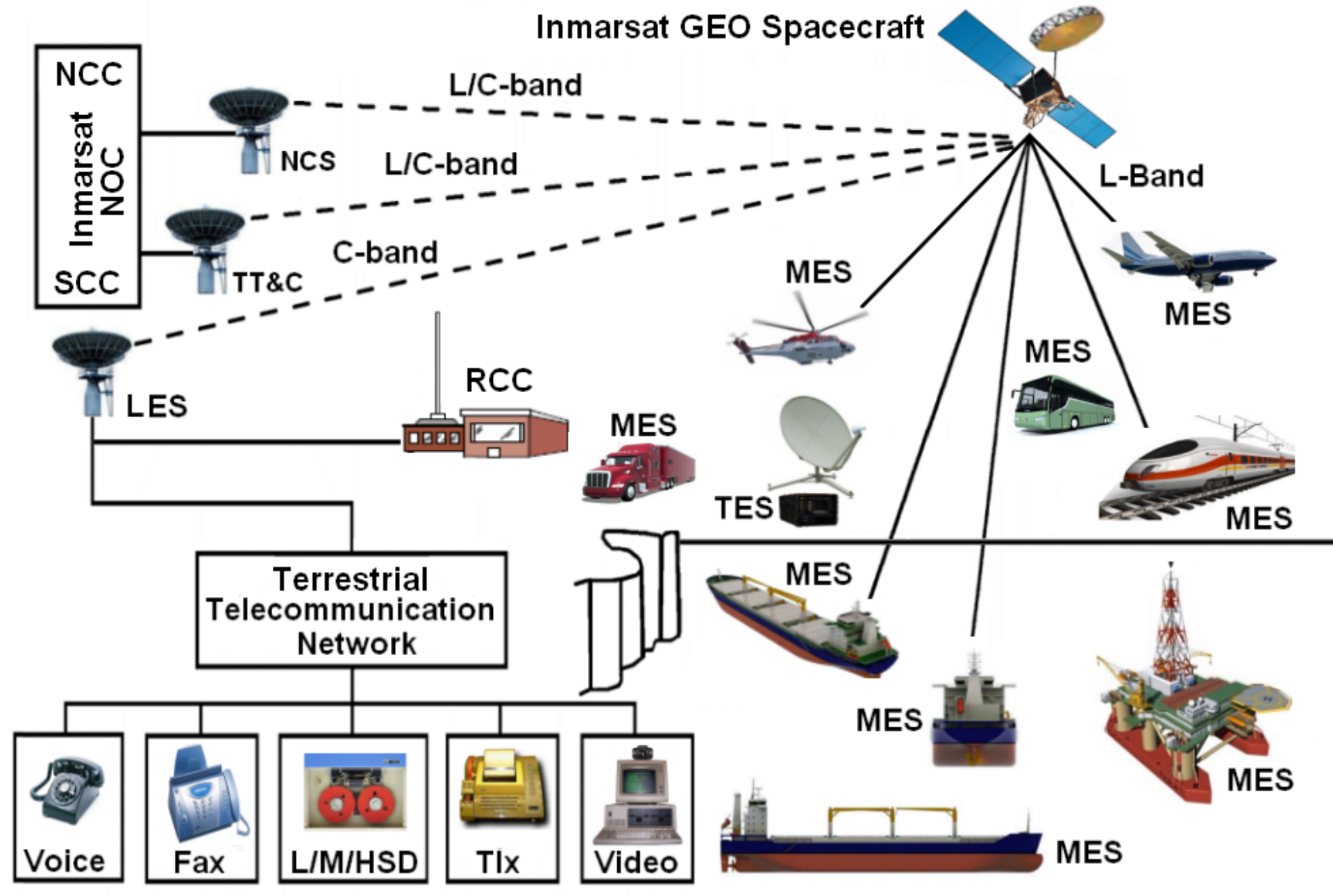
Orbcomm Coverage Map by GES



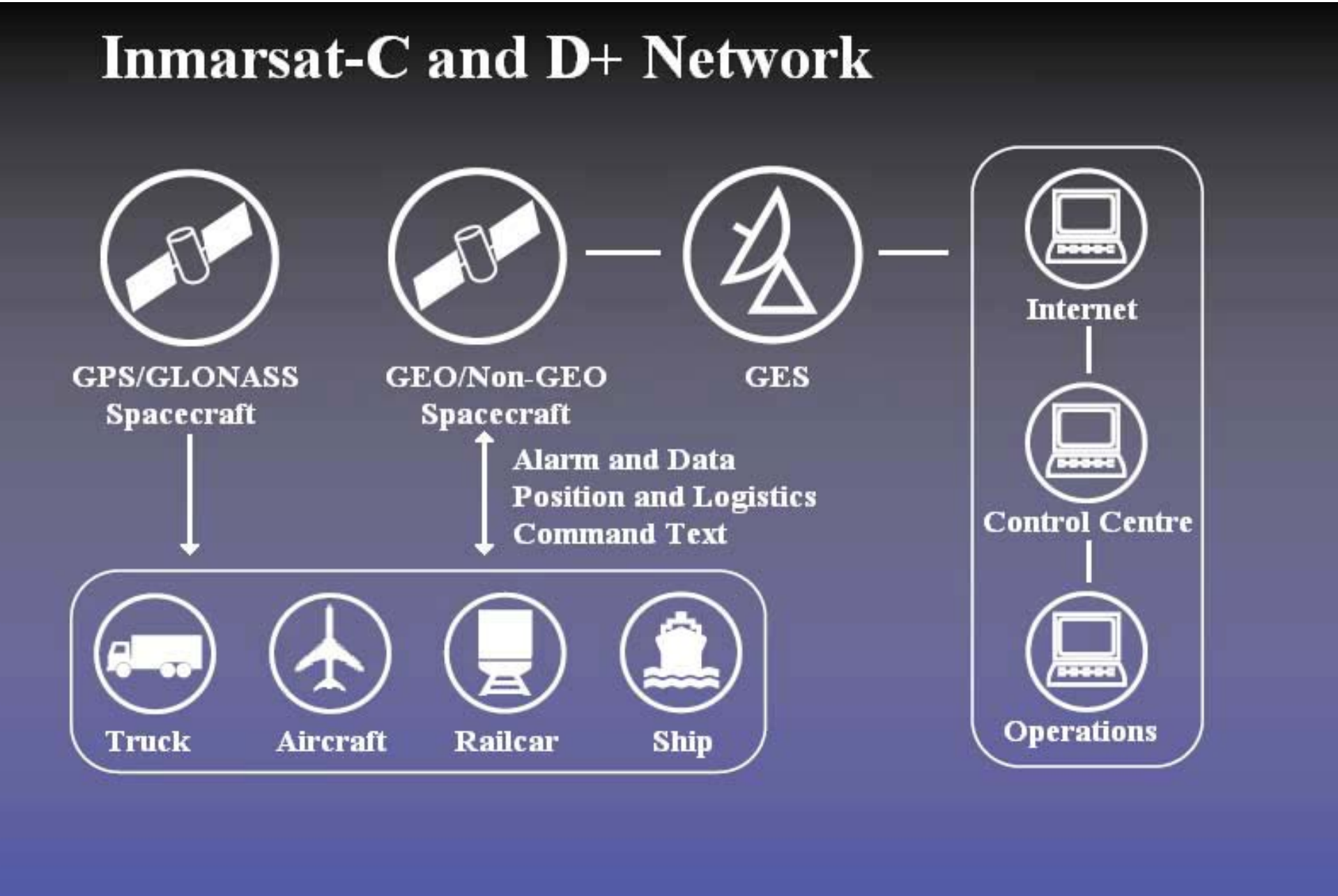
Inmarsat Mobile Satellite Service



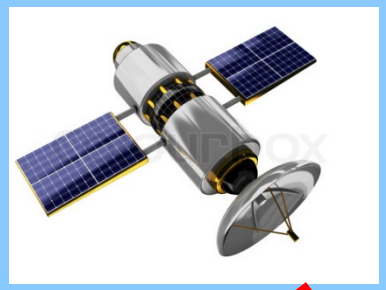
Inmarsat Mobile Satellite System



Inmarsat-C and D+ Network SAT

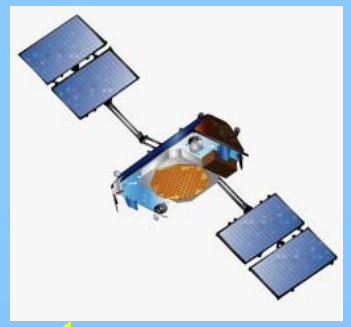


How does Work Satellite Asset Tracking (SAT)

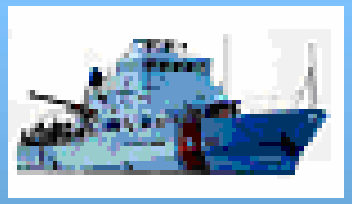


GPS or GLONASS Spacecraft

GNSS-1 System



GEO and Non-GEO Satellites



Tracking Object

Tracking Devices onboard Mobiles

Communication Satellite Link

Processing Centre

Ground Gateway

GTS

First Generation of Global Navigation Satellite System (GNSS)

- The US GPS (Global Position System);
-Accuracy: Velocity vector is around 10 m/s and in each direction is around 10 m;
- GPS constellation consists of 24 LEO satellites;

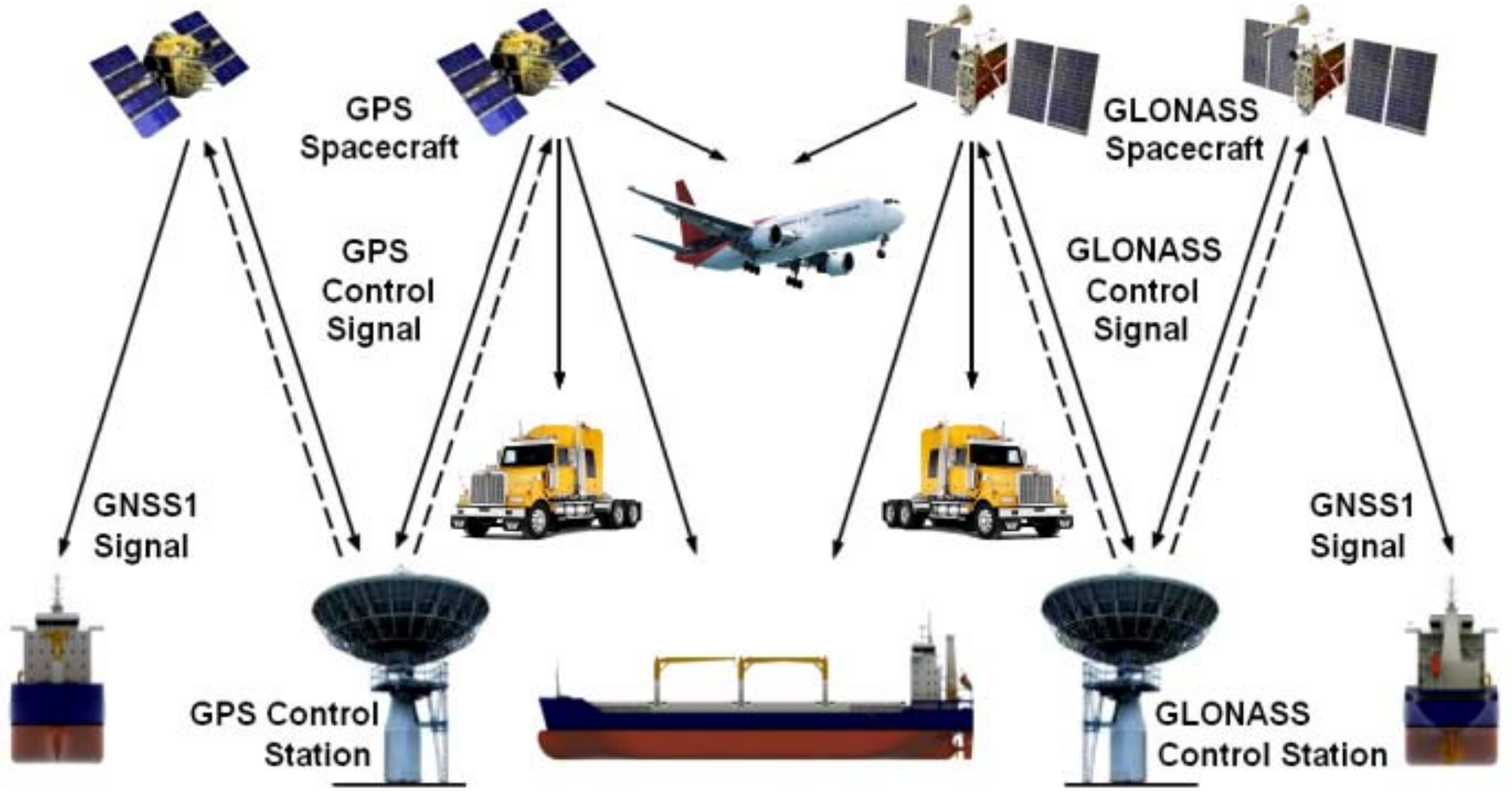
- The Russian GLONASS (Global Navigation Satellite System);
- Accuracy: Velocity vector is around 10 m/s and in each direction is around 10 m;
- GLONASS constellation consists of 24 Medium Earth Orbit (MEO) satellites.

Second Generation of GNSS

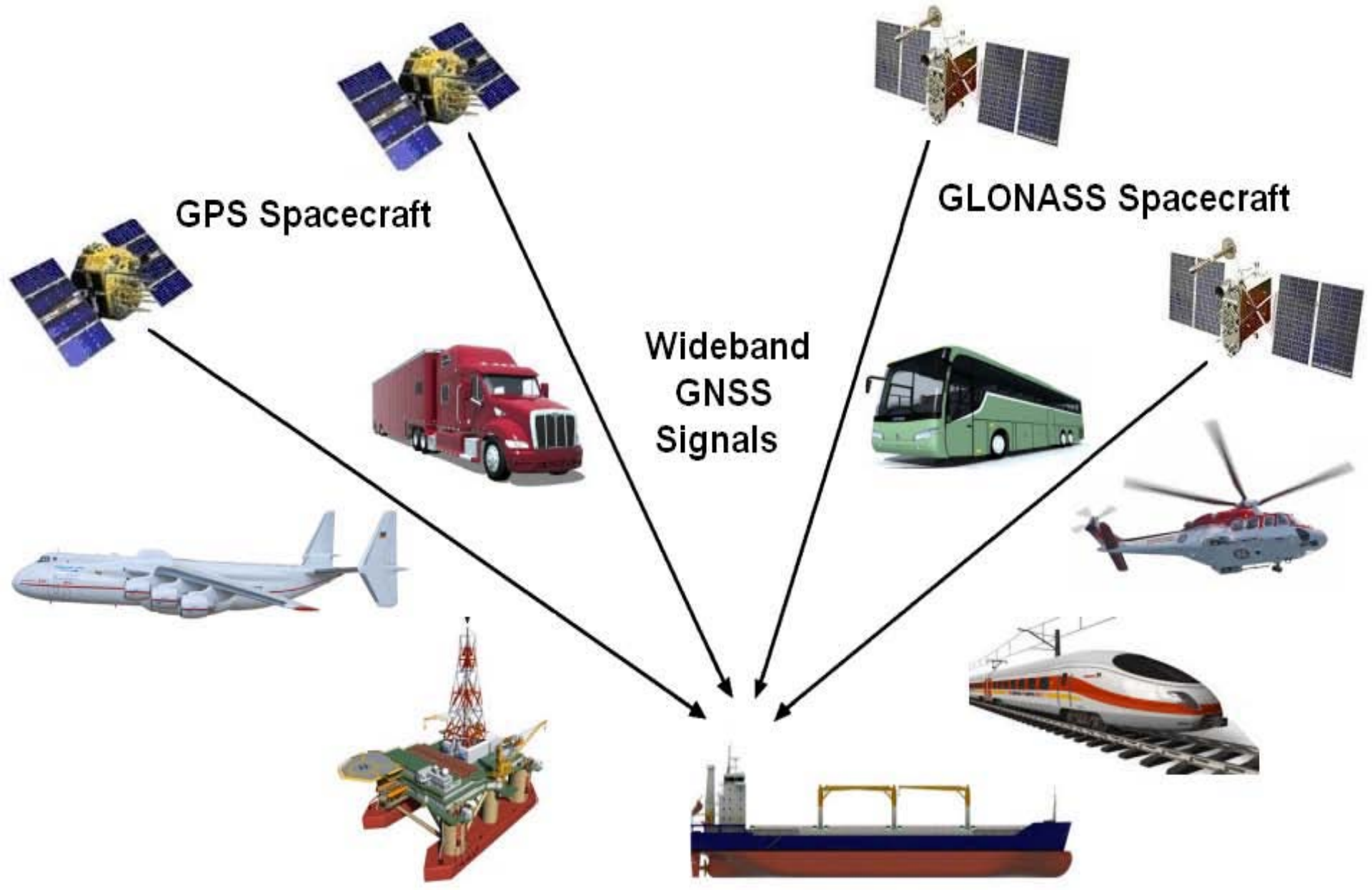
- The European GALILEO (in name of Galileo) not operational, and still is not clear if will be operational ever;
- Accuracy: velocity vector is up to 4 m/s and in each direction is around 1 m;
- GALILEO constellation consists of 24 LEO and GEO satellites;

- The Chinese COMPASS (BeiDou) operational regionally and has to be globally operational sometimes in 2020;
- Accuracy: velocity vector is up to 4 m/s and in each direction is around 1 m;
- GLONASS constellation consists of 24 MEO and GEO satellites.

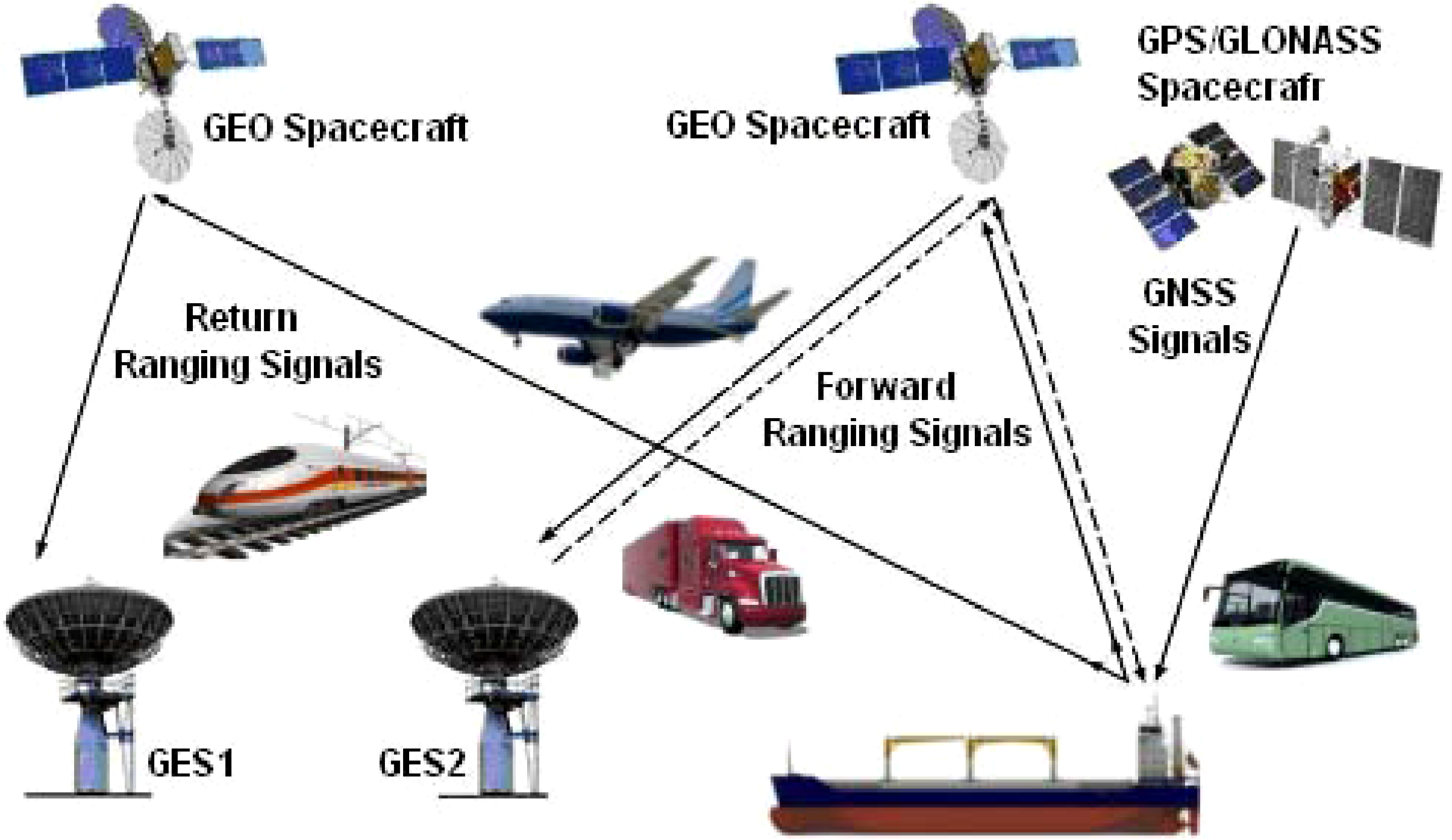
Existing GPS and GLONASS Integrated GNSS-1 Network



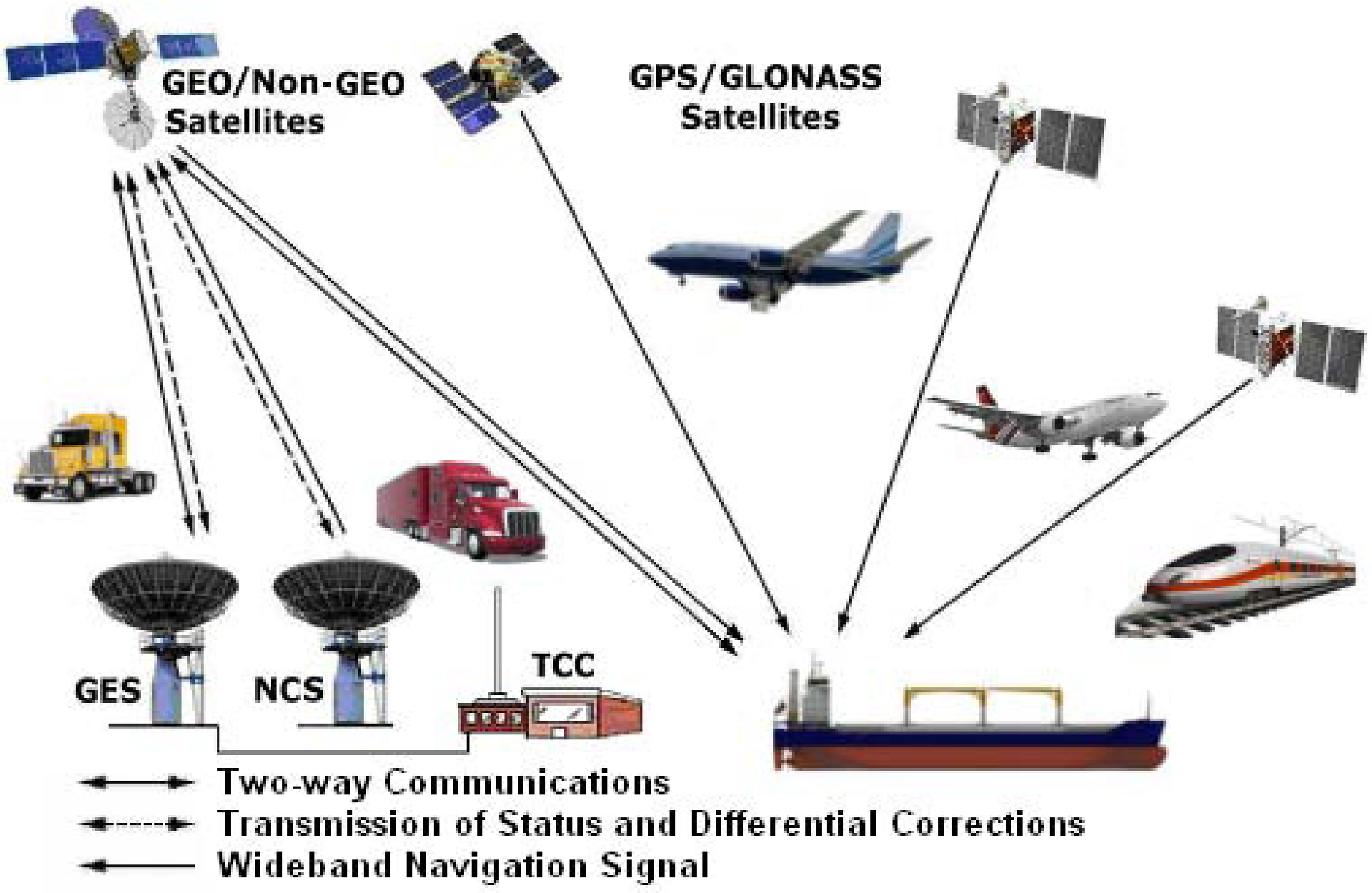
Passive GNSS Mobile Determination



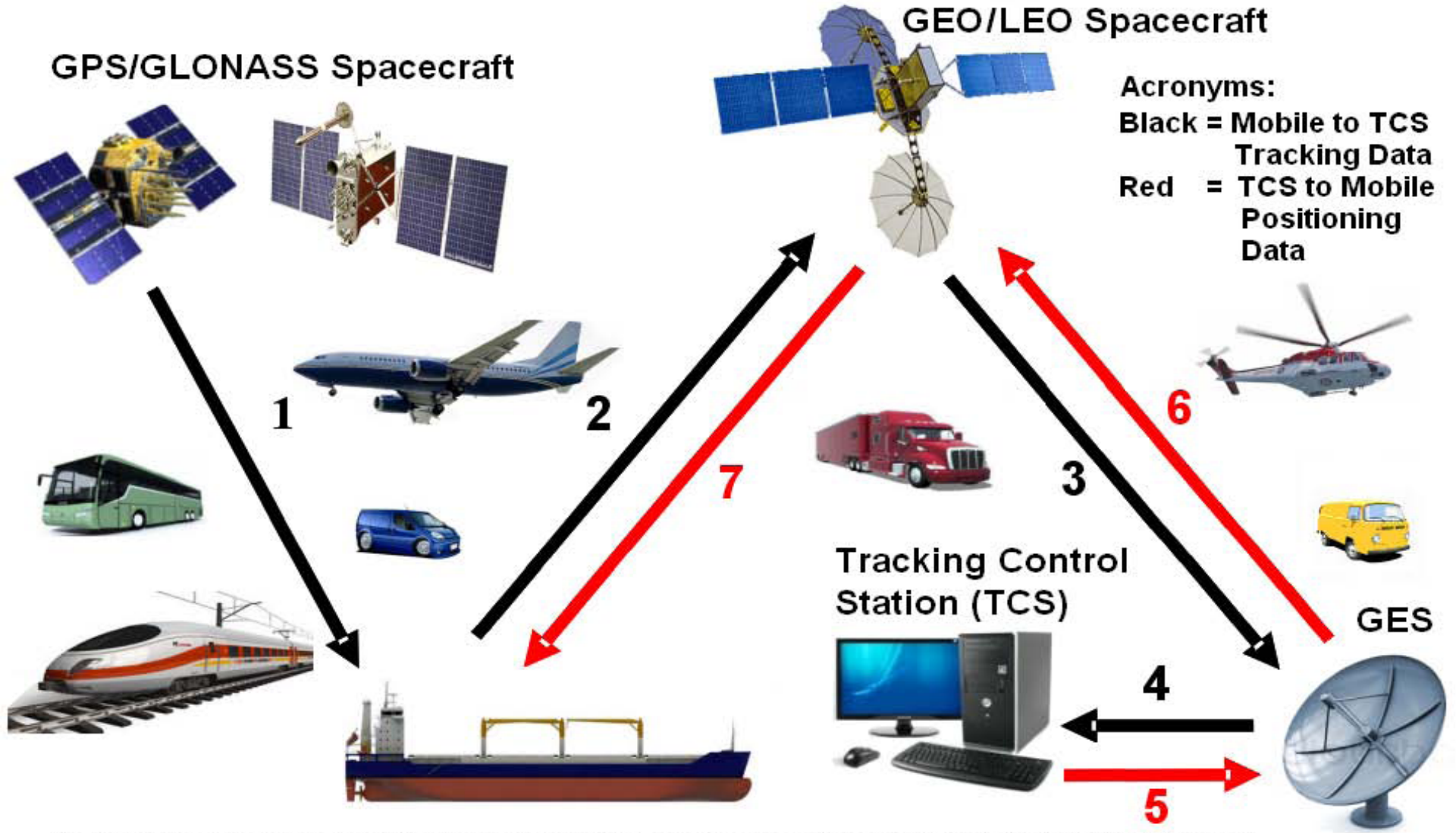
Active GNSS Mobile Determination



Hybrid GNSS Mobile Determination



Global Mobile SAT



1 = For instance, aircraft GAT unit is geting determination signals from GPS or GLONASS spacecraft

2 = These signals (PVT, altitude and aircraft ID) GAT transceiver is sending to the GEO/LEO spacecraft

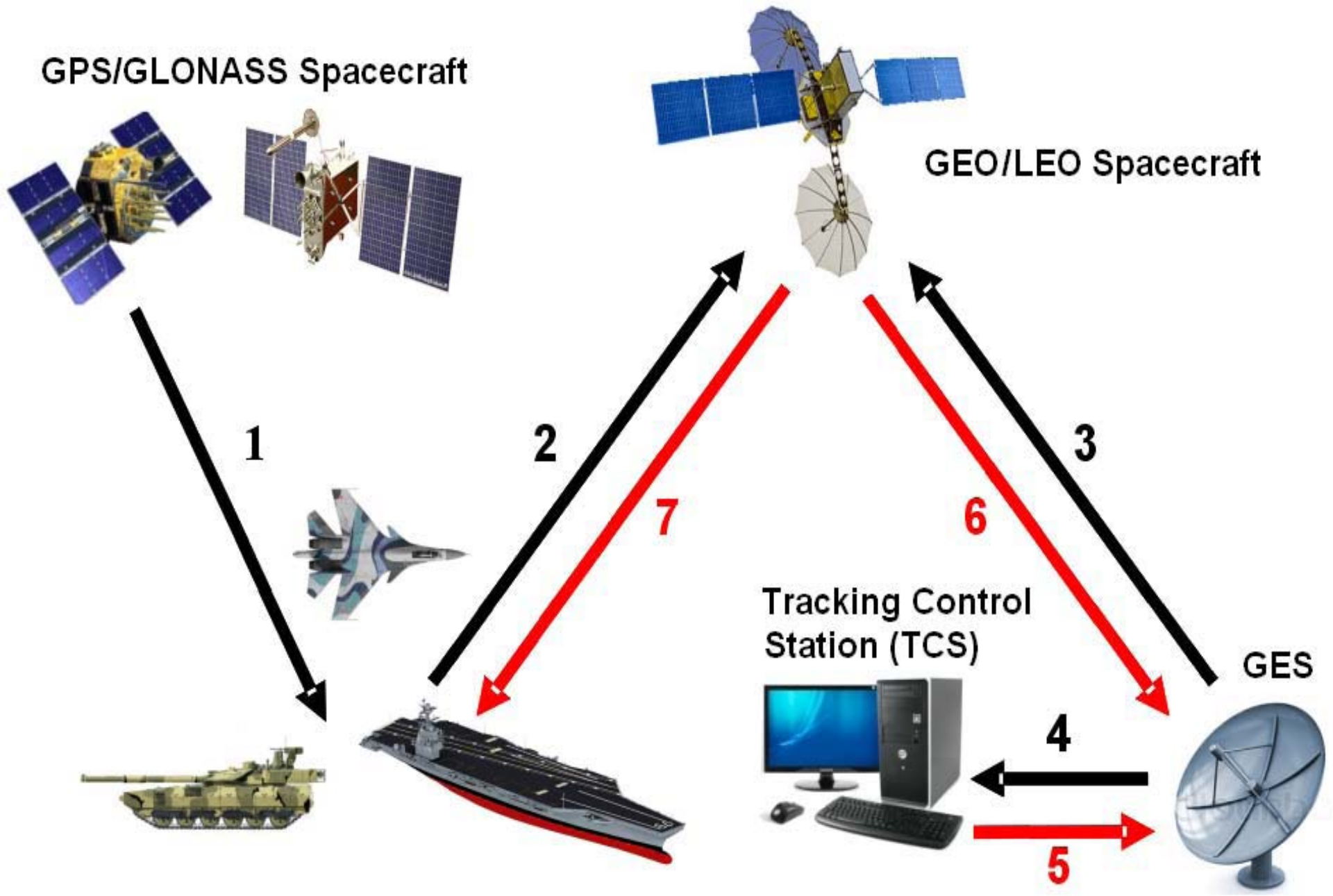
3 = Satellite transponder is forwarding PVT data to the Ground Earth Station (GES)

4 = From GES via terrestrial telecommunication network PVT data are sent to the TCS

NEW SOLUTIONS FOR ENHANCED MOBILE SAFETY AND SECURITY

To enhance safety and security in transportation systems it will be necessary to implement SAT for all mobile solutions, especially for ships and aircraft. In above figure is important to explain what happens when TCS receives Tacking Data from mobiles indicated by black Lines? This data has to be processed in TCS and displayed on like radar screen, which later tracking controller may send as Position, Velocity and Time (PVT) data to all mobiles in certain area. On any mobile request TCS operator may send PVT data of all mobiles in vicinity for enhanced security and collision avoidance. On the other hand, each mobile, such as ships and aircraft will be also able to provide polling of position data memorized in TCS for any adjacent mobile (ship or aircraft) and use it for enhanced collision avoidance.

Global Military Tracking (GMT)



SATELLITE ASSET TRACKING (SAT)

Inmarsat, Iridium, Globalstar and Orbcomm operators offer global two-way data transfer devices in size as personal CD players. With its reduced consumption of main, solar or battery power this units are an effective way of remotely collecting position data from Ships, Containers, Vehicles, Wagons and Aircraft to the Control Centres. The author of this presentation has developed projects for all mobile SAT applications including for living beings.

1. Global Ships Tracking (GST)

The Long Range Identification and Tracking (LRIT) of ships was established as an international system on 19 May 2006 by the IMO as resolution MSC.202(81), which amends chapter V of the International SOLAs Convention.

What is problem with this System:

- The name is not adequate, is better to call it GST.

- Is not covering vessels below 300 gross tonnage.

- Is not providing GST data in one Centre worldwide or to provide separate centres for each Ocean Region.

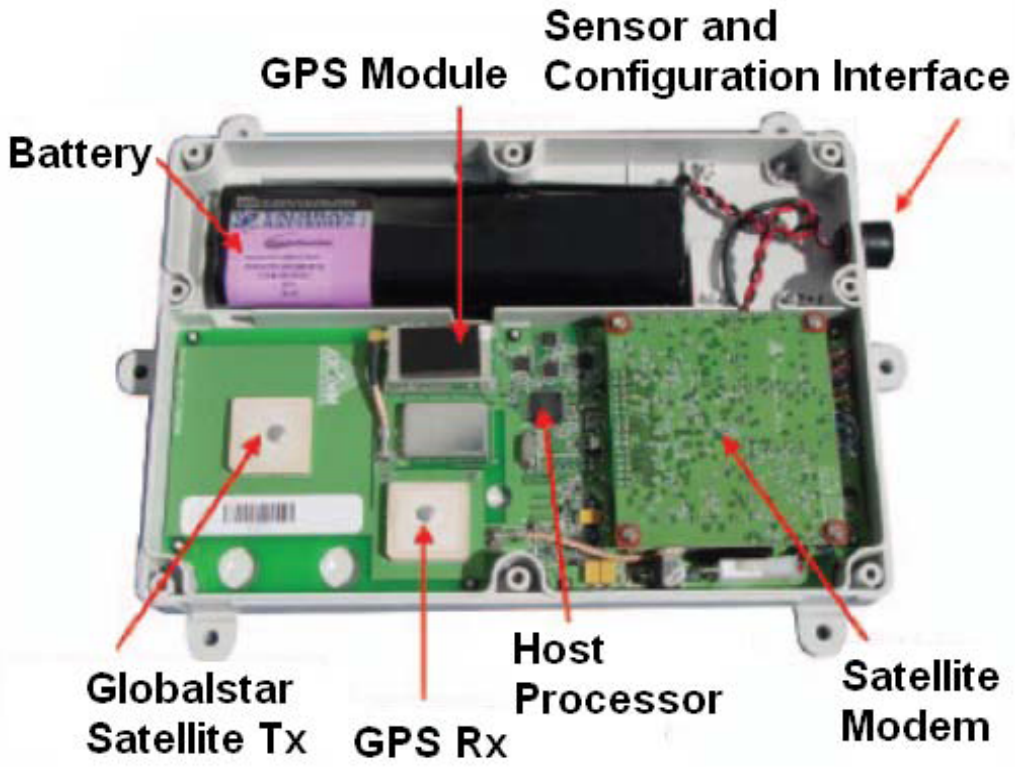
- Is using Satellite Transceiver instead Transmitter only, so in second case the unit can be more cost effective.

- Will be necessary to be provided coverage of Polar areas using Hybrid Satellite Orbits, for instance GEO and PEO.

2. Global Container Tracking (GCT)

1. Provides end-to-end GCT during complete intermodal operations in loading places, on the roads or railways, in the ports, onboard ships and in discharging places.
2. The System is using SAT Units combined by Satellite Transceiver (Receiver-Rx/Transceiver and GPS Rx and integrated with RFID (Tag Readers and Tags).
3. SAT Units have minimum 5 till 10 years lasting batteries supply, Readers can be connected to public or solar power supply, while Tags also use own batteries.
4. RFID devices can also provide data of personnel identification, so will be known which operators are handling their containers and cargo.

SAT Units Configuration



1. SAT Unit is installed in each container and has own 5 years battery supply.
2. This Unit if has line of sight is able to send position data to the Control Centre via Land Earth Station (LES) minimum twice per day.

SAT Units Networks

The SAT Unit is providing direct data from the following installations:

1. **Standalone Container in Ports or Yards**
2. **Trucks loaded by Standalone Containers**
3. **Wagons loaded by Standalone Containers**

3. Global Vehicle Tracking (GVT)

1. Provides full satellite GVT for private persons, companies, military, police, governments and insurance organizations. The system can control vehicles in and outside of country better then any current GPRS system.
2. The System is using SAT Units combined by Satellite Transceiver (Receiver-Rx/Transceiver and GPS Rx. This Unit can be integrated with RFID (Tag Readers and Tags) for Electronic Vehicle Registration (EVR). With special sensor and with command sent from Control Centre the SAT unit can switch off engine of vehicle.
1. SAT Units have own power supply for anti theft use or can be also powered via vehicle batteries.

4. Global Wagons Tracking (GWT)

1. Provides GWT during complete logistics, loading and discharging operations, on the rail roads and in the stations inside and outside of one hypothetical country.
2. The System is using SAT Units combined by Satellite Transceiver (Receiver-Rx/Transceiver and GPS Rx. This Unit can be used in integration with RFID (Tag Readers and Tags) for control of wagons, locos and signalization.
3. SAT Units have minimum 5 years lasting batteries supply, Readers can be connected to public or solar power supply, while Tags also use own batteries.
4. RFID units can provide personnel identification, so Rail companies will know which staff and operators are handling their wagons and cargo.

5. Global Aircraft Tracking (GAT)

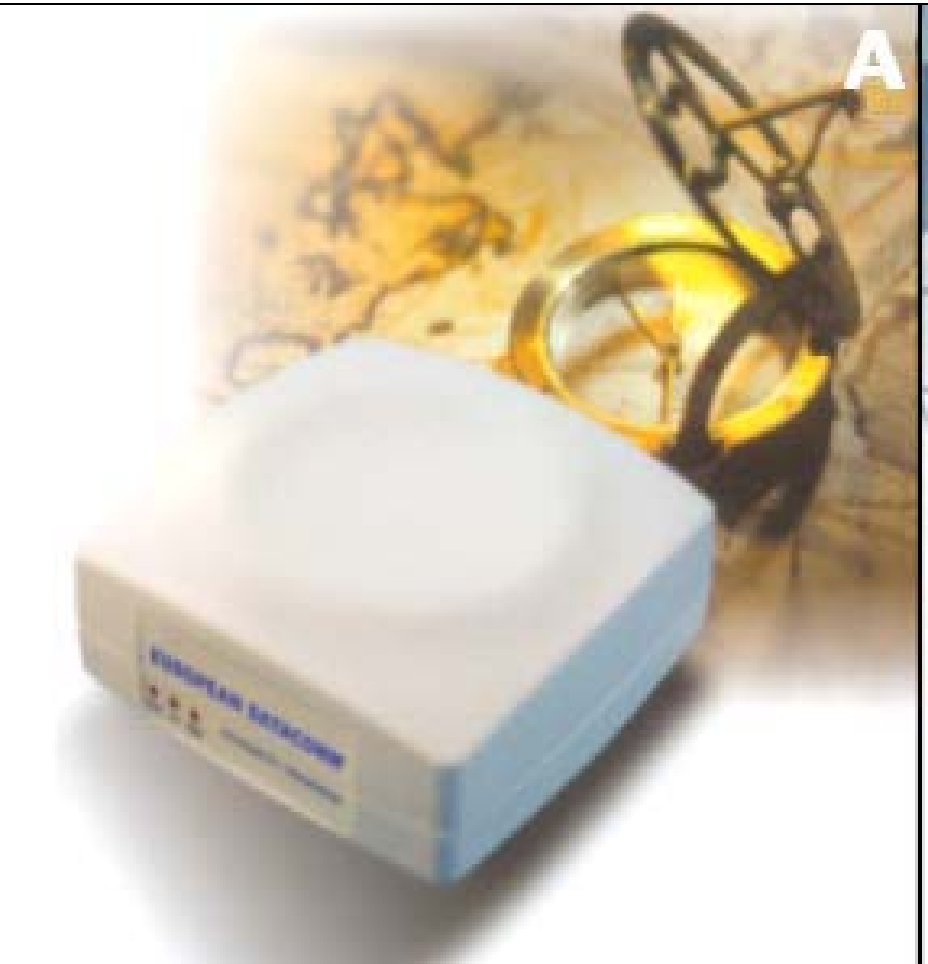
1. Provides full satellite GAT for private, corporate, government all size aircraft and helicopters.
2. Project for GAT will provide better Logistics and determination automatically for each aircraft fitted with this equipment, so using this service we can avoid scenario like crash of Air France Aircraft. All airmen people and ICAO have to file shame because we couldn’t find three the wreck in two weeks and what is very strange in area of few thousand miles. In fact, our GAT can locate crashed planes in real time anywhere within few hundred meters.
3. The System is using SAT Units combined by small Satellite Transceiver (Receiver-Rx/Transceiver and GPS Rx. SAT Unit has own batteries for any case of power loss onboard aircraft and can be powered via onboard main or batteries power supply as well.

Global Aeronautical Distress and Safety System (GDAS)

To improve safety and security at sea International Maritime Organization (IMO) has adopted Global Maritime Distress and Safety System, on 9 November 1988 and. On 1 February 1999 the GMDSS has become implemented for all SOLAS ships.

Using knowledge acquired onboard ships author of this presentation has proposed Global Aeronautical Distress and Safety System (GADSS) in 2000 and introduced it in shortly his book published by Springer in 2005. He also wrote the chapter of GADSS network in the book Global Aeronautical CNS published by AIAA in 2013. However, the concept of operations for the GADSS was developed by ICAO in 2014.

First (A) and Second (B) Generation of SkyWave SAT Inmarsat D+ Equipment + GPS for SAT



Inmarsat Third Generation of IsatData Pro and IsatM2M SAT of Orbcomm System for SAT: IDP-609 & IDP-680 + GPS/GLNOASS (Left) and IDP-782 + GPS (Right)

Inmarsat IDP-800 of Orbcomm System + GPS/GLONASS Battery/Vehicle Powered (Left) SAT and SG-7100 Cellular with WiFi + GPS and Satellite Optionally

Multisatellite Quake System SAT Units via Iridium/Orbcomm (Left) and Inmarsat/ Iridium/Orbcomm (Right) + GPS and Optional Cellular (GSM) for all SAT

Iridium Hawk Eye 7200A (Left) of Blue Sky Network System + GPS/GLONASS and Optional Hawk Eye 100A with Voice, Bluetooth and Messaging (Right) for GAT/GDASS

Iridium RST430 IridiTRAK + GPS SAT for all mobiles (Left) of Beam System and Iridium SBD Warior 9603N + GPS Controller of Satelligent System (Right)

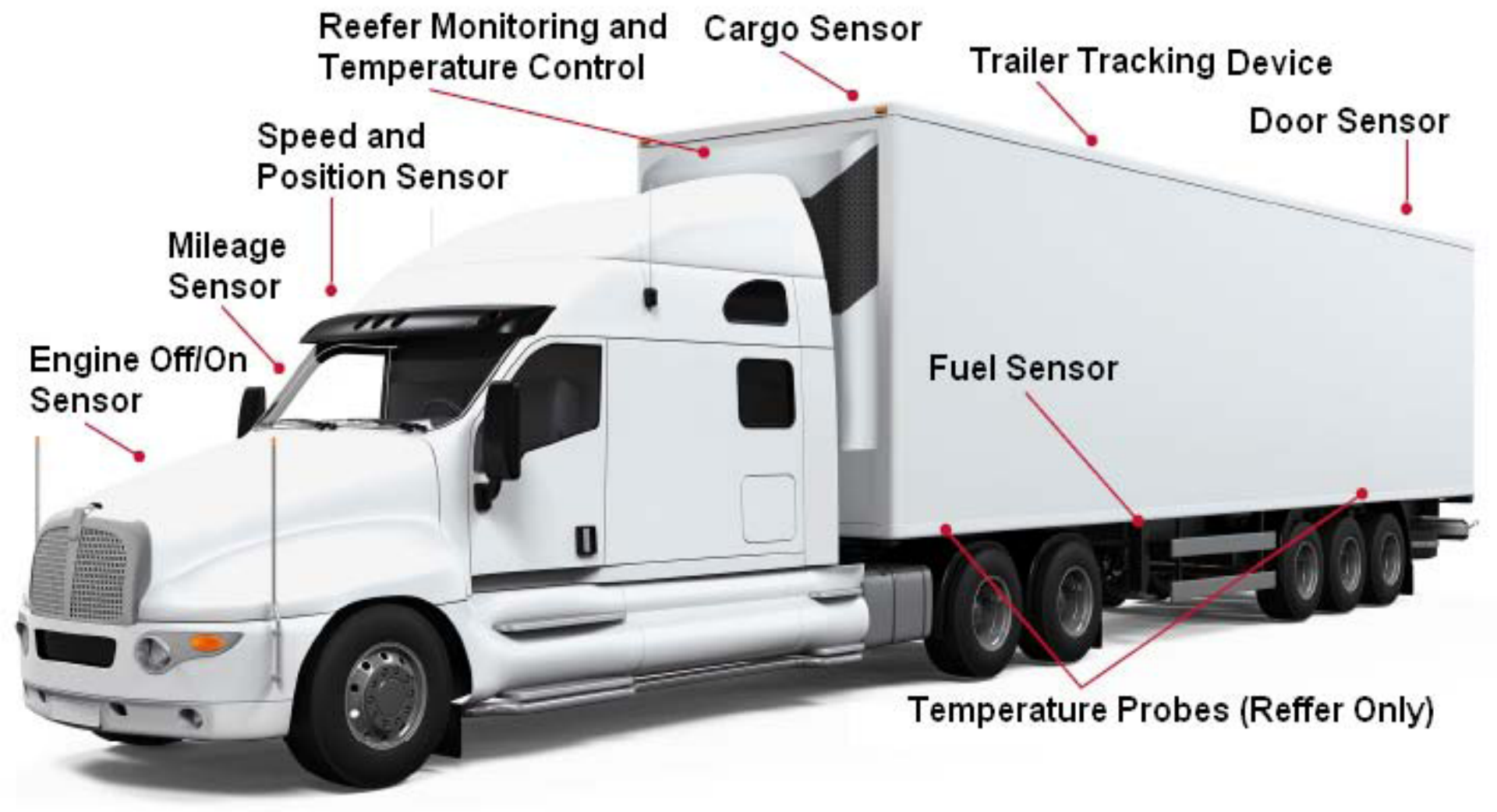
Iridium Global Track G200R SAT and Management of TransMedia Technology System with GPRS, GPS, Small Display, Kay Board + Small Printer

Globalstar Simplex SmartOne and SmartOne C Mobile Trackers + GPS Both

Orbcomm GT-700 SAT and GT-1100 Cellular/Satellite with Solar/Vehicle Power for Trailer and Container Tracking + Both GPS

Orbcomm Heavy Equipment PT-7000 Cellular with Optional Satellite Tracker and Global Transportation Management RT-6000+ Cellular, Satellite of Dual Mode with Many Sensors – Both with GPS

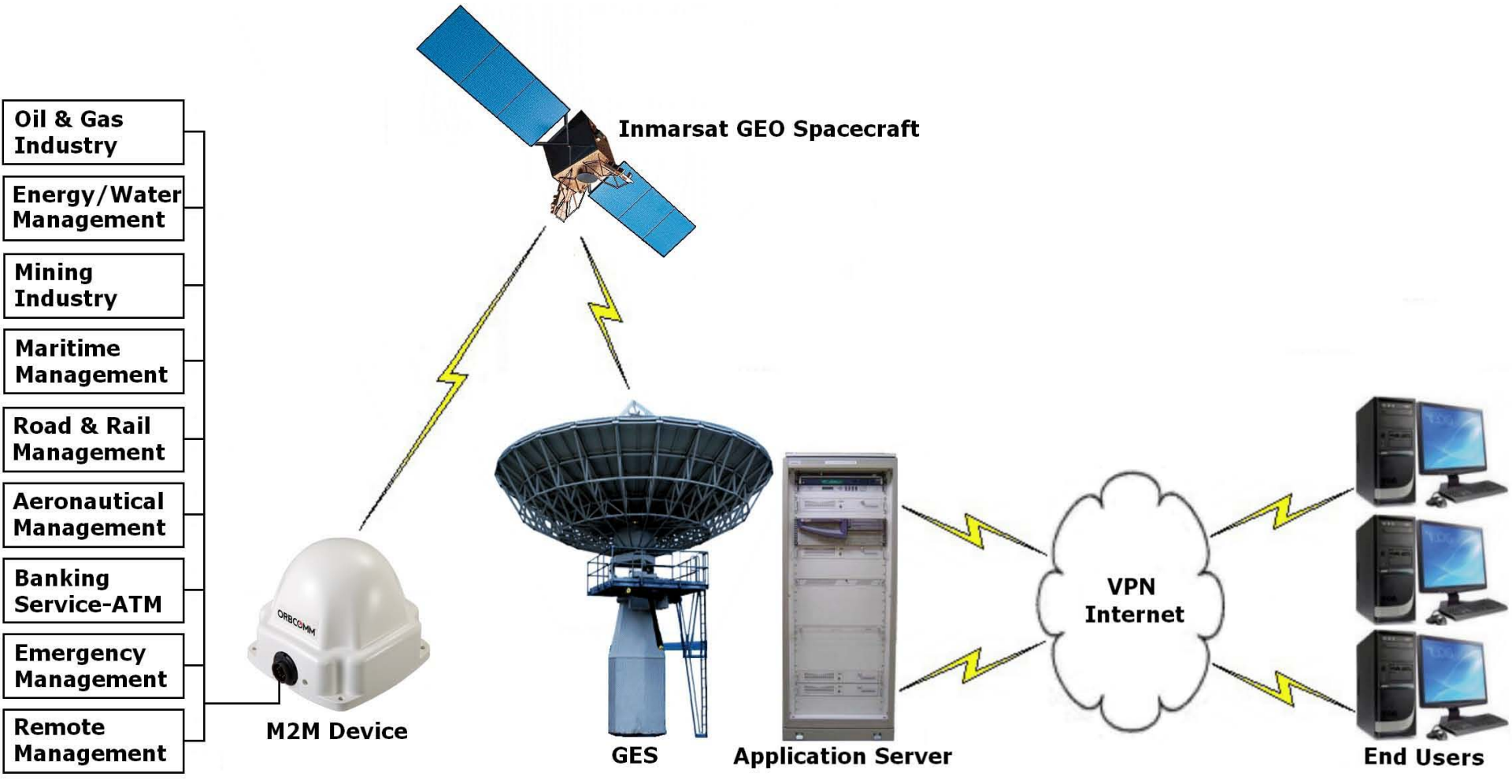
Orbcomm SAT and Management with Monitoring Sensors



Iridium InReach and Shout Nano Personal Trackers + GPS Both

Globalstar GeoPro and Spot Personal Trackers + GPS Both

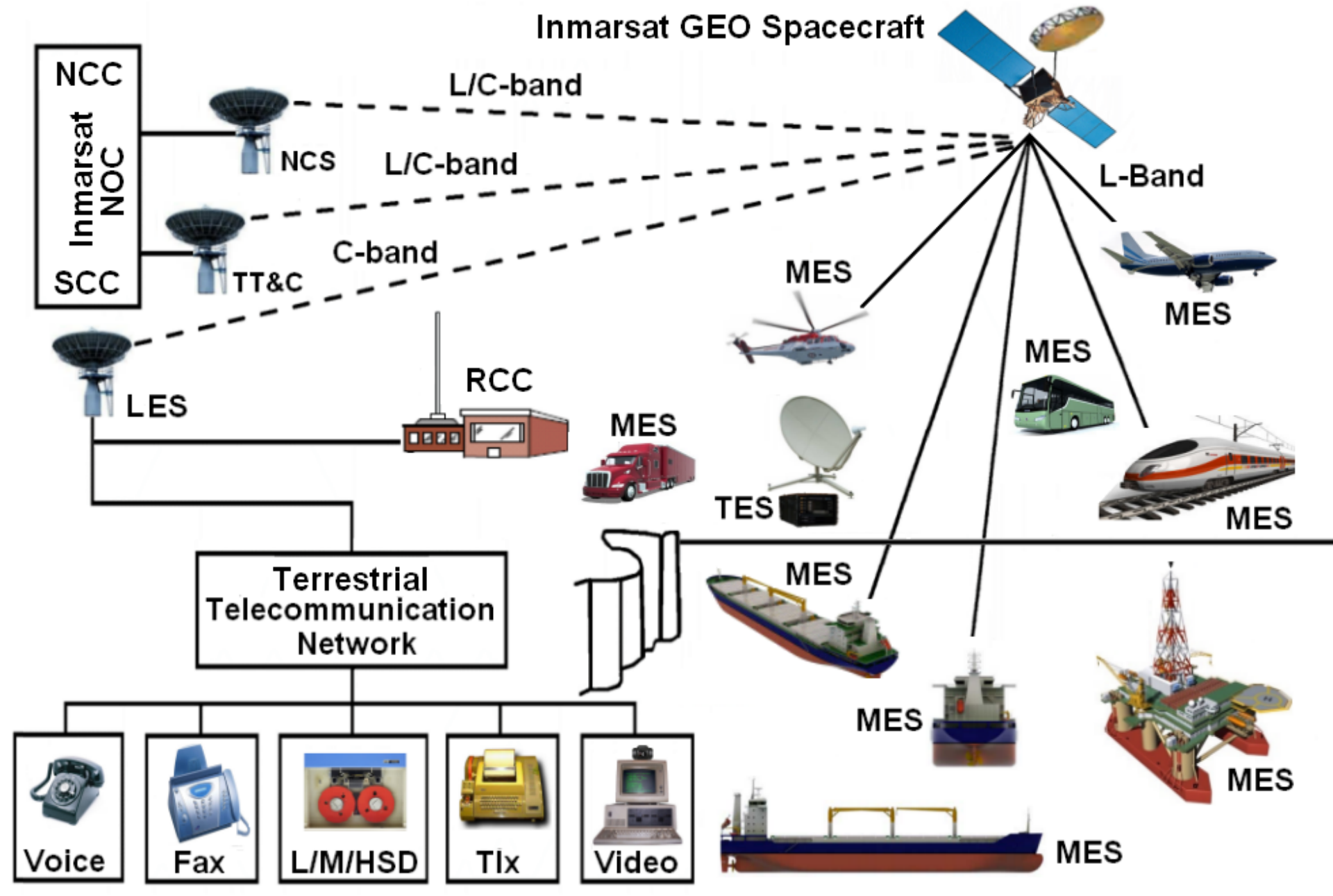
Inmarsat SCADA (M2M) via SAT Device and GEO Spacecraft without GPS Receiver



Who will Utilize SAT & Logistics?

1. Shipping Companies and Ports
2. State and Provincial Departments
3. Private Organizations
4. Police/Military/Intelligent Services
6. Truck, Bus and Rail Companies
7. Taxi and Private Vehicles
8. Insurance Companies
9. Aircraft Companies and Airports

DVB-RCS for Global SAT

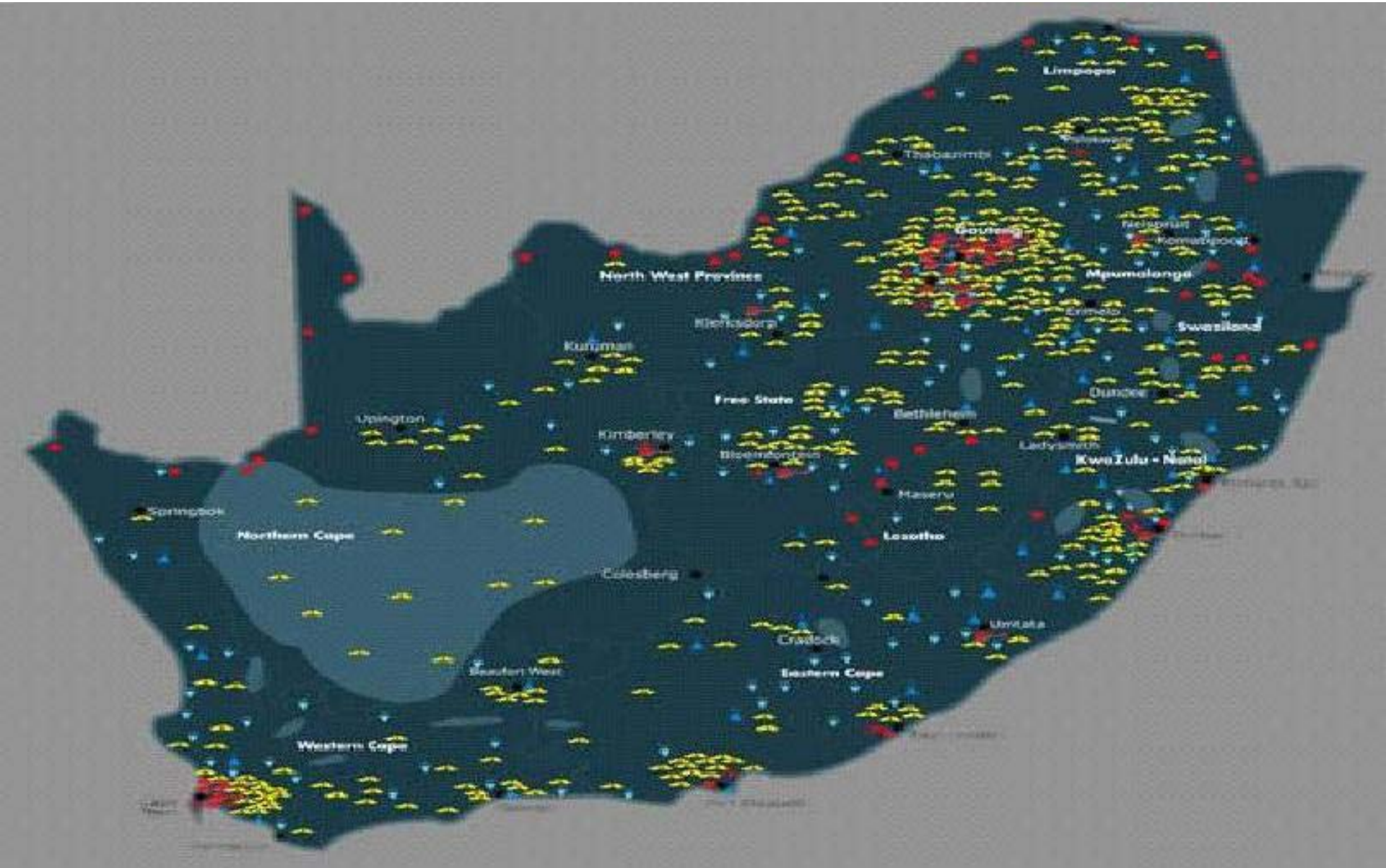


Competitors for Land Vehicles Tracking

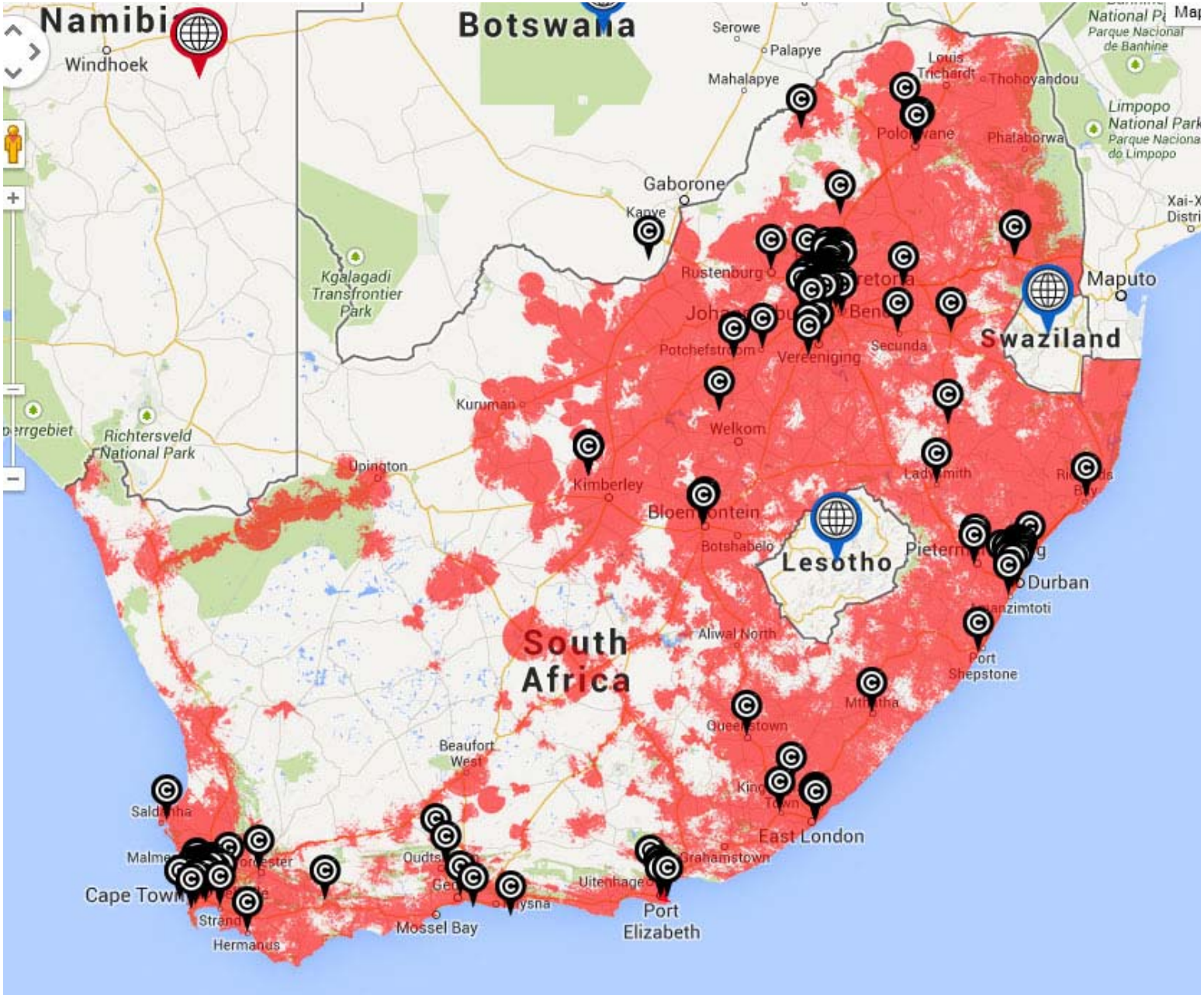
The competitors are using GPS via GSM or GPRS and usually provide Asset Tracking only inside of South Africa. Two companies such as DigiCore (cost of unit is about R12000) and Compass cost of unite is about R9000) are providing Wireless Satellite Asset Tracking and Fleet Management also to cover Country requirements only. In South Africa exist a Company for SAT, known as Skygistics, which units price is about $1000, but we never heard about their activities.

Product Name	Matrix			Netstar			
	MX1	MX2	MX3	Sleuth	Phone In	Early Warning	Vigil
Hardware Costs	R 1,389	R 2,999	R 5,998	R 699	R 1,950	R 2,931	R 8,665
Rental Option	R 159	R 288	R 428	R 137	R 174	R 239	R 365
Services Costs	R 99	R 169	R 199	R 98	R 117	R 159	R 222
Product Name	Tracker			Bandit			SkyTrax
Hardware Costs	R 1,950	R 2,600	R 4,000	R 2,195	R 2,895	R 4,395	R 2,589
Rental Option	R 139	R 226	R 430	R 189	R 229	R 289	R 199
Services Costs	R 108	R 162	R 294	R 134	R 149	R 149	R 129

Vodacom Coverage for GSM & GPRS Cellular Service



Cell-C Coverage for Cellular Service



Telkom Mobile WiFi Coverage

Telkom Mobile Coverage

Thanks for your attention!!!

Please, any questions?!

The End

Thank you for your attention!

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