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WHAT IS GPS?

- Global Positioning System (GPS) is a radio based navigational system used to determine exact position.
- It was developed by the department of defense (USA).
- Many countries now have their own regional or global positioning system e.g. Russia- GLONASS, EU - Galileo; china – Bei Deu; India – IRNSS (under development).



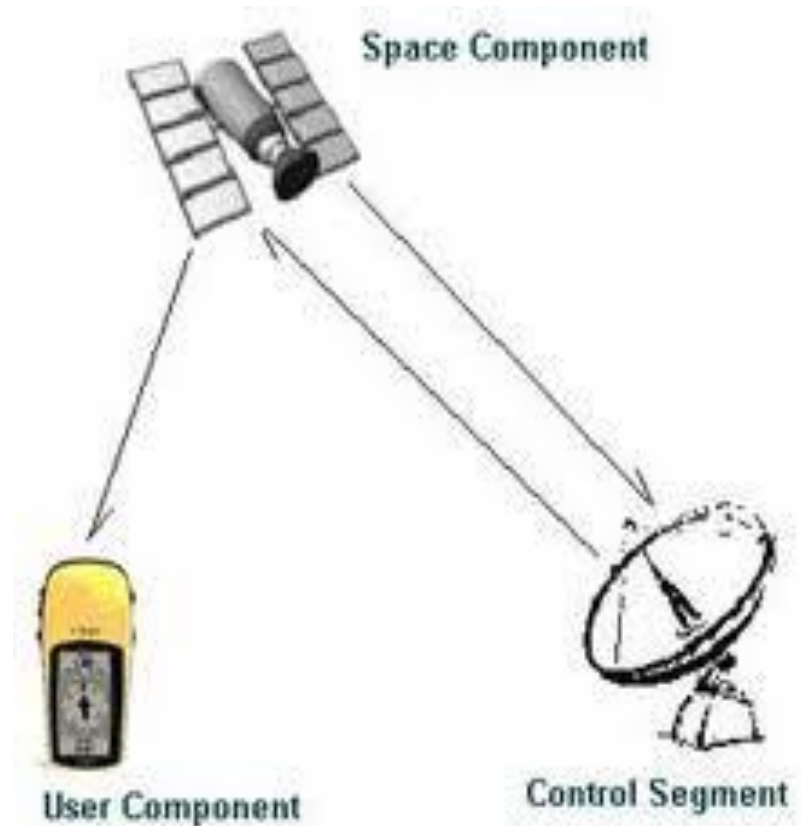


It is a
“constellation
” of 32 Earth-
orbiting
satellites
that can
provide
continuous
three-
dimensional
positioning
24 hrs a day
throughout
the world.



SEGMENTS OF GPS

- Space segment.
- Control segment.
- User segment.



APPLICATION OF GPS IN MINING:

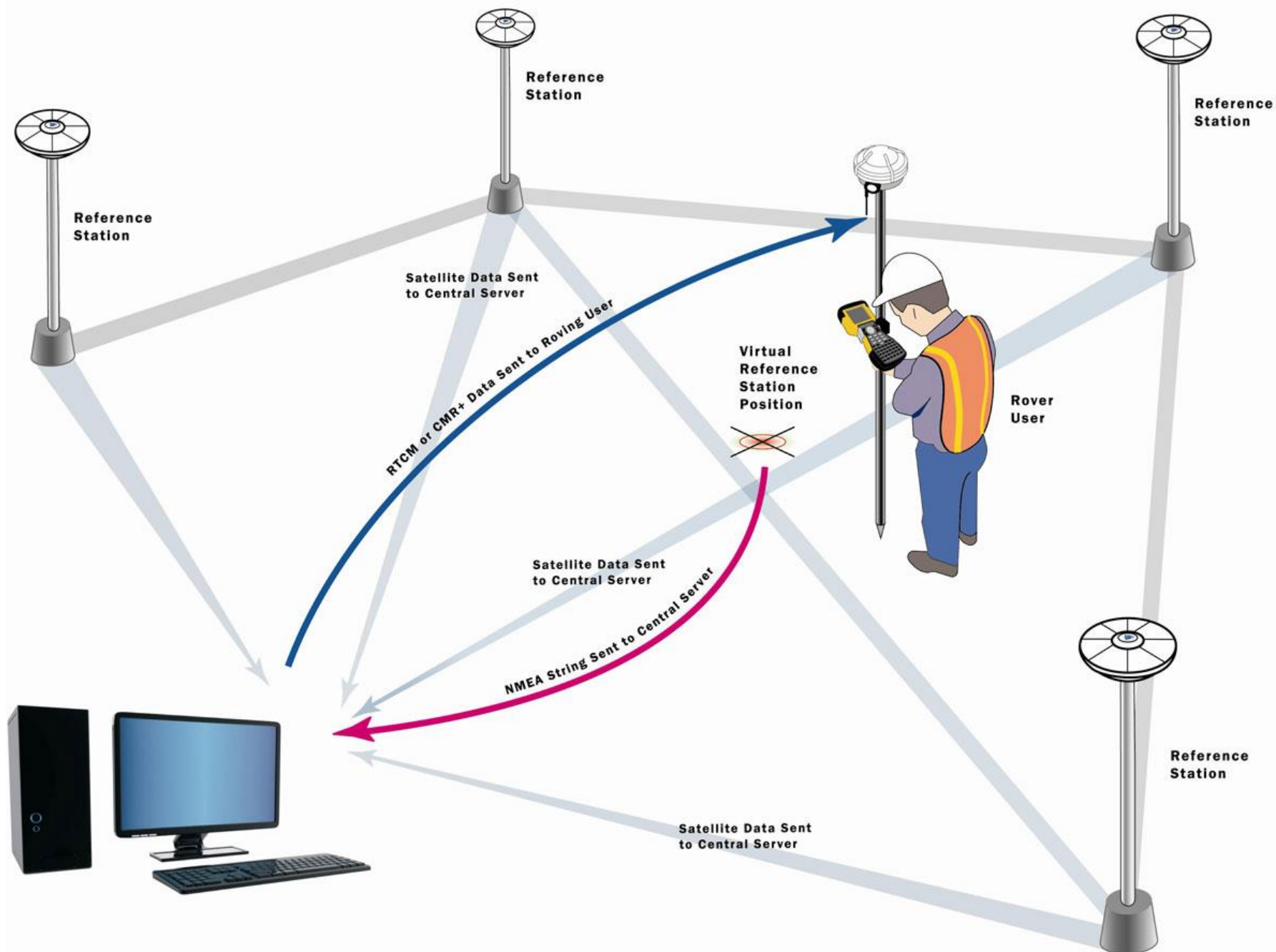
- Surveying
- Pre-blast survey and blast locations.
- High precision machine control.
- Hazard avoidance
- Truck fleet management
- Collision avoidance.



SURVEYING

- Most mines now use RTK GPS systems for surveying.
- GPS considerably speeds up the surveying process and reduces the time surveyors are in the field often in vulnerable locations.
- GPS system gives an absolute position, the tedious process of establishing field control points is entirely eliminated.





SURVEYING

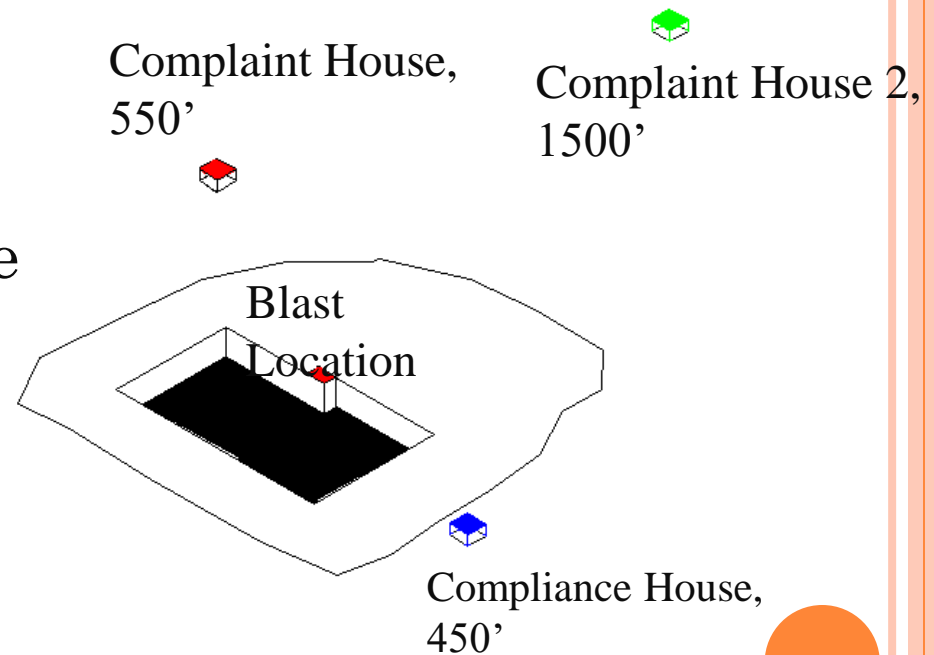
Advantages:

- No line of sight required.
- No weather restrictions.
- Satellite surveying can be one person job, saving time and labour.
- Base lines of hundreds of kilometres may be observed thereby removing the need for extensive geodetic networks of conventional observations.



PRE-BLAST SURVEY AND BLAST LOCATIONS

- Establish spatial relationships
- Establish distances
- Establish allowable charge weights
- Liability protection



HIGH PRECISION MACHINE CONTROL

- High precision guidance systems are fitted to the mining equipment.
- The systems are accurate enough to eliminate the need for survey design pegs in the field.
- machines record the positions that they have worked and so build a gridfile of the completed job. This can be turned into an “as-built” drawing – all without ever having a surveyor in the field.



HIGH PRECISION MACHINE CONTROL

- a) **Dozers** - Complete earth moving jobs can be done without the need for field survey pegging; sophisticated stripping design can be implemented that provides for the optimal efficient movement of material, with GPS guiding the operator as to where to move the material and how far to push it.
- b) **Drills** - Information generated from drilling can be logged onto GPS systems on excavation equipment.



HIGH PRECISION MACHINE CONTROL

○ c) **Hydraulic Excavators:**

- can be used to design grades on benches, knowing the position of the excavator bucket.
- Accurate selective mining of mineralized horizons.
- Reducing overdig, or lost coal.



HIGH PRECISION MACHINE CONTROL

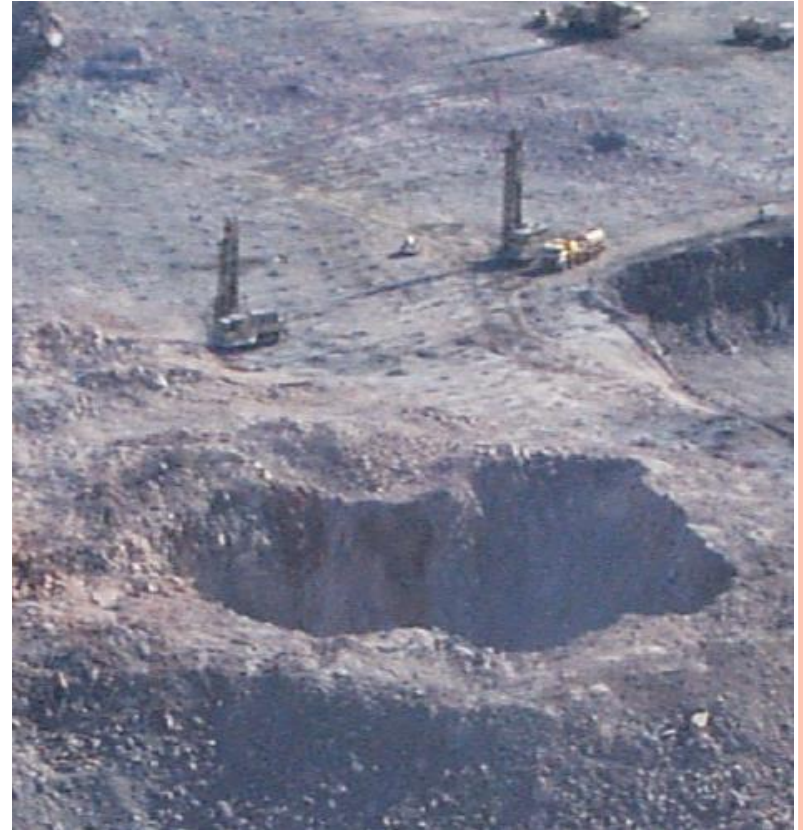
Advantages:

- Productivity gains
- Elimination of mistakes and rework
- Elimination of field survey
- high recovery
- lower dilution of the valuable mineral
- added operators' confidence.



HAZARD AVOIDANCE

- hazardous openings is encountered in many open pits where the deposit has been previously mined by underground methods.



HAZARD AVOIDANCE

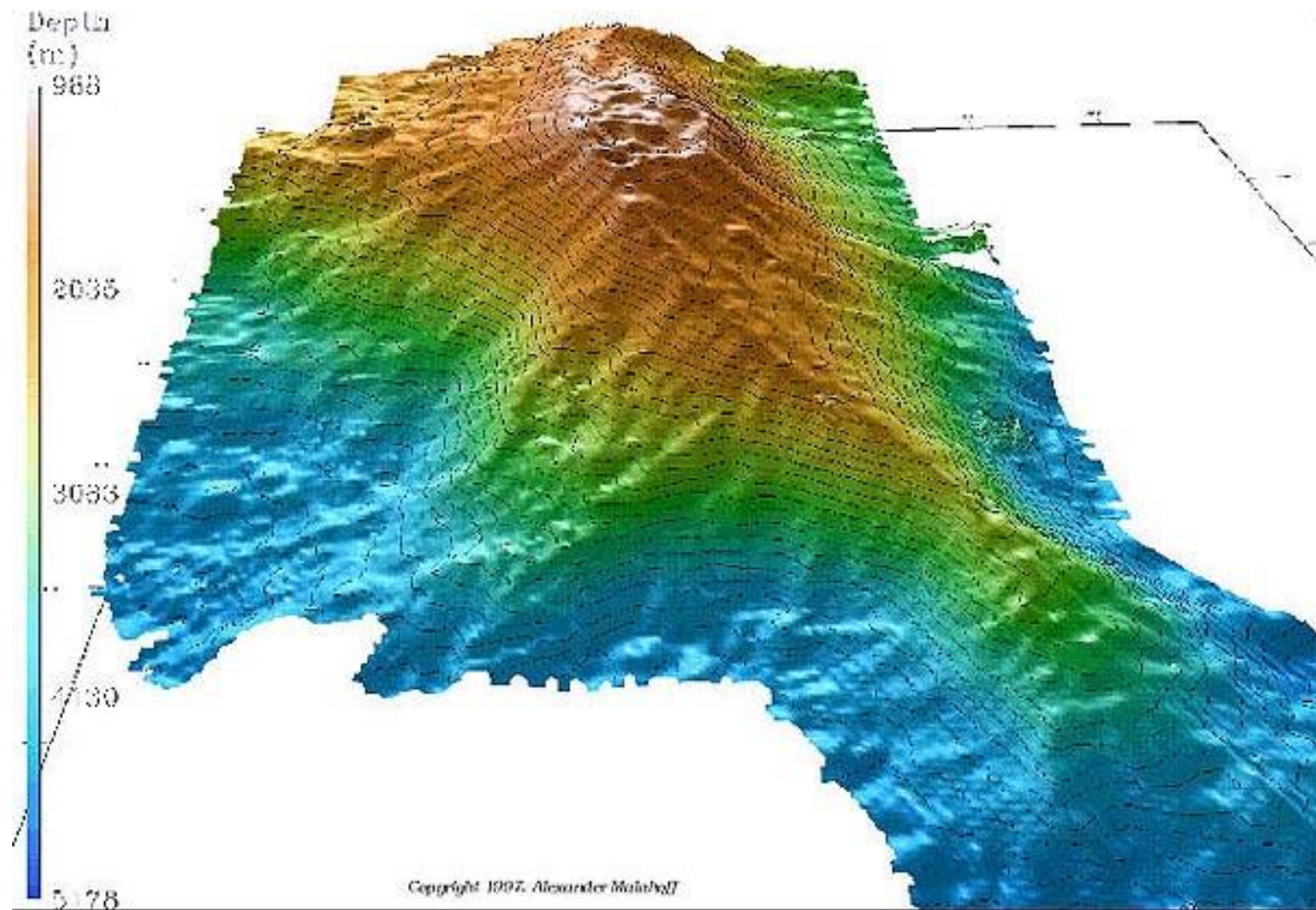
- GPS systems can be set up to warn the operator of site hazards.
- The dozer can be fitted with a cab computer which shows the dozer in its true position on a map of the site.
- It is also possible to set up the dozer so that it automatically broadcasts an assistance required signal at the operators command or if it is tilted beyond a preset angle. The signal from the machine can include its position, making it easy to find.



DIGITAL TERRAIN MODEL MANAGEMENT

- A **digital terrain model** is a digital model or 3D representation of a terrain's surface.
- It requires determination of the base points which can be fed to a computer to calculate DTM.
- RTK GPS can be use to calculate the parameters of the base points

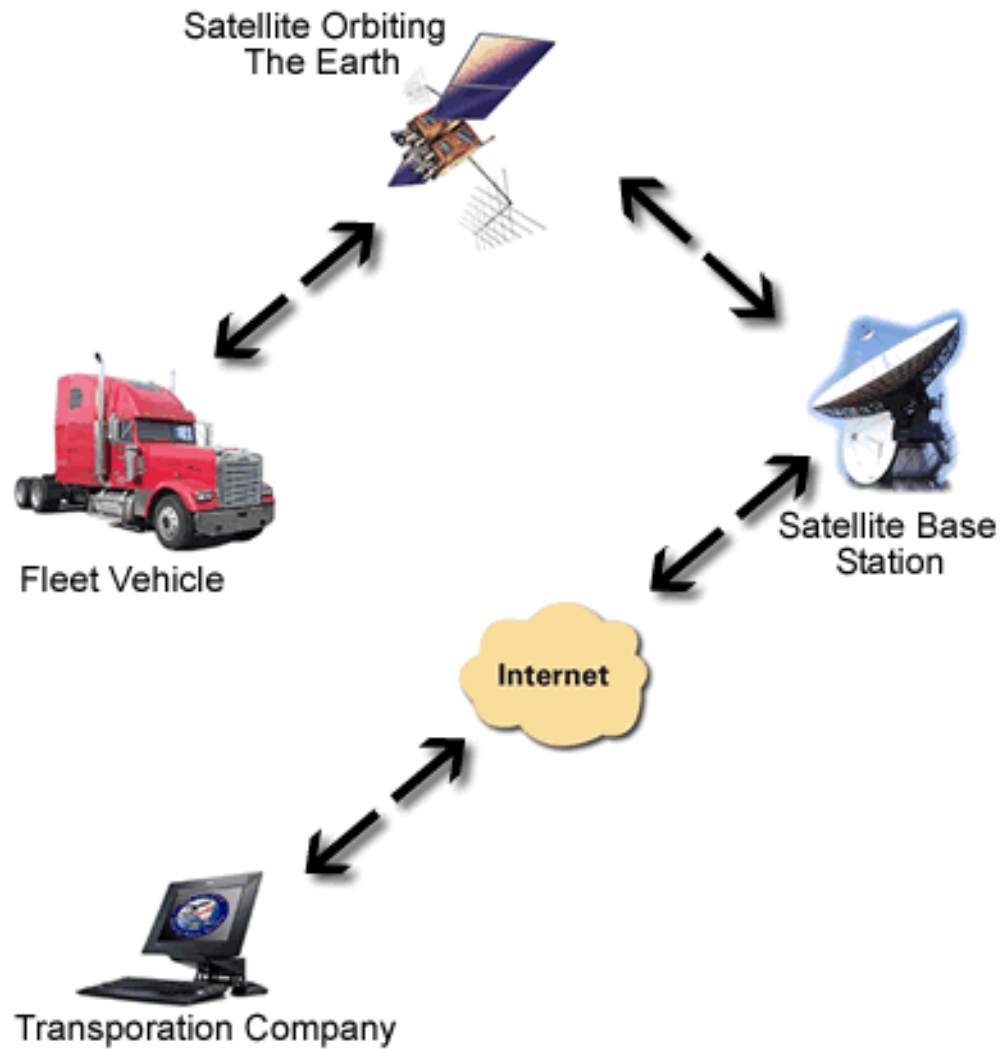




TRUCK FLEET MANAGEMENT

- Trucks can be assigned to different loading machines in real time to improve overall efficiency.
- The central control station knows at all times the whereabouts of each truck in the fleet.
- Stand alone GPS is generally adequate for this task.





COLLISION AVOIDANCE

- If all mobile vehicles are fitted with GPS and telemetry systems, they can continuously report their position to a central control base.
- Software at the base can then analyse the data and warn when two vehicles are on a collision course.
- This technology is deployed with the with civilian air flights in crowded air corridors.



RELIABILITY

- The accuracy of GPS can be from a few centimeters to a few meters.
- The reliability of GPS can be undermined by selective availability.
- Selective availability is the deliberate introduction of error in the positioning system.
- DGPS and RTK GPS can negate the effect of SA.

