Global Navigation Satellite Systems (GNSS)

A brief overview of GNSS

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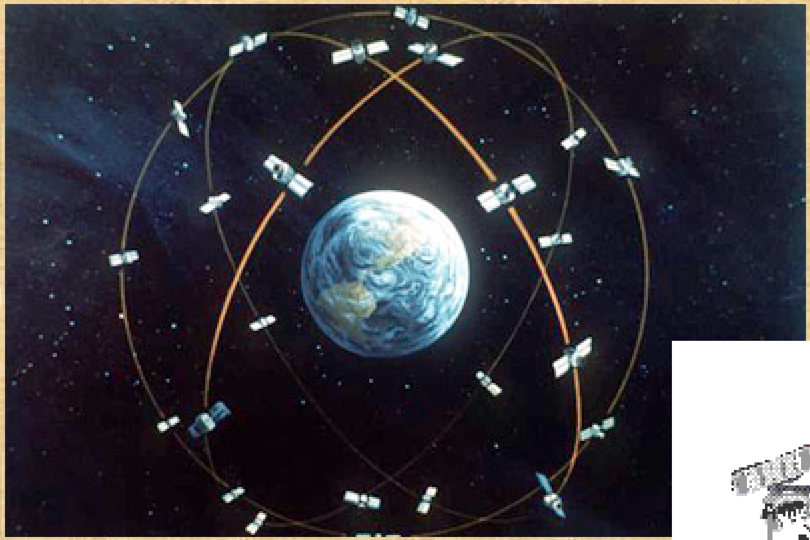
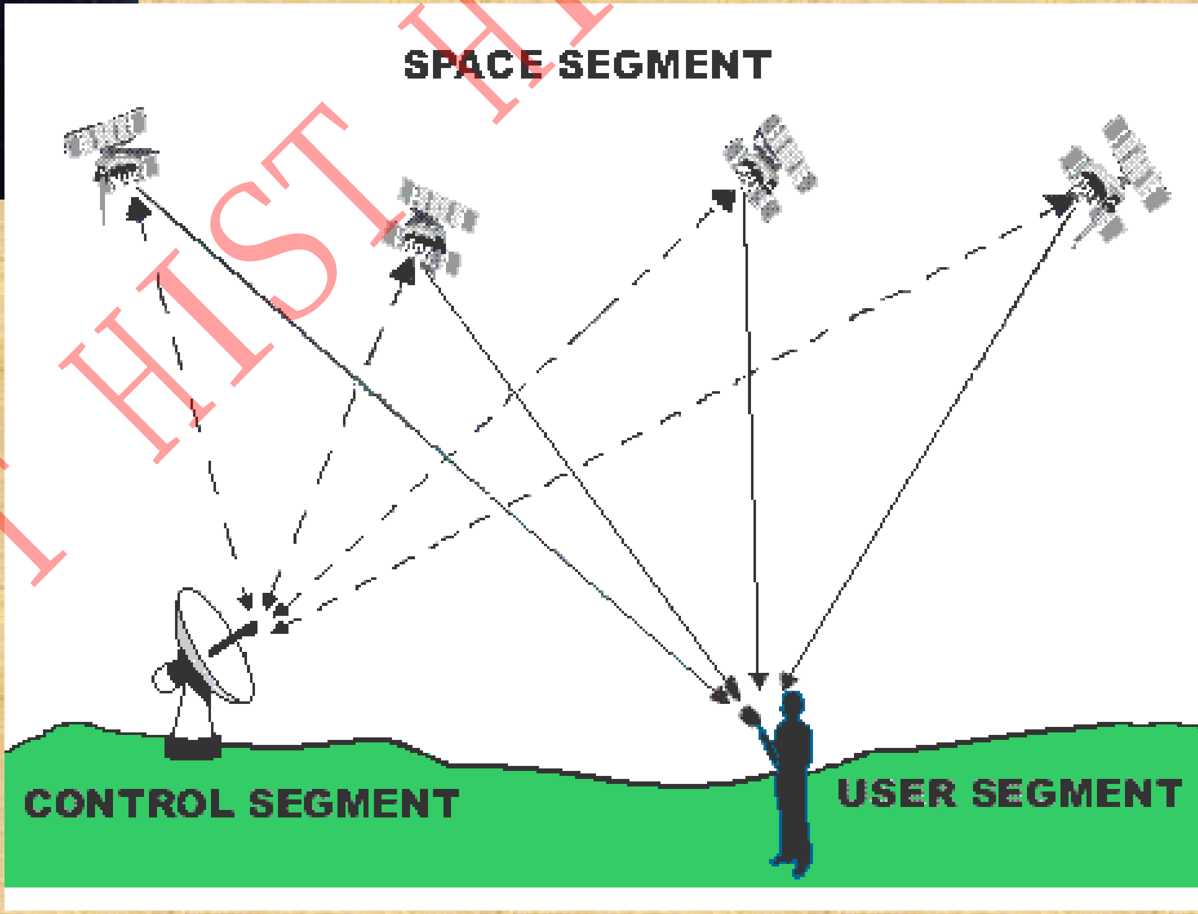
International Systems

1. **GPS – Global Positioning System- USA - (24 +)**
2. **GLONASS Global Navigation) System Satellite – Russia - (24 +)**
3. **Galileo - European Union** in preparation
4. **Compass - China** in preparation

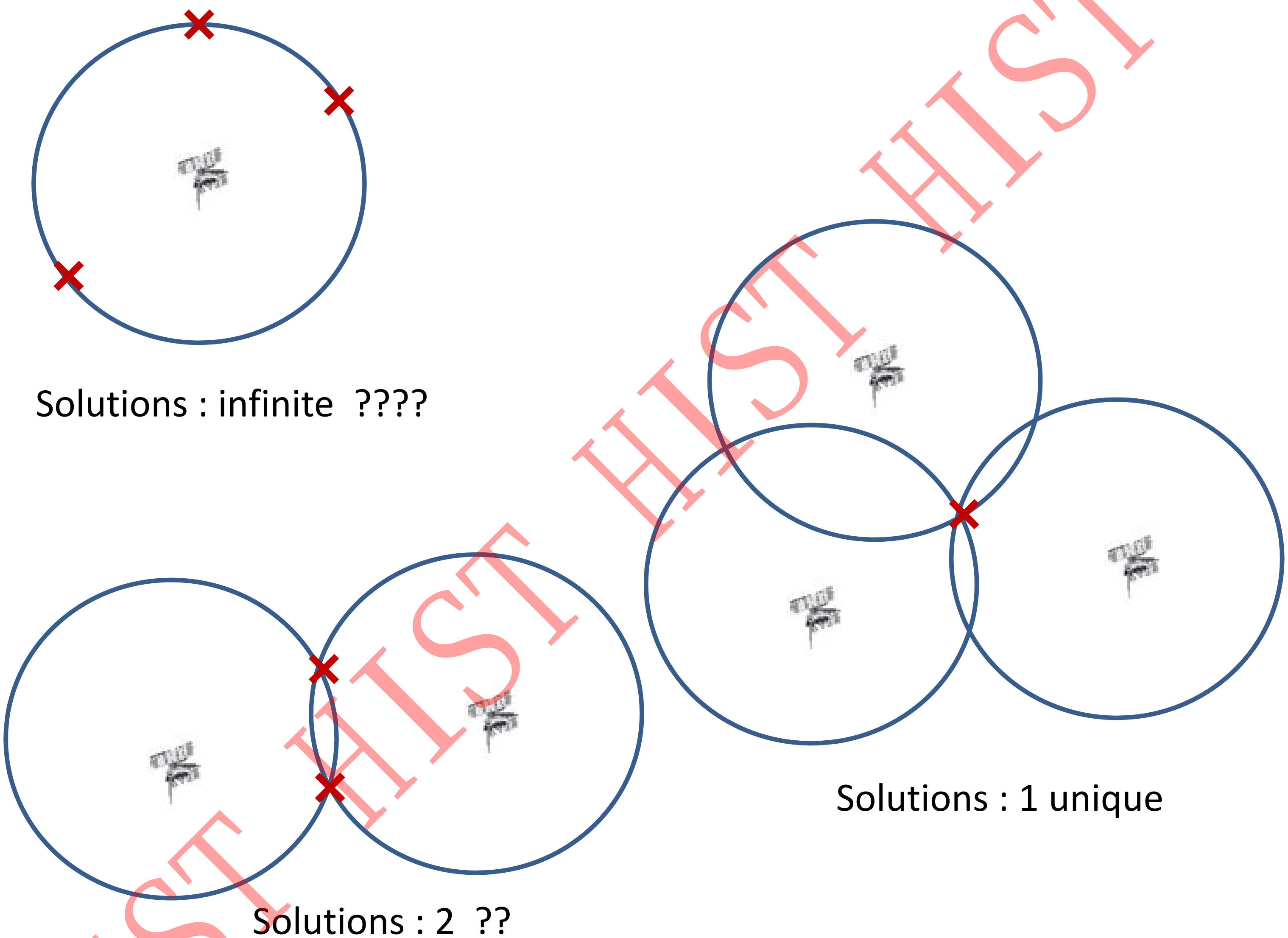
5. **IRNSS - regional Indian system**

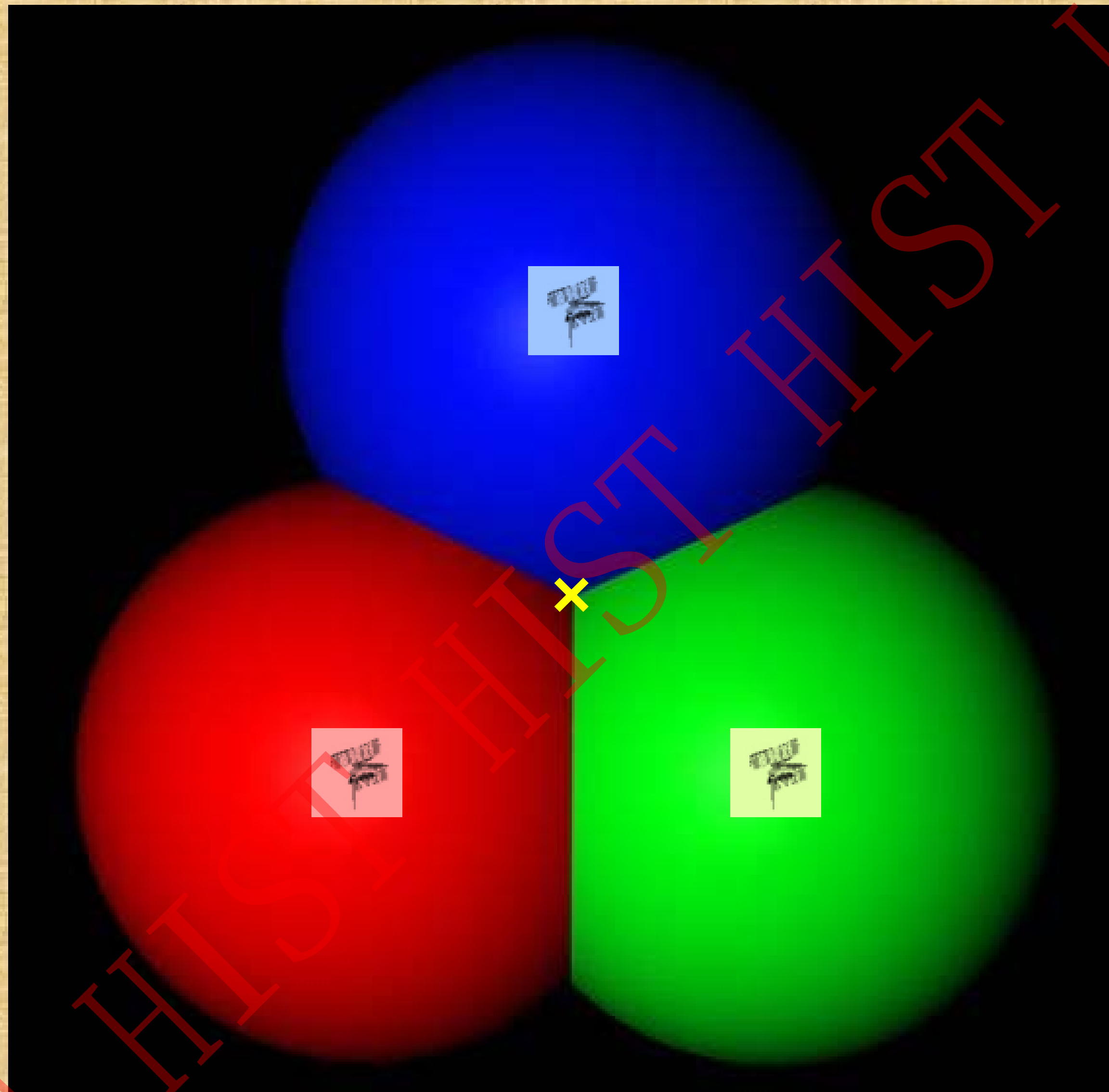


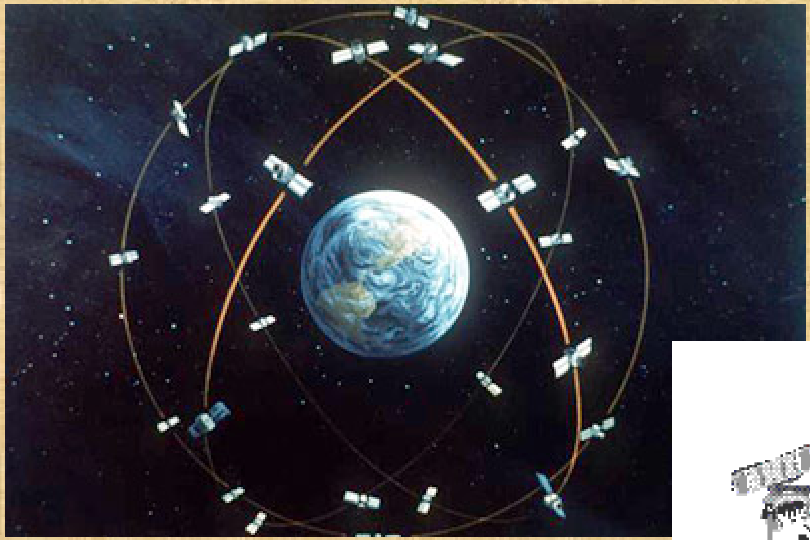

SPACE SEGMENT
CONTROL SEGMENT
USER SEGMENT

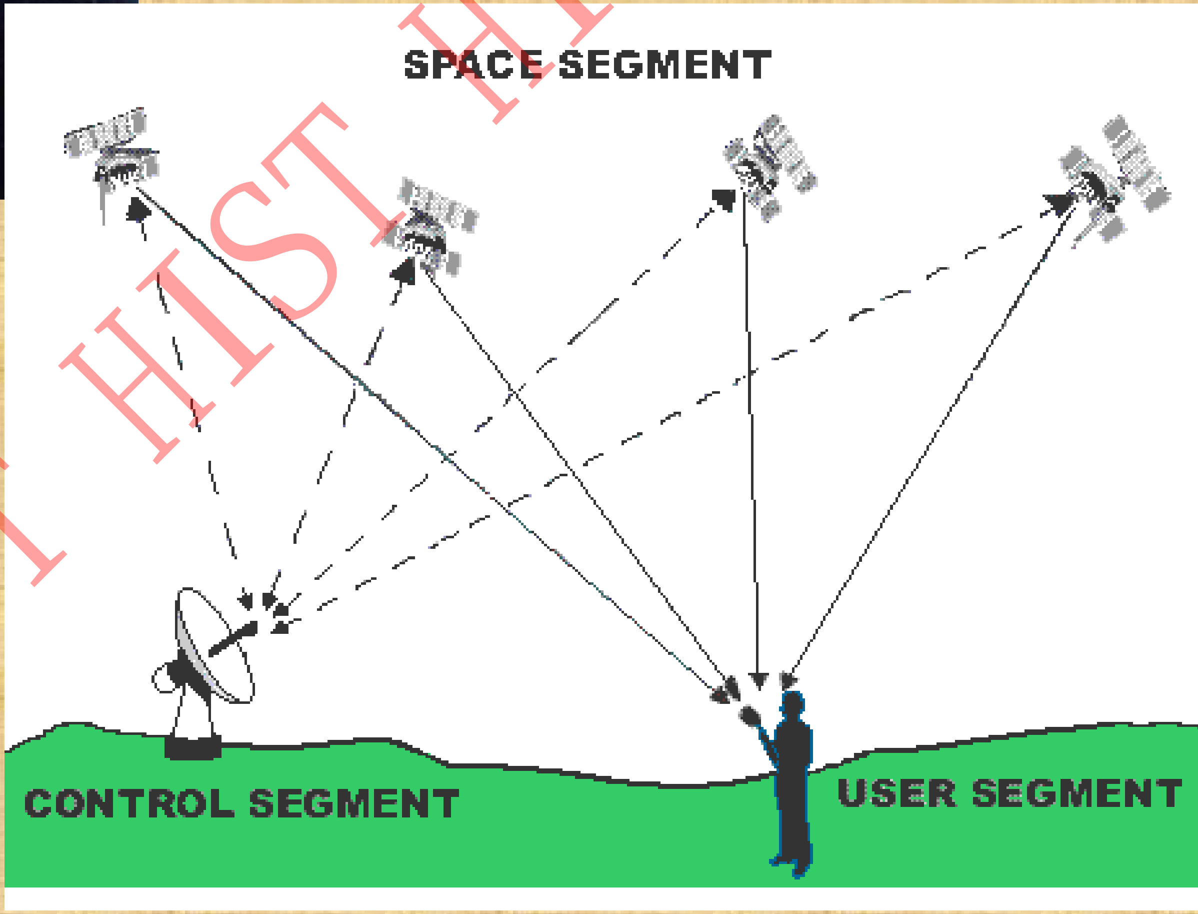
Geometric principle:

Distance measurement








SPACE SEGMENT
CONTROL SEGMENT
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GPS Positioning Modes

GPS requires open sky

- Absolute positioning

  1 receiver - accuracy 5 to 20 m (100 m

- Relative positioning

  2 or more receivers   1 cm to 1 m accuracy

GPS Positioning Modes

Differential (Relative) GPS

One known station two or more unknown stations

- Static GPS (post processing)
- Rapid Static
- Stop-and–Go(post processing)
- RTK **(results in the field - accuracy 10 cm to 1-2 m)**
- RTK Post processing **(cm accuracy)**

Differential GPS with fixed nationally distributed base stations – one user instrument only - post processing

Absolute GPS

Handheld receivers and navigation systems (acc 2 to 20 m)

GPS- accuracy measures

- VDOP - Vertical Dilution of Precision: accuracy degradation in vertical direction
- HDOP - Horizontal Dilution of Precision: accuracy degradation in horizontal plane
- PDOP - Positional Dilution of Precision: accuracy degradation in 3D position
- GDOP - Geometric Dilution of Precision: accuracy degradation in 3D position and time

DOP is a measure of the satellite constellation

DOP is a factor and has no units

(theoretical accuracy of all contributing factors x DOP provides an accuracy estimate)

DOP values between 1 and 20 (1 = ideal 2-5 = good > 20 = poor)

Projections and Reference Ellipsoids

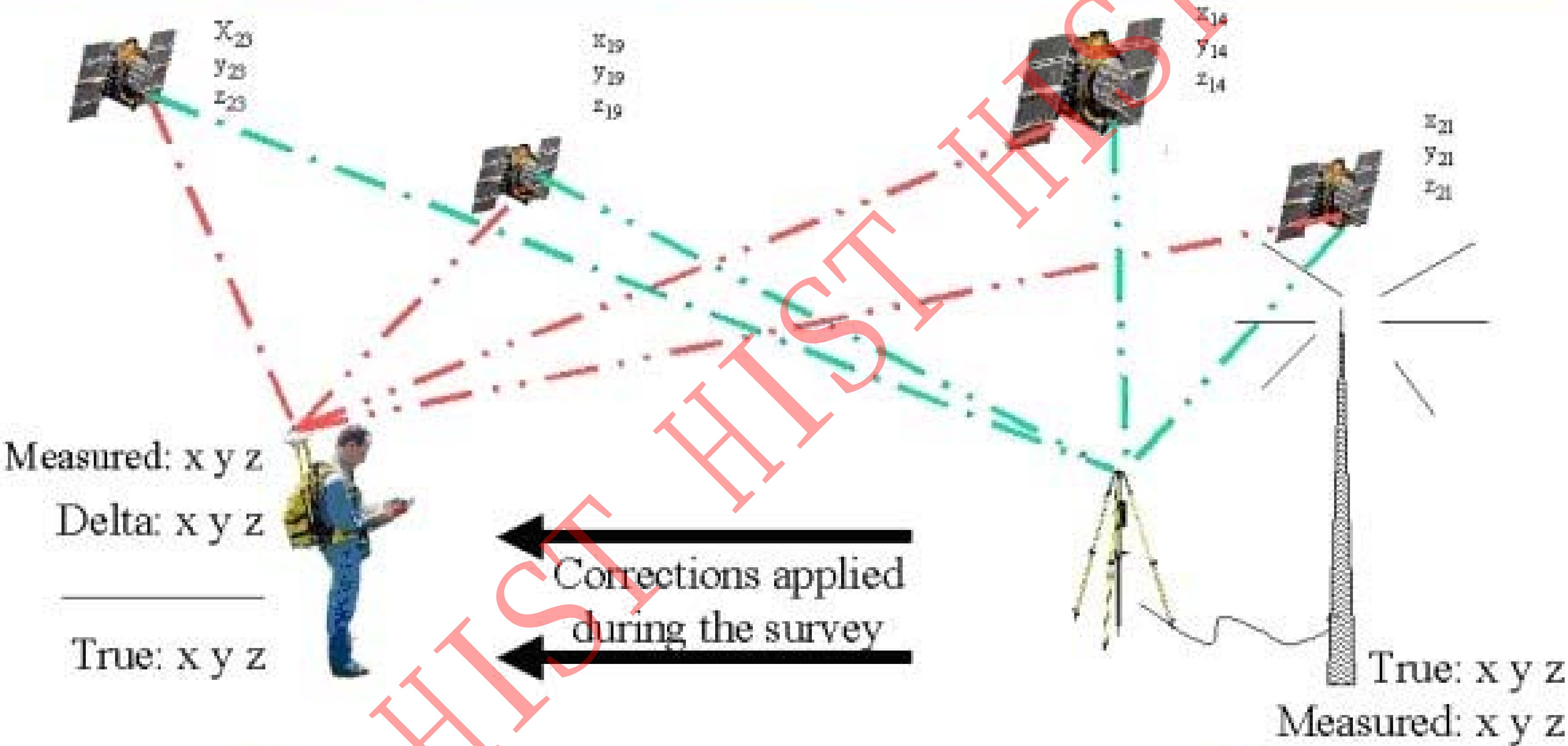
- Reference Ellipsoid :
  - WGS84 (default)

- Coordinates:
  - On a projection surface : UTM
  - On the ellipsoid : Latitude and Longitude

  - Both reference ellipsoid and projection can be changed on most receivers

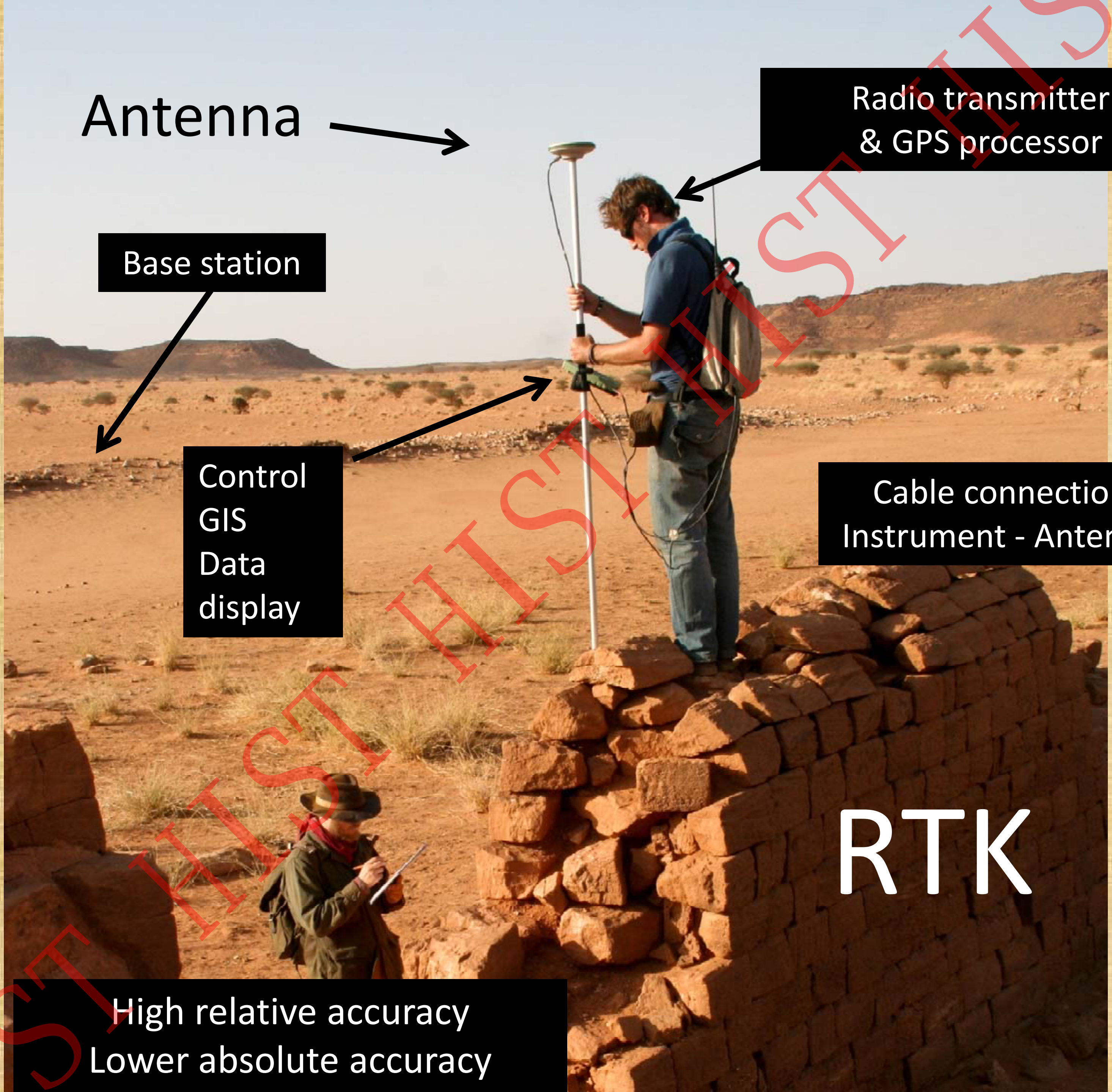
Differential GPS
Survey accuracy

Real-Time Differential GPS



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Ocean Service
National Geodetic Survey

Positioning America for the Future


Antenna
Radio transmitter
& GPS processor
Base station
Control
GIS
Data
display
Cable connection
Instrument - Antenna
RTK
High relative accuracy
Lower absolute accuracy

Real Time Kinematic RTK

Features:

- on site /real time results
- cm relative accuracy (on site) absolute 2-3 m
- cm accuracy with post-processing
- real time mapping/GIS capability
- setting out capability


Google
ANY TIME

- GNNS (GPS)
- Inertial Measurement Unit (IMU)
- Laser Scanner
- Multi Camera System

Total Station

mm or cm accuracy on site