




**3rd FIG Young Surveyors European Meeting**  
16 May 2015 Sofia, Bulgaria

*'European Young Surveyors  
together for tomorrow's  
challenges'*



**The History of Geodesy  
Told through Maps**

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16<sup>th</sup> May 2015 Sofia

**Missionaries in 5000 years**



*With all due respect...*

## SUMMARIZED CHRONOLOGY

**3000 BC** : While settling, people were needed who understand geometries for building villages and dividing lands into parts. It is known that Egyptian, Assyrian, Babylonian were realized such surveying techniques. ➡

**1700 BC** : After floating of Nile river, land surveying were realized to set back to lost fields' boundaries. (32 cm wide and 5.36 m long first text book "Papyrus Rhind" explain the geometric shapes like circle, triangle, trapezoids, etc. ➡

**550+ BC** : Thereafter Greeks took important role in surveying. Names in that period are well known by almost everybody in the world. Pythagoras (570–495 BC), Plato (428–348 BC), Aristotle (384-322 BC), Eratosthenes (275–194 BC), Ptolemy (83–161 BC)

**500 BC** : Pythagoras thought and proposed that earth is not like a disk, it is round as a sphere ➡

**450 BC** : Herodotus (484-425 BC), make a World map ➡

**350 BC** : Aristotle prove Pythagoras's thesis. ➡

**230 BC** : Eratosthenes, made a survey in Egypt using sun's angle of elevation in Alexandria and Syene (now Aswan) in order to calculate Earth circumferences. As a result of that survey he calculated the Earth circumferences about 46.000 km Moreover he also make the map of known World, c. 194 BC. ➡

<b>150</b>	: Ptolemy (AD 90-168) argued that the earth was the center of the universe. As a result of that geocentric earth system had been referred. Ptolemais also make a map of known World. ➡
<b>827</b>	: During middle ages in Europe center of surveying and mapping developments move to Arabic World. Al Mamun made meridian arc survey in Bagdad and calculate the Radius of the Earth. Words we use today such as Azimuth, Zenith, Nadir, Alidade and etc. had been adopted to other languages from that period of Arabic language.
<b>1492</b>	: Christopher Columbus, discovered America
<b>1543</b>	: Nicolaus Copernicus (19.02.1473 - 24.05.1543), described his heliocentric system and theory. He accurately calculated many astronomical constants, such as the period of the planets, time of the solar and lunar eclipses, and the instantaneous motion of the moon. ➡
<b>1569</b>	: Gerardus Mercator (3.5.1512 - 2.12.1594), He developed a map projection and he published a map of the World, 1569 ➡
<b>1600s</b>	: Telescope developed by Johannes Kepler (27.12.1571 – 15.11.1630) open a new period in astronomy and surveying World ➡
<b>1614</b>	: Willebrord van Roijen Snellius, (1580-30.10.1626) introduced resection method for obtaining coordinates of a point by observing only directions. ➡

<b>1735+</b>	: Those days center of mapping and surveying actives move to France. Bides precise meridian arc calculation, during French Revolution a common metric system was introduced.
<b>1801</b>	: Meter unit legally accepted as 1/40000000 of the earth's circumferences around the poles.
<b>1808</b>	: Napoleon cadaster process was began and relative to that Bavaria cadaster institution began surveying for 1:5000 scale map production and decided to use those outputs also for 1:25000 scale map production. All those work was done by using plane table surveying technique and that process completed in 1840 ➡
<b>1830</b>	: Friedrich Wilhelm Bessel (22.7.1784 - 8.4.1846) studied for determining the earth shape and introduce an ellipsoid that has been used as reference ellipsoid.
<b>1832-1847</b>	: Carl-Friedrich Gauß (30.4.1777 - 23.2.1855), developed and introduced least square techniques.
<b>1873</b>	: Gauss described it first as «mathematical figure of the earth» in 1828 and J.F.Listing firstly used the term of "Geoid"

**1<sup>st</sup> World War+**

: Photogrammetry turn to a very powerful spatial data acquisition technique,.

**1924**

: International ellipsoid was accepted. That is Hayford Ellipsoid 1909.

**2<sup>nd</sup> World War+**

: Radar technology was used as the primary electronic distance measurement. EDM Measurement, calculation and computer systems and data determination periods was began.

**1957**

: First geodetic satellite was launched, Sputnik

**Thereafter**

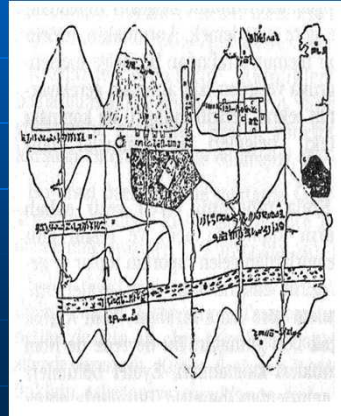
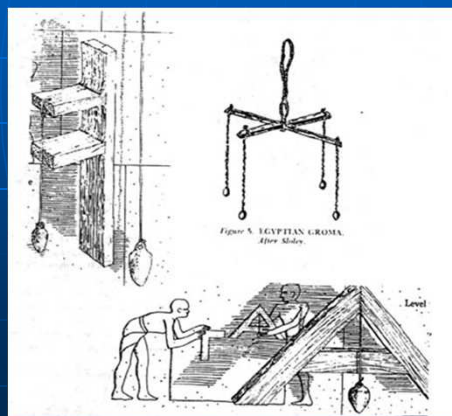
: Period of positioning determination by using satellite systems and techniques began.

**Till Today**

: Terrestrial surveying systems turn to robotic systems.

Systems' integrations getting more efficient and affordable.

Most of the surveying systems turn to electronic, computerized and unmanned systems.



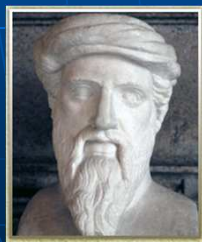
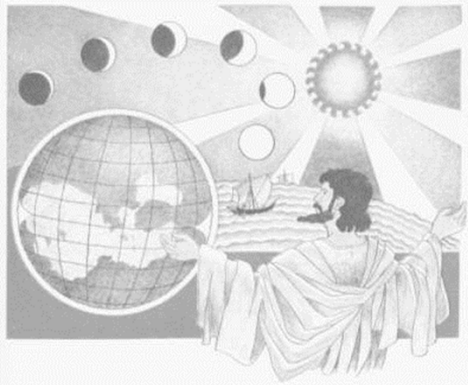
# Rhind Mathematical Papyrus

British Museum, London



A portion of the Rhind Papyrus

**Date** Second Intermediate Period of Egypt  
**Place of origin** Thebes  
**Language(s)** Egyptian (Hieratic)  
**Size** Length: 536 centimetres (211 in)  
Width: 32 centimetres (13 in)  
**Other** BM/Big no. AE 10058,  
Reg no. 1865,0218.3

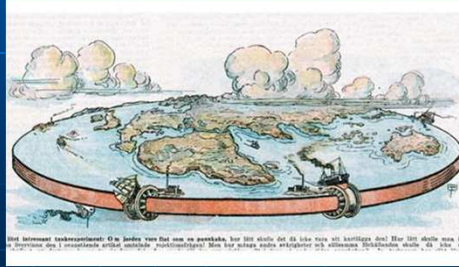
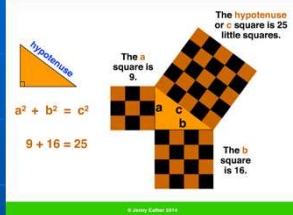


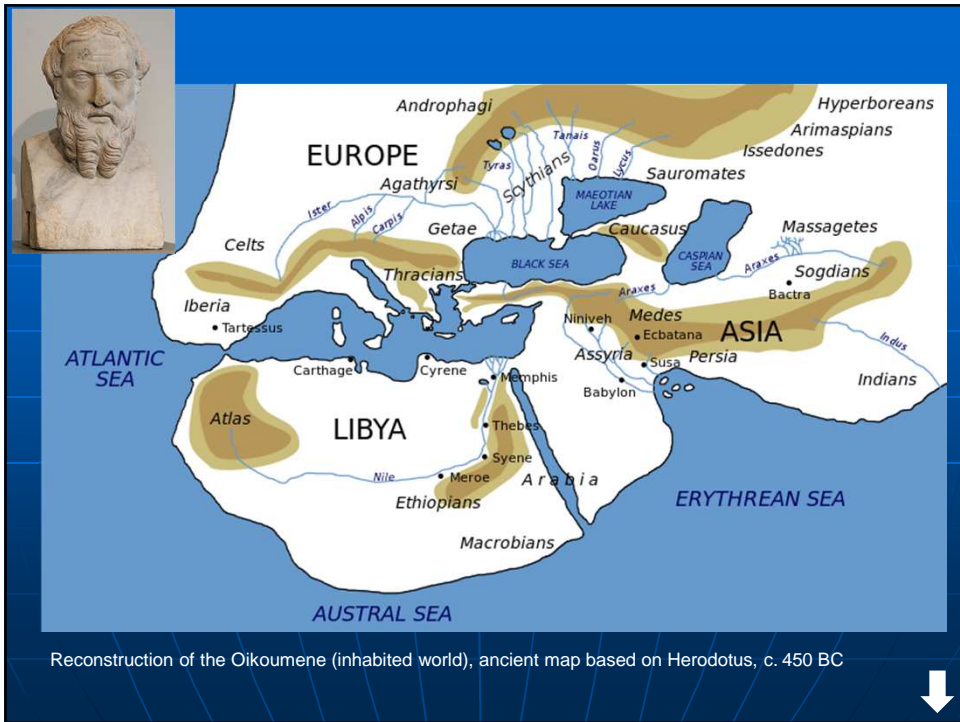
## Pythagoras




Pythagoras' theorem says that the area of the square built upon the hypotenuse of a right-angled triangle is equal to the sum of the areas of the squares upon the remaining sides.

### the theorem






### Map Found in Çatalhöyük (6000-5000 BC)



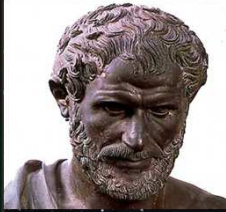
Map obtained in 1963 in Çatalhöyük/MidAnatolia/Turkey is the oldest map known. This founding takes the history of surveying almost 2400 years back.



Çatalhöyük Haritasının Renkli Çizimi  
Color Drawing of the Çatalhöyük Map

This map shows the settlement plan of Çatalhöyük village.

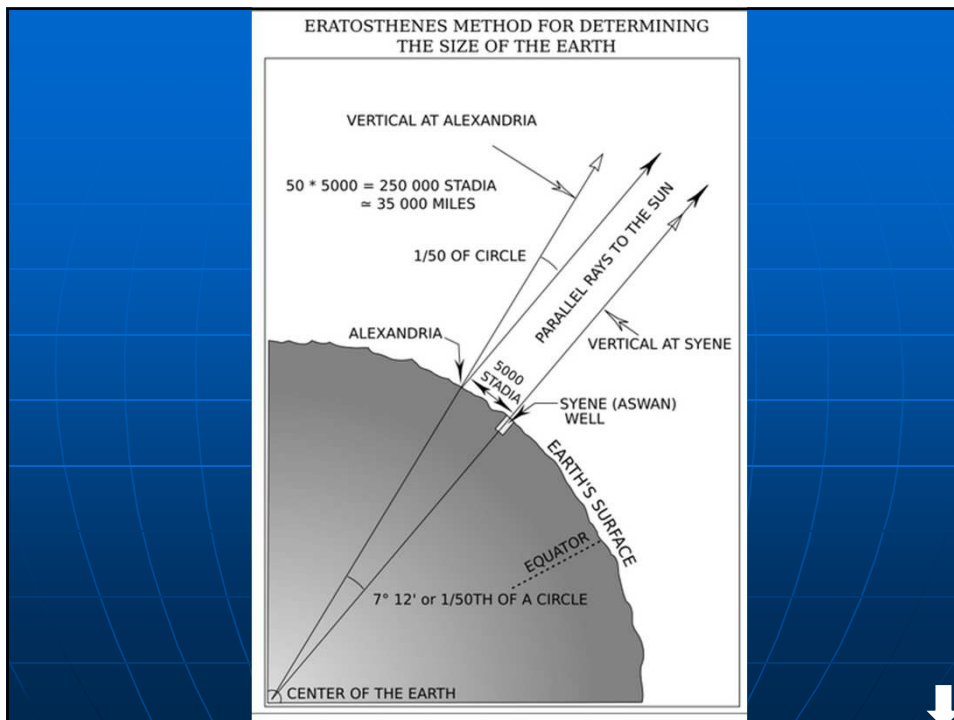
It is displayed in «Anadolu Medeniyetleri Müzesi- Anatolian Civilization Museum» in Ankara.

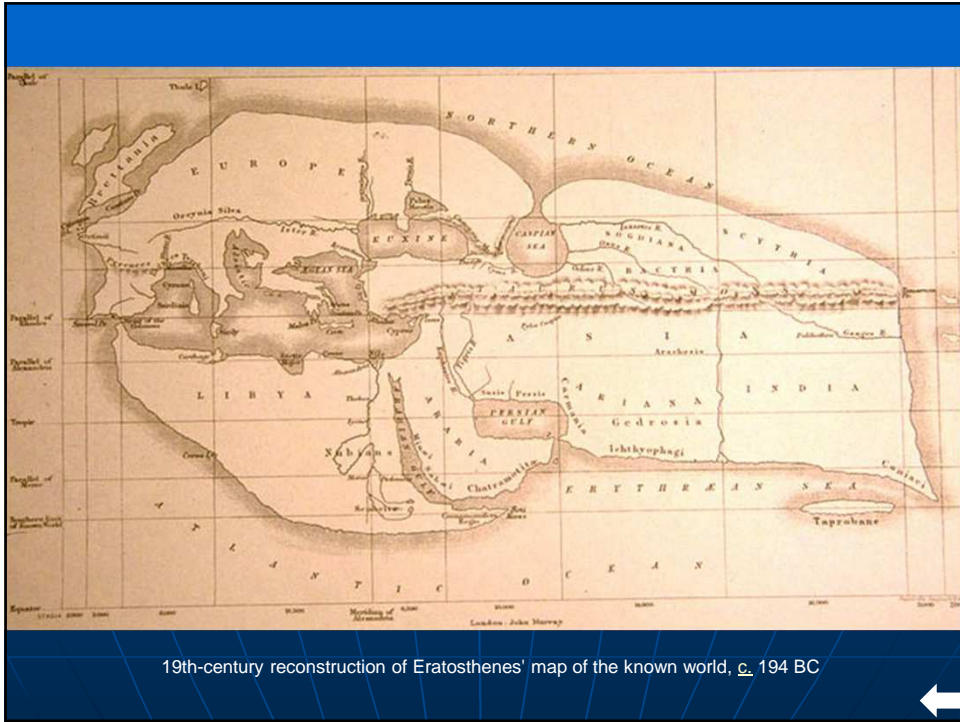


Aristotle observed "there are stars seen in Egypt and Cyprus which are not seen in the northerly regions. "Since this could only happen on a curved surface, he too believed Earth was a sphere" of no great size, for otherwise the effect of so slight a change of place would not be quickly apparent."

Aristotle provided physical and observational arguments supporting the idea of a spherical Earth:

- Every portion of the Earth tends toward the center until by compression and convergence they form a sphere.
- Travelers going south see southern constellations rise higher above the horizon; and
- The shadow of Earth on the Moon during a lunar eclipse is round.



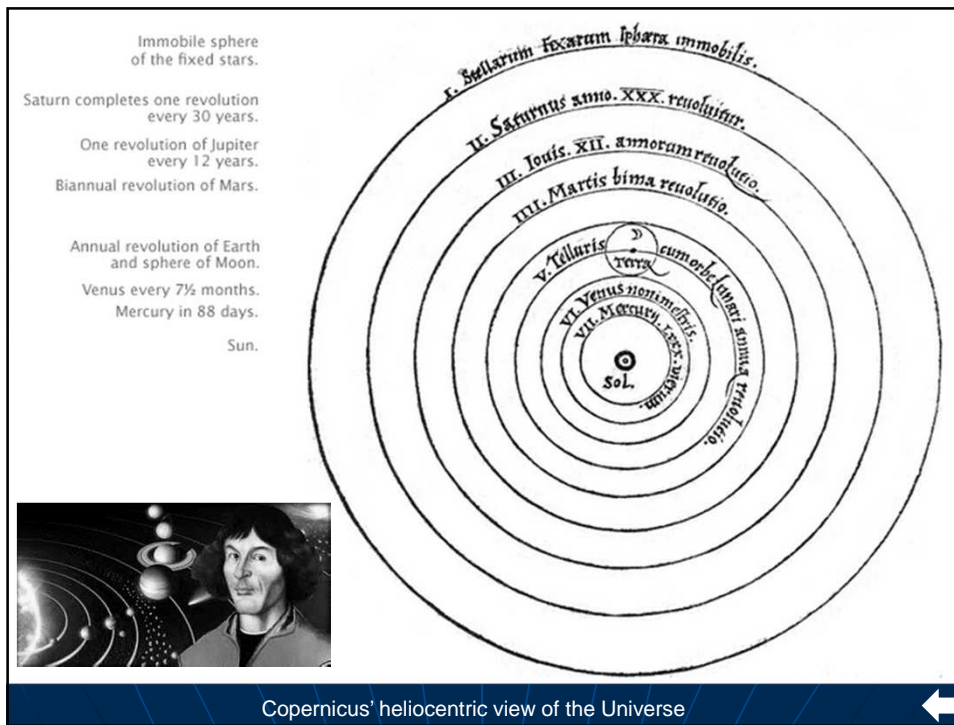


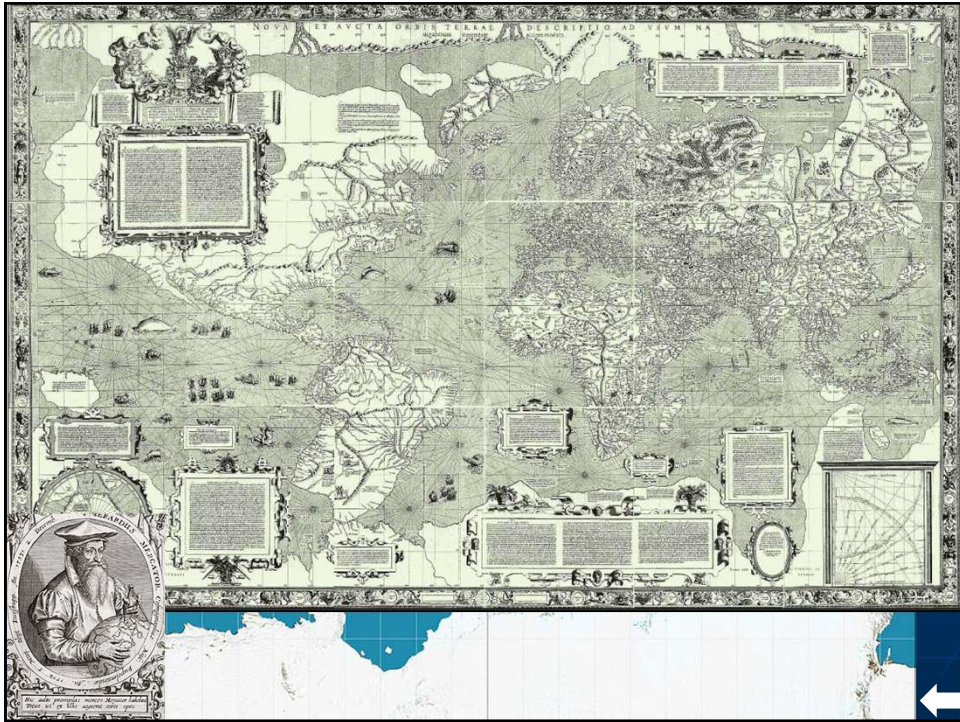
19th-century reconstruction of Eratosthenes' map of the known world, c. 194 BC



Ptolemy's world map, reconstituted from Ptolemy's *Geography* (circa 150) in the 15th century, indicating "Sinae" (China) at the extreme right, beyond the island of "Taprobane" (Sri Lanka, oversized) and the "Aurea Chersonesus" (Southeast Asian peninsula).

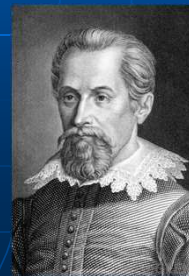


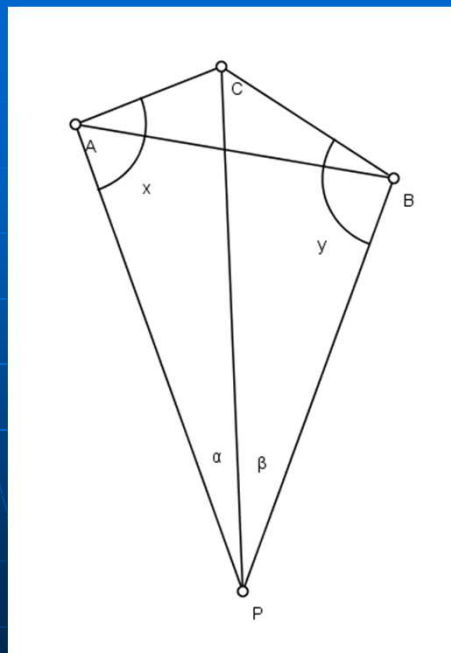
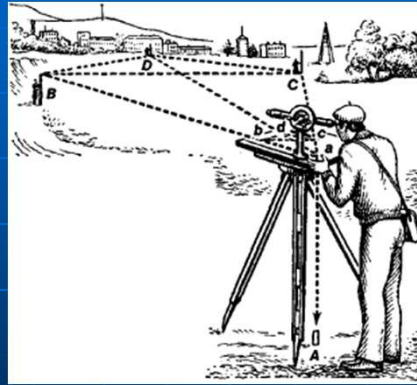




Woodcut illustration of a 46 m (150 ft) focal length Keplerian astronomical refracting telescope built by Johannes Hevelius.

The Keplerian Telescope, invented by Johannes Kepler in 1611, is an improvement on Galileo's design. It uses a convex lens as the eyepiece instead of Galileo's concave one. The advantages of this arrangement is that the rays of light emerging from the eyepieces are converging. This allows for a much wider field of view and greater eye relief, but the image for the viewer is inverted.





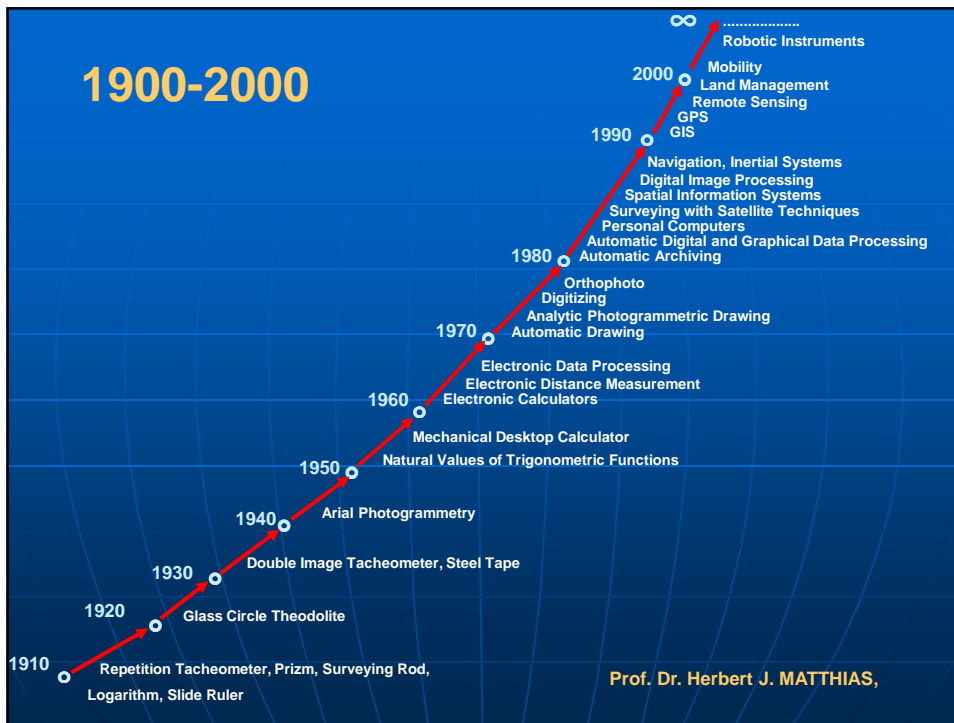
**Willebrord Snellius**



Willebrord Snel van Royen (1580–1626)

<b>Born</b>	13 June 1580 Leiden, Dutch Republic
<b>Died</b>	30 October 1626 (aged 46) Leiden, Dutch Republic
<b>Nationality</b>	Dutch
<b>Fields</b>	Astronomer and mathematician
<b>Institutions</b>	University of Leiden
<b>Alma mater</b>	University of Leiden
<b>Academic advisors</b>	Ludolph van Ceulen Rudolph Snellius
<b>Notable students</b>	Jacobus Golius
<b>Known for</b>	Snell's law

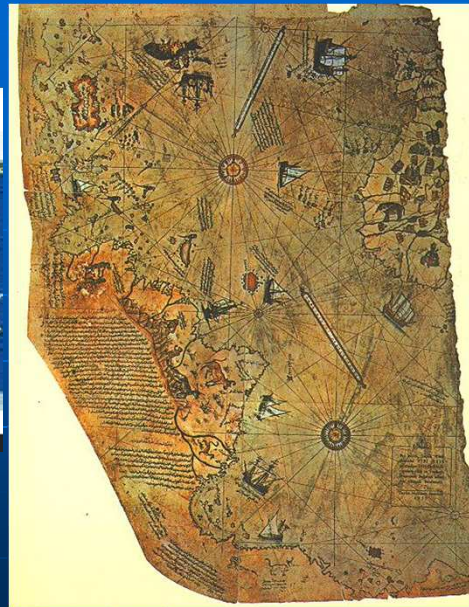




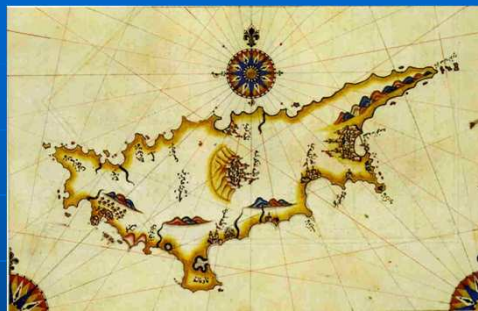
# PIRI REİS

(1470-1554)

## Piri Reis



## Cyprus



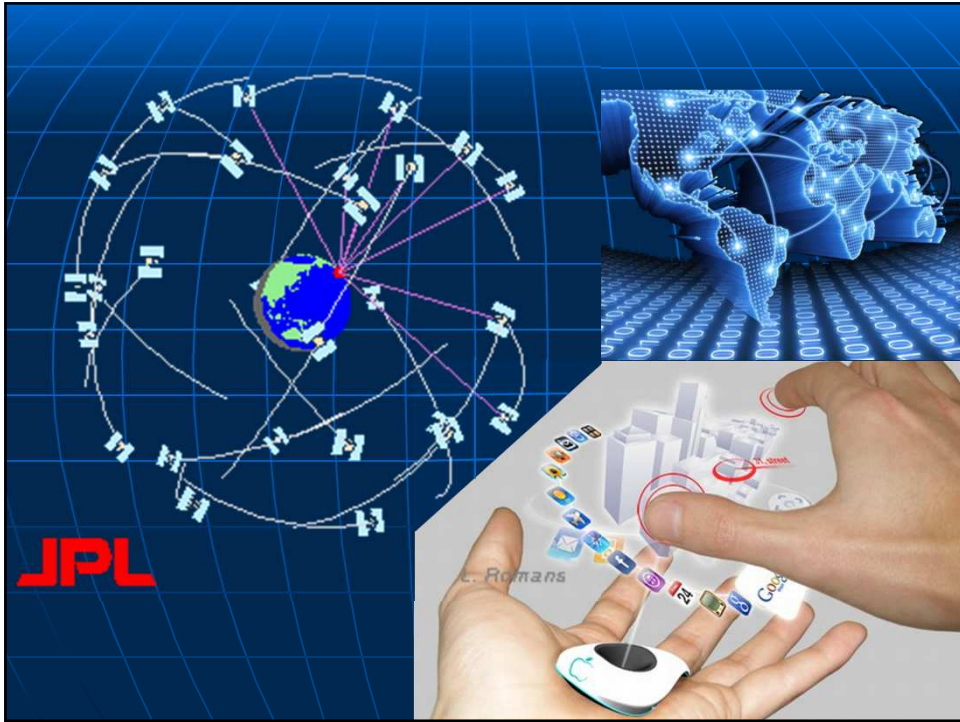
ATLAS, No: 146-Mayis 2005

# Mytilene



ATLAS, No: 146-Mays 2005

# Close Future



A better future can only be built on Past Experiences



Wish you successful feature...

Contact: [celikn@itu.edu.tr](mailto:celikn@itu.edu.tr)