

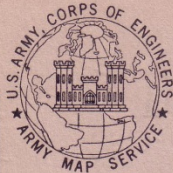
GNSS – Then and Now

Cliff Mugnier C.P., C.M.S.

LSU CENTER FOR GEOINFORMATICS

Sputnik - 1957

- Launched by the USSR, it quickly became apparent to the APL – Applied Physics Labs at Johns Hopkins University that by pre-determining an artificial satellite's orbital position, an observer could discern his own position by measuring the Doppler shift of the satellite's transmissions.



ARMY MAP SERVICE

NOVEMBER 1959

TECHNICAL REPORT No. 27

Technical information concerning current problems or proposals related to mapping.

U. S. ARMY WORLD GEODETIC SYSTEM 1959

(PART 1: METHODS)

Project MO-011

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ARMY MAP SERVICE • 6500 BROOKS LANE • WASHINGTON 25, D. C.

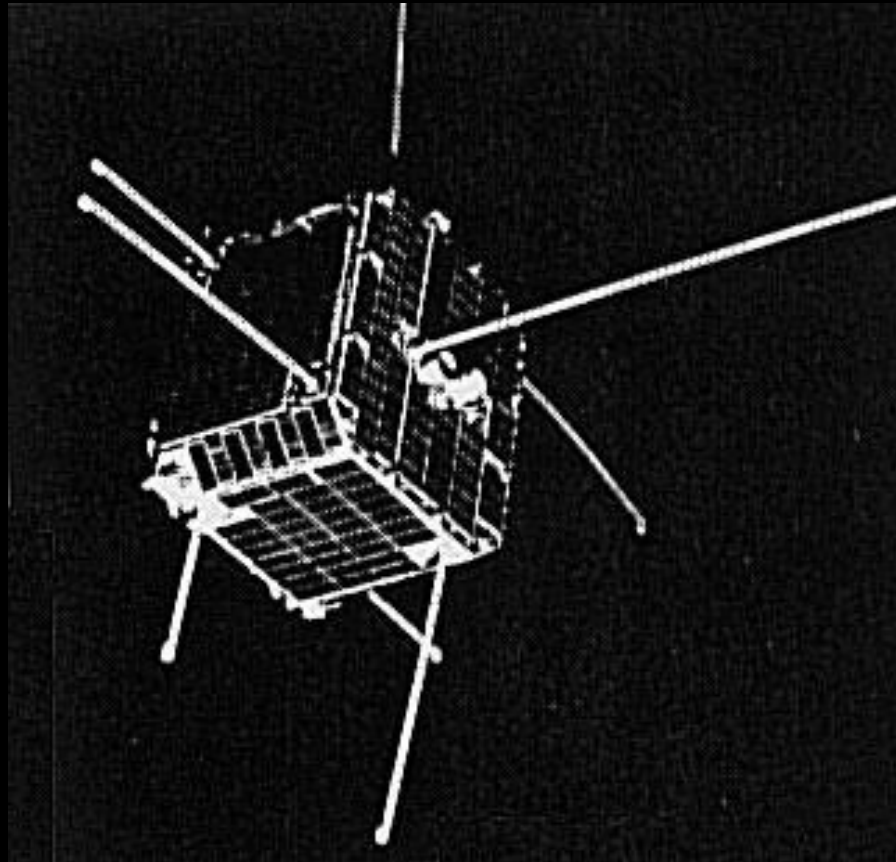
WORLD GEODETIC SYSTEM 1960

- *WGS60 ellipsoid**:
 - $a = 6,378,166$ m.
 - $1/f = 298.3$

** This was the first Astrogeodetic World Datum computed by Dr. Irene Fischer.*

SECOR

Sequential Collation of Ranges



ANNA



UNCLASSIFIED

BRL

REPORT NO. 784
OCTOBER 1951

SPATIAL TRIANGULATION BY MEANS OF PHOTOGRAMMETRY

H. Schmid

PROPERTY OF
CLIFFORD J. MUGNIER
LIEUTENANT,
CORPS OF ENGINEERS

Ordnance Research & Development Project No. TB3-0838

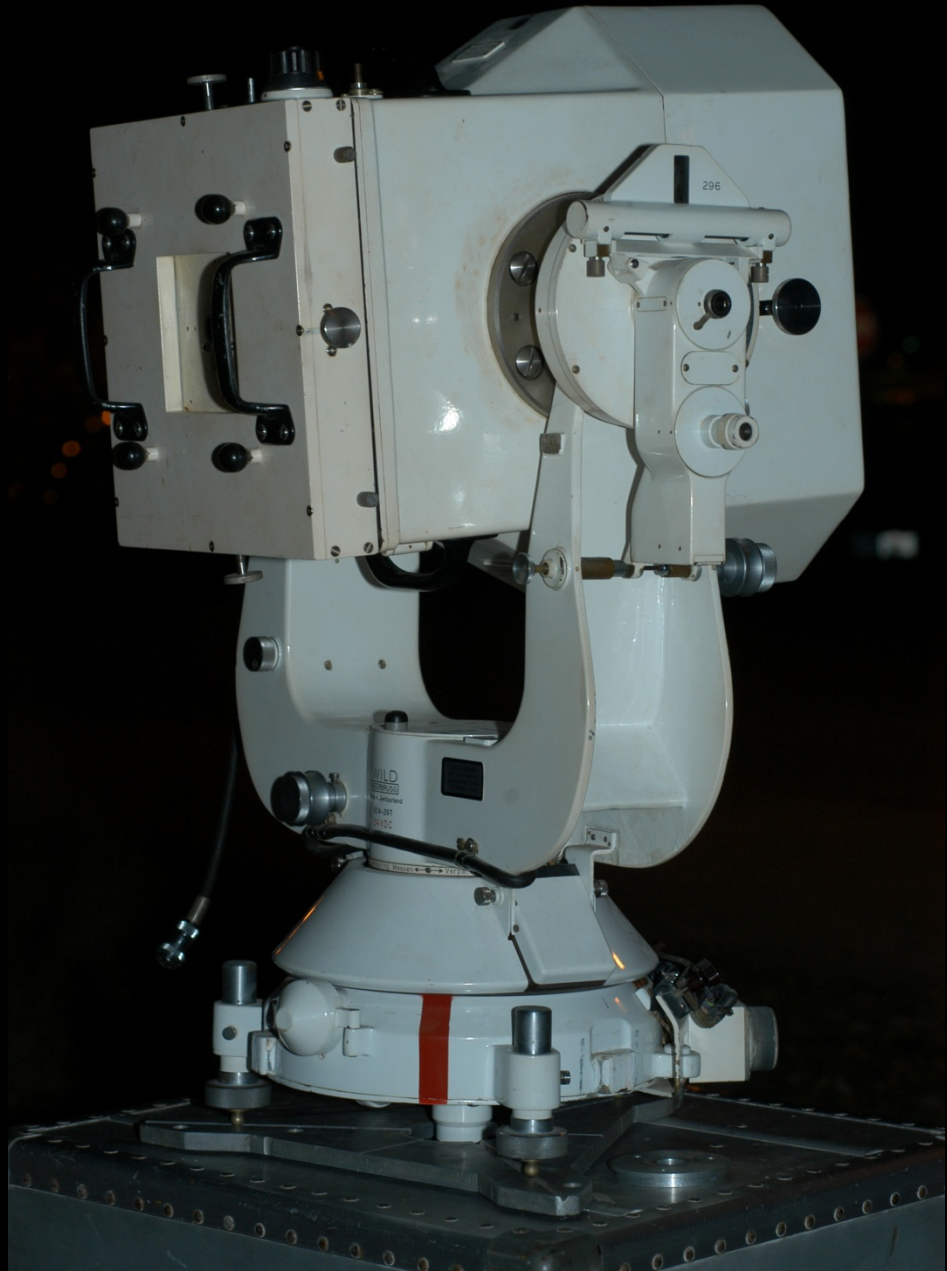
BALLISTIC RESEARCH LABORATORIES

ABERDEEN PROVING GROUND, MARYLAND

UNCLASSIFIED

BC-4 WORLD PRIMARY NETWORK



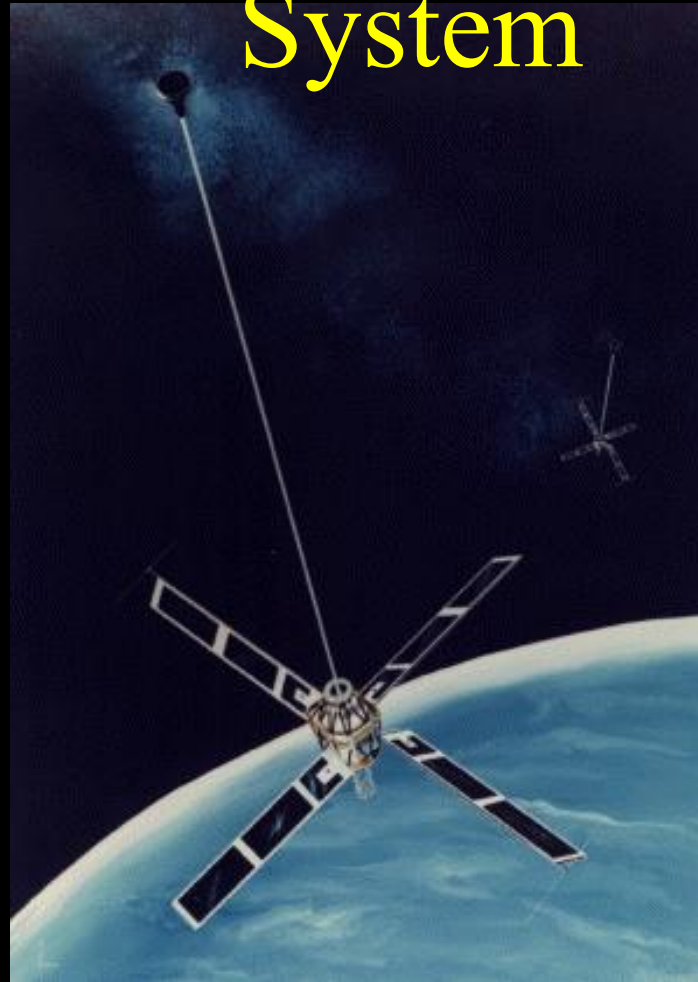




WORLD GEODETIC SYSTEM 1966

- *NWL 9d ellipsoid:*
 - $a = 6,378,145$ m.
 - $1/f = 298.25$

NAVY TRANSIT Satellite System





WORLD GEODETIC SYSTEM 1972

- *WGS72 ellipsoid:*
- $a = 6,378,135$ m.
 - $1/f = 298.26$

1974

- *The Department of Defense World Geodetic System 1972*
Thomas O. Seppelin, 1974. (Unclassified)

**Surveying with Geodetic Satellites by civilians is opened
up.**

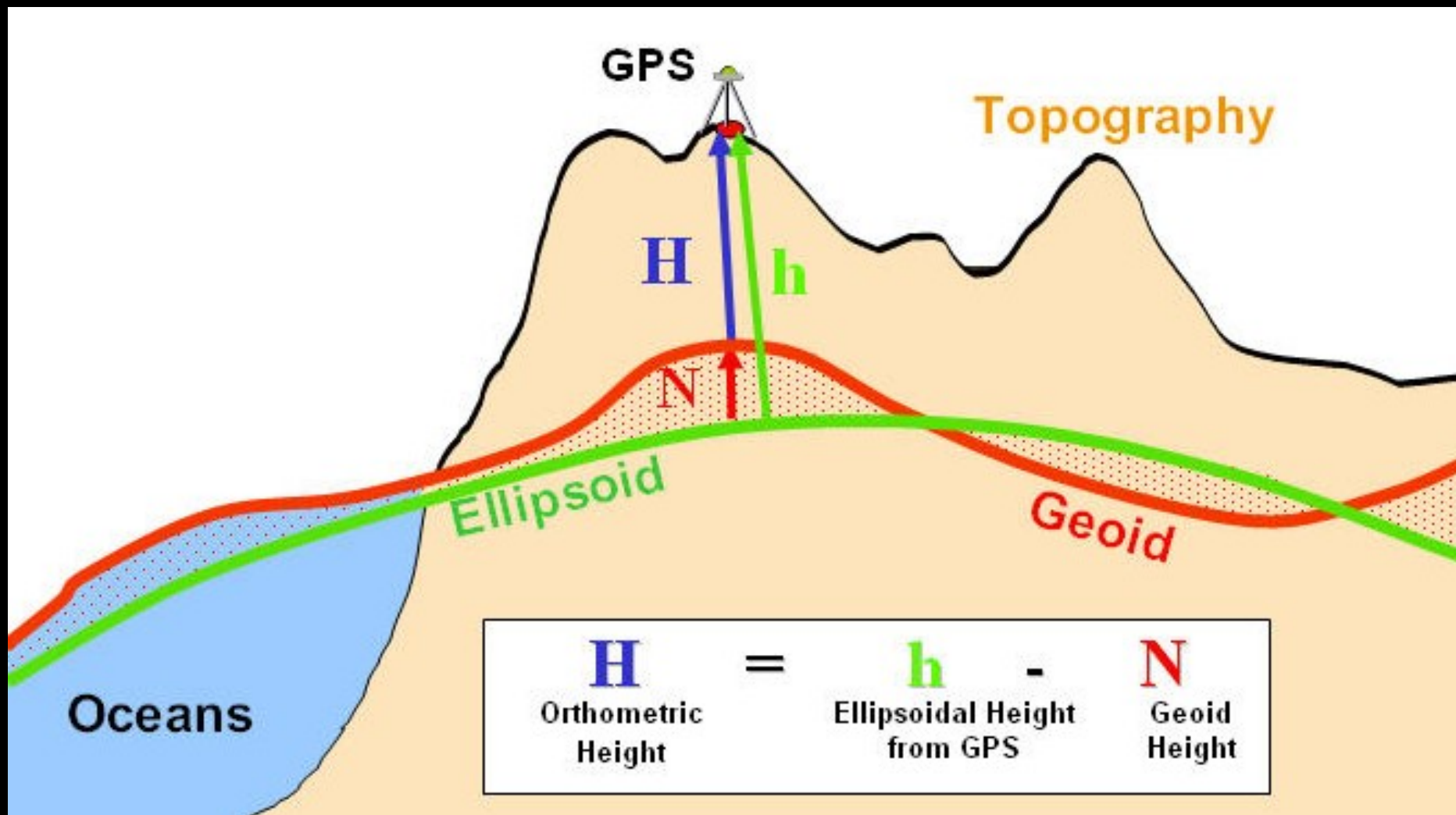
NAVSTAR – Global Positioning System

- *WGS84 ellipsoid:*
 - $a = 6,378,137$ m.
 - $1/f = 298.257223563\dots$



3D Positioning is now possible

- Problem: GPS yields ellipsoid heights
- Solution: the GEOID
- Problem: the Geoid is Top Secret!
- Solution: declassify & observe more gravity





FG-5 Absolute Gravity Meter ($\pm 1\mu\text{gal}$)



WILD Heerbrugg T-4 Astronomical Theodolite

(Modified for semi-auto deflection of the vertical)

MX Missile Program



MX Missile Basing



CONGRESS OF THE US
Office of Technology
Washington, D.C. 20515

Fall of the Soviet Union

- In December of 1991, as the world watched in amazement, the Soviet Union disintegrated into fifteen separate countries. Its collapse was hailed by the west as a victory for freedom, a triumph of democracy over totalitarianism, and evidence of the superiority of capitalism over socialism. The United States rejoiced as its formidable enemy was brought to its knees, thereby ending the Cold War which had hovered over these two superpowers since the end of World War II. Indeed, the breakup of the Soviet Union transformed the entire world political situation, leading to a complete reformulation of political, economic and military alliances all over the globe.



National Height Modernization Study

Report to Congress

Executive Summary



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
National Geodetic Survey

June 1998

Global Navigation Satellite Systems

- **GPS**
- **GLONASS**
- **GALILEO**
- **COMPASS**

QUESTIONS?

