

SESMIM PROJECT
STRENGTHENING EXTRACTIVE SECTOR MANAGEMENT IN MONGOLIA

FOSS4G Remote Sensing Training Workshop Day 1

Gus Ribeiro
GIS-Cadastral Specialist

2016.12.01 - 06

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Who am I?

A Canadian Professional Engineer

From Project Engineer to President of own Firm

Later started a Software Development company

AEC, GIS, applications on AutoCAD, MicroSation CAD

Clients over 50 countries. Software was used to

on HK airport, 3 Gorges dam, island for Oresund bridge

Between Denmark and Sweden, also

on digital Cadastral Mapping of Alberta

International ICT, GIS consulting over 15 years in

Asia, Americas, Africa

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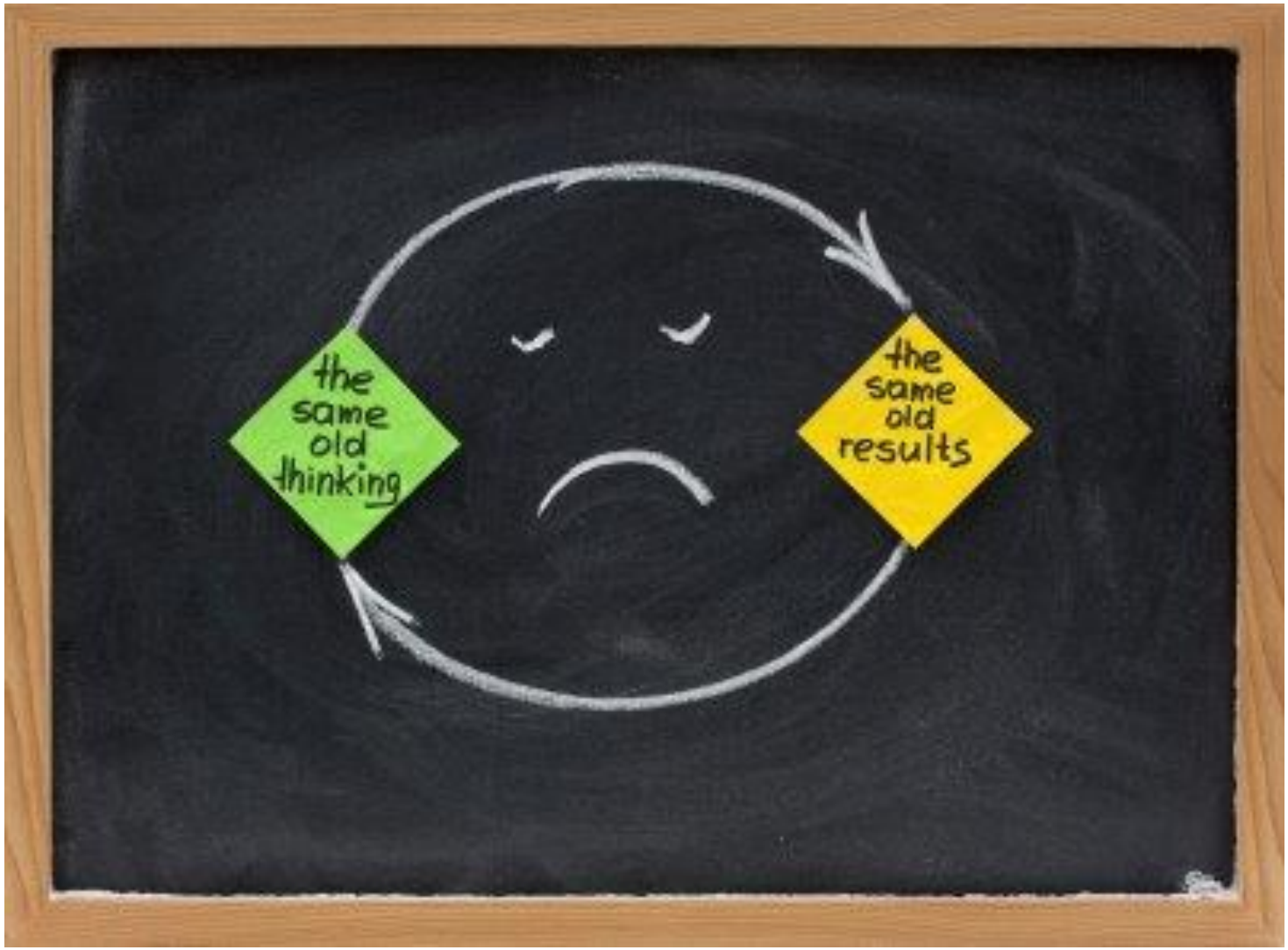
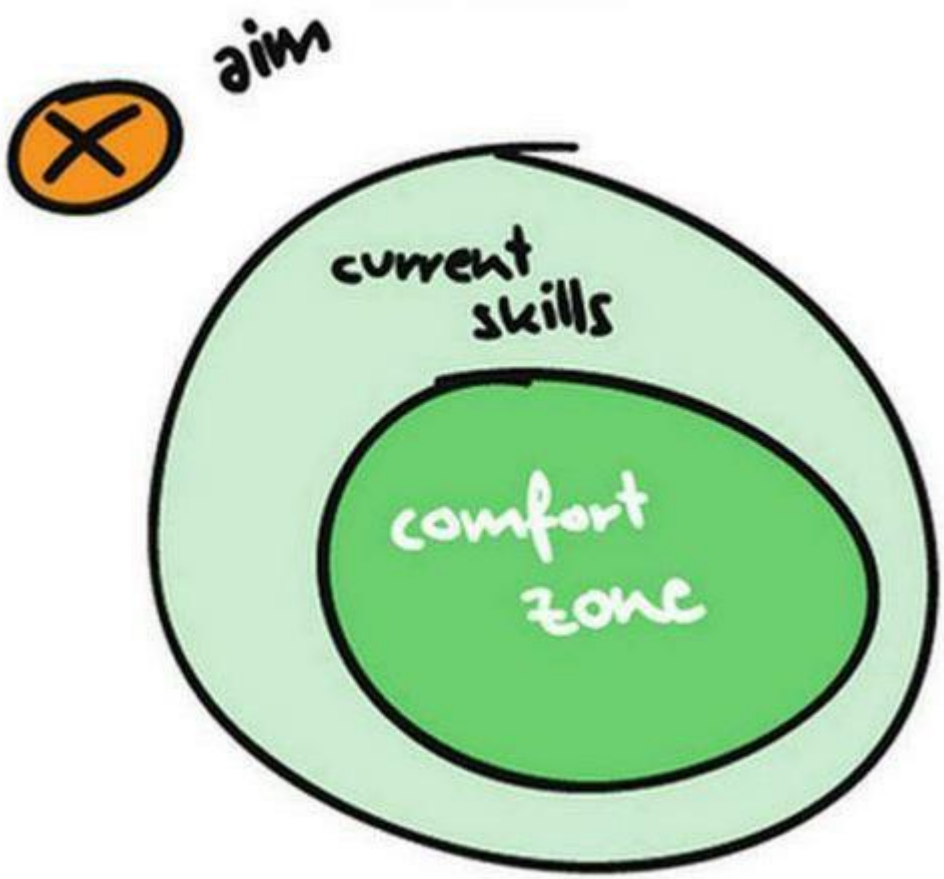
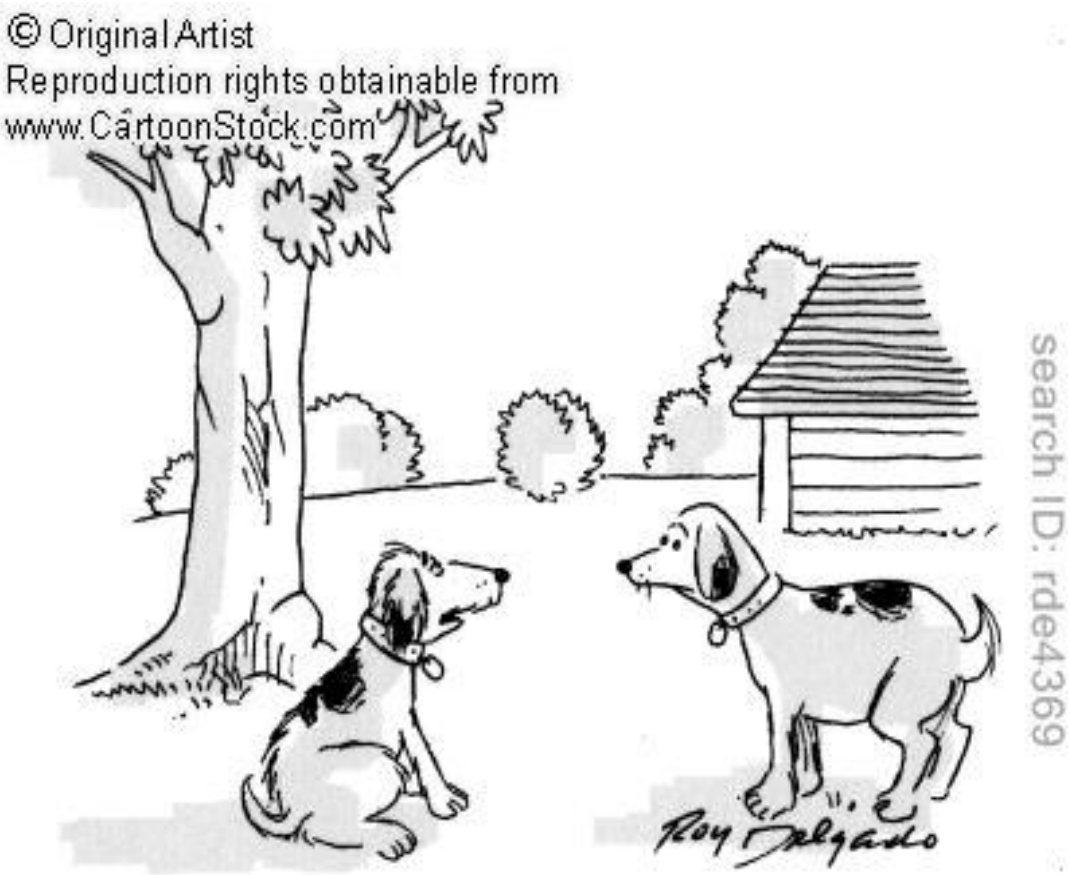


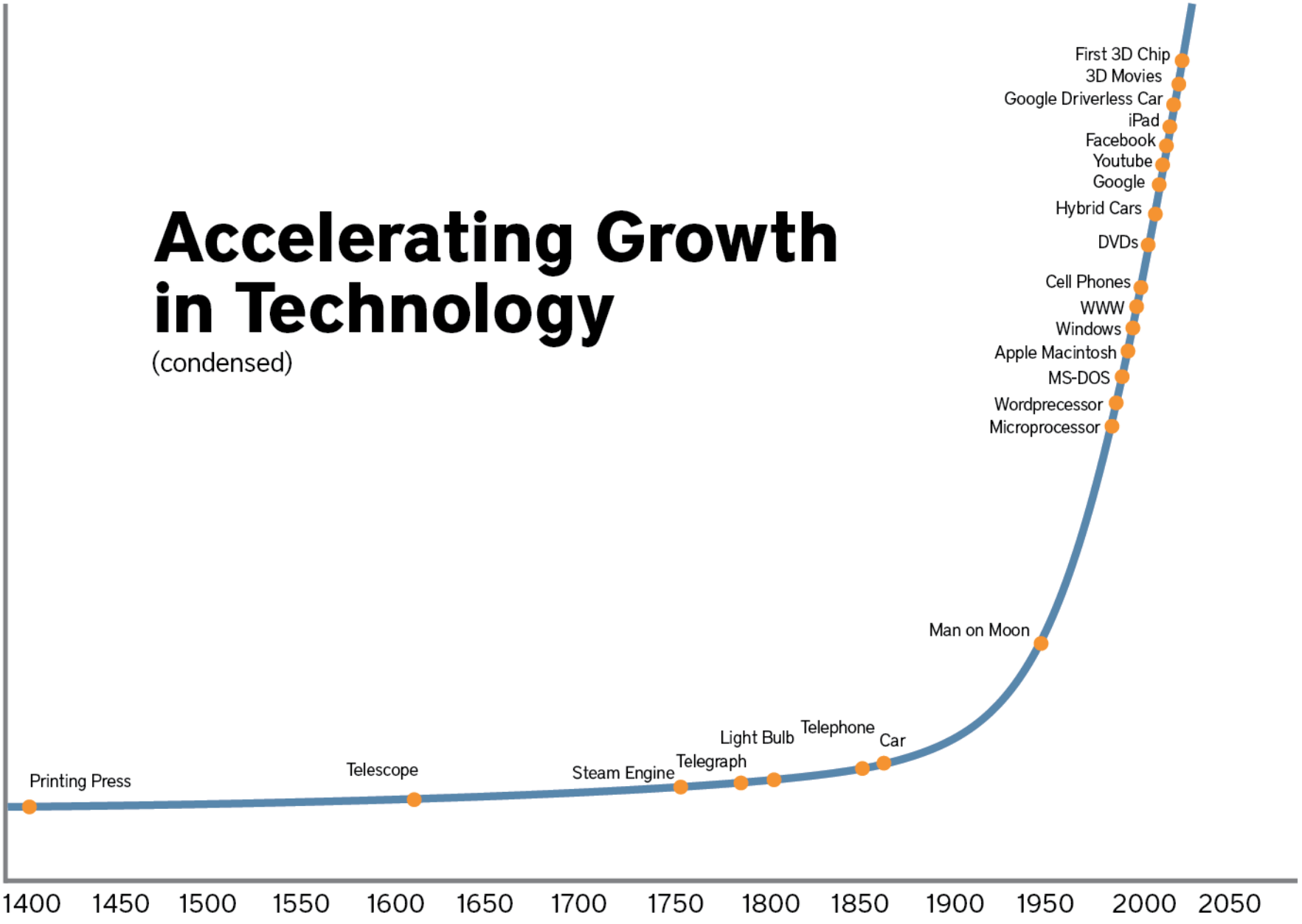

aim
current skills
comfort zone



"I was a good dog, but I never took the time to make myself a great dog."

Accelerating Growth in Technology

(condensed)



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"Every two days now we create as much information as we did from the dawn of civilization up until 2003"

That's something like five exabytes of data (10^{18})

Eric Schmidt, Chairman of Google



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Workshop Objectives

- Good Understanding about Remote Sensing
- Look and Discuss Case Studies
- Learn about FOSS4G and Tools to Use
- Where & How can we get data for RS
- Hands on Exercises using MultiSpec & QGIS

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Day	Description
1	Introduction and orientation
	What is remote sensing?
	FOSS4G & OSGeo
	FOSS4G Remote Sensing Applications
	Basic geodesy and geo-registration
2	Case studies – project examples of remote sensing
	Remote sensing raster image formats
	Where can we get remote sensing data?
3	Introduction to Multispec
	Introduction to QGIS-GRASS
4	Applying Multispec and QGIS to remote sensing – Group exercise

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Housekeeping

- Disclaimer: We have tried to ensure that all data, software, presentations, etc., provided during training are free for you to use, and share with others for non-commercial purposes. If otherwise please obtain the required permissions otherwise delete from your system.
- You are free to re-use any training material we have prepared as part of this workshop, to localise and to use to train others. Just acknowledge the authors of all material where applicable.

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What is remote sensing?

"Science of obtaining information about objects or areas from a distance, typically from aircraft or satellites."

National Oceanic & Atmospheric Administration

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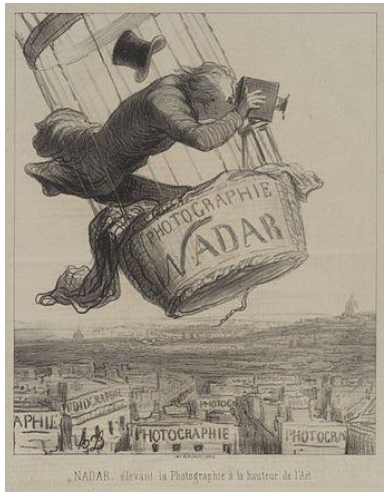
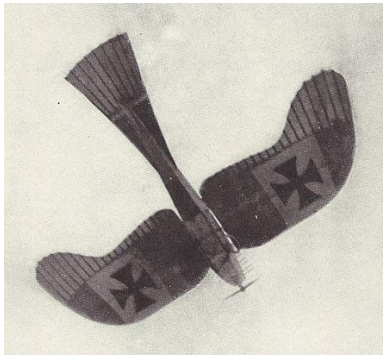
History - In the Beginning...



1862 Nadar France





WWII Mosquito Bomber



1911 Kite Grand Rapids Michigan

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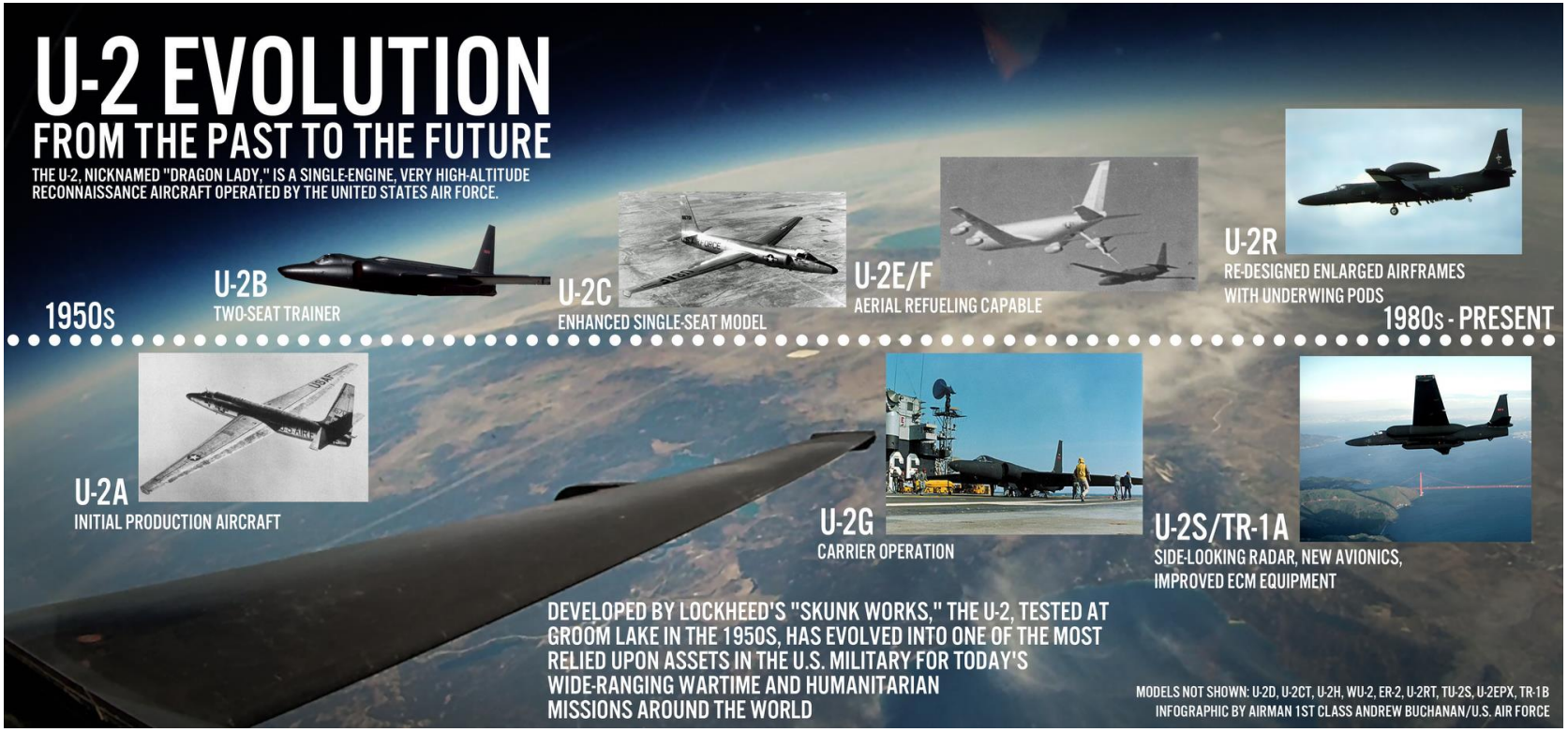
U-2 “Dragon Lady”



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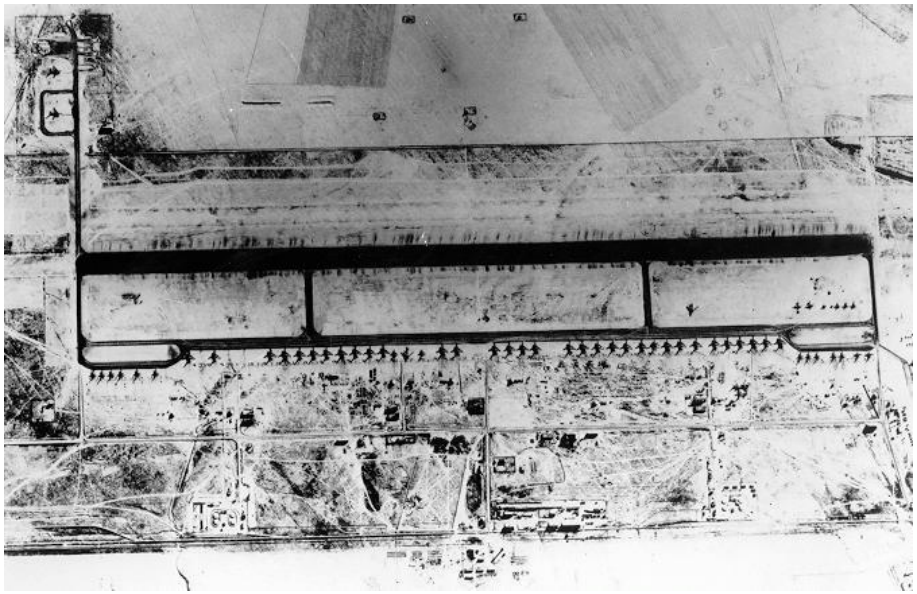
1960s to 1970s



U-2 aerial photograph of an airfield in the Soviet Union



First CORONA satellite photograph (airfield)

Reference: Professor Paul R. Baumann, Department of Geography, State University of New York

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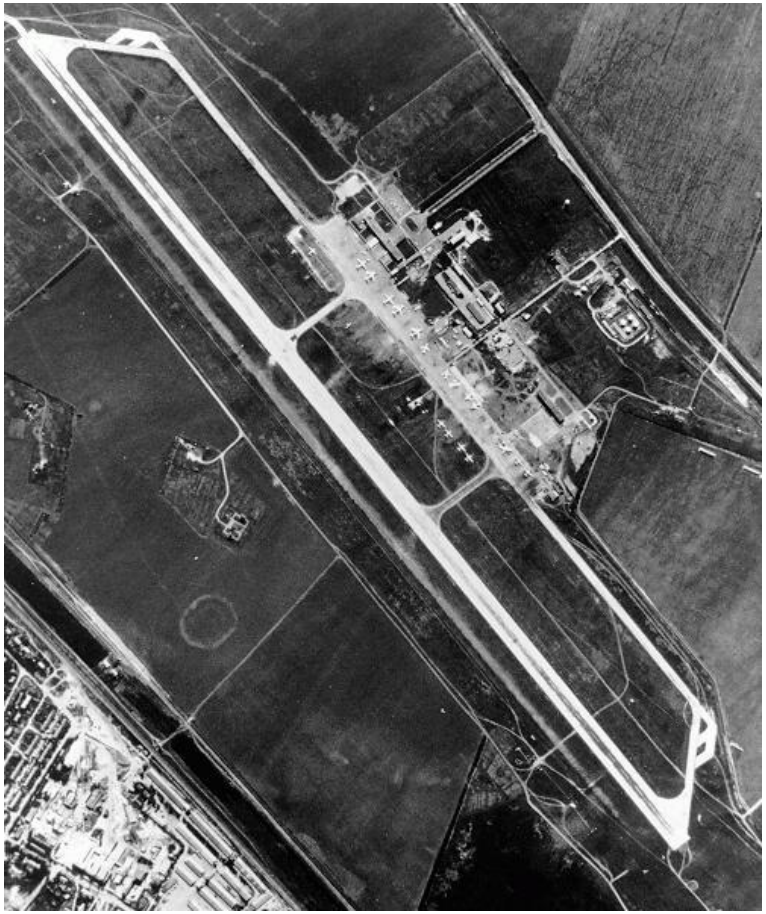
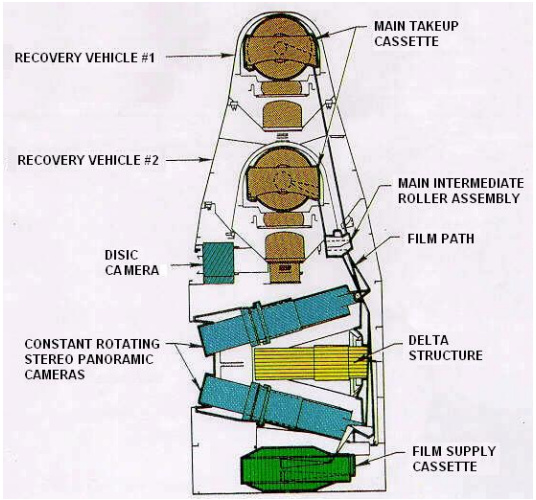
The CORONA Project - 1972







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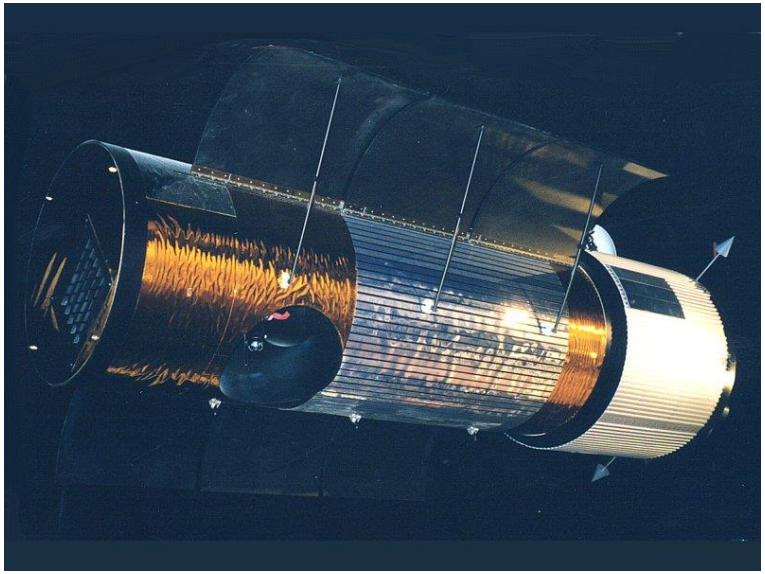
The Keyhole Project



Artist rendition of a KH-12 satellite



Zhawar Kill supprt complex in Afghanistan

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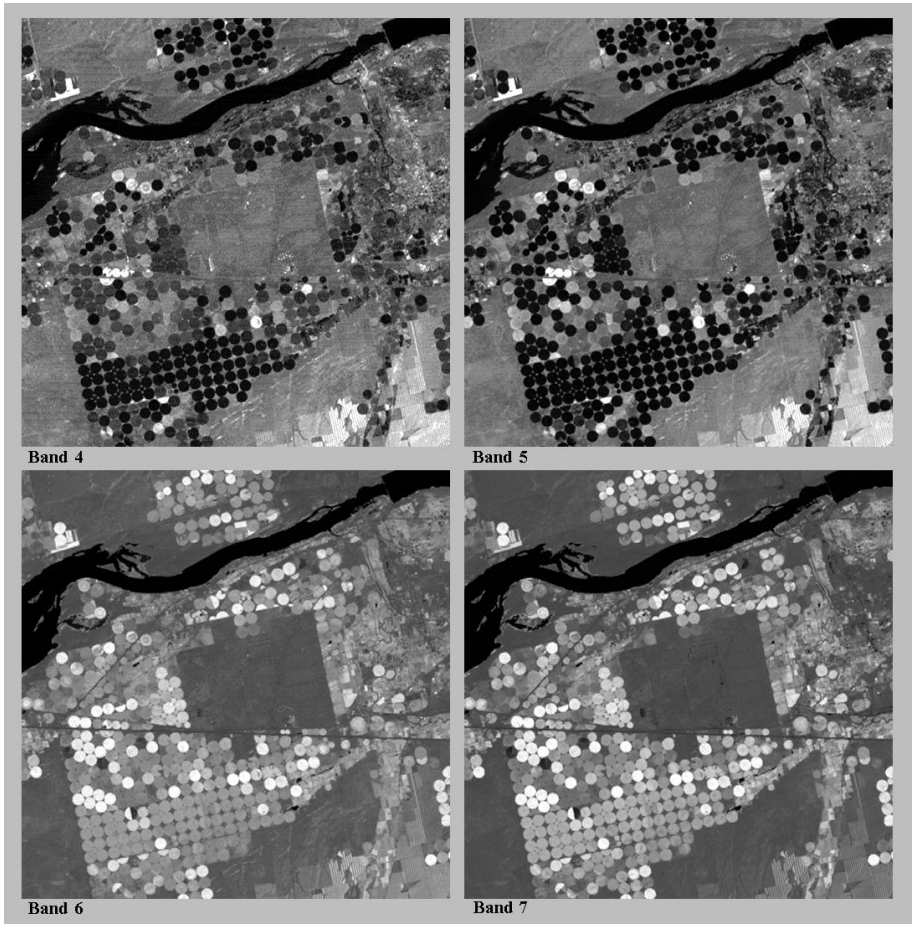
LANDSAT Program: Mission Earth



Landsat 1 satellite



MSS bands pivot irrigation Columbia River in Oregon

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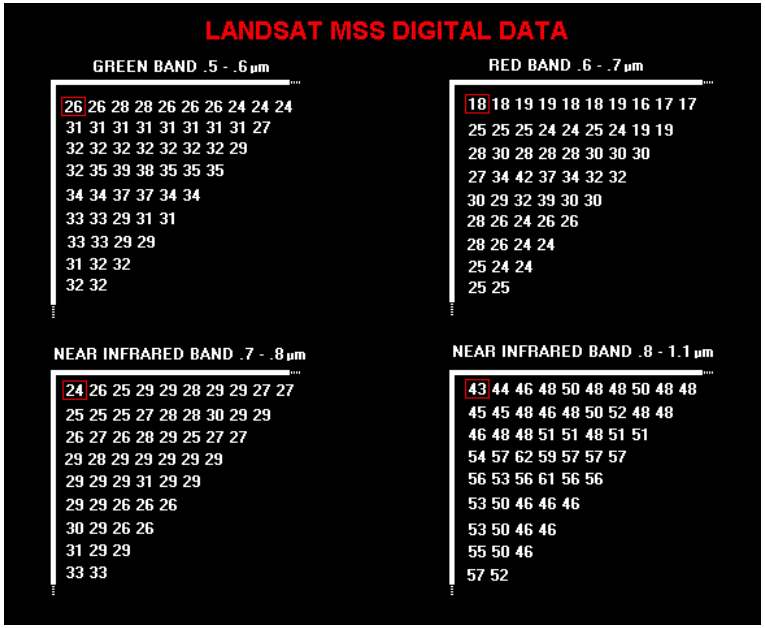
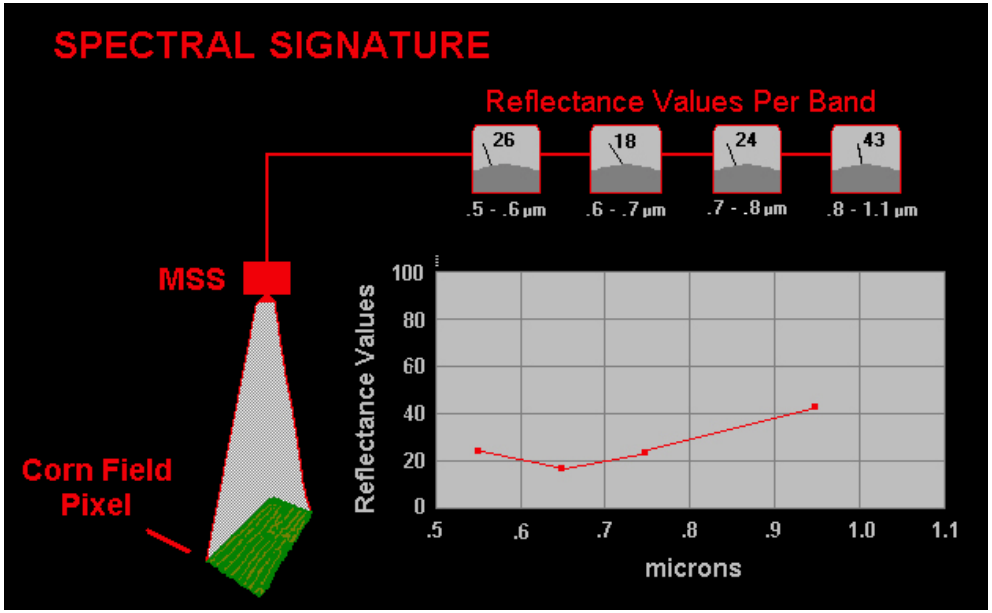
LANDSAT Data





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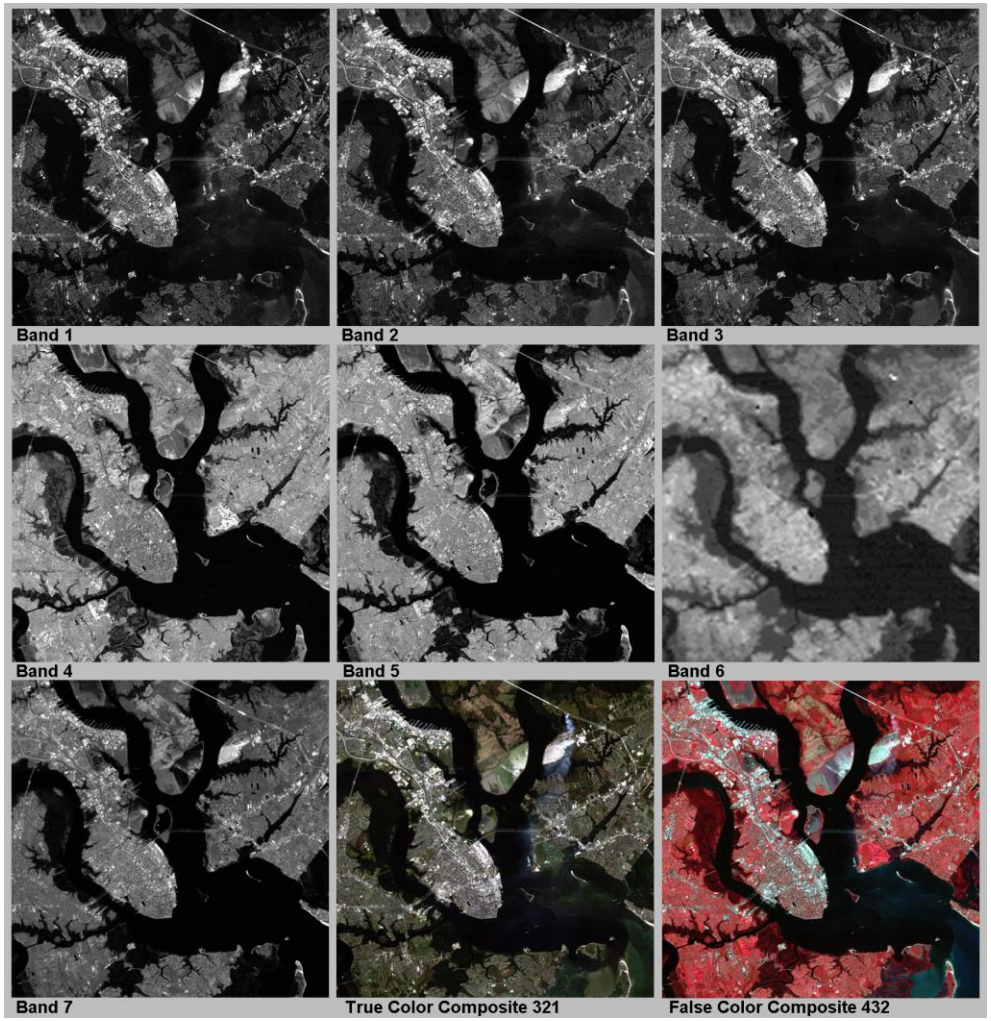
Landsat 4 - 1980s



Band No.	Wavelength Interval (µm)	SpectralResponse	Resolution (m)
1	0.45 - 0.52	Blue Green	30
2	0.52 - 0.60	Green	30
3	0.63 - 0.69	Red	30
4	0.76 - 0.90	Near IR	30
5	1.55 - 1.75	Mid-IR	30
6	10.40 - 12.50	Thermal IR	120
7	2.08 - 2.35	Mid-IR	30



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Other Remote Sensing Satellites

- Landsat 7 – Continuous operation 1999 to 2012
- Landsat 8 – 2013 onwards
  - Processing: Level 1 T – Terrain corrected
  - OLI multispectral bands 1-7,9: 30 m, panchromatic band 8: 15 m
  - GeoTIFF data format, UTM WGS84
- Quickbird – 2001, multispectral resolution 2.4 m
- Spot Image – 1986, SPOT 7 2014, resolution 10 m RMS
- NOAA – GOES, AVHRR/3 channel 1.09 km

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FOSS4G & OSGeo4W

- Open Source Geo Foundation for Windows (2006)
  - Promote collaborative development of geospatial technologies
  - Support broader FOSS geospatial community
  - Software development & open access to government produced geospatial data, e.g. OSM
- Free & Open Source for Geospatial software (2004)
  - Roots GRASS & Mapserver
  - Today QGIS, PostGIS, OSM
  - Open geospatial standards

OSGeo
Your Open Source Compass

FOSS4G BOSTON 2017

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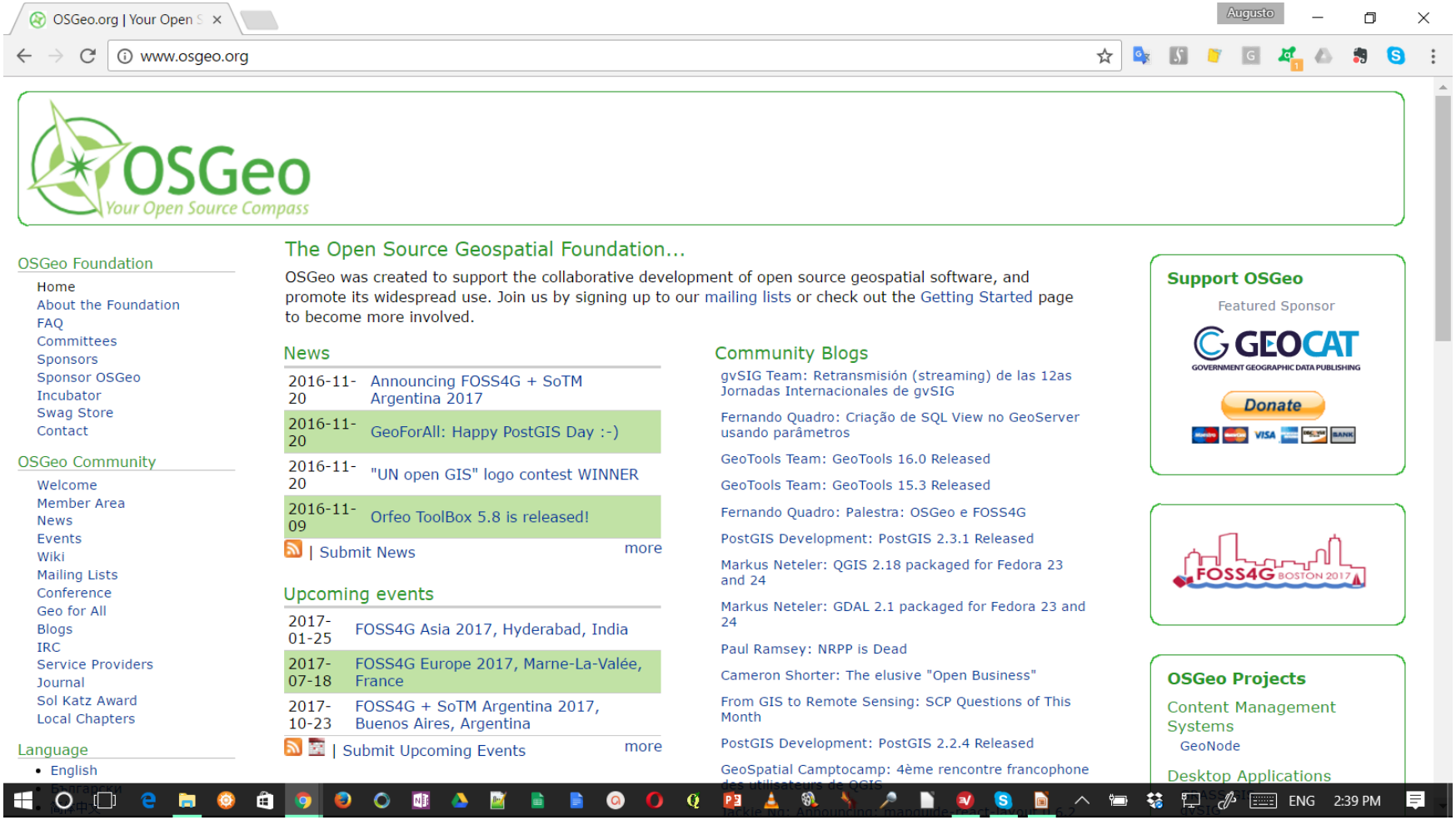
OSGeo Foundation



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FOSS4G Remote Sensing Apps

- QGIS – Originally Quantum GIS (2002 Gary Sherman)
  - Incubated OSGeo Foundation 2007, released v1.0 2009
  - Plugins Python or C++
  - Dependencies SQLite, GDAL, GRASS, PostGIS, PostgreSQL
  - OS MS Windows, Linux, Mac OSX, UNIX
- Multispec – Perdue Research Foundation, LARSYS
- SAGA GIS – System for Automated Goescientific Analysis
  - University of Gottingen 2004 moved to University of Hamburg
  - Available plugins to QGIS

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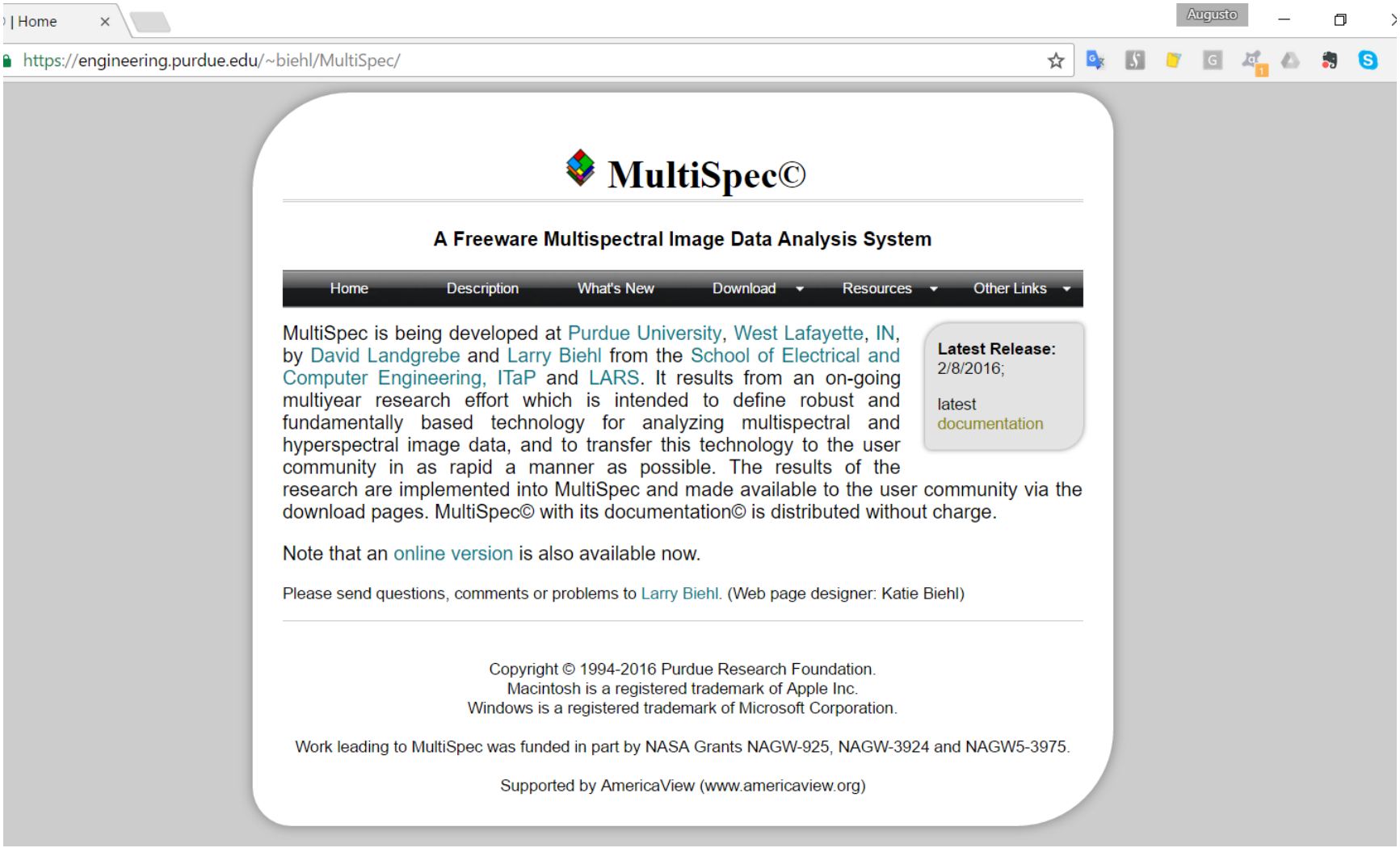
QGIS Application



MultiSpec – Perdue Research Foundation



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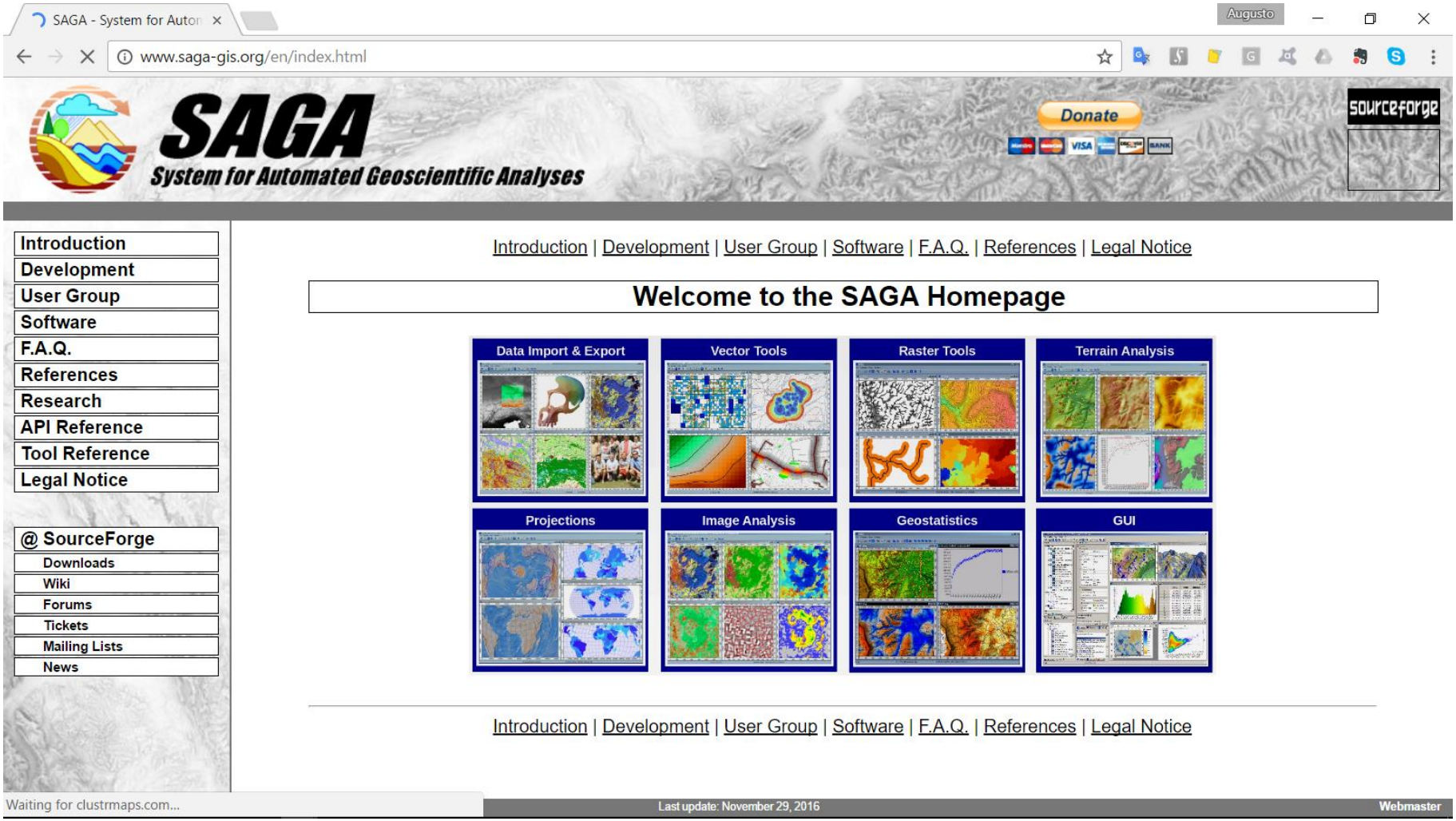
SAGA GIS



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GEODESY

Ellipsoids, Geoids, Map Projections & Datums

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"When the architect lays the foundation stone in a crooked manner, the wall will remain crooked till the heights of heaven"

Ancient Persian saying

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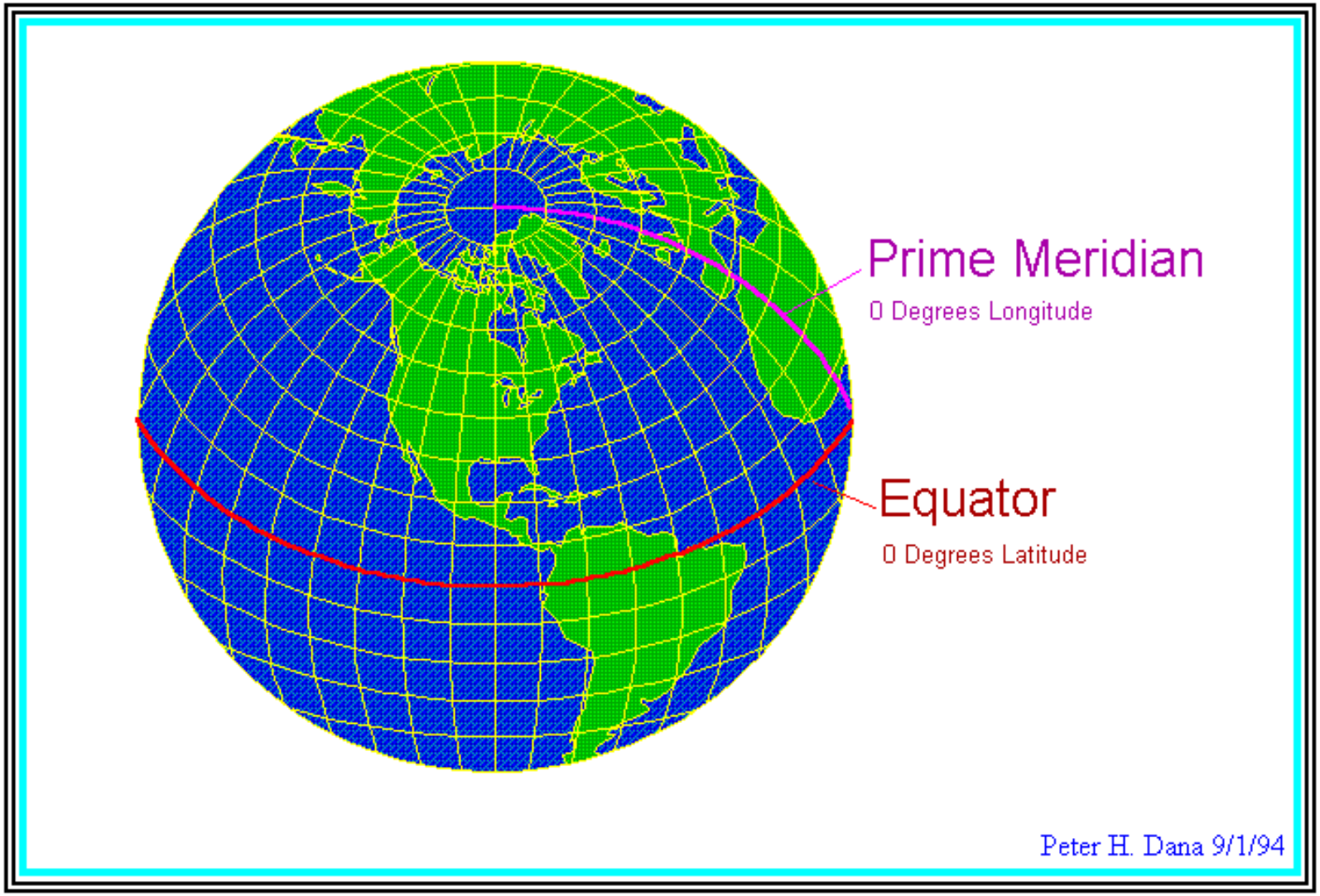
Longitude & Latitude



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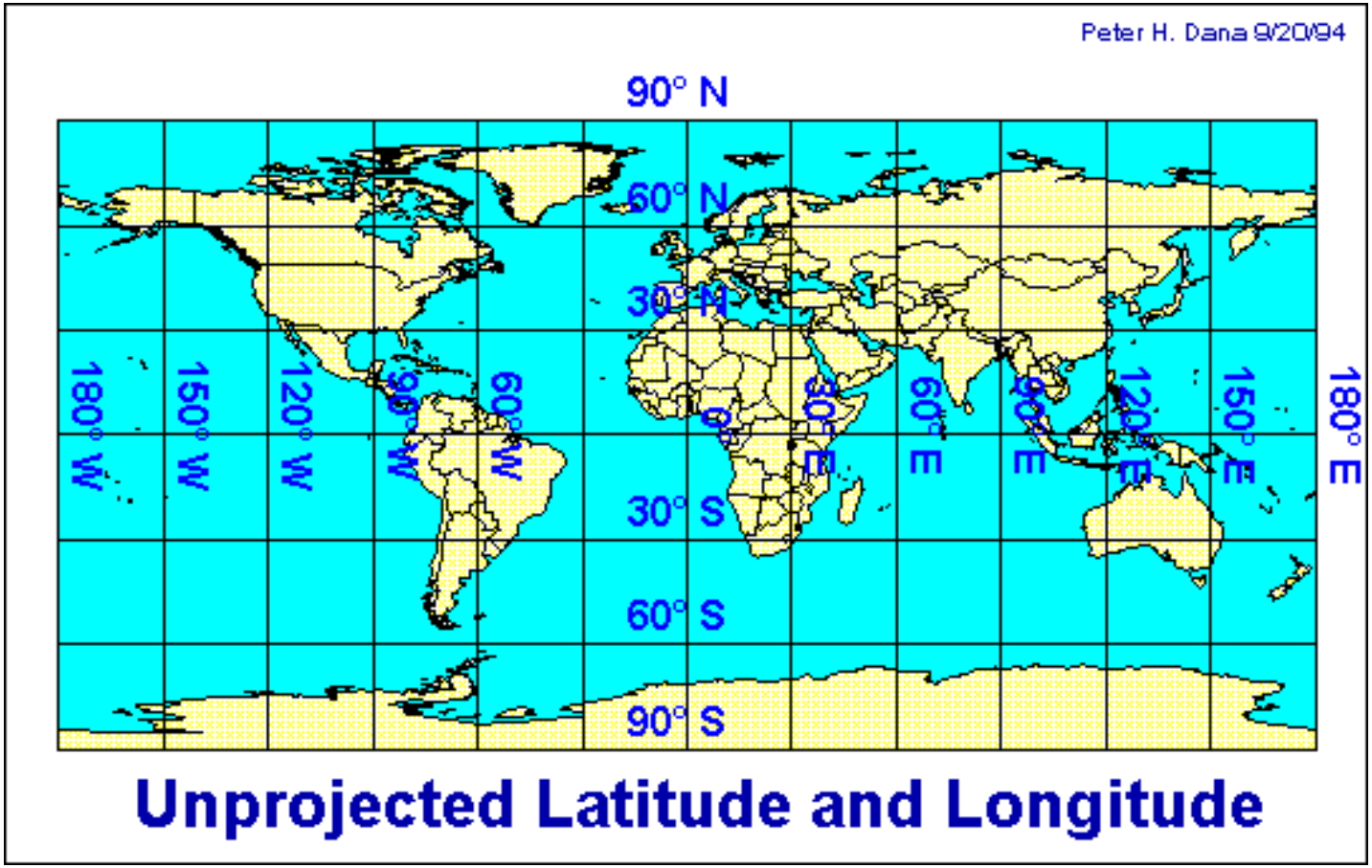
Longitude & Latitude – Geographic Coordinate System



Incorrect title it is Mercator Projection

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Our Earth is not a Sphere



It is slightly flattened at the Poles so it is actually more like an Ellipsoid

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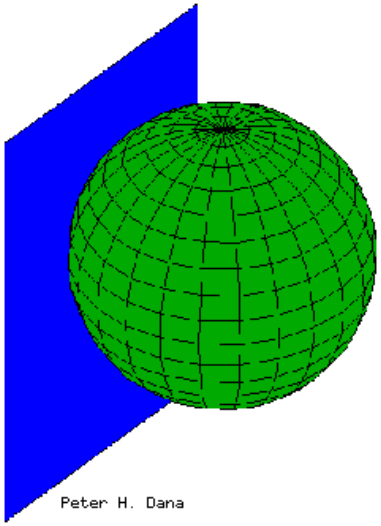
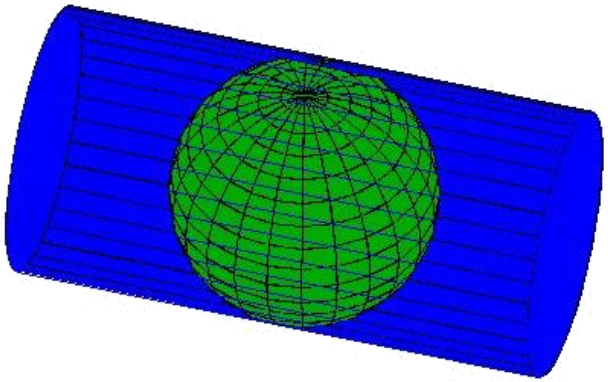
Datums

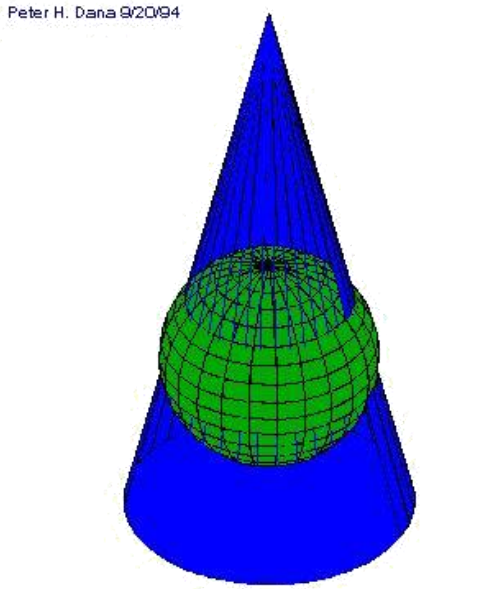
- The Mathematical model that most closely fits the shape of the Earth is an “Ellipsoid”
- An Ellipsoid is used to Project onto Maps rather than the uneven surface of the Earth.
- An Ellipsoid that is “oriented” relative to the Earth’s Poles & surface is called a DATUM

Maps are Projections of the Earth onto Paper





Transverse Cylindrical Projection Surface



Secant Conic Projection

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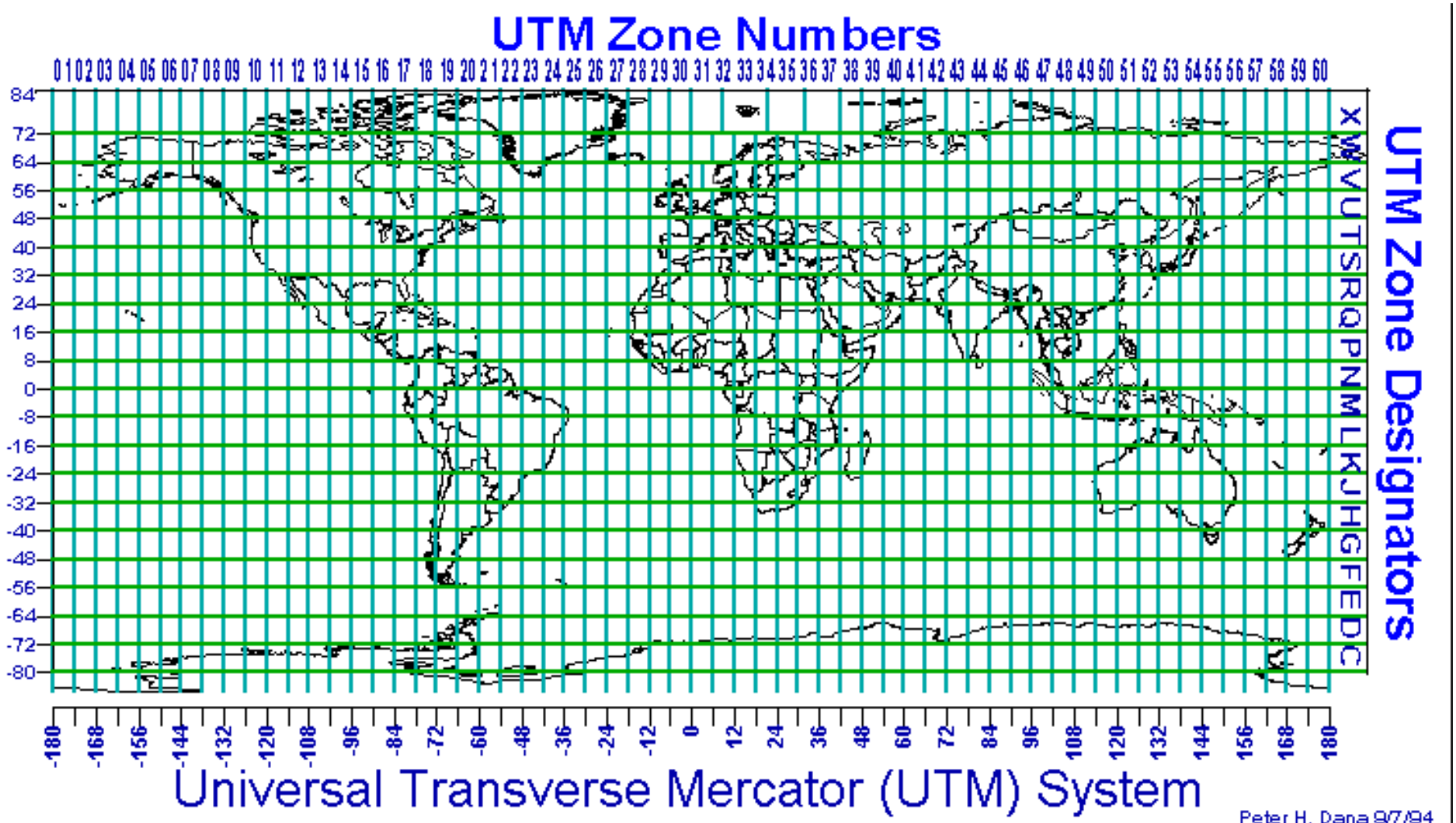
UTM Projection



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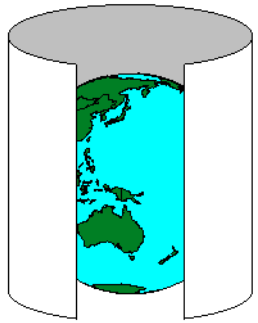
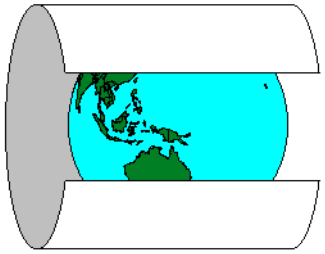
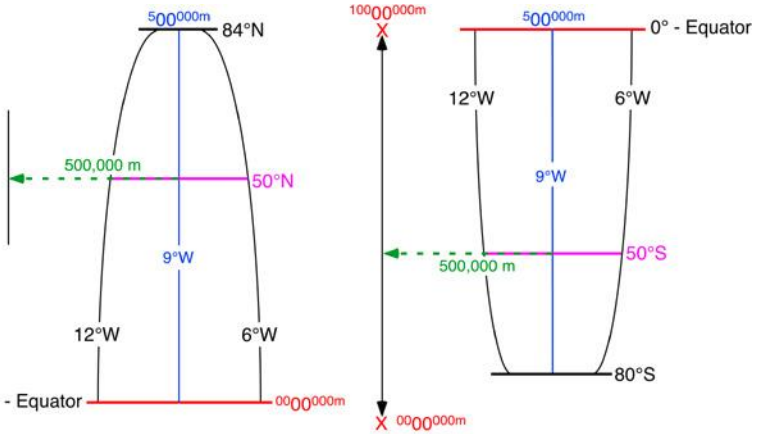
UTM 6 degree Zones

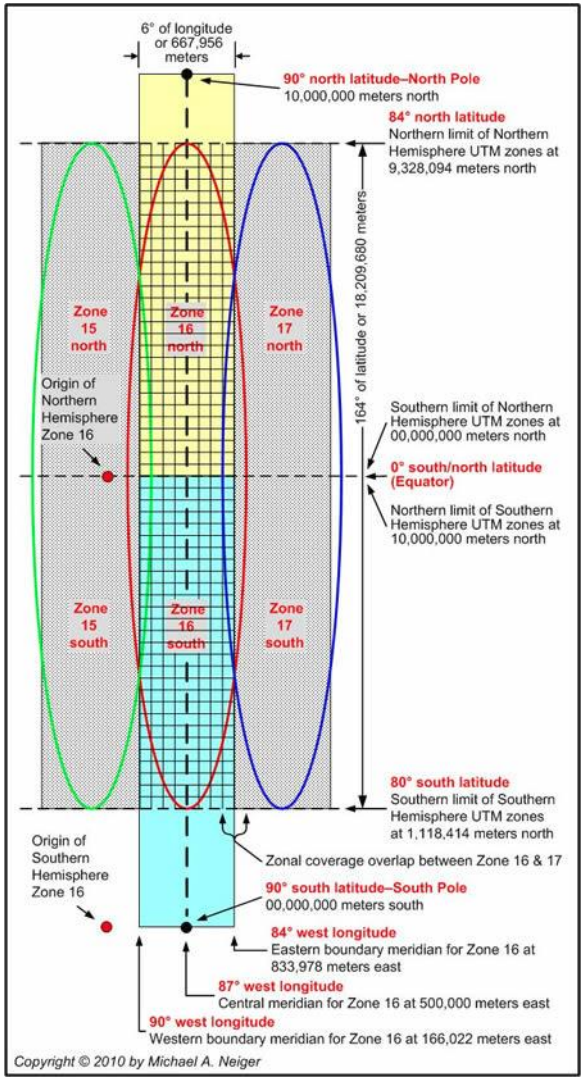


Mercator projection



Transverse Mercator projection





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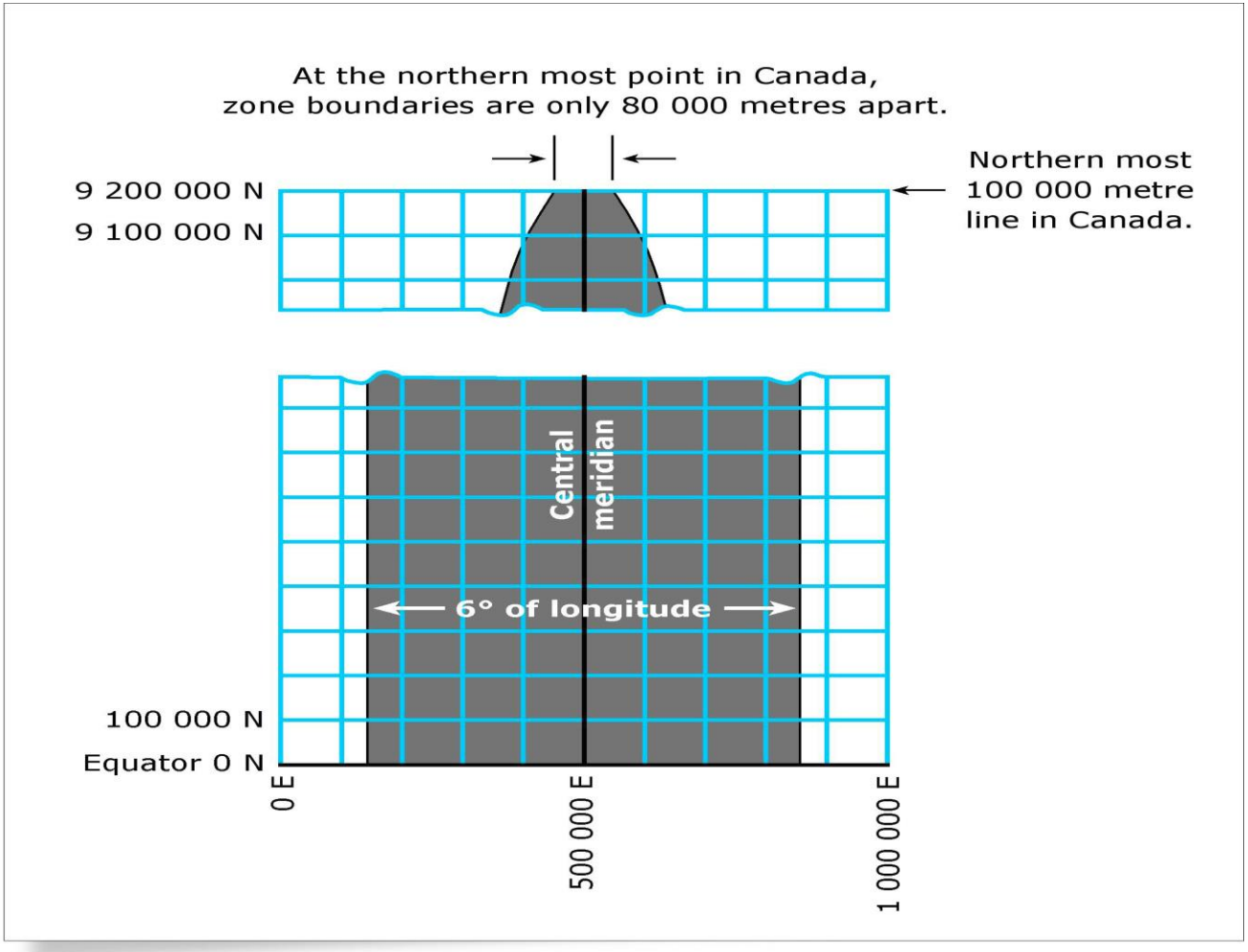
UTM Characteristics



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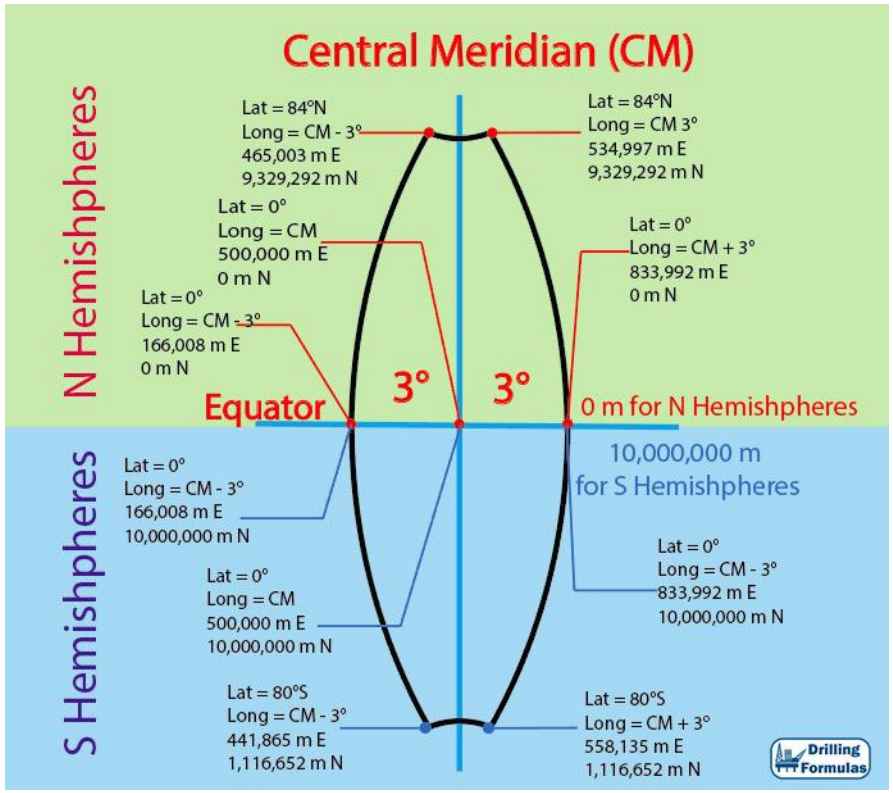
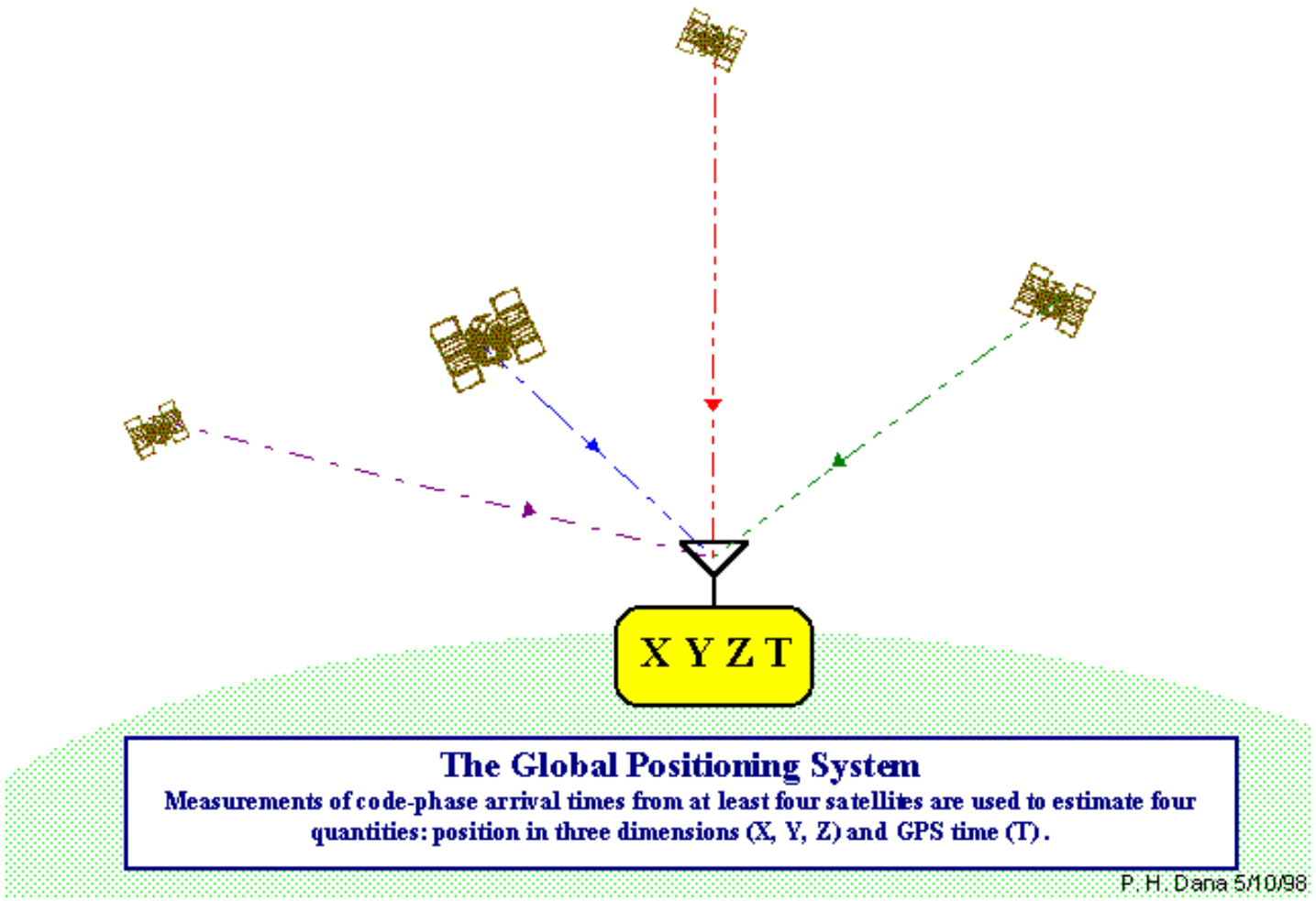
3TM Projection



GNSS Satellites Rotate around the 'centre' of the Earth



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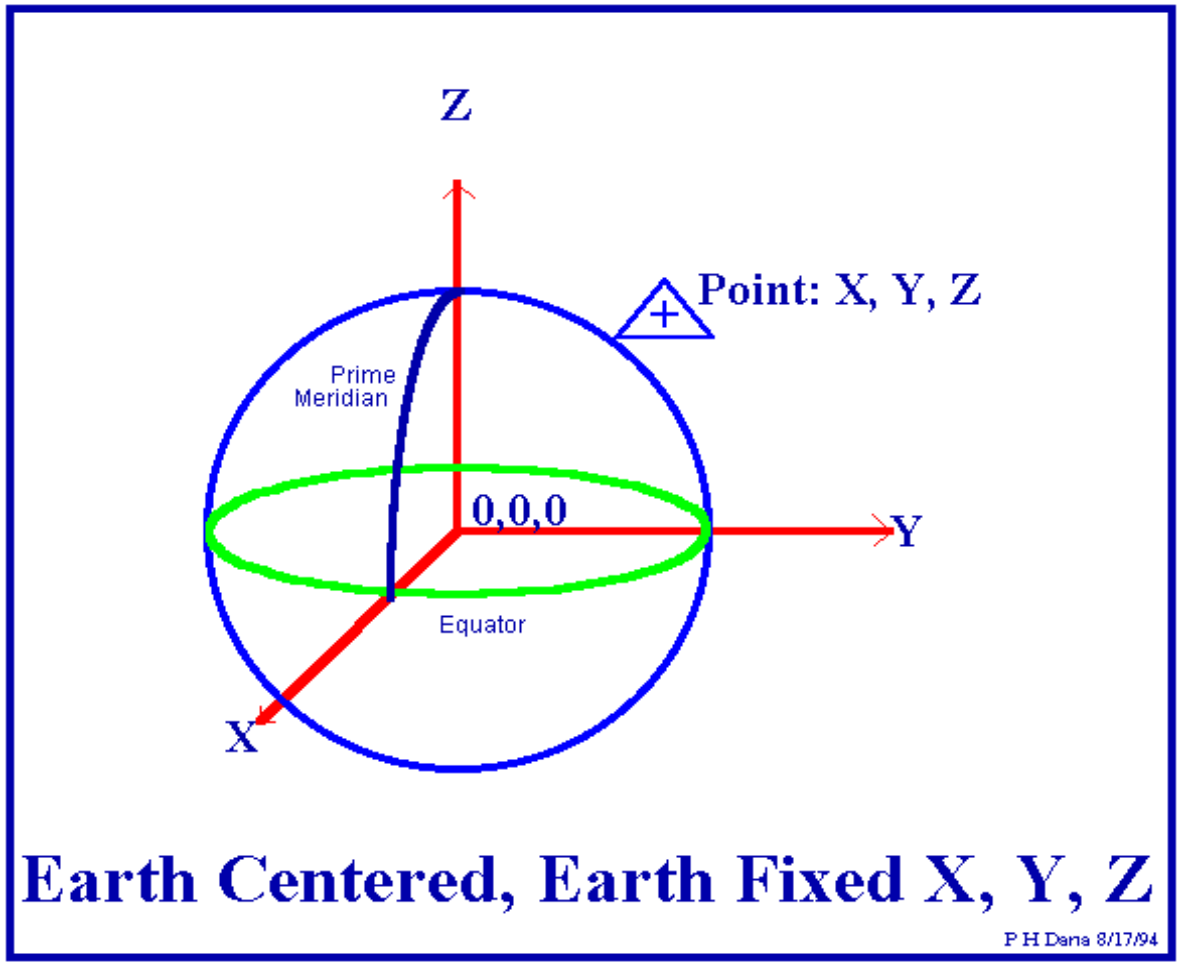
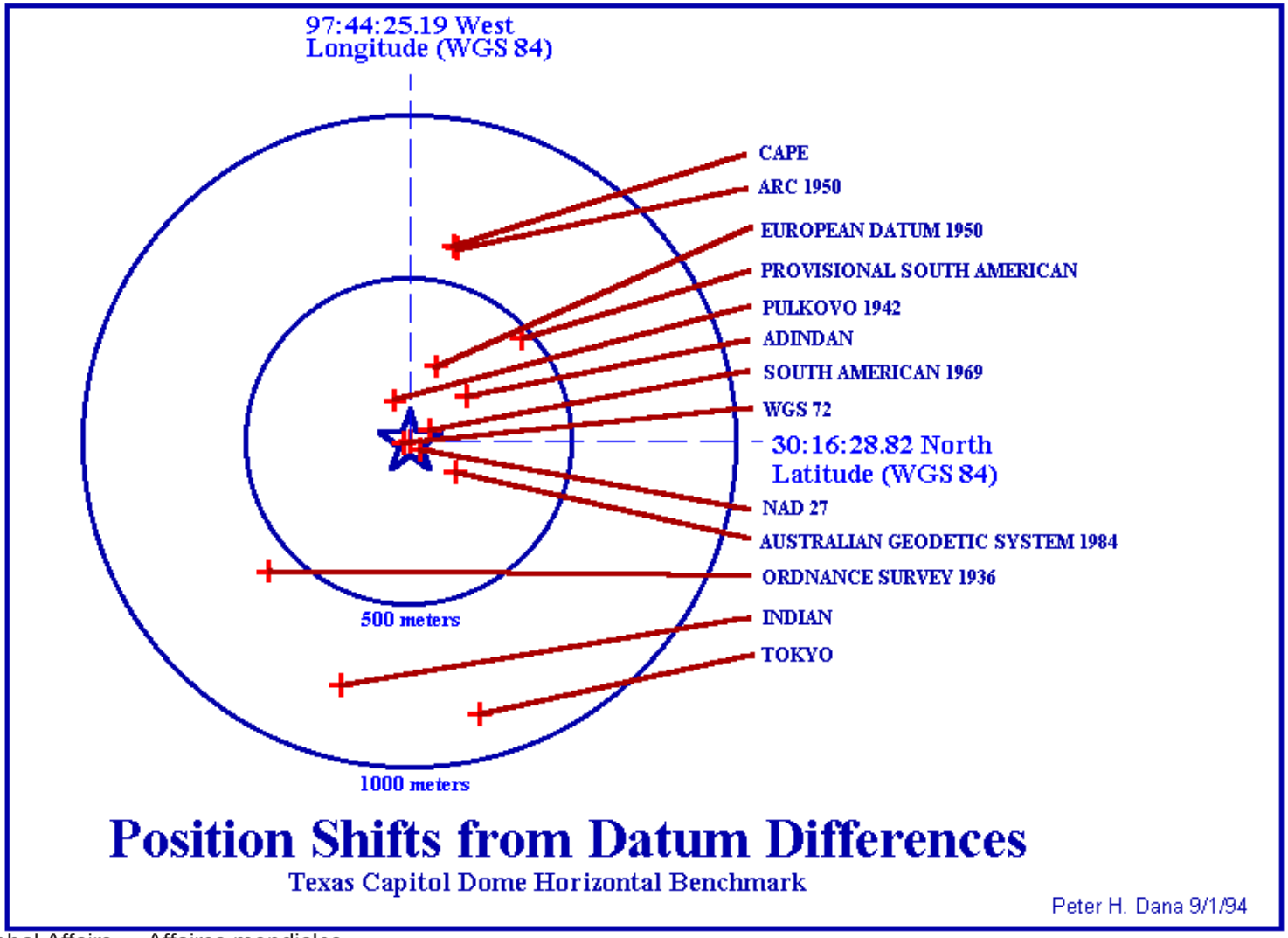
GNSS Measurements from the Earth's centre of Mass



Horizontal differences between various Datums



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GNSS versus Geoid Height

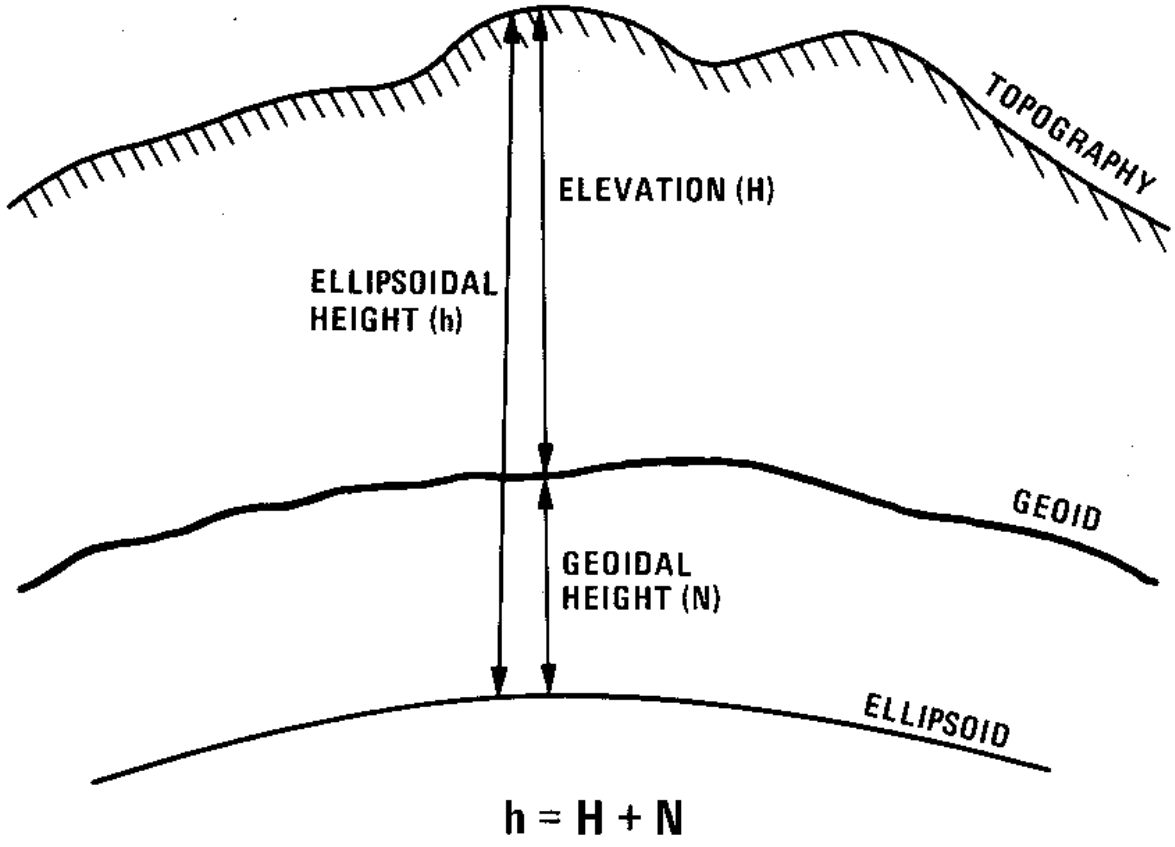
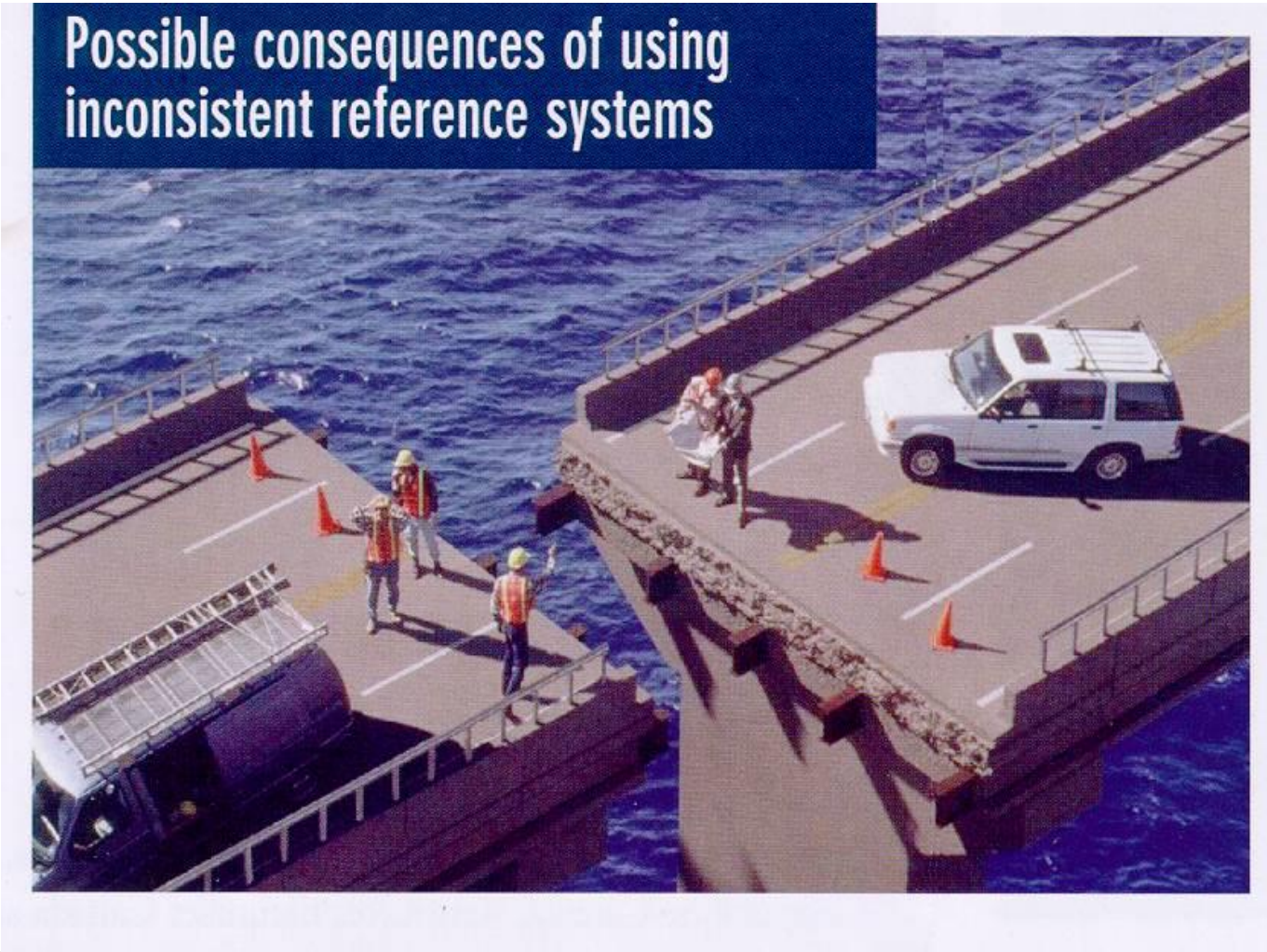


Figure 2-20. Ellipsoidal Height, Elevation and Geoidal Height


Possible consequences of using inconsistent reference systems

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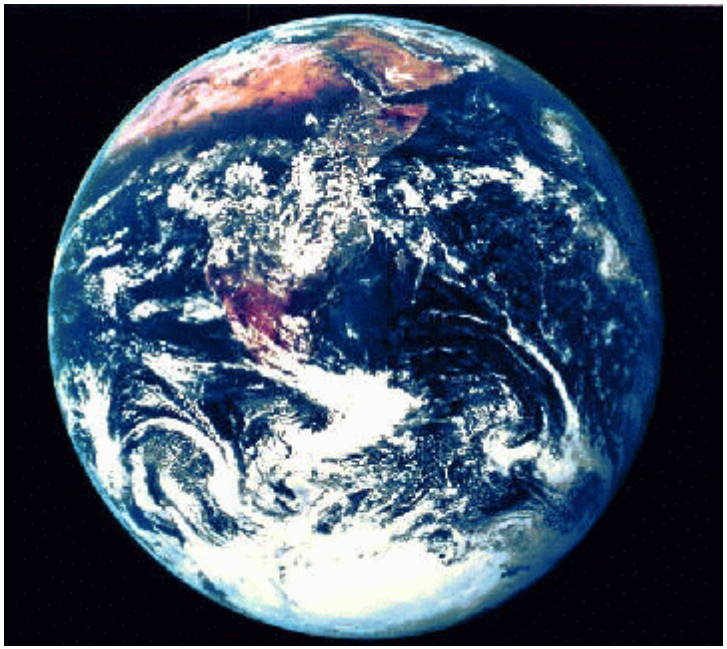
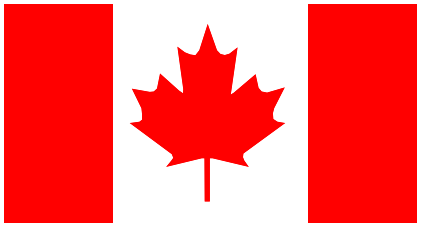
Thank you!







баярлалаа!