Current State of Practice:

– Horizontal often presumes a flat Earth.

– Vertical references a curved "Sea Level."

– Computer databases work best with 1 origin.

What is the Conflict?

- Humans separate horizontal and vertical.
  (We stand erect and walk on a "flat Earth.")

- Existing mathematical models have two origins.
  (Lat/lon for horizontal & geoid for vertical.)

- The conflict is humans versus computers.
  (It is a matter of origins and perspectives.)

What are the Challenges?

– To use common definitions and standards.

– To master "complexity" and be unique.

– How good is it? Spatial Data Accuracy

Goals - A solution (new model) should:

- Accommodate digital measurements/sensors.

- Use same proven equations worldwide.

- Provide an option to judge data quality.

- Be readily available & easy to learn.

- Provide backward compatibility.

Solution:
The 3-D Global Spatial Data Model (GSDM) is built on an integrated 3-D database, is universally available, is easy to use, and is already in place.

The Global Spatial Data Model (GSDM) provides a simple Universal 3-D mathematical model for the Global Spatial Data Infrastructure which supports GIS applications in disciplines such as:

Surveying		Engineering
Planning	**3-D Core Concepts**	Mapping
Avionics	**Global X/Y/Z Metric Rectangular Coordinates**	Remote Sensing
Fleet Dispatch	**Origin - Earth Center of Mass**	Computer Graphics
Navigation	**X/Y is in the Plane of Equator Z is mean spin axis of Earth**	Geography
Facilities Management	**Rules of Solid Geometry and Vector Algebra Used Throughout**	Transportation (Driverless Everything)

3-D Core Concepts
- Global X/Y/Z Metric Rectangular Coordinates
- Origin - Earth Center of Mass
- X/Y is in the Plane of Equator Z is mean spin axis of Earth
- Rules of Solid Geometry and Vector Algebra Used Throughout
- Model does NOT Distort Physical Measurement
- Standard Deviations Give Data Quality
- Local Users Work With Differences

Think Globally – Work Locally

The National Geodetic Survey (NGS):

- Is responsible for National Spatial Reference System (NSRS), basis of positioning in the US.

- Will publish new geodetic datums in 2022.

- Is considering "best" way to serve users.

- Has opportunity to exploit new methods.

Benefits: The GSDM. . .

- Supports users of BIG DATA worldwide.

- Uses equations that are in the public domain.

- Defines spatial data accuracy to accommodate:

  1. Absolute values (archived/mapped).

  2. Relative values (measurements/construction).

- Answers - "accuracy with respect to what?"

- Can be used by all spatial data disciplines.

Resources: Learn More!

- 3-D Book by Earl F. Burkholder

  1. First Edition 2008

  2. Second Edition available 2017.

- Global COGO, Inc. web site.

  http://www.globalcogo.com

THE 3-D GLOBAL SPATIAL DATA MODEL
Foundation of the Spatial Data Infrastructure

EARL F. BURKHOLDER