Challenge/Opportunity for
Spatial Data Users World-wide

The following should be considered with an open mind and judged on the merits of the beginning assumptions and subsequent observations.

I. The digital revolution of the past 50 years has had an enormous impact on various facets of society – one being the collection, manipulation, and use of spatial data.
   A. Spatial data are now characterized as digital and 3-D.
   B. The earth-centered earth-fixed (ECEF) coordinate system defined by the U.S. DoD for the NAVSTAR (GPS) satellite system is used world-wide and has a single origin at the Earth's center of mass.
   C. The Global Spatial Data Model (GSDM):
      1. Starts with the assumption of a single origin for 3-D spatial data.
      2. Is built on standard mathematical operations and rules of solid geometry.
      3. Is still out in front of current practice but offers many benefits.
      4. Accommodates current practice and digital 3-D data.
      5. Includes both a:
         a. Functional model for describing geometrical relationships.
         b. Stochastic model for describing spatial data accuracy.
      6. Can be used with equal ease on any defined 3-D datum:
         a. ITRF (any specified epoch).
         b. WGS84 (any realization).
         c. NAD83 (as published by NGS).

II. The present is always somewhere between the past and the future. With regard to the digital revolution, we need to consider how spatial data:
   A. Have been used in the past – traditional analog horizontal & vertical.
   B. Are currently used – combining horizontal and vertical with digital.
   C. Will be used in the future – integrated digital 3-D (via the GSDM).

III. A transition from the past to the future is both a challenge and an opportunity for spatial data users. Thomas S. Kuhn describes the processes involved in such a transition in "The Structure of Scientific Revolutions." Several quotes are:
   A. Page 67 - …"*the awareness of anomaly had lasted so long and penetrated so deep that one can appropriately describe the fields affected by it as in a state of growing crisis.*"
   B. Page 84 - …"*a crisis may end with the emergence of a new candidate for paradigm and with the ensuing battle over its acceptance.*"
   C. Page 153 – "*Probably the single most prevalent claim advanced by proponents of a new paradigm is that they can solve the problems that have led the old one to a crisis.*"
   D. Page 158 – "*Because scientists are reasonable men, one or another argument will ultimately persuade many of them. But there is no single argument that can or should persuade them all.*"

IV. Consequences of making the transition to an integrated digital 3-D system include:
   A. Elevations are a derived quantity.
      1. Ellipsoid heights are more quantifiable and will be used in many applications.
      2. Search for the elusive geoid should continue for those really needing it.
   B. The grid/ground distance difference will become moot because:
      1. Local directions and distances are represented without distortion.
      2. Complex map projections, although still useful for cartographic representation, are not needed for local use of spatial data.
   C. Spatial data users all over the world can work with flat-earth coordinate differences:
      1. While sharing a common rigorous ECEF reference system for spatial data.
      2. But, they are free to define/use any derivative system for local applications.
   D. Spatial data accuracy can be quantified component by component using simple statistics and standard error propagation techniques.
      1. Local and network accuracies have a concise mathematical definition.
      2. The algorithms are all public domain.