

Status of Imagery Standards in TC211

26 November 2014

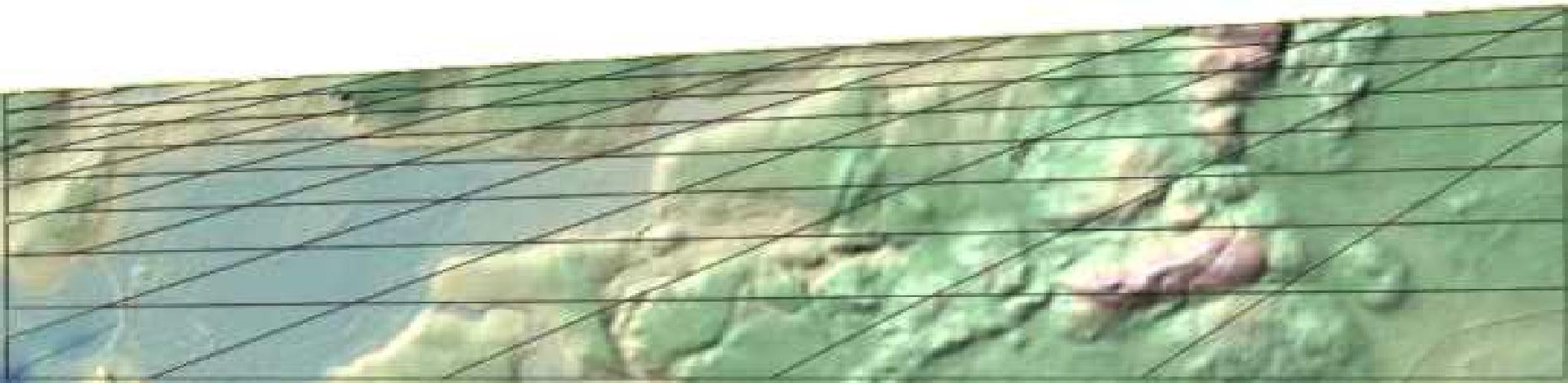
C Douglas O'Brien - Canada

Liping Di - USA

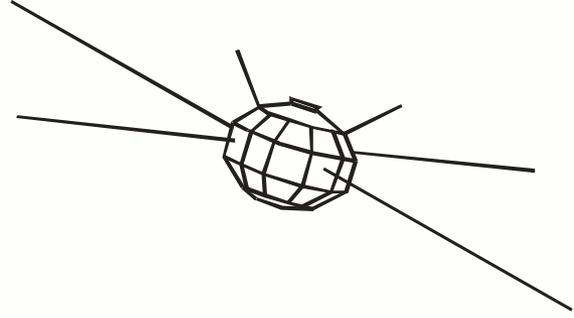
Jianya Gong - China

Wenxiu Gao - China

Wolfgang Kresse - Germany

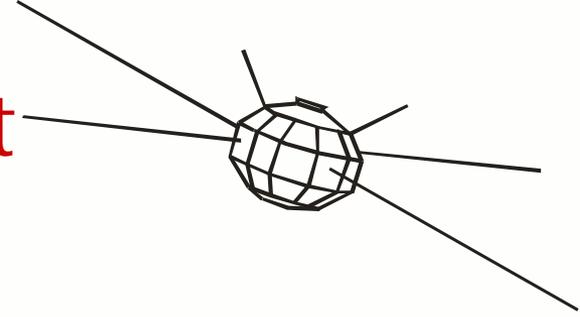


Imagery, Gridded and Coverage Data



- ❖ **Imagery and gridded data is the dominant form of geographic information.**
- ❖ This has led to the development of a number of standards that are well used for the storage, encoding, manipulation and exchange of geographic imagery, gridded and coverage data – from satellite imagery to undersea bathymetry to elevation grids.
- ❖ ISO TC211 has developed 8 standards, Technical Specifications, and Technical Reports and has 2 new standards and one revision in work.

Standards Development



Published standards

- ISO/TR 19120:2001** Geographic information - **Functional standards**
- ISO 19101-2:2008** Geographic information - **Preference model - Part 2: Imagery**
- ISO 19115-2:2009** Geographic information - **Metadata - Part 2: Extensions for imagery and gridded data**
- ISO/TS 19129:2009** Geographic information - **Imagery, gridded and coverage data framework**
- ISO/TS 19130:2010** Geographic information - **Imagery sensor models for geopositioning**
- ISO/TS 19130-2** Geographic information - **Imagery sensor models for geopositioning - Part 2: SAR, InSAR, lidar and sonar**
- ISO/TS 19139-2:2012** Geographic information - **Metadata - XML Schema Implementation - Part 2 : Extensions for imagery and gridded data**
- ISO/TS 19159-1** Geographic information - **Calibration and validation of remote sensing imagery sensors - Part 1: Optical sensor**

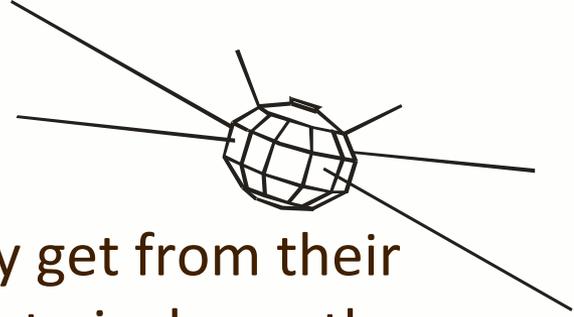
Under preparation

- WI 19159-2** Geographic information - **Calibration and validation of remote sensing imagery sensors - Part 1: Lidar**
- WI 19130-1** Geographic information - **Imagery sensor models for geopositioning** (Revision of ISO/TS 19130:2010)
- WI 19163** Geographic information - **Content components and encoding rules for imagery and gridded data**

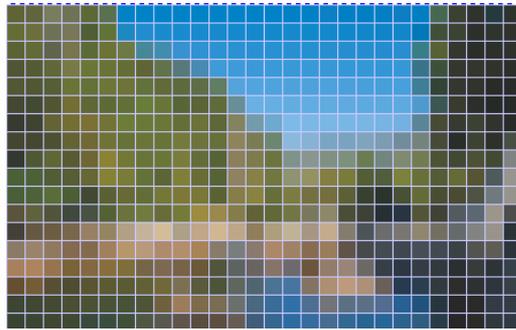
Related

- ISO 19123:2005** Geographic information -- **Schema for coverage geometry and functions**

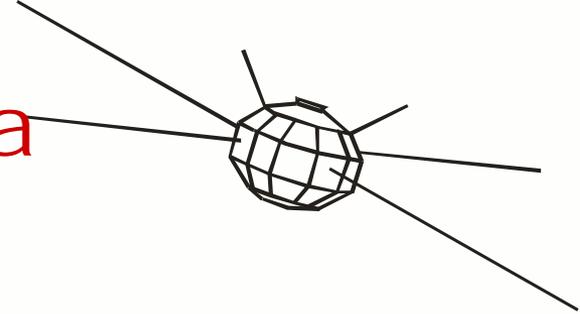
What is Imagery?



- ❖ Most people are familiar with the images they get from their cameras or cell phones. They have a sense that pixels are the little dots that make up an image and that the number of megapixels in an image determines how sharp the image is. This seems simple.
- ❖ Beyond the initial apparent simplicity imagery gets much more complex.

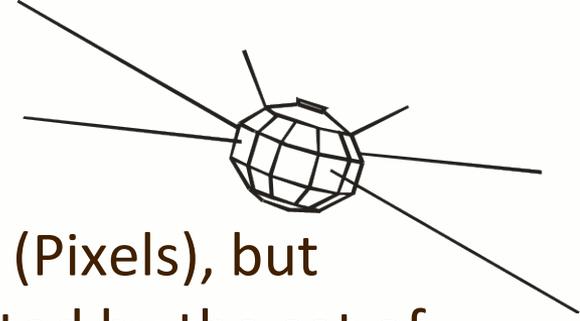


Coverages and Metadata

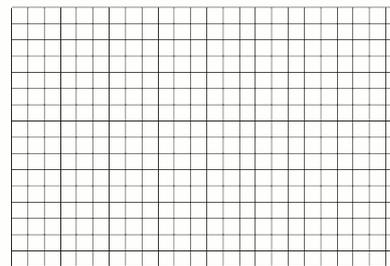


- ❖ There are 2 areas of complexity:
 - ❖ Metadata; and
 - ❖ Coverage geometry.
- ❖ Extensive metadata is needed to describe remote sensing imagery. This is addressed in several of the TC211 standards.
- ❖ In addition coverage geometry views imagery and other similar types of data as mathematical fields that can manipulated and transformed.
- ❖ The basic coverage geometry is addressed in **ISO 19123 - Schema for coverage geometry and functions.**
- ❖ The framework that links the coverage geometry and metadata is addressed in **ISO 19129 - Imagery, gridded and coverage data framework.**
- ❖ The overall structure is defined in **ISO 19101-2 – Reference Model Part 2 Imagery**

Coverages Concept



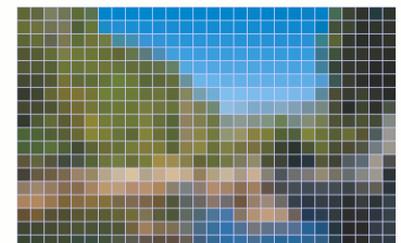
- ❖ An image is not just a set of picture elements (Pixels), but rather the underlying visual surface represented by the set of pixels.
- ❖ An interpolation function can operate on this underlying surface to generate intermediate values between the pixels.
- ❖ One set of pixels can be converted to another of a different density or geometry.
- ❖ For example a satellite image can be orthorectified to adjust it to be spatially referenced to the earth.



Value Matrix

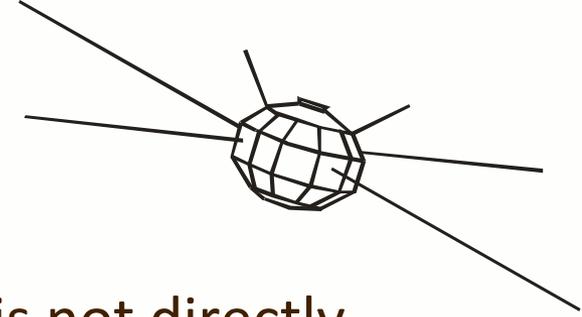


Coverage
Function

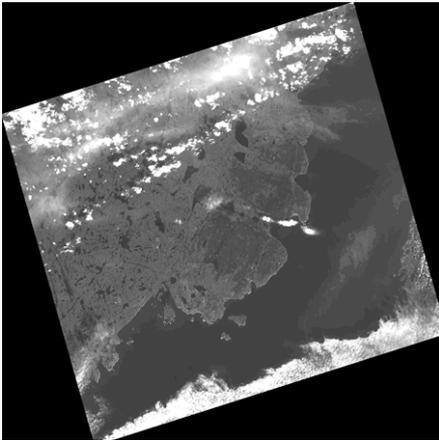


Image

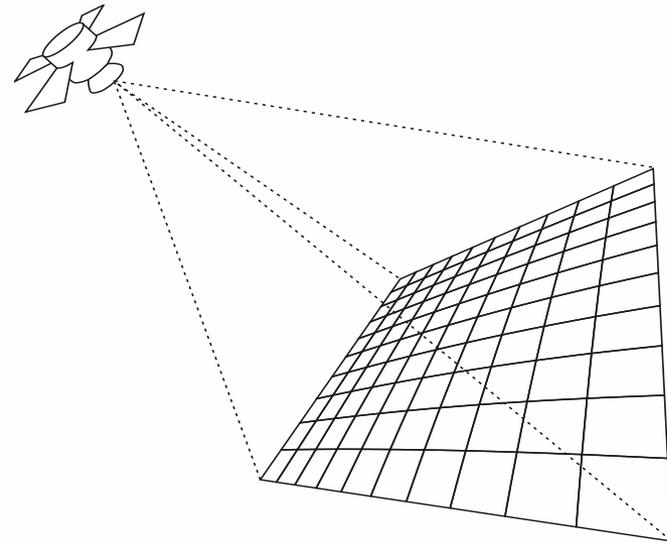
Satellite Imagery



- ❖ Raw satellite imagery may be viewed but it is not directly usable until it is processed. It needs to be orthorectified and georeferenced.

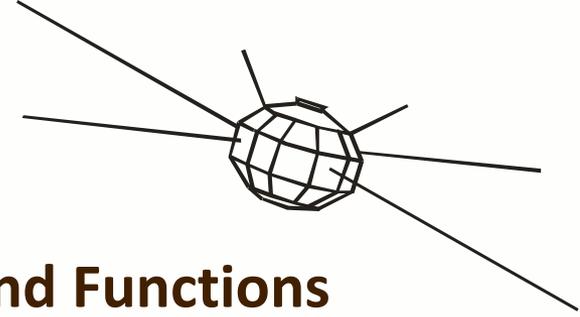


Spot Image 4 satellite image over part of Quebec Canada.

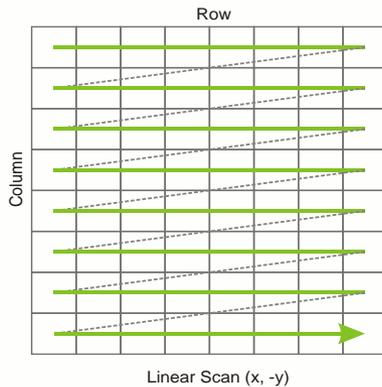


Geometric distortions must be mathematically adjusted for, and the image must be referenced to the earth..

Coverage Types

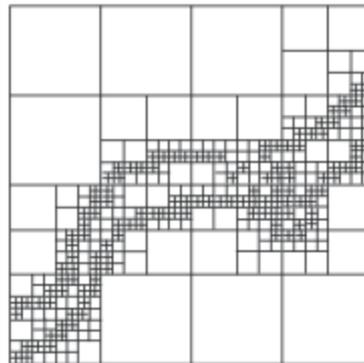
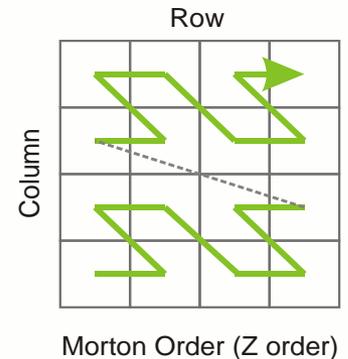


- ❖ **ISO Standard 19123 - Coverage Geometry and Functions** defines a number of different types of coverages.

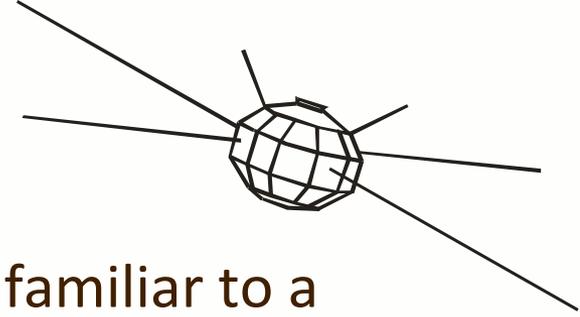


A Quadrilateral Grid is the most common type of coverage. The example is a Linear Scan Quadrilateral Grid in Row then Column order.

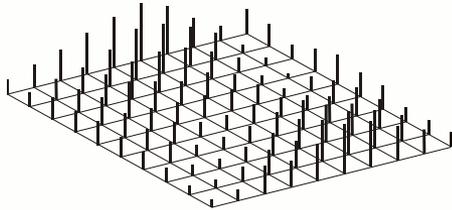
There are many other types of grid traversal methods. The example shows a Morton order traversal. This order is useful in that it supports non-uniform grid cells such as in a quad-tree.



Coverage Types

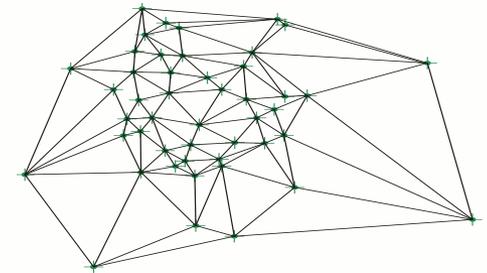


- ❖ There are a number of other coverage types familiar to a user.

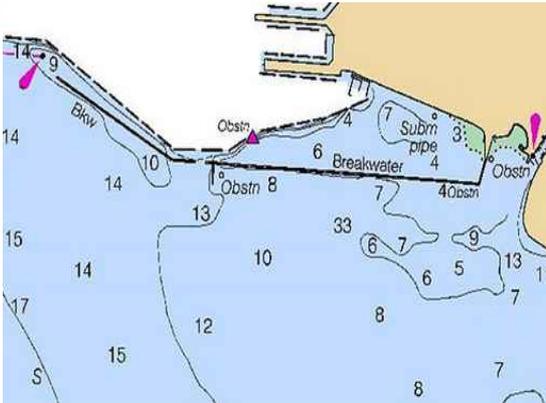
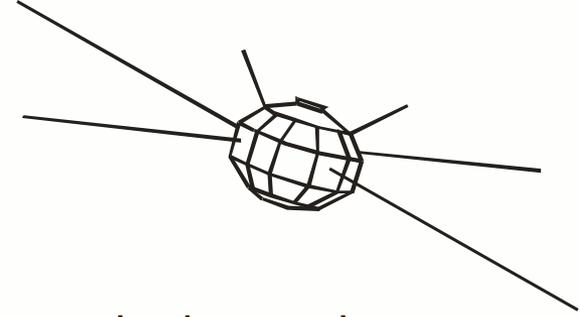


A grid of elevation values supporting a Digital Elevation Model (DEM) is illustrated. A DEM is an ordered array of ground elevations at regularly spaced intervals.

Another way to represent an elevation surface is a Triangular Irregular Network (TIN) coverage. A TIN is a coverage defined by irregularly distributed nodes with three-dimensional coordinates (x , y , and z) that are arranged in a network of non-overlapping triangles.



Coverage Types

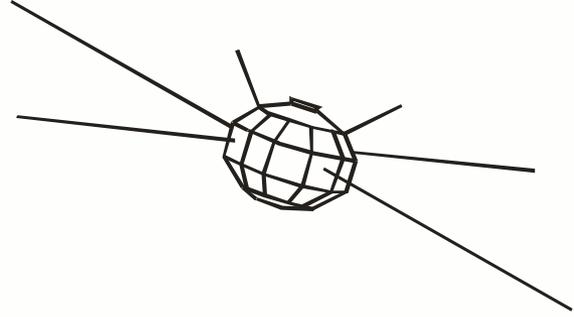


The point set is well used in ocean hydrography to represent depth soundings. Closely related is the Thiessen polygon coverage which divides an area into a set of polygon areas by forming the set of direct positions that are closer to that point than to any other point in the defining set

A vector field coverage is used for the representation of flows such as river currents or winds.

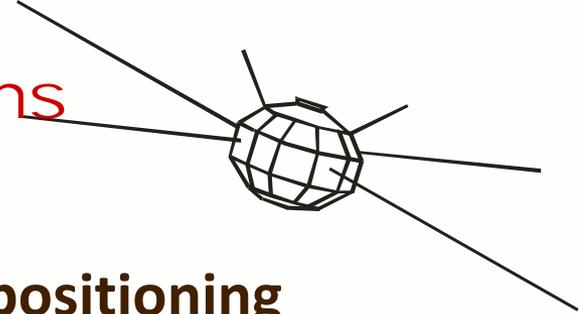


ISO 19115-2 Metadata Part 2 Extensions for Imagery

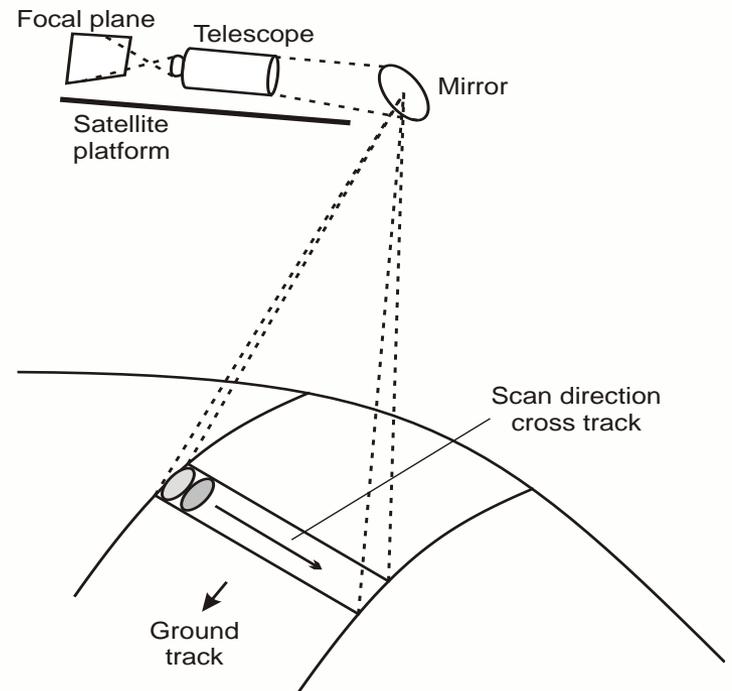


- ❖ The fundamental metadata standard **ISO 19115:2003 – Metadata** includes metadata for coverage data in general.
- ❖ **ISO 19115-2:2009 Metadata -- Part 2: Extensions for imagery and gridded data** adds to the metadata standard by defining the schema required for describing imagery and gridded data.
- ❖ It provides information about :
 - ❖ the properties of the measuring equipment used to acquire the data,
 - ❖ the geometry of the measuring process employed by the equipment, and
 - ❖ the production process used to digitize the raw data.
- ❖ This extension deals with metadata needed to describe the derivation of geographic information from raw data.

ISO 19130 Metadata Part 2 Extensions for Imagery

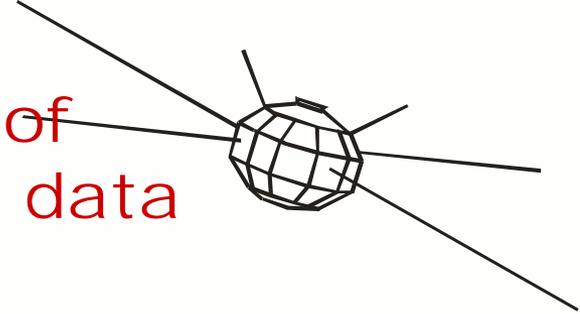


- ❖ **ISO/TS 19130 Imagery sensor models for geopositioning** identifies the information required to determine the relationship between the position of a remotely sensed pixel in image coordinates and its geoposition.
- ❖ It supports exploitation of remotely sensed images.
- ❖ It defines the metadata to be distributed with the image to enable user determination of geographic position from the observations.



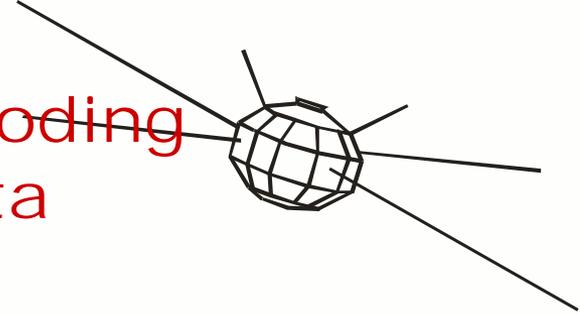
❖ Line Scan Satellite Imager

19159 Calibration and validation of remote sensing imagery sensors and data



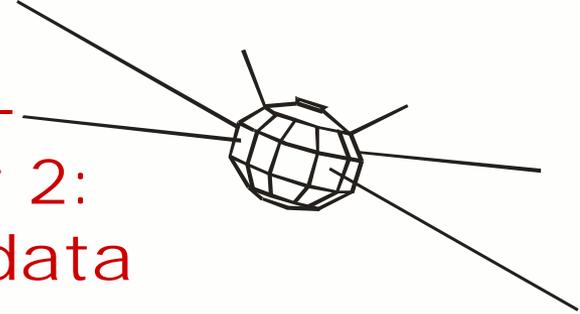
- ❖ **ISO/TS 19159** defines the calibration and validation of airborne and spaceborne remote sensing imagery sensors.
- ❖ The term "calibration" refers to geometry, radiometry, and spectral, and includes the instrument calibration in a laboratory as well as in situ calibration methods.
- ❖ The validation methods address validation of the calibration information.
- ❖ **This standard is in several parts:**
 - ❖ Part 1 – Optical Sensors (completed)
 - ❖ Part 2 – Lidar (in work)
 - ❖ Part 3 – Radar SAR, InSAR (planned)
 - ❖ Part 4 – Lidar Sonar (planned)

19163 Content components and encoding rules for imagery and gridded data



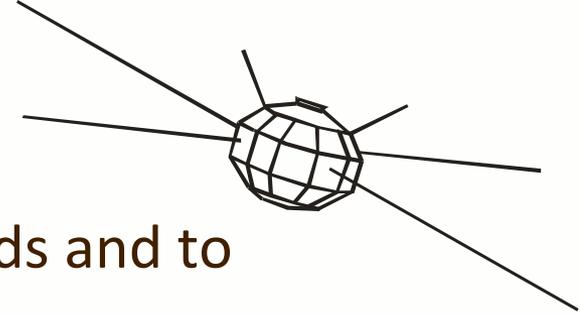
- ❖ The standardization of **an approach to handle the multiple encoding formats for imagery and gridded data** has been a goal since 2004.
- ❖ The standard 19163 classifies imagery and regularly-spaced gridded thematic data into types based on attribute property, sensor type, and spatial property, and defines an encoding-neutral content model for the required components for each type of data.
- ❖ It also specifies logical data structures and the rules for encoding the content components in the structures.
- ❖ Additional parts to this standard are planned to provide examples on how to bind the logical data structures to selected commonly-used physical data formats. It does not define any new physical data formats.

ISO 19139-2 Metadata Metadata – XML schema implementation -- Part 2: Extensions for imagery and gridded data



- ❖ ISO 19139-2:2012 defines Geographic Metadata for imagery and gridded data encoding.
- ❖ This complements the ISO 19139 XML schema corresponding to the fundamental ISO 19115 Metadata standard.
- ❖ This is an XML Schema implementation derived from ISO 19115-2.

Evolution of the Standards



- ❖ All standards evolve to address additional needs and to correct deficiencies.
- ❖ One of the Imagery, Gridded and Coverage Data standards is in the process of revision (ISO 19130).
- ❖ This is related to the evolution of several standards.

