

# OpenGeospatial Consortium (OGC) Sensor Web Enablement (SWE) and SensorML

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## OpenGeospatial Consortium (OGC)



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- Consortium of 250+ companies, government agencies, and academic institutes
- Open Standards development by consensus process
- Interoperability Programs provide end-to-end implementation and testing before spec approval
- Standard encodings (e.g. GML, SensorML, O&M, etc.)
- Standard Web Service interfaces; e.g.:
  - Web Map Service (WMS)
  - Web Feature Service (WFS)
  - Web Coverage Service (WCS)
  - Catalog Service
  - Sensor Web Enablement Services (SOS, SAS, SPS)

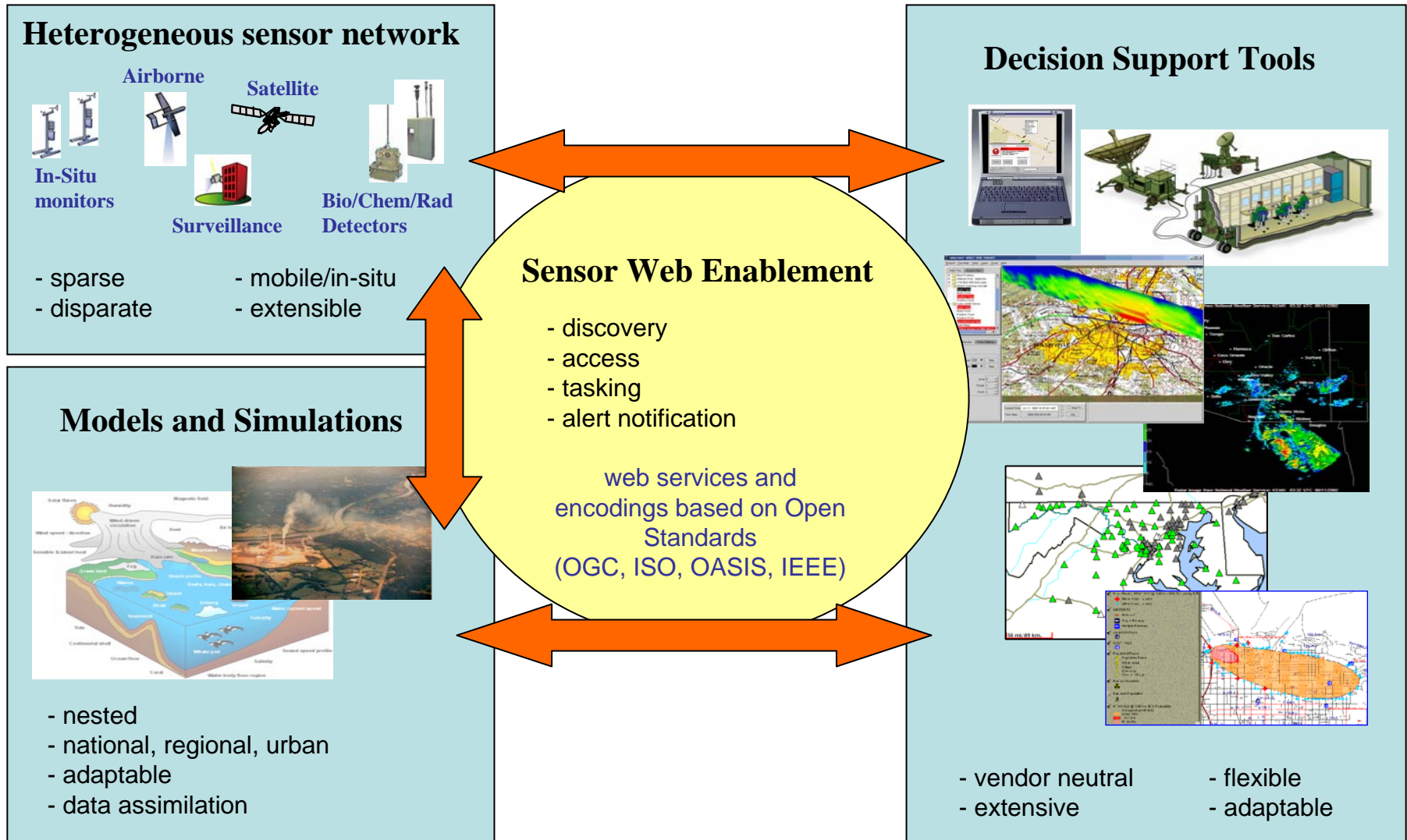
## Sensor Web Desires



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- Quickly **discover sensors** (secure or public) that can meet my needs – location, observables, quality, ability to task
- **Obtain sensor information** in a standard encoding that is understandable by me and my software
- Readily **access sensor observations** in a common manner, and in a form specific to my needs
- **Task sensors**, when possible, to meet my specific needs
- Subscribe to and **receive alerts** when a sensor measures a particular phenomenon

# Sensor Web Enablement Framework



## Scope of SensorML Support



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### Designed to support a wide range of sensors

Including both dynamic and stationary platforms

Including both in-situ and remote sensors



### Examples:

**Stationary, in-situ** – chemical “sniffer”, thermometer, strain gauge

**Stationary, remote** – stream velocity profiler, tripod-mounted camera, Doppler radar

**Dynamic, in-situ** – aircraft mounted ozone “sniffer”, GPS unit, dropsonde

**Dynamic, remote** – satellite radiometer, airborne lidar, soldier-mounted video



## Information Provided by SensorML



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### Observation characteristics

Physical properties measured (e.g. radiometry, temperature, concentration, etc.)

Quality characteristics (e.g. accuracy, precision)

Response characteristics (e.g. spectral curve, temporal response, etc.)

### Geometry Characteristics

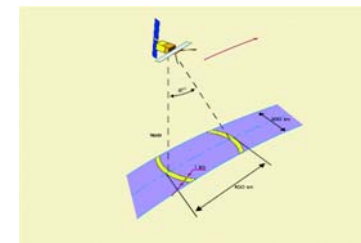
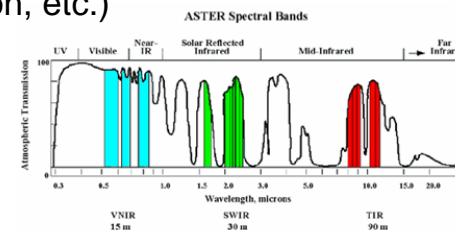
Size, shape, spatial weight function (e.g. point spread function) of individual samples

Geometric and temporal characteristics of sample collections (e.g. scans or arrays)

### Description and Documentation

Overall information about the sensor

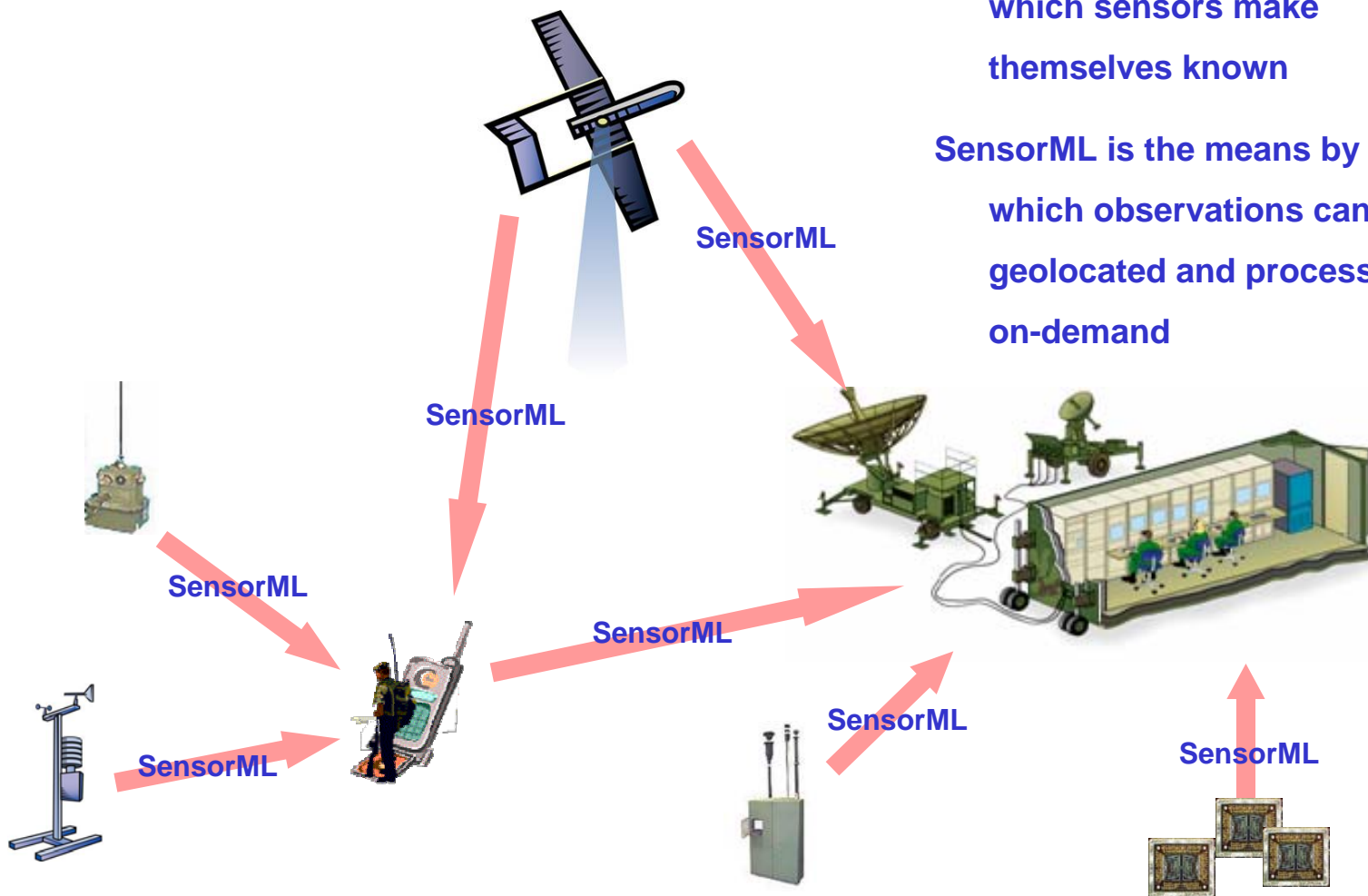
History and reference information supporting the SensorML document



# Real-Time Management of Sensor Web Assets



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SensorML is the means by which sensors make themselves known

SensorML is the means by which observations can be geolocated and processed on-demand

## SensorML Concepts

### In SensorML-TML, everything is modeled as a Process

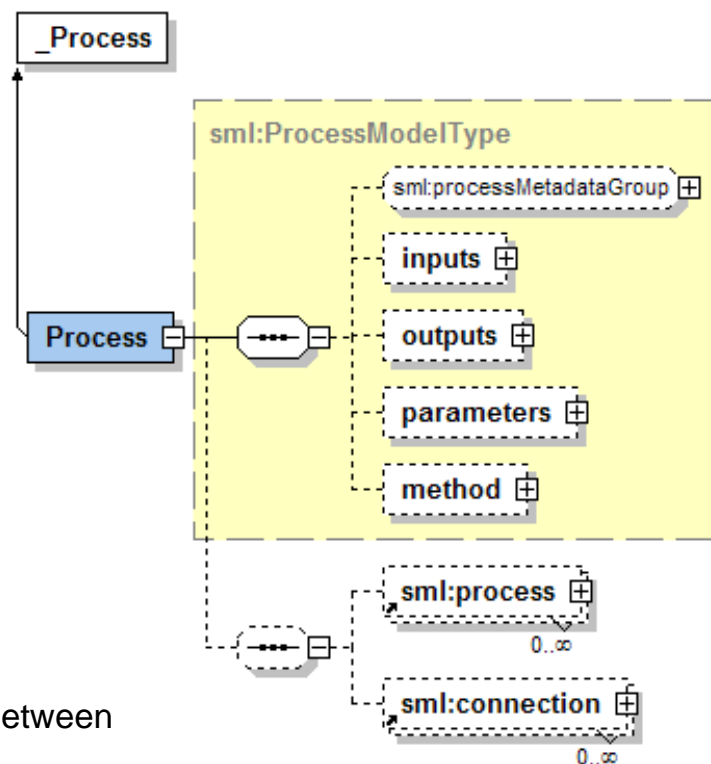
- Process Models, Transforms, etc
- Transducers (sensors, actuators, filters, etc)
- Process Chains
- Systems

### Process Model has five sections

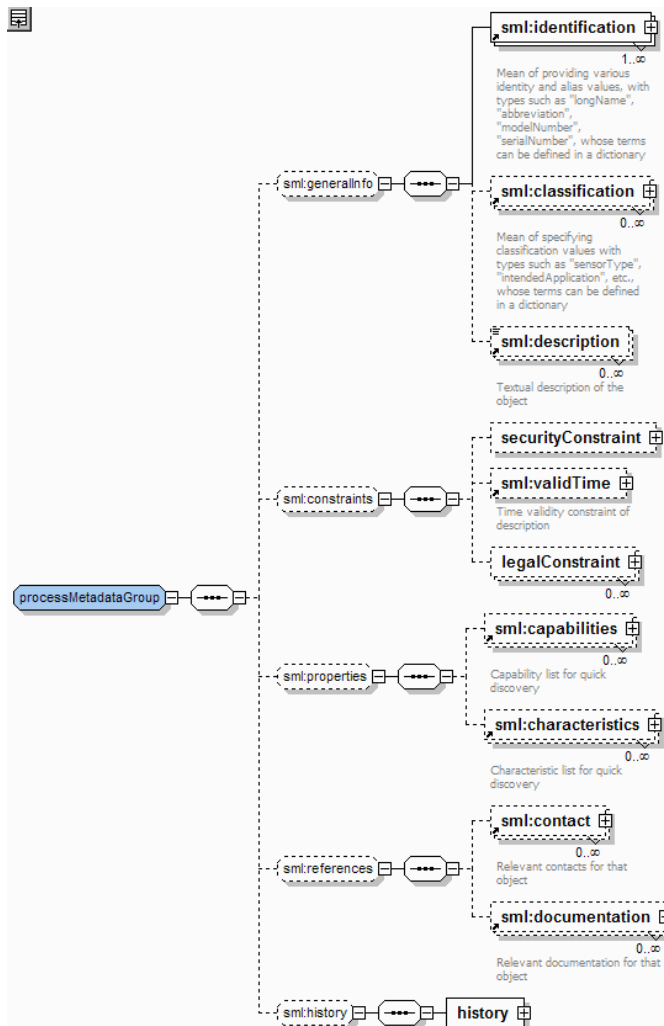
- process metadata
- inputs
- outputs
- parameters
- method (algorithm description or code)

### Process is a Composite design (Process Chain)

- Process can contain other processes and links between them
- Process can itself be included as a process in other process chains

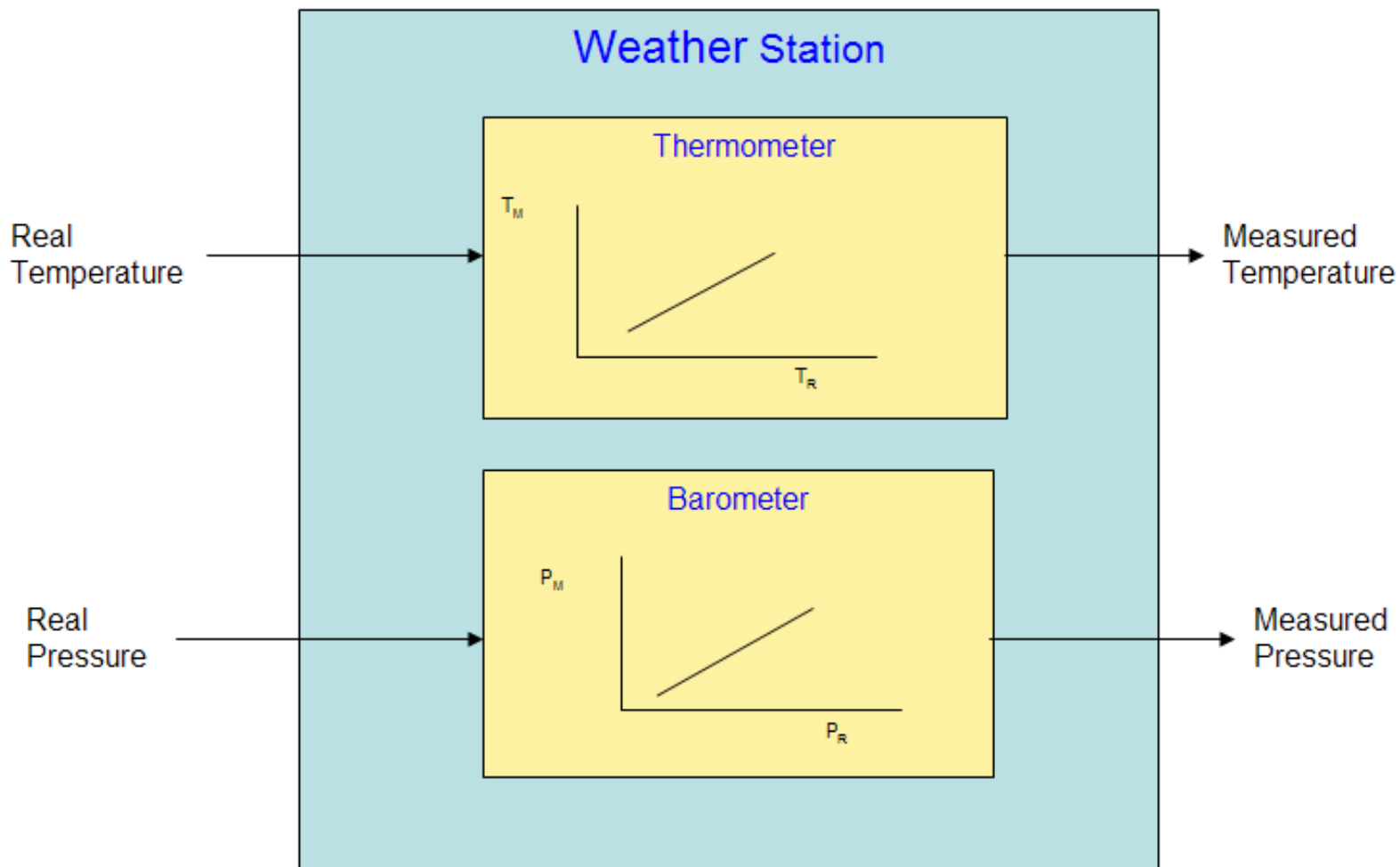


# Process/Sensor/System Metadata

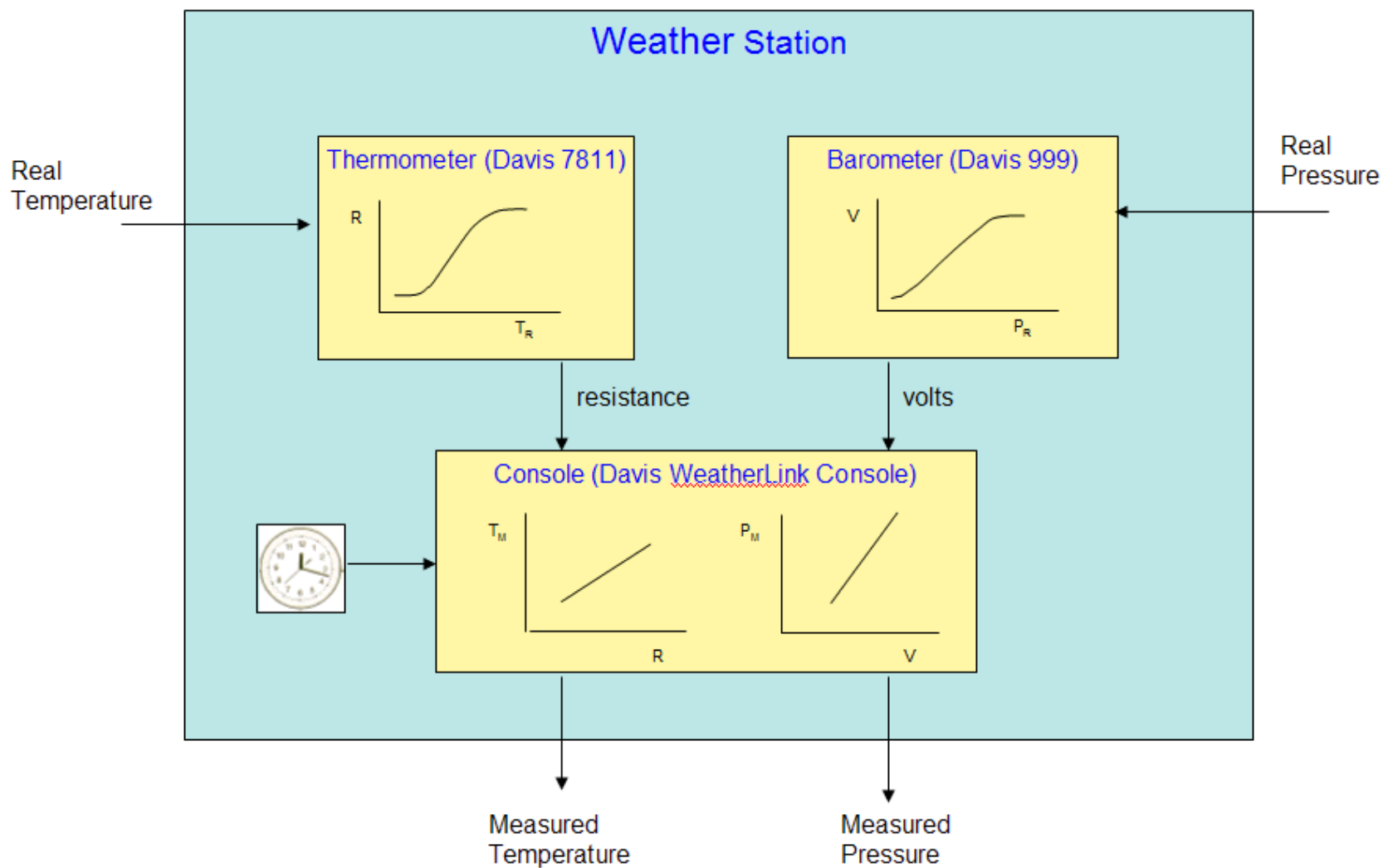


**Metadata is primarily for discovery and assistance, and not to be used within process execution**

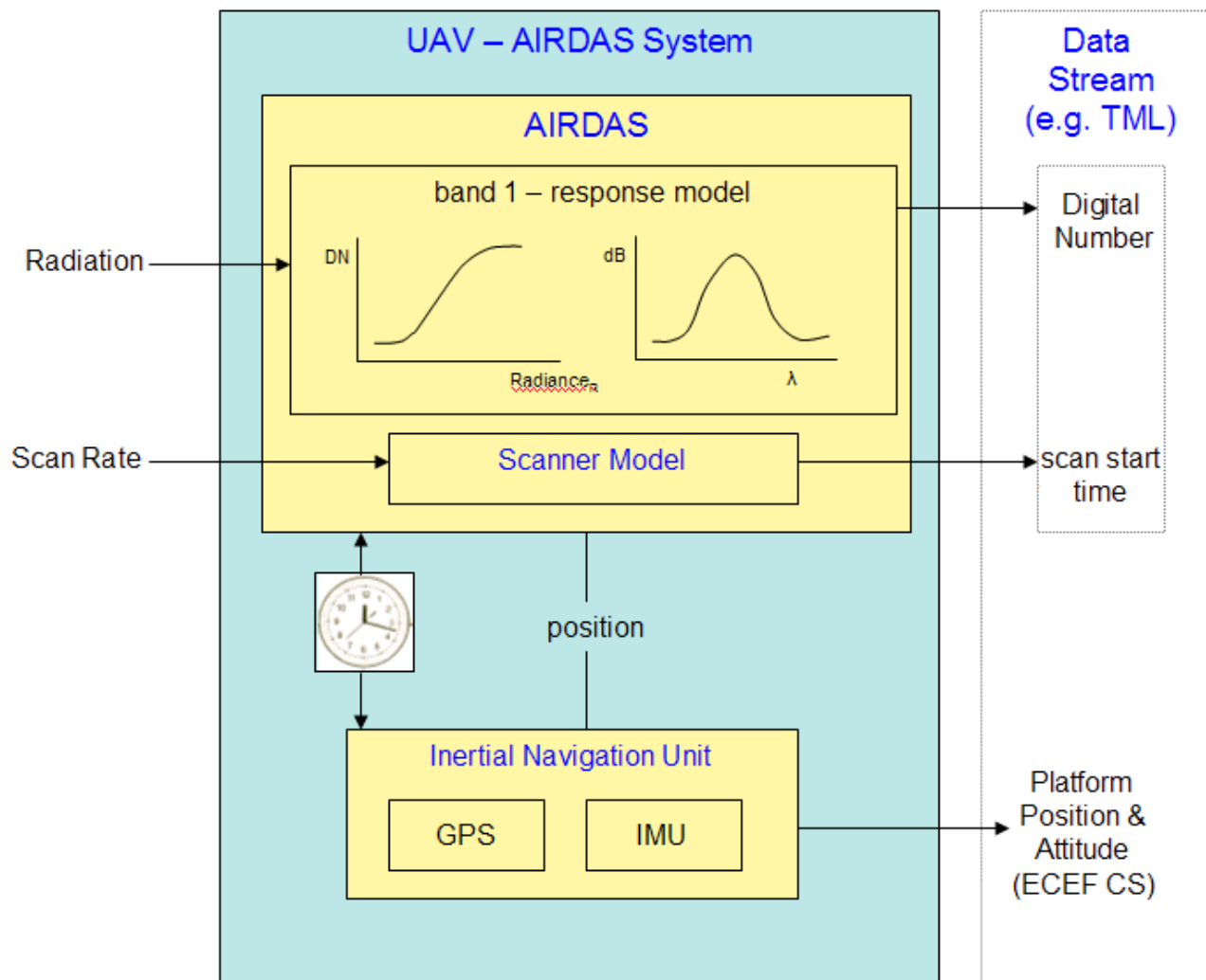
## System Example – Simple Weather Station



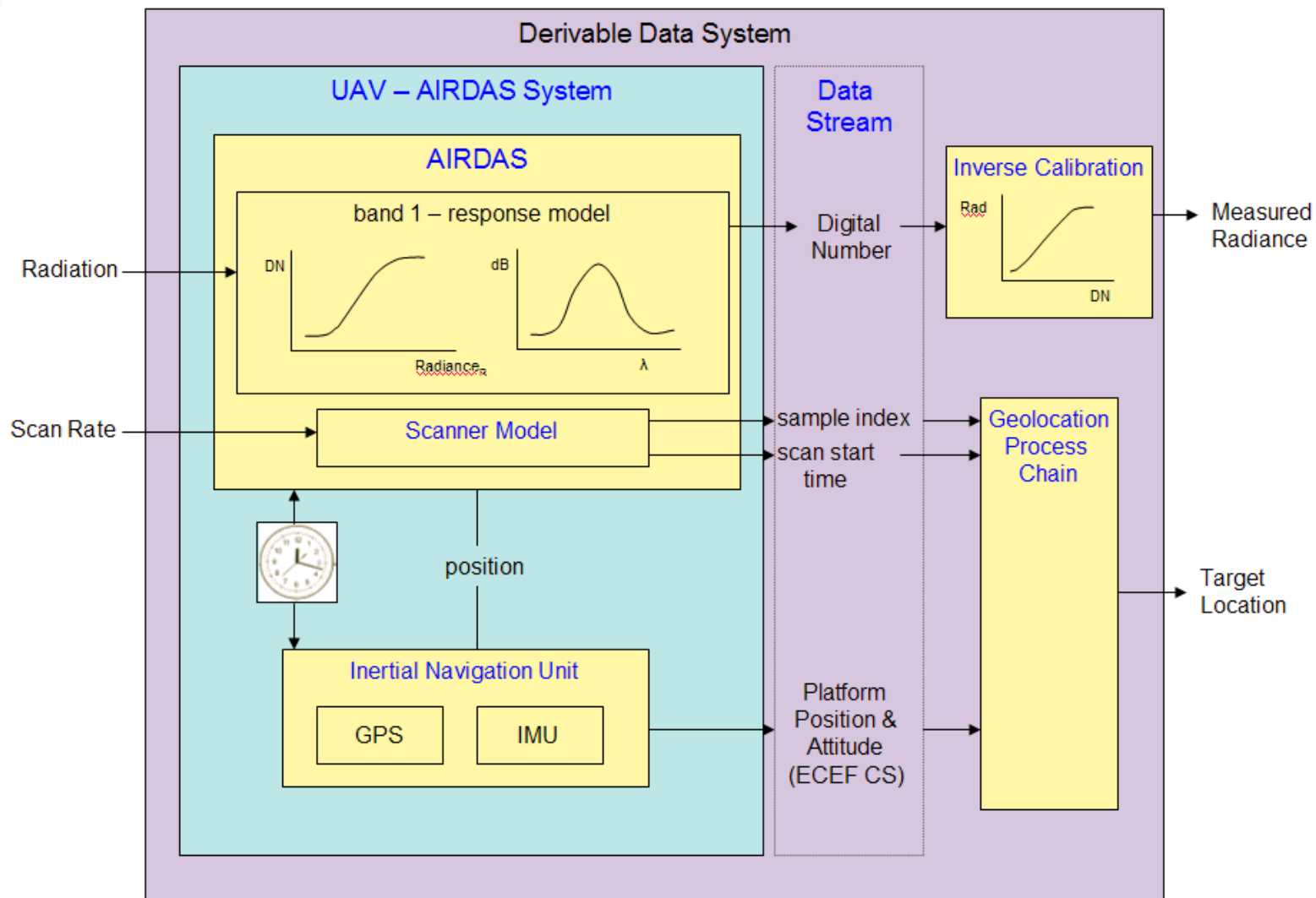
## System Example – More explicit weather station



## System Example – Basic UAV-AIRDAS system



## System Example – AIRDAS with derivable data

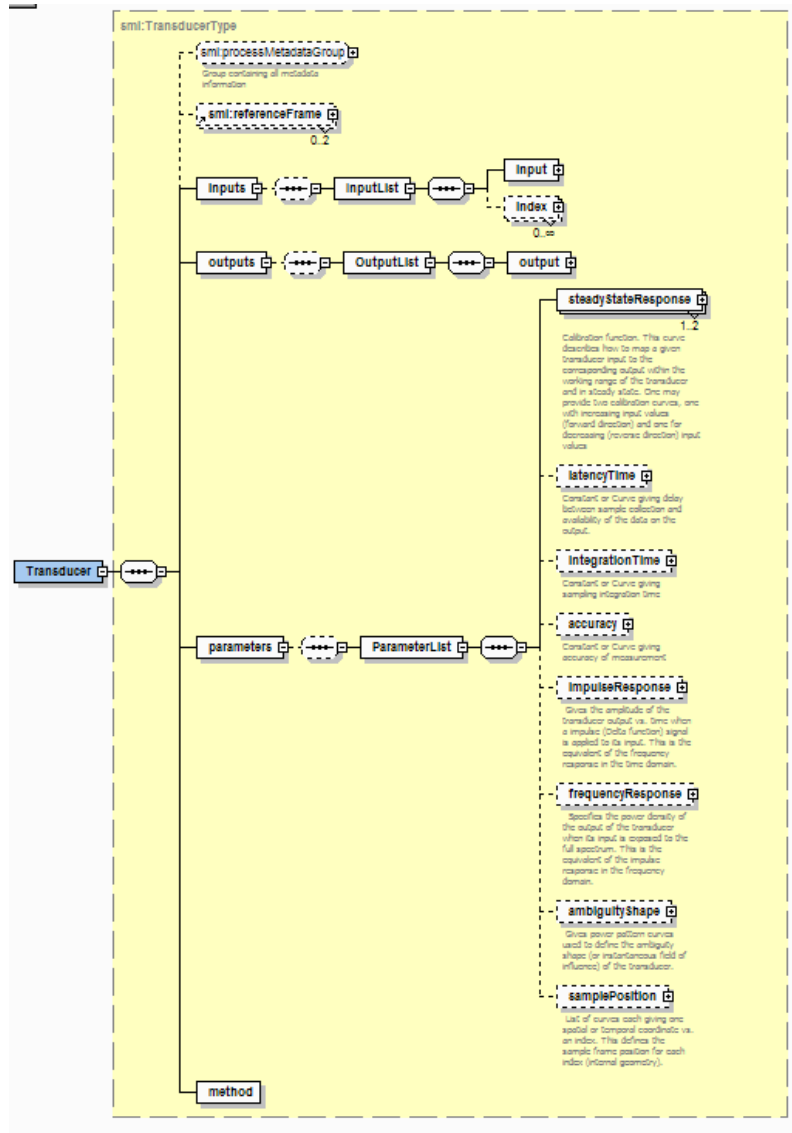


## Transducer Process



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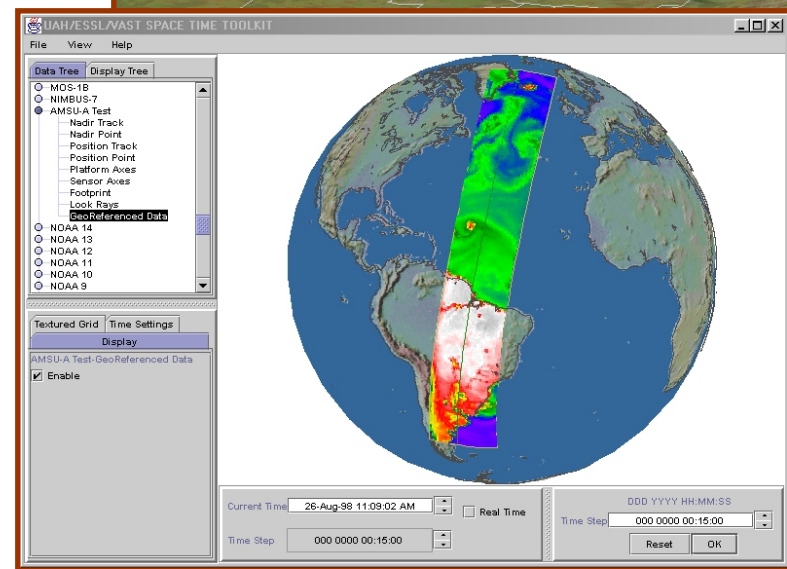
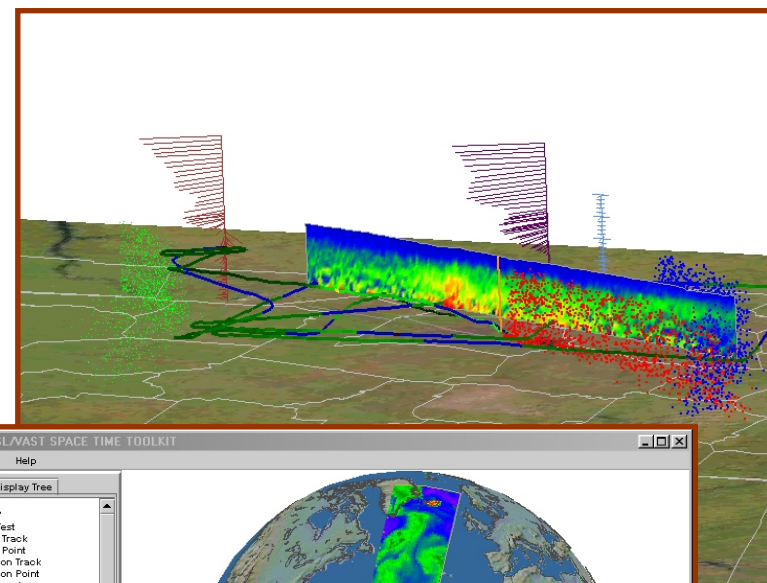
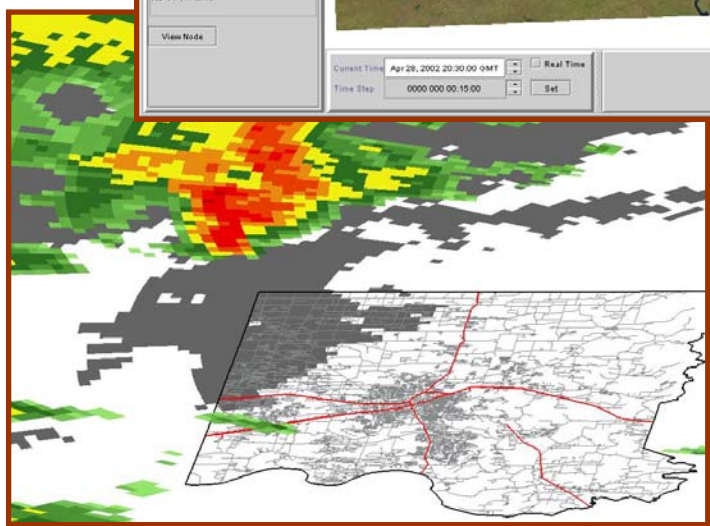
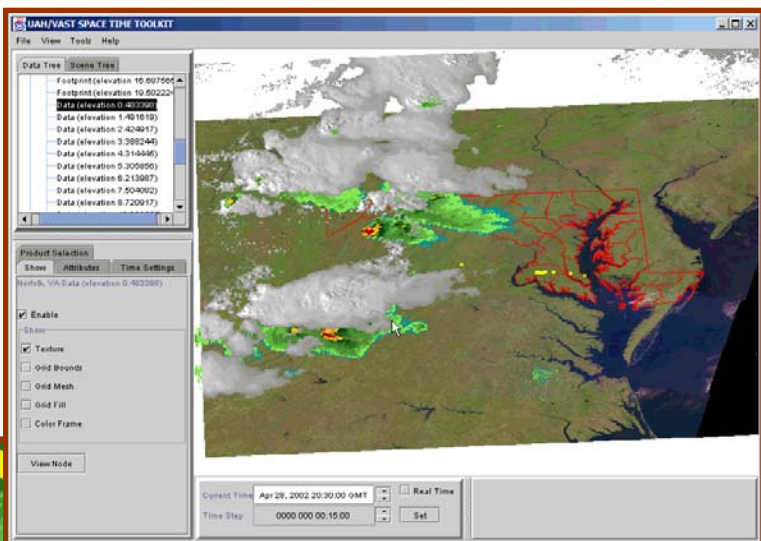
- Single input and output
- Parameters
  - steadyStateResponse
  - latencyTime
  - integrationTime
  - impulseResponse
  - frequencyResponse
  - ambiguityShape
  - samplePosition



# Integration of Sensor Observations within Decision Support Tool



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## Relevant Links



**OpenGeospatial Consortium –**

**<http://www.opengeospatial.org>**

**SensorML –**

**<http://vast.uah.edu/SensorML>**

**Space Time Toolkit –**

**<http://vast.uah.edu/SpaceTimeToolkit>**