

Web3D Collaborative Naval Visualization Workshop

3D Metadata Model(s)

for Archival Data Publication

Challenges in 3D Model Management

- What is the part number / identifier for this ?
- Where did this 3D model come from?
- What tools and algorithms were used to acquire and process it?
- Does this model have a real counterpart?
- ...

GeoVisualization

Derived

Products

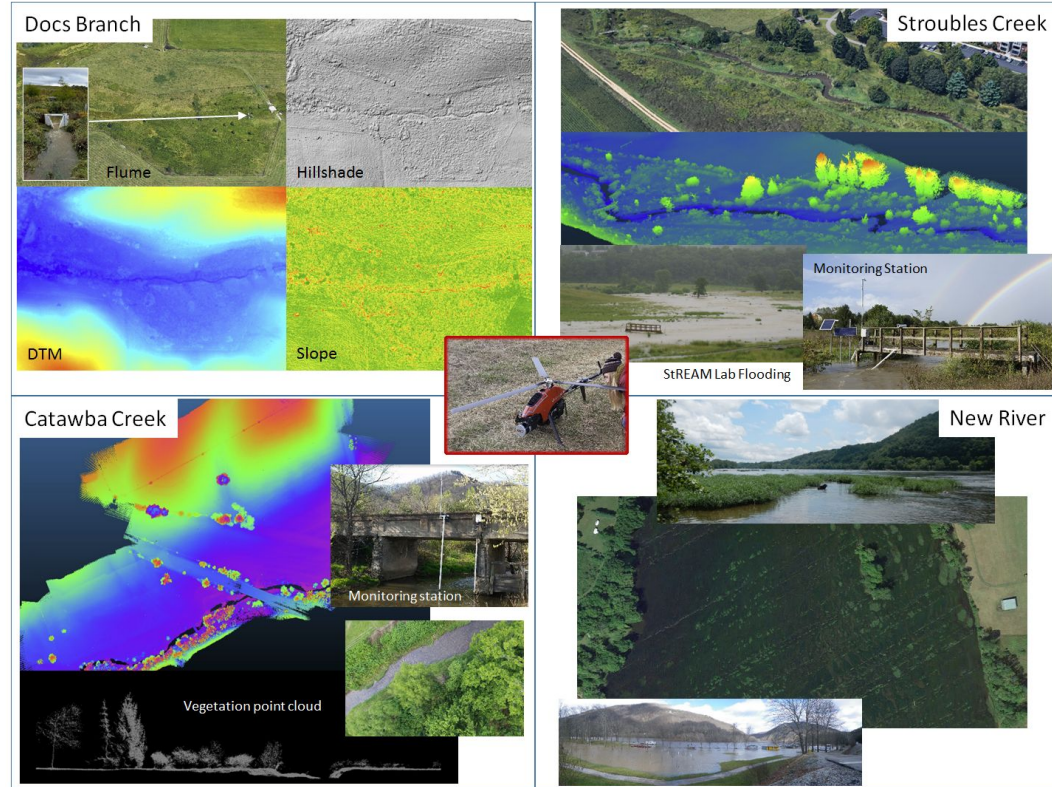
GPS:

DTM (TIN),

Aspect

Slope

CHM



Processing

There are many processing options depending in the acquisition platform, the goals of the dataset, and the target products.

Considerations:

- No one tool or vendor has a future-proof solution (AI and processing algorithms continue to evolve)
- Data may need to move between multiple tools at different stages of processing
- X3D's metadata capability means that shapes can be annotated w provenance, parts numbers, etc

Web3D Approach

Describing Digital Twins and 3D Model Surrogates:

1. Identify Relevant Vocabularies (Reference Terms, Ontologies, ...)
2. Show Exemplars with encoded X3D Metadata
3. Work with WWW technology stack to scale to large collections of models and 3D interactive services

X3D and Metadata

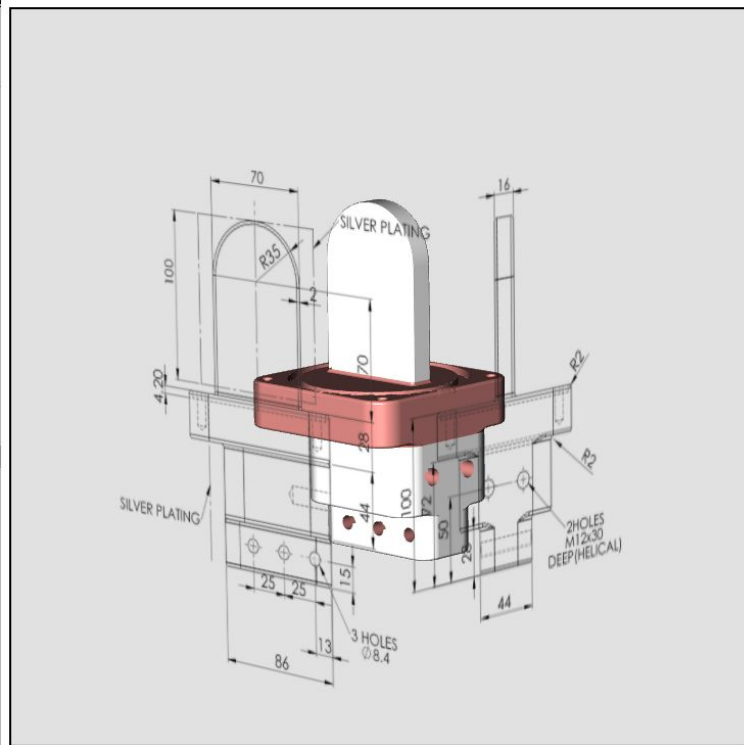
Describing 3D models and scenes:

- Provide structured data methods and API for accessing metadata information
- Must support many vocabularies and data types
- X3D Metadata nodes can refer to any X3D node:
<MetadataSet> allows extensibility to complex vocabularies

X3D Metadata Examples

- 3DPS WG: CAD Models w parts catalog references
- Heritage WG: VT examples of [Smithsonian](#)
- Medical WG: [SNOMED CT, FMA](#) : Medical and Clinical terms

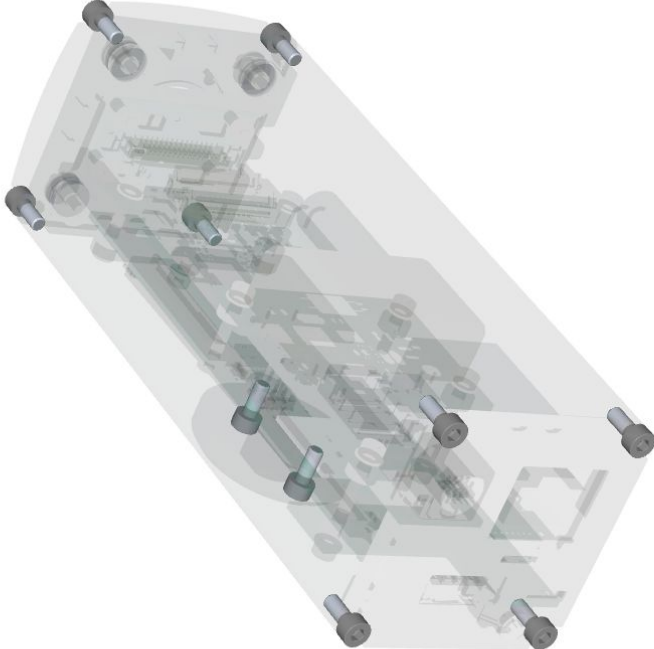
Integrate 3D and 2D drawings



3D CAD model and 2D drawings courtesy of [Supreme Enterprises](#).

Product Catalog

reset model ← NC393-M2260-CS-ASSY View ?



0353-98-01 [upload] [info] [close]

0353-00-15	0393-18-30
0353-30-20	0393-18-31
0353-96-01	0393-20-11
0353-97-25	0393-30-30
0353-98-01	0393-63-01
0353-99-01	0393-83-01
0353-99-10	0393-90-06
0353-99-16	0393-90-07
0353-99-161	
0353-99-25	
0393-00-20A	
0393-00-21B	
0393-00-22B	
0393-00-23A	
0393-02-61	
0393-10-01	
0393-11-01	
0393-11-10	
0393-11-11	
0393-12-29	
0393-12-30	
0393-12-31	
0393-13-01	

https://community.elphel.com/x3d/index.html?animate&model=/x3d/x3d_model_files/x3d/NC393-M2260-CS-ASSY.x3d

Advanced Research Computing: arc.vt.edu

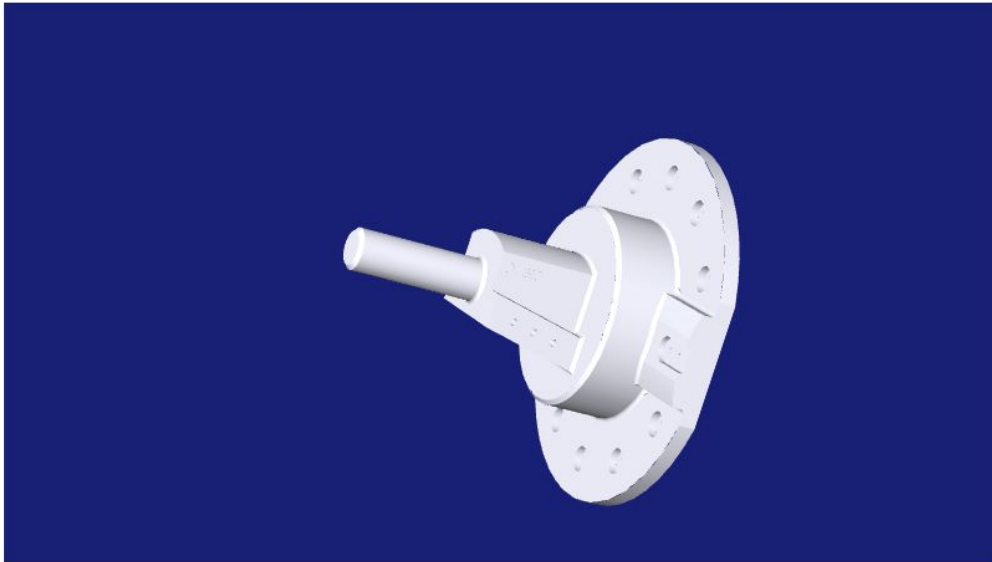
STEP to X3D

Zoom

NistCtc05Asme1Ap203Spri.x3d

[\(.x3d scene, pretty-print source\)](#), statistics, info & logs, [X3DOM Player](#)

NIST Product and Manufacturing Information
(PMI) Complex Test Case 5.



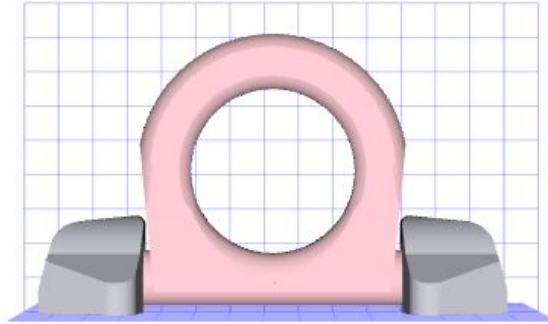
Generated from STEP file from the
NIST Conformance Suite.

Product Demonstration

Part: VRBS-4-t Welded Lifting Point
Manufacturer: [RUD](#)

STEP (AP203) CAD file obtained from
[PART Community](#) online catalog.

X3D [Download](#)



Show 1 cm. grid


Show Swivel Freedom

Reset View

Model may be rotated by dragging with mouse

Buddha with metadata x +

Not secure | metagrid2.sv.vt.edu/~npolys/Web3DHeritage/smithsonian/buddhaFinalWeb3.html



Smithsonian Buddha in X3D with embedded Metadata

Freer Gallery of Art and Arthur M. Sackler Gallery
Buddha draped in robes portraying the Realms of Existence
Origin: probably Henan province, China
Period: Northern Qi dynasty 550-577
Type: Sculpture, Stone
Accession Number: F1923.15

https://www.si.edu/object/fsq_F1923
OBJ model downloaded from:
<https://3d.si.edu/browser>

Nicholas Polys (VT) & web3d.org

VirginiaTech
Invent the Future™

web3D
CONSORTIUM

X3D: Web3D.org
[X3DOM - X3DOM.org](https://www.khronos.org/x3d/)

buddhaPacked (3).x3d

Show all x

1:09 AM 12/6/2019

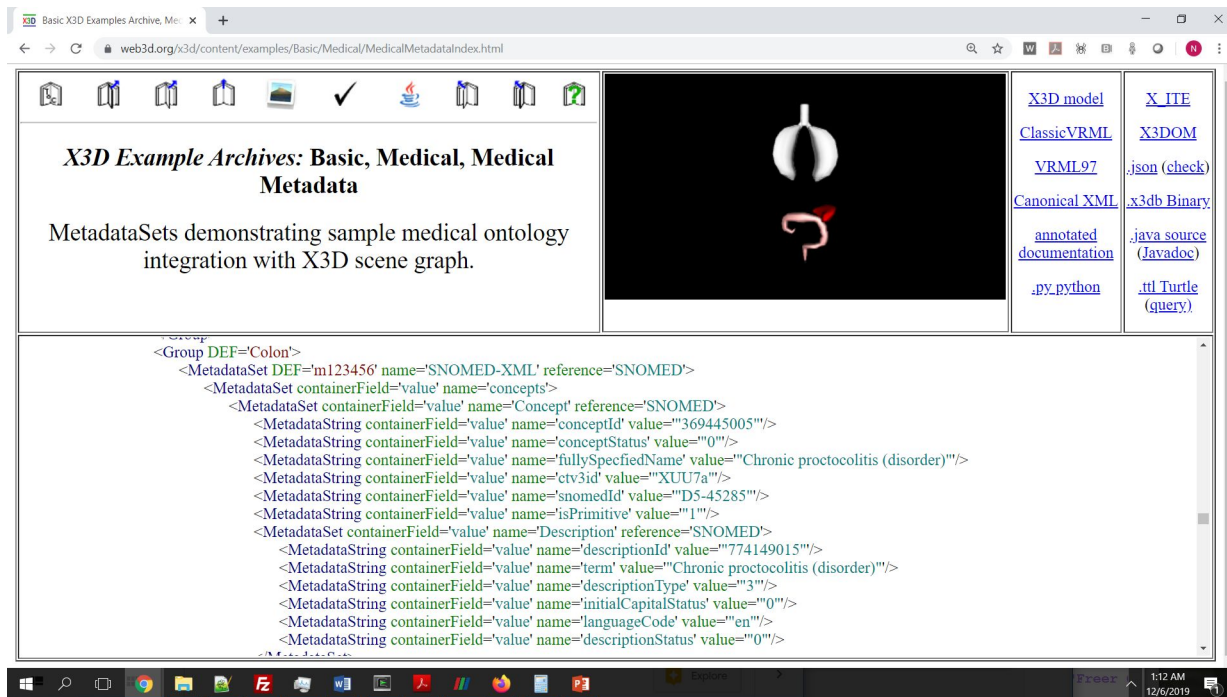
Emerging Metadata Vocabulary

Smithsonian and Library Community :

[3D Metadata Model](#)

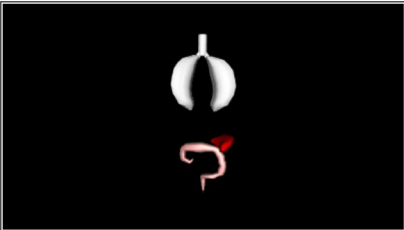
Medical Example:

SNOMED and FMA terms in X3D



X3D Example Archives: Basic, Medical, Medical Metadata

MetadataSets demonstrating sample medical ontology integration with X3D scene graph.



- [X3D model](#)
- [X_ITE](#)
- [ClassicVRML](#)
- [X3DOM](#)
- [VRML97](#)
- [.json \(check\)](#)
- [Canonical XML](#)
- [.x3db Binary](#)
- [.annotated documentation](#)
- [.java source \(Javadoc\)](#)
- [.py_python](#)
- [.ttl Turtle \(query\)](#)

```
<Group DEF='Colon'>
  <MetadataSet DEF='m123456' name='SNOMED-XML' reference='SNOMED'>
    <MetadataSet containerField='value' name='concepts'>
      <MetadataSet containerField='value' name='Concept' reference='SNOMED'>
        <MetadataString containerField='value' name='conceptId' value='369445005' />
        <MetadataString containerField='value' name='conceptStatus' value='0' />
        <MetadataString containerField='value' name='fullySpecifiedName' value='Chronic proctocolitis (disorder)' />
        <MetadataString containerField='value' name='ctv3id' value='XUU7a' />
        <MetadataString containerField='value' name='snomedId' value='D5-45285' />
        <MetadataString containerField='value' name='isPrimitive' value='1' />
        <MetadataSet containerField='value' name='Description' reference='SNOMED'>
          <MetadataString containerField='value' name='descriptionId' value='774149015' />
          <MetadataString containerField='value' name='term' value='Chronic proctocolitis (disorder)' />
          <MetadataString containerField='value' name='descriptionType' value='3' />
          <MetadataString containerField='value' name='initialCapitalStatus' value='0' />
          <MetadataString containerField='value' name='languageCode' value='en' />
          <MetadataString containerField='value' name='descriptionStatus' value='0' />
        </MetadataSet>
      </MetadataSet>
    </MetadataSet>
  </Group>
```

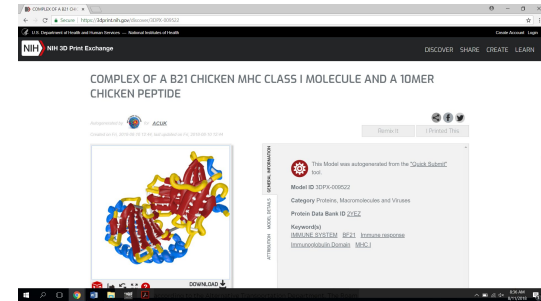
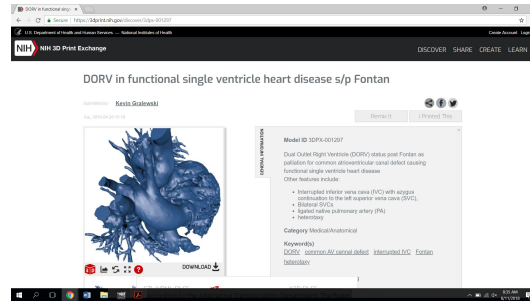
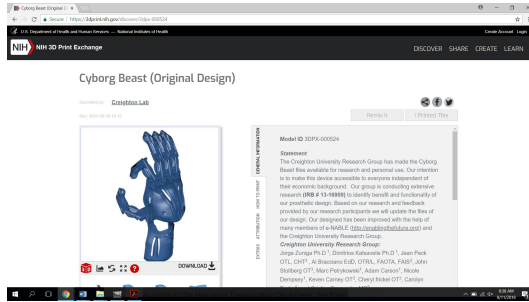
Next Steps

- Develop more examples of diverse vocabularies and X3D IT architectures (all Working Groups)
- Develop Recommendations and Specifications for expressing and using these relationships in X3D

www.web3d.org

NIH X3D Printing

3dprint.nih.gov



web 3D
CONSORTIUM

Processing: Lidar

Typical tasks:

- Remove noise and errors
- Get statistics of the point cloud
- Resample / reduce
- Generate 3D surface model
 - Scan angle can be used as a normal vector each point, resulting in better surfaces
 - May include approaches like Poisson disk sampling, marching cubes, draping, or ball-and-pivot
 - Object detection / segmentation

Processing Lidar

- Commercial tools like Esri, Geomagic, Photoscan are black-boxes and users must rely on the companies to validate and test for confidence in the result
- Open source 3D tools like MeshLab, Blender, and CloudCompare are commonly used and the basis for our pipelines
- Python's Laspy library makes loading and manipulating .las data easy; e.g.:
 - `Las2x3d.py`

Requirements



-

-

Requirements

-
-

Requirements

-

-

Requirements

-

-