AM Data Management Working Group
Additive Manufacturing Common Data Model

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Overarching Goal

• Make Additive Manufacturing (AM) data FAIR – Findable, Accessible, Interoperable, and Reusable

• Lack of a common vocabulary, common representation, and common exchange formats all hinder these goals

• According to GO FAIR, the FAIR Principles include:
  • Findable: “Metadata and data should be easy to find for both humans and computers.”
  • Interoperable: “(Meta)data use a formal, accessible, shared and broadly applicable language for knowledge representation.” and
  • Reusable: “… metadata and data should be well described so that they can be replicated and/or combined in different settings.”
Common Data Model in context of CDD and CDEF

### Common Data Dictionary

- **build ID** – globally unique identifier of a build, of type string
- **powder lot ID** – globally unique identifier of a lot of powder, of type string
- **powder reuse number** – the number of times the powder has been reused, of type int ≥ 0
- **ASTM F3490-21**

### Common Data Model

- **Build**: is a class, defined by `buildID` with a single value of type string, defined by `powderLot` with values of type `PowderLot`. // by saying “with values” I am stating that a single build could use multiple powder lots

### Common Data Exchange Format

```json
{
  "Build": {
    "buildID": "abc123-build",
    "powderLot": [
      { "powderLotID": "def456-powder",
        "powderReuseNumber": 2 },
      { "powderLotID": "ghi789-powder",
        "powderReuseNumber": 0 } ]
  }
}
```

### The CDEF is built to exchange data modeled by the CDM, which puts structure around the CDD. So, the CDEF builds upon the CDM, which in turn builds upon the CDD.
Making Additive Manufacturing Data FAIR through a Common Data Model

1. **Users can explore & select attributes of interest from a Common Data Model (CDM)**

2. **SemTK uses metadata mappings linking CDM to each data stores’ data model to generate queries.**

3. **Data retrieved from stores and mapped to CDM for integration**

- Retrieve & Map
  - GEFDTP → CDM
  - AMMD → CDM
  - AFRL HT → CDM
  - DMSAM → CDM
  - System X → CDM

Use a Common Data Model to make additive manufacturing data **Findable, Accessible, Interoperable, and Reusable**
AM Common Data Model Working Group

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GitHub repo: https://github.com/kaggour/AM-CDM
Excerpts from CDM (written in SADL)

Semantic Application Design Language (SADL)
https://github.com/SemanticApplicationDesignLanguage

Base
Material
System
Process
Build
Test-Inspection-Characterization

http://www.gm.com/CDM-base/

http://www.gm.com/CDM-material/

http://www.gm.com/CDM-system/

http://www.gm.com/CDM-process/

http://www.gm.com/CDM-build/

http://www.gm.com/CDM-

Test-Inspection-Characterization
Build-centric view (visualized in SemTK)


Test-Inspection-Characterization
Material-centric view (visualized in SemTK)