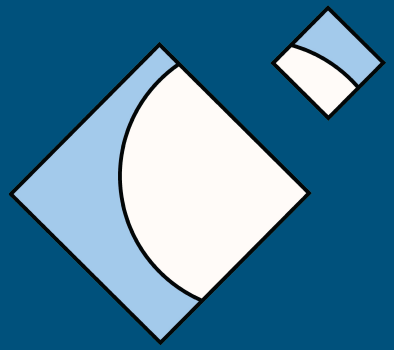
MetaSat: Metadata for SmallSat Missions



OSCW 2020

Allie Williams (they/them/theirs)

Center for Astrophysics | Harvard & Smithsonian

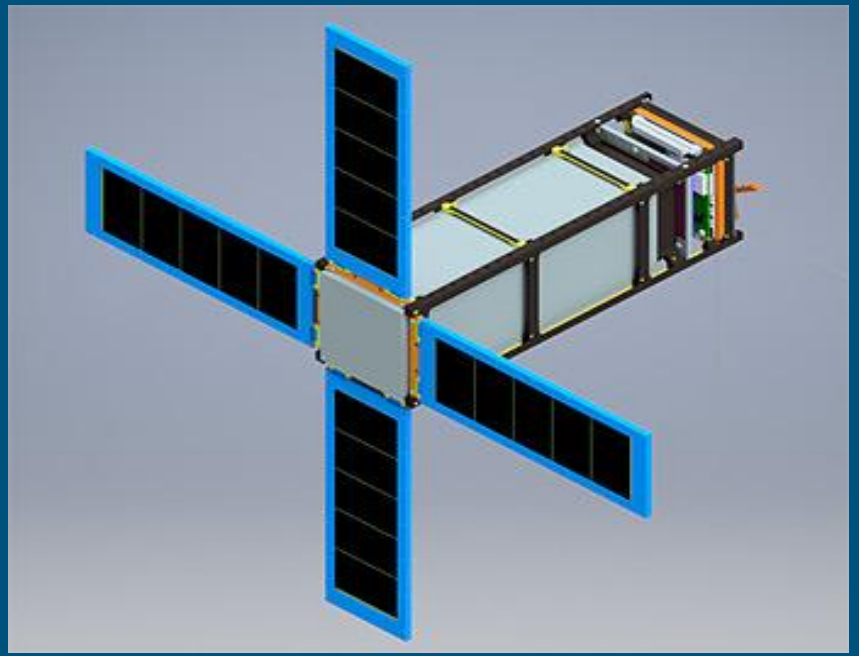
Who are we?

- The Center for Astrophysics (CfA) is an astrophysics research collaboration between Harvard University and the Smithsonian in Cambridge, MA.
- Wolbach Library serves the CfA and is the largest astrophysics research library in the world
- Part of our mission is to “anticipate challenges that impact the astrophysics community”
    - This means that we need to stay on top of trends in astrophysics AND information science
    - Facilitate communication and collaboration

CfA exterior shot showing the observatory
https://chandra.harvard.edu/about/asc.html

Remote teams face communication difficulties

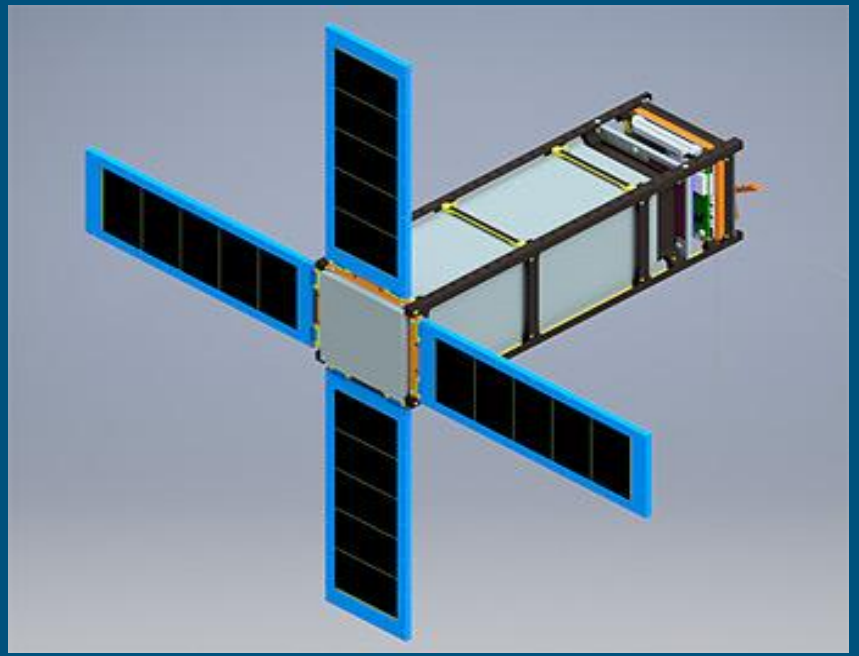
- Distant teams have a hard time communicating
  - NMSU INCA and NASA Goddard



NMSU's INCA CubeSat
https://space.skyrocket.de/doc_sdat/inca.htm

Remote teams face communication difficulties

- Distant teams have a hard time communicating
  - NMSU INCA and NASA Goddard
- Imperial vs SI units, British vs American spelling, different terms and variable names for the same thing…



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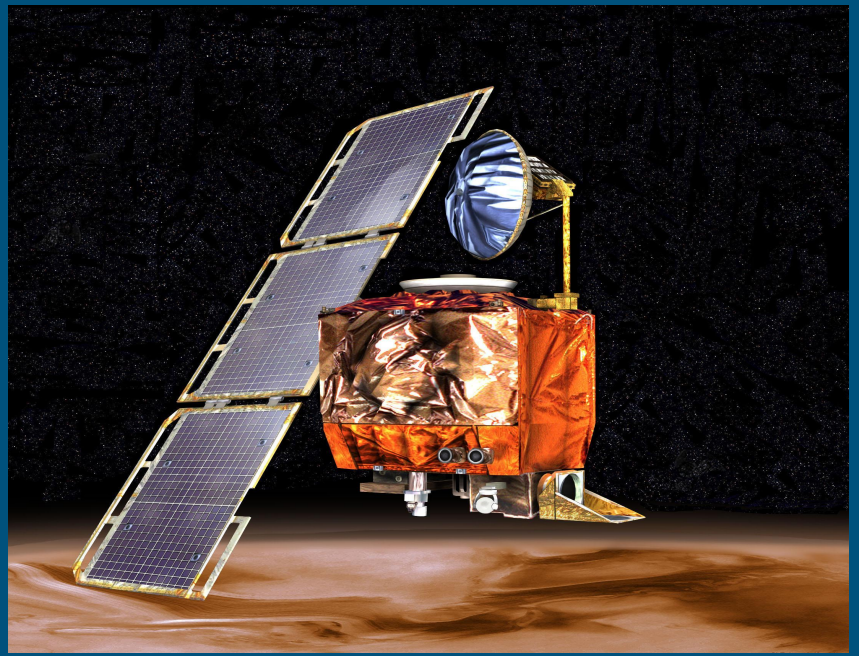
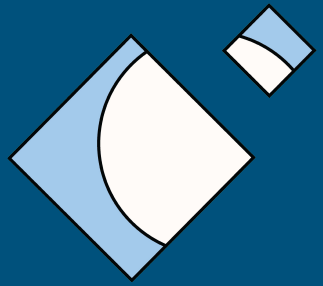
- Imperial vs SI units
- Example: Mars Climate Orbiter (MCO)
  - NASA satellite launched in 1998
  - Software on Earth used imperial units (lbsf*s), while software on spacecraft used metric (N*s)
  - Satellite could not establish orbit around Mars, and crashed into the planet



Render of the Mars Climate Orbiter
https://en.wikipedia.org/wiki/Mars_Climate_Orbiter

MetaSat is a linked data vocabulary of satellite terms



MetaSat logo

- We are creating free and open linked data URIs to cover all parts of a satellite mission
  - Mission/people information
  - Launch
  - Ground stations and data
  - Hardware

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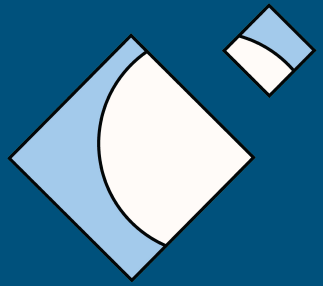

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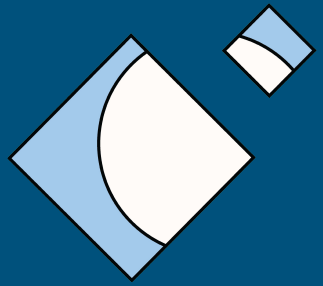

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- Linked data: a "collection of interrelated datasets on the Web" that is easy for machines to access [W3C]

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  - A collection of **JSON-LD example files**
    - Files to inspire; metadata about real missions in JSON-LD

PICARD mission metadata

https://gitlab.com/metasat/metasat-schema/-/blob/master/Examples/PICARD_MISSION_EXAMPLE.jsonld

```jsonld
{
    "@context": {
        "id": "@id",
        "@vocab": "https://schema.space/metasat/",

        "schema": "http://schema.org/"
    },
    "mission": {
        "missionType": "Solar Science",
        "name": "PICARD",
        "spaceAgency": {
            "name": "National Centre for Space Studies",
            "alternateName": "CNES"
        },
        "country": "France",
        "launchSegment": {
            "launchTimestamp": "15 June 2010, 14:42:21 UTC",
            "rocket": "Dnepr",
            "launchSite": "Dombarovsky, Site 370/13",
            "launchServiceProvider": "ISC Kosmotras"
        },
        "spaceSegment": {
            "spacecraft": {
                "internationalDesignator": "2010-028A",
                "noradID": "36598",
                "mass": {
                    "schema:value": "100",
                    "schema:unitCode": "KGM"
                },
                "lastContact": "4 April 2014 UTC",
```

What we've done so far

- Three major parts/tools:
  - A **vocabulary of concepts**
  - A set of metadata **crosswalks**
  - A collection of **JSON-LD example files**
- The public facing part: Our website
  - https://schema.space/
  - Example concept: https://schema.space/metasat/FPGA

FPGA

Field-Programmable Gate Array

https://schema.space/metasat/FPGA

Description: Array of logic gates that are reprogrammable (source)

Example: None

Synonym(s): None

Concept Segments: Space Segment, Ground Segment

Concept Families: Communications, Computer Hardware

suggest an edit

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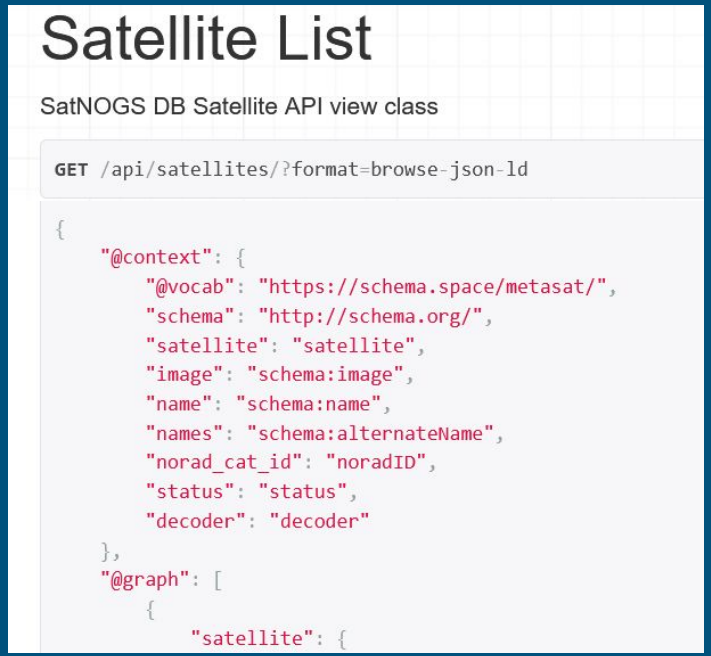
- The implementation: SatNOGS

MetaSat is a collaborative effort with the SmallSat community

- SatNOGS API



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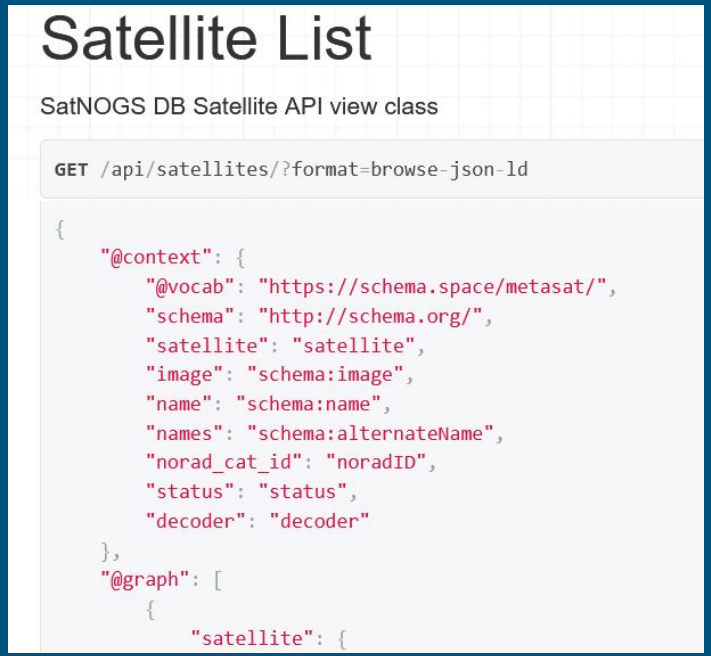
- SatNOGS API
- Jonathan's space report – GCAT
  - General Catalog of Artificial Space Objects
  - Publicly available but hard to use (txt or tsv files)



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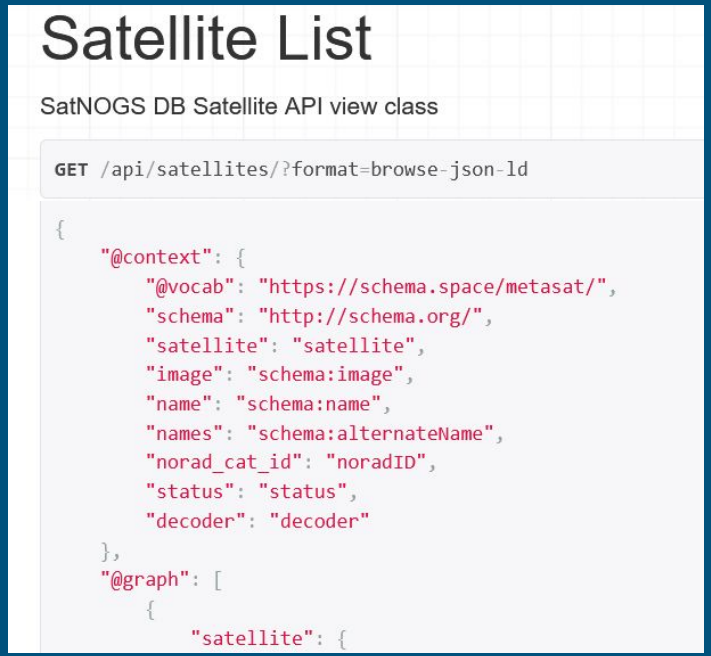

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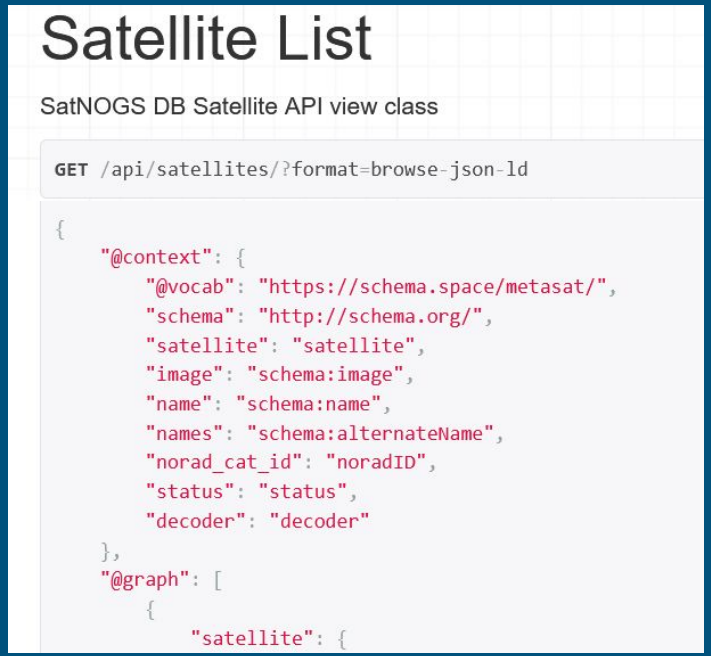
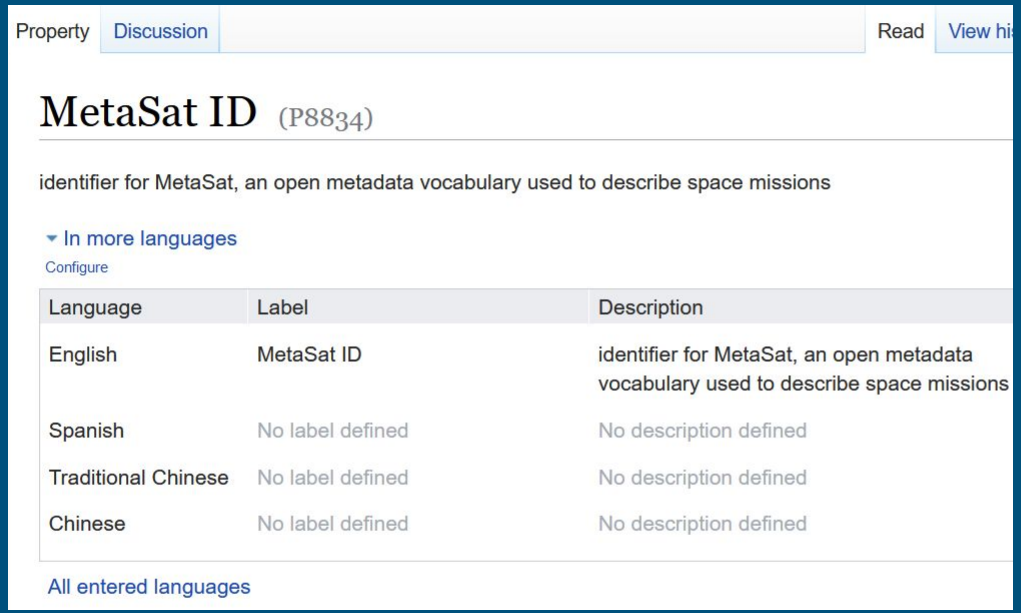
- Enables future federated search
  - A single search application can search a variety of sources



What we're doing next

- Official 1.0 release
- RDF implementation
  - Linked data!
- Wikidata incorporation
  - Wikidata item: Q101095843
  - Wikidata property: P8834



Want to contribute?

- Please do! This is an open project
- Leave us an issue on our GitLab repo
  - https://gitlab.com/metasat/metasat-schema
- Email us (metasat@schema.space)
- Email me! (allie.williams@cfa.harvard.edu)
- Can give suggestions or ask for clarification, let us know what topics are unclear to you and we can make guides, as well!