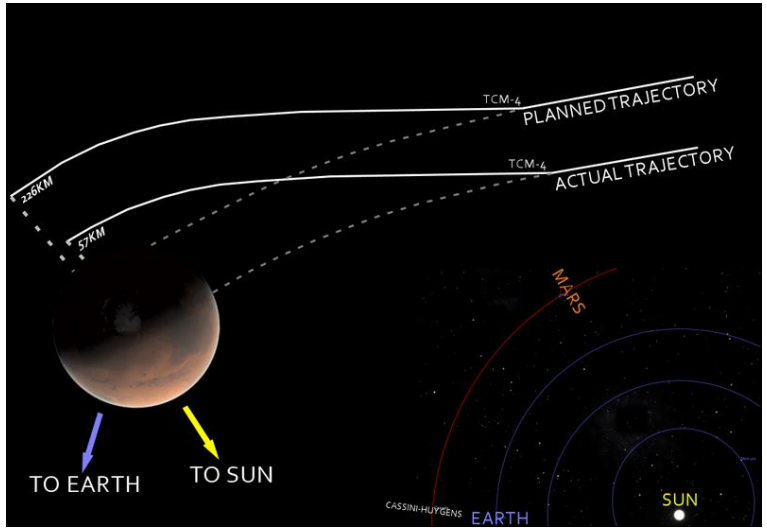
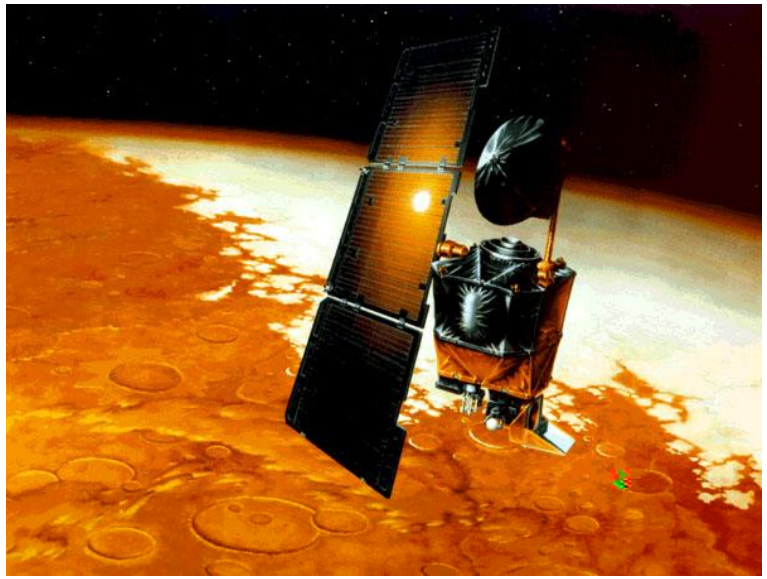
QUDT

QUDT Introduction

A key NASA Motivation



Web posted at: 1:46 p.m. EDT (1746 GMT)



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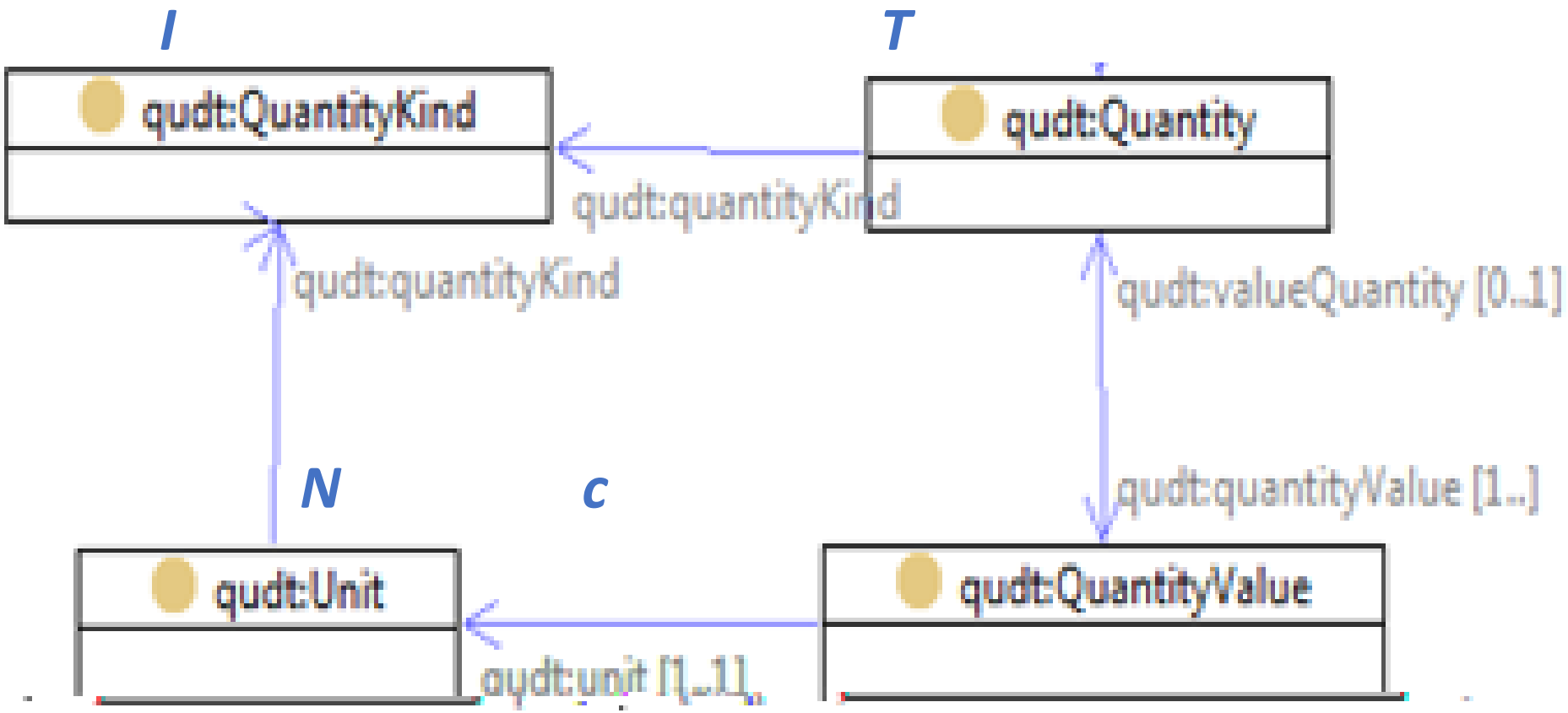
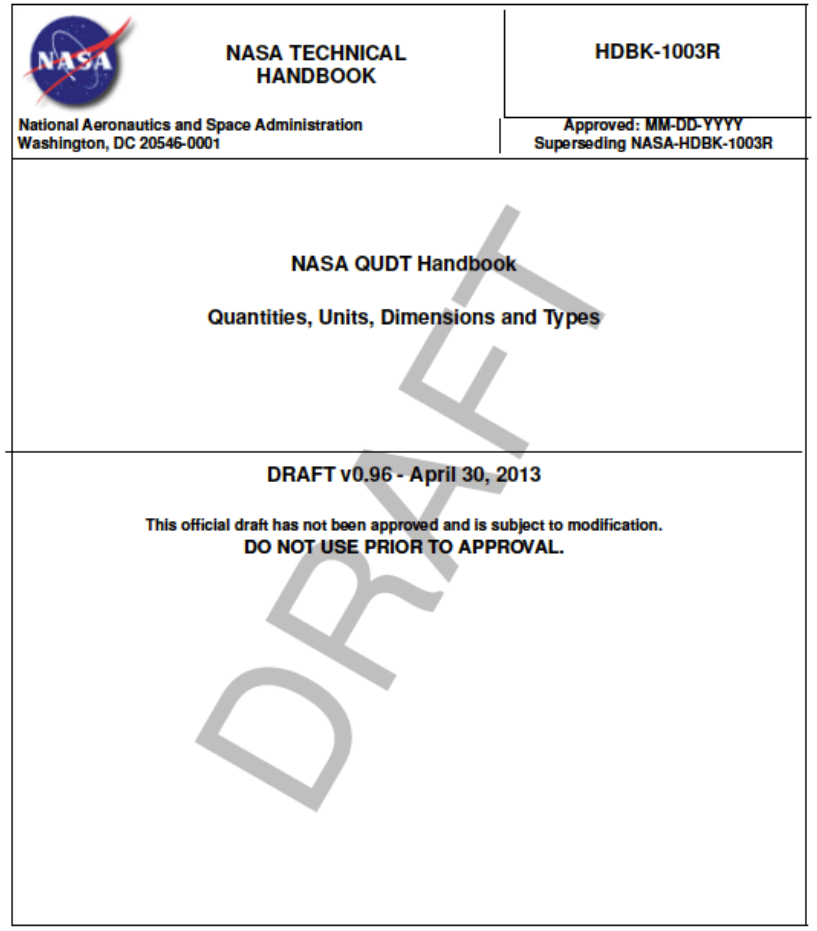
Machine-readable Metadata



NASA Motivations For the Constellation Program (Return to Moon and Mars)



NASA TECHNICAL HANDBOOK

HDBK-1003R

National Aeronautics and Space Administration
Washington, DC 20546-0001

Approved: MM-DD-YYYY
Superseding NASA-HDBK-1003R

NASA QUDT Handbook

Quantities, Units, Dimensions and Types

DRAFT v0.96 - April 30, 2013

This official draft has not been approved and is subject to modification.
DO NOT USE PRIOR TO APPROVAL.

DRAFT

The electronic version is the official approved document. Verify this is the correct version before use.

THIS HANDBOOK HAS NOT BEEN REVIEWED FOR EXPORT CONTROL RESTRICTIONS; CONSULT YOUR CENTER/FACILITY/HEADQUARTERS EXPORT CONTROL PROCEDURES/AUTHORITY PRIOR TO DISTRIBUTION OF THIS DOCUMENT.

NASA QUDT started with ISO-80000 standards

What is QUDT.org?

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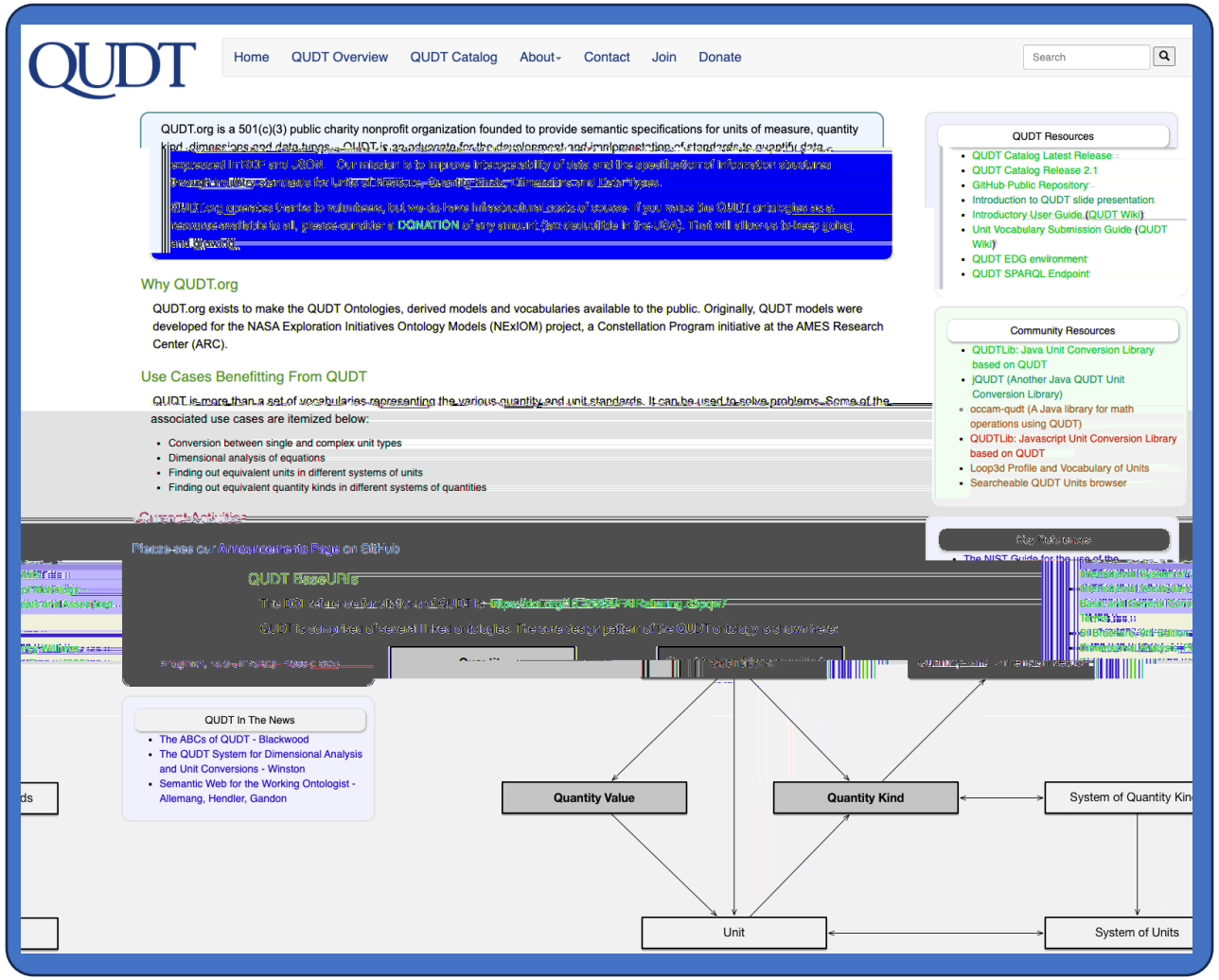

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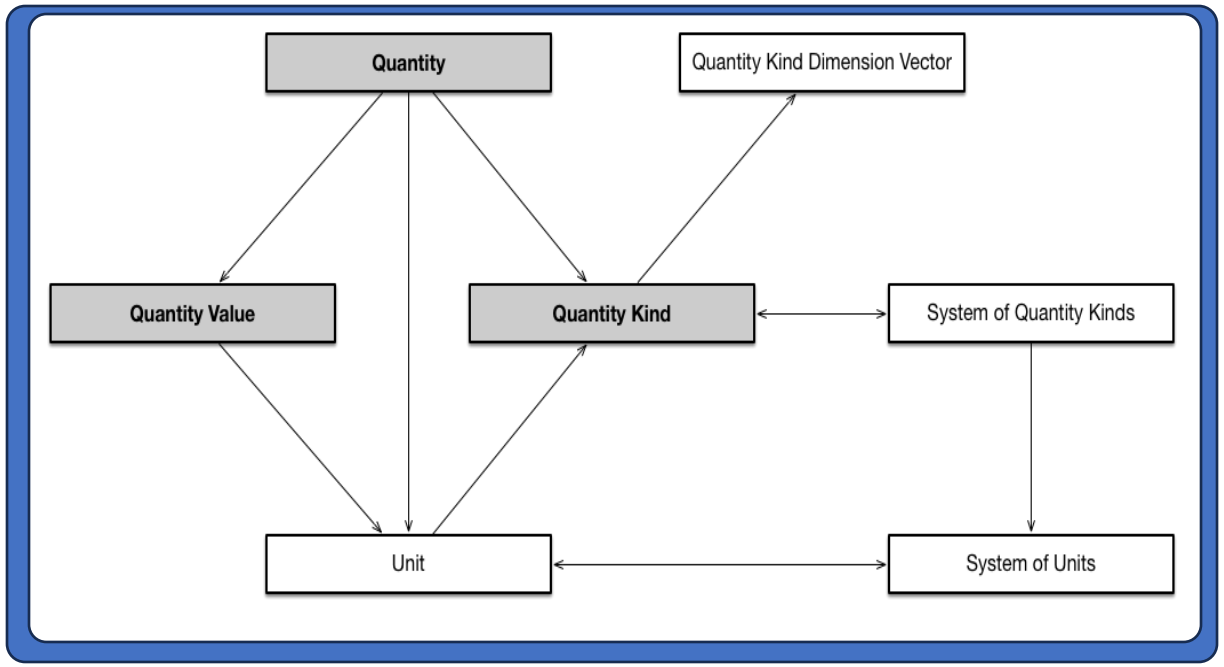
What is QUDT?



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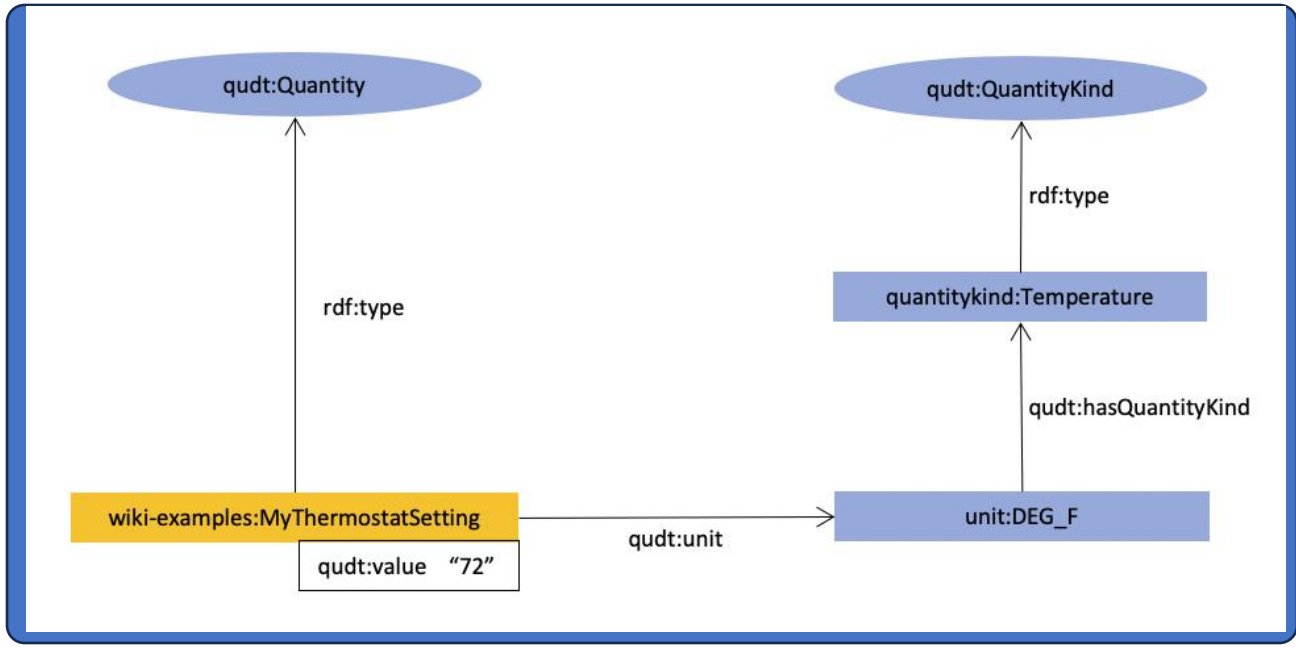

Key Features of QUDT

- Exists as a set of FAIR-compliant modular graphs for
  - Schema (both OWL and SHACL)
  - Vocabularies of
    - 2807 Units
    - 1169 Quantity Kinds
    - 224 Dimension Vectors (for the 7 SI base dimensions)
    - 328 Physical Constants
    - 11 Systems of Units
    - 10 Systems of Quantity Kinds
- Fully resolvable URIs for all vocabulary instances, (with content negotiation), and for the entire graphs
- Defined grammar for unit URI names
- Encoded as Turtle RDF files
- Web-based browsing and SPARQL querying
- QUDT is licensed under a Creative Commons Attribution 4.0 International License

Adoption – Standards Activities

Adoption – Sample of Organisations

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Community Software Contributions

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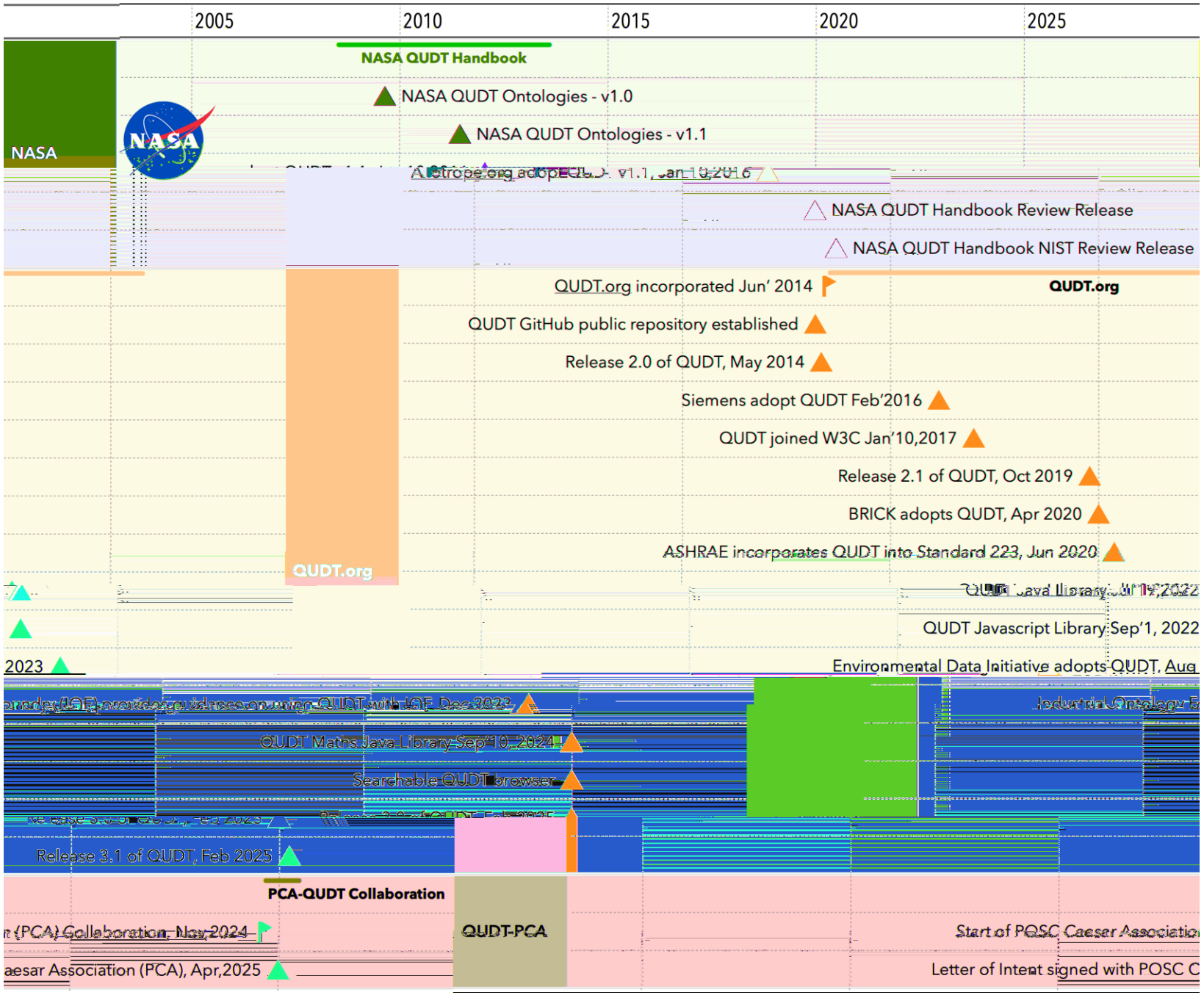
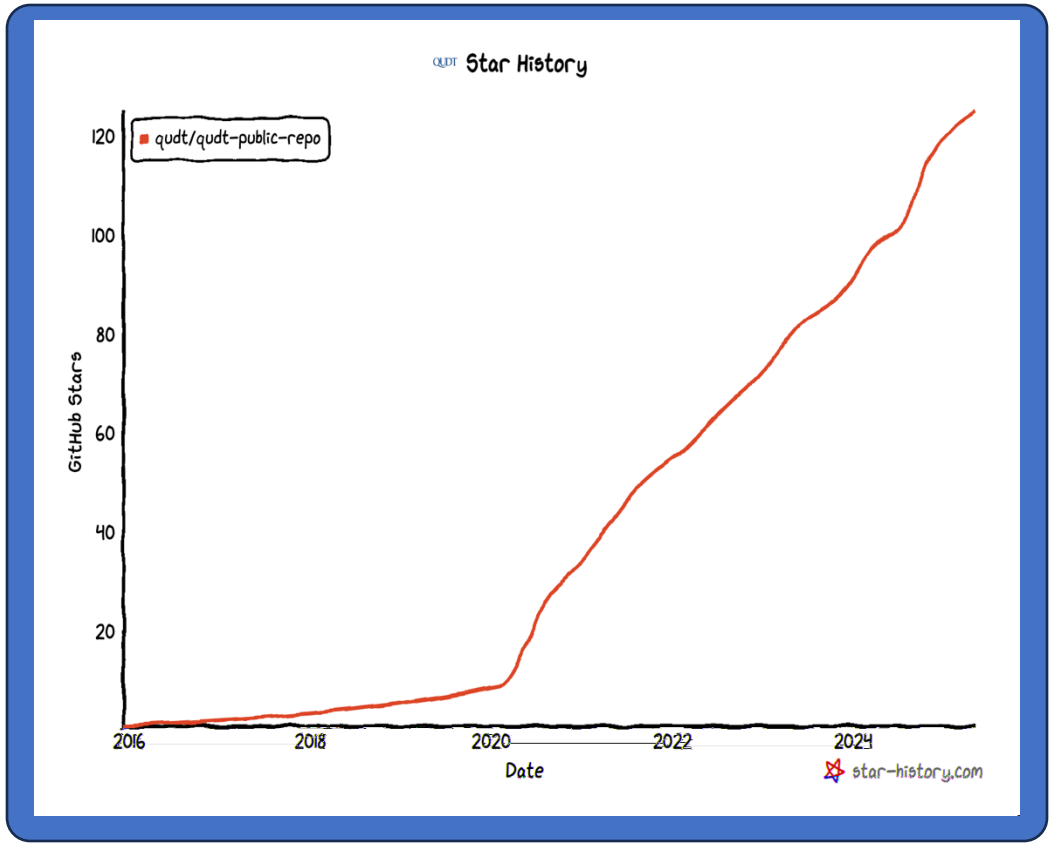
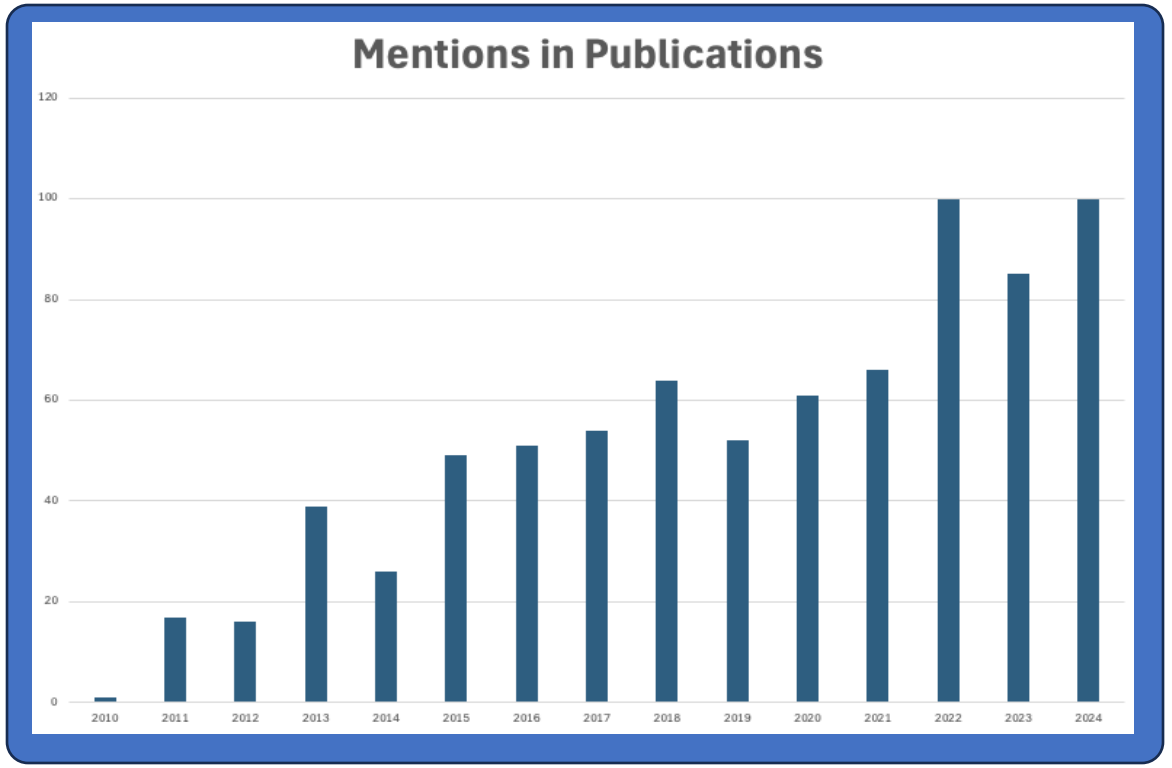

2005
2010
2015
2020
2025
NASA QUDT Handbook
NASA
NASA QUDT Ontologies - v1.0
NASA QUDT Ontologies - v1.1
NASA QUDT Handbook Review Release
NASA QUDT Handbook NIST Review Release
QUDT.org incorporated Jun' 2014
QUDT.org
QUDT GitHub public repository established
Release 2.0 of QUDT, May 2014
Siemens adopt QUDT Feb'2016
QUDT joined W3C Jan'10,2017
Release 2.1 of QUDT, Oct 2019
BRICK adopts QUDT, Apr 2020
ASHRAE incorporates QUDT into Standard 223, Jun 2020
QUDT.org
QUDT Javascript Library Sep'1, 2022
2023
Environmental Data Initiative adopts QUDT, Aug
QUDT Maths Java Library Sep'10, 2024
Searchable QUDT browser
Release 3.1 of QUDT, Feb 2025
PCA-QUDT Collaboration
QUDT-PCA
Letter of Intent signed with POSC C

Interest Trends





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Finding out more …

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- _____
- _____
- _____

Demo 1: Units of Force

```
SELECT DISTINCT ?qk ?qku (COALESCE(?labelEn, ?qkl) AS ?label)
WHERE {
    BIND (quantitykind:Force AS ?arg1) .
    ?qk rdf:type qudt:QuantityKind .
    FILTER (?qk = ?arg1) .
    ?qku qudt:hasQuantityKind ?qk .
   ?qku a qudt:Unit .
   ?qku rdfs:label ?qkl .
    OPTIONAL {
    ?qku rdfs:label ?labelEn .
    FILTER (lang(?labelEn) = "en")
  }
} ORDER BY ?qku
```

which results in 23 values for ?qku:

qk	qku	label
qudtqk:Force	unit:CentiN	CentiNewton
qudtqk:Force	unit:DYN	Dyne
qudtqk:Force	unit:DeciN	DeciNewton
qudtqk:Force	unit:GM_F	Gram Force
qudtqk:Force	unit:GigaN	GigaN
qudtqk:Force	unit:KIP_F	Kip
qudtqk:Force	unit:KiloGM-M-PER-SEC2	kilogram metre per second squared
qudtqk:Force	unit:KiloGM_F	Kilogram Force
qudtqk:Force	unit:KiloLB_F	KiloPound Force
qudtqk:Force	unit:KiloN	Kilonewton
qudtqk:Force	unit:KiloPOND	Kilopond
qudtqk:Force	unit:LB_F	Pound Force

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Demo 2: Unit Conversion

```
SELECT DISTINCT ?toConvert ?label ?into (COALESCE(?labelEn, ?otherUnitLabel) AS ?otherlabel) ?multiplyB
WHERE {
BIND ("To convert" AS ?toConvert) .
BIND ("into" AS ?into) .
BIND ("multiply by" AS ?multiplyBy) .
BIND (unit:MilliGRAY as ?unit) .
?unit rdfs:label ?label .
?unit qudt:conversionMultiplier ?cm1 .
?unit qudt:hasQuantityKind/qudt:hasDimensionVector ?qkdv .
?otherUnit qudt:hasQuantityKind/qudt:hasDimensionVector ?qkdv .
?otherUnit a qudt:Unit .
FILTER (?otherUnit != ?unit) .
?otherUnit qudt:conversionMultiplier ?cm2 .
?otherUnit rdfs:label ?otherUnitLabel .
  OPTIONAL {
    ?otherUnit rdfs:label ?labelEn .
    FILTER (lang(?labelEn) = "en") .
}
BIND ((?cm1/?cm2) AS ?multiplier) .
}
ORDER BY ?otherlabel
```

Executing this query produces output that looks like this:

```
Milligray       into    BTU-IT-PER-lb                                   multiply by     0.000000429922
Milligray       into    British Thermal Unit (TH) per Pound             multiply by     0.000000430210433
Milligray       into    Calorie (international Table) per Gram          multiply by     0.00000023884589662
Milligray       into    Calorie (thermochemical) per Gram               multiply by     0.00000023900573613
Milligray       into    Erg per Gram                                    multiply by     10.0
```

Supporting information

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QUDT Supports Multiple Communities

- Linked Data community
  - Resolvable URIs for graphs and individuals
  - Continuously updated
- Industrial User community
  - Versioning of Releases for embedding and managing within industrial applications
- Choice of OWL or SHACL representation for the schemas
- Explicit or dynamically inferred (SHACL) properties
  - E.g. “applicableUnits” for each QuantityKind
- Available for use with or without the need for reasoners

Future standards should keep these disparate needs in mind

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F.A.I.R.

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Governance Management

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Governance

Policies, Principles, Processes, Issues, Measures

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Quality Assurance

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Current Developments

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