

Observation Facilities in the VO

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Why

- **ObsTAP / EPN-TAP** have “facility” / “instrument_host_name” keywords respectively. For efficient data mining, a standardization of such nomenclature is needed.
- *The same is true for target names: EPN-TAP is requiring that IAU names are used for bodies in the solar system.*
- There is no official standard for “observation facilities” names. We propose to build such list.
- The goal is to have that list endorsed by a long-lived international alliance, to ensure its sustainability (such as IAU, IVOA, IPDA...).

What

- Facilities are the spacecraft/telescopes:

Grouping of Facilities	Facilities
Institute/Observatory	Telescope
Space Mission	Spacecraft
Institute/University	Experiment Facility
Institute/Project	Field Analogue
Institute/University	Numerical Experiment/Model

- We focus here on “Telescopes” and “Spacecraft” types of facilities
- Grouping of facilities may not always be present, or may not represent a group of colocated facilities (e.g. the LOFAR international stations all over Europe, or the VLA network)

Spacecraft

- Several spacecraft name lists available:
 - NASA/NAIF (Navigation and Ancillary Information Facility)
 - NASA/NSSDC (National Space Science Data Center)
 - NASA/PDS (Planetary Data System)
 - SPASE/SMWG (Solar and Magnetospheric Working Group)
 - SANA (Space Assigned Numbers Authority)
- Not the same names (upper/lower case, but not only) nor same IDs, although most are compiled by NASA entities.
- Spacecraft may also be part of a Mission.
E.g.: *The Cassini-Orbiter and Huygens-Probe are two spacecraft of the Cassini-Huygens Mission.*

Available Lists

List	Facility Type	number of Records
NSSDC	space	7203
NASA/NAIF	space	196
NASA/PDS	space	50+
SPASE	space + ground	215
SANA	space	1053
AAS	ground	417
Harvard/ADS	ground	257
IRAF	ground	58
IAU/MPC	ground	1864
Xephem	ground	461

Available Information

List	Name	ID	Alt Name	Desc	Contact	Location	Launch	URL	Target	WL Range
NSSDC	x	x					x	x		
NASA/NAIF	x	x								
NASA/PDS	x	x			x				x	
SPASE	x	x	x	x	x	x		x	x	x
SANA	x	x			x					
AAS	x	x								x
Harvard/ADS	x	x								
IRAF	x	x				x				
IAU/MPC	x	x				x				
Xephem	x	x				x				

Spacecraft lists SPASE/SMWG

<http://www.spase-group.org/smwg/explorer/>

The screenshot displays the SPASE/SMWG Explorer interface. The top banner features the SPASE logo on the left and the text "SPACE PHYSICS ARCHIVE SEARCH AND EXTRACT" on the right. Below the banner is a navigation pane on the left with a tree view of spacecraft categories: SMWG, Document, Instrument, and Observatory. Under Observatory, various spacecraft are listed, including ACE, AE-C, AE-D, AE-E, AE, AIM, AMPTE, AMPTE_CCE, AMPTE_IRM, AMPTE_UKS, ARTEMIS, AUGSBURG, AUGSBURG, Aeros-A, Akebono, Alouette1, Alouette2, Apollo12-LM, Apollo14-LM, Apollo15-LM, Aureol3, BARREL, BAS, BBSO, CANMOS, CANOPUS, CARISMA, and CHAMP. The ACE spacecraft is selected and highlighted.

The main content area shows the "Overview" tab for the ACE spacecraft. The page title is "Observatory: ACE". The "Observatory ID" is "spase://SMWG/Observatory/ACE" with an XML link. The "Name" is "ACE". The "Alternate name" includes "Advanced Composition Explorer", "1997-045A", and "Explorer 71". The "Description" states: "The objective of the Advanced Composition Explorer (ACE) is to collect observations of particles of solar, interplanetary, interstellar, and galactic origins, spanning the energy range from that of KeV solar wind ions to galactic cosmic ray nuclei up to 600 MeV/nucleon. Definitive studies will be made of the abundances of essentially all isotopes from H to Zn (Z = 1-30), with exploratory isotope studies extending to Zr (Z = 40). The ACE payload includes six high resolution spectrometers, each designed to provide the optimum charge, mass, or charge-state resolution in its particular energy range. Each spectrometer has a geometry factor optimized for the expected flux levels, so as to provide a collecting power greater by a factor of 10-1000 times that of previous or planned experiments. The payload also includes three additional instruments of standard design to monitor energetic electrons, H and He ions, and a magnetometer. The ACE spacecraft is based on the design of the Charge Composition Explorer, built at JHU/APL for the Active Magnetospheric Particle Tracer Explorer (AMPTE) program. The spacecraft spin axis is pointed towards the Sun to within +/- 20 degrees, and it occupies a halo orbit about the L1 Earth-Sun libration point. Powered by solar cells, the spacecraft has a design life of at least five years, and it returns data in daily tape recorder dumps, received through NASA JPL's Deep Space Network and initially processed at NASA-GSFC. The average data telemetry rate is 6.7 Kbs."

The "Additional information" section includes links to the "ACE Home Page" (ACE mission home page at Caltech with data download) and "NSSDC's Master Catalog" (Information about the ACE mission).

The "Contact" section shows a table with the following entry:

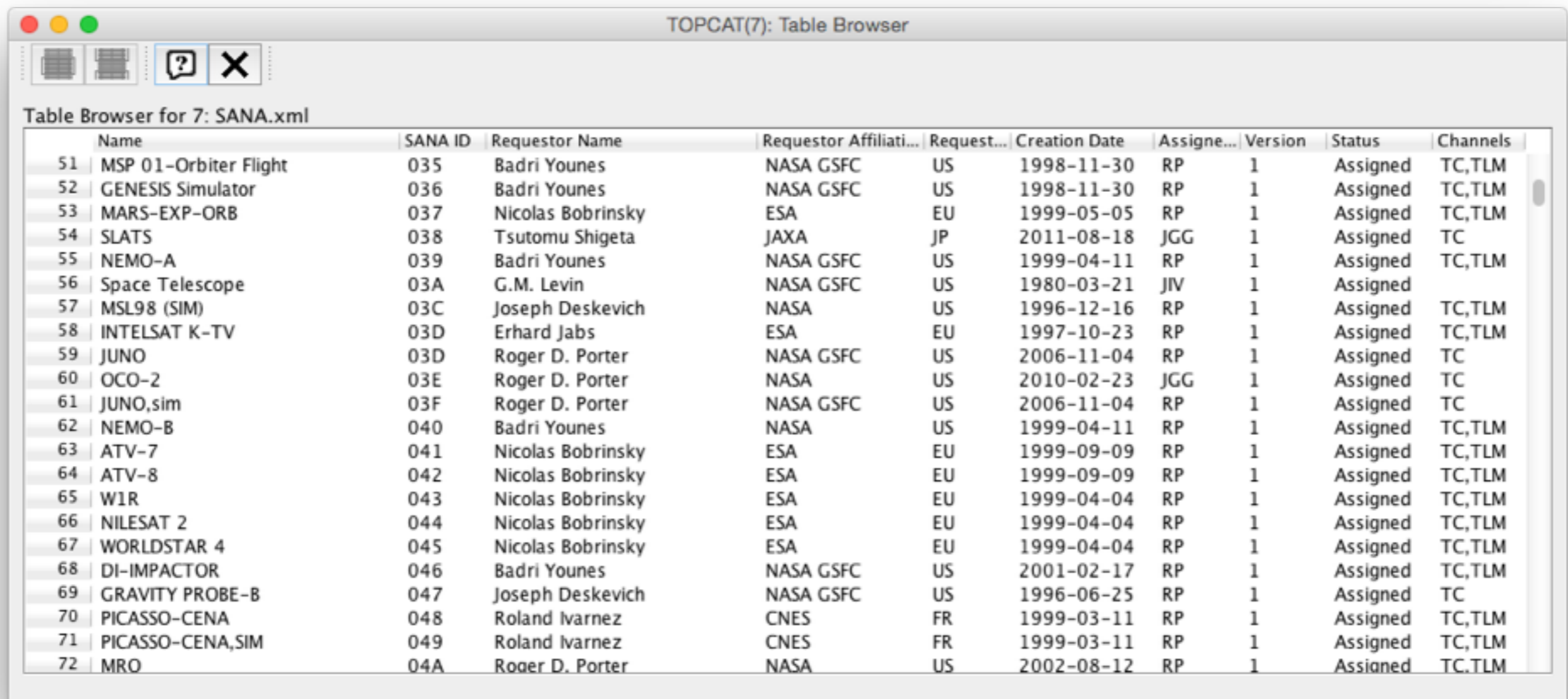
Role	Person
1. Principal investigator	spase://SMWG/Person/Edward.C.Stone.Jr XML

The "Release date" is "2010-08-05 18:19:16". The "Prior ID" is "spase://vspo/observatory/2".

Spacecraft lists

SANA

1053 items



TOPCAT(7): Table Browser

Table Browser for 7: SANA.xml

	Name	SANA ID	Requestor Name	Requestor Affiliati...	Request...	Creation Date	Assigne...	Version	Status	Channels
51	MSP 01-Orbiter Flight	035	Badri Younes	NASA GSFC	US	1998-11-30	RP	1	Assigned	TC,TLM
52	GENESIS Simulator	036	Badri Younes	NASA GSFC	US	1998-11-30	RP	1	Assigned	TC,TLM
53	MARS-EXP-ORB	037	Nicolas Bobrinsky	ESA	EU	1999-05-05	RP	1	Assigned	TC,TLM
54	SLATS	038	Tsutomu Shigeta	JAXA	JP	2011-08-18	JGG	1	Assigned	TC
55	NEMO-A	039	Badri Younes	NASA GSFC	US	1999-04-11	RP	1	Assigned	TC,TLM
56	Space Telescope	03A	G.M. Levin	NASA GSFC	US	1980-03-21	JIV	1	Assigned	
57	MSL98 (SIM)	03C	Joseph Deskevich	NASA	US	1996-12-16	RP	1	Assigned	TC,TLM
58	INTELSAT K-TV	03D	Erhard Jabs	ESA	EU	1997-10-23	RP	1	Assigned	TC,TLM
59	JUNO	03D	Roger D. Porter	NASA GSFC	US	2006-11-04	RP	1	Assigned	TC
60	OCO-2	03E	Roger D. Porter	NASA	US	2010-02-23	JGG	1	Assigned	TC
61	JUNO,sim	03F	Roger D. Porter	NASA GSFC	US	2006-11-04	RP	1	Assigned	TC
62	NEMO-B	040	Badri Younes	NASA	US	1999-04-11	RP	1	Assigned	TC,TLM
63	ATV-7	041	Nicolas Bobrinsky	ESA	EU	1999-09-09	RP	1	Assigned	TC,TLM
64	ATV-8	042	Nicolas Bobrinsky	ESA	EU	1999-09-09	RP	1	Assigned	TC,TLM
65	W1R	043	Nicolas Bobrinsky	ESA	EU	1999-04-04	RP	1	Assigned	TC,TLM
66	NILESAT 2	044	Nicolas Bobrinsky	ESA	EU	1999-04-04	RP	1	Assigned	TC,TLM
67	WORLDSTAR 4	045	Nicolas Bobrinsky	ESA	EU	1999-04-04	RP	1	Assigned	TC,TLM
68	DI-IMPACTOR	046	Badri Younes	NASA GSFC	US	2001-02-17	RP	1	Assigned	TC,TLM
69	GRAVITY PROBE-B	047	Joseph Deskevich	NASA GSFC	US	1996-06-25	RP	1	Assigned	TC
70	PICASSO-CENA	048	Roland Ivarnez	CNES	FR	1999-03-11	RP	1	Assigned	TC,TLM
71	PICASSO-CENA,SIM	049	Roland Ivarnez	CNES	FR	1999-03-11	RP	1	Assigned	TC,TLM
72	MRO	04A	Roger D. Porter	NASA	US	2002-08-12	RP	1	Assigned	TC,TLM

Telescope lists

IAU/MPC

1864 items

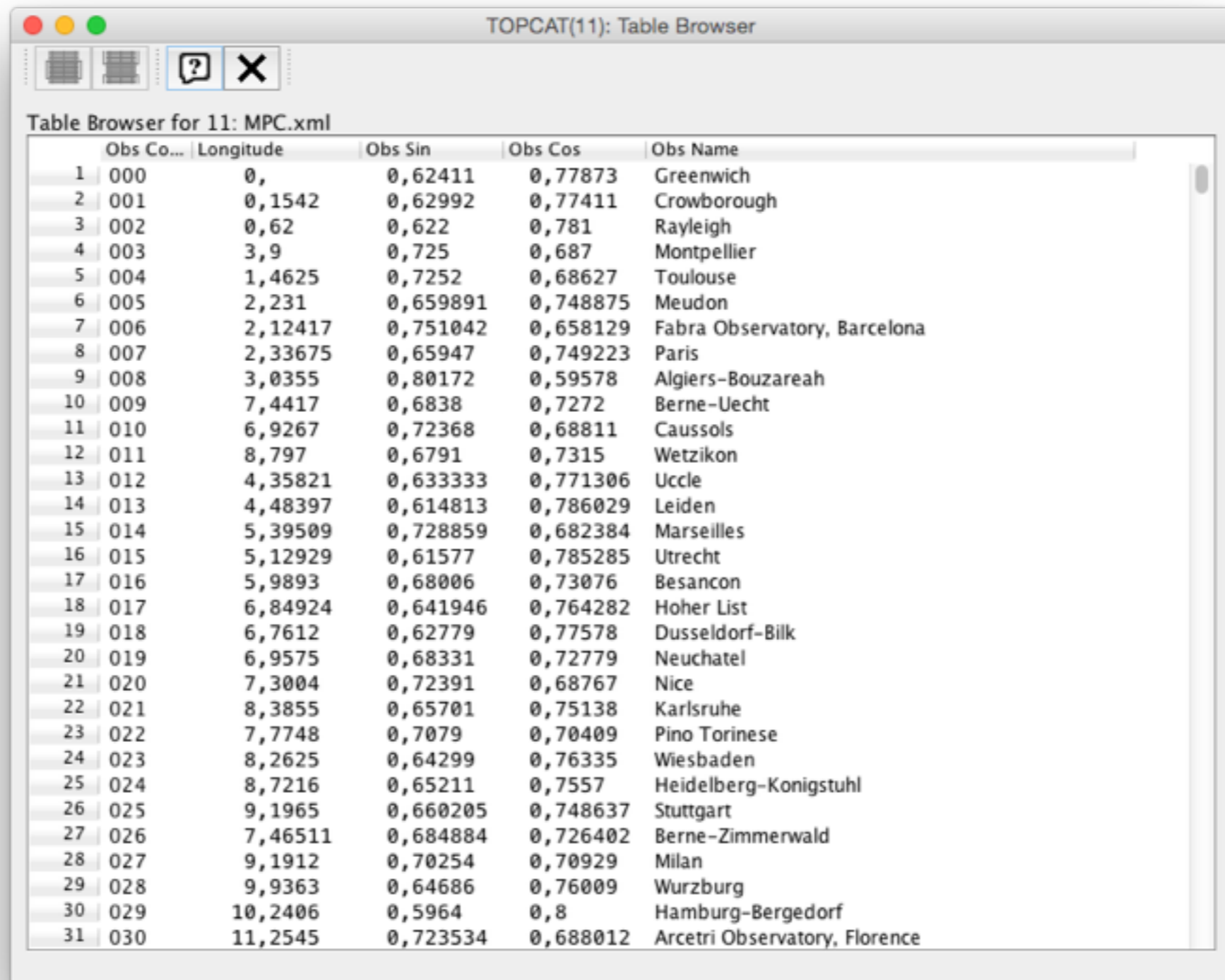


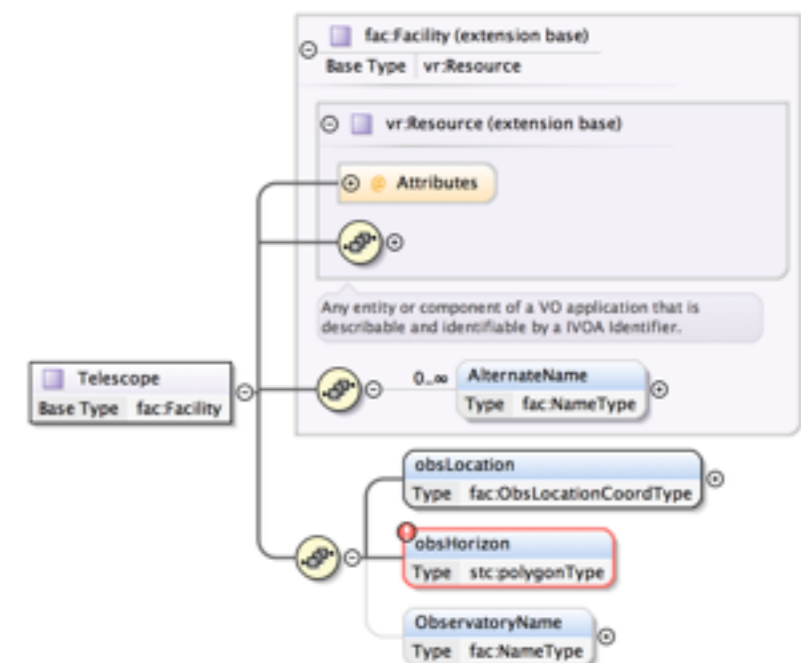
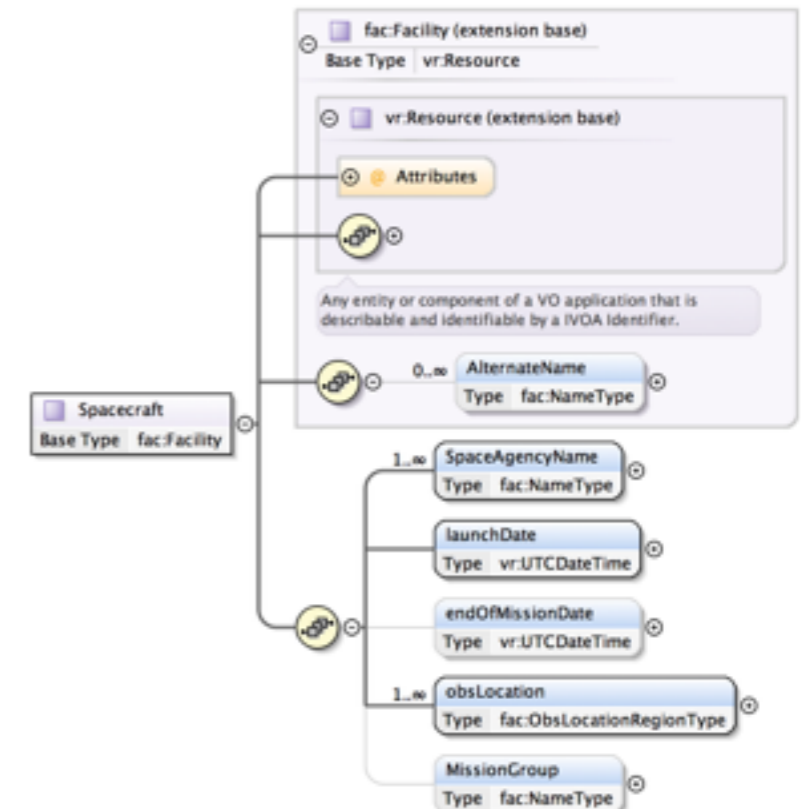
Table Browser for 11: MPC.xml

	Obs Co...	Longitude	Obs Sin	Obs Cos	Obs Name
1	000	0,	0,62411	0,77873	Greenwich
2	001	0,1542	0,62992	0,77411	Crowborough
3	002	0,62	0,622	0,781	Rayleigh
4	003	3,9	0,725	0,687	Montpellier
5	004	1,4625	0,7252	0,68627	Toulouse
6	005	2,231	0,659891	0,748875	Meudon
7	006	2,12417	0,751042	0,658129	Fabra Observatory, Barcelona
8	007	2,33675	0,65947	0,749223	Paris
9	008	3,0355	0,80172	0,59578	Algiers-Bouzareah
10	009	7,4417	0,6838	0,7272	Berne-Uecht
11	010	6,9267	0,72368	0,68811	Caussols
12	011	8,797	0,6791	0,7315	Wetzikon
13	012	4,35821	0,633333	0,771306	Uccle
14	013	4,48397	0,614813	0,786029	Leiden
15	014	5,39509	0,728859	0,682384	Marseilles
16	015	5,12929	0,61577	0,785285	Utrecht
17	016	5,9893	0,68006	0,73076	Besancon
18	017	6,84924	0,641946	0,764282	Hoher List
19	018	6,7612	0,62779	0,77578	Dusseldorf-Bilk
20	019	6,9575	0,68331	0,72779	Neuchatel
21	020	7,3004	0,72391	0,68767	Nice
22	021	8,3855	0,65701	0,75138	Karlsruhe
23	022	7,7748	0,7079	0,70409	Pino Torinese
24	023	8,2625	0,64299	0,76335	Wiesbaden
25	024	8,7216	0,65211	0,7557	Heidelberg-Konigstuhl
26	025	9,1965	0,660205	0,748637	Stuttgart
27	026	7,46511	0,684884	0,726402	Berne-Zimmerwald
28	027	9,1912	0,70254	0,70929	Milan
29	028	9,9363	0,64686	0,76009	Wurzburg
30	029	10,2406	0,5964	0,8	Hamburg-Bergedorf
31	030	11,2545	0,723534	0,688012	Arcetri Observatory, Florence

VOFacility

as an extension of VOResource

- Extension of VOResource with addition of:
`<alternateName>` + “namingAuthority” attribute
`<title>Cassini</title>`
`<alternateName>CASSINI</alternateName>`
`<alternateName>Cassini Orbiter</alternateName>`
`<alternateName namingAuthority="naif">-82</alternateName>`
`<alternateName namingAuthority="nssdc">1997-061A</alternateName>`
`<alternateName namingAuthority="pds">co</alternateName>`
- **Spacecraft** = extension of Facility with:
 + LaunchDate + EndOfMissionDate
 + SpaceAgencyName + MissionGroup +
 + ObsLocation [ObsRegion + TimeInterval [StartTime + StopTime]]
- **Telescope** = extension of Facility with:
 + ObservatoryName
 + ObsLocation [long,lat,alt]
 + ObsHorizon [polygon]
- Next: Add Instruments with references to Facilities.
- Next-next:FieldAnalog, Laboratory Experiment and Numerical Experiment



List Compilation

- Compilation using match functions of TOPCAT is possible, but not very efficient: a lot of things to be fixed by hand.
- Definition of adequate list format needed:
 - JSON formatted record will be created for name-resolver (ElasticSearch at IMCCE, same as SSODnet)
 - Other: VOFacility XML records ? VOTable ?
- Once standard list is compiled in adequate form: propose list for endorsement to IPDA/IAU/IVOA

Current Work Plan

There are several objectives to this action:

- Create a **name resolver** for observation facilities (ground based observatories and space missions)
- Promote a **standard nomenclature** for Observation Facilities
- There are several lists of observation facilities and a need to be able to search for observation facilities, whatever alias is used. This means: being able to link those lists.
- Help **observation planning** with provision of sky horizon elevations at each Observatory
- Related to that: find a way to generate automatically horizon from google API, or GIS ? Then users can edit it for fine tuning buildings etc. Maybe use something like the footprint editor?
http://aladin.u-strasbg.fr/footprint_editor/
- Set up a database for **amateur astronomer** observatories
- **Extend the EPN-TAP core** data model in order to be able to include observatories and **share the 'matrix of observatories' (<http://iwf.oeaw.ac.at/matrix/>) database via EPN-TAP**. The basis for the data model additions will be provided by VOFacility and VOResource definitions.

Inventory

- <https://voparis-confluence.obspm.fr/display/VES/Existing+List+of+Observatories+and+Spacecraft>
- Austrian team started to cross-match all identified lists. Result to be used in their “Observatory Matrix”

```
{ "nssdc:2004-023A": { "alternateName": { "namingAuthority": "nssdc", "name": "Navstar 55", "id": "2004-023A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=2004-023A", "title": "NSSDC catalog entry" }, "launchDate": "2004-06-23" }, "nssdc:1973-105A": { "alternateName": { "namingAuthority": "nssdc", "name": "Cosmos 625", "id": "1973-105A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1973-105A", "title": "NSSDC catalog entry" }, "launchDate": "1973-12-21" }, "nssdc:1967-023A": { "alternateName": { "namingAuthority": "nssdc", "name": "Cosmos 148", "id": "1967-023A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1967-023A", "title": "NSSDC catalog entry" }, "launchDate": "1967-03-16" }, "xephem:Lick Observatory (36-inch)": { "alternateName": { "namingAuthority": "xephem", "name": "Lick Observatory (36-inch)", "id": "xephem:Lick Observatory (36-inch)" }, "facilityType": "observatory", "location": { "coordinates": { "lat": 37.33333333333336, "alt": 1290.0, "lon": 121.65 } }, "nssdc:1977-001A": { "alternateName": { "namingAuthority": "nssdc", "name": "Cosmos 888", "id": "1977-001A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1977-001A", "title": "NSSDC catalog entry" }, "launchDate": "1977-01-06" }, "nssdc:1977-054A": { "alternateName": { "namingAuthority": "nssdc", "name": "Molniya 1-37", "id": "1977-054A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1977-054A", "title": "NSSDC catalog entry" }, "launchDate": "1977-06-24" }, "xephem:Kenosha": { "alternateName": { "namingAuthority": "xephem", "name": "Kenosha", "id": "xephem:Kenosha" }, "facilityType": "observatory", "location": { "country": "Wisconsin", "coordinates": { "lat": 42.59527777777778, "alt": 185.9, "lon": 87.83638888888889 } }, "nssdc:1981-003A": { "alternateName": { "namingAuthority": "nssdc", "name": "Cosmos 1238", "id": "1981-003A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1981-003A", "title": "NSSDC catalog entry" }, "launchDate": "1981-01-16" }, "iau-mpc:106": { "alternateName": { "namingAuthority": "iau-mpc", "id": "106", "name": "Crni Vrh" }, "facilityType": "observatory", "location": { "coordinates": { "cos": 0.69662, "lon": 14.0711, "sin": 0.71519 } }, "iau-mpc:107": { "alternateName": { "namingAuthority": "iau-mpc", "id": "107", "name": "Cavezzo" }, "facilityType": "observatory", "location": { "coordinates": { "cos": 0.70998, "lon": 11.003, "sin": 0.70186 } }, "iau-mpc:104": { "alternateName": { "namingAuthority": "iau-mpc", "id": "104", "name": "San Marcello Pistoiese" }, "facilityType": "observatory", "location": { "coordinates": { "cos": 0.71985, "lon": 10.8042, "sin": 0.69202 } }, "nssdc:1972-018A": { "alternateName": { "namingAuthority": "nssdc", "name": "DMSP 5B/F2", "id": "1972-018A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1972-018A", "title": "NSSDC catalog entry" }, "launchDate": "1972-03-24" }, "iau-mpc:103": { "alternateName": { "namingAuthority": "iau-mpc", "id": "103", "name": "Ljubljana" }, "facilityType": "observatory", "location": { "coordinates": { "cos": 0.694, "lon": 14.47, "sin": 0.715 } }, "iau-mpc:100": { "alternateName": { "namingAuthority": "iau-mpc", "id": "100", "name": "Ahtari" }, "facilityType": "observatory", "location": { "coordinates": { "cos": 0.462, "lon": 24.13, "sin": 0.884 } }, "iau-mpc:101": { "alternateName": { "namingAuthority": "iau-mpc", "id": "101", "name": "Kharkov" }, "facilityType": "observatory", "location": { "coordinates": { "cos": 0.64403, "lon": 36.2322, "sin": 0.76246 } }, "nssdc:1976-028A": { "alternateName": { "namingAuthority": "nssdc", "name": "Cosmos 810", "id": "1976-028A" }, "facilityType": "spacecraft", "referenceURL": { "url": "http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1976-028A", "title": "NSSDC catalog entry" }, "launchDate": "1976-03-26" },
```

NB: New page just added from PDS4 search interface

Resolver at IMCCE: Quaero

- Same name resolver as SSoDNet, using a rest interface.

- Some data already included:

<https://api.ssodnet.imcce.fr/quaero/1/sso/ACE>

Result:

```
{"class":["Orbiter","Payload","Operational"],  
"updated":"2017-05-09","name":"ACE","aliases":  
["1997-045A","24912","ADVANCED COMPOSITION  
EXPLORER"],"parent":"Sun","system":"Sun","id":"ACE",  
"ephemeris":false,"type":"Spacecraft"}
```

Goal of today's meeting

- Presentation of IMCCE resolver
- Presentation of IWF observatory database and lists matching process
- Decide on consistent record structure (IMCCE/IWF)
- Decide on update and exchange process
- Next steps