

# Facilities and Instruments in the IVOA Registry and Resources

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# Context

- The VESPA group has developed EPN-TAP, a protocol similar to ObsTAP for solar system and planetary observational data.
- In the description, the facility and instrument are part of the observations metadata.
- Databases or archives may have different names for facilities or instruments
- There is a need for a reference list for such objects and the registry is probably the right place to store it.



# IPDA/IVOA interaction

- Other contextual aspect: IPDA is proposing to build a planetary facility and instrument list, in collaboration with other communities (such as IVOA, SPASE, IAU...)
- Proposed plan:
  - IPDA (and planetary data partners) to provide a reference list of planetary space missions and instruments.
  - SPASE (and other heliophysics partners) to provide a reference list of heliophysics missions and instruments.
  - IVOA (and other astrophysics partners) to provide a reference list of astrophysics facility and instruments (with planetary observations in our case, but not only)
  - Other partners (Europlanet and IMPEX, for instance) can start the list of models, simulations, field analogs

# Facility

- There are several observation facility types:
  - **Ground based observatory** — *CFHT, CTA, LOFAR...*
  - **Space mission** — *Cassini, HST, XMM, Opportunity...*
  - **Laboratory Experiment** — *Ice spectroscopy...*
  - **Field Analog** — *Island, Sahara...*
  - **Simulation** — *Atmospheric Global Circulation Model of Mars, Venus or Titan; MHD modeling of the jovian magnetosphere...*
- It can be described as an extension of “VOResource”
- A facility contains instruments. It has location, which may depend on time.

# Instrument

- An instrument belongs to a facility
- There are many types of instruments (*imager, spectrometer, spectro-imager, coronagraph, magnetometer, radio receiver, particle analyzer...*). Such lists already exist and have to be checked and compiled.
- An instrument has an observation coverage (*time range, spectral range, resolution, field of view...*), observational parameters (UCDs?)
- It can be described as an extension of “VOResource”.

# Spacecraft listing

- **NSSDC/COSPAR** list = 7203 spacecraft [www]  
*Fields: ID, name, launch date, description URL*  
*NB: alternate names and **instruments** in desc. URL*
- **NASA/NAIF** list = 196 spacecraft [txt]  
*Fields: ID, name*  
*NB: contains synonyms; **instruments** can be retrieved*
- **CCSDS/SANA** list = 1053 spacecraft [xml]  
*Fields: ID, name, requestor, creation date, version, status, communication channel*
- **Wikipedia: TBD** [www]

# Ground Obs. listing

- **IAU/MPC** list: 1864 items [txt]  
*Fields: code, longitude, cos, sin, name*  
*NB1: contains some spacecraft*  
*NB2: does not contain any radio telescopes*
- **NASA/NAIF** list: 35 items [txt]  
*Fields: code, name*  
*NB: Deep Space Network radio stations*
- **Wikipedia: TBD** [www]

# Space Physics Listing

- **SPASE/SMWG Registry:** 1781 Observatories [xml]  
*Fields:* id, name, alternate name, description, contact, location  
*NB:* contains spacecrafts and ground observatories (including ground magnetometers)
- **SPASE/SMWG Registry:** 2325 Instruments [xml]  
*Fields:* id, name, alternate name, description, contact, location, instrument type, investigation name, observatory

NB: SPASE = Space Physics Archive Search and Extract  
SMWG = SPASE Metadata Working Group



# Example of Observatory in the SPASE Registry

The screenshot shows a web browser window titled "Registry Explorer" displaying the SPASE Registry. The address bar shows "www.spase-group.org/registry/explorer/". The page features a header with the SPASE logo and the text "SPACE PHYSICS ARCHIVE SEARCH AND EXTRACT". A left sidebar lists various observatories under the "Resource" section, with "ACE" selected. The main content area displays the details for the "Observatory: ACE".

**Observatory: ACE**

SPASE version 2.2.0

**Observatory ID**  
spase://SMWG/Observatory/ACE [XML](#)

**Name**  
ACE

**Alternate name**  
Advanced Composition Explorer  
1997-045A  
Explorer 71

**Description**  
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.

**Additional information**

[ACE Home Page](#)  
ACE mission home page at Caltech with data download

[NSSDC's Master Catalog](#)  
Information about the ACE mission

**Contact**

Role	Person
1. Principal investigator	<a href="#">spase://SMWG/Person/Edward.C.Stone.Jr</a> <a href="#">XML</a>

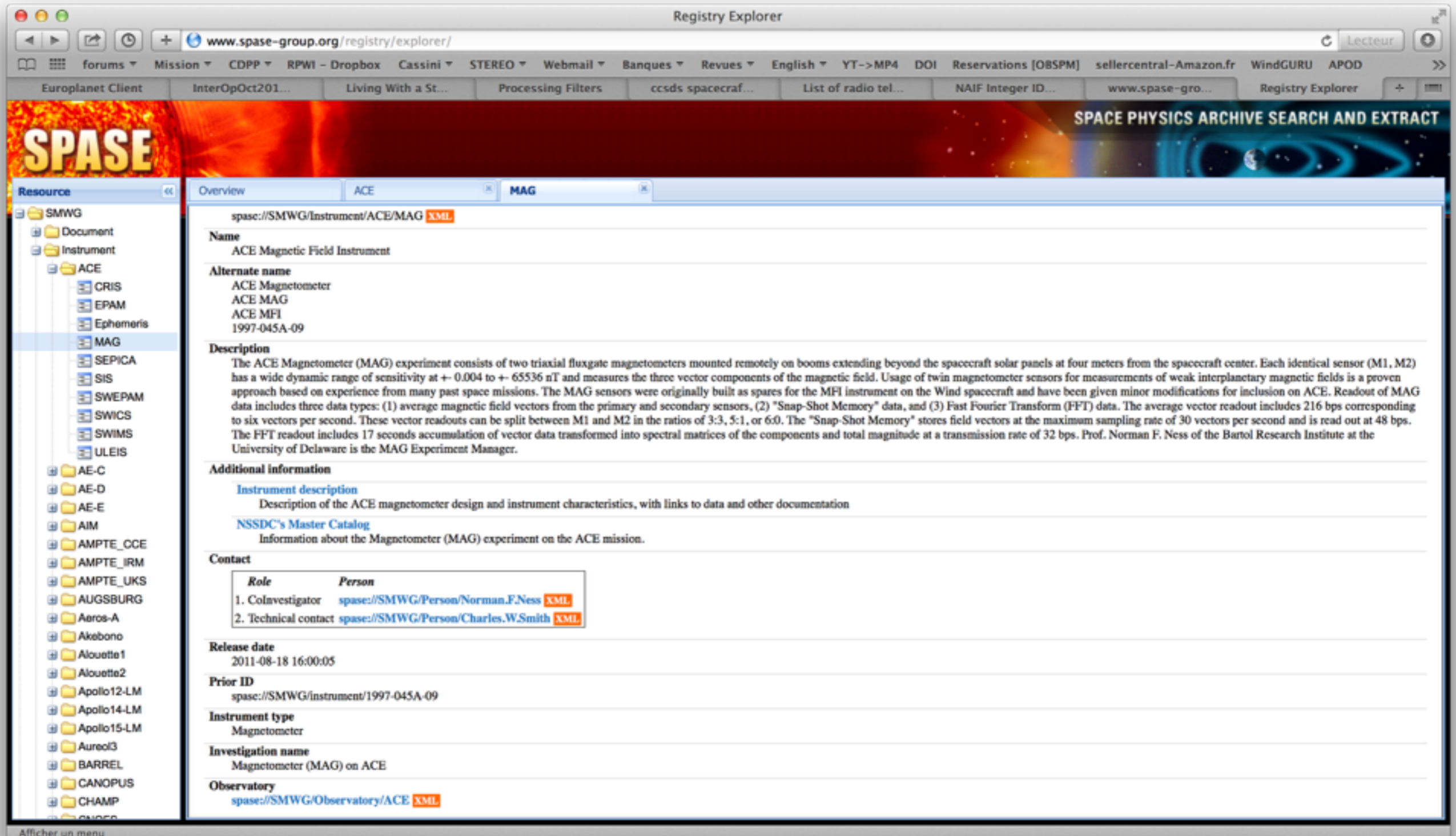
**Release date**  
2010-08-05 18:19:16

**Prior ID**  
[spase://vspro/observatory/2](#)

**Location**

**Region**  
Heliosphere Inner

# Example of Instrument in the SPASE Registry



The screenshot displays the SPASE Registry Explorer interface. The browser address bar shows [www.spase-group.org/registry/explorer/](http://www.spase-group.org/registry/explorer/). The left sidebar shows a tree view of resources, with 'MAG' selected under the 'ACE' instrument category. The main content area displays the following details for the 'ACE Magnetic Field Instrument':

- Name:** ACE Magnetic Field Instrument
- Alternate name:** ACE Magnetometer, ACE MAG, ACE MFI, 1997-045A-09
- Description:** The ACE Magnetometer (MAG) experiment consists of two triaxial fluxgate magnetometers mounted remotely on booms extending beyond the spacecraft solar panels at four meters from the spacecraft center. Each identical sensor (M1, M2) has a wide dynamic range of sensitivity at  $\pm 0.004$  to  $\pm 65536$  nT and measures the three vector components of the magnetic field. Usage of twin magnetometer sensors for measurements of weak interplanetary magnetic fields is a proven approach based on experience from many past space missions. The MAG sensors were originally built as spares for the MFI instrument on the Wind spacecraft and have been given minor modifications for inclusion on ACE. Readout of MAG data includes three data types: (1) average magnetic field vectors from the primary and secondary sensors, (2) "Snap-Shot Memory" data, and (3) Fast Fourier Transform (FFT) data. The average vector readout includes 216 bps corresponding to six vectors per second. These vector readouts can be split between M1 and M2 in the ratios of 3:3, 5:1, or 6:0. The "Snap-Shot Memory" stores field vectors at the maximum sampling rate of 30 vectors per second and is read out at 48 bps. The FFT readout includes 17 seconds accumulation of vector data transformed into spectral matrices of the components and total magnitude at a transmission rate of 32 bps. Prof. Norman F. Ness of the Bartol Research Institute at the University of Delaware is the MAG Experiment Manager.
- Additional information:**
  - [Instrument description](#): Description of the ACE magnetometer design and instrument characteristics, with links to data and other documentation
  - [NSSDC's Master Catalog](#): Information about the Magnetometer (MAG) experiment on the ACE mission.
- Contact:**

Role	Person
1. Coinvestigator	<a href="mailto:spase://SMWG/Person/Norman.F.Ness">spase://SMWG/Person/Norman.F.Ness</a> XML
2. Technical contact	<a href="mailto:spase://SMWG/Person/Charles.W.Smith">spase://SMWG/Person/Charles.W.Smith</a> XML
- Release date:** 2011-08-18 16:00:05
- Prior ID:** [spase://SMWG/Instrument/1997-045A-09](mailto:spase://SMWG/Instrument/1997-045A-09)
- Instrument type:** Magnetometer
- Investigation name:** Magnetometer (MAG) on ACE
- Observatory:** [spase://SMWG/Observatory/ACE](mailto:spase://SMWG/Observatory/ACE) XML

# putative VOFacility

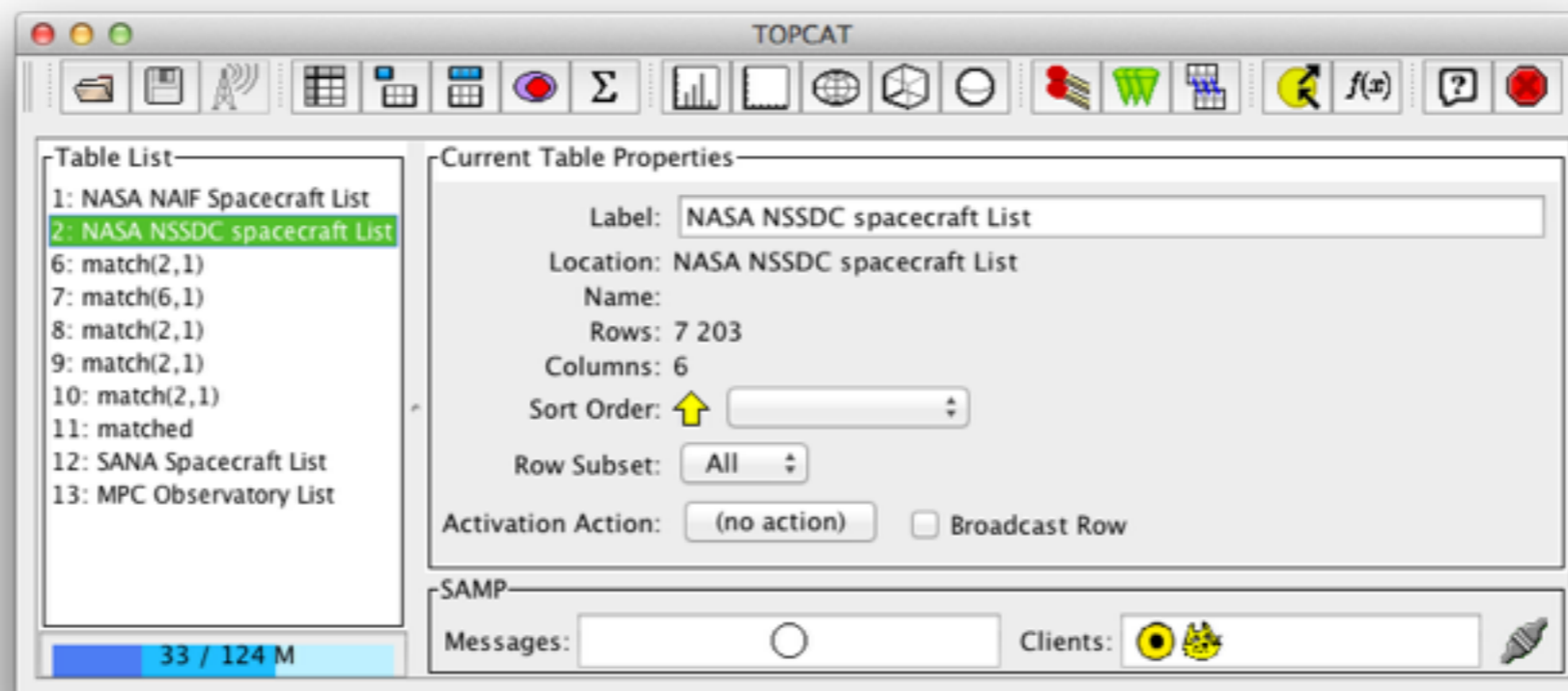
- Extension of VOResource with:
  - [0...∞] AlternateName + “origin” attribute
  - Location (region/target + coordinates)
  - Class (predefined list: Spacecraft/GroundObs...)
  - List of instruments (list of ivo-id)

# putative VOInstrument

- Extension of VOResource with:
  - [0...∞] AlternateName + “origin” attribute
  - Instrument type (predefined list TDB)
  - Hosting Facility: ivo-id
  - Coverage:
    - temporal
    - spectral (*bounds instead of band*)
    - ...
  - Measured parameter ucd (phot.flux, phys.magfield, phys.particle...)

# First steps

- Build reference list, compiling various sources into VOTables  
*NB: done for NSSDC/COSPAR, NASA/NAIF, CCSDS/SANA & IAU/MPC*
- Cross-match lists (*ongoing*) and propose a preliminary reference list



# Further Steps (1)

- Work with Semantics on observational parameter ucd listing and other semantic related topics
- Work with DCP for reference list consolidation
- Work with Registry to build up VOFacility and VOInstrument as extensions of VOResource
- Work with SPASE to cross-link IVOA and SPASE registries for instruments and observatories (to avoid duplicated entries). Discuss also with NASA/PDS4 registry team.

# Further Steps (2)

- Check with IPDA, IAU and other organization if anything is missing.
- Joint endorsement of reference list by IVOA/IPDA/SPASE/IAU
- Build a name resolver using this reference list

**NB:** First version will contain only Spacecraft and Ground Observatories.