SPASE and the Space Physics Data Dictionary

Joe King
Jim Thieman
Todd King

SECDC-WG Presentation
March 26, 2003

WHAT IS SPASE?

Space Physics Archive Search & Exchange

SPASE is a system being developed by an international consortium of space physics data archive groups interested in making the data search and retrieval process easier for the space physics community.

SPASE is open to other groups that wish to join the effort…..

PRESENT PARTICIPANTS

Participation in SPASE is voluntary and composed of groups that realize the value and importance of interoperability (easy finding and exchange of data) among the data centers.

- CNES/CNRS Plasma Physics (CDPP) Data Archive
- NASA/National Space Science Data Center
- Planetary Data System- UCLA Plasma Physics Interactions Node
- Rutherford Appleton Laboratory
- Southwest Research Institute
- Applied Physics Laboratory

Centre de Données de la Physique des Plasmas

NASA National Space Science Data Center NSSDC

PDS/PPI Planetary Plasma Interactions Node NASA's Planetary Data System

CLRC Rutherford Appleton Laboratory
Council for the Central Laboratory of the Research Councils

Southwest Research INSTITUTE™

THE JOHNS HOPKINS UNIVERSITY APL

WHY IS SPASE NEEDED?

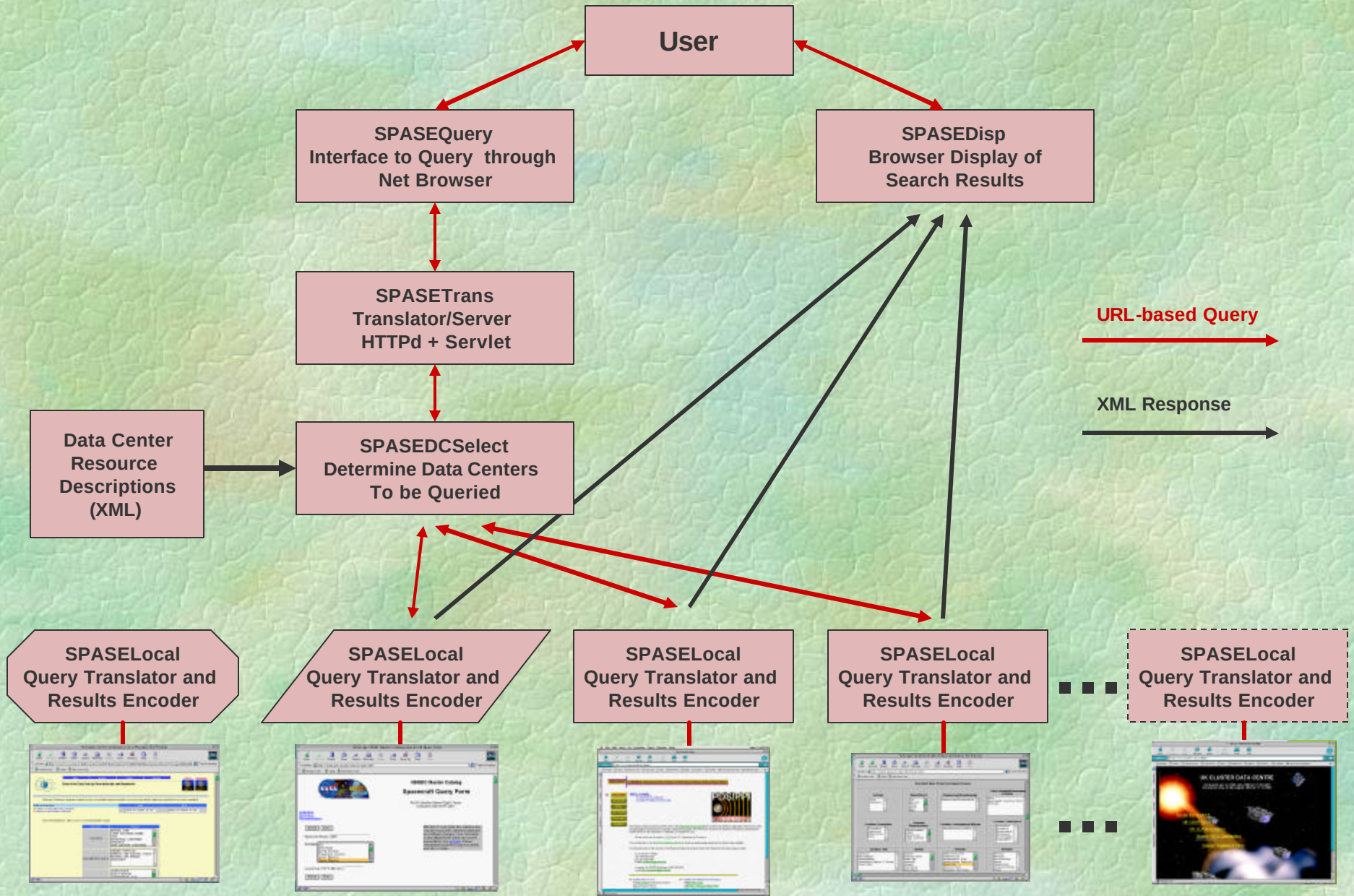
- Space Physics data archives are increasing in both size and geographic distribution
- Simple browser searching for data is inefficient and often incomplete
- Lists of web links have grown very large and quickly go out of date
- A uniform method to search and retrieve data from many different archives would be a useful and important tool for the community

PROPOSED STEPS

- Step 1 - Develop a common data dictionary/terminology
- Step 2 - Simple cross-system searches by spacecraft, experiment, time, location, instrument type, physical parameter, etc. with simple link to data request
- Step 3 - Add ability to sort data sets or subsets of the data according to criteria of interest such as overlapping time spans or common locations
- Step 4 - Enable ordering only data sets or parts of data sets that follow a given search or intercomparison rule such as data from spacecraft in the magnetotail in January, 1998

SPASE SYSTEM ELEMENTS

EXAMPLE ARCHITECTURE



Data Dictionary Work

- **Why are we doing this?**
  - To make it easier to locate information in a cooperative of autonomous data systems.
- **Where are we now?**
  - We have evaluated needs, compared existing solutions (CDPP, NSSDC, SwRI, etc.), and formulated a starting draft for a data dictionary
- **What do we want to accomplish?**
  - Decide on what the content values of the dictionary should be, then what technology should be used to hold the content
- **… and then**
  - Write it up and spread the word.

Space Physics Data Dictionary Approach

- Compare past and present data dictionaries in Space Physics and related disciplines

- Formulate an “interlingua” to translate queries to and results from local data archives terminology

  - Determine content (keyword values) for interlingua

  - Determine technical framework for the content

- Work with interested groups to remain compatible among LWS and VxO approaches

TERMINOLOGY COMPARISON

Keyword Categories	Harvey "Interlingua"	NASA Master Directory	Planetary Data System PDSBrowse	SwRI Structured Browser	SwRI Hierarchical Browser	Astrobrowse
		http://nssdc.gsfc.nasa.gov/nmd/nr	http://pds.jpl.nasa.gov/pdsbrows.htm	http://cluster.space.swri.edu/vidf/stru	http://cluster.space.swri.edu/vidf/jsframe	http://legacy.gsfc.nasa.gov/ab/
Spacecraft	Instrument	Source	Instrument_Host_Name>Instrument_Host_Type		Satellites	
Experiment	Instrument				Experiments	
Instrument	Instrument	Sensor	Instrument_Name>Instrument_Type		Instruments	
Location/Source	Location	Location	Target_Name>Target_Type	Ionosphere		Target Name
				Magnetosphere		RA/DEC
				Interplanetary Medium		
				Atmosphere		
				Sun		
				Planet/Object		
				Regions		
Data Site	Attributes	Data Center	Node_Name			
Data Type			Data_Object_Type	Orbit Attitude/Measurement		
				Engineering/Housekeeping		
Time Span	Time	Start Time	Start_TIme		Start Time	
		Stop Time	Stop_Time		End Time	
Physical Parameters	Observable>Property	Parameter Group>Parameter	Data Set Descriptors	Optical		Wavelength Band
				Particles		
				Neutrals		
				Composition		
				Waves and Fields		
Discipline	Discipline	Discipline>Subdiscipline		Activity		
Miscellaneous Keywords	Attributes	General Keywords				
Data Media	Medium	Storage Medium				
Data Set Name	ID Code	Entry Title			Virtuals	
Data Organization				Data Organization		
Contacts	Attributes	Investigator				
		Technical Contact				
		Author				
Mission/Project Name	Instrument	Campaign/Project	Mission_name	Projects	Projects	
				Mission		
References		Reference				
Quality Information		Quality				
Abstract		Summary				
Format	Format			File Type		
Analysis Tools				Analysis Tools		
Access	Access					

Space Physics Data Dictionary Workshop Results

- Space Physics Data Dictionary Workshop held at GSFC March 19-20
- Approximately 25 in attendance
- Standards and technical approaches to data dictionaries discussed
- Main time spent on Data Dictionary “Elements” and the possible values for each element as presented in subsequent viewgraphs - note that these are still preliminary
- Results are being presented at this EGS/AGU/EUG splinter group meeting for broader science community feedback
- Additional work to be done in Toulouse on April 14, including the Nice feedback
- Expectation of continued work on the dictionary with presentation at an American science meeting of relevance in the Fall, 2003 timeframe, probably AGU

Space Physics Data Dictionary Elements

Project

The mission or project under which the data was collected. The value is taken from an approved list of project names.
Example: Cluster

Observatory

The spacecraft, facility or platform that served as host for the instrument that collected the data. The value is taken from an approved list of observatory names.
Example: Cluster1, Cluster2, Cluster3, Cluster4

Experiment Type

The type of experiment the instrument performs. This is the technique of observation. For example, an electron density may be measured by a particle detector This is selected from a list of approved names.
Example: Magnetometer, Particle Detector

Instrument Name

The instrument used to collect the data. The value is taken from an approved list of names. Note: This is
Example: HIC, MAG

Observatory Spatial Region

A characterization of the spatial region the observatory was in while observations were taken. This is selected from a list of approved names.
Example: Magnetosphere, Solar Wind

Observatory Position

The extent of the region traversed by the observatory while observations were made. Values are selected from a list of approved names. Values may have a relational form.
Example: Radial>5.0, latitude>10, latitude<60

Observed Source

The body or object that emits, reflects or greatly influences the physical entity that is measured.
Example: *Earth, Moon, Sun*

Space Physics Data Dictionary Elements (cont.)

Observed Spatial Region

The regime observed by the instrument. This is the physical concept which is observed and measured. The value is selected from a list of approved names.
Example: Magnetosphere, Solar Wind, Cloud Tops, Sun, Mars, Mesosphere

Observed Spatial Extent

The extent of the region observed by the instrument. For in-situ instruments this is the same as the Observatory Position Extent, whereas this will different for remote sensing instruments. Values are selected from a list of approved names. Values may have a relation form.
Example: Radial>5.0, latitude>10, latitude<60

Observed Time Span

The span in time over which the observation was taken. Values are selected from a list of approved names. Values may have a relation form.
Example: Start>19990319, Stop<20030319

Physical Entity

The physical aspect of the observation.
Example: particles, waves, fields, photons

Physical Parameter

A property of the observation that is measured by an instrument or derived from observed data. Values may have a relation form.
Example: Velocity, Flux, Energy Range, Wavelength, density, temperature, magnitude and direction, fluctuations, spectrum of fluctuations, etc

Product Processing Level

The type of processing performed on the observation. Values are selected from a list of approved names.
Example: Raw, Calibrated, Detailed, Reduced, Key Parameters, Derived, Catalog

Product Representative Form

The form the observation is represented in. This can be a data stream or a prepared format such as a spectrogram .
Example: Image, Tabular, Spectrogram, Magnetogram

Space Physics Data Dictionary
Physical Entity Concepts

The regime observed by the instrument. This is the physical concept that is observed and measured. Physical Entity is a fixed concept that can set to one of the following tokens:

Photons:
Particles:
Electron:
Proton:
Alpha:
Element: (Z>2)
Molecule:

Aerosol:
Cluster:
Waves:
Fields:
Electric:
Magnetic:

Space Physics Data Dictionary

Physical Parameter

A property of the observation that is measured by an instrument or derived from observed data. In an implementation the Physical Parameter applies to the most recently defined Physical Entity. For example, if the Physical Entity of Electron is specified and the Physical Parameter of Density is set, then desired concept is Electron Density. Physical Parameter is a flexible concept that can set to one of the following tokens:

Density:
Integral Flux:
Differential Flux:
Temperature:
Velocity:
Distribution Function:
Wavelength:
Polarization:
Group:
Phase:
Mass:
Charge:
Magnitude:
Pressure:
Indices:
Potential:
Composition:

SUMMARY

- Space Physics data dictionary work is an important first step to a SPASE system
- Initial work on content has begun
  - Draft of main keyword elements made
  - Potential dictionary management technologies discussed
- Drafts will continue to be presented to the community for comment
- Refine and elaborate as time continues

- Results and current work can be found at: http://www.igpp.ucla.edu/spase
- (http://sdss.nasa.gov/spase may be a future site for reviewing the work)