



Developing Web Interfaces for Scientific Data Archives

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Dec 2, 2009

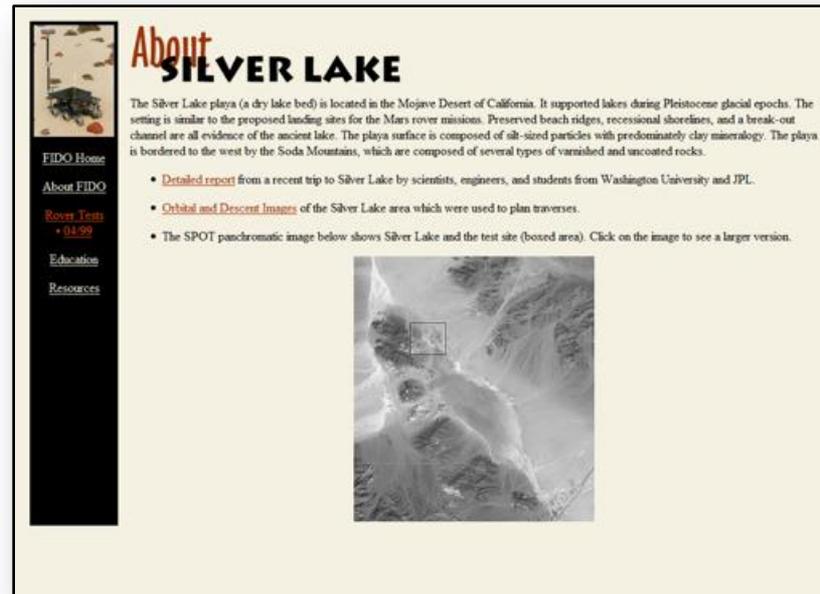
Supported under NASA Grant NNG05GB73G, "Planetary Data System Geosciences Node"

PDS Geosciences Node

- Formed in 1988 to produce, maintain, and distribute archives of geosciences-related mission data for Mars, Venus, Mercury, and planetary moons
- Data sets distributed on optical media until late 1990s
 - Exponential data volume growth
 - Increase in data updates via recalibrations
 - Improved technology supporting electronic search and distribution
 - Change in nature of archives
 - Need for correlating data as missions studied same targets with different instruments
 - Landed missions produced metadata that detailed decision-making process behind data collection

Early interfaces

- Simple design
 - Traverse archive volume directory structures
 - Download individual files
 - View archive documentation
 - Static data product pages



SPECTRAL LIBRARY

Your cart is empty

Sample Information:

Sample ID	Sample Classification	SNP
ALH77005_CP_0	natural, solid, mars, rock, unclassified, unclassified, unclassified	9-900

Product Information for Sample ALH77005_CP_0

Product ID	Product Name	Pro Cont (%)
ALH77005_CP_0_VNR_C4547056_0101TAB	ALH77005_CP_0_VNR_C4547056_0101TAB	0214
ALH77005_CP_0_C4547056_0101	ALH77005_CP_0_C4547056_0101	

Opportunity (MERB) Analyst's Notebook

SQL SUMMARY REPORTS

Enter sql or select from list. Then select a report to access documents and data.

SQL: 1090

REPORT:

Product ID	Product Name	Pro Cont (%)
1 P 295963283 ESP AD __P2601 L8 C1	1 product L8	
1 P 295963316 ETH AD __P2601 L7 C1	1 product L7	
1 P 295963379 ETH AD __P2627 L4 C1	3 products L457	
1 P 295963482 ETH AD __P2627 L4 C1	3 products L457	
1 P 295963096 ETH AD __P2627 L4 C1	3 products L457	
1 P 295963715 ETH AD __P2627 L4 C1	3 products L457	
1 P 295963812 ETH AD __P2627 L4 C1	3 products L457	

Lunar Orbital Data Explorer

MAP SEARCH - Lunar Cylindrical Projection

Select Products By Area

Product Types: Selected Products By Area: 0

Product Name: CLEM HIRES HDIM 27

Mars Orbital Data Explorer

SEARCH RESULTS

Products Found: 12,294

Instrument	Type	Product ID	Obs Time
MRO CRISM	DDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	DDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_DE194_D081	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_JF150_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279
MRO CRISM	TRDR	FT100003CHE_01_BA156_T882	2007-01-07705-42:56:279

Apollo 16 Analyst's Notebook

Zoom in and use the Identify tool to view experiments and link to the results. Sample and experiment locations were taken from the Preliminary Science Report sketches and an approximate map.

Query: Select the desired objects and stations from the table below. Results will be highlighted in yellow on the map and summarized in the table below. Click on a record in the table to highlight the record on the map. Use the identify tool to link to the detailed results.

Sample	Station	Features
01175	1	Rock Sam
01125	1	Rock Sam
01295	1	Rock Sam
01016	1	Rock Sam
01155	1	Rock Sam
01015	1	Rock Sam
01515	1	Rock Sam
01516	1	Rock Sam
01517	1	Rock Sam
01518	1	Rock Sam

Phoenix Analyst's Notebook

Phoenix Mission Historical Overview

Specify columns to show:

Sol	Activity	Coordinated Obs	RAC	Dig Summary	Dig Location
13	TESA atmospheric measurement: RA acquire sample with RAC documentation; SSI multispectral spot "Lony" and "Mad Hatter"	Vapor Data: 22:23:23 23:28:21 03:48:51 07:25:48		13 filter camp site selection	sol (Solo Bear)
15	TESA shake; RA sample test	Vapor Data: 10:58:01 12:43:42 18:14:05		Mission Success	Test Sprinkle
16	TESA atmospheric measurement: TESA shake with open full "chord/silhouettes"				
20	TESA-4 mid temp profile				
21	OH magnets: TESP				
22	TESA-4 high temp trenching in "Worm"				
28	WCL thin test: TSP				
32	Scrape "Snow White"				
35	OH pre-sample and				
36	SSI and MET coord atmospheric obs				
37	Coordinated spect with S&D				
40	Stand-down: Ramp				
43	WCL soil B analysis; needle touch test				
48	AFM linear calibrat				

SQL SUMMARY REPORTS

Enter sql or select from list. Then select a report to access documents and data.

SQL: 21

REPORT:

Phoenix / Mars Reconnaissance Orbiter (MRO) Coordinated Observations

Showing all MRO passes for this sol. Showing 1 of 5 observations for this MRO pass.

Developing web interfaces

- Electronic access is primary means for locating and disseminating science data
 - Directory browsing via FTP or HTTP
 - Browser-based interface (simple to complex)
 - Web services that allow client applications connections (e.g., ArcGIS, Google Earth)

Keys to developing web interfaces

Specialized knowledge

Iterative development
process

Specialized knowledge domains

Science data

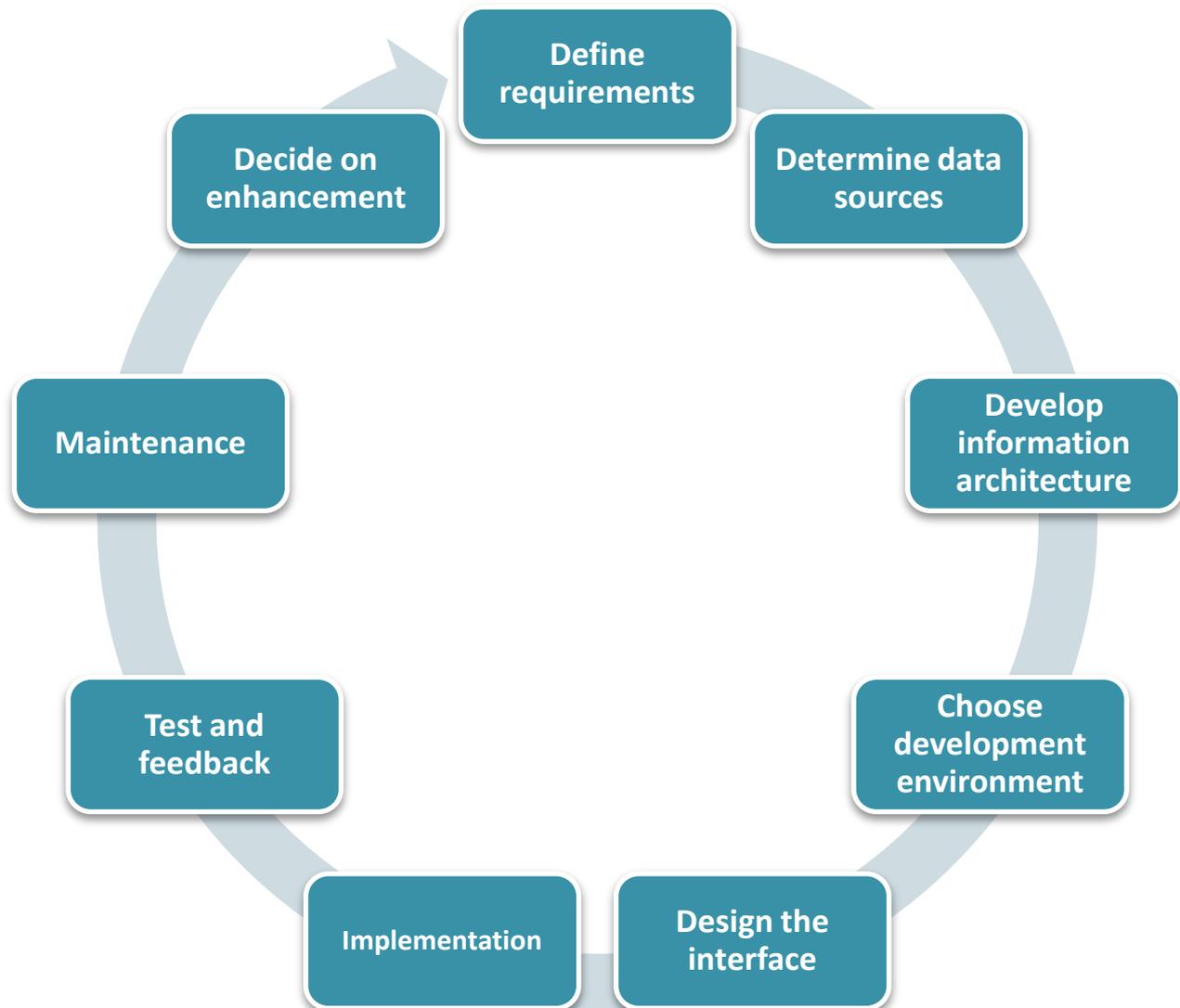
Data archiving

User interface design

Information architecture

- Must expend resources to gain missing expertise
 - Research/training
 - Adding team members

Interface development lifecycle



Define requirements

- Understand interface purpose and how it relates to science archive
 - What is intent?
 - What information is to be included?
 - How is information acquired?
 - Who are end users?
 - What are end users' expectations?
- Define
 - Data sources
 - Functionality
 - Deliverables
 - Security
 - Hardware/software limitations
 - Cost
- Create specific, attainable goals
- Incorporate use cases
 - Detail services, tasks, and functions of interface

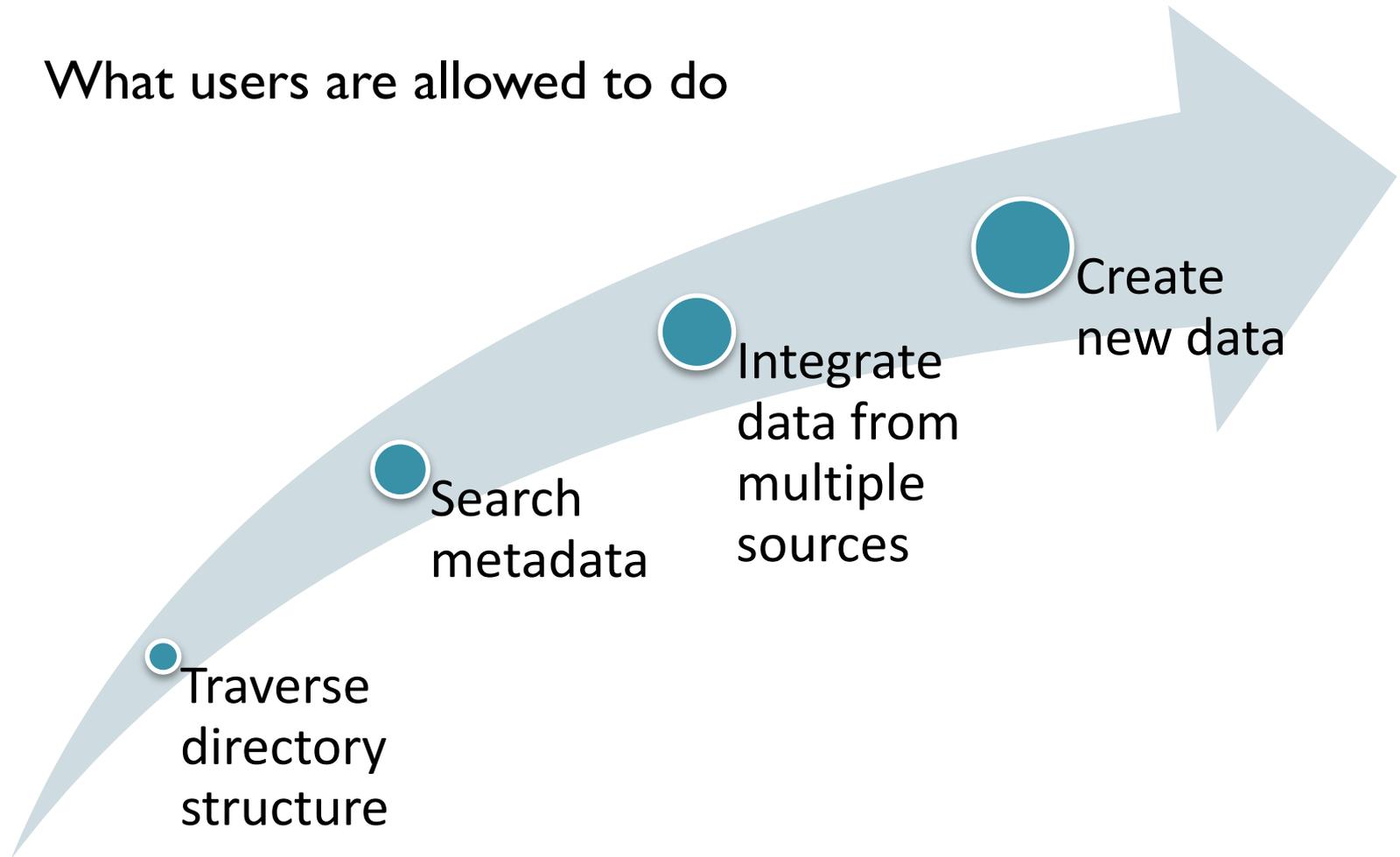
Primary factors driving requirements

Money resources

Time resources

Complexity

What users are allowed to do



Determine data sources

- More than just data files—integration of information from a number of sources
 - Data product metadata
 - Documentation
 - Data product documents (data provider)
 - Archive documents (data provider or archiving entity)
 - Additional documents from data collection phase (people directly and indirectly involved)

Example: daily reports from non-deterministic Mars rover and lander missions were captured to preserve knowledge and intent behind the decisions

Data quality

- Data must be well-formed and well-documented
 - Interface developers may have to invest considerable resources

Example: data from older Mars Global Surveyor's MOC instrument were reprojected into areocentric projection used by newer Mars missions

- Recast data must be clearly labeled and described
 - Change in format
 - Subset into smaller parts
 - Used to create new product

Additional considerations

- Political
- Ethical
- Access rights
- Legal (ITAR – International Traffic in Arms Regulations)

Develop information architecture

- Information architecture models system in which interface is developed and made operational
- Stakeholders interact with system in different ways
 - Data providers
 - End users
 - Developers
- End users will be affected by requirements placed on them
 - Is user required to download client software?
 - Is user required to have an account for access?
- Longevity and availability are important drivers

Choose development environment

- Factors in selection of development environment
 - Information architecture
 - Size and expertise of development team
 - Technologies required to support planned interface
- Development environment maturity
 - Increase long term stability of interface
 - Minimize effort required to maintain functionality

Design the interface

- Web interface is initial entry to an archive
- Bad design can impede users, even if there is useful functionality underneath
- Users' initial perception is significant factor in success of interface

Design criteria	
Readability	Usability

Readability

- Readability elements may be considered hygiene factors

Color

- Color theory (principles of correct use)
- Physical factors (color blindness)
- Cultural color associations
- Standard practices

Images

- Icons provide subconscious cues
- Too many images damage users' perceptions of professionalism

Other

- White space
- Navigation aids
- Text
- Font choice
- Layout

Usability

“The capability of the software product to be understood, learned, used and attractive to the user...” [ISO 9126-1]

Learnability

- First time users
- Consistency and intuitiveness

Understandability

- Expected user domain knowledge
- Common terminology
- Clear instructions

Operability

- How easily can a user find and retrieve what he or she is looking for?

Implementation, testing, and feedback

“The most well-defined interface can suffer from the reality of implementation” *[Merlyn, 1991]*

- New technology
- Schedule pressures
- Personnel changes
- Requirement “scope creep”

Testing

- Ongoing process during design phase
- Begin early in implementation phase and occur regularly
- Use appropriate test group
- Include stress test

Feedback

- Seek from testers prior to release
- Seek from users after release
 - Online (e-mail, forum, survey)
 - In person (science conferences)

Maintenance

- Plan for longevity
 - Design interface to be viable for many years
 - Keep documentation and unit testing procedures up to date
 - Test interfaces regularly for broken links and loss of functionality
- Prepare for “progress”
 - Development platform and server hardware/operating system may become obsolete
 - Client web browser standards may change

Eventually, there will be a time when the interface must be updated, replaced, or retired.

Enhancements

- Brought about by
 - Increased user abilities and expectations
 - Updates to technology supporting the interface
- Types of enhancements
 - New data from data providers
 - Improved versions of existing data
 - Interface enhancements based on user experiences and requests

MER Analyst's Notebook
SPiRiT MER-A

Getting Started
New to the Notebook?
Learn about its features.

Lost and Found
Where are my data? Find out about the Notebook's organization.

What Happened?
Date look a little funny?
See how the browse images and charts were created.

Picture This
What do all those icons mean? Check out the icon glossary.

Produced by the EDS
Geosciences Node at Washington University in St. Louis. Send comments to meran@wustl.wustl.edu.

Sol 84 Summary

Other Sols: 001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 050 051 052 053 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079 080 081 082 083 084 085 086 087 088 089 090 091 092 093 094 095 096 097 098 099 100 101 102 103 104

Product Overview | Documentation

Product Summary 2 P 133814459 EDN 22 32 P2113 L4 C1

Downsampled EDR - Left
2 P 133814459 EDN 22 32 P2113 L4 C1

Open this product in a new Product View window

Product List:

Sol	Product ID	Product Name	Actions
84	2 B 133792335	EDR 22 32 N1940 N0 M1	Browse
84	2 A 133811277	EDR 22 32 N1419 N0 M1	Browse
84	2 P 133814398	EDN 22 32 P2113 L2 C1	Browse
84	2 P 133814429	EDN 22 32 P2113 L3 C1	Browse
84	2 P 133814459	EDN 22 32 P2113 L4 C1	Browse
84	2 P 133814489	EDN 22 32 P2113 L5 C1	Browse
84	2 P 133814519	EDN 22 32 P2113 L6 C1	Browse
84	2 P 133814549	ESF 22 32 P2113 L7 C1	Browse
84	2 P 133814597	EDN 22 32 P2113 R2 C1	Browse
84	2 P 133814628	EDN 22 32 P2113 R3 C1	Browse
84	2 P 133814658	EDN 22 32 P2113 R4 C1	Browse
84	2 P 133814678	EDN 22 32 P2113 R5 C1	Browse

Spirit (MERA) Analyst's Notebook **TEAM**

SOL SUMMARY REPORTS
Enter sol or select from list. Then select a report to access documents and data.

SOL: 84 | Sol 85

REPORT: Data products

Product List:

Product ID	Product Name	Products
2 B 133792335	EDR 22 32 N1940 N0 M1	1 product : N0
2 A 133811277	EDR 22 32 N1419 N0 M1	1 product : N0
2 P 133814398	EDN 22 32 P2113 L2 C1	6 products : L234567
2 P 133814597	EDN 22 32 P2113 R2 C1	7 products : R1234567
2 P 133814836	ESF 22 32 P2111 L2 C1	13 products : L234567 R1234567
2 P 133815245	ESF 22 32 P2600 L8 C1	1 product : L8
2 F 133825232	EDN 22 32 P1121 L0 M1	1 product : L0
2 F 133825315	ESF 22 32 P1127 L0 M1	1 product : L0
2 M 133825381	EFF 22 32 P2979 M1 F1	28 products : M1
2 M 133825455	EFF 22 32 P2959 M1 F1	7 products : M1
2 F 133825556	EDN 22 32 P1111 L0 M1	2 products : L0

Panoramic Camera Downsampled EDR - Science
2 P 133814459 EDN 22 32 P2113 L4 C1

Product Summary 2 P 133814459 EDN 22 32 P2113 L4 C1

Image

Site Map

PDS Label

Derived Products

Related Products

Product Documents

Help

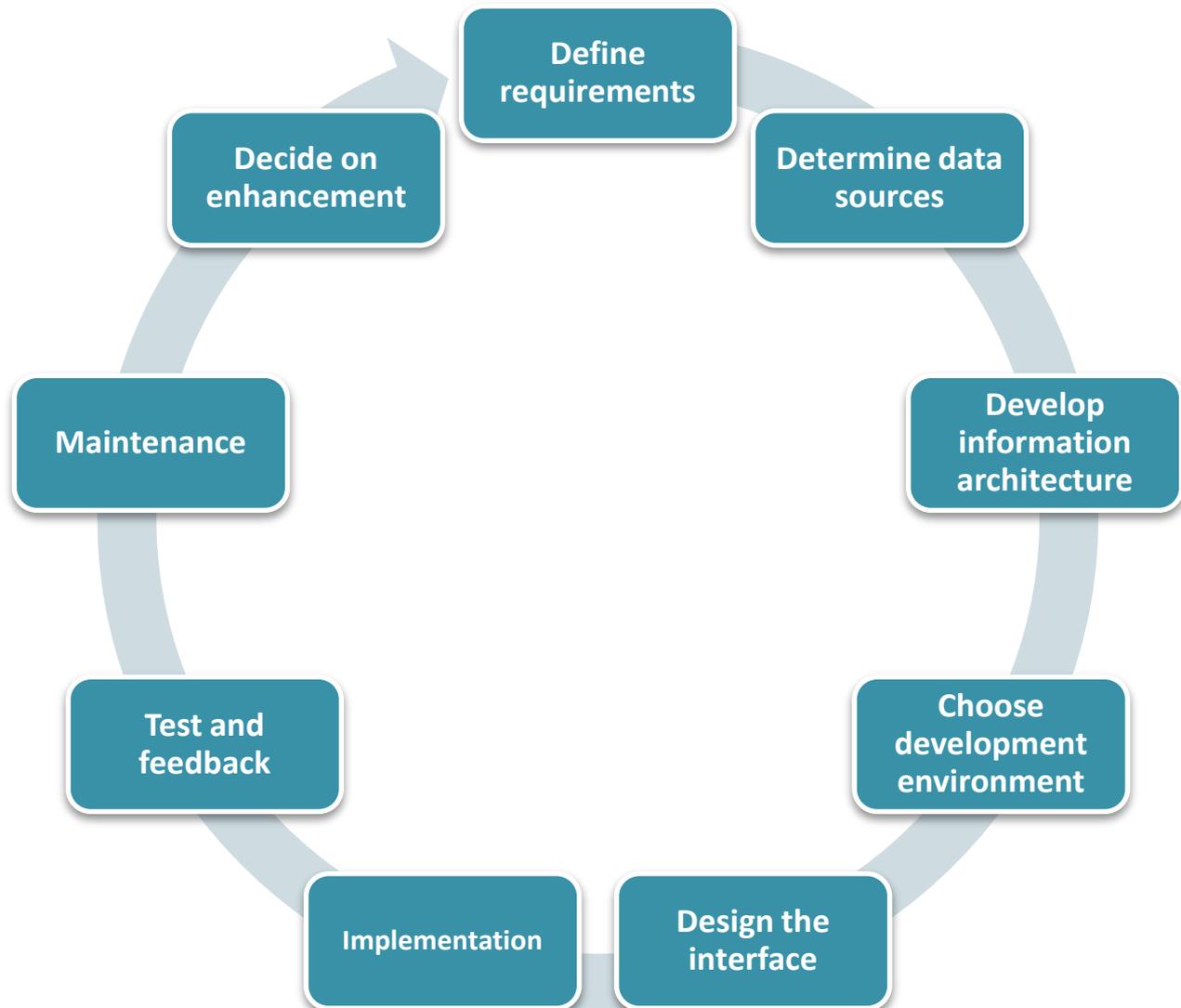
This browse image is not the actual data product. [View full resolution image.](#)

Download Product Files
Product Data File (231 KB)

Meta Data Overview

Sol (Planet Day Number)	84
Local True Solar Time	10:09:25
Rover Motion Counter	(22.32.319.1836.182)

Interface development lifecycle



Conclusion

- Require four knowledge domains
 - science data
 - data archiving
 - information architecture
 - user interface design
- Consider requirements in terms of resources
- Intentionally plan for longevity
- Involve all system stakeholders early in the process
- Maintain open communications throughout



QUESTIONS?