



Developing Web Interfaces for Scientific Data Archives

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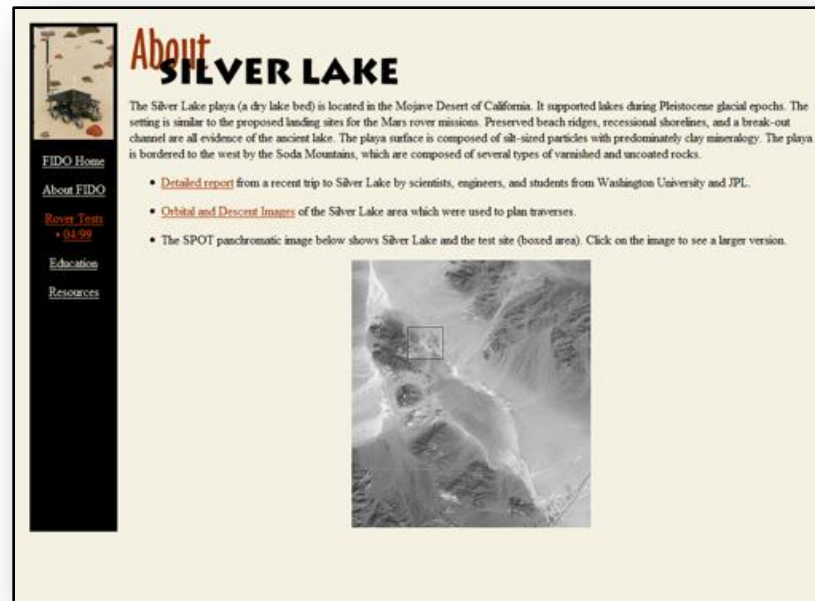
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PDS Geosciences Node

- 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	SNR
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 ID
ALH77005_CP_0_VNIR_C4547056_0101TAB	ALH77005_CP_0_VNIR_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: `sol.1809` No next sql

REPORT: Data products

Product Summary 1f

Product ID	Product Name	Pro Cont ID
1 P 295963283 ESF 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 295963402 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	
1 P 295963812 ETH AD __P2627 L4 C1	3 products L457	

Lunar Orbital Data Explorer

Home | Data Product Search | Tools | Data Set Browser | Download | Help & Resources | Back to Search

MAP SEARCH - Lunar Cylindrical Projection

Select Products By Area

Map Contents

- Product Query Results
- Product Query Lat/Lon Bounding Box
- Product Query Footprint
- Grid Lines

Data Set Files Selected

View in Table

Product Types

CLEM HIRIS HDIM 27

Map Tool Reference Panel

GEOSCIENCES

Mars Orbital Data Explorer

Home | Data Product Search | Tools | Data Set Browser | Download | Back to Search

SEARCH RESULTS

Products Found: 12,294

Display Product Thumbnails

Instrument	Type	Product ID	Obs Time
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:279
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:381
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:279
MRO CRISM	TDR	FT200003CHE 01 J1150 T882	2007-01-07705-42:56:381
MRO CRISM	TDR	FT200003CHE 01 J1150 T882	2007-01-07705-42:56:279
MRO CRISM	TDR	FT200003CHE 01 BA156 T882	2007-01-07705-42:56:381
MRO CRISM	TDR	FT200003CHE 01 BA156 T882	2007-01-07705-42:56:279
MRO CRISM	TDR	FT200003CHE 01 BA156 T882	2007-01-07705-42:56:381
MRO CRISM	TDR	FT200003CHE 01 BA156 T882	2007-01-07705-42:56:279
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:381
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:279
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MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:279
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:381
MRO CRISM	DDR	FT200003CHE 01 DE194 D081	2007-01-07705-42:56:279

Apollo 16 Analyst's Notebook

Home | Stations | Mission Summaries | Resources | Help

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.

Zoom In | Zoom Out | Full Extent | Identify | Prev Extent | Next Extent | Pan | Help | Legend

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.

Objects: Rocks

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

Phoenix Analyst's Notebook

Home | Sol Summaries | Mission Summaries | Search | Resources | Help

Phoenix Mission Historical Overview

How to use this page

- Specify columns to show
- Download the table

Sol	Activity	Coordinated Obs	RAC	Site	Dig Summary	Dig Location
14	TESA atmospheric measurements: RA acquire sample with RAC documentation; SSI multispectral spot "Long" and "Mad Hatter"	Vapor Data: 22:22:13 23:26:21 03:48:51 07:25:48			13 filter camp site selection	sol (Ruby Bear)
15	TESA shake; RA sample test	Vapor Data: 10:58:01, 12:43:42, 18:14:00			Test Sprinkle	
16	TESA atmospheric measurements: TESA shake with open full "quadrifolds"					
20	TESA-4 mid temp trenching in "Worm"					
21	OH magnets: TESP					
22	TESA-4 high temp trenching in "Worm"					
28	WCL thin test: TESP					
32	Scrape "Snow White"					
35	OH pre-sample air					
36	SSI and MET coord atmospheric obs					
37	Coordinated spectra with S&D					
40	Stand-down: Ramp					
43	WCL soil B analysis; needle touch test					
48	AFM linear calibration					

Phoenix / Mars Reconnaissance Orbiter (MRO) Coordinated Observations

Sol 21

Showing all MRO passes for this Sol

Showing 1 of 5 observations for this MRO pass

Observation Time

MRO3 PHO3 2008 2008 1408 87

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

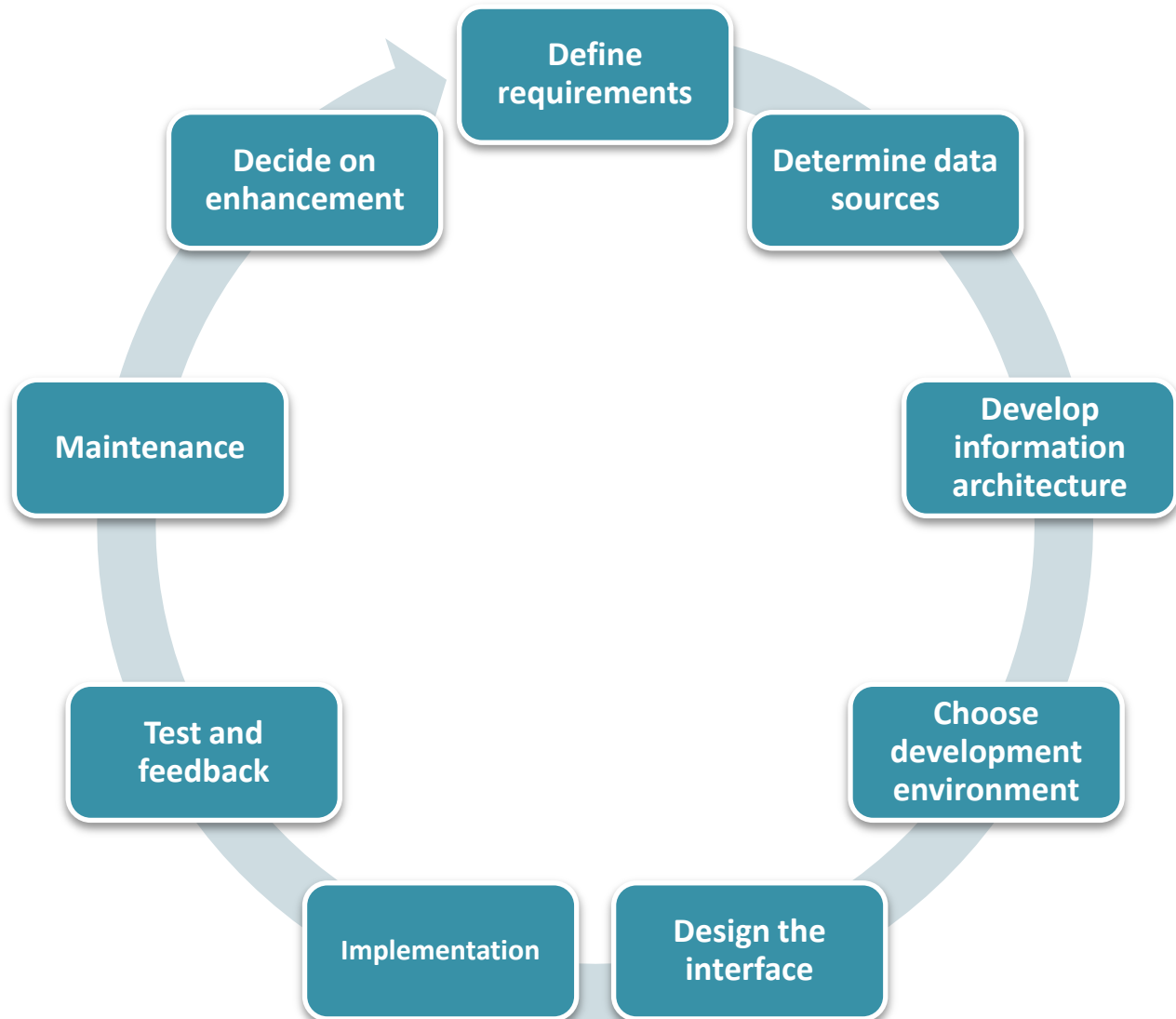
Data archiving

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

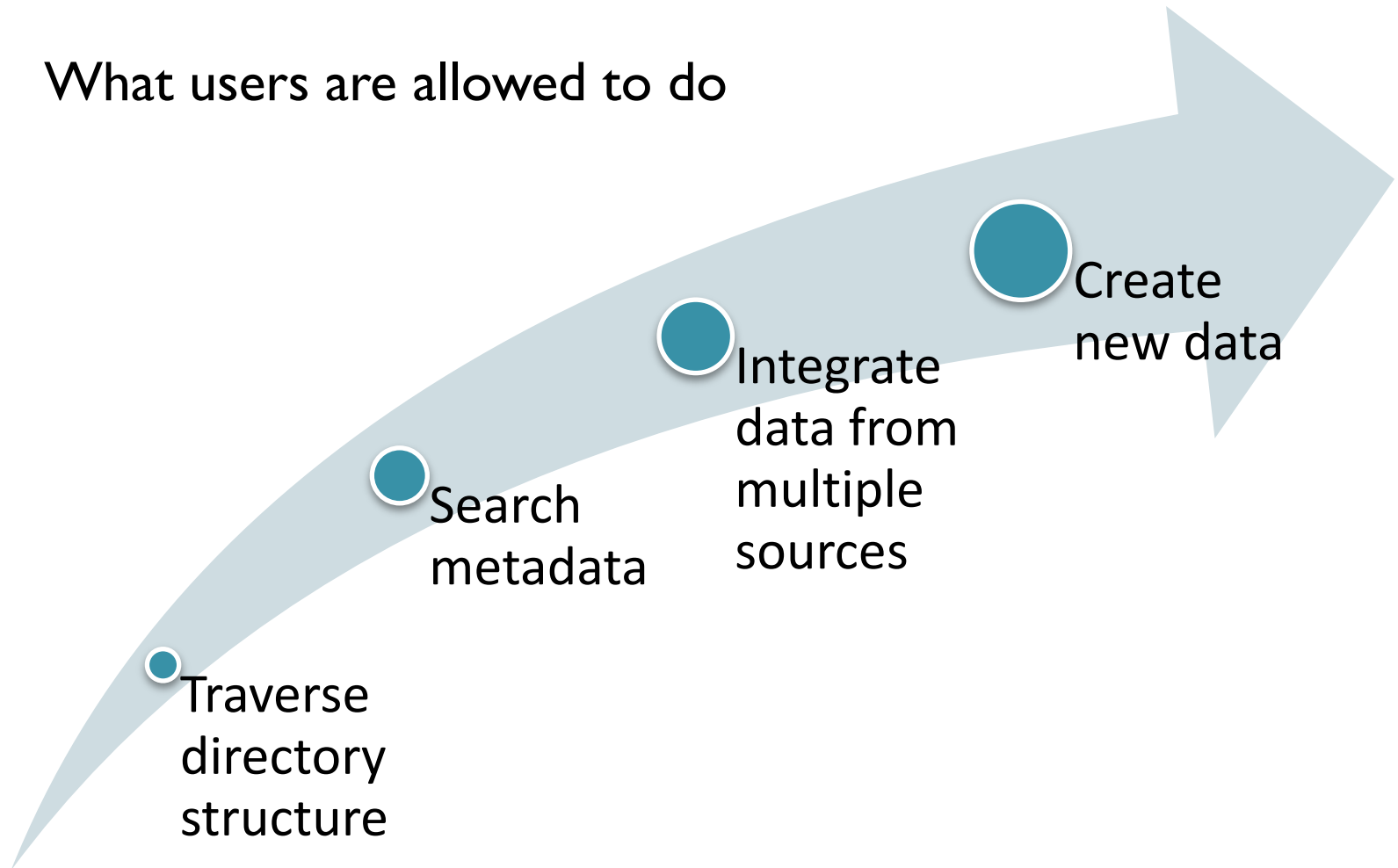
Primary factors driving requirements

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 these icons mean? Check out the icon glossary.

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

Sol	Product ID	Browse
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

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

Open this product in a new Product View window

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

SOL SUMMARY REPORTS
Overview

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

SOL: Sol 83 | Sol 85

REPORT: Data products

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

PRODUCT MENU

- Overview
- Image
- Site Map
- PDS Label
- Derived Products
- Related Products
- Product Documents
- Help

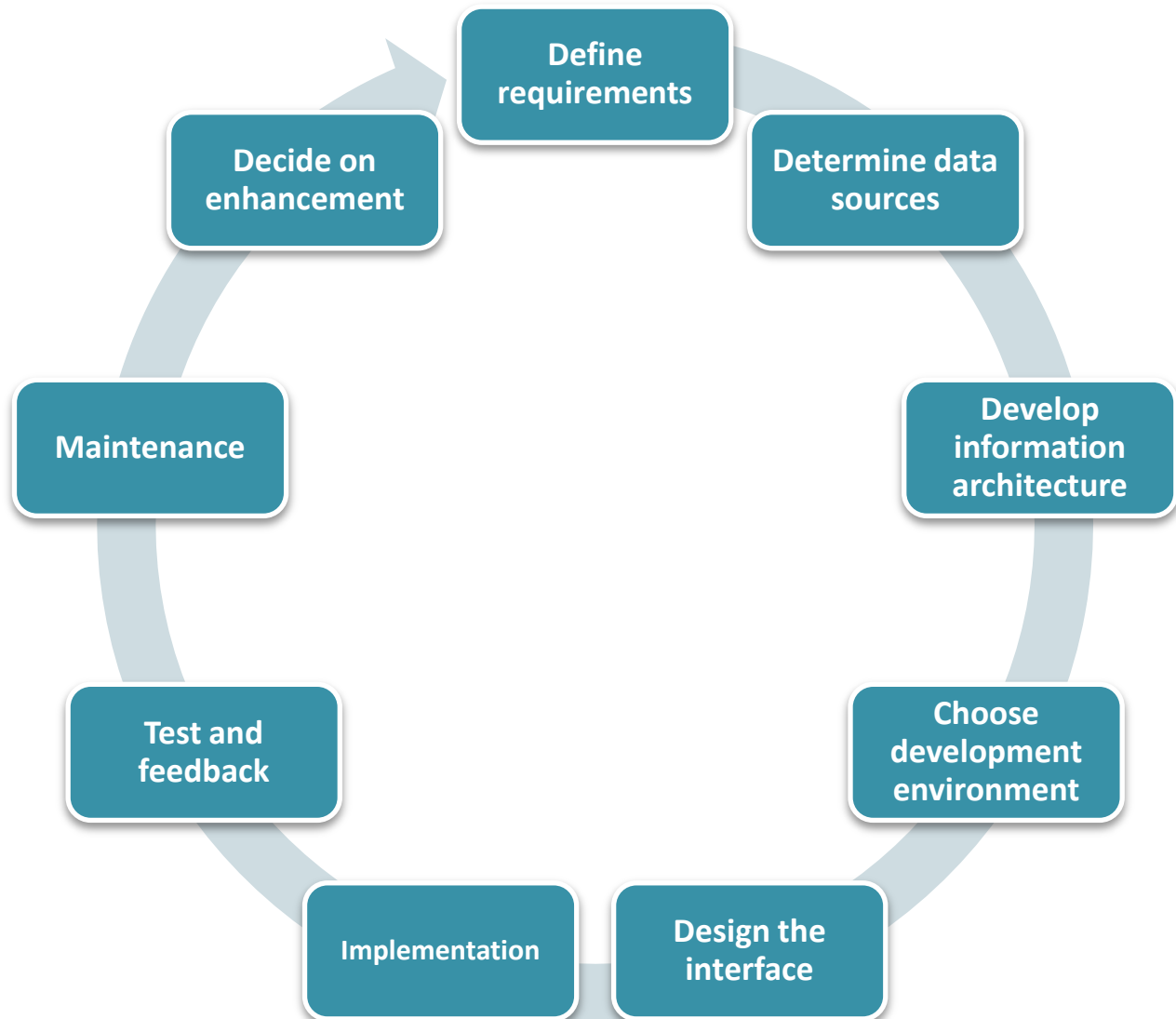
Product Summary 2 P 133814459 EDN 22 32 P2113 L4 C1

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?