

ESA PSA Report to IPDA SC

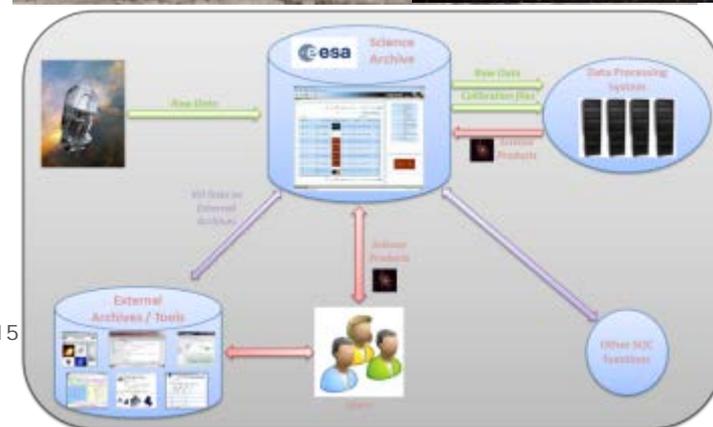
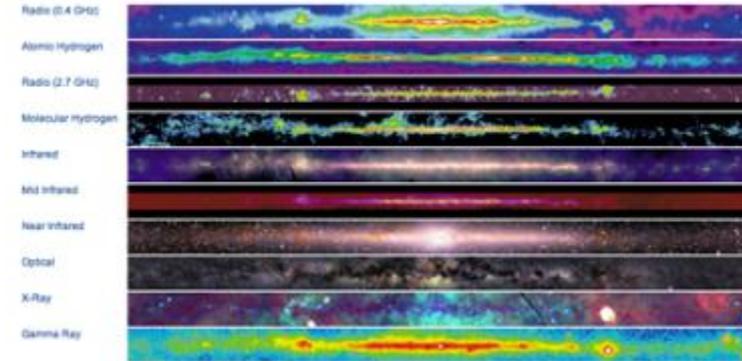
Christophe Arviset and the PSA team
IPDA SC, JAXA, Tokyo
22/07/2015

Highlight of the year : Philae landing !



Overall context: ESAC Science Archives Strategy

1. Large set of science archives co-located at ESAC are a major research asset for community.
2. Need to be kept readily available for future users and novel uses.
3. Thus, must plan now for next 5–20+ years.
4. Planning based around 3 major goals:
 - a. Enable maximum scientific exploitation of data sets,
 - b. Enable efficient long-term preservation of data, software and knowledge, using modern technology
 - c. Enable cost-effective archive production by integration in, and across, projects.



ESA Science Archives



ESAC Science Data Centre (ESDC)



Christophe Arviset

Guido de Marchi



H/ESDC



Archives
Head Scientist

Astro Archive Group

Bruno Merin

Jesus Salgado



Archives
Science Lead

Astro Archi
Technical L



XMM-Newton

Planck

ISO

Herschel

Hubble

Exosat

Euclid

Gaia

LisaPF

Multi-Mission Interface

PSA Group

Guido de Marchi

Isa Barbarisi



etary Archives
ience Lead

Planetary Ar
Technical L



(temporarily)

Mars Express

Rosetta

Venus Express

Huygens, Giotto, SMART-1

BepiColombo

Exomars

Solar Helio Archive Group

Arnaud Masson

Beatriz Martinez



Helio
Archives
Science Lead



Solar
Arch
Tech. Lead

Cluster

Ulysses

Solar Orbiter

Soho

Archive Software Engineers

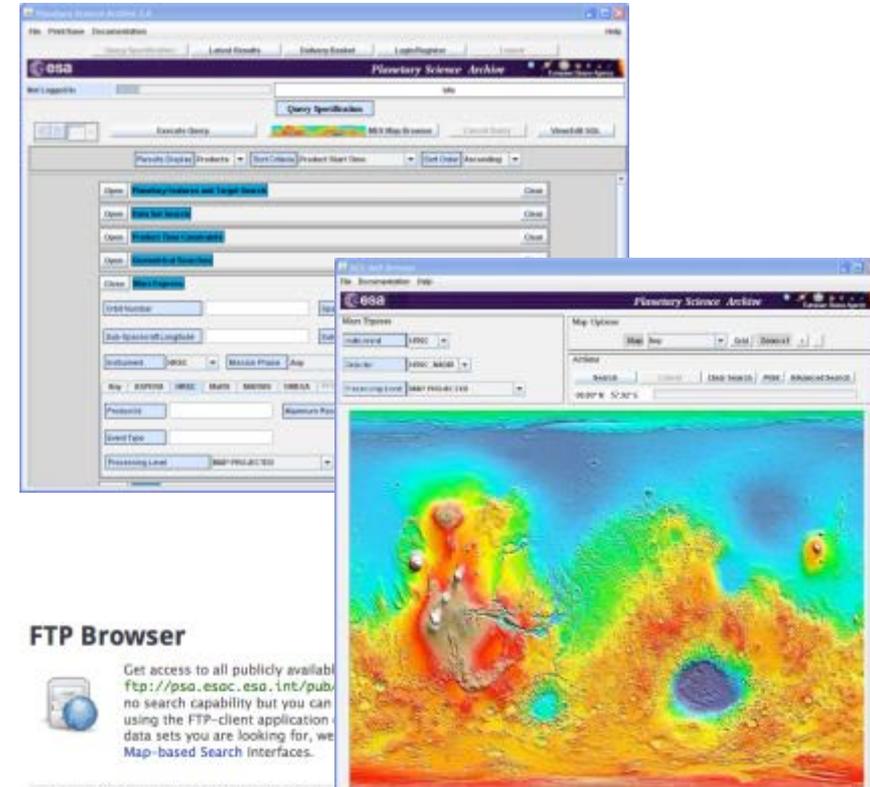
Common software libraries and tools repository, full open source

Astro
SOCs/SGSs
(archive scientists)

Planetary
SOCs/SGSs
(archive scientists)

Solar Helio
SOCs/SGSs
(archive scientists)

1. Available since **March 2004**:
 - a. <http://archives.esac.esa.int/psa>
2. **Low development, but plans to a totally renewed PSA**
3. Datasets received from PI teams
 - a. **Peer-reviewed** by independent team
 - b. **Internally validated** before ingestion into the PSA
4. Around **28TB** of data on hard disks
5. Access services (details this afternoon)
 - a. **Advanced search** interface
 - b. **Map based** query for MEX
 - c. **FTP Browser** (not searchable)
 - d. **Machine interface** (PAIO)



The image shows two overlapping screenshots of the Planetary Science Archive (PSA) web interface. The top screenshot displays a search interface with fields for 'Query Specifications', 'Execute Query', and 'View All Data'. Below this, there are several 'Open' buttons for different data products like 'Planetary Orbiter and Target Data', 'Mars Orbiter Data', 'Mars Express Data', and 'Mars Express Data'. The bottom screenshot shows a 'Map Options' panel with a 'Map' dropdown set to 'Mars' and a 'Map Options' section with 'Mars' selected. Below the map options is a large, colorful topographic map of Mars, showing various terrain features in shades of red, orange, yellow, and blue.

FTP Browser

Get access to all publicly available <ftp://psa.esac.esa.int/pub/> data sets you are looking for, we have no search capability but you can use the FTP-client application or Map-based Search interfaces.

BEPI Giotto EARTH-BASED Huygens

Mars Express Orbiter Data

- Analyser of Space Plasmas and Energetic Atoms (ASPERA-3)
- High Resolution Stereo Camera (HRSC)
- Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS)
- Mars Express Orbiter Radio Science (MRS)
- Observatoire pour la Minéralogie, l'Eau, les Glaces et l'Activité (OMEGA)
- Planetary Fourier Spectrometer (PFS)
- Spectroscopy for Investigation of Characteristics of the Atmosphere of Mars (SPICAM)

Ancillary Data

- SPICE Repository
- SPICE PDS Data Set
- ESOC Ancillary Information

Visit the mission page for more information.

Batch Download

Please contact us first if you wish to use our FTP service for batch downloading or minor functionality. This will allow us to prepare the servers and avoid any potential difficulties that may arise.

User's Guides

- PSA FTP Access Guide
View | Download
- Active/Passive FTP Explanatory Note
View | Download

1. **Mars Express** instrument and auxiliary data (ongoing)
2. **Venus Express** instrument and auxiliary data (ongoing)
3. **Rosetta** instrument and auxiliary data (ongoing)
4. **Chandrayaan 1** – pipelines from PSA for 3 European instruments
 - a. Planning for interoperable data access with ISRO
5. **Giotto** data from comet Halley and Gripp-Skellerup
 - a. Comet Halley ground-based observations (Halley-Watch)
6. **SMART-1** instrument and auxiliary data
7. **Huygens** (complete)
8. **BepiColombo / ExoMars** data handling and archive support – in preparation.
Will use PDS4

- **Mars Express**: More than 19Tb of data are now available. Main updates from last year include:
 - **HRSC** has delivered a recalibrated version of their entire radiometrically calibrated dataset, new version of map-projected dataset to follow soon, will begin delivery of new mosaic dataset
 - **SPICAM** delivered a new dataset: partially calibrated IR for the entire mission, under review now.
 - **MaRS radio science** data caught up with delivery schedule, with a few gaps in older data.
 - **MARSIS Electron density profiles** reviewed and returned comments for updated to PI team.
 - Calibrated data from ASPERA, HRSC, SPICAM and MARSIS AIS coming in regularly.



1. *Venus Express*:

- a. Deliveries made regularly by all teams, most are up to date and several have already delivered all basic datasets through end of mission ahead of schedule.
- b. **SPICAV-SOIR** and **VMC** working on recalibrations of entire datasets.
- c. **VeRA** radio science has sped up delivery of datasets in a push to catch up to delivery schedule (currently sending in data from 2011).
- d. Several teams are preparing higher level datasets for inclusion in archive.

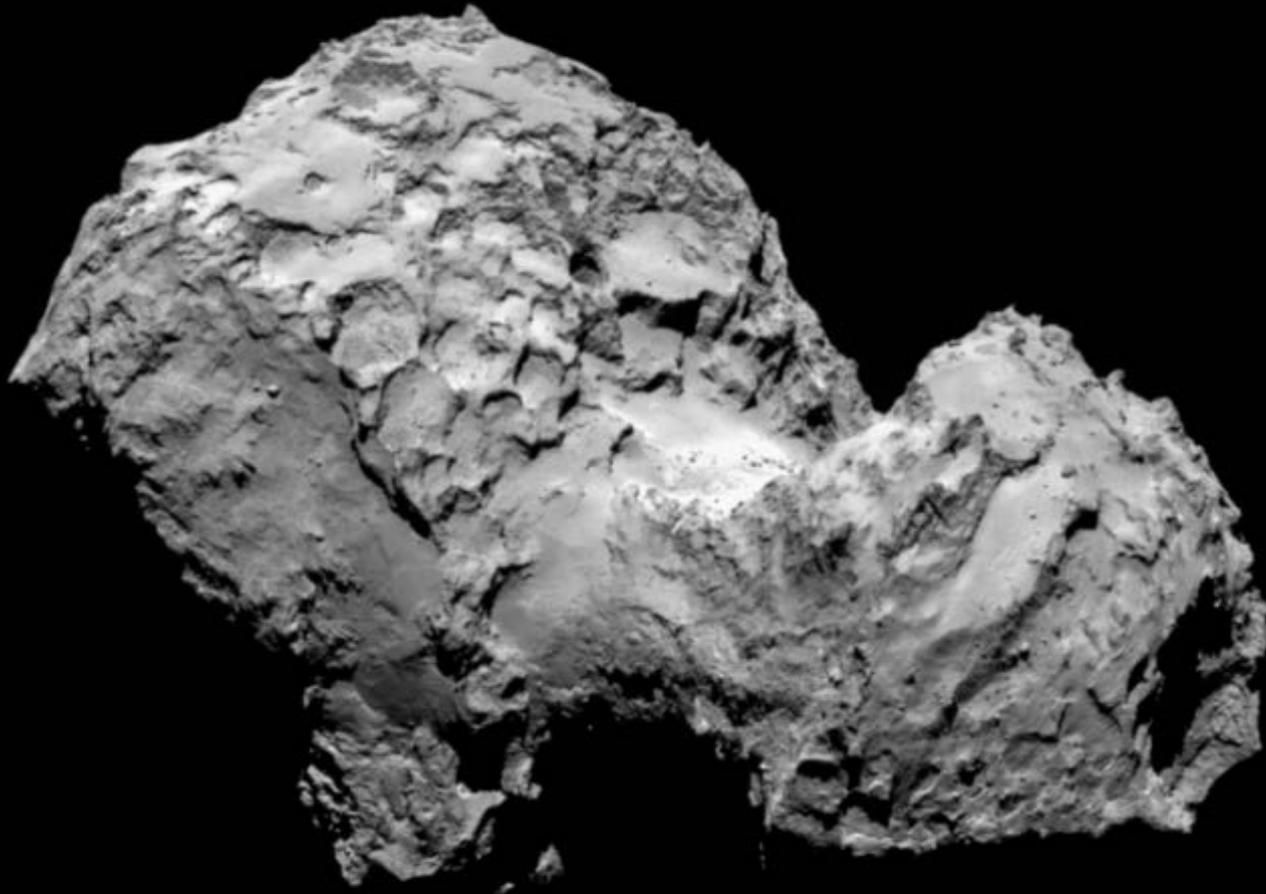
2. Post-operations phase officially began 1 January 2015.

- a. **Archive consolidation** is a main focus of this phase, aiming for 1.5 year support to cover this.
- b. A final archive review will be performed.
- c. Selection process reviewers is in progress.



venus express

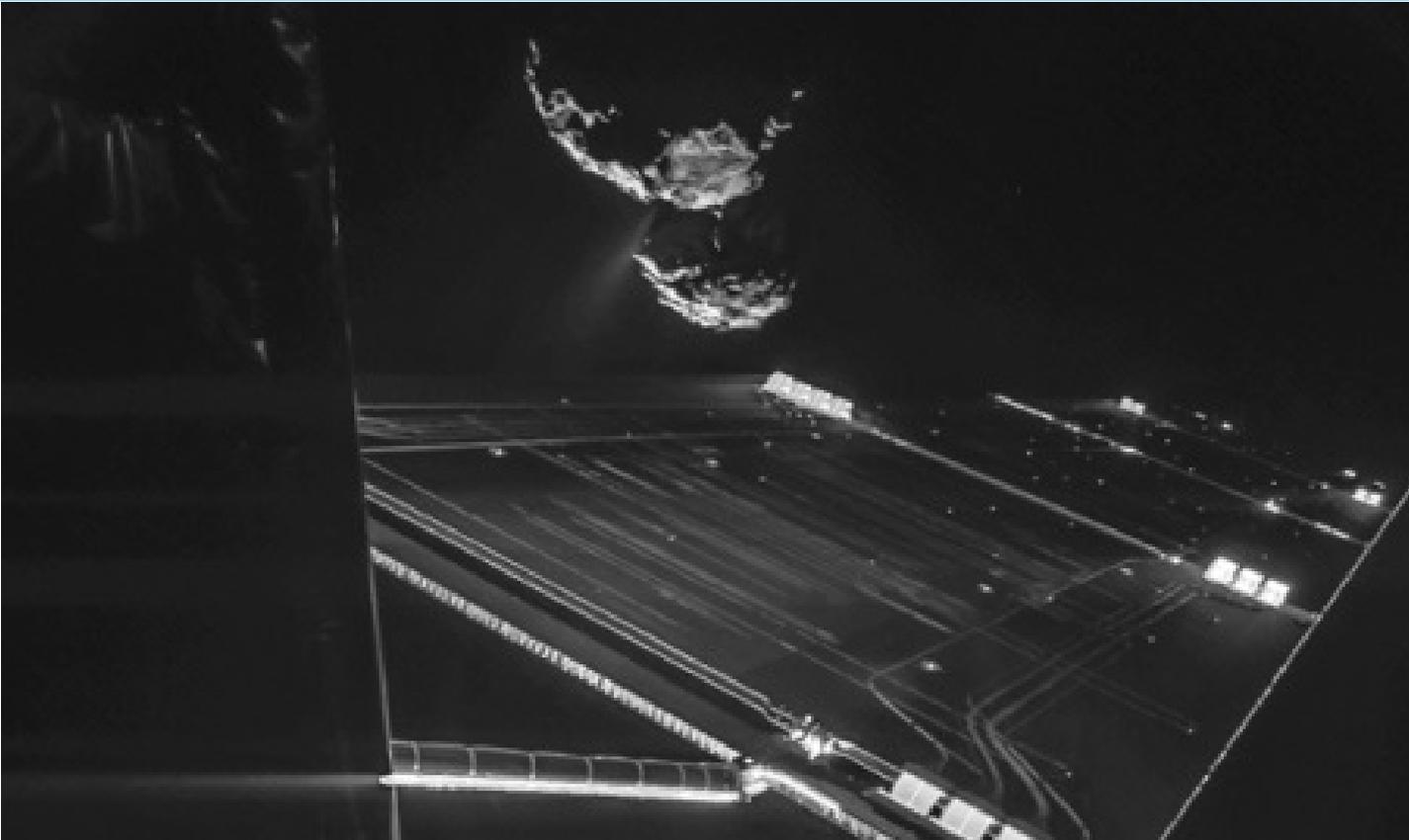
Rosetta – comet arrival – 6th Aug 2014



OSIRIS data covering this time period (mid-June through mid-Sept) due 10th September for testing & PSA ingestion.



Rosetta Selfie from the Philae lander



Lander CIVA data containing this image delivered & under processing before PSA ingestion.

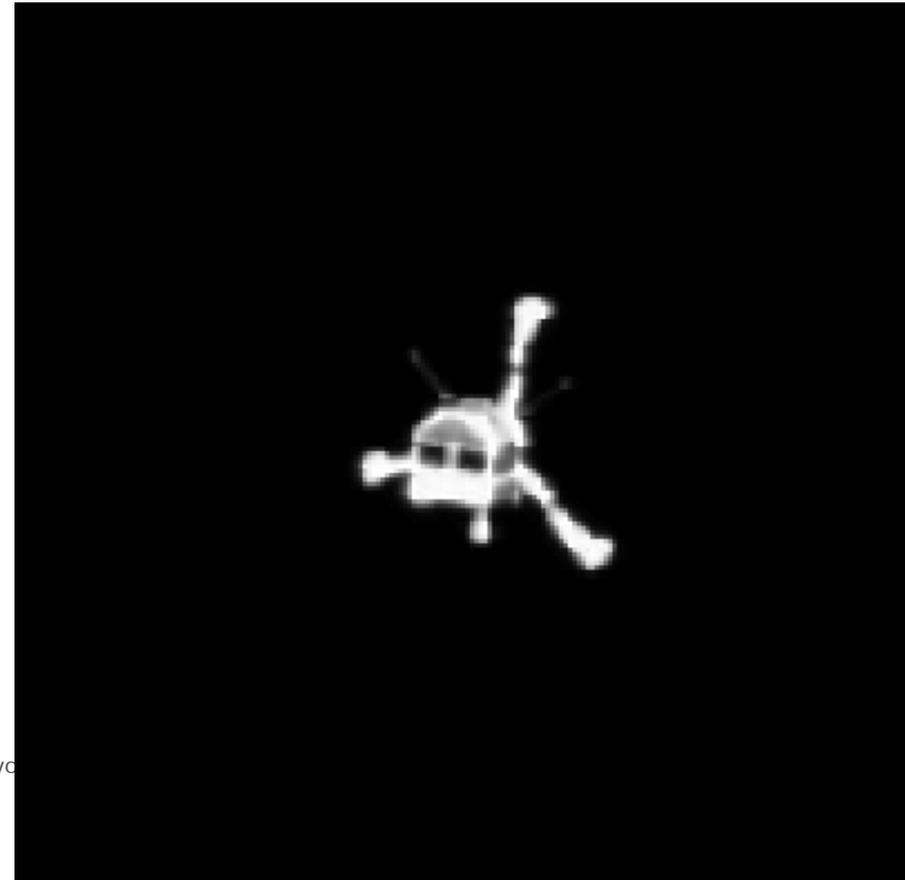


Rosetta Philae landing – separation & initial descent



Lander data for this phase being delivered for PSA processing & ingestion.

OSIRIS data from landing – expected Dec 2015



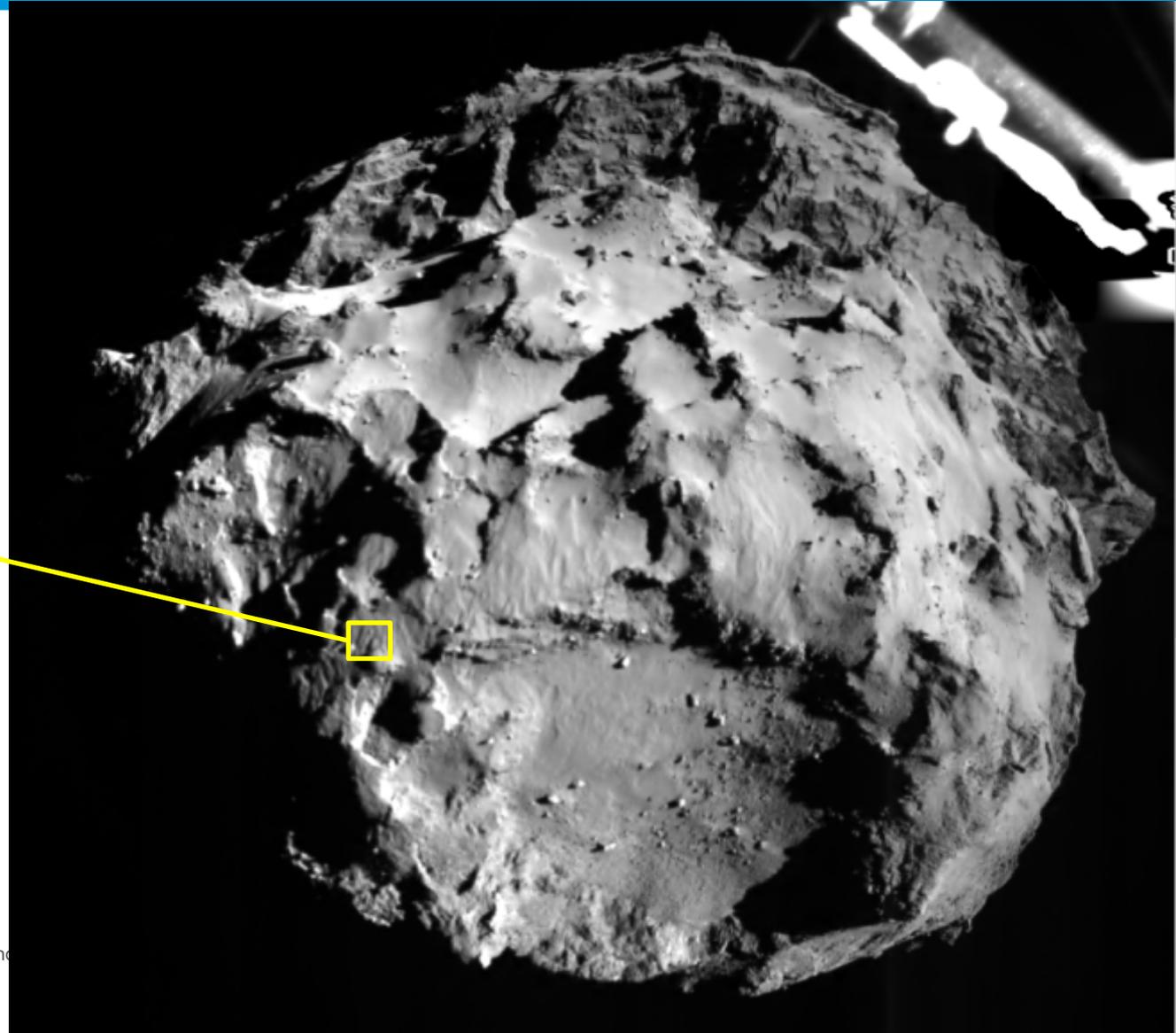
Rosetta Philae landing – descent & landing View from Philae



Lander data for this phase being delivered for PSA processing & ingestion.



40m from surface
1st landing site 😊



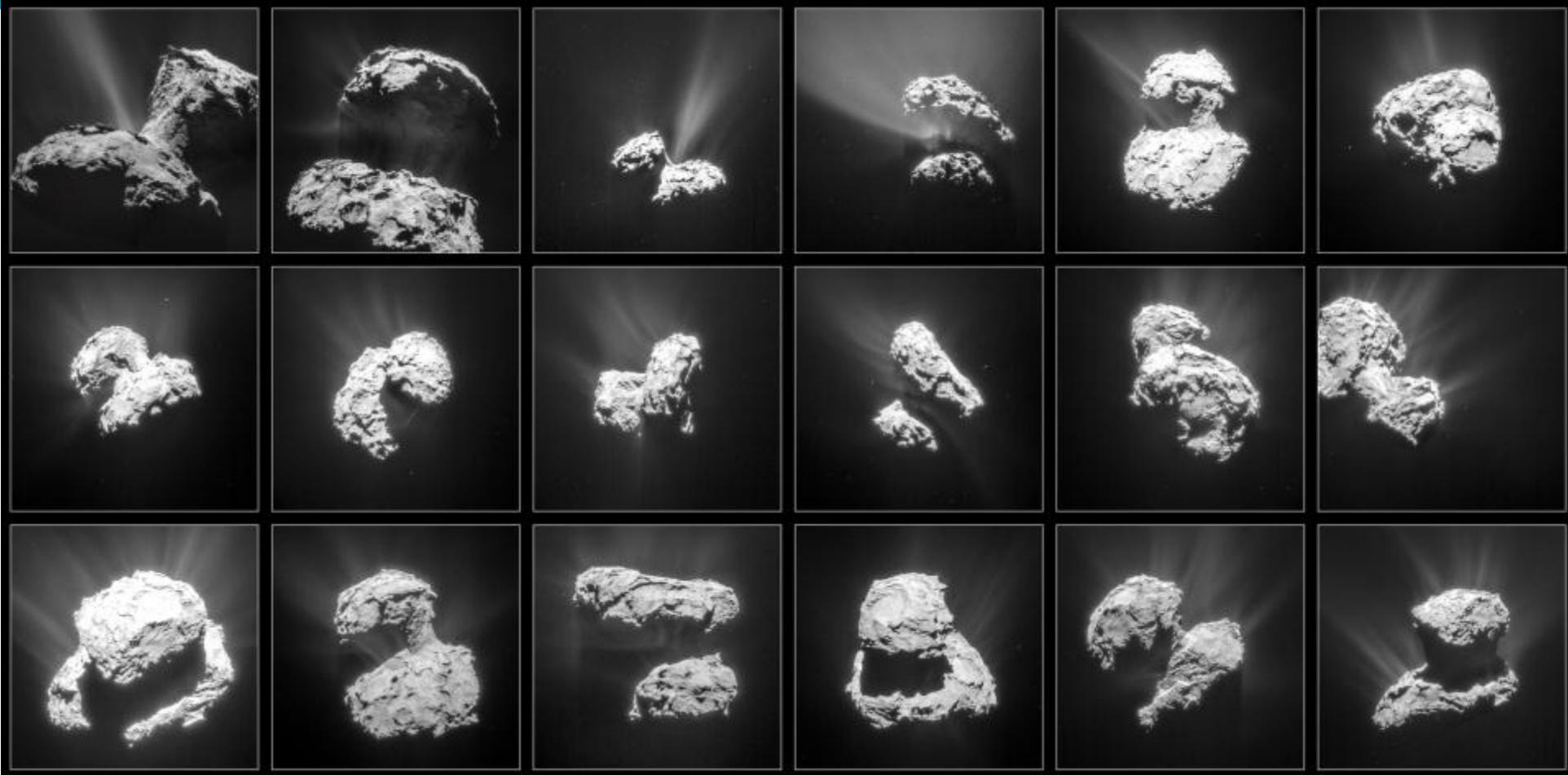
Rosetta Philae landing – On-comet image



Lander data for this phase being delivered for PSA processing & ingestion.



Rosetta NAVCAM imagery – increasing activity



NAVCAM data ingested on PSA & publicly available covering until mid-Dec 2014

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Updates on mission archive status - Rosetta



1. Archive Delivery schedule in place for the Rosetta PI teams & lander
2. 1st delivery has been made by the majority of teams.
3. Each delivery is being run through DVAL process including PDS interaction
4. Expect first release of data for COSIMA, ROSINA, OSIRIS, RPC-MAG by mid-end July 2015. Further deliveries after that.

| Mission Phase Abb ⁿ | End date | Delivery Date |
|--------------------------------|-------------------|----------------------------|
| PRL (Pre-Landing) | 2014-11-19 | 2015-05-19 |
| ESC1 (Escort phase 1) | 2015-03-10 | 2015-09-10 : NEXT DELIVERY |
| ESC2 | 2015-06-30 | 2015-12-30 |
| ESC3 | 2015-10-21 | 2016-04-21 |
| ESC4 | 2015-12-31 | 2016-06-31 |



Navigation Camera Images

1. NAVCAM Image data being released on a monthly basis
2. Next release is planned for end July and will cover mid-Dec 2014 to mid-Jan 2015
3. Very positive public feedback on the data in the image browser – see relevant slides

3D Shape Model & Coordinate system

1. Coordinate system is now agreed for 67P
2. MOC Shape model is being prepared & to be rolled out on 6th August.
3. OSIRIS Shape model has undergone review and an update is to be made to correct coordinate system. This is a low resolution version. A new version may become available (high resolution – SHAP4S) very soon

Additional Manpower being added to the Rosetta team to support archiving

1. PSA 4.2 covers Lander Data
2. More than 3500 Rosetta NavCam images for your enjoyment, released in the ESAC Images Archive Browser: <http://imagearchives.esac.esa.int/>
3. They cover the period from the "Medium Term Plan 5" - July 3 2014 - to the "Medium Term Plan 10" - December 19, 2014 - as the spacecraft circled the comet at ranges between 20 and 30 kilometers, using the OSIRIS camera to search for the Philae lander.
4. On going work on shape model 3D Visualization Tool
5. Key mission for new PSA



Archive Image Browser

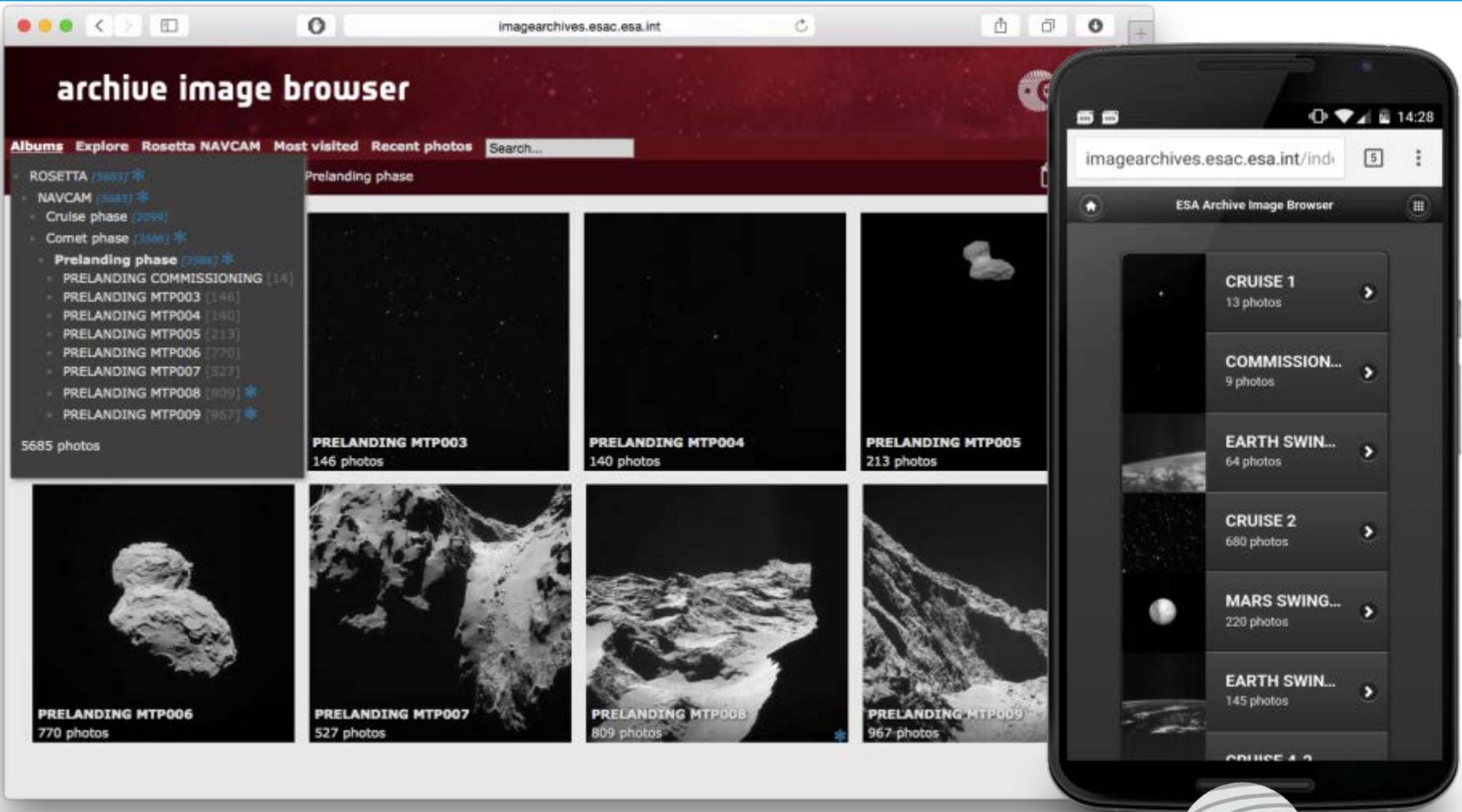


Image Browser – Philae Landing Day

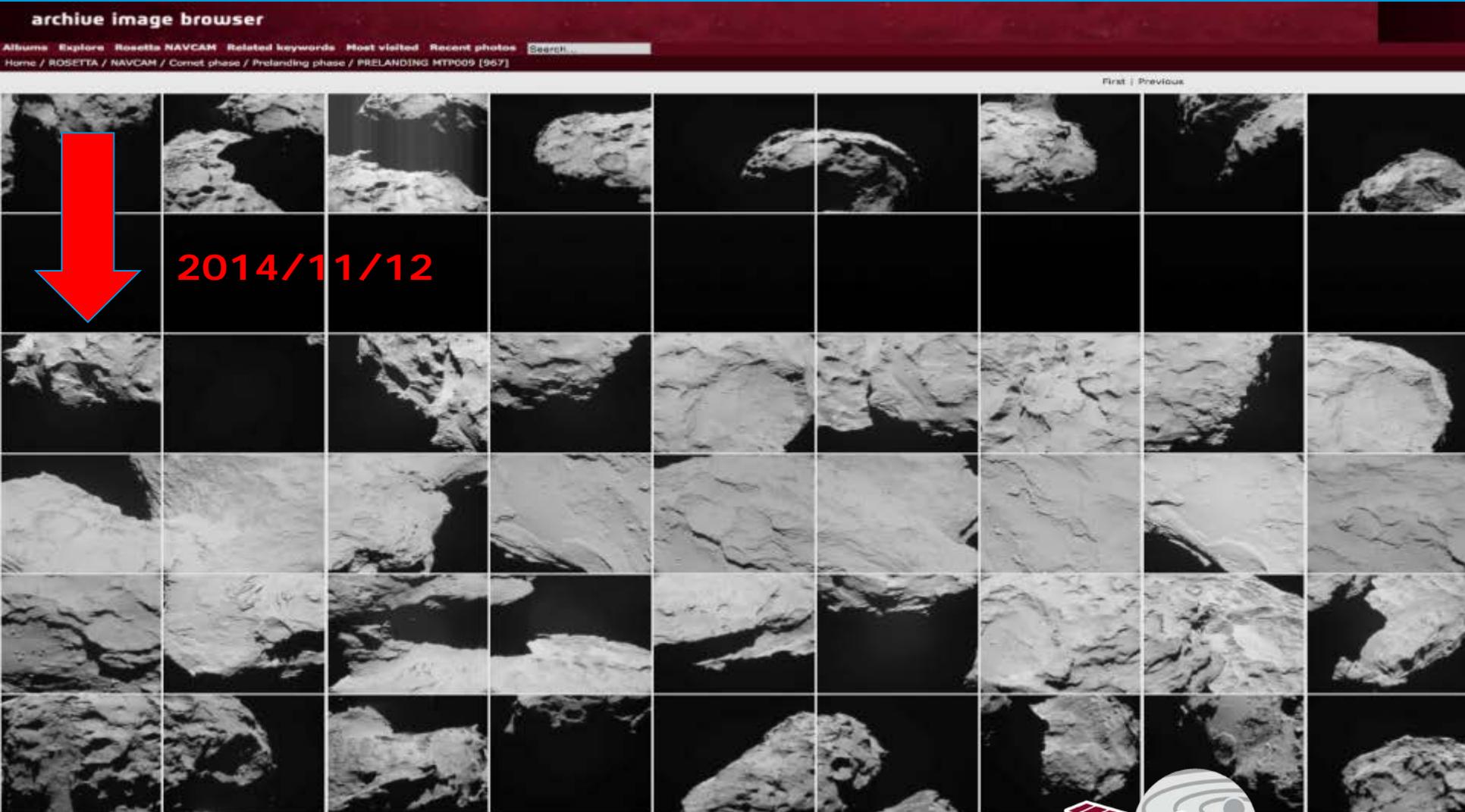
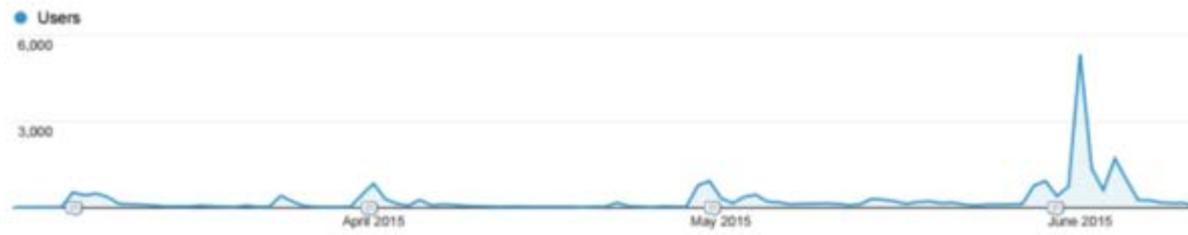
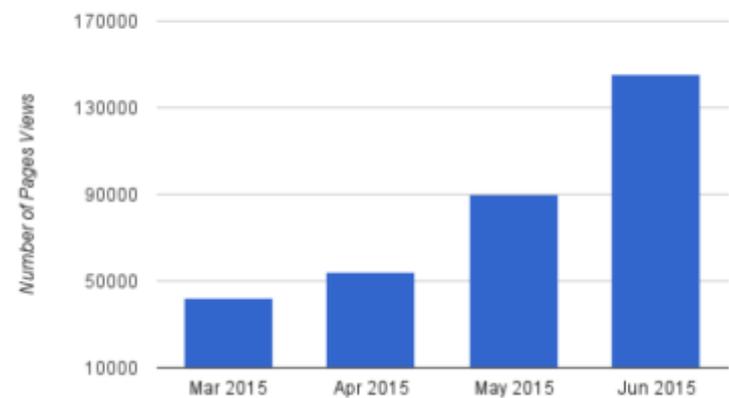


Image Browser - Active Users

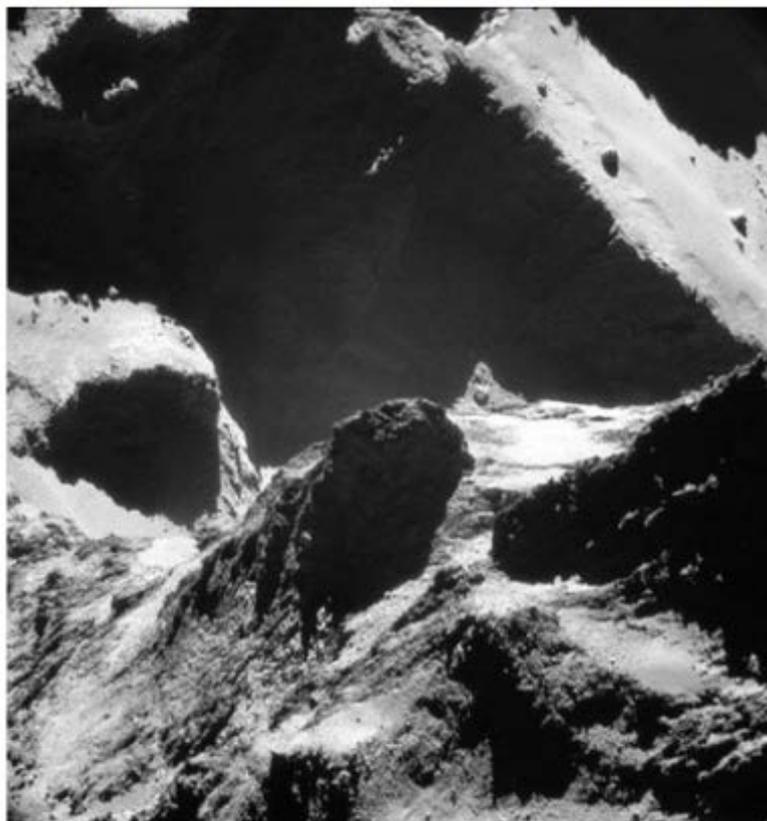


Image Browser - Number of Pages Views



 **ESA - European Space Agency** 
May 28 at 2:43pm · 

Today, perhaps the most anticipated set of NAVCAM images of Comet 67P/Churyumov-Gerasimenko have been released by the Rosetta Mission... <http://blogs.esa.int/.../navcam-image-bonanza-close-orbits-a.../>



Like · Comment · Share ·  3,254  57  1,030

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ESA Rosetta Mission @ESA_Rosetta · May 28

#ICYMI Latest NAVCAM release includes images of #67P from #CometLanding: ow.ly/NzTgK



  153  165 

[View photo](#)



SPACEFLIGHT NOW

HOME NEWS LAUNCH SCHEDULE MISSION REPORTS ARCHIVE ASTRON

Breaking News June 11, 2015 in Mission Reports: Live coverage: Station crew preps for lan

Tour comet 67P in Rosetta's latest image release

Posted on May 21, 2015 by Stephen Clark

SCIENCES ET Avenir

Espace

> EN IMAGES. Gros plans féériques sur la comète Tchouri

EN IMAGES. Gros plans féériques sur la comète Tchouri

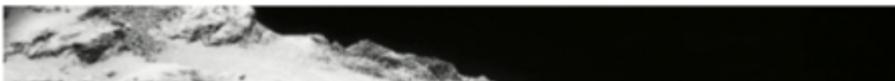


Par Audrey Boehly
Voir tous ses articles

Publié le 04-06-2015 à 14h00

A+ A- Print

Plus de 1700 nouvelles images prises par Rosetta, certaines à seulement 8 km de la surface de la comète, viennent d'être publiées par l'ESA.



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1,776 Portraits of a Comet

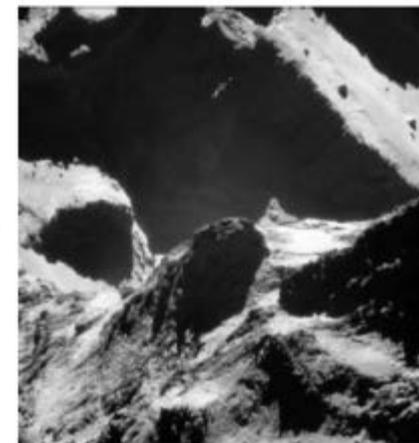
By Caleb A. Scharf | May 29, 2015 |



How do I love thee? Let me count the ways.

Between the 23rd of September and the 21st of November 2014 ESA's Rosetta mission made its closest orbital passes of Comet 67-P/C-G, coming to within 8 km of the surface during and after Philae's plucky landing sequence.

ESA has now released its archive of NAVCAM imagery from this part of the mission, containing a staggering 1,776 images. You can access the full library here. Although not as high-resolution as the OSIRIS science camera, these images more than make up for that with their coverage.



Cometary portrait. One of 1,776 such portraits.

ESA/Rosetta/NAVCAM





Tour comet 67P/Churyumov-Gerasimenko in Rosetta's latest image release

Posted on 1 June 2015 by Stephen Clark



science **space**

Pictures from the Rosetta space probe's close encounter with Comet 67P released

This story was published: 6 DAYS AGO | JUNE 05, 2015 10:15AM

1 comment



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THE PLANETARY SOCIETY
Your place in space

More than 1000 Rosetta NavCam images released!

Posted By Emily Lakdawalla

2015/04/29 16:50 UTC

Topics: Rosetta and Philae, pretty pictures, comets, comet Churyumov-Gerasimenko

Today the European Space Agency released a ton of NavCam images, taken as the spacecraft approached and then entered orbit at the comet. You can see the comet in all its sunlit and shadowy moods. The new release includes images taken from ranges between 800 and 30 kilometers to the comet, through late September 2014. At that time the comet wasn't yet particularly active, so the comet's jets are not obvious in the thumbnail images; you have to download contrast to reveal them. You can access all the data here at the Rosetta archive image browser. You can find out more blog.

To give you a taste of the data that has been released today, ESA made a video:



- Further missions/instruments ingestion
 - Browser value increases exponentially with amount of data hosted
 - Already working on MEX and Hubble
- Development of specific extensions
- Open Data Portal ?

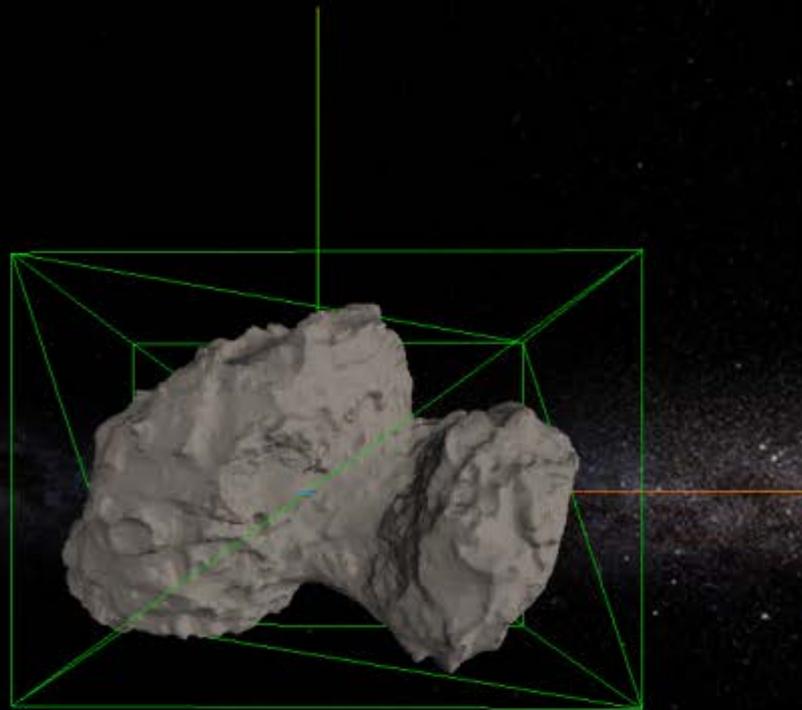


3D Visualization – 67P Comet



Info: The model matches NAVCAM data gathered during the close orbit phase in Sept/Oct 2014

Download
OBJ File (9MB)
WRL File (10MB)
STL File (38MB)



| | |
|--------------|---------------------------------------|
| Date: | 1 November 2014 |
| BoundingBox: | <input checked="" type="checkbox"/> |
| Axis: | <input checked="" type="checkbox"/> |
| Stars: | <input type="checkbox"/> |
| MilkyWay: | <input checked="" type="checkbox"/> |
| Play: | <input type="checkbox"/> |
| Speed: | <input type="range" value="0.1"/> 0.1 |
| Reference: | ESA/ESOC/FD |

Close Controls



1. **Huygens:**
 - a. Iterating with NASA colleagues on DISR – under review.

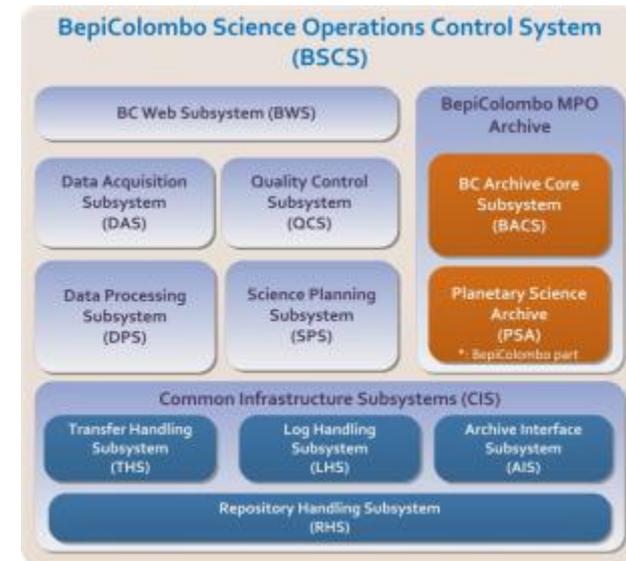
2. **SPICE:** Updated Rosetta, MEX and VEX data sets released.

3. **Chandrayaan-1:** Data delivered to ISRO and released.
 - a. Aim to implement interoperability.

Future missions - BepiColombo



1. Joint mission between ESA and JAXA
 - a. Will use PDS4
 - b. Working on interoperable access / sharing of archiving tasks
 - c. ESA SGS will offer capabilities to run instruments' data pipelines
2. The BepiColombo Archive Core System (BACS) will be the mission archive
 - a. Supports archiving and distribution of all non-science mission operational data (e.g. telemetry, planning files, quick-look analysis reports,..)
 - b. Access throughout the different phases of the mission
 - c. Provides access for searching and retrieving data through a web user interface and a TAP service
3. The PSA will provide the archive for all the science data of BepiColombo and will be available throughout the mission up to and including the legacy phase



bepicolombo
European Space Agency

BepiColombo Archiving Timeline



| Mission Phase | Milestone / Activity | Date |
|--|---|-------------------------------|
| Before Launch | Archiving Plan signed version due | Aug 2016 |
| | EAICD first version due (ready for peer-review) | Aug 2016 |
| | Peer-review of available documentation, data samples and pipelines | End of 2016 |
| | Ingestion of on-ground calibration and laboratory measurements | 2016 |
| Launch | | January 2017 |
| Cruise Phase | First in-flight data expected during Near-Earth Commissioning | February 2017 or later |
| | First data delivery (and ingestion in archive) during Commissioning | February 2017 or later |
| | EAICD second version due (ready for peer-review) | End of 2018 |
| | Solar Conjunction Experiment (radio science) | Aug 2019 |
| | Venus flybys | Sep 2019, May 2020 |
| | First science data delivery (and ingestion in archive) during Cruise | Aug 2019 or later |
| | First science data public release during Cruise | Feb 2020 or later |
| | EAICD final version due (ready for peer-review) | May 2023 |
| Peer-review of documentation, data and pipelines | End of 2023 | |
| Mercury Orbit Insertion (MOI) | | January 2024 |
| Start of Mercury Nominal Science Operations | | May 2024 |
| Mercury Science Phase | First data delivery (and ingestion in archive) during Science Phase | May 2024 |
| | Peer-review of the first data delivery | September 2024 |
| | First data public release during Nominal phase | December 2024 |
| EOM | | November 2027 |
| Post-Operations Phase | Final data delivery | EOM + 6 months |
| | Peer-review after the final data delivery | EOM + 6 months |
| | Archive transfer to Legacy Phase | EOM + 1.5 years |



1. 11 Instruments on MPO (ESA) and 5 on MMO (JAXA)
2. Pipelines for 4 out of 11 MPO instruments expected by Launch (Jan 2017)
 - a. First draft of PDS4 templates ready for all raw & calibrated products; currently iterating with instrument teams for consolidation
 - b. Pipeline for 2 instruments ready to produce PDS4 raw products
 - c. PDS4 validate tool integrated in the system for validation of pipeline products
3. Expected product types (ongoing discussions): Table_Character, Table_Binary, Array_2D, Array_3D, Array_2D_Spectrum + CDF (limited), FITS
 - a. CDF will be used by several MMO instruments; Planning to exercise generation of PDS4 labels soon with information/tools provided by PDS PPI and IPDA



1. Working on consolidation of PDS4 archiving conventions, including logical identifiers, filenames, bundle content and organization
2. Exercising data delivery to PSA based on PDS4 concepts (using PDS4 SIP class); Delivery of both individual products or bundles possible. Bundle generation optionally after delivery to PSA; generally very successful
3. Generation of both mission bundle and instrument bundles exercised
4. PDS4 geometry handling / implementation needs further work; to be exercised in the coming months
5. First draft of EAICD (equivalent to PDS SIS documents) for 4 out of 11 ESA instruments expected in Feb 2016



1. Joint missions between ESA and ROSCOSMOS
 - a. Telemetry is sent to ESAC
 - b. Pipeline to convert TM into PDS4 Products
 - c. PSA to generate Bundle and ingestion into the Archive
 - d. Mirroring mechanism with IKI (both ExoMars16 and ExoMars18).
 - e. Joint effort with Bepi Colombo for PDS4 Naming Conventions

2. Initiate discussions on Exomars 2018
 - a. ALTEC will channel all Rover TM to ESAC (not as PDS4 products)
 - b. PSA started work for Surface analysis and discovery.



1. PSA requires all our PDS3 data providers to run our PSA Volume Verification Tool (PVV)
 - a. If it passes the PVV, we (PSA) can ingest it!
 - b. PVV is always used in combination with PDS validation tools, but many issues remain.

2. For Rosetta Data Validation (DVal) tool now in use with instrument teams.
 - a. Automated validation from PVV and other tools combined.
 - b. Core validation tool for Rosetta data.
 - c. Single validation to qualify data for ingestion at PSA and PDS...

3. For PDS4 missions (BepiC, Exomars)
 - a. NASA Validate Tool

New PSA Development Plans

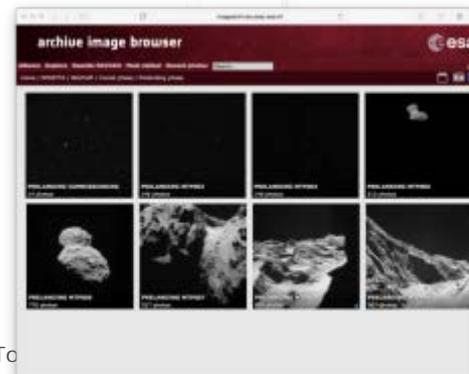
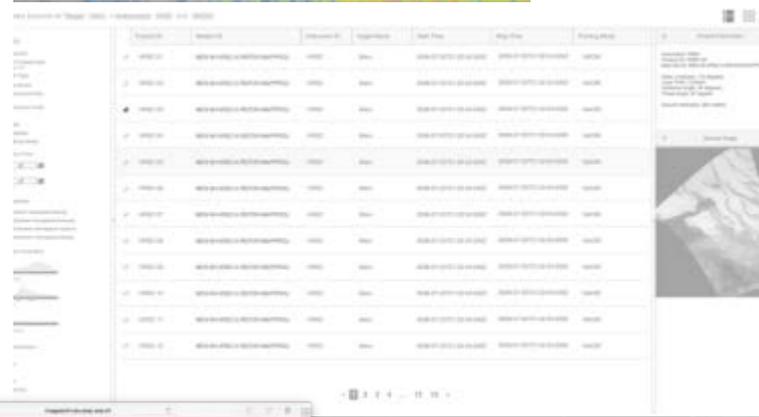
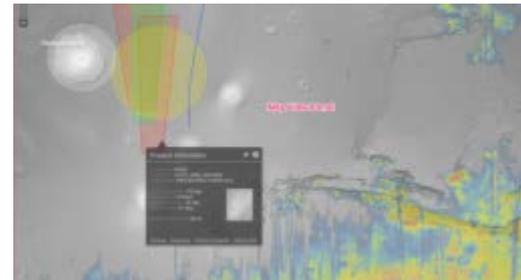


Goals

1. The new PSA development is mostly driven by the evolution of the PDS standard (PDS4), and the growing need for better interfaces and advanced applications to **support science exploitation**, including a better integration within Planetary GIS Users workflows.
2. Stronger collaboration and interoperability with different planetary institutions and nodes (VESPA, IPDA, PDS Geosciences node..)

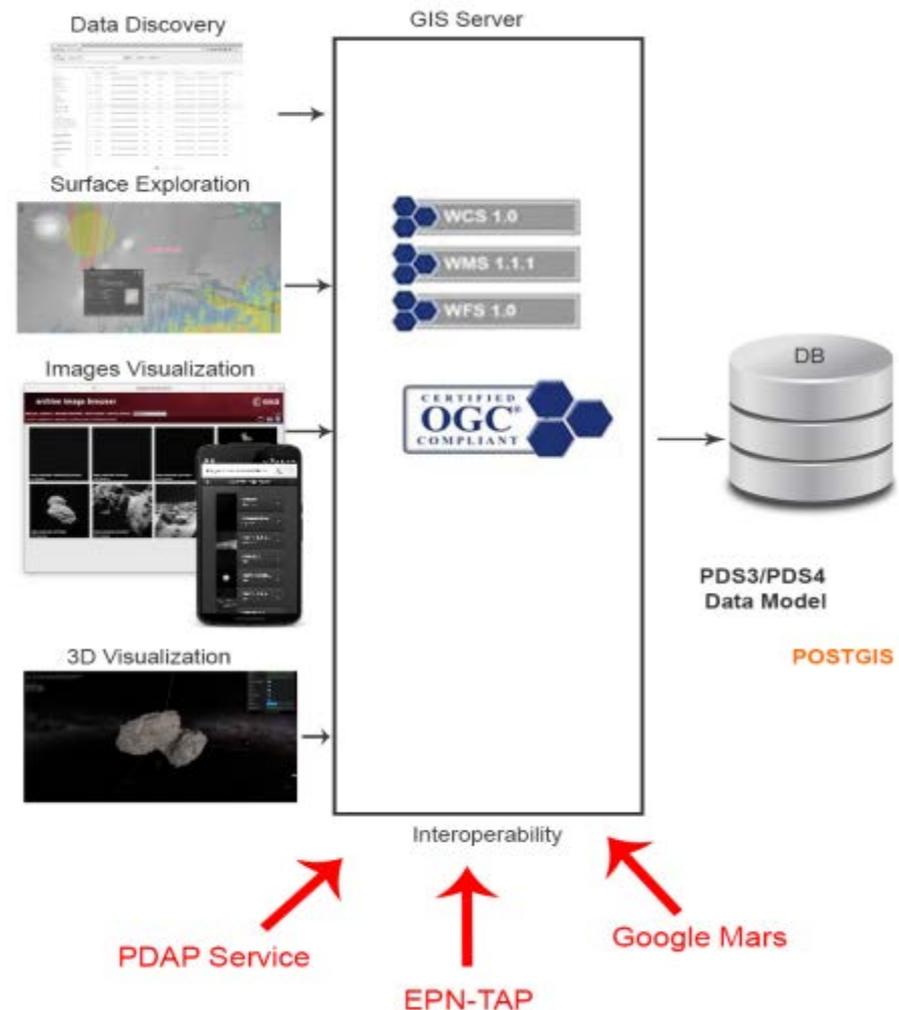
New PSA Highlights:

1. Better Data Discovery and Visualization
2. Surface Exploration - GIS Technology for geospatial data
3. Archive Image Browser
<http://imagearchives.esac.esa.int>
4. 3D Capabilities



New PSA System Architecture

1. Support PDS3/PDS4
2. New database, PostgreSQL, with PostGIS plug in
3. GIS server
4. Thin Layer web client
5. Surface Exploration – GIS technology for geospatial data
6. Archive Image Browser
7. 3D visualization
8. Interoperability (PDAP, EPN-TAP, Google Mars, ...)
9. Enables building of added value services



1. Interoperability

- a. PDAP in development (V1.0 1.Jan.2013)
- b. EPN-TAP analysis done in July 2015.

2. PDS3/PDS4

- a. Data Model mapping PDS3 and PDS4 metadata
- b. Plan to create user group to assess PDS4 geometry for ExoMars16 and Bepi Colombo
Use of NASA Generate Tool

3. Software Tools

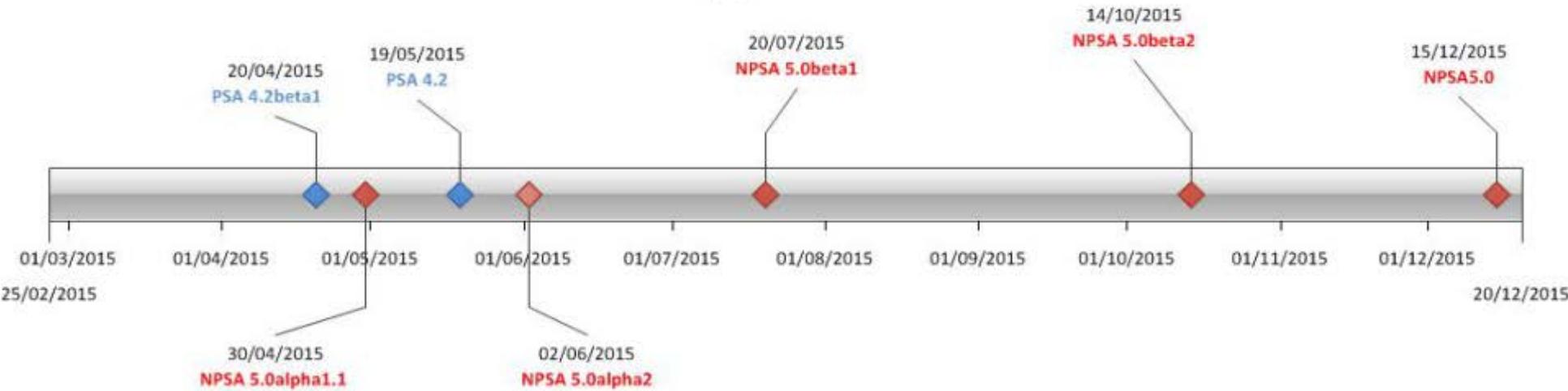
- a. Bundle Generator Software Development - Specific for ExoMars and Bepi Colombo
- b. Plans to use/assess NASA PDS4 Validation Tool



New PSA Development Timeline



Planetary Archive Roadmap v0.2 18/05/2015



1. PSA 5.0beta1 (Jul 2015)

- Ingestion and retrieval of ExoMars16 and Bepi Colombo PDS4 Bundles and Products
- Assessment of EPN-TAP
- First Prototype User Interface (Map + Metadata)

2. PSA 5.0beta2 (Oct 2015)

- PDAP Implementation

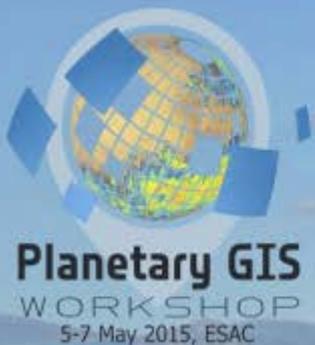
3. PSA 5.0 (Dec 2015) - Public release

- Authentication Mechanism



ESAC Planetary GIS Workshop

5-7 May 2015, Madrid, Spain



Objectives

Evaluate of **State-Of-The-Art**

Identify **Scientific Use-Cases**

Rally **Geospatial Mapping Community**
in Europe

Motivate **Open, Community-Driven,**
Collaborative data exploitation

Encourage use of **Geospatial Standards**



Details

80+

participants

40+

institutions

12

countries

Discussion Forum

to address common GIS challenges

Hands-On Training

on main GIS tools

Feedback Survey

captured in workshop report



Community Evaluation

lecture-unconference mix well received

cooperation, networking, **knowledge sharing**

Future Workshops

interest in **periodic workshops**

more **handsons**

longer **open session**

geological mapping track

similar workshops for other communities

- atmospheres, plasma, magnetospheres

Future Workshops ... continued

more **technical discussions with software developers**

dedicated **workshops for data providers**

list of tools for planetary data analysis

Community Building - online & offline

desire to **discuss and share** further

led to **OpenPlanetary** initiative



OpenPlanetary

OpenPlanetary is an initiative by planetary scientists and mappers to use and share Planetary Data and GIS technologies to expand our understanding of the planets. It aims at creating an online community, using tools such as [Slack](#), [Twitter](#), [Github](#) and [StackExchange](#).

[JOIN THE COMMUNITY](#)



community-driven

direct outcome of ESAC Planetary GIS Workshop

stay connected

online sharing solutions

knowledge, resources, code, tools and services

via forums, wiki, stackexchange, github, slack

online events

tool demos, surveys, hackathons, tutorials, topical discussions

follow-ups of past and anticipation of future workshops



focus

community building

use cases

planetary mapping

tutorials & hacks

tool demos

Currently **engaging the Planetary Science Community**
to contribute to discussions using **#Slack**.



Open**Planetary**

openplanetary.github.io

JOIN THE COMMUNITY

1. Objectives:

- a. Advise ESA on the future development of the PSA content, interfaces, documentation, compatibility with other planetary science archives and tools.
- b. Act as a focus for the interests of the scientific community in the PSA and as an advocate for the PSA within that community.

2. Members: The PSA-UG is comprised of 6 members covering a range of expertise in scientific disciplines.



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Remote Sensing: Solid Surfaces
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Project Scientist Representative
PSA-UG Observer
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Status:

1. <http://archives.esac.esa.int/psa/psa-ug>
2. Three face-to-face meetings so far (aim for 2 per year).
3. Regular promotion of PSA-UG and the PSA at conferences.
4. Canvassing the community for inputs on the current state of the PSA and the way forwards.
5. Providing recommendations for the future PSA and the interfaces and services we will provide to the community.

Questionnaire:

1. The PSA-UG distributed a questionnaire to the community for inputs:
2. <http://surveymonkey.com/s/psaug>
3. *Responses show there to be a strong interest from the community in improving our interoperability access to data, and expanding our access to tools for data reading and manipulation.*

1. Many changes on-going and upcoming in the PSA
 - a. Aim at ensuring *data archiving* and *science exploitation* for all ESA Planetary mission (past, current and future)
 - b. Changes of people
 - c. Totally new PSA software systems being built

2. Listening to science community
 - a. Through PSA-User Group
 - b. GIS workshop

3. ESA remains fully committed to IPDA



Thanks to the PSA Team



1. PSA is the result of the effort of many people
2. Data Handling and Archive Scientists
 - a. Guido de Marchi (PSA Science Lead, acting), Maud Barth (Rosetta), Sebastien Besse (Rosetta), Diego Fraga (Rosetta), Emmanuel Grotheer (MEX, VEX), Dave Heather (Exomars 2018), Santa Martinez (BepiC),
3. PSA software engineers
 - a. Isa Barbarisi (PSA Technical Lead), Ruben Docal, Alan Macfarlane, Carlos Rios
4. BepiColombo, Exomars, MEX, Rosetta, VEX Science Ground Segment teams
5. PSA User Group

