

RESEARCH PRODUCTS ACROSS SPACE MISSIONS – A PROTOTYPE FOR CENTRAL STORAGE, VISUALIZATION AND USABILITY

WHAT WE CAN LEARN AND USE FROM
TERRESTRIAL DEVELOPMENTS

Mario d'Amore, Andrea Naß, Martin Mühlbauer, Torsten Heinen, Mathias Boeck, Jörn Helbert, Torsten Riedlinger, Ralf Jaumann und Günter Strunz

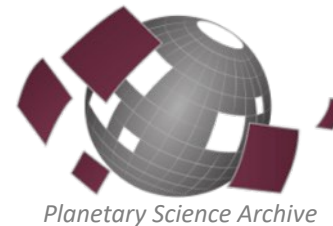
EGU • May 2020

STATUS QUO

PLANETARY SCIENCES

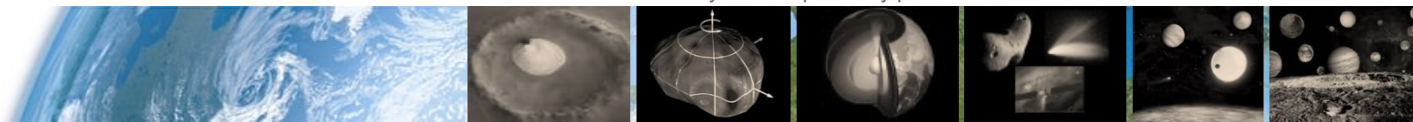
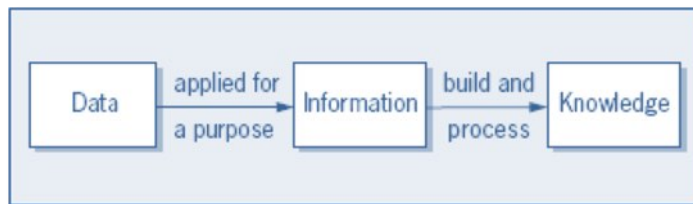
Digital data like raster images, data cubes and tables, terrain-model and photomosaics as well as the respective pieces of **meta information** are stores in **digital archives** or **repositories**.

Main archives are ...



A number of **national space science institutes** and **agencies** across the globe may provide access to **archived mission data for a period of time**.

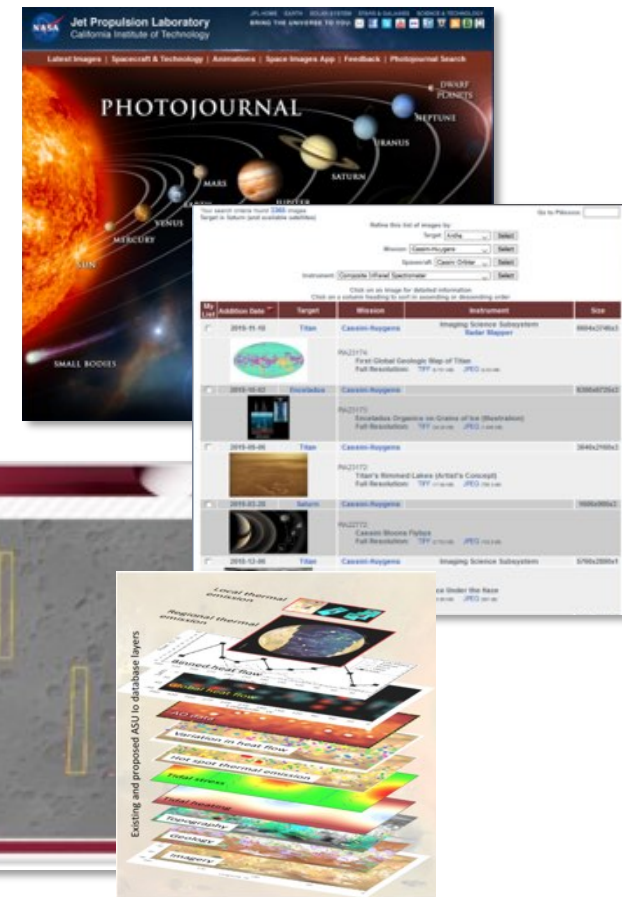
Use to compile **higher-level research products** to form a basis for **continued research, new scientific** and **engineering studies** and **to improve our understanding of the outer space**.



STATUS QUO PLANETARY SCIENCES

In the **planetary sciences first efforts** are being made. e.g.

- the **Astropedia Annex** within **PDS** for registering and hosting derived geospatial products,
- the **Photojournal** hosted by **JPL**,
A searchable collection of press release images from NASA planetary missions
- the **PSA** is simplifying the archiving needs to help promote the access to scientific products.
- **Individual database structures** managing data of different bodies, e.g. for Io



Williams et al., (2019) LPSC

Beside this main repositories **first initiatives** came handling data (infra)structure and accessibility:



PlanMap (Horizon2020)



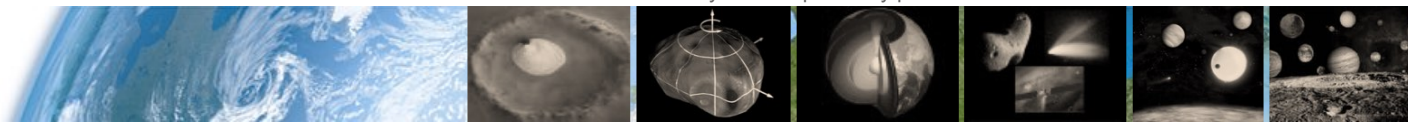
VESPA (Europlanet)



MAPSIT (NASA)

Towards an information system for planetary products

Folie 3



STATUS QUO

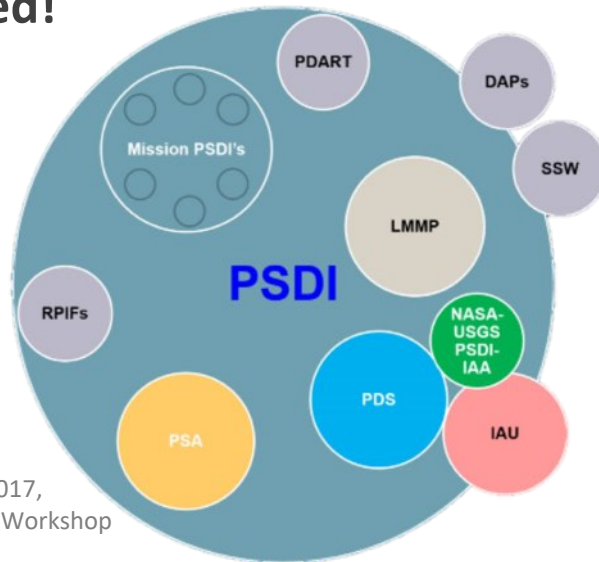
RE-USE OF SCIENTIFIC DATA – IN GENERAL

In order to achieve a

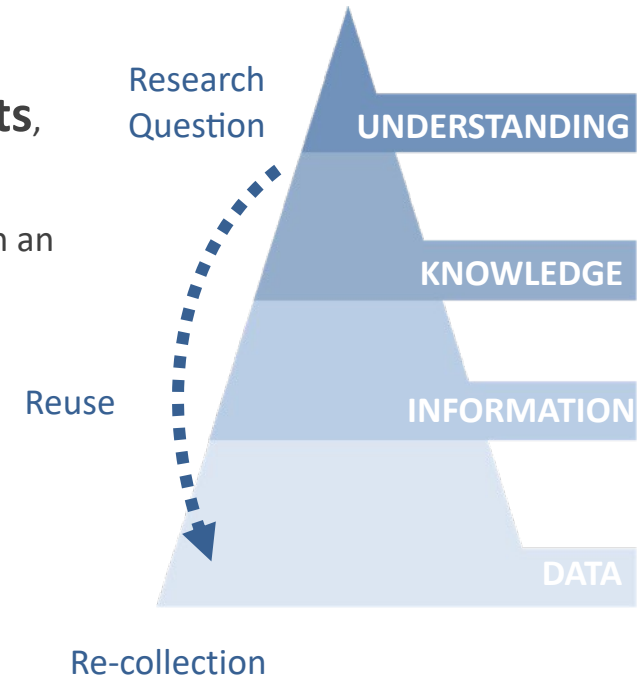
re-usability and **sustainability** for the **scientific results**,

a **consistent** and **extensive data basis** accessible through an
common infrastructure in a research environment

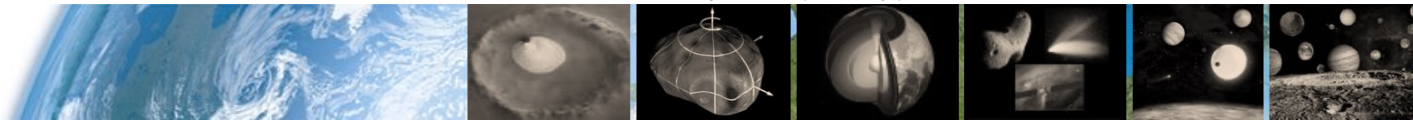
is needed!



Gaddis et al., 2017,
Planetary Data Workshop



Therefore, **a formal coordination of
organizational processes are required!**



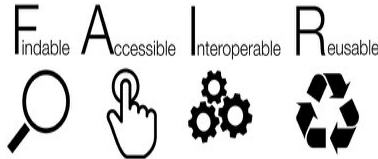
STATUS QUO

RE-USE OF SCIENTIFIC DATA – IN GENERAL

Open Access providing on-line access to scientific information, refers to Peer-reviewed scientific research articles and Research data, **that is free of charge to the reader.** (Horizon 2020 Online Manuals)

International Standards for metadata, data schemas, APIs

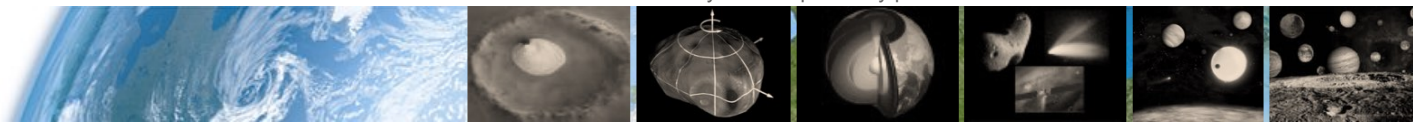
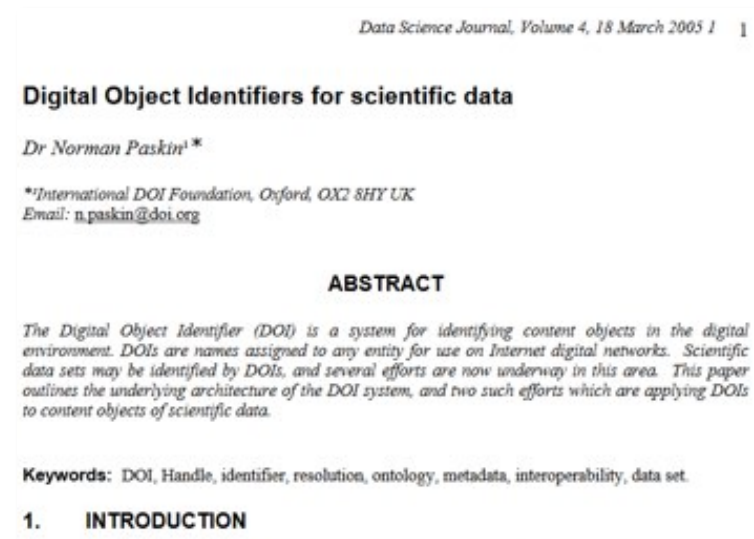
Principle of **F**indable **A**ccessible **I**nteroperable **R**eusable data (e.g. Wilkinson et al, 2016)



Publisher rules and **guidelines**, e.g. Nature and Elsevier

Requirements within **external funding**

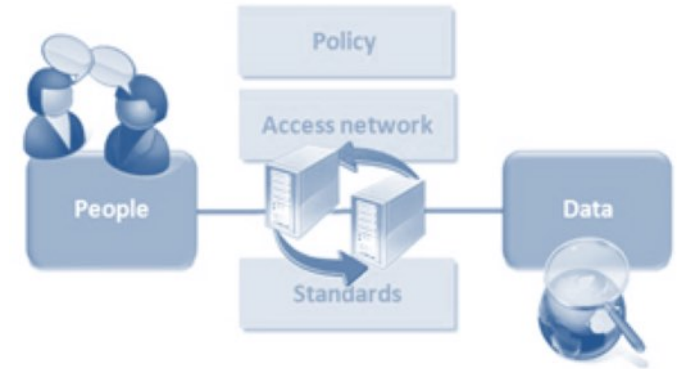
Digital Object identifier for scientific data



STATUS QUO

RE-USE OF SCIENTIFIC DATA – IN SPATIAL

Spatial data infrastructure (SDI) is a **framework** of **spatial data, metadata, users** and **tools** that are interactively **connected** in order to use spatial data in an **efficient** and **flexible** way.



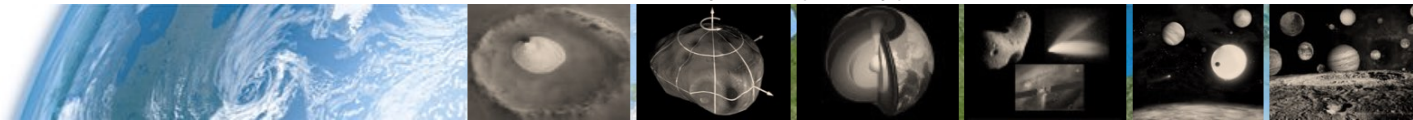
Earth sciences infrastructures growing organically.

These (might) **differ from** developments in the **planetary sciences**, but present a great potential

to avoid similar problems and handle challenges right from the beginning.



Different level of SDIs



STATUS QUO

INSTITUTE FOR PLANETARY RESEARCH

- Nearly all **data** could **spatially** – related or referenced

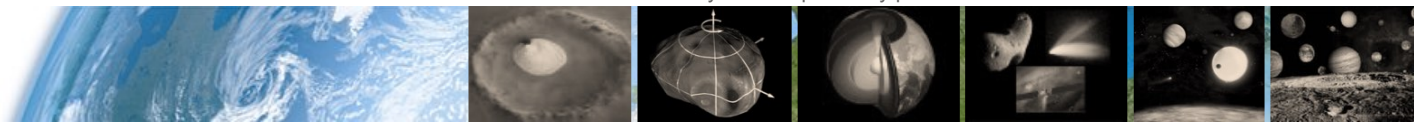
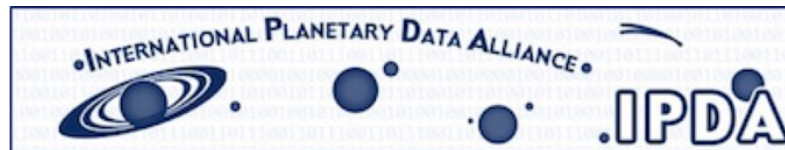
- Regional Planetary Image Facility



and **elib**

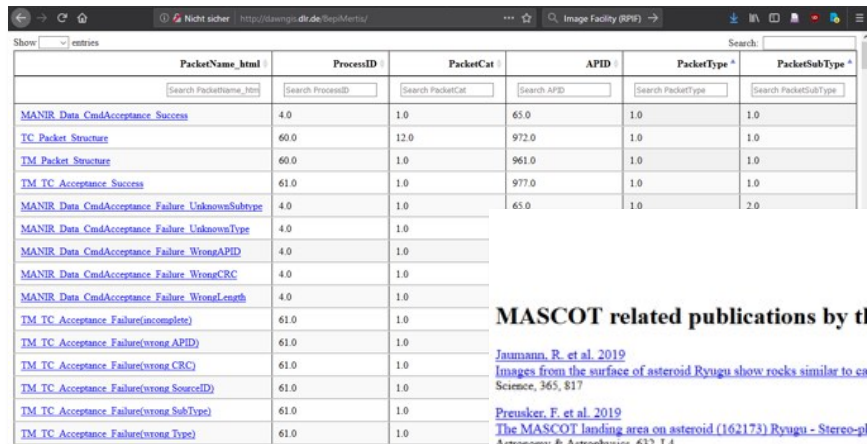
- Connection to **international Organizations, Institutes, and Initiatives** like

PSA USER GROUP



STATUS QUO INSTITUTE FOR PLANETARY RESEARCH

Mission data centrally managed in **PostgreSQL** via **metadata**
Scientific products are stored **decentral** locally or on team sites.



PacketName_html	ProcessID	PacketCat	APID	PacketType	PacketSubType
MANIR_Data_CmdAcceptance_Success	4.0	1.0	65.0	1.0	1.0
TC_Packet_Structure	60.0	12.0	972.0	1.0	1.0
TM_Packet_Structure	60.0	1.0	961.0	1.0	1.0
TM_TC_Acceptance_Success	61.0	1.0	977.0	1.0	1.0
MANIR_Data_CmdAcceptance_Failure_UnknownSubType	4.0	1.0	65.0	1.0	2.0
MANIR_Data_CmdAcceptance_Failure_UnknownType	4.0	1.0			
MANIR_Data_CmdAcceptance_Failure_WrongAPID	4.0	1.0			
MANIR_Data_CmdAcceptance_Failure_WrongCRC	4.0	1.0			
MANIR_Data_CmdAcceptance_Failure_WrongLength	4.0	1.0			
TM_TC_Acceptance_Failure(incomplete)	61.0	1.0			
TM_TC_Acceptance_Failure(wrong APID)	61.0	1.0			
TM_TC_Acceptance_Failure(wrong CRC)	61.0	1.0			
TM_TC_Acceptance_Failure(wrong SourceID)	61.0	1.0			
TM_TC_Acceptance_Failure(wrong SubType)	61.0	1.0			
TM_TC_Acceptance_Failure(wrong Type)	61.0	1.0			

<http://dawn-gis.dlr.de/BepiMertis/>

MASCOT related publications by the Institute of Planetary Research

Jaumann, R. et al. 2019
Images from the surface of asteroid Ryugu show rocks similar to carbonaceous chondrite meteorites.
Science, 365, 817

Preusker, F. et al. 2019
The MASCOT landing area on asteroid (162173) Ryugu - Stereo-photogrammetric analysis using images of the ONC onboard the Hayabusa2
Astronomy & Astrophysics, 632, L4

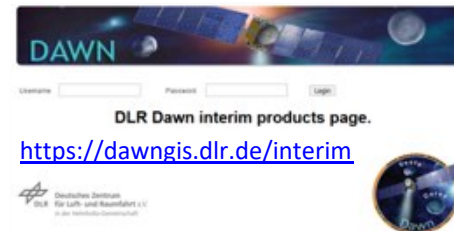
Scholten, F. et al. 2019
The descent and bouncing path of the Hayabusa2 lander MASCOT at asteroid (162173) Ryugu.
Astronomy & Astrophysics, 632, L3

Scholten, F. et al. 2019
The Hayabusa2 lander MASCOT on the surface of asteroid (162173) Ryugu - Stereo-photogrammetric analysis of MASCAM image data
Astronomy & Astrophysics, 632, L5

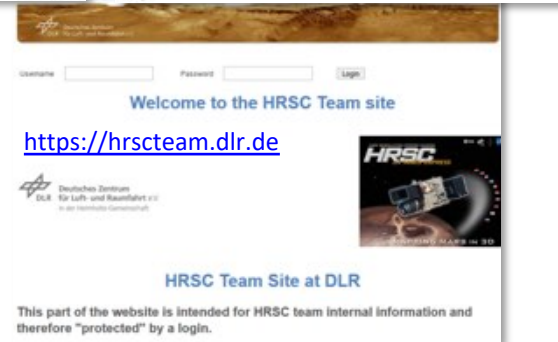
<http://europa.dlr.de/Hayabusa2/MASCOT/index.html>



<https://insighthp3.dlr.de/hp3/>



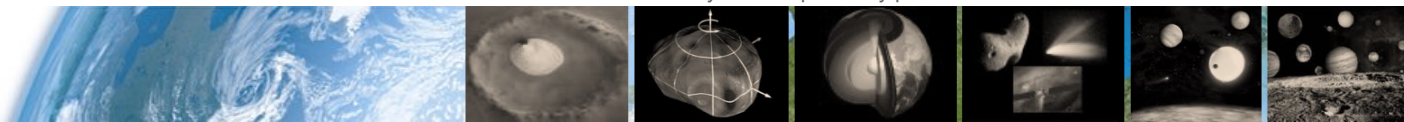
<https://dawn-gis.dlr.de/interim>



However, **first use cases for scientific results** in **PostgreSQL** exists.

Towards an information system for planetary products

Folie 8



STATUS QUO

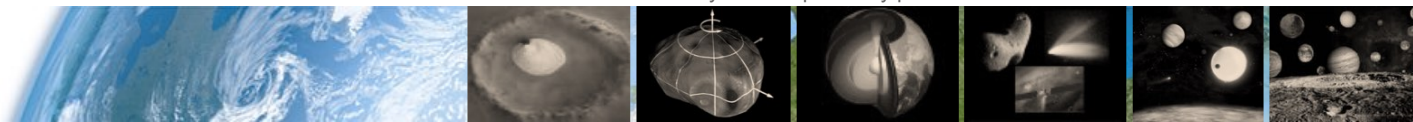
WHAT WE ARE WORKING FOR

Question is

How scientific products at PF can be archived long term and central, to enable crosslinks via spatial-temporal relations and metadata to build a sustainable and reusable base for further studies?

Therefore we

- Highlight the **potential of spatial and temporal relation within current Earth-based developments** in infrastructure, database and web-based accessibility.
- Underline the **benefit of provisioning research data and scientific products.**
- Present the **first prototype** for a **planetary information system** at PF.
- Consider challenges came up like **individual workarounds**, load, organize, access, deliver data etc.



SPECTRAL MEETS GEOLOGY

... MERTIS

... MASCS DATABASE

... EXAMPLES FOR JOINED RESEARCH AREAS

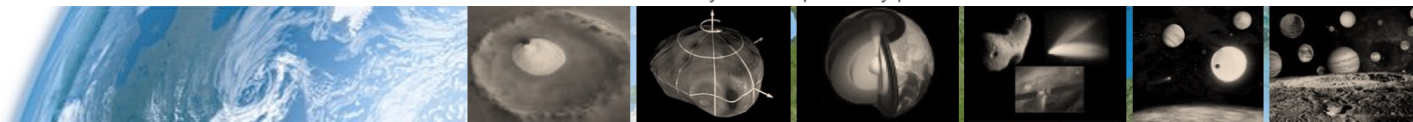
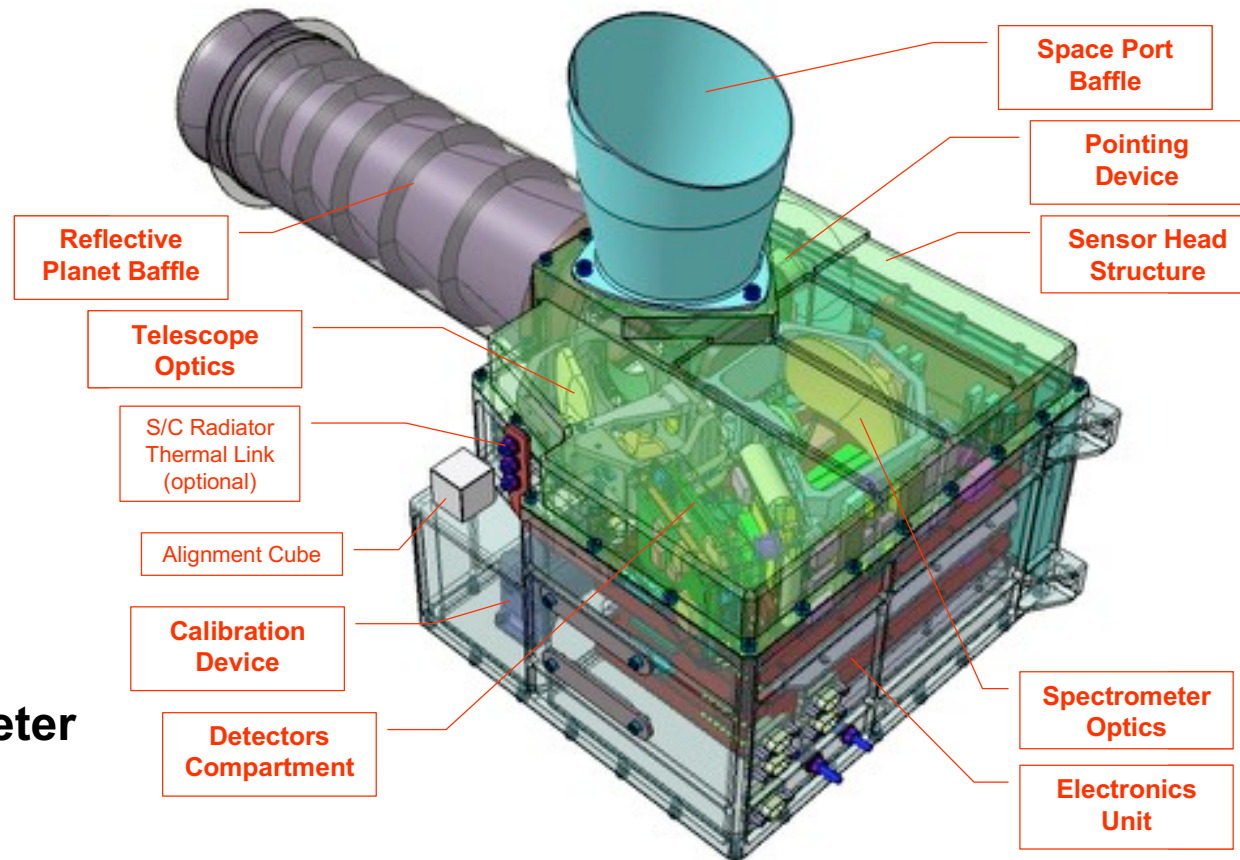
MERTIS – MERCURY RATIO METER AND THERMAL INFRARED IMAGING SPECTROMETER

Principle Investigators

Prof. H. Hiesinger
University of Münster

Dr. J. Helbert
DLR

- Monoblock
- 3.1 kg - 10W
- Uncooled microbolometer
- 7-14 μ m @ 200nm
- Global coverage @ up to 280m
- Integrated μ -radiometer 7-40 μ m
- No comparable instrument on the NASA MESSENGER mission



Scientific goals of MERTIS

MERTIS has four main scientific objectives, building on the general science objectives of the Bepi-Colombo mission.

1. Study of Mercury's surface composition in the TIR

2. Identification of rock-forming minerals

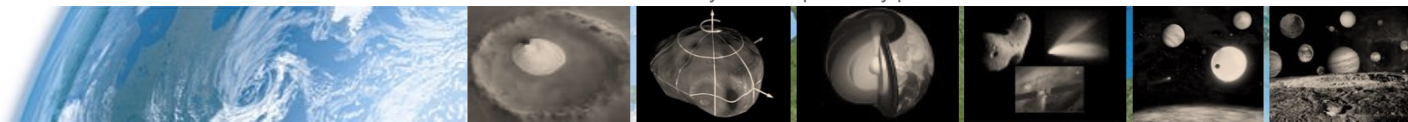
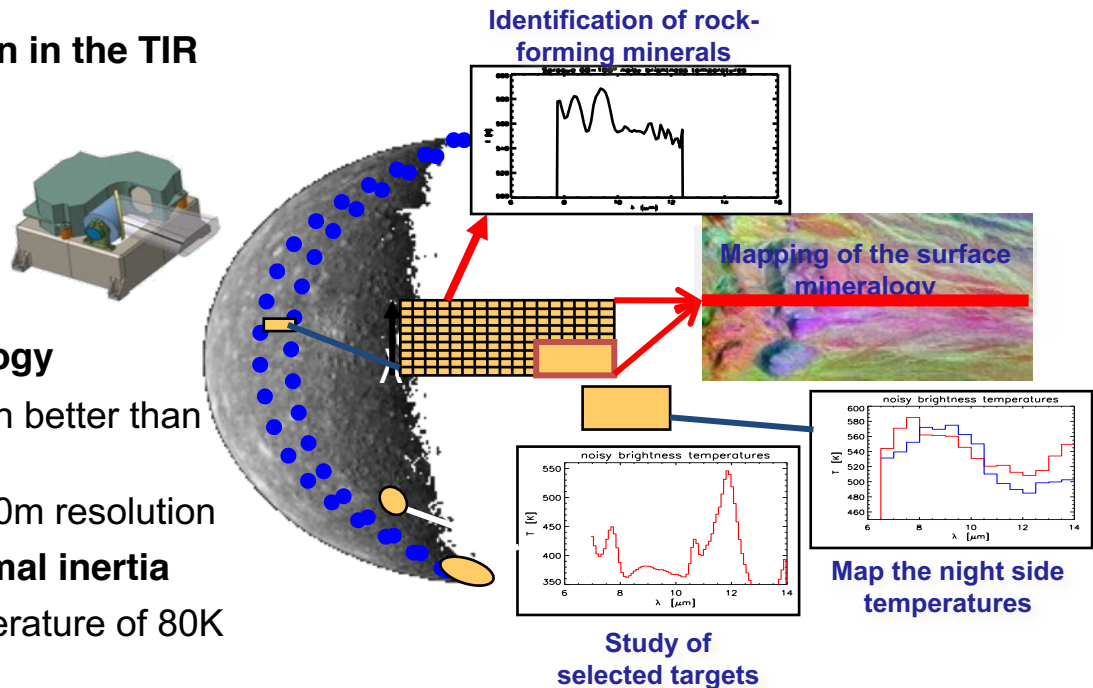
- Spectral range 7-14 μm
- Spectral resolution better than 200nm

3. Global mapping of the surface mineralogy

- Global mapping with spatial resolution better than 500m
- 10% of the planet with better than 500m resolution

4. Study of surface temperature and thermal inertia

- NETD <1K for typical nightside temperature of 80K



MASCS DLR Database – Structure

MeasurementsTable

Column	Type
seq_counter	smallint
sc_time	integer
packet_subseconds	smallint
int_time	smallint
int_count	smallint
period	smallint
dark_freq	smallint
temp_1	real
temp_2	real
nir_gain	smallint
other_channel_on	boolean
nir_lamp_on	boolean
vis_lamp_on	boolean
binning	smallint
start_pixel	smallint
end_pixel	smallint
spectrum_number	smallint
spectrum_met	integer
spectrum_subseconds	integer
[...]	
[...]	
rad_avg_345_355	real
rad_avg_445_455	real
rad_avg_495_505	real
rad_avg_545_555	real
rad_avg_595_605	real
rad_avg_645_655	real
rad_avg_700_750	real
rad_avg_845_850	real
dark_scan	smallint
temp_1_flag	smallint
temp_2_flag	smallint
target_latitude_set_0	real
target_longitude_set_0	real

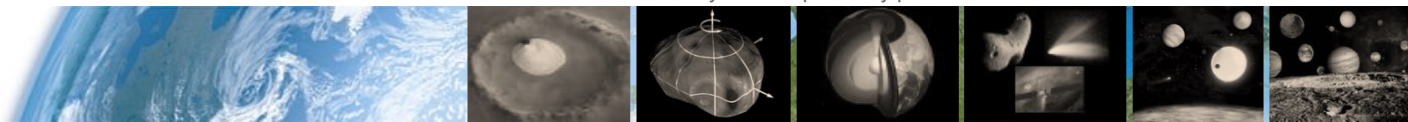
ROI Tables

Regular Grid

name	lonmin	lonmax	latmin	latmax	xres	yres
Kuiper/Rudaki Area 0.5 dpp	-70	-30	-15	5	0.5	0.5
Kuiper/Rudaki Area 1 dpp	-70	-30	-15	5	1	1
Global Map 1 dpp -80/+80 lat	-180	180	-80	80	1	1
Global Map 4 dpp -80/+80 lat	-180	180	-80	80	4	4
Global Map 10 dpp -80/+80 lat	-180	180	-80	80	10	10
Bluetongue .3 dpp grid	-107.95	-101.95	-12.14	-6.44	0.3	0.3
Bluetongue .6*.84 dpp grid	-108.64	-103.24	-13.82	-6.26	0.6	0.84

User defined targets

name	id	group_id	group_name
internal deposits	1	1	Kuiper Crater
Murasaki crater interior	2	1	Kuiper Crater
central peak	3	1	Kuiper Crater
external reference area	4	1	Kuiper Crater
impact_melt	5	2	bluetongue
internal_deposits	6	2	bluetongue
reference_ext_area	7	2	bluetongue
central_peak	8	2	bluetongue



MASCS DLR Database – Structure

measurments

Column	Type
data_ind	integer
[...]	
target_latitude_set_0	real
target_longitude_set_0	real
fov	geography(Polygon)
fov_center	geography(Point)

ROIs

name	id	group_id	group_name
internal deposits	1	1	Kuiper Crater
Murasaki crater interior	2	1	Kuiper Crater
central peak	3	1	Kuiper Crater
external reference area	4	1	Kuiper Crater
impact_melt	5	2	bluetongue
internal_deposits	6	2	bluetongue
reference_ext_area	7	2	bluetongue
central_peak	8	2	bluetongue

1-to-1 relation

1-to-1 relation

intersection

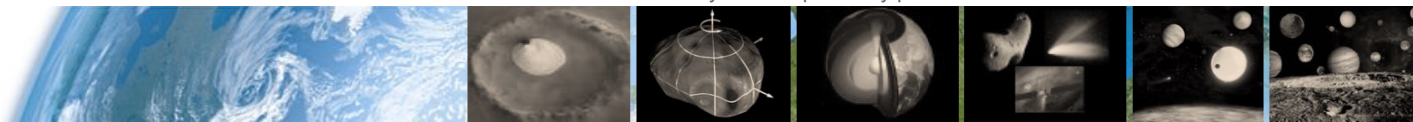
Column	Type
id_poly	integer
id_meas	integer

The intersection table is automatically updated on data table or user polygon tables change

FOV from **meas_data_small**

Polygon from **regular_grid**

[see example 3 on the next page]



MASCS DLR Database – Data Extraction

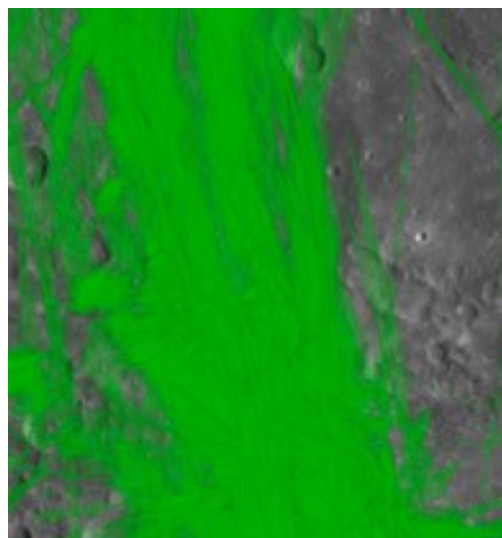
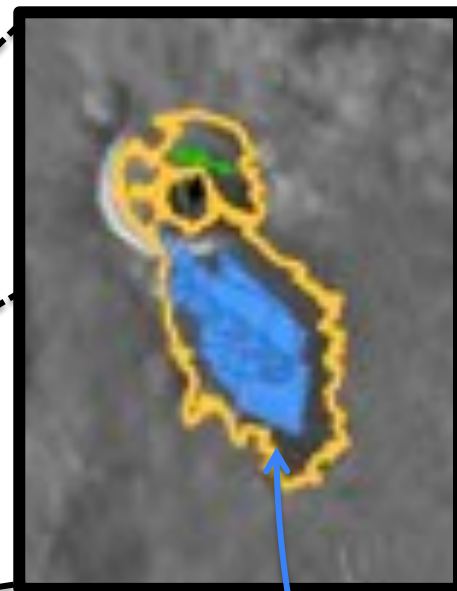
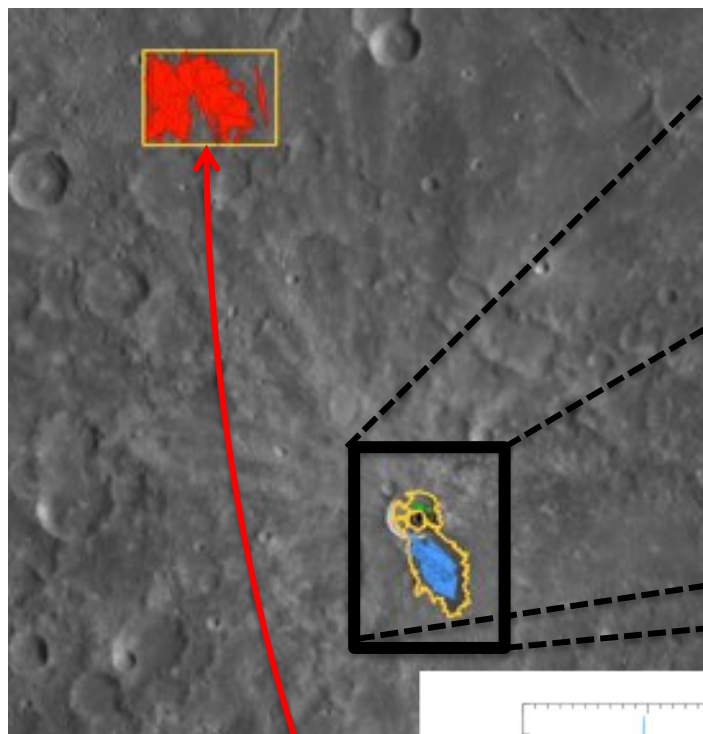
Waters Crater, Mercury

[lat,lon = -8.96,105.45, IAU <https://planetarynames.wr.usgs.gov/Feature/15086>]

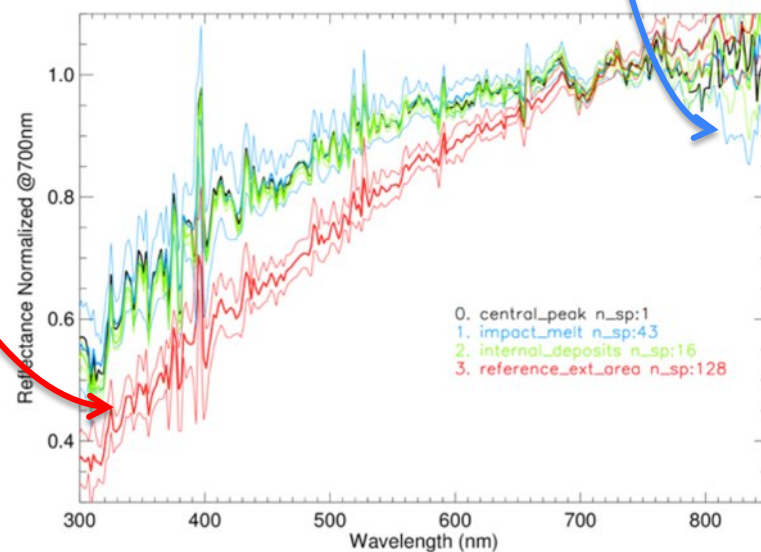


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Towards an i



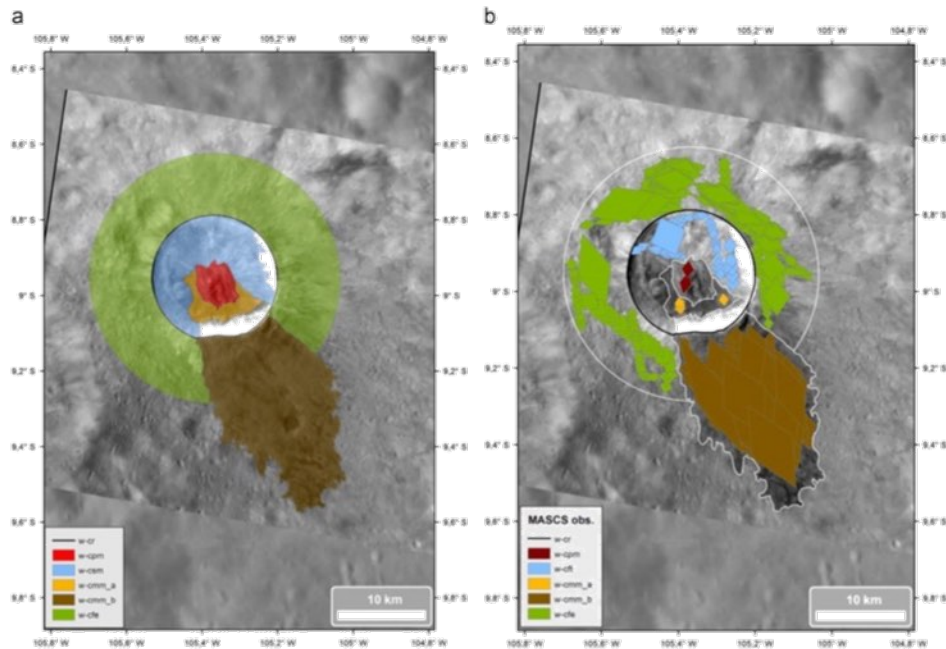


Fig. 2. (a) Waters crater (8.9 S, 105.4 W) geologic map. The mapped units are: Waters crater peak material (w-cpm), Waters crater floor and terraces (w-cft), Waters crater internal melt material (w-cmm_a), Waters crater external melt material (w-cmm_b) and Waters crater fresh ejecta (w-cfe). (b) MASCS coverage over Waters crater (8.9 S, 105.4 W). Moreover, Waters crater rim (w-cr) is defined. Polygons represent MASCS footprints and have been color coded to match the different geologic units displayed in 2a. Both panels use MDIS NAC image EN0229495136M at 44 mpp overlain on the MDIS monochrome global mosaic at 250 mpp as their background.

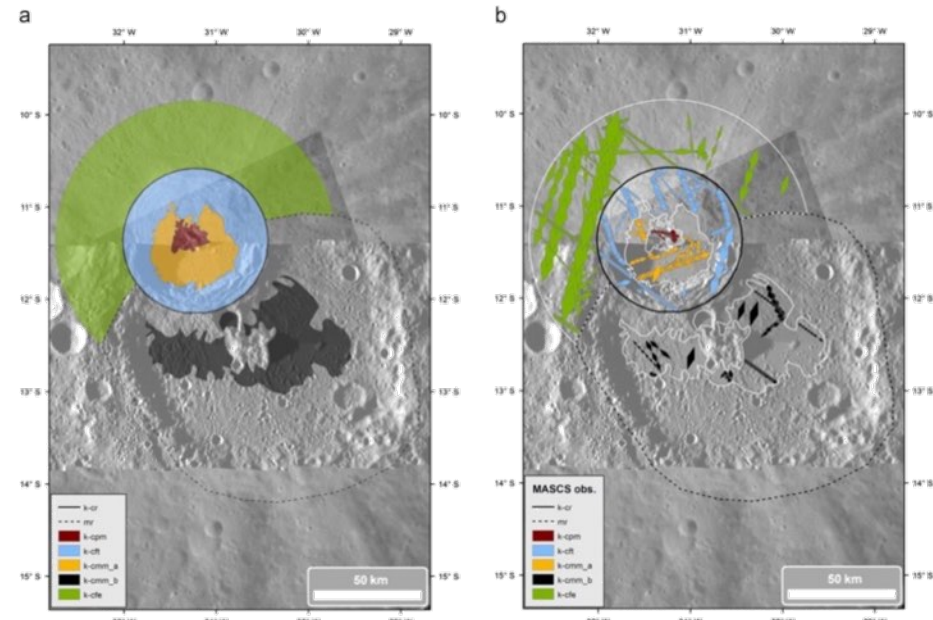


Fig. 3. (a) Kuiper crater (11.3 S, 31.3 W) geologic map. The mapped units are: Kuiper crater peak material (k-cpm), Kuiper crater floor and terraces (k-cft), Kuiper crater internal melt material (k-cmm_a), Kuiper crater external melt material (k-cmm_b) and Kuiper crater fresh ejecta (k-cfe). Moreover, Kuiper crater rim (k-cr) and Murasaki crater rim (mr) are defined. (b) MASCS coverage over Kuiper crater (11.3 S, 31.3 W). Polygons represent MASCS footprints and have been color coded to match the different geologic units displayed in 3a. Both panels use MDIS NAC images EN0223659984M, EN0228372224M, EN0228372226M, EN0228372268M and EN0228372270M overlain on MDIS WAC image EW0223443634I as their background.

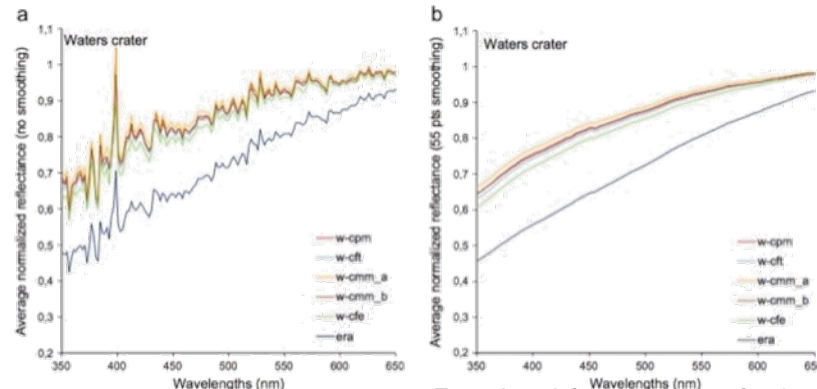
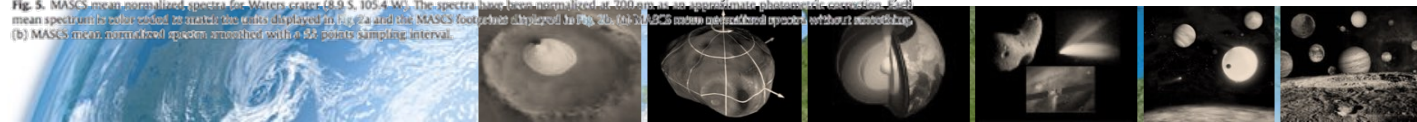


Fig. 5. MASCS mean-normalized spectra for Waters crater (8.9 S, 105.4 W). The spectra have been normalized at 400 nm to the appropriate photometric correction level. (a) MASCS mean-normalized spectra without smoothing. (b) MASCS mean-normalized spectra smoothed with a 65 nm points sampling interval.



PLANETARY MEETS TERRESTRIAL

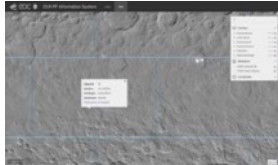
... INFORMATION SYSTEMS


... EOC-GEOSERVICE

... UKIS

PLANETARY MEETS TERRESTRIAL

STRUCTURE OF INFORMATION SYSTEMS



Web client ( UKIS)

Data services (EOC-Geoservice)



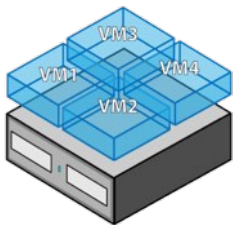
Database (EOC-Geoservice)



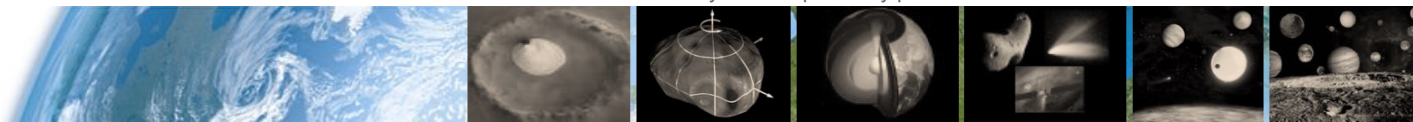
Operating system



Virtualization



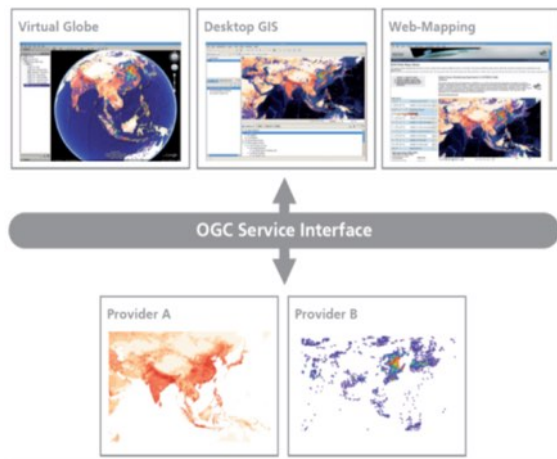
Hardware



PLANETARY MEETS TERRESTRIAL

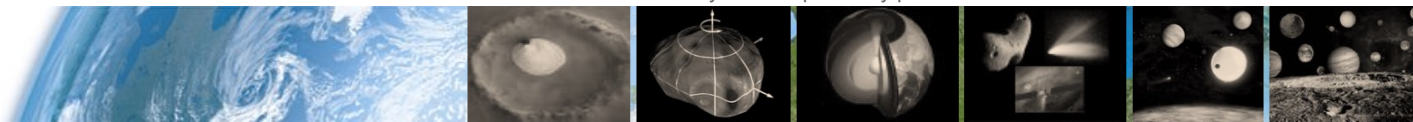
EOC-GEOSERVICE

- For users: web-based access to data and products of DLR's Earth Observation Center (EOC) via standardized geo data services



OGC Web Service Specifications used by the DFD infrastructure			
WMS Web Map Service	WCS Web Coverage Service	WFS Web Feature Service	CSW Catalogue Service
Allows portrayal (rendering) of geospatial datasets and access to georeferenced map images	Allows retrieval of geospatial datasets representing space-varying phenomena (Coverages)	Allows access to discrete vector-based geospatial datasets (Features)	Allows data and service discovery as well as access to XML metadata

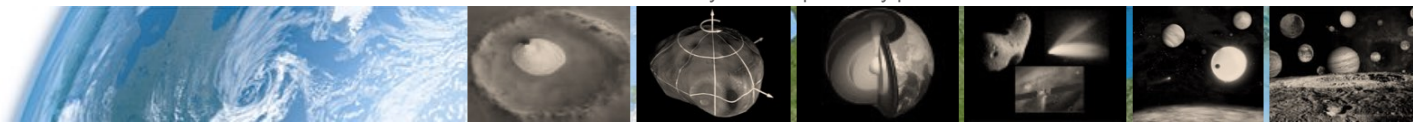
- For EOC: platform for publishing remote sensing data and products



PLANETARY MEETS TERRESTRIAL

UKIS

- UKIS is an abbreviation for „Umwelt- und Kriseninformationssysteme“ (Environmental and Crisis Information Systems)
- Task: development of reusable software that can be applied in all departments of our institute
- Goal: facilitation and acceleration of the implementation of web-based information systems for environmental and crisis applications
- Trend: open source (on <http://github.com/dlr-eoc>)



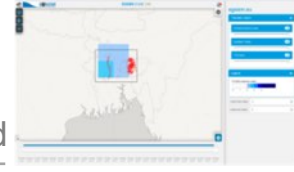
PLANETARY MEETS TERRESTRIAL

UKIS EXAMPLES

ZKI Activations



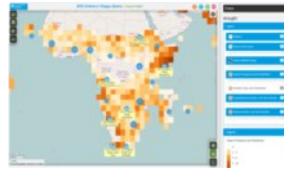
Earth's Gravity Field



Maritime Safety



SOS Children's Villages



Water Detection



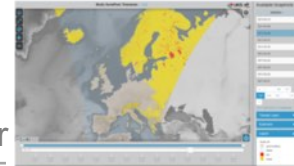
Tsunami Early Warning



Video Production



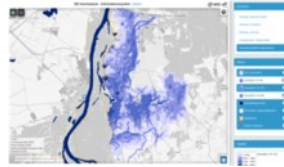
Snow Cover



Coasts



Flood Simulation



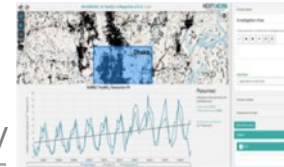
Change Detection



Fire Detection



Air Quality

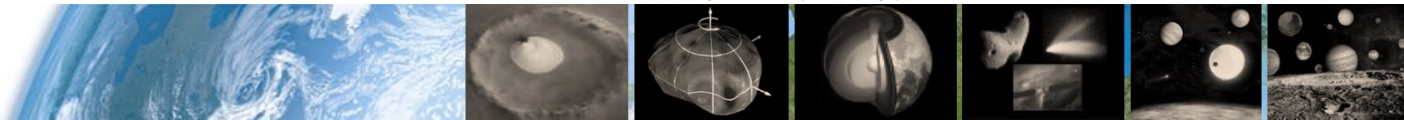


EOC-Geoservice



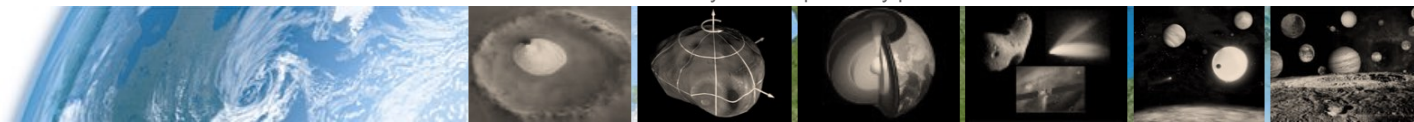
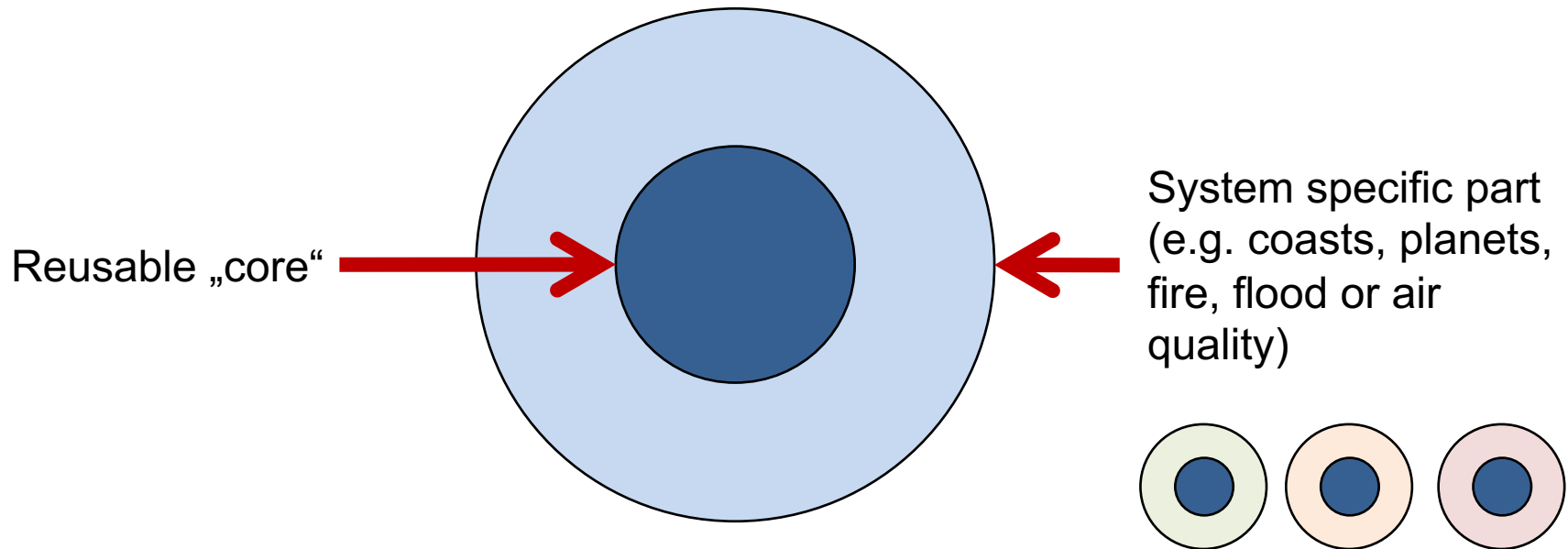
Towards an information system for planetary products

Folie 21



PLANETARY MEETS TERRESTRIAL

STRUCTURE OF THE UKIS WEB CLIENT



FIRST IMPLEMENTATION

... QUESTIONS WE LIKE TO ANSWER

... SAMPLE DATA SET

... PROTOTYPE

FIRST IMPLEMENTATION

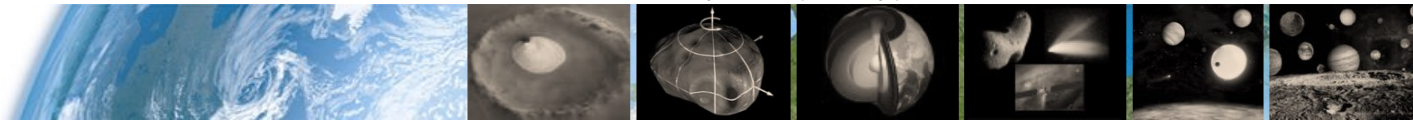
QUESTIONS WE LIKE TO ANSWER

DFD has data of **Earth Observation**, **PF** of **planetary data** .

However, **questions** and challenges are **comparable**:

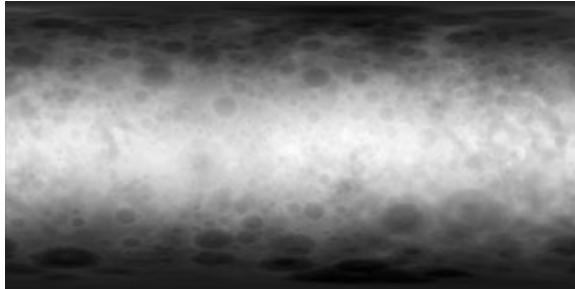
How data can be

- **structurally organized** (data model),
- **uniformly described** (metadata),
- **commonly accessible** (standards),
- **visualized** and
- **linked to other scientific information** like publication ?

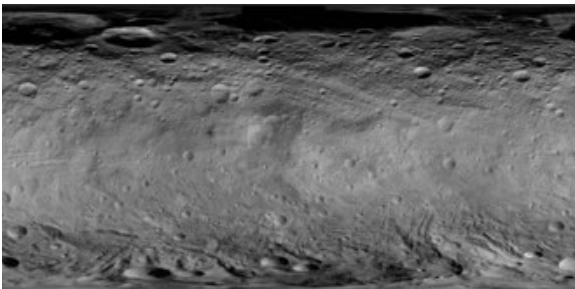


FIRST IMPLEMENTATION

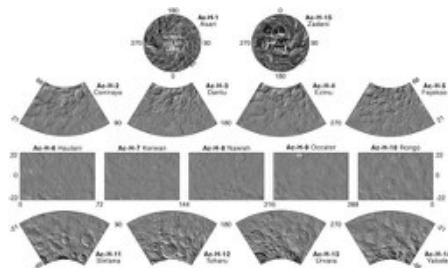
SAMPLE DATA SET – DAWN, CERES



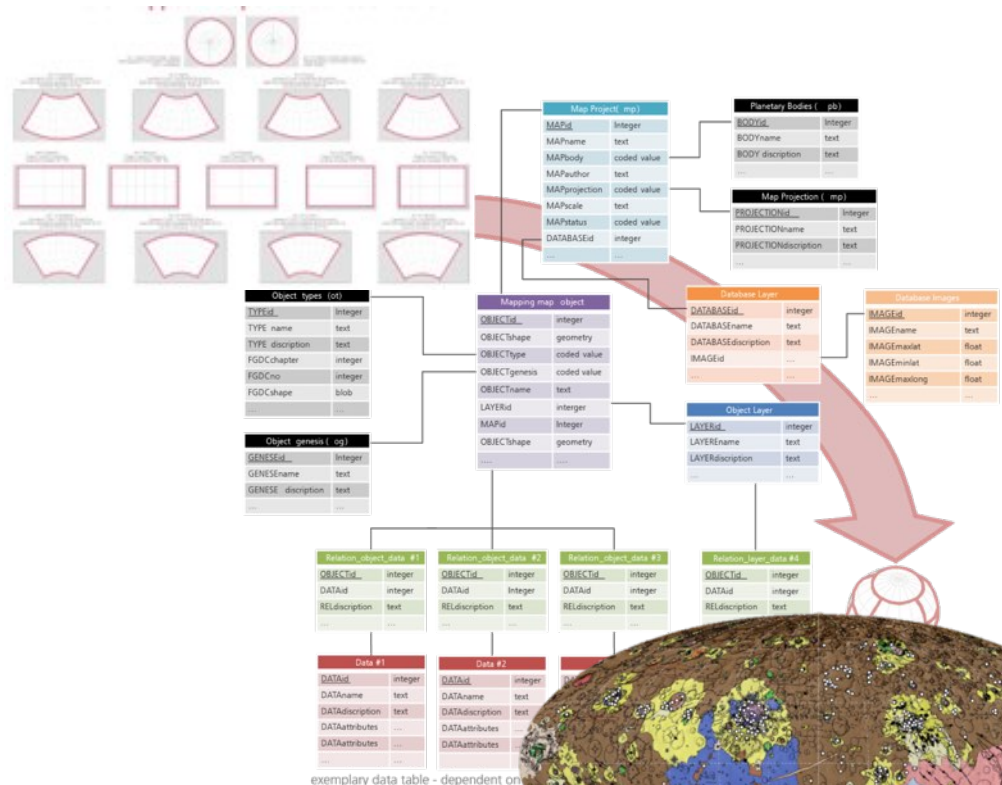
Ceres Dawn FC2 HAMO Global DTM



Ceres Dawn FC2 HAMO Global



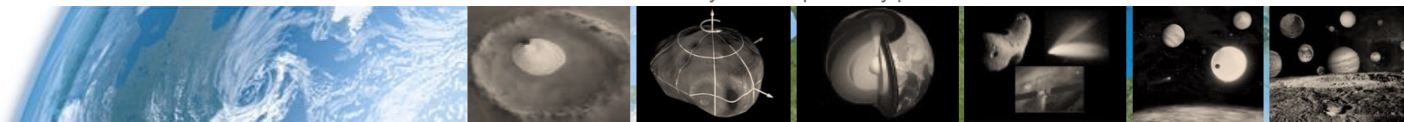
Roatsch et al (2016) PSS



Naß and the Dawn Mapping Team (2019) *EPSC*
Williams (2018) *ICARUS*

Towards an information system for planetary products

Folie 25

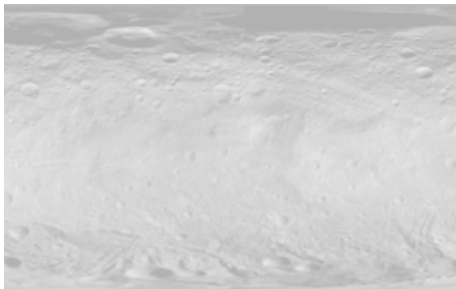


FIRST IMPLEMENTATION

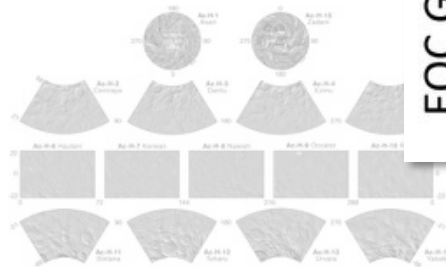
SAMPLE DATA SET – DAWN, CERES



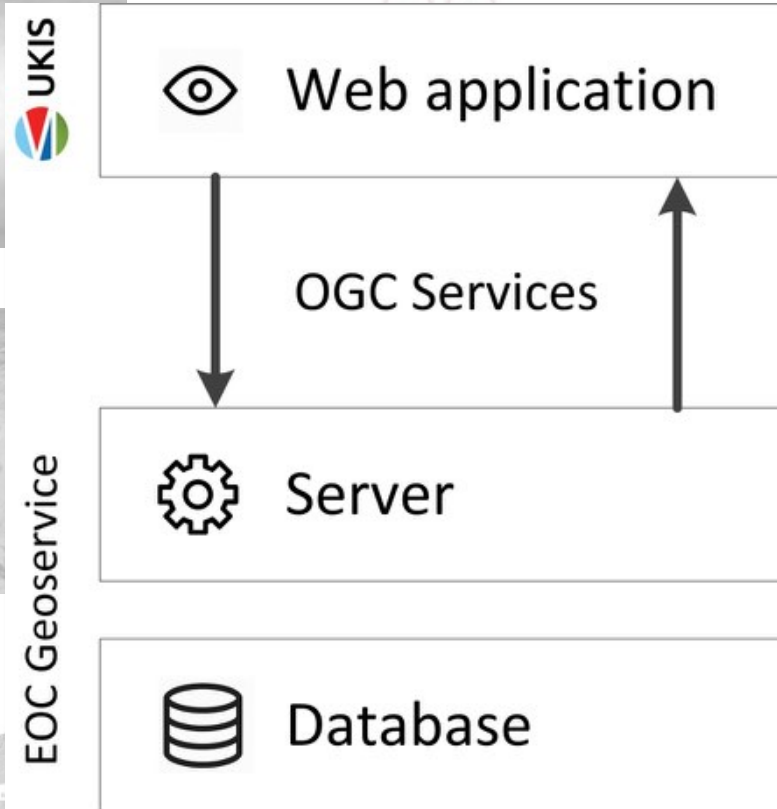
Ceres Dawn FC2 HAMO Global DTM



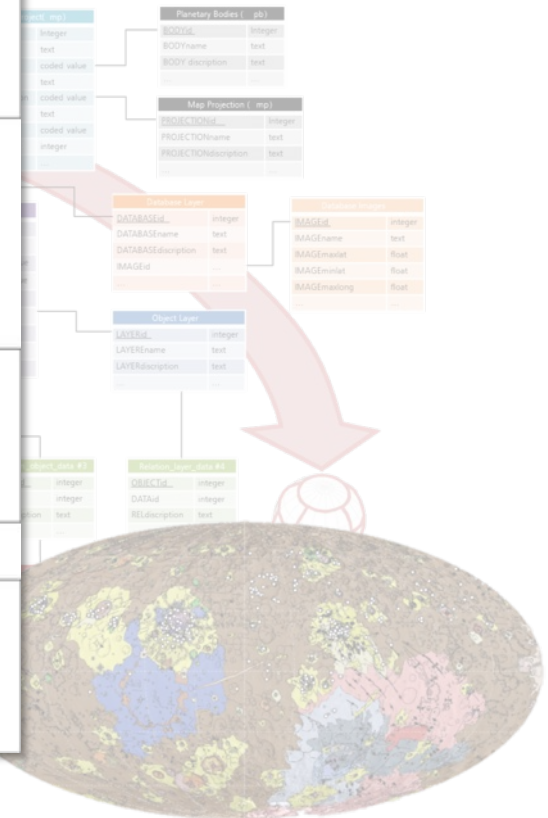
Ceres Dawn FC2 HAMO Global



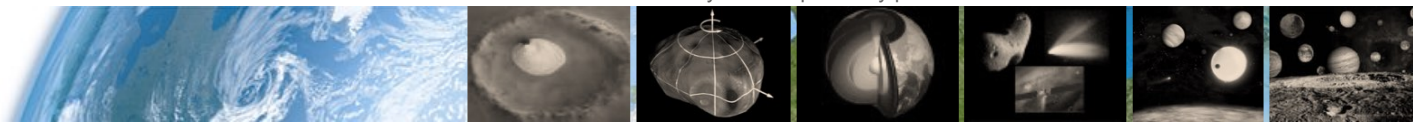
Roatsch et al (2016) PSS



Schematic structure of DLR's EOC Geoservice and UKIS.
Naß, d'Amore, Mühlbauer, Heinen, Böck,
Helbert, Riedlinger, Jaumann, Strunz (2020) LPSC, EGU



Naß and the Dawn Mapping Team (2019) EPSC
Williams (2018) ICARUS



FIRST IMPLEMENTATION

EOC GEOSERVICE, GEOSERVER

Layer-Vorschau
Liste aller konfigurierten Layer im GeoServer mit Vorschaumöglichkeit für verschiedene Formate

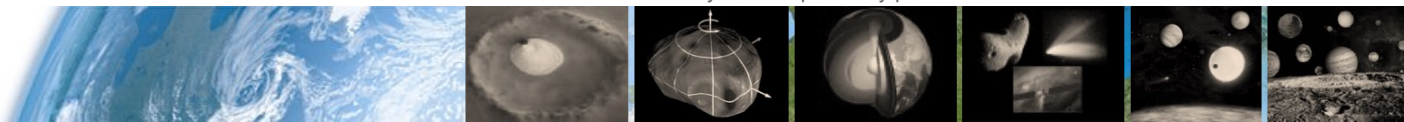
Ergebnisse 1 bis 22 (von 22 Objekten)

Typ	Titel	Name	Geläufige Formate	Alle Formate
Raster	CERES_LamoDTM_global	pf:CERES_LamoDTM_global	OpenLayers KML	Bitte wählen
Raster	CERES_LamoDTM_global_4326	pf:CERES_LamoDTM_global_4326	OpenLayers KML	Bitte wählen
Raster	CERES_LamoDTM_Occator	pf:CERES_LamoDTM_Occator	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad01Asari	pf:CERES_Lamo_quad01Asari	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad02Coniraya	pf:CERES_Lamo_quad02Coniraya	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad03Dantu	pf:CERES_Lamo_quad03Dantu	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad06Haulani	pf:CERES_Lamo_quad06Haulani	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad07Kerwan	pf:CERES_Lamo_quad07Kerwan	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad08Hawish	pf:CERES_Lamo_quad08Hawish	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad09Occator	pf:CERES_Lamo_quad09Occator	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad10Rongo	pf:CERES_Lamo_quad10Rongo	OpenLayers KML	Bitte wählen
Raster	CERES_Lamo_quad11Zadeni	pf:CERES_Lamo_quad11Zadeni	OpenLayers KML	Bitte wählen
Vector	GeoContacts	pf:GeoContacts	OpenLayers KML GML	Bitte wählen
Vector	GeoUnits	pf:GeoUnits	OpenLayers KML GML	Bitte wählen
Vector	LineFeature	pf:LineFeature	OpenLayers KML GML	Bitte wählen
Vector	MapGraticular	pf:MapGraticular	OpenLayers KML GML	Bitte wählen

Organize raster and vector data in one structure

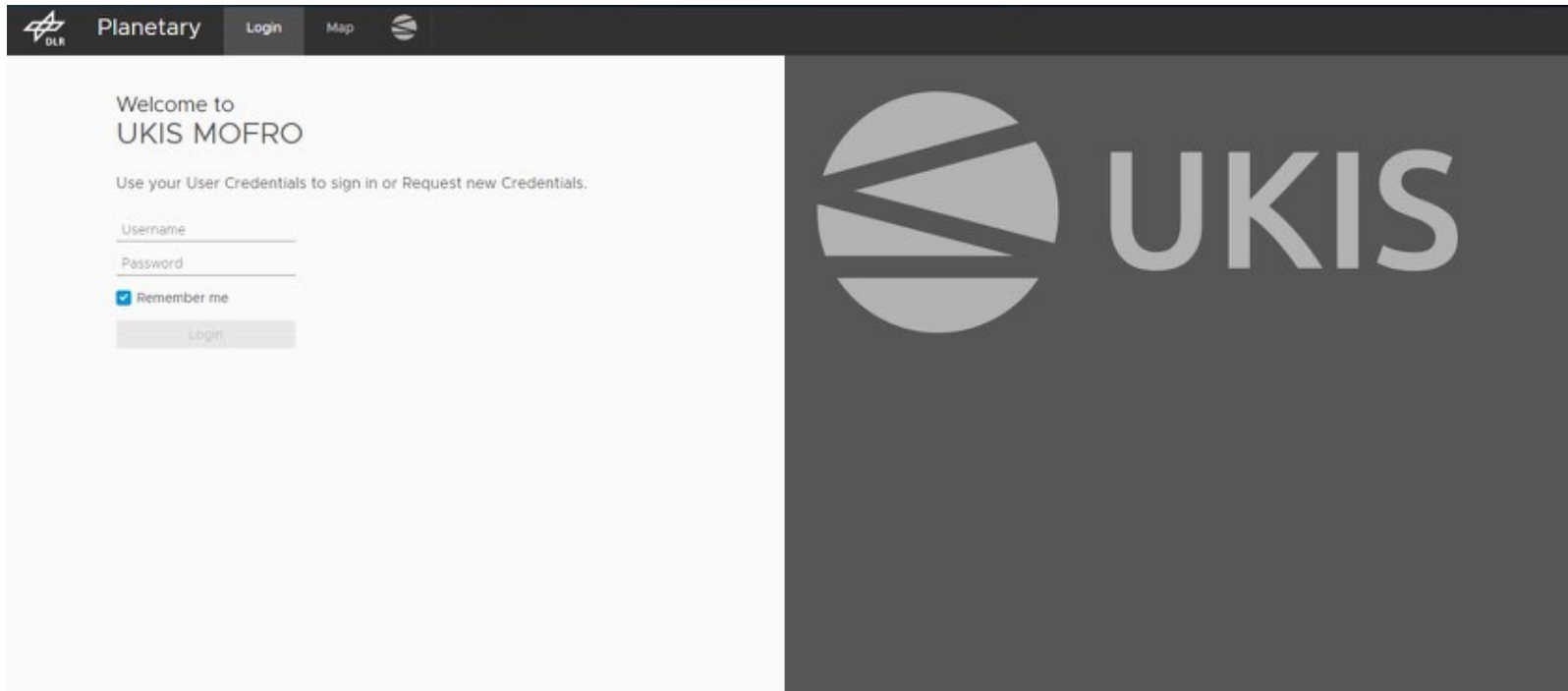
Towards an information system for planetary products

Folie 27



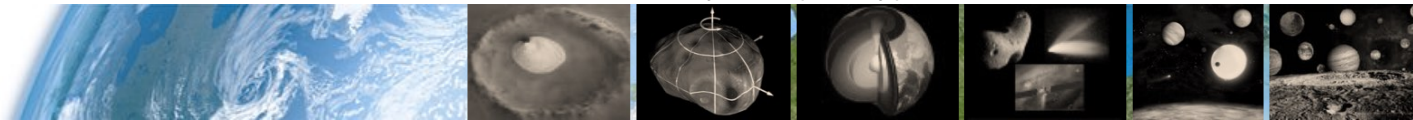
FIRST IMPLEMENTATION

UKIS-BASED INFORMATION SYSTEM FOR PF



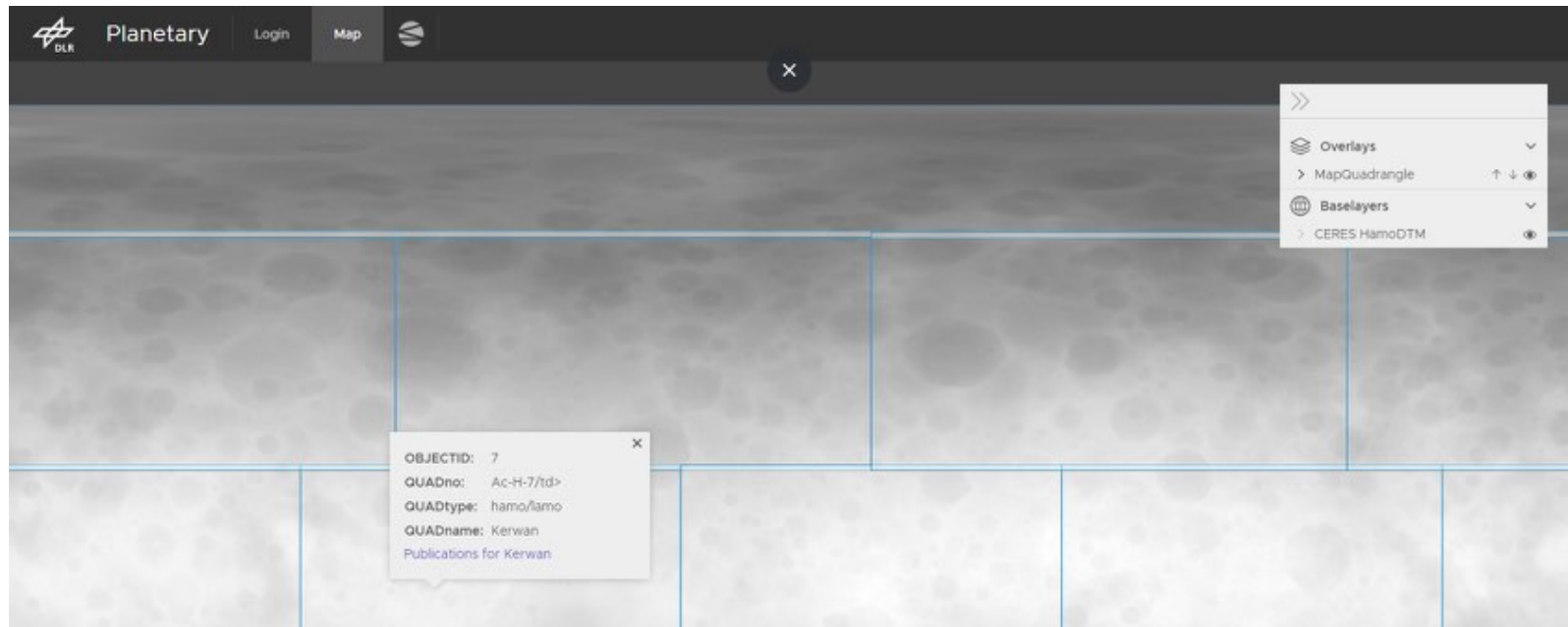
The screenshot shows the login interface for the UKIS MOFRO system. At the top, there is a navigation bar with the DLR logo, the text "Planetary", and buttons for "Login" and "Map". The main content area is split into two panels. The left panel is white and contains the text "Welcome to UKIS MOFRO" and "Use your User Credentials to sign in or Request new Credentials." Below this are input fields for "Username" and "Password", a "Remember me" checkbox, and a "Login" button. The right panel is dark gray and features a large, stylized "UKIS" logo.

Login GUI for the users



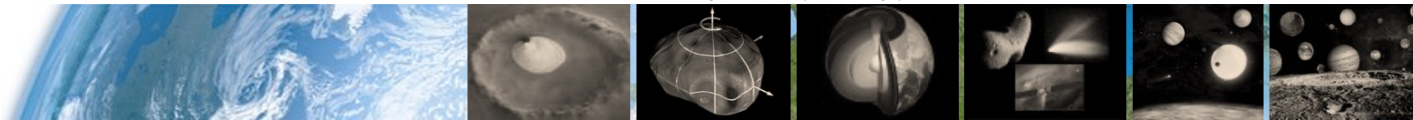
FIRST IMPLEMENTATION

UKIS-BASED INFORMATION SYSTEM FOR PF



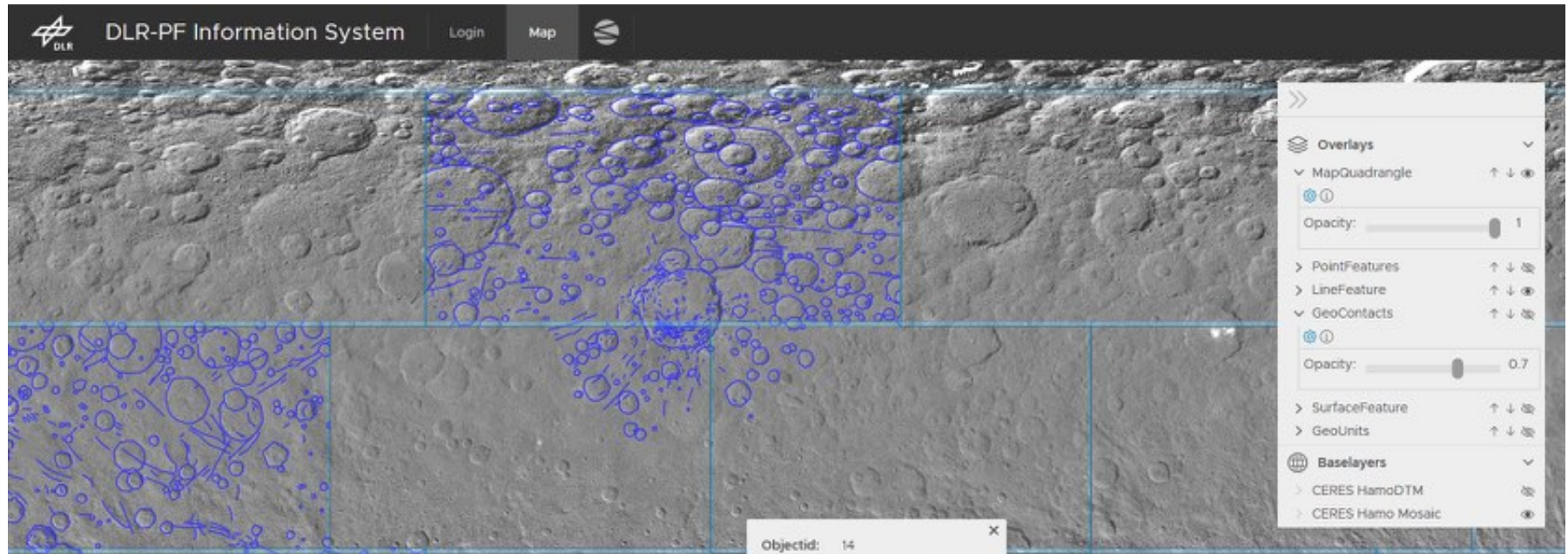
Global Datasets

DTM + quadrangle borders + add attributes



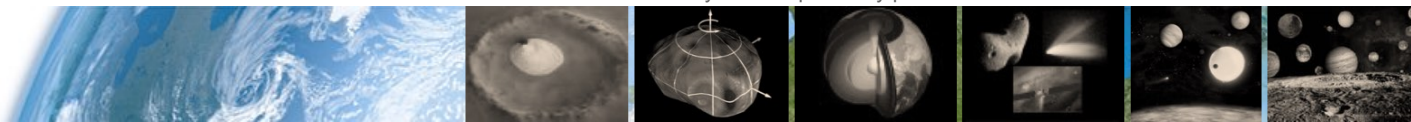
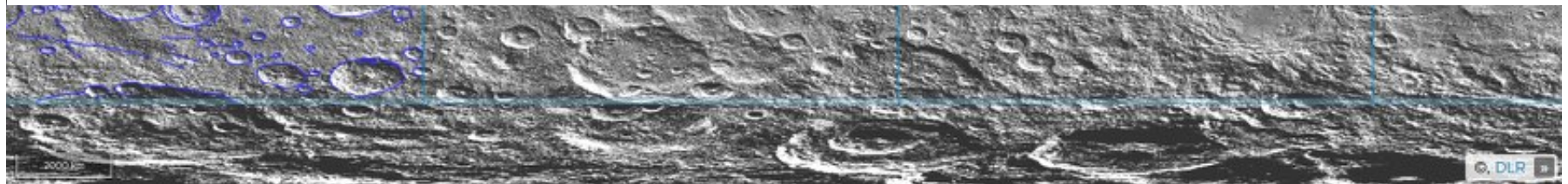
FIRST IMPLEMENTATION

UKIS-BASED INFORMATION SYSTEM FOR PF



Global Datasets

HAMO mosaic + Geologic mapping examples



FIRST IMPLEMENTATION

UKIS-BASED INFORMATION SYSTEM FOR PF

The screenshot displays two browser windows. The left window shows a map interface with a search box and a results list. The right window shows the 'electronic library' search results page for 'Kerwan'.

Search Results (Right Window):

Titel, Zusammenfassung, Schlagwörter, Volltextsuche in hochgeladenen Dateien entspricht "Kerwan" AND Institute & Einrichtungen entspricht einem von "Institut für Planetenforschung"

Zeige Treffer 1 bis 7 von 7.
[Suche verfeinern](#) | [Neue Suche](#)

Ergebnisse sortieren: nach Jahr (neueste zuerst) | [Neu ordnen](#)

7 Treffer als [ASCII Citation](#) | [exportieren](#) | [Exportieren](#)

- Palomba, E. und Longobardo, A. und Desantis, M.C. und Carozzo, F. G. und Galano, Anna und Zambon, F. und Raponi, A. und Ciannelli, M. und Stephan, Katrin und Williams, D.A. und Ammannito, E. und Capria, M.T. und Fonte, S. und Giardino, M. und Tosi, F. und Raymond, C.A. und Russell, C.T. (2017) *Mineralogical mapping of the Kerwan quadrangle on Ceres*. Icarus: International Journal of Solar System Studies, Seiten 1-7. DOI: 10.1016/j.icarus.2017.07.021 ISSN 0019-1035 Volltext nicht online.
- Palomba, E. und Longobardo, A. und Desantis, M.C. und Galano, Anna und Carozzo, G. und Zambon, F. und Raponi, A. und Ciannelli, M. und Ammannito, E. und Stephan, Katrin und Williams, D.A. und Capria, M. T. und Fonte, S. und Giardino, M. und Tosi, F. und Raymond, C.A. und Russell, C.T. (2017) *Mineralogical Mapping of the Kerwan Quadrangle on Ceres*. In: LPI Contribution, 1964, Seite 2056. 48th Lunar and Planetary Science Conference, 20. - 24. März 2017, The Woodlands, Texas, US. Volltext nicht online.
- Schulzeck, Franziska und Krohn, Katrin und v. d. Gathen, Isabel und Schmedemann, Nico und Stephan, Katrin und Jaumann, R. und Williams, D.A. und Wagner, Roland und Buzickowski, D.L. und Meist, S. und Scully, J.E.C. und Kenner, Elke und Matz, Klaus-Dieter und Naß, Andrea und Preusker, Frank und Roatsch, Thomas und Raymond, C.A. und Russell, C.T. (2017) *Geologic mapping of the Ac-H-7 Kerwan quadrangle: Assessing diverse crater morphologies*. Icarus. Elsevier. DOI: 10.1016/j.icarus.2017.12.007 ISSN 0019-1035 Volltext nicht online.
- Williams, D.A. und Meist, S. und Kneissl, T. und Paschert, J. H. und Hiesinger, H. und Schmedemann, N. und Neesemann, A. und Buzickowski, D.L. und Scully, J.E.C. und Marchi, S. und Schenk, P. und Jaumann, R. und Roatsch, T. und Preusker, F. und Nathues, A. und Schäfer, M. und Hoffmann, M. und Raymond, C.A. und Russell, C.T. (2016) *Geologic Mapping of the Ac-H-7 Kerwan Quadrangle of Ceres from NASA Dawn Mission*. 47th Lunar and Planetary Science Conference, Woodlands, Texas.
- Scully, J.E.C. und Williams, D.A. und Meist, S. und Buzickowski, D.L. und Jaumann, Ralf und Raymond, C.A. und Russell, Christopher T. und Preusker, Thomas und Preusker, Frank und Platz, B. G. und Nathues, A. und Hoffmann, M. und Ray, Thomas und Schenk, P. und Marchi, S.

Map Interface (Left Window):

OBJECTID: 7
 QUADno: Ac-H-7/td>
 QUADtype: hamo/lamo
 QUADname: Kerwan
 Publications for Kerwan

Crosslink to ELIB via metadata and attributes

The screenshot displays two browser windows. The left window shows a map interface with a search box and a results list. The right window shows the 'electronic library' search results page for 'Kerwan'.

Search Results (Right Window):

Titel, Zusammenfassung, Schlagwörter, Volltextsuche in hochgeladenen Dateien entspricht "Kerwan" AND Institute & Einrichtungen entspricht einem von "Institut für Planetenforschung"

Zeige Treffer 1 bis 7 von 7.
[Suche verfeinern](#) | [Neue Suche](#)

Ergebnisse sortieren: nach Jahr (neueste zuerst) | [Neu ordnen](#)

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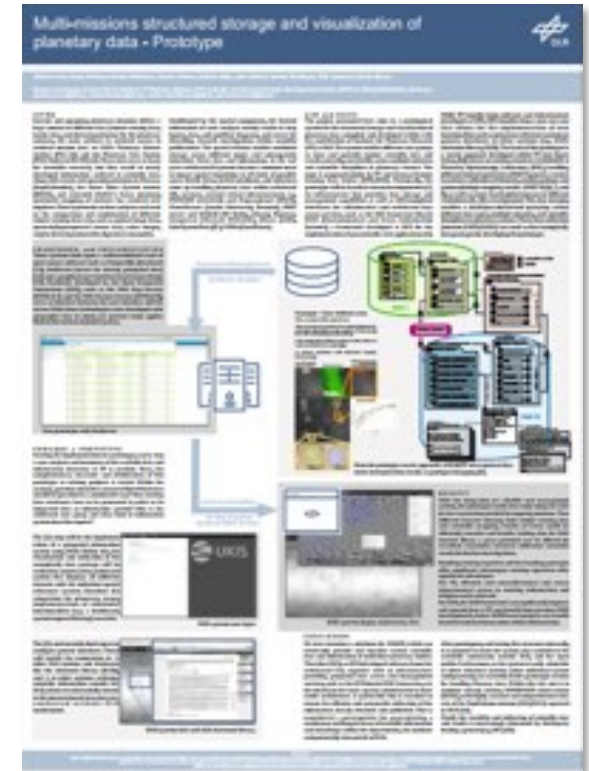
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OBJECTID: 7
 QUADno: Ac-H-7/td>
 QUADtype: hamo/lamo
 QUADname: Kerwan
 Publications for Kerwan

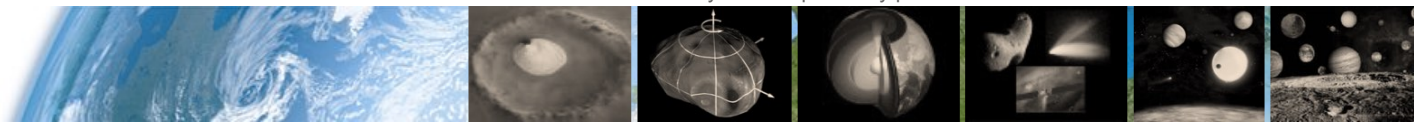
FIRST IMPLEMENTATION

NEXT STEPS

- **discuss** current implementation **with planetary colleagues at LPSC** and the **terrestrial community at EGU**
- **Prototype for Mercury** in preparation to BepiColombo
- **Prototype for Mars** as conclusive status of HRSC
- Look for **more case studies**
- **Metadata** for **describe** data **as uniform as possible** and **flexible as necessary**.



Naß, d'Amore, Mühlbauer, Heinen, Böck, Helbert, Riedlinger, Jaumann, Strunz (2020) LPSC, EGU



BENEFIT FOR US

... SPATIAL AND TEMPORAL POTENTIAL

... PROVISIONING RESEARCH DATA

... SUSTAINABLE SOFTWARE

... CHALLENGES

... BUT!

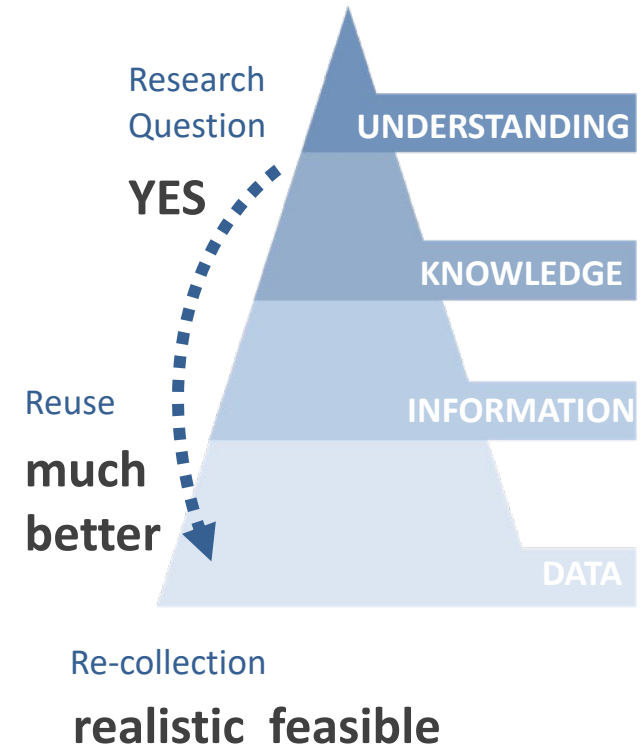
BENEFIT BUT ...

before we can continue we need to discuss

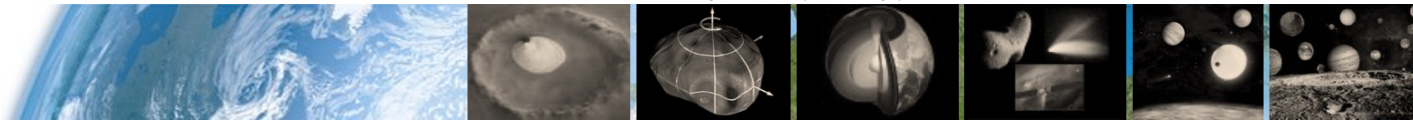
- Funding?
- Responsibility?
- Data Models ?
- User groups?
- Sustainability?
- Re-use?

Furthermore, **topics** like

- Semantic search?
- Linked data Open | linked data?
- Text Analyses?
- Ontology?



And this is where we like to start the discussion ...



THANK YOU!

Mario d' Amore, Andrea Naß, Martin Mühlbauer, Torsten Heine, Mathias Boeck, Jörn Helbert, Torsten Riedlinger, Ralf Jaumann und Günter Strunz

German Aerospace Center (DLR) Berlin and Oberpfaffenhofen

Contact

Mario.dAmore@dlr

Andrea.Nass@dlr.de

Martin.Muehlbauer@dlr.de

