THE ROSETTA SCIENCE ARCHIVE: PREPARING FOR LEGACY SCIENCE. D. J. Heather[1,2], M. G. G. Taylor[1], S. Besse[2], I. Barbarisi[2], A. Montero[2], R. Docasal[2], B. Grieger[2], and the PSA and ESDC Teams. [1]ESA / ESTEC, Keplerlaan 1, 2201 AZ, Noordwijk ZH, The Netherlands. [2]ESA / ESAC, Villanueva de la Canada, Spain. (David.Heather@esa.int).

Introduction: 30 September 2016 marked the end of the Rosetta mission as the spacecraft came to rest on the surface of comet 67P/Churyumov-Gerasimenko. Although this marked an end to the spacecraft's active operations, intensive work continued for several years, with instrument teams updating their science data in response to scientific reviews and delivering them for ingestion into ESA's Planetary Science Archive (PSA) [1]. ESA has worked with a number of instrument teams to produce new and enhanced data products in this time, and has also been working internally to improve the Rosetta specific support provided by the PSA in an effort to provide the best long-term archive possible for the Rosetta mission.

This presentation will outline the final status of the Rosetta archive, as well as highlighting some of the archive enhancement activities that have been completed to finalise and prepare the Rosetta archive for legacy.

Status of the Rosetta data in the Planetary Science Archive: All science data from the Rosetta mission are hosted jointly by the Planetary Science Archive (PSA) at ESA (http://psa.esa.int) [1,2], and by NASA's PDS Small Bodies Node (SBN).

All teams have now completed both their nominal science data deliveries from the comet phase, and where appropriate, delivered data from their enhanced archiving activities. All reviews were closed out and the majority of final products were delivered to the PSA in 2020.

The long duration of the Rosetta mission, along with its diverse suite of instrumentation and the range of targets observed throughout its lifetime combined to make this an extremely challenging mission to archive [3]. In order to track the evolution and ensure the quality of the data from each instrument throughout the long mission, a total of nine independent science data reviews were completed for Rosetta. Five of these took place after the closure of the nominal mission, along with a number of small individual reviews that were needed to assess the final deliveries from some of the teams using their latest pipelines. In combination, these reviews have assessed the complete Rosetta data holdings, and closely examined the updated outputs from the enhanced archiving activities, discussed in the following section. This series of reviews has ensured that the Rosetta archive is now ready for the long-term.

Selected Rosetta Enhanced Archiving Activities: The nominal archive deliveries from the Rosetta mission are of excellent quality, and will be of immense interest and use for many decades to come thanks to the efforts of all involved in their production, assessment, storage and dissemination. However, there is always more that can be done as calibrations and data reduction processes improve.

Once the resources from the operational mission came to an end, ESA established a number of joint activities with the Rosetta instrument teams to allow them to continue to work on enhancing their archive content. The updates planned were focused on key aspects of an instrument's calibration or the production of higher-level data / information, and were therefore very specific to each instrument's needs. Several of these activities continued through to the very end of Rosetta funding in December 2020 when the full 'archive enhancement' process was officially completed, and a few final deliveries from these activities are still pending or being prepared for release. In parallel with these instrument team activities, significant effort was placed on enhancing some of the services available in the PSA itself that would allow for users to query, retrieve and exploit these new products. This presentation will highlight just a few of the activities within the archive enhancement to give a flavour of the updates that have been completed and those few that are expected to be delivered in the coming months.

Almost all instrument teams have now provided a *Science User Guide* for their data, and most teams have also updated their calibrations, with some producing higher-level processed data and derived products based on these updates.

For example, the OSIRIS team has delivered straylight corrected, I/F corrected, three-dimensional georeferenced, and boresight corrected / full frame data products. These are all already available in the archive. OSIRIS has also delivered their data additionally in FITS format, and provide quicklook (browse) versions of their products, to allow an end-user to more easily sift through the data and select the images they may be

interested in. Outside of the officially supported activities, the OSIRIS team aims to make a re-delivery of all of their data using their final and best pipelines in April/May 2021. The aim is to have this large volume of data available in the final archive by end of summer 2021.

The VIRTIS team also updated their spectral and geometrical calibrations, and will deliver mapping products to the final archive. This work has been extended into early 2021, with the aim to close out and release the final versions by summer.

The Rosetta Plasma Consortium (RPC) instrument suite completed several cross-calibrations that greatly improved the final data from each experiment, as well as a number of activities individual to each instrument. An illumination map of the comet has also been produced to help with their cross-calibration work, and this will be released in the archive this year.

The MIDAS and GIADA teams have delivered higher level products in the form of a dust particle catalog from the comet coma and dust environment maps, with omnidirectional plus time products, respectively. Similarly, the COSIMA team has delivered a ground-based catalog of spectra for comparison to help calibrate and understand their in-flight data; this is expected to be released this year.

A separate activity was also established to produce and deliver data set(s) containing supporting ground-based observations of the comet. These data were taken simultaneously with Rosetta operations and could provide some important contextual information that will be of considerable value to the end user community. Final versions of these products were delivered in mid-2020. There is still some work needed to have these ready for a full ingestion, but the aim is to have these available in the archive this year.

In addition to these activities with the instrument teams, the Rosetta ESA archiving team produced and released calibrated data sets for the NAVCAM instrument, and archived all of the radiation monitor data produced by the SREM instrument on Rosetta, Work is ongoing with colleagues at PDS to include the latest shape models from the comet into the final Rosetta archive this year.

Final PSA Updates: In order to support the new and enhanced products being delivered to the PSA, and prepare the archive for legacy phase, some additional work has been completed within the PSA. Updates have included the implementation of a centralized solution to the problem of geometry on the comet and the production of consistent set of queriable geometry data [4]. The latest version of the PSA includes a number of features to help exploit the Rosetta data with this in mind, including a 3D orbital view of the comet allowing for data query and download, as detailed in [5].

In addition, an 'Advanced Search' panel has been included in the latest version of the PSA, allowing for more specific parameters to be queried. These include complex Instrument Modes for ROSINA and various specific parameters for COSIMA to allow users to quickly identify and retrieve the specific data they need. RPC users can now also query by type of measurement of calibration source using the Advanced panel.

Finally, a number of specific implementations were completed to allow for the Rosetta Housekeeping data to be queried. With the large number of subsystems and data types available, it was important to provide specific functions that will allow users to more easily access the data they need, and this has been implemented within the Advanced Search. The Housekeeping data also had a complex set of browse products, with a non-one-to-one relationship between browse data and the actual product, and thanks to some additional effort these are now all accessible using the PSA's postcard and product viewer.

Summary: This poster presentation will outline the status of the final Rosetta science archive in ESA's PSA and in NASA's PDS. In addition, an overview of the few remaining activities will be provided. Thanks to the support of the instrument teams and the entire PSA team, the Rosetta archive will remain an immensely valuable resource for scientists in years to come, and the full scientific potential of the mission can be realized.

References: [1] Besse, S. et al., (2018) Planetary and Space Science v150, 131-140; [2] Besse, S. et al., (2021) ESA's Planetary Science Archive efforts to support the scientific community, this meeting; [3] Barthelemy, M. et al., (2018) Planetary and Space Science v150, 91-103; [4] Manaud, N. et al., (2021) GEOGEN: A new approach and tool for computing the geometry metadata of ESA's PSA observational data products, this meeting; [5] Barbarisi, I. et al., PSA 2020: Toward the Discovery of ESA Planetary Data Through 2D and 3D Interfaces, this meeting.