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Set-up of a digital image archive for MOMS-2P(PRIRODA) data

HOLGER MAASS, KLAUS- DIETER MISSLING and HANS- JUERGEN WOLF, Neustrelitz

ABSTRACT

MOMS-2P sensor, German contribution to the international MIR/ PRIRODA mission, was successful developed, brought into space and tested. In parallel a distributed ground segment was installed in co-operati The on between Russia and Germany. This segment is now passed over into operational phase.
This paper describes the ground segment for the scientific data and its constituent components. It deals with the processing chain from the product generation to the user services and is focused on the so called product library.
The paper reviews the results up to now and gives an outlook for the further mission.

1. INTRODUCTION

With the launch of the Russian space station MIR in the mid 80ies began the planning of the remote sensing module PRIRODA. The sensor equipment was designed for the development and verification of new remote sensing methods and for investigations of regional and global questions in climatology, oceanography and ecology. For this reason the PRIRODA module carries a broad variety of different sensors covering the microwave, visible, near infrared and infrared spectral regions using active and passive techniques (Zimmermann).
Germany participates in the PRIRODA mission with the sensors MOS (MOS-User-Guide) and MOMS-2P (MOMS on Priroda, 1997). The MOS- sensor (*http://www.ba.dlr.de/NE-WS/ws5/mos.html*) is an imaging spectrometer optimised for investigation of the 'ocean-atmosphere' system. A similar sensor flow successful on the Indian IRS-P3 for more then one year.
The MOMS-2P sensor (*http://www.nz.dlr.de/moms2p/index.html*), developed by DASA in co-operation with Kayser Threde GmbH and RKK Energia/ near Moscow, is the youngest member of a family of threeline stereo scanners with multispectral features (MOMS-01, MOMS-02, MOMS-2P) operated in space, which were originally proposed in the 80ies (Meißner, 1982) and developed several times (Kaufmann et al., 1988).
The first part of MOMS-2P was launched on board of module PRIRODA on April 23, 1996 from the Cosmodrome in Baikonur. The MOMS-2P optics module followed about two weeks later. Due to manifold problems with the PRIRODA module, the MOMS checkout phase took much longer than expected, and was closed by mid October and continued by the commissioning phase till March, 1997.

2. MOMS-2P GROUND SEGMENT

A distributed ground segment was built in co-operation with the Russian side to fulfil the mission requirements (see Figure 1). It consists of similar parts in Russia and Germany for sensor operation and scientific data handling. The GSOC is responsible for the MOMS sensor control. The Russian ZUP controls the whole MIR station and assigns station resources to the planning team on the one hand and inserts MOMS control sequences into the telecommand stream of the station on the other hand. The German part of the ground segment for scientific data (reception station, PAF) is located at the DFD Neustrelitz, whereas the Russian reception station is in Obninsk and the PAF in Mytishi. Because the existing Russian communication infrastructure was not powerful and reliable enough, separate communication links are operated between the control centers as well as the processing facilities.

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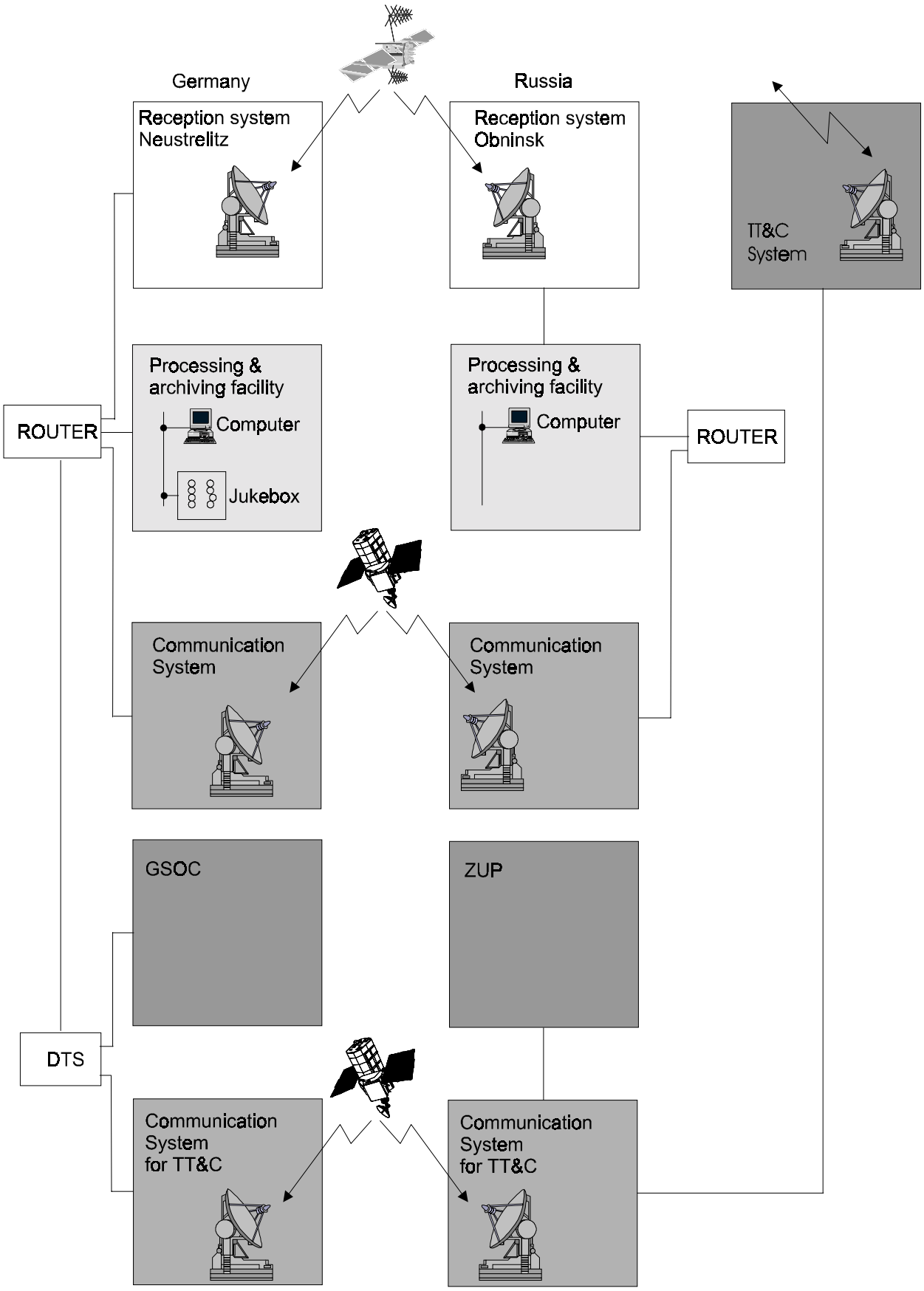

Figure 1: Distributed Ground Segment for MOMS-2P on MIR/ PRIRODA.

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3. PRODUCT GENERATION

In Figure 2 the whole Hardware system (ground station, PAF) is shown. It consists of a variety of special devices (reception station, computer clients with designated tasks) and common servers (archive, data pool, data base etc.), which are connected via FDDI.
The reception station is an ensemble of universal components for reception in X- band (antenna system including steering computer and receiver) and parts specific to the Russian telemetry (Bit-synchroniser, Frame-synchroniser). Data will be stored continuously in real time on high speed tape with a data rate of 61.44 $Mbits^{-1}$. After reception the data will immediately transferred to the data pool server of the PAF.
The data pool server is starting point for the systematic data processing and decouples the processors, reception station and archive. All incoming raw data will be processed systematically up to Level 1B (see Figure 3). This Figure also shows the co-operating institutes in this work. The DLR institute for Optoelectronic is responsible for sensor examination and makes profound quality checks of products. The GFZ contributes precise ephemeris of the MOMS-2P orbit. The GSOC produces files containing (fast) coarse ephemeris, an attitude solution and integrated gyro data (MOMS on PRIRODA, 1997). Main archive for all products is located at DFD.

4. PRODUCT LIBRARY

The product library is the internal core instrument for data management and data archiving of all MOMS-2P data streams in the ground segment. It consists of two main parts :

- Inventory
- Archive

This system is responsible for data ingestion from all MOMS- processors and provides all input data for starting the systematic processing. It keeps an inventory of all products including all interim data and reports. The product library takes care, that all files (products, ancillary data) will be archived in the planned manner. The user services also obtain needed information from this system.
Permanent monitoring processes keep the consistency between inventory and archive. Figure 4 shows the integration in the whole ground segment.

4.1 Inventory

The inventory manages all ingested meta data of the MOMS processing system. Via this system information about location, history, characteristic and state of each product are derivable. For this reason also all interim and ancillary data will be included in. The user services will be provided with a guide and views of inventory data.

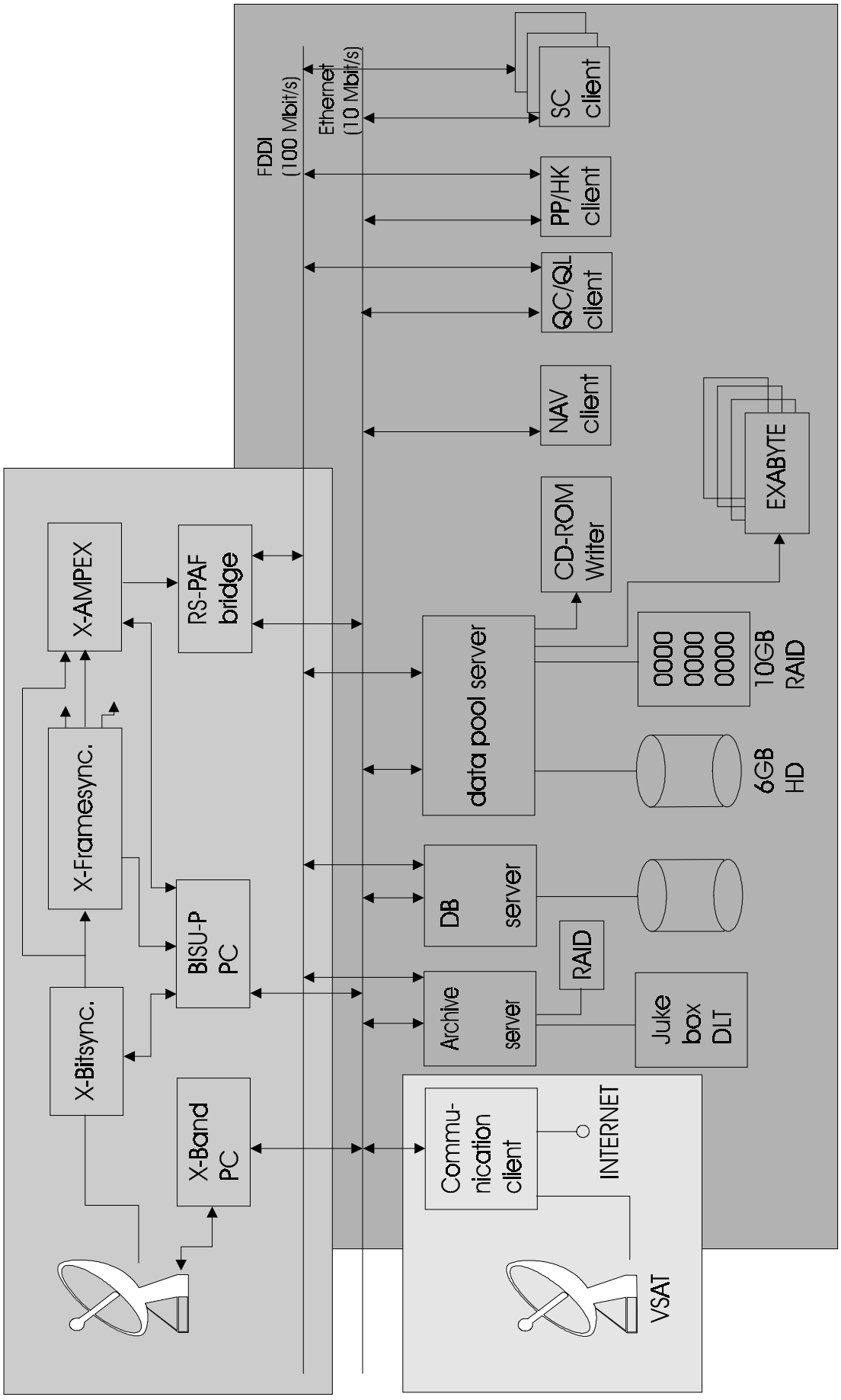

Figure 2: Hardware Configuration MOMS-2P Ground Segment at DFD Neustrelitz.

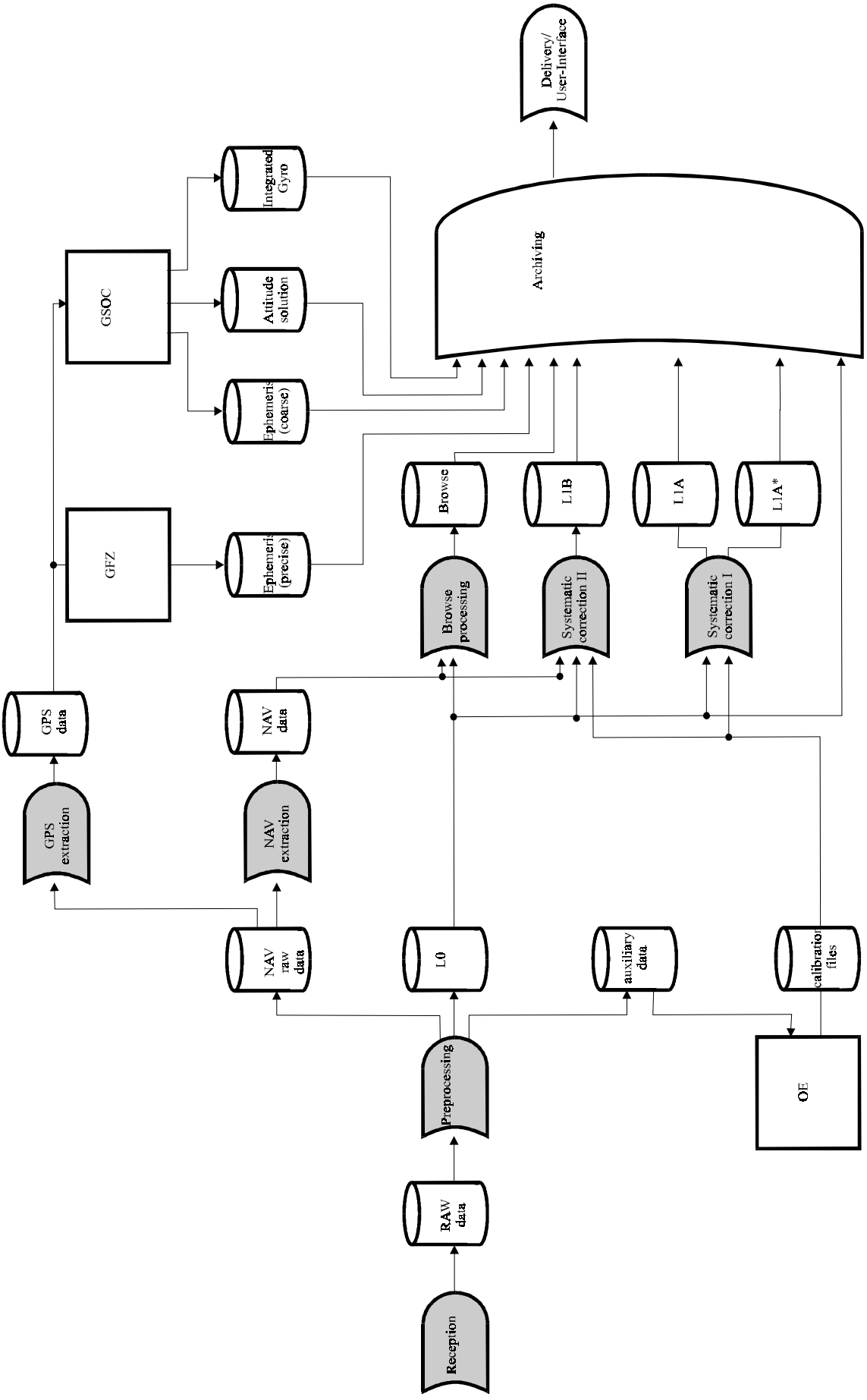

Figure 3: Processing Chain MOMS-2P.

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4.2 Archive

The archive was designed for an online access to the estimated data amount of the whole mission (3 TB). That includes raw and auxiliary data, reports and products of different levels. The realised archive (see Figure 5) consists of a juke box, which handles the tapes, a disk array, serves as cache, and an archive server, which controls the archive system using a HSM- software. Through the multilevel hierarchical storage management the advantages of different media (disk : fast but expensive and tape: cheap but slow) can be combined with a new quality of reliability, using such techniques like double of critical paths, hot spares and RAID5 functionally. The system supports NFS, FTP and RPC and offers external processes a virtual unlimited file system. DLT tapes were chosen in account of

- good value- performance quotient,
- high reliability (devices and media),
- foreseeable future of this technology.

5. USER SERVICES

Online user services are realised by the ISIS (*http://isis.dlr.de*). The Intelligent Satellite Data Information System is the central user interface to the data archived at the German Remote Sensing Data Center (DFD) and supplies the MOMS user community with a variety of on-line services including

- Inventory access,
- Browse service,
- Thesaurus and
- Order service.

It supports an entire spectrum of hardware platforms and operates different interfaces and is available via the common communication lines.

Inventory service
- search and retrieval of data within MOMS catalogue as well as assisted multimission queries
- receiving of footprints using the map browser
- providing of a multitude of meta data characterising scenes
- geographical database
- access to texts and software in an 'infoboard'
- routing to various international information systems and archives

Browse service
on-line visualisation of digital browse quicklooks,

- down scaled and JPEG-compressed versions
- from one channel

of the full size images direct inside a GISIS or WWW session.

Thesaurus
enables a thematic search of MOMS products.

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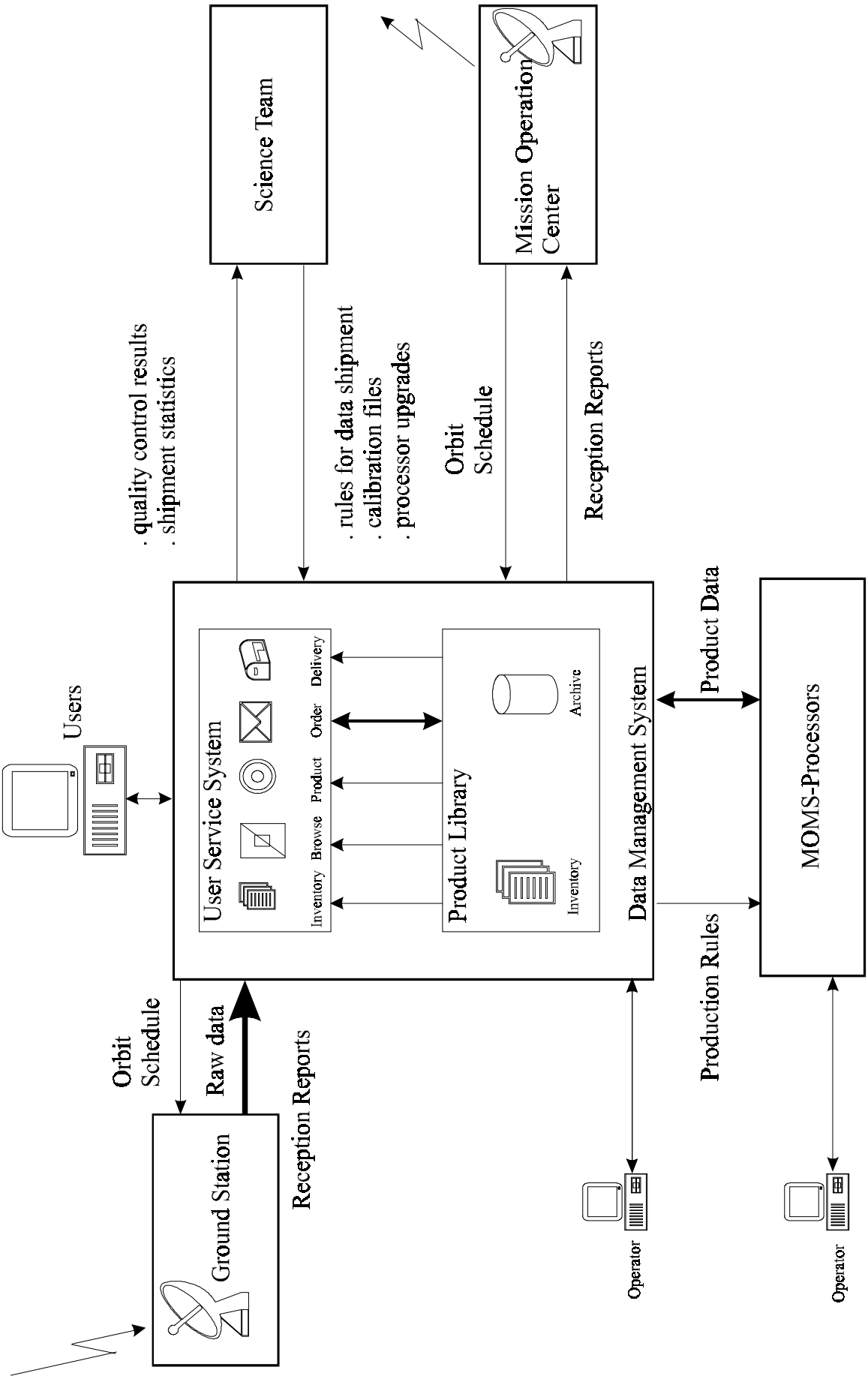

Figure 4: Product Library - Core of the Ground Segment.

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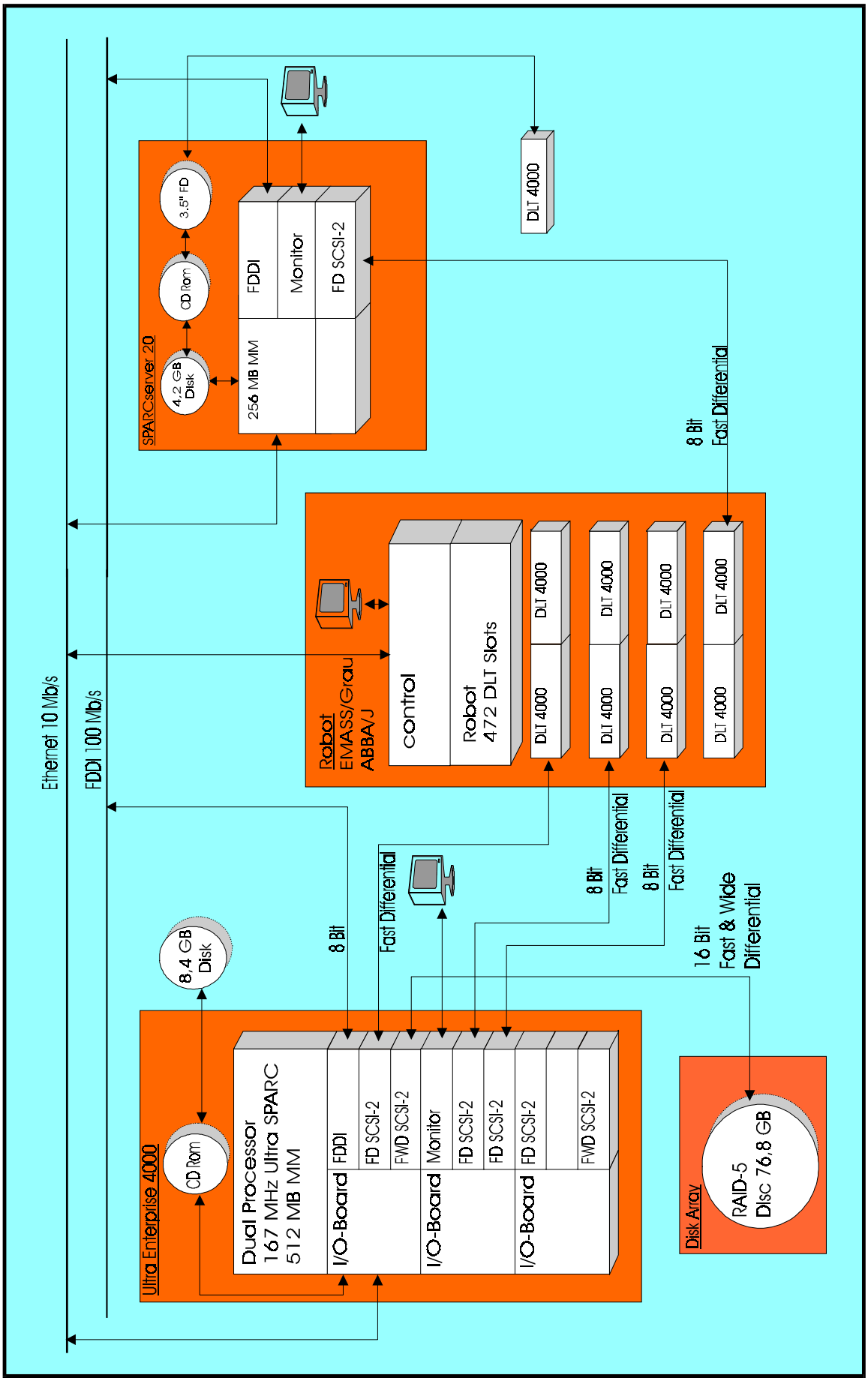

Figure 5: MOMS-2P - online Archive.

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Order service
Order can be placed directly from an ISIS session or with order form[3] via letter or fax. A help desk is installed to support the user in all questions of getting data. Data products will be delivered via CD-ROM or EXABYTE. This media are broad spread, have a sufficient capacity and are secure enough. Besides this online services a printed data user handbook [3] is available. This handbook can also be downloaded via anonymous ftp or WWW (*http://www.nz.dlr.de/moms2p/ug/index.html*).

6. CONCLUSION

The described system was successful implemented and stands its first acid test, but the way was not a trivial undertaking. Many unforeseen problems had conquered, especially caused in the co-operation with Russian side by not working communication infrastructure, misunderstandings and the economical upheaval in Russia. But this problems were compensated by high efforts of all partners.

7. ACKNOWLEDGEMENT

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8. REFERENCES

Zimmermann, G.: MISSION PRIRODA German Proposals to Scientific Program,DLR, Institute for Space Sensor Technology, Berlin.

MOS-User-Guide: DLR, Institute for Space Sensor Technology, Berlin.

MOMS on PRIRODA (1997): Data user handbook, DFD, Neustrelitz.

Meißner, D. (1982): Modular Optoelectronic Multispectral Scanner (MOMS) development, 20th Goddard Memorial Symp. and 4th Joint AAS/ DGLR Symp., AAS-82, 131, NASA- GSFC.

Kaufmann, H., Meißner, D., Bodechtel, J., Behr, F.J., Geerken, R., Jung, K. (1988): Design of the spectral bands for the German MOMS-02 sensor, Proc. of the 4th Int. Symp. on Spectral Signatures of Objects in Remote Sensing. Aussois, France, ESA SP-287, ESTEC, pp. 425-430.

9. ABBREVIATIONS

DARA	German Space Agency GmbH
DASA	Daimler Benz Aerospace AG
DFD	Deutsches Fernerkundungsdatenzentrum (German Remote Sensing Data Center)
DLR	German Aerospace Research Establishment
DTS	Data Transfer System
GFZ	Geoforschungszentrum Potsdam
GSOC	German Space Operation Center
HSM	Hierarchical Storage Management
ISIS	Intelligent Satellite Data Information System
MIR	Russian for (planet) earth
MOMS	Modular Optoelectronic Multispectral Stereo Scanner
MOS	Modular Optoelectronic Scanner
PAF	Processing and Archiving Facility
PRIRODA	Russian for Nature
TT & C	Telemetry, Tracking & Command
ZUP	Zentre Uprawlenie Poljota (Russian for flight control center)