National Aeronautics and Space Administration

direct readout

*developing technologies for **real-time** collection, processing, and distribution of Earth science data*

NISDS Control System (NCS)

Data Storage

Science Processing Algorithms (SPAs)

NISGS Status Event/ Logging System (NSLS)

Information Services (IS)

Simulcast

Real-Time Software Telemetry

Processing System Manager (PSM)

The Direct Readout Laboratory (DRL) at NASA's Goddard Space Flight Center develops technologies to maximize the utility of Earth science data for real-time decision-making.

- The DRL serves as the bridge between user needs and mission objectives.
- The DRL's technology development process stresses continuity and standardization.
- DRL technologies enable instant access to instrument data and derivative products from the Aqua and Terra missions and, in the future, the NPP and NPOESS missions.
- DRL technologies are designed to be scalable, extensible, portable and easy to use.

www.nasa.gov
directreadout.gsfc.nasa.gov

NASA Direct Readout Program Vision

Unification of the Global Direct Readout Community for data democratization and understanding of Earth processes as a system

NASA Direct Readout Program

Building upon NASA's mission #1: "To understand and protect our home planet":

The **Direct Readout Laboratory** (DRL) acting as the implementation arm of NASA's Direct Readout Program endeavors to:

Enable

- The utility of NASA's Earth science data
- Technologies for decision-support infrastructure
- Technology solutions for real-time and regional applications
- Continuity among missions to minimize end-user impact
- Real-time applications support systems

The DRL also provides:

- Data transport tools for NASA's Earth science data
- Real-time data processing tools that are modular, scalable, portable & extensible
- Utility via the promotion of standards in pre processing sub-systems, Science Procesing Algorithms (SPAs) interfaces, visualization and real-time processing systems

Identify and understand the needs of a global community that use NASA's Direct Broadcast data.

- Promote synergy between NASA, the community and interdependent direct broadcast data users
- Act as a technical conduit between the mission and the public

Guide the direct readout community and NASA's Direct Broadcast Earth science missions.

- Bridge mission planning based on lesson's learned and the establishment that use NASA Direct Broadcast
- To provide technical and implementation insight to new missions that wish to use Direct Broadcast
- Educate on the importance and utility of NASA's data

National Aeronautics and Space Administration

Direct Readout Model

Internal Mission Team

Mission Objectives
(e.g., NPP)

- Protocol/Data Interface Compatibility
- Spacecraft I&T for Direct Readout
- Direct Readout RDR and SDR Algorithms and Verification
- Working Group Meetings
- System Meetings
- Science Team Meetings

Report the State-of-the-Community

DIRECT READOUT

Direct Readout Laboratory

Provide a Roadmap to Future Technology

External Direct Readout Community

- Frequently Asked Questions
- Email
- Technology Transfer
- Technology Enabling
- Public Release Software
- Web Portal Feedback
- Open-door Policy
- Demonstrations
- Presentations
- Conferences

- **R&D Organizations**
- **General Public**
- **Commercial Sector**
- **Other Government Agencies**

www.nasa.gov
directreadout.gsfc.nasa.gov

DIRECT READOUT

DIRECT READOUT PROGRAM ROADMAP

AVHRR
SeaWiFS
OLS
HIRS
SSM/I, SSMIS, SSM/T, SSM/T-2

MODIS

MODIS
AIRS
AMSU
HSB
AMSR-E

VIIRS
CrIS
ATMS
OMPS
CMIS
(NPOESS Only)

Spacecraft and Instrument Evolution

L-Band, S-Band
665 - 2 Mbps
BPSK

X-Band
13.1 Mbps
Convolutional
UOQPSK
NRZ-M

X-Band
15 Mbps
OQPSK
NRZ-M

X-Band • X-Band, L-Band
15 Mbps • 20, 3.8 Mbps
Convolutional
QPSK • OQPSK
NRZ-M
Compression

Standardization and Increasing RF, Modulation, and Bandwidth Requirements

- Custom Formatters and Ingest Software
- Analog Custom Receivers
- NOAA Level B (AVHRR)
- Limited Data Distribution Mechanisms

- Spacecraft Specific STPS
- Level-0
- Return Link Processor
- Analog Configurable Receivers
- MODIS Level-1
- MODIS Simulcast

- Reconfigurable RT-STPS
- Return Link Processor
- Digital Configurable Receivers
- MODIS and AIRS Level-1
- NEpster with Level-0 and Level-1 Data
- MODIS Simulcast

- User Reconfigurable RT-STPS
- Multi-Mission Digital Receiver
- Instrument SDR Software and Select EDR Algorithms
- NEpster with RDR, SDR, and EDR Data Products
- Simulcast of Select Instruments
- Multi-Mission Scheduler and Controller
- Science Processing Algorithm Wrapper
- Real-time Data Management and Processing Tools
- HDF to GIS Data Transport Tools

DIRECT READOUT
directreadout.gsfc.nasa.gov

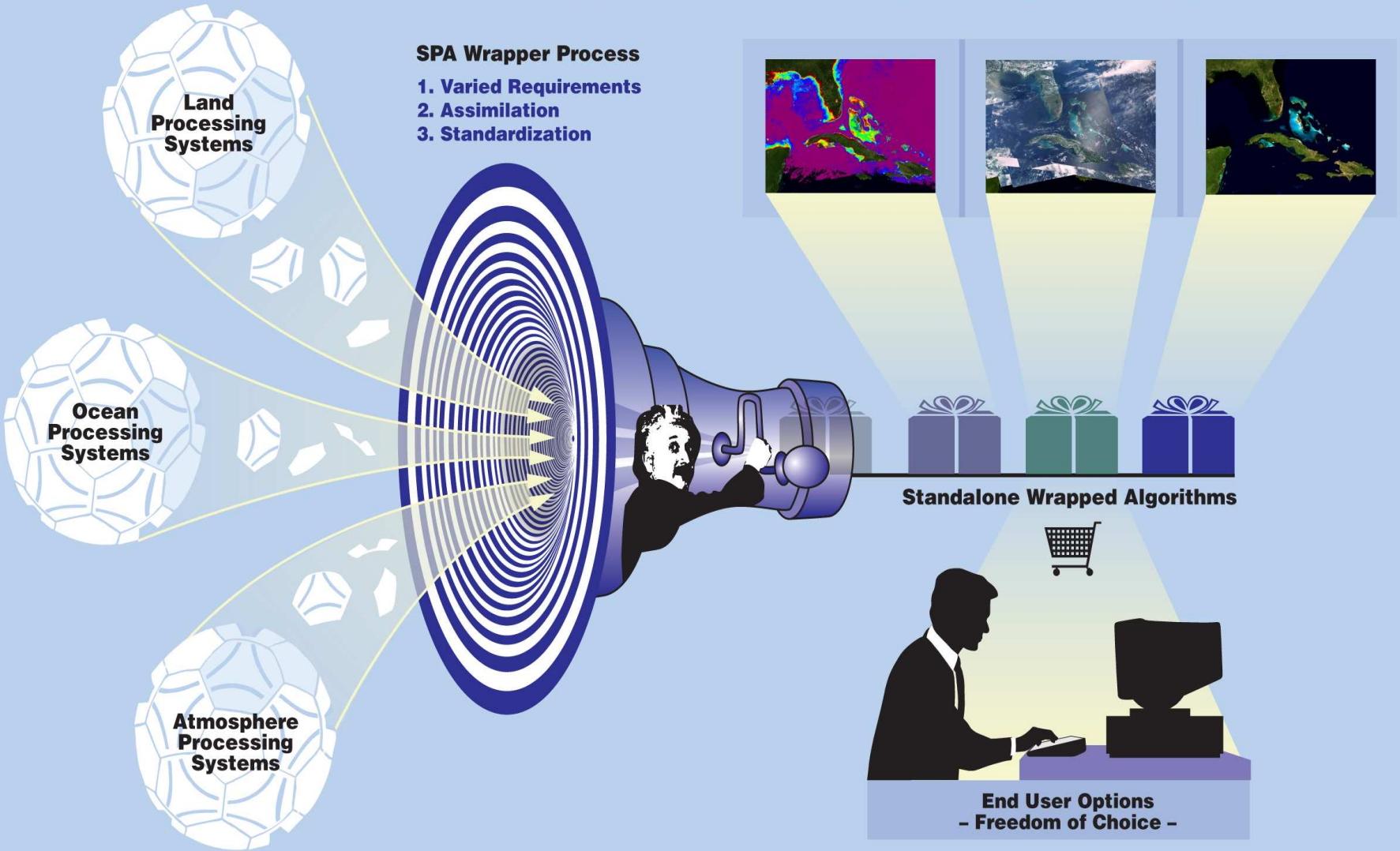
Evolution of Concurrent Ground Systems Supporting Technologies and Algorithm Development

Driving Force Behind DRL Technology Development

- Utility and transportability of Earth science data
- Modularity, scalability, portability & extensibility of DR Tools
- Real-time data processing tools
- Utility via the promotion of **standards** in pre -processing sub-systems, SPAs interfaces, visualization and real-time processing systems

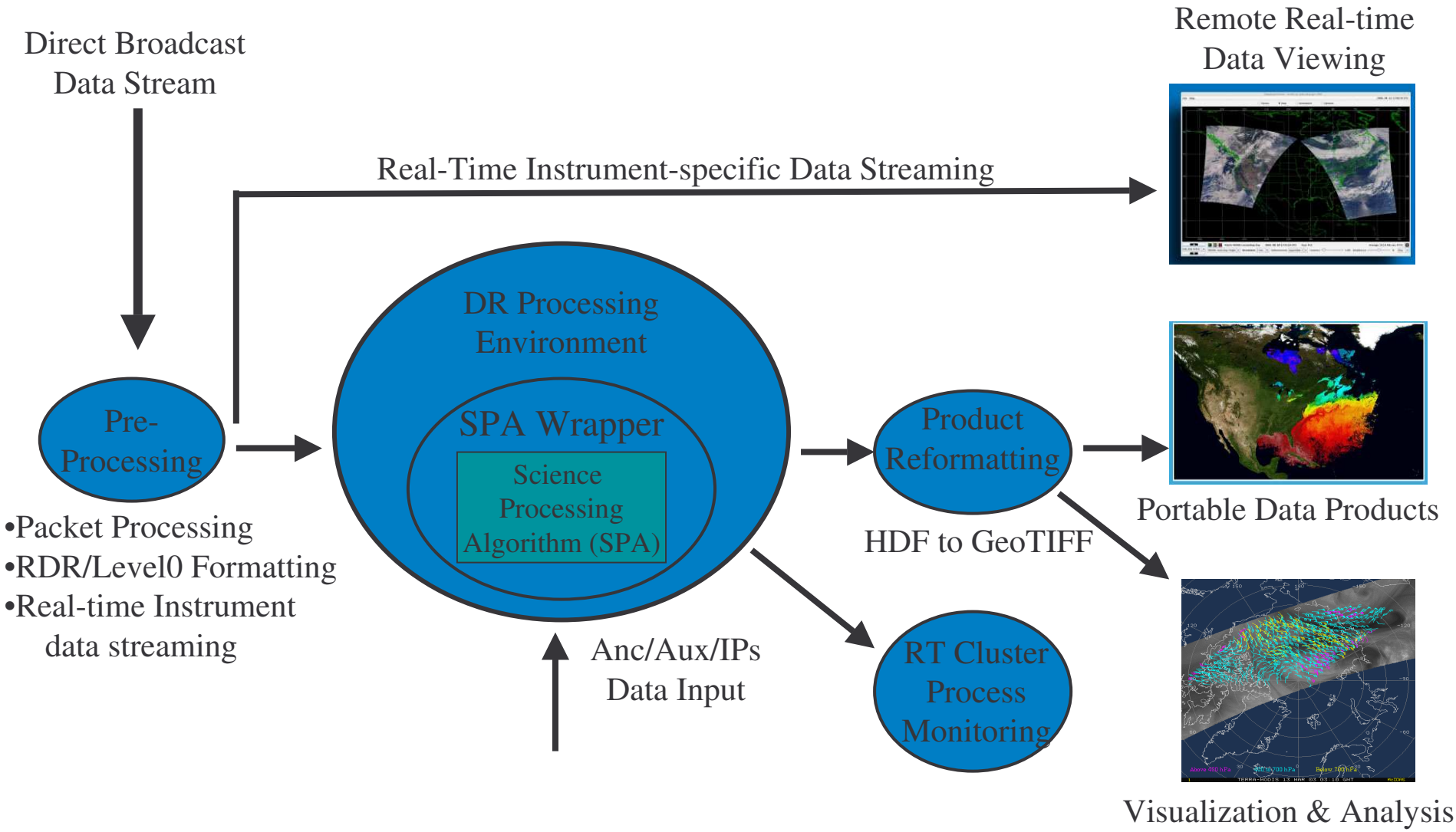
National Aeronautics and Space Administration

Science Processing Algorithm (SPA) Wrapper

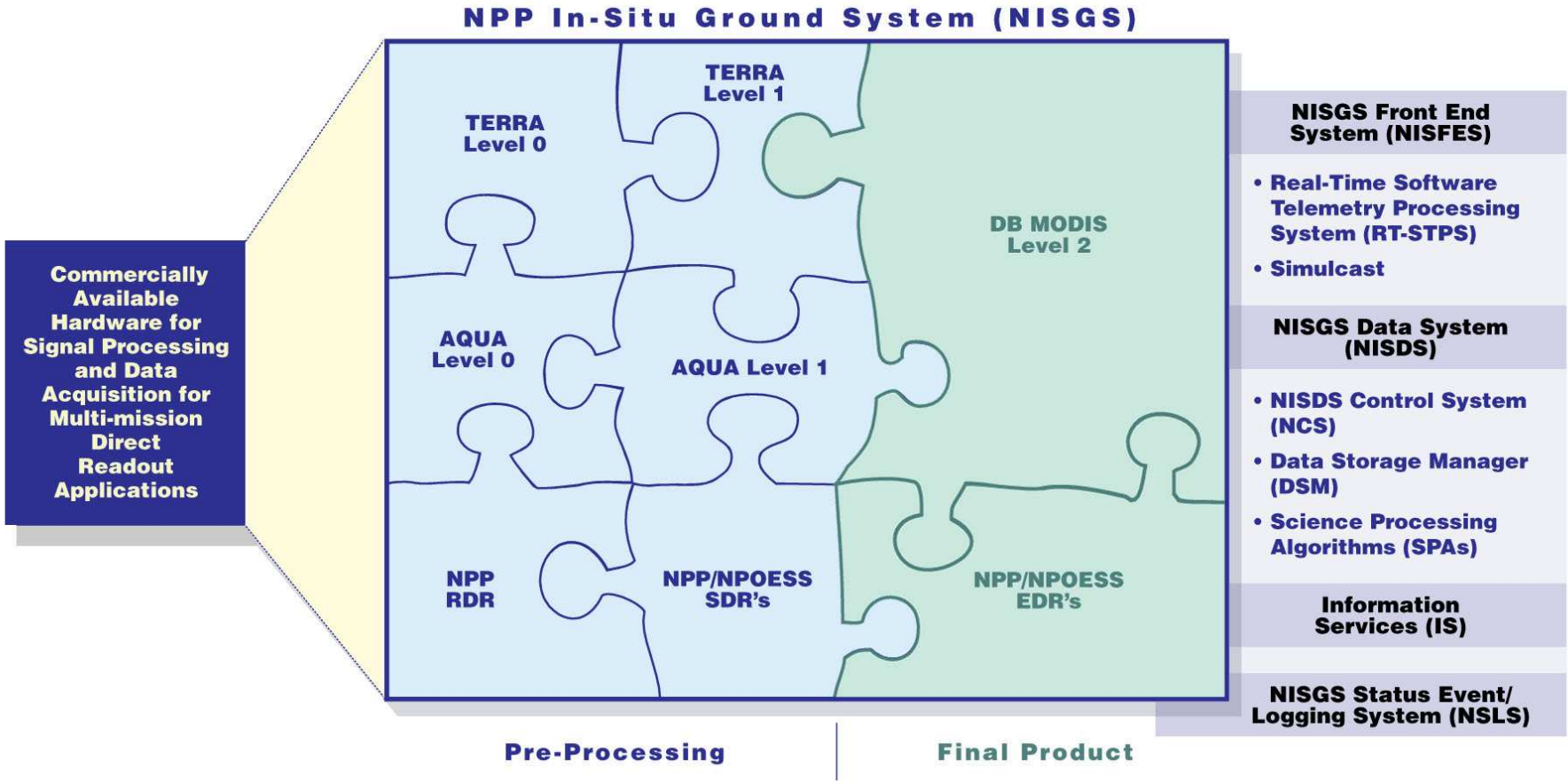


NPP In-Situ Ground System (NISGS)

IPOPP Framework Paradigm



Modular Components Approach



Key Points

- Together we're building the foundation for the next generation direct readout
- The DRL and its partners are developing technology tools and making available science processing algorithms (SPA's) on the road to NPP and NPOESS
- Therefore we need your participation, input and guidance
- The DRL and its partners want to ensure the use and utility of Earth science data

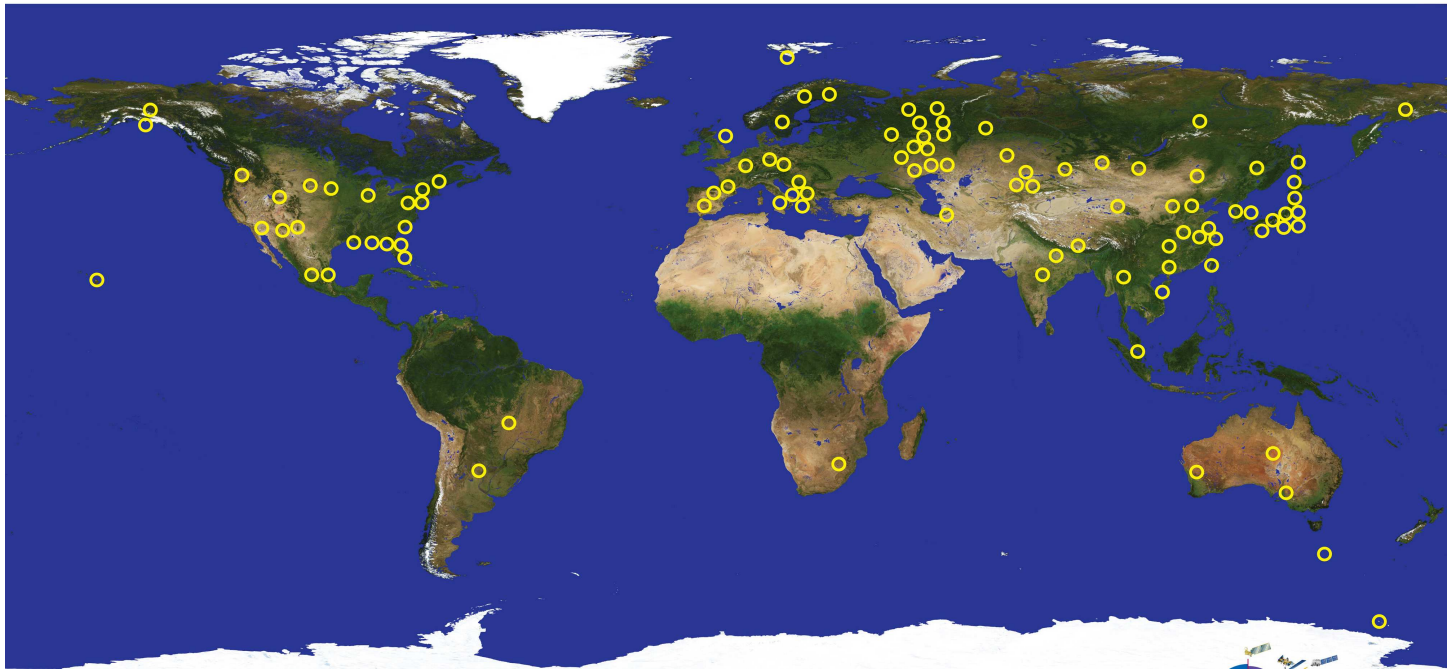
The World of Direct Readout

Terra/Aqua Direct Readout Sites

125 confirmed EOS direct readout ground systems world-wide.

50% owned by government agencies and organizations

35% owned by educational institutions, 15% owned by the commercial sector



85% of these ground stations support real-time applications.

30 countries have EOS direct readout capabilities.

There are 1880 registered users on the NASA DR Portal

http://directreadout.gsfc.nasa.gov

Terra/Aqua/NPP & Instrument Status

- Terra & Aqua MODIS functioning nominaly on primary fomatter and RF chain
  - AQUA AIRS and AMSU functioning nominaly
- Terra Mission has been given a 3 year support extension with yearly evaluation.
- NPP launch scheduled for end of 2009
  - Changed to afternoon orbit
  - OMPS on-board
  - CERES being evaluated for on-board

National Aeronautics and Space Administration

International EOS/NPP Direct Readout Meeting

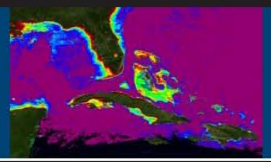
March 31 - April 3, 2008
Bangkok, Thailand

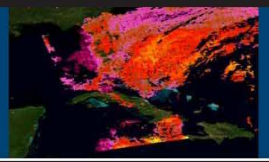
direct broadcast

Please join us in Bangkok to discuss the latest developments in the understanding and applications of Direct Broadcast data. The 2008 meeting, hosted by the Asian Institute of Technology, will focus on:

- *Direct Readout Product Applications in Operations*
- Direct Broadcast Missions and Instrument Status and Plans
- Direct Readout Application Product Sharing and Transport Mechanisms
- Direct Readout Science Processing Algorithms
- Direct Readout Systems

For registration, logistics, and other information, go to:
http://dbmeeting.gsfc.nasa.gov





www.nasa.gov
directreadout.gsfc.nasa.gov

AIT
ASIAN INSTITUTE OF TECHNOLOGY

THE UNIVERSITY of WISCONSIN MADISON

DRL Contact Info

Patrick Coronado:

patrick.coronado@nasa.gov

Kelvin Brentzel:

kelvin.brentzel@gsfc.nasa.gov

The Direct Readout Web Portal:

http://directreadout.gsfc.nasa.gov