John Overton
Bill Thomas

CIMSS
Space Science and Engineering Center

Agenda

- Organizational Changes
- Program Launch Schedule
- Field Terminal MOA – Our Charter
- NPOESS Restructure Impacts to FTS
- Field Terminal Architectures
- Manifested Sensors/Environmental Data Records
- IPO Direct Readout Business Philosophy
- IPOPP Development Team
- IPOPP Alpha Test Site Opportunity
- IPOPP – Overview

PEO Organization*

* As Approved by the EXCOM on March 14, 2006

NPOESS EXCOM

Dr. M. Griffin - *Administrator of NASA*
G. Peyton – *Under Secretary of the Air Force (A)*
VADM (ret.) C. Lautenbacher – *Under Secretary of Commerce for Oceans and Atmosphere*

Environmental Satellites Program Executive Office (PEO)

Dan Stockton – PEO (NOAA)

Deputy PEO – Col E. Phillips (USAF) (Acting)

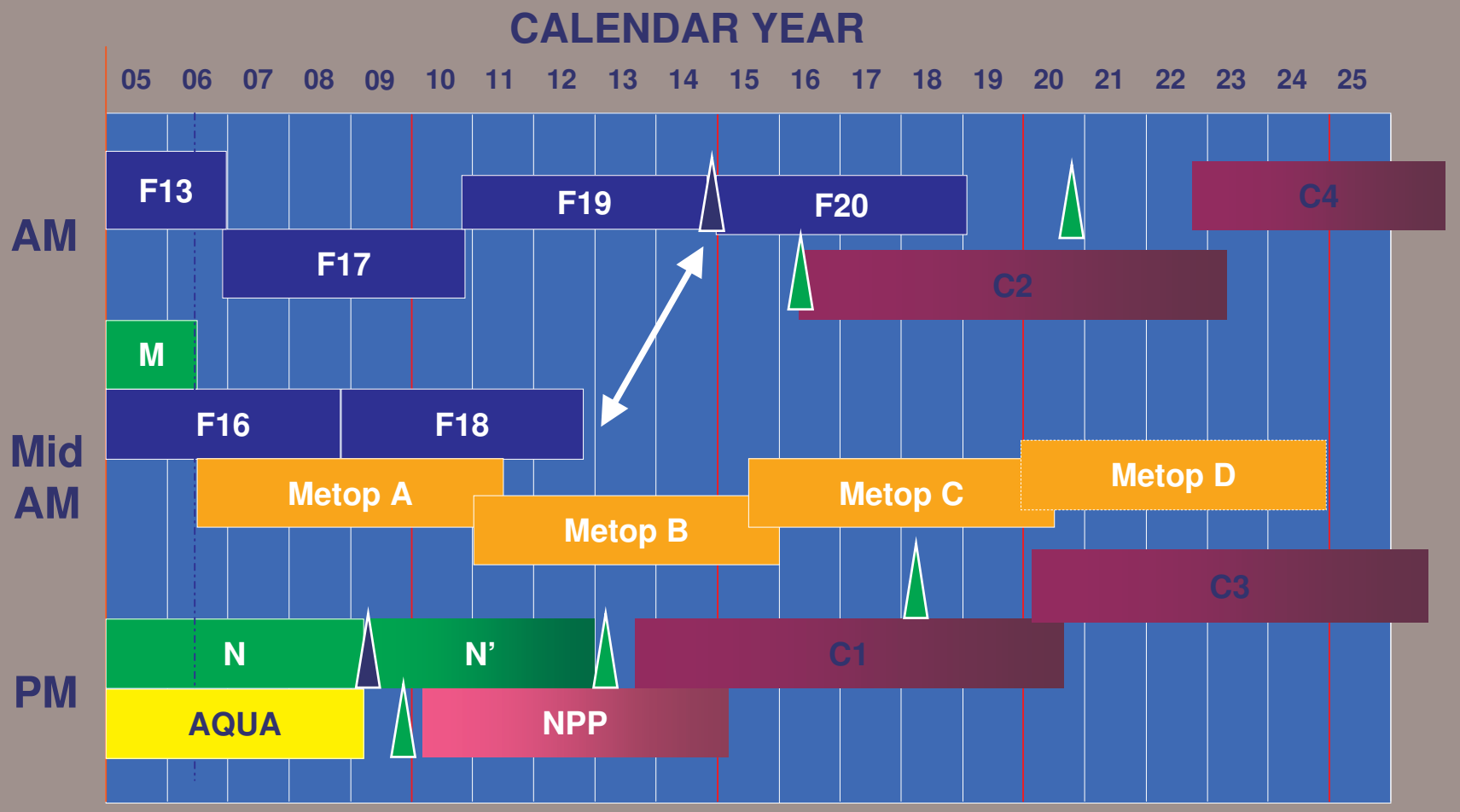
Senior Policy/Plans - P. Wilczynski (NOAA)
Senior Policy/Plans - **Vacant**
Chief Engineer - K. Anderson (NASA)
Chief Scientist - **Vacant**
Senior DoD - Maj T. Cole (USAF)
Senior NOAA – K. Boyd (Acting)

Senior NASA - A. Carson
Senior Budget Advisor - K. Gilmore
Senior Tech. Advisor - M. Haas
Senior Comm. Advisor - T. Bucher
SUAG Rep – M. Bonadonna (NOAA)

PEO Portfolio

POES MGR	NPOESS SPD	ATP DIR	OPS DIR	DMSP SPD	NPP PROJ MGR
M. Mignogno (NOAA)	S. Simione (USAF) (Acting)	S. Schneider (NASA)	B. Needham (NOAA)	Col B. Smith (USAF)	K. Schwer (NASA)

Launch Schedule



Preserves Mission Continuity!

Field Terminal MOA

IPO "Contract" with User Agencies

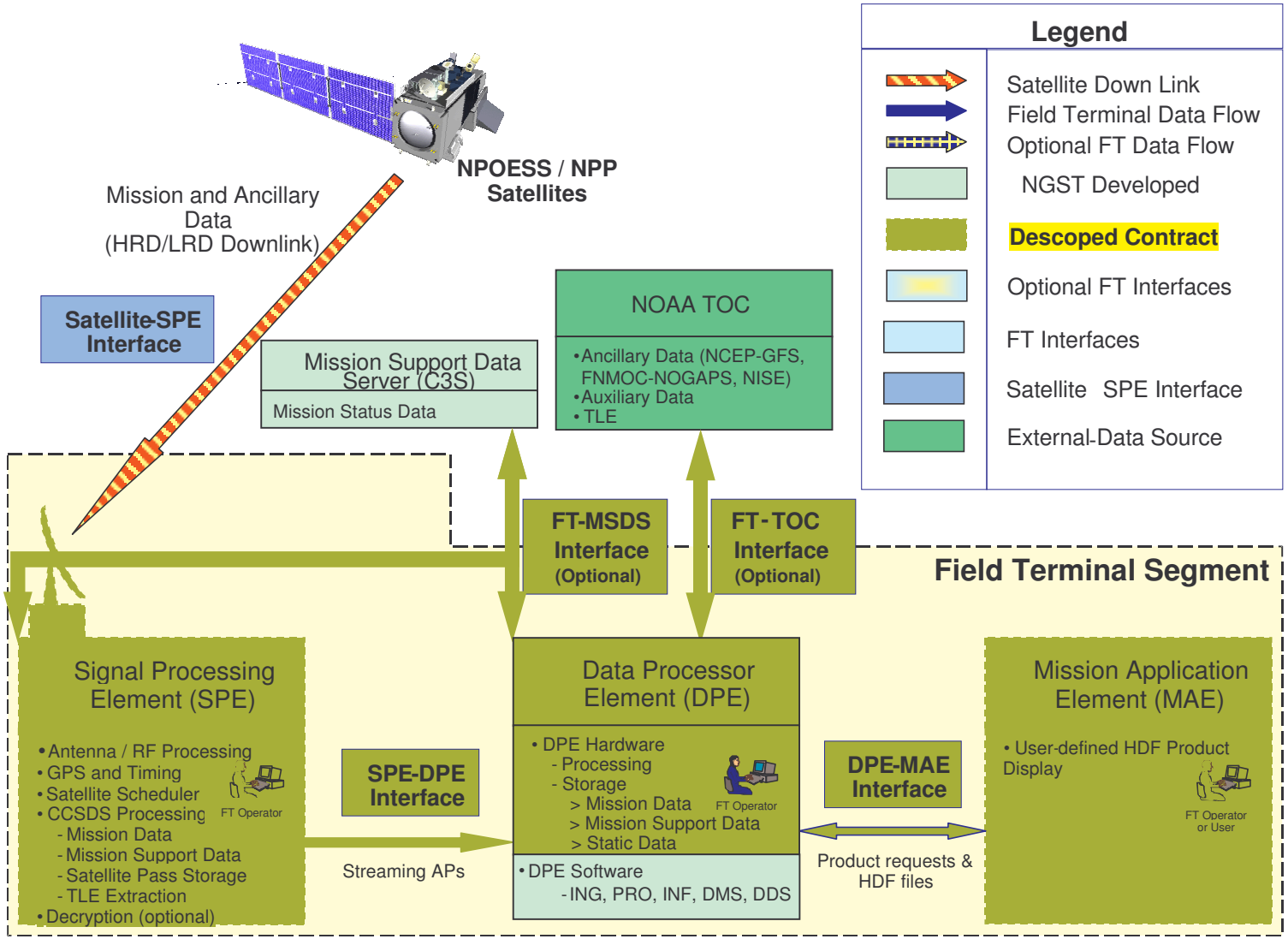
- Purpose
  - Institutionalize System Interface responsibility at the Field Terminal (Direct Readout Ground Station)
  - Allocation of agency responsibilities
    - IPO develops Sensor Data Processing Software and Decryption Capability (NPOESS Contract and Other Activities, e.g., IPOPP)
    - User Agencies acquire Field Terminals
  - Commitment of funding for fulfillment of those responsibilities

- Signatories
  - System Program Director, Integrated Program Office (IPO) NPOESS
  - Oceanographer of the NAVY
  - Director of Weather, USAF
  - Assistant Deputy Chief of Staff for Intelligence, USA
  - Assistant Administrator for Satellite and Information Services, NOAA NESDIS and NWS

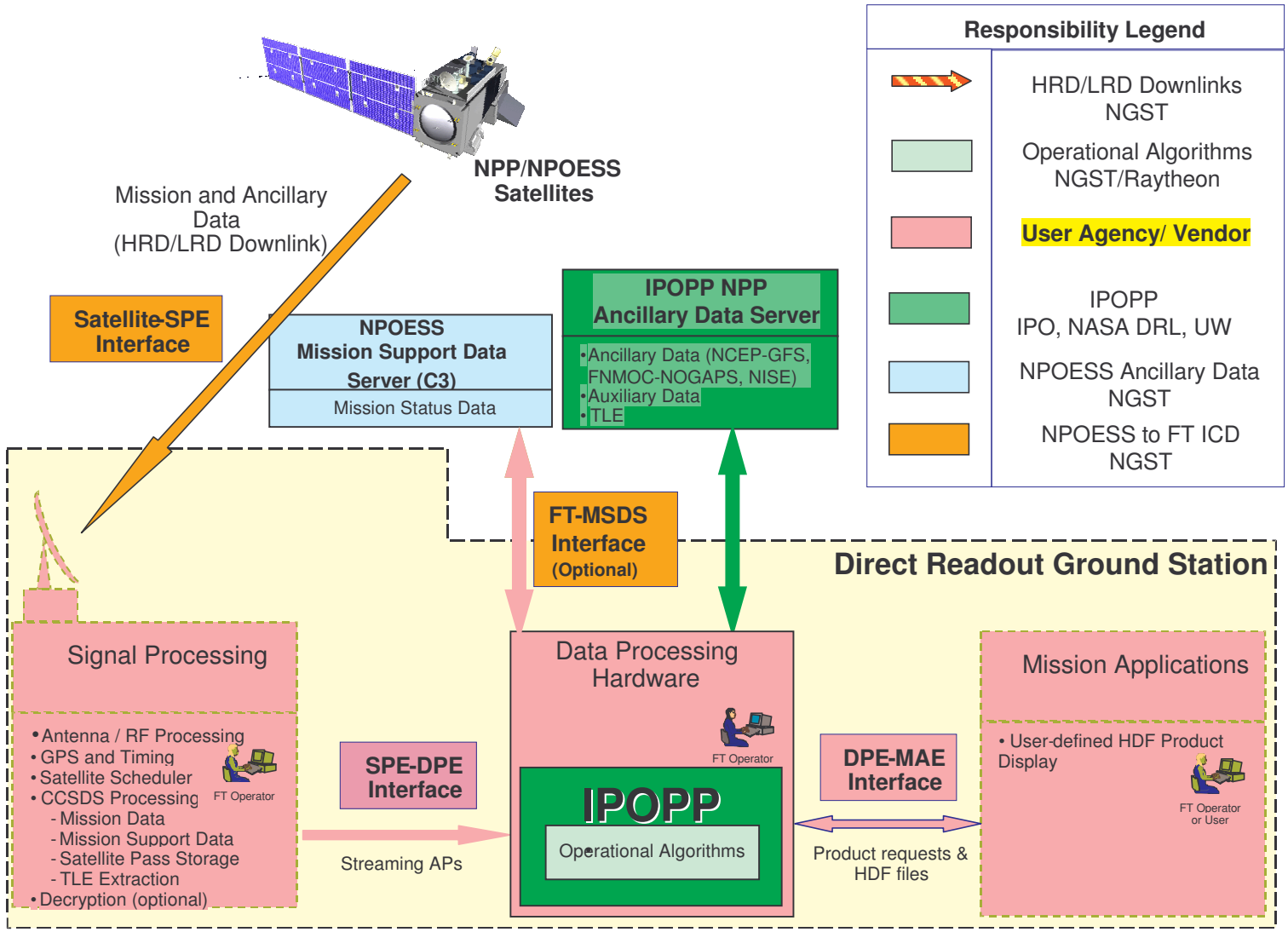
NPOESS Contract Restructure Impacts to Field Terminal Segment

- Ground Rules & Assumptions reduced NGST Field Terminal Segment (FTS) software development scope
  - Will deliver only operational HRD and LRD Algorithms
  - Deleted continued development of NPOESS Reference Field Terminal
  - Deleted NPP Demo of post launch NPP HRD processing using NPOESS Reference Field Terminal
  - Will only support IBM AIX Operating System
  - Retained Original LRD baseline design on NPOESS
    - Using JPEG-2000 Lossy Compression
  - Will monitor HRD and LRD downlinks at Svalbard

NGST's "On Contract" Field Terminal Architecture (post-Restructure)



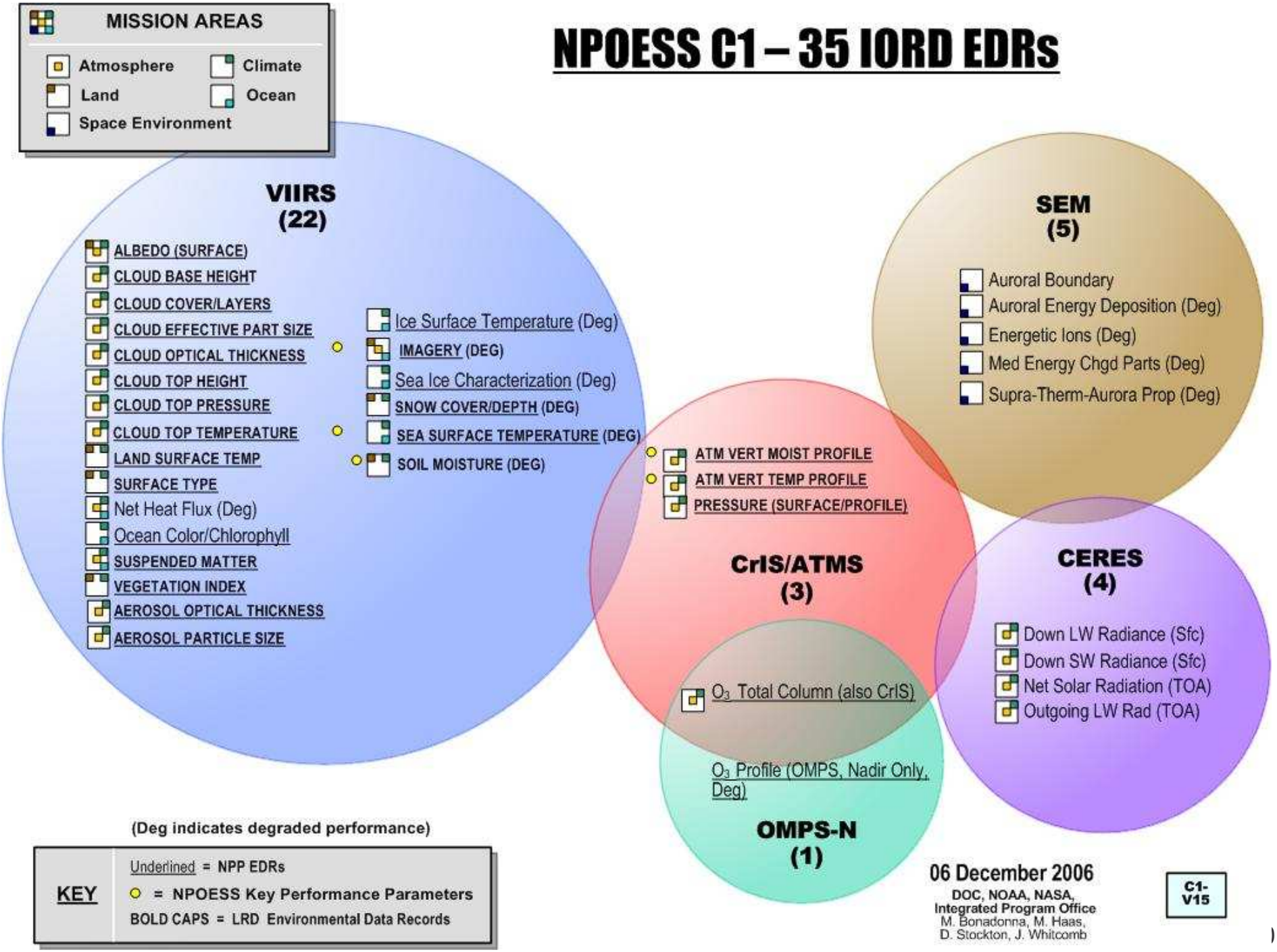
The "New" Field Terminal Architecture



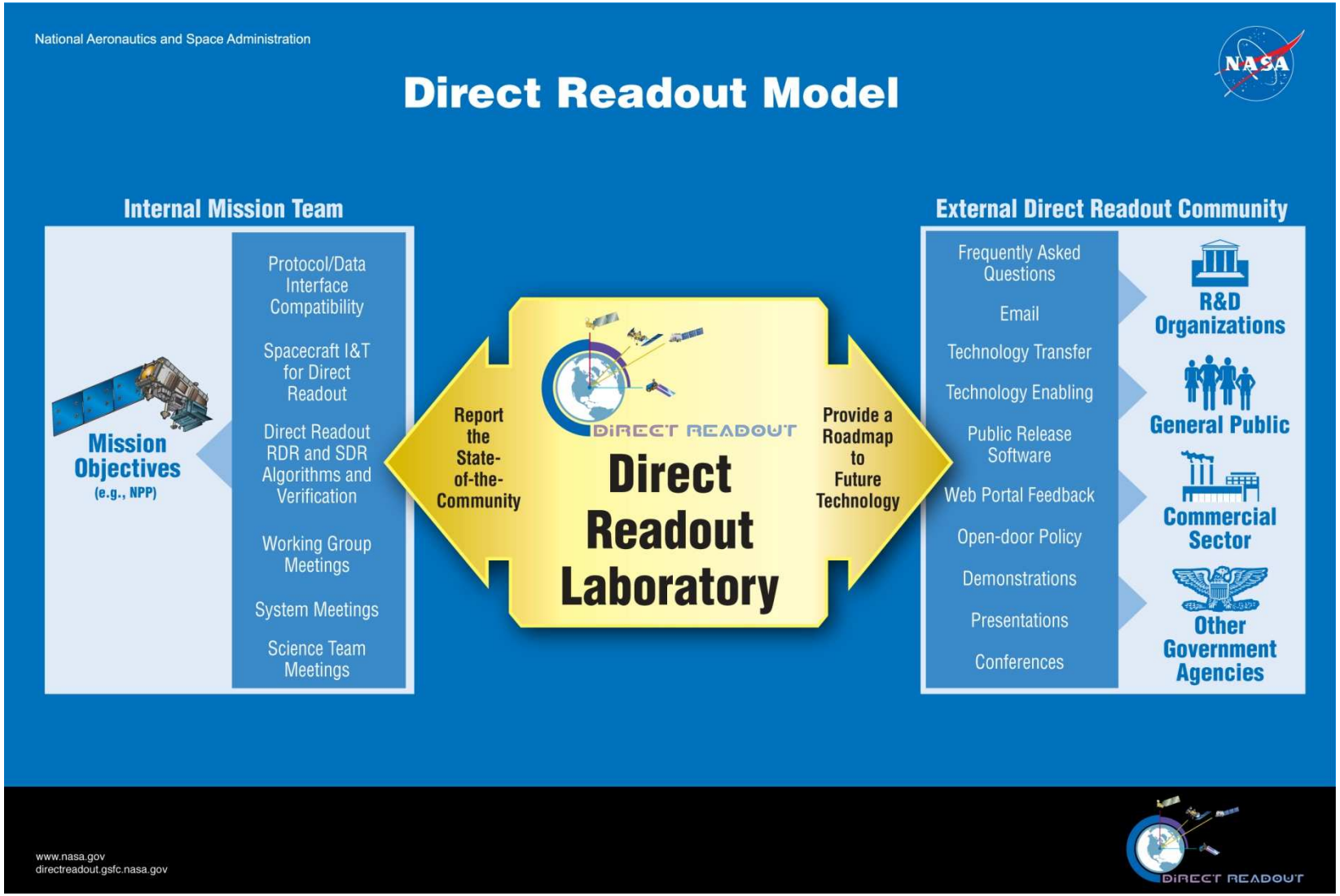
Post Certification Sensors

Satellite	NPP	C1	C2	C3	C4
Launch	**Sep 2009**	**2013**	**2016**	**2020**	**2022**
Nodal Time Ascending	**1330**	**1330**	**0530**	**1330**	**0530**
VIIRS	X	X	X	X	X
Microwave Imager/Sounder			X	X	X
CrIS	X	X		X	
ATMS	X	X		X	
OMPS Nadir	X	X		X	
SEM (MEPED and TED)		X		X	
CERES		X			
SARSAT		X	X	X	X
ADCS		X	X	X	X

NPOESS C1 – 35 IORD EDRs



Business Philosophy



IPO Vision for Direct Readout Users

- IPO remains committed to meeting the terms of the Field Terminal MOA
  - Post-restructure task allocation will be different
    - Less from NGST
    - More from IPOPP
  - Established Partnership with NASA DRL and UW will need to evolve
- IPO was already developing IPOPP for NPP
  - Using LINUX Operating System
  - Using Operational Coded Algorithms from NPOESS IDPS
- IPO is working to “fill in the holes” by extending IPOPP into NPOESS era
  - Sensor manifest for NPOESS C1 and C2 virtually the same as NPP
  - LRD first available on NPOESS C1
- Allows Industry to do “what they do best” – integrate government provided technology into their Product Lines tailored to their Customer’s requirements

International Polar Orbiter Processing Package

• The International Polar Orbiter Processing Package (IPOPP) is a software package that will be critical to the Direct Broadcast (DB) user community throughout it's transition from EOS to NPOESS

• IPOPP is the primary processing package that will enable the DB community to process, visualize, and evaluate NPP Sensor and Environmental Data Records - which is a necessity for the DB community during the transition from the Earth Observing System Era to the NPOESS Era.

• NOTE: Terra (and perhaps Aqua) are subject to being decommissioned once NPP has completed CAL/VAL. Terra mission life was extended when NPP launch schedule moved to April 08 (now September 09).

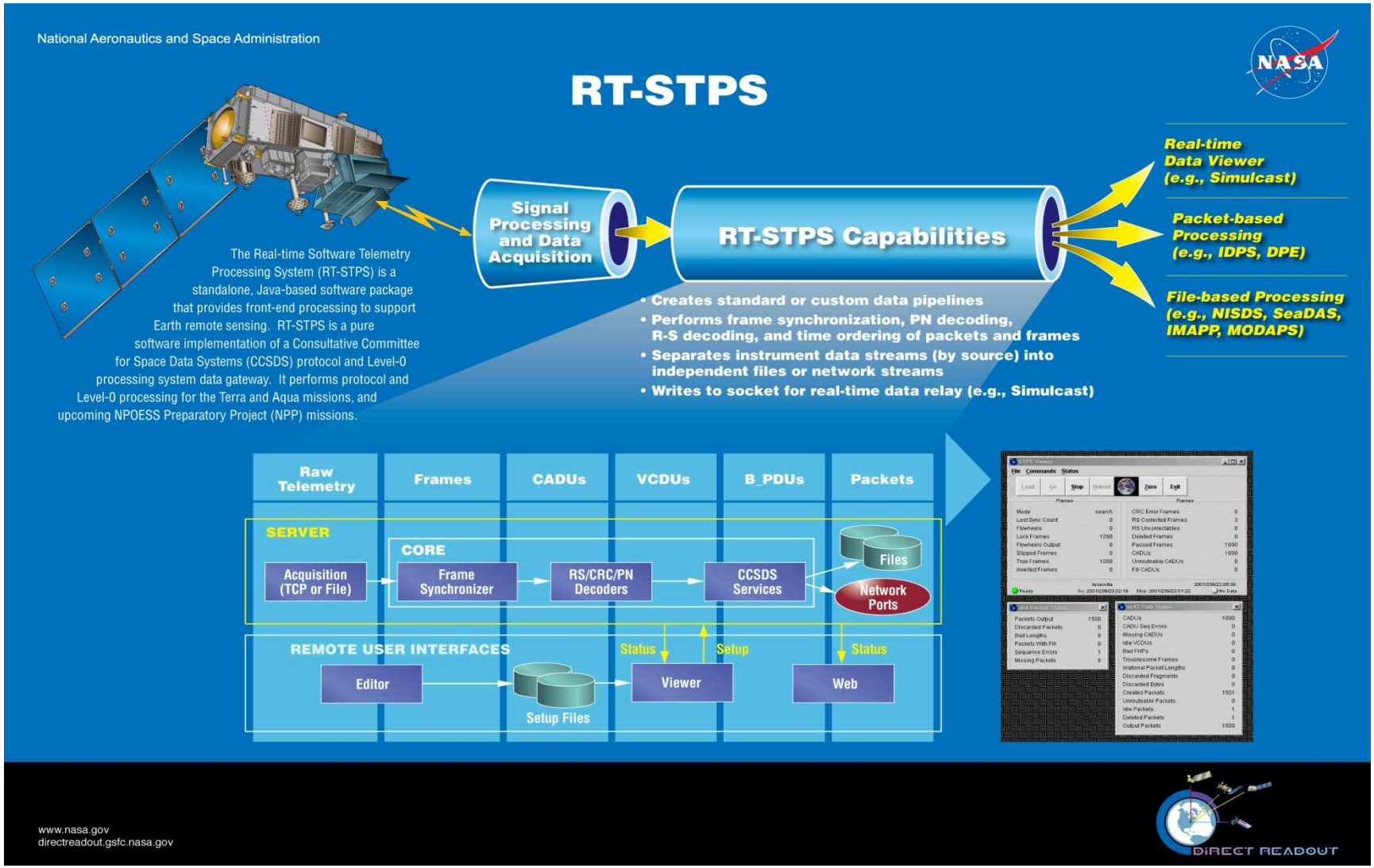
The IPOPP Partnership

- NASA Direct Readout Lab – NPP In-situ Ground Station
  - Director: Patrick Coronado
  - System Engineer: Kelvin Brentzel
- University of Wisconsin, Space Science Engineering Center, Cooperative Institute of Meteorological Satellite Studies (CIMSS) – IMAPP
  - Principal Investigator: Dr. Allen Huang
  - Co-Principal Investigator: Liam Gumley
- NPOESS Integrated Program Office – Direct Readout Mission
  - Project Manager: John Overton
  - System Engineer: Dr. Bill Thomas
  - System Analyst: Gordon Fesenger

NASA DRL Role in IPOPP Development

- Provide Updated RT-STPS for NPP from NISGS
- Update RT-STPS for NPOESS
- Integrate NPOESS Decryption functionality into RT-STPS
- Build upon NISGS Framework to include (SPA) wrapped MODIS algorithms to develop IPOPP
- Provide SDR's (level 1b) software for VIIRS, CrIS, ATMS, and OMPS
- Provide Active Fires and Vegetation Index Level 2 product software
- Coordinate with NASA SeaDAS project for integration of Ocean products
- Provide visualization and analysis tools
- Provide web portal to DB Community

Real-Time Software Telemetry Processing System



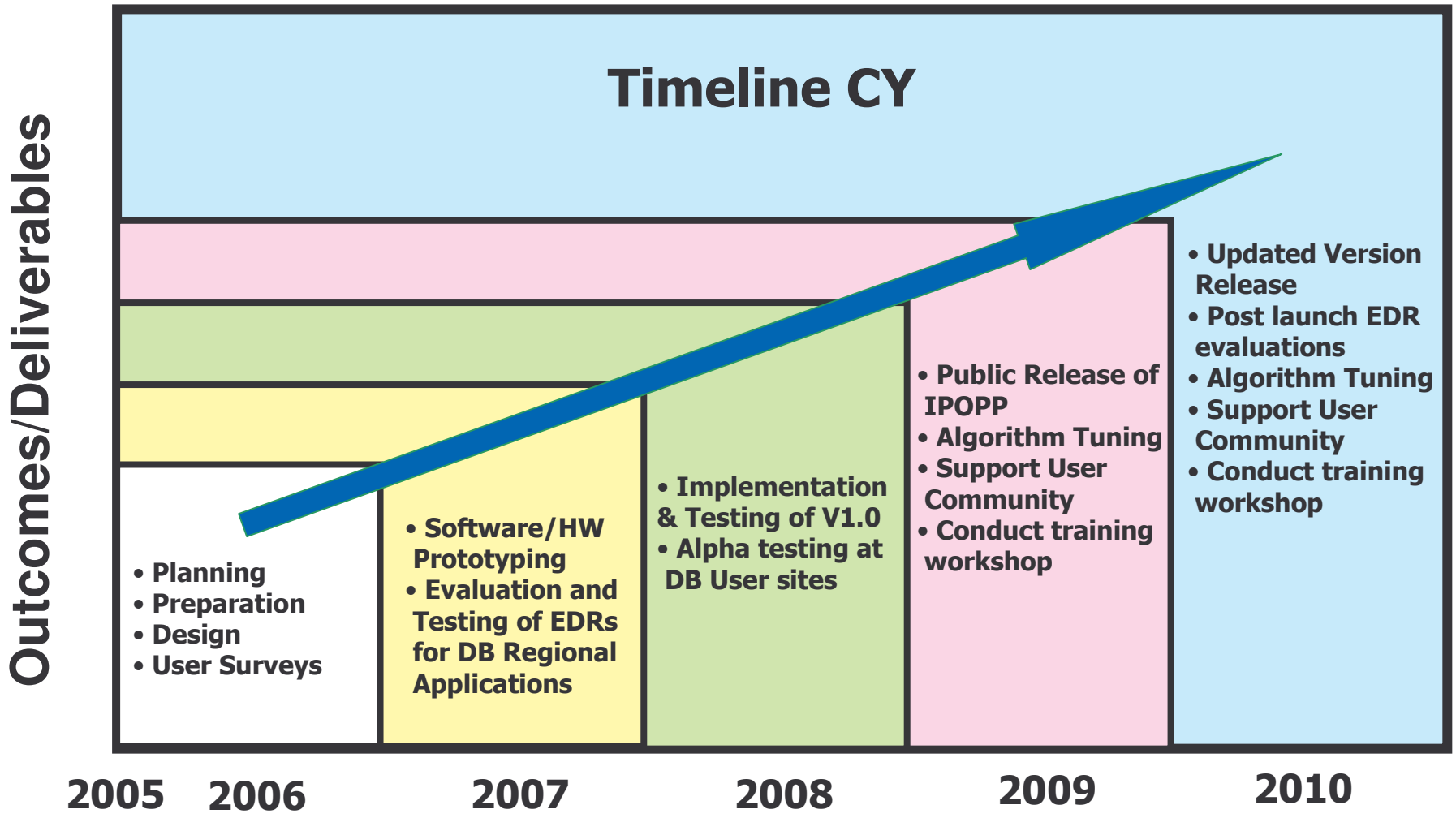
CIMSS Role in IPOPP Development

- Participate and engage in IDPS Algorithm Transformation into a form where they can be run on Linux
- Focus on Atmosphere EDRs, Utilities, and HRD/LRD CAL/VAL
- Provide visualization and analysis tools
- Prototype and validate multi-platform compatibility
- Support Open Source packaging with NASA DRL
- Provide Training Workshops and Educate Users, Scientists, and Students

IPO Role in IPOPP Development

- Provide management and system engineering oversight to meet project goals and objectives
- Provide the NPOESS IDPS Operational Algorithms
- Solicit input from DB Community for operational use of IPOPP products
- Focus development on products most needed by DB community and CAL/VAL campaign
- Provide sufficient funding to assure IPOPP availability prior to launch of NPP
- Focal point for DB community to the NPOESS Program

International Polar Orbiter Processing Package (IPOPP) Milestones



Important Documents for DB Community

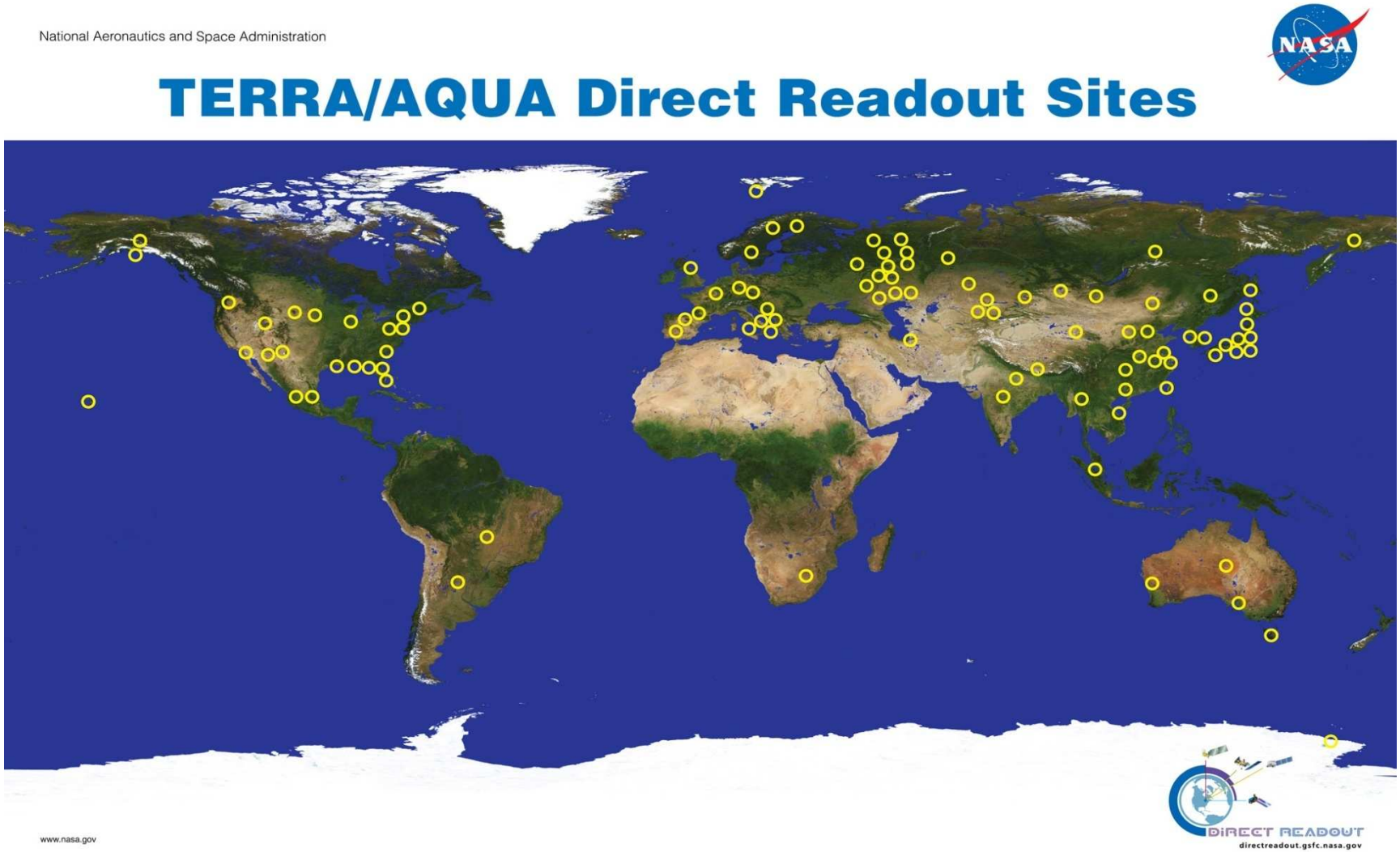
- NASA DRL portal is place to find program documentation for NPP and in the future NPOESS

  (http://directreadout.gsfc.nasa.gov)

- Examples of release documents are:

  - *Interface Requirements Document (IRD) for National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) Mission System to Direct Broadcast Users Interface.* GSFC 429-01-02-19. December 2001. (PDF)
  - *National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) Spacecraft High Rate Data (HRD) Radio Frequency (RF) Interface Control Document (ICD) to the Direct Broadcast Stations.* GSFC 429-03-02-24 (Original CH-01). May 2004. (PDF)
  - *National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) Mission Data Format Control Book (MFDCB).* GSFC 429-05-02-42. Effective Date: April 14, 2006. (PDF)

DB Community Registered X-Band Receiving Stations



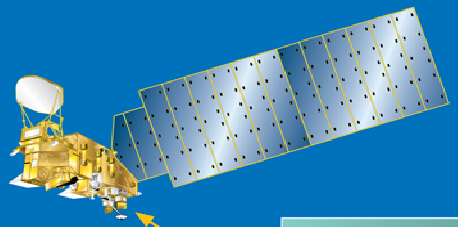
Alpha Test Site Opportunity

- Opportunity join elite group of Test Sites
  - US Government
    - NASA Direct Readout Laboratory
    - USDA Forest Service Remote Sensing Applications Center (RSAC)
  - Universities
    - Oregon State University (OSU)
    - University of South Florida (USF)
    - University of Wisconsin (UW – CIMSS)
  - International (Pending Approval of Agreements)
    - Instituto Nacional de Pesquisas Espaciais (INPE) (Brazil's National Institute for Space Research)
    - Bureau of Meteorology, Australia
    - India National Remote Sensing Agency (NRSA)
- IPO provides IPOPP Software on your hardware
  - Build 1 MODIS (TERRA and AQUA)
  - Build 2 – 4 MODIS, VIIRS, CrIS, ATMS (TERRA, AQUA, NPP)

IPOPP Architecture

National Aeronautics and Space Administration

International Polar Orbiter Processing Package (IPOPP) Elements for Terra, Aqua, and NPP



IPOPP is the primary processing package that will enable the Direct Broadcast (DB) community to process, visualize, and evaluate NPP Sensor and Environmental Data Records–which is a necessity for the DB community during the transition from the Earth Observing System Era to the NPOESS Era.

L1A/RDRs
- Protocol Processing
- Raw Data
- Formatting

HDFEOS / HDF-5

L1B/SDRs
- MODIS
- AIRS
- VIIRS
- CrIS
- ATMS
- OMPS
- Geo Cal

HDFEOS / HDF-5

Utilities
- GIS
- H_2G
- Analysis
- Visualization
- Ancillary Data

Cal/Val
- Field Campaign
- SDR Intercomparison
- EDR Intercomparison
- SDR/EDR Validation

L2/L3/EDRs

Atmosphere	Land	Water	Space
• AVMP • AVTP • AVPP • Sus Matt • AOT • APSP • CBH • CC/L • CEPS • COT • CTH/CTP/CTT • O3 Profile • O3 Column • Imagery*	• Active Fires • Surf Albedo • LST • Surface Type • Vegetation Index • Snow Cover/Depth • Imagery*	• SST • OCC • NHF • Sea Ice Char • IST	Future NPOESS Era

Information Services - System, Science, Application, Education, and Training

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

NPP · NPOESS · DIRECT READOUT

IPOPP Development Goals

- Facilitate the International Direct Broadcast Community Continuous Involvement in Algorithm development for NPP/NPOESS
  - By providing mission continuity from EOS to NPOESS; by participating in NPP Calibration/Validation
  - By Enabling Regional Application Development

- Provide software to generate EDRs in near real-time from NPP/NPOESS Direct Broadcast Downlinks
  - Open source (GPL)
  - Freely available (no COTS licenses required)
  - Easy to install & run
  - Multi-platform (e.g., Linux, Solaris, OS X)
  - HDF5 data format
  - Self-contained, Modular
  - Uses consistent & up to date calibration Look Up Tables
  - Reuse and leverage legacy software (IMAPP)
  - Build on NISGS foundation

IPOPP
Building on the foundation of IMAPP and NISGS

- IMAPP provided DB Community access to EOS data through an open source multi-platform processing environment with validated algorithms

- NISGS will provide evolved technology applications for NPOESS instruments on NPP starting at the signal processing element (RT-STPS), all sensor Level 1A/B (SDRs) products, and Level 2 (EDR) processing for Active Fires and Vegetation Index

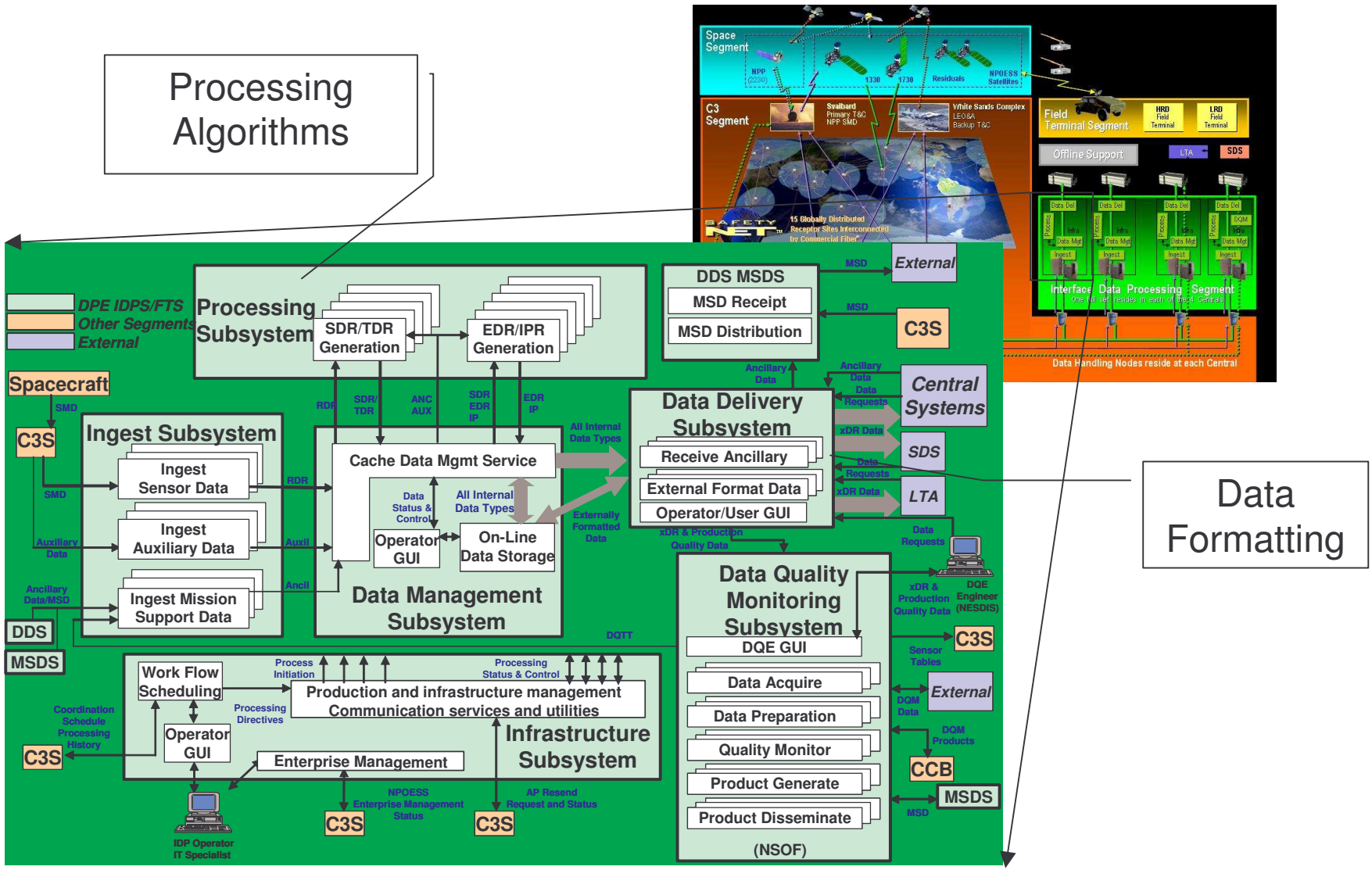
- IPOPP will extend NISGS using development principles and goals of IMAPP to provide DB Community access to NPOESS sensor data on NPP through an open source multi-platform processing environment with validated algorithms

EOS to NPOESS: Level 1A = RDR, Level 1B = SDR, Level 2 = EDR

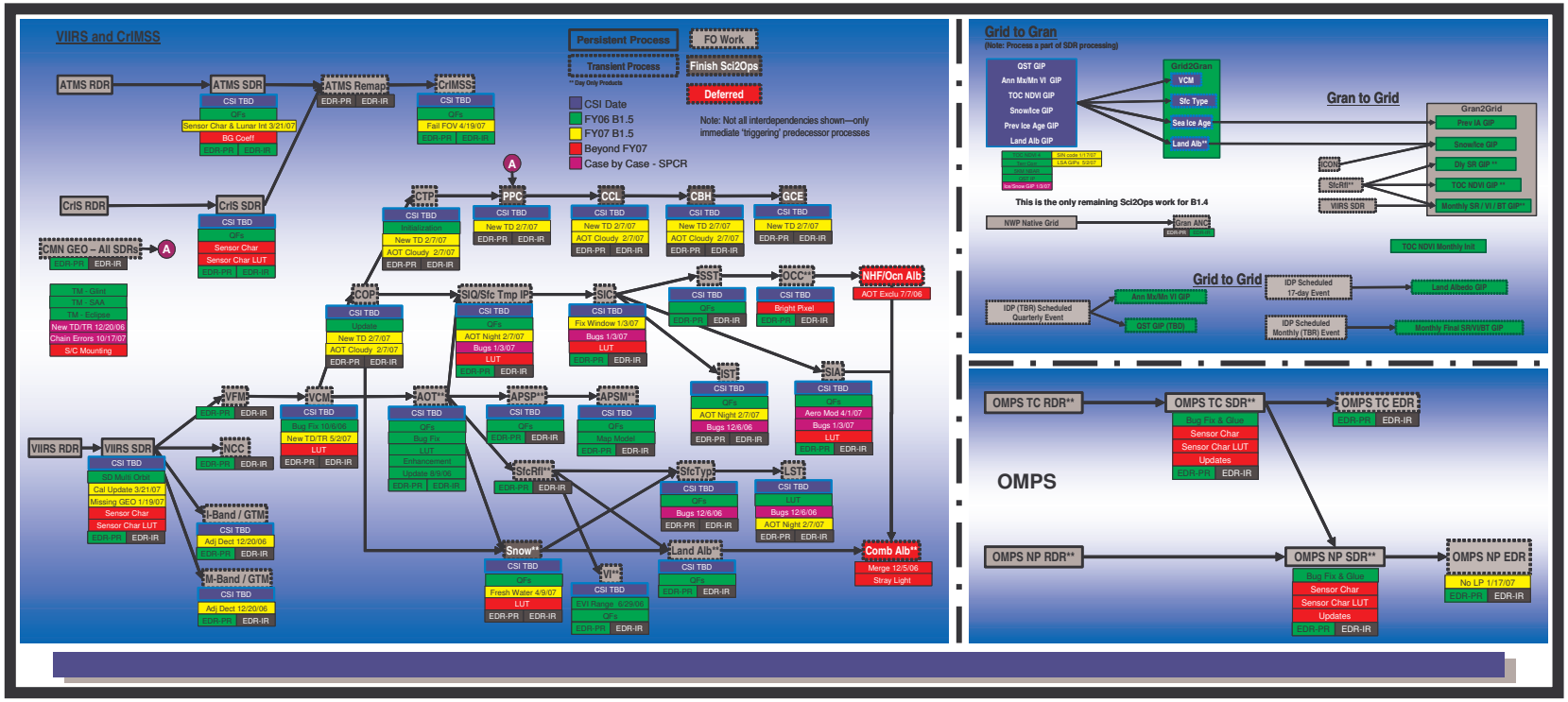
IPOPP Development Approach for NPP: Leverage Reusable Assets

- Extend NISGS infrastructure
  - To accommodate NPP processing algorithms
  - To support NPP data formats
  - To provide commonality from EOS through NPOESS
- Integrate processing algorithms from IDPS
  - To leverage validation efforts
  - To facilitate DB user feedback
- Adapt software to serve DB needs
  - Flexibility/Extensibility
  - Maintainability
  - Experimentation and Analysis
  - Limit impact of IDPS processing algorithm changes

IDPS Architecture

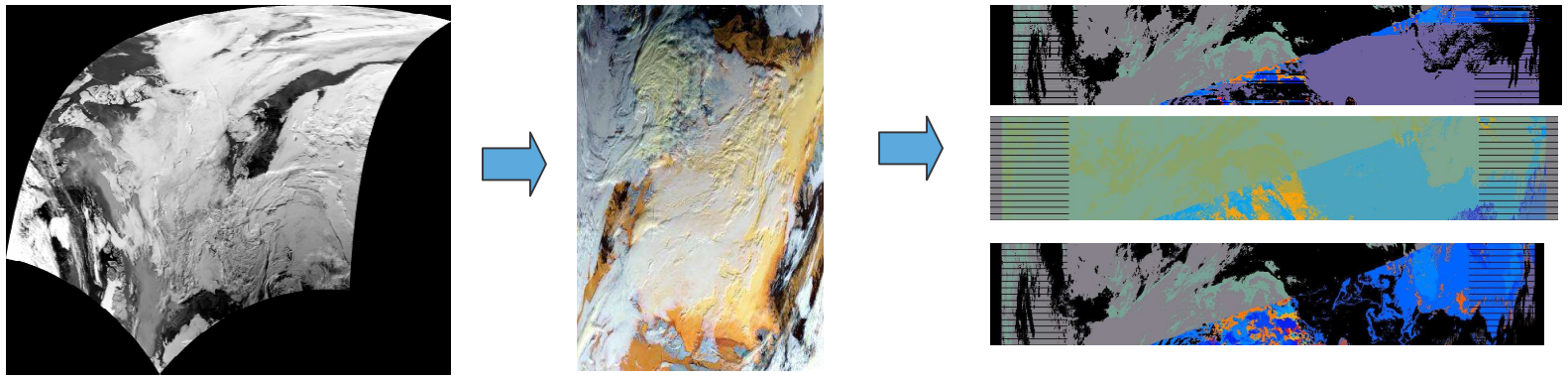


IDPS NPP Algorithm Processing Interdependencies



- IPOPP Science Algorithms for NPP
  - Based on core of IDPS NPP processing algorithms
  - Support NPP data formats
  - Tailored to provide commonality from EOS through NPOESS

IPOPP: Encouraging early examination of NPP Algorithms



- DB Algorithm evaluation benefits
  - Facilitate a global Cal/Val campaign
  - Enable experimentation with NPP data formats
  - Provide timely feedback to the NPOESS program
  - Support regional processing

Data Processing Algorithm Adaptation Opportunities

- Use of global, retained intermediate products
  - Challenging for DB application
- Ancillary Data Products
  - Starting point is the Official Dynamic Ancillary Data
- Granule vs. swath processing
  - IDPS granule size is optimized for Centrals processing
  - Tailorable for DB processing
- Granule vs. swath output formats
  - SPA wrapper offers flexibility to adapt output formats
- Processing chain simplification
  - DB processing may

Questions

- Points of Contact at IPO
  - NPOESS Ground Systems
    - Director, Jim Valenti
      - 301.713.4744
      - James.Valenti@noaa.gov
    - Deputy Director/IDPS, Joe Mulligan
      - 301.713.4803
      - Joseph.Mulligan@noaa.gov
    - Direct Readout, John Overton (Aerospace)
      - 301.713.4747
      - John.Overton@noaa.gov
    - Direct Readout, Bill Thomas (MITRE)
      - 301.713.4764
      - William.M.Thomas@noaa.gov