Suomi National Polar-orbiting Partnership (SNPP)
NASA VIIRS Level-1 Algorithm/Software Development

Fred Patt

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Background

- The SNPP ROSES AO (November 2013) stated that "NASA… is arranging for the NASA Level-1 Suomi NPP product algorithm development…"
- The SNPP Project Scientist, Dr. James Gleason chartered the formation of a working group with representation from the existing VIIRS PEATEs.
  - Goal: provide a fast efficient, easy-to-maintain, VIIRS Level-1 algorithm that provides diagnostic insight and that can be adapted for time-dependent changes in the instrument.
  - Fred Patt was asked to coordinate the WG.
- Kick-off meeting was held on December 12, 2013, and meetings have continued every 2 to 3 weeks.

L1ASWG Membership

- **Fred Patt (Ocean lead and overall coordinator)**
- **Vincent Chiang (VCST lead)**
- **Liam Gumley (Atmosphere lead)**
- **Gary Lin (Geolocation lead)**
- **Ed Masuoka (Land lead)**
- Sam Anderson (VCST)
- Sean Bailey (Ocean)
- Carol Davidson (Land)
- Hongda Chen (VCST)
- Sadashiva Devadiga (Land)
- Steve Dutcher (Atmosphere)
- Gene Eplee (Ocean)
- Gene Feldman (Ocean)
- Gwyn Fireman (Ocean)
- Bruce Flynn (Atmosphere)
- Bryan Franz (Ocean)
- Alfreda Hall (ESDIS)
- James Kuyper (Geolocation)
- Ning Lei (VCST)
- Chengbo Sun (VCST)
- Bin Tan (Geolocation)
- Kevin Turpie (Ocean)
- Jack Xiong (VCST)
- Robert Wolfe (Geolocation/Land)
- Zhangshi Yin (Geolocation)

Primary Objectives Defined by L1ASWG

- VIIRS Level-1 processing starting from EDOS Level-0 data feed.
- Modular, well-documented, efficient, robust, portable software, owned and maintained by NASA.
- Straightforward implementation of instrument calibration equations and support for calibration updates.
- Data product formats developed and maintained by NASA. Level-1B and Geolocation will be the standard final products.
- Separate executables and products for Level-1A, Geolocation and Level-1B.
- Reasonable granule length chosen by NASA.
  - Granule length specified at runtime.
  - 6 minutes was requested by the Atmosphere team for standard products and agreed to by other teams.
- Reduce number of calibrated data files (i.e., eliminate separate files for each VIIRS band).
  - One file per resolution (M-band, I-band, DNB).
  - Currently IDPS generates over 22,000 SDRs per day.

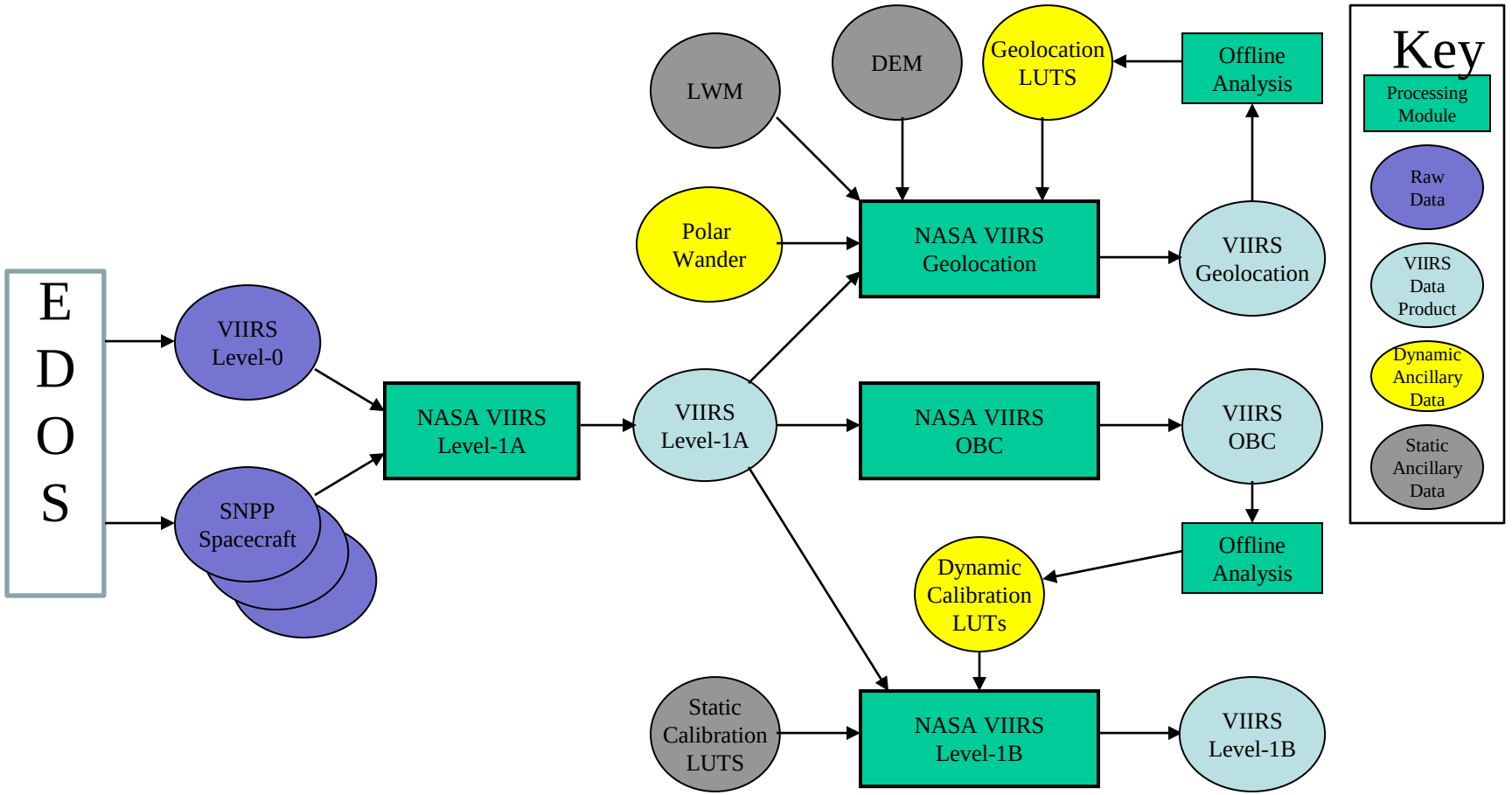
Further Objectives

- Product formats compatible with both NetCDF4 and HDF5
  - Serve the largest possible user community
- Modular calibration and geolocation software
  - Run standalone or link with existing software
- Rapid-prototyping development methodology
  - Schedule and resource constraints
- Re-use of existing software
- Compliance with metadata standards (ISO, CF)
- Public release of software

Accomplishments

- ATBD updates submitted in July 2014.
- Authorization to proceed from J. Gleason in October 2014.
- NASA data product formats developed.
  - NetCDF 4 with internal compression, HDF5 compatible
- EDOS testing started in November 2014, routine data deliveries in August 2015.
  - Deliveries of IDPS products ended March 31, 2016.
- V1.0 software completed October 2015.
  - Full L1 processing chain and critical algorithm improvements
- V2.0 software completed June 2016.
  - Additional functionality and algorithm enhancements
  - Public release of software in progress

VIIRS Level-1 Processing Flow



Features that Support Direct Readout

- Variable granule length specified at runtime
  - Support an entire DR scene as a single file
- Scan-by-scan processing
  - Reduced memory usage
- Internal data object compression
  - Reduced file size by ~50%
  - Chunking defined to optimize I/O
- L1B and geolocation products can be generated for a single resolution if desired
  - Reduced execution time
- Land/water mask and terrain correction* are optional
  - Reduced execution time and eliminate need for large static files.

*Future feature to be implemented

Band M7/I2 Replacement

- VIIRS Band M7 was removed from the SNPP DR data stream on December 10, 2014 to provide downlink bandwidth for CrIS full spectral operations.
- The GSFC DRL implemented a capability to substitute aggregated I2 data for M7 in SDRs to support downstream applications that require M7 data.
- The DRL will implement an equivalent capability for the NASA L1B products prior to the release of the NASA L1 software.
  - The substitution will be independently verified by the L1ASWG.

Source Code Configuration Management

- The Level-1 source code has been configured in a Git repository developed and maintained by the Ocean SIPS.
- Individual development team members create local branches for source code modifications.
- Modified source files are merged into the master branch upon acceptance.
- The repository will be made publicly accessible after the software release has been approved by NASA.
  - The Open Source Software Request has been submitted.
  - Our plan is to release the software ASAP, pending NASA approval.
- VCST maintains a separate FTP site for delivery of the dynamic radiometric calibration LUTs.

Sample Products and Formats

Product formats (NetCDF CDL) and sample files can be found at:

ftp://samoa.gsfc.nasa.gov/pub/VIIRSL1/

QUESTIONS?

BACKUP

Responsibilities

- Ocean SIPS
  - L0-to-1A and OBC file processing software
  - Data product formats
  - Calibration ATBD support
- Geolocation Team
  - Geolocation ATBD updates
  - L1A-to-Geolocation processing software
- VCST
  - Calibration ATBD updates
  - L1A-to-L1B processing software
- Land SIPS
  - Data product formats
  - Software development and testing support
- Atmosphere SIPS
  - Data product formats
  - Software development and testing support