Science Code to Delivered Algorithm Packages

Presented by

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- Xingpin Liu – Monitoring Tools
- Haibing Sun – Physical Collocations
- Meizhu Fan – Data testing & AIADD Document
- Aiwu Li – Algorithm Integration
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- Ray Garcia – AIT Midwest Lead
- William Straka – Algorithm Integration
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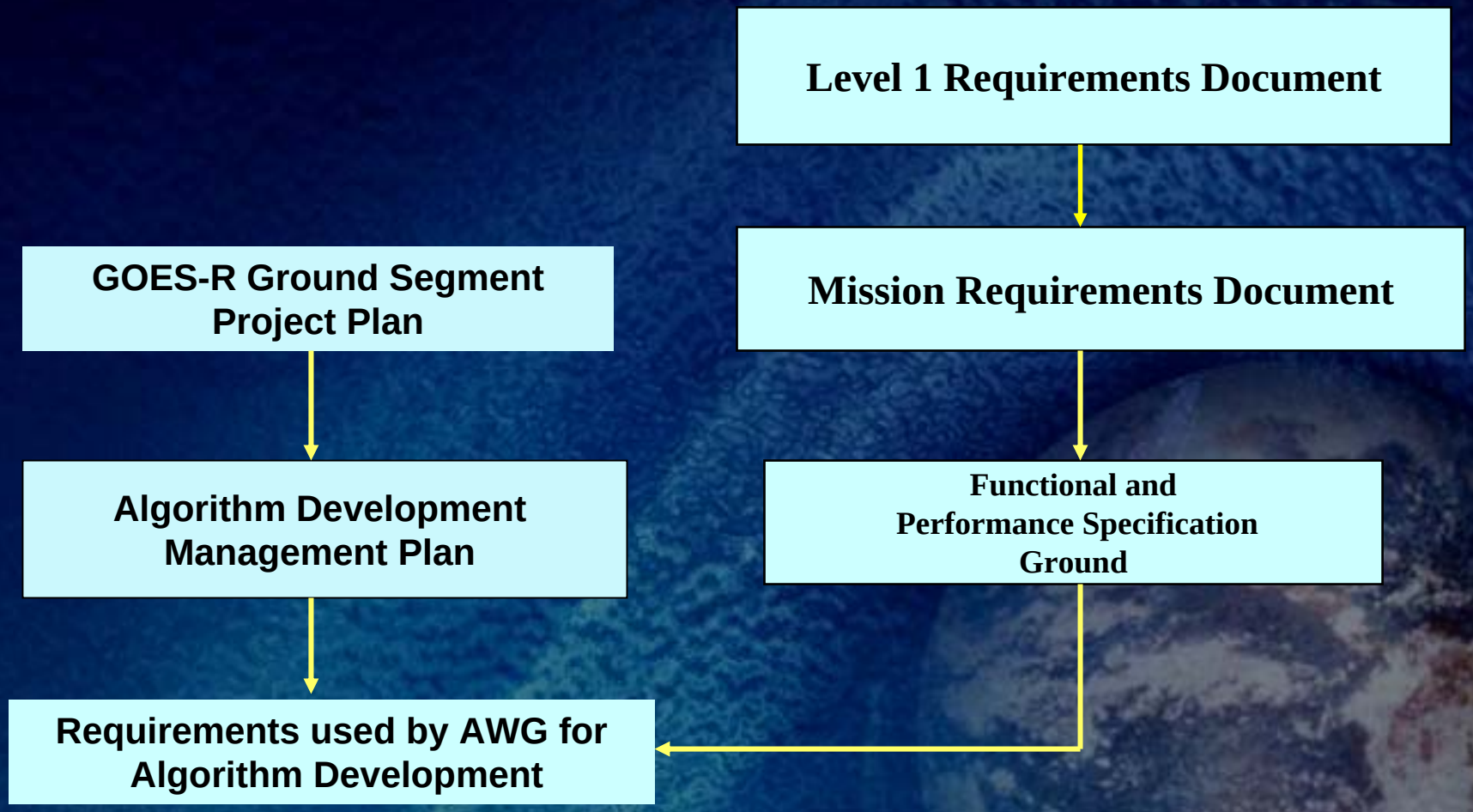
Outline

- Requirements
- Schedule – Deliveries and Milestones
- Milestones
- Role of Integration Team
- Ground Rules
- Framework
- 80% Algorithm Packages
- 100% Algorithm Packages
- Technical Interchange Meetings
- Summary

Requirements Flowdown



Requirements

- As described in the “Algorithm Development Management Plan For Ground Segment Product Generation”
  - » AWG is to develop algorithms to meet F&PS requirements for 57 products.
  - » AWG is to deliver ATBDs and Algorithm Packages to GOES-R GSP

Project Management

- Developed Basis of Estimates (BOEs) for tasks within the AWG Project
  - » Delivered 5 BOEs for BOE Algorithm Development on May 19, 2008
  - » Delivered BOEs for BOE R3/CWG/Tailoring on May 28, 2008
- Conducted Integrated Baseline Review on July 30th 2008
  - » AWG schedules were baselined by Dec. 31 2008
- Implemented Earned Value Management
  - » Schedule development -> **Rolling Wave Planning** -> progressive elaboration planning where the work to be accomplished in the near term is planned in detail level, while work far in the future is planned at a relatively high level.
  - » 2 year detailed schedules were developed

Develop Schedules with all the Algorithm Teams

- Worked with each of the algorithm teams to developed their schedules
  - » Identified tasks
  - » Determined timeframes
  - » Implemented CMMI
    - – Development phases
    - – Reviews
    - – Milestones
- Tied all the algorithm schedules to the Integration Team schedule

Milestones for Baseline Products

- **Deliveries and Milestones**
  - » Draft ATBD – September 2008
  - » 80% ATBD and Algorithm Package – September 2009
  - » 100% ATBD and Algorithm Package – September 2010
  - » Maintenance Delivery of ATBD and Algorithm Package – September 2012

Milestones for Option 2 Products

- **Deliveries and Milestones**
  - » Draft ATBD – September 2008
  - » 80% ATBD and Algorithm Package – September 2010
  - » 100% ATBD and Algorithm Package – September 2011
  - » If Option 2 products are picked up:
    - – Maintenance Delivery of ATBD and Algorithm Package – September 2012

CMMI Level 3 Process

- Enables the AWG to show that we understand the requirements and that we can develop the algorithms to meet those requirements

- Five major reviews
  - » Algorithm Design Review (ADR)
  - » Critical Design Review (CDR)
  - » Test Readiness Review (TRR)
  - » Code Unit Test Review (CUTR)
  - » Algorithm Readiness Review (ARR)

As Described in the BOE, the AIT Has Implemented Development Phases

- 80% delivery to the GSP
  - » Algorithm Development and Testing
  - » Draft ATBD Delivery
  - » Algorithm Demonstration
  - » Algorithm Documentation
  - » Collaboration with AIT
  - » 80% ATBD Algorithm Package Delivery

- 100% delivery to the GSP
  - » Algorithm Development and Testing
  - » Algorithm Demonstration
  - » Algorithm Documentation
  - » Collaboration with AIT
  - » 100% ATBD Algorithm Package Delivery

- Within each phase are more detailed tasks specific to each product team

AWG Integration Team

- Team was formed to coordinate the algorithm development activities of all the AWG product teams
- Develop system where all AWG algorithms can be tested
- Work with AWG Product Teams on preparing the deliverables to the Ground Segment Project (GSP)
- Interface with the GSP on all AWG deliveries
  - » All deliveries to the GSP are made by the AIT, not the individual product teams

AWG Integration Team

- Lead the following technical reviews
  - » Critical Design Review
  - » Test Readiness Review
  - » Code Unit Test Review
  - » Algorithm (System) Readiness Review
- Provide guidance for the Algorithm Design Reviews (ADR)
- Provide documentation support
- Maintain configuration management for all the algorithms
- Provide support for:
  - » Inegrated Baseline Reviews (IBR)
  - » Bases of Estimates (BOE)
  - » Integrated Master Schedules (IMS)

AIT Development Goals

- Bring scientific consistency between all products
  - » Same ancillary data
  - » One radiative transfer model
- Bring software consistency to all algorithm software
  - » All software looks the same
- Address short latency requirements for the products
  - » Reduce risks associated with product precedence latencies

AIT Implementation of Ground Rules

- All AWG algorithms must be developed using Fortran 90/95 and/or C/C++
  - » No dependence on McIDAS, MATLAB or IDL
- All Input coefficient files and Output files will be constrained to use one data format, NetCDF4
  - » No product specific binary files
  - » Enables the implementation of code generators for the I/O
- All products will be run within one system, no individual programs

AWG Integration Team: Framework Testbed

- One program to integrate and test all AWG Level-2 algorithms (currently reads in proxy and simulated ABI data)
  - » Designed to handle large volumes of data where all the radiance and ancillary data is stored in memory
- Framework enables testing of the AWG algorithms in an efficient way:
  - » Products may be tested with product precedence using other algorithm outputs
  - » Products have been tested on a large amount of proxy and/or simulated data
- Reduces processing time by:
  - » Reducing redundant I/O
    - – Ancillary data sets
    - – Level 1B Data (Proxy or Simulated)
    - – ABI products
  - » Only performs the radiative transfer calculations once
- Enables the evaluation of the algorithms for scientific accuracy in a controlled environment using common libraries

Implementation of AWG Product Team Internal Deliveries

- 80% delivery to the GSP
  - » Three internal deliveries to the AIT from each Algorithm Team
  - » Three major reviews – ADR, CDR, TRR
- 100% delivery to the GSP
  - » Two internal deliveries to the AIT from each Algorithm Team
  - » Two major review – CUTR and ARR
- Track risks and actions and address them at each major review

Algorithm Preparation and Delviery Process

- Algorithm Design Review
- First Delivery to AIT
- Second Delivery to AIT
- Critical Design Review
- Draft ATBD Delivery
- Third Delivery to AIT
- Test Readiness Review
- 100% Algorithm Package Delivery to GSP
- Code Unit Test Review
- Fourth Delivery to AIT
- Fifth Delivery to AIT
- TIMs
- Algorithm Readiness Review
- 100% Algorith Package Delivery to GSP

Algorithm Design Review

- Purpose of the Algorithm Design Review
  - » Choose the best algorithm that will meet the requirements
- Candidate algorithms
  - » Advantages
  - » Disadvantages
  - » Heritage

AWG Product Team Internal Delivery 1 to the AIT

- An algorithm that works (may be heritage)
  - » This delivery is used to determine the interfaces to the algorithm
  - » Algorithm was evaluated on how to integrate into the framework
  - » Determination of ancillary data for movement toward commonality

AWG Product Team Internal Delivery 2 to the AIT

- An AWG algorithm that runs off proxy or simulated ABI data and conforms to the variable naming convention
  - » Product Team delivers an AWG algorithm
  - » Move code to standardization early
  - » Algorithm is integrated into the framework for testing
  - » Initial product precedence tests are done

Critical Design Review

- Purpose of the CDR is to describe the chosen algorithm that will meet the requirements
- Algorithm Theoretical Basis
  - » The physical and mathematical description of the algorithm that was chosen to meet the requirements
- Algorithm Risks are identified

Draft ATBDs

- On September 30th, 2008 the AWG delivered the Draft Algorithm Theoretical Basis Documents (ATBDs) to the GSP for all 57 algorithms

AWG Product Team Internal Delivery 3 to the AIT

- Algorithm meets 80% of the product accuracy and the software meets the STAR coding standards
  - » Standardization of code is complete (common software)
  - » All algorithms use the proxy (MODIS, SEVIRI, GOES) and/or simulated data sets
  - » Full product precedence are used (where possible)
  - » Algorithm meets 80% of accuracy and is ready for delivery
  - » Initial tests using common ancillary data and radiative transfer models are conducted
  - » Initial latency tests are conducted

Test Readiness Review

- Show that the algorithm within the Framework (that meets coding standards) gives the same answers as the offline research code
- Shows that the AWG is prepared for end to end test of the algorithm with full product precedence where the outputs are in NetCDF format
- Provide validation that shows that the product will meet the 80% requirements

80% Algorithm Package Delivery

- On September 30th, 2009 the AWG delivered the 80% Algorithm Package to the GOES-R GSP for the Baseline Algorithms
  - » ATBD
  - » Algorithm Interfaces and Ancillary Data Description (AIADD) Document
  - » Test Data
    - – Proxy, Simulated, and Ancillary Input Data Sets
    - – Output Data Sets
    - – Associated Coefficient Data Sets
  - » DD250 Form
  - » MD5sum value for each file (check sum)

- On September 30th, 2010 the AWG will deliver the 80% Algorithm Package to the GOES-R GSP for the Option 2 Algorithms

Code Unit Test Review

- The CUTR addresses the software readiness:
  - » Software meets coding standards
  - » Error messaging is addressed
  - » Interfaces have been finalized
  - » Common libraries used
  - » Common missing values used
  - » Quality flags are discussed
  - » Metadata is addressed

AWG Product Team Internal Delivery 4 to the AIT

- Verification that the algorithm may be run and the timing is close to the latency requirement. All products use the same libraries
  - » Scientific consistency between all algorithms is complete (common science)
  - » Begin addressing software issues from the CUTR
  - » Algorithms will be implementable at this point due to thorough testing to determine any latency issues by the AIT

AWG Product Team Internal Delivery 5 to the AIT

- Algorithm is complete; meets 100% accuracy and is ready for delivery to the GSP
  - » All issues have been addressed
  - » Algorithms are scientifically consistent
  - » Algorithms have software consistentcy
  - » Latency of algorithms has been tested
  - » Product precedence are fully implemented

Technical Interchange Meetings (TIM) with Harris and GSP

- Received questions about the Baseline 80% ATBDs from Harris
- AWG responds to the questions
- The responses are reviewed at TIMs with Harris and the GSP
- TIMs are very useful since they give the AWG a better understanding of the content of the ATBD required for Harris to implment the algorithms

Algorithm Readiness Review

- The ARR will describe the tests that will be conducted to show that the algorithm will be ready for the 100% delivery
  - » All scientific dependencies have been addressed
    - – Product precedence have been fully tested
    - – CRTM has been implemented and tested
    - – Graceful degradation of ancillary data has been identified and tested
  - » The algorithm has been tested on full seasonal data and will meet the requirements
  - » All algorithms will be tested with simulated ABI data
- Risks and actions have been addressed

100% Algorithm Package Delivery

- On September 30th, 2010 the AWG will deliver the 100% Algorithm Package to the GOES-R GSP for the Baseline Algorithms
  - » ATBD
  - » Algorithm Interfaces and Ancillary Data Description (AIADD) Document
  - » Test Data
    - – Proxy and Simulated Input Data Set
    - – Output Data Sets
    - – Associated Coefficient Data Sets
  - » DD250 Form
  - » MD5sum value for each file (check sum)

- On September 30th, 2011 the AWG will deliver the 100% Algorithm Package to the GOES-R GSP for the Option 2 Algorithms

Summary: What the AWG Has Accomplished

- Algorithm Design Review (ADR)
  - » ADRs have been conducted for all 57 products
- Critical Design Review (CDR)
  - » CDRs have been conducted for 56 products
  - » Visibility CDR in August
- Draft ATBD delivered for all algorithms by September 30th, 2008

Summary: What the AWG Has Accomplished

- Test Readiness Review (TRR)
  - » TRRs have been conducted for 49 products
  - » 7 product TRRs will be conducted by the end of August
  - » Visibility TRR will be conducted in 2011
- 80% Baseline Algorithm Package Delivery was completed on September 30th, 2009
- Code Unit Test Review (CUTR)
  - » CUTRs have been conducted for 35 products
  - » Option 2 TRRs will be conducted in FY11

Summary: Tasks to Accomplish in the Near Future

- Algorithm (System) Readiness Review (ARR)
  - » Baseline product ARRs will be completed by September 1, 2010
  - » Option 2 product ARRs will be completed by September 1, 2011
- 100% Baseline Algorithm Package and 80% Option 2 Algorithm Package will be delivered on September 30, 2010
- 100% Option 2 Algorithm Package will be delivered on September 30, 2011

Next Phase: Validation

- Development of Product Performance Methodology
- Development of Routine and Deep Dive Validation Tools
- Continued Interaction with Harris through TIMs

AIT & Product Team Meetings – Tuesday

- 8:15 am Hydrology Team
- 9:15 am Radiation Budget Team
- 10:15 am SST Team
- 11:15 am Lightning Team
- Lunch
- 1:15 pm AAA Team
- 2:15 pm Cryosphere Team
- 3:15 pm Imagery Team
- 4:15 pm Winds Team

AIT & Product Team Meetings – Wednesday

- 8:30 am Land Team
- 9:30 am Sounding Team
- 10:30 am Ocean Dynamic Team
- 11:30 am Proxy Team
- Lunch
- 1:00 pm Cloud Team
- 2:00 pm Physical Collocations
- 3:00 pm Aviation
- 4:00 pm Cloud Shadows and Parallax