



GOES R

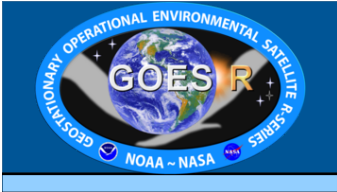
Benefits of an Enterprise Algorithm Change Management Process



NOAA ~ NASA



Heather Kilcoyne
NOAA/NESDIS/GOES-R
07 January 2015



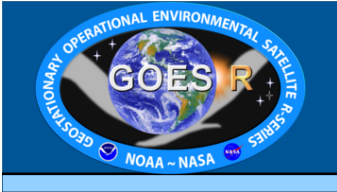
Overview

- What is an Algorithm Change?
- Why are Changes so Complicated?
- How are All Systems the Same?
- How do we Improve the Process Across the Enterprise?
- How do we Accommodate Differences between Satellite Programs?
- How do we Move towards a Common Process?
- How do we Benefit from an Enterprise Change Management Process?



What is an Algorithm Change?

- An Algorithm Change is a modification of the operational software that computes a data product.
- Throughout the phases of a satellite mission, reasons to change a data product algorithm arise, some examples are:
 - Pre-Launch: Testing increases knowledge of instrument performance and implementation of science in algorithms
 - Calibration/Validation (Cal/Val): Instrument calibration tweaks and resolution of errors, both software bugs and science application/implementation
 - Operations: Evolution of requirements with changing user needs and science advancement
- The Satellite Ground System (GS) must be prepared to collect, approve, test, and implement these changes correctly and efficiently in order to deliver reliable and consistent data to the users.



Why are Changes so Complicated?

- People, people, lots of people!
 - Many different organizations (consisting of many different people) are involved in finding, investigating, and resolving the issues, and then implementing in the operational system.
 - Each group of people has a different vocabulary, way of working, and motivation.
- System Environments
 - Each organization works within their own systems.
 - Security concerns limit access across systems.
 - Transfer of software between environments can be difficult, as different programming languages, compilers, and even operating systems are used.
- Motivations
 - Scientists are motivated by data product accuracy.
 - System Software Engineers are motivated by operational system stability.
- Control
 - Users depend on the product being accurate and consistent, as surprises in the data quality or format can affect user applications.
 - A disciplined approach to change must be used to limit interference in their operational use.

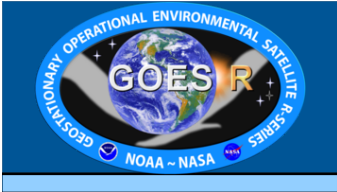


How are all Systems the Same?

Regardless of system, all changes follow the same path....

- Detect/Identify discrepancy (Algorithm Issue) in operational data product
- Report issue for communication with Project and Team
- Prioritize within Discipline's tasks after evaluation if within scope and resources
- Investigate cause
- Resolve the issue in the code, deliver change package, test, and approve the change to the baseline
- Implement the solution in the operational system
- Verify solution implemented correctly in operational system

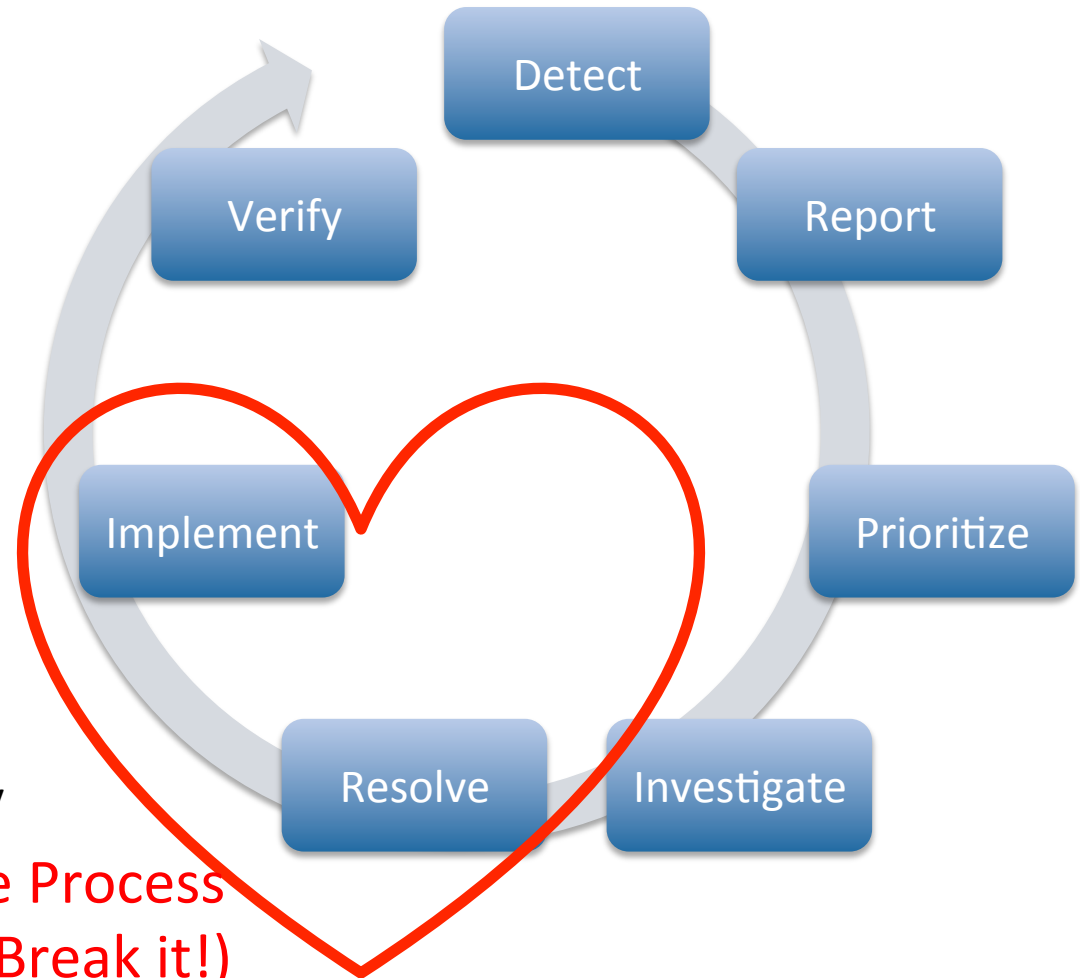


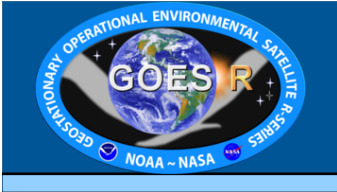


How are all Systems the Same?

Regardless of system, all changes follow the same path....

- Detect/Identify discrepancy (Algorithm Issue) in operational data product
- Report issue for communication with Project and Team
- Prioritize within Discipline's tasks after evaluation if within scope and resources
- Investigate cause
- Resolve the issue in the code, deliver change package, test, and approve the change to the baseline
- Implement the solution in the operational system
- Verify solution implemented correctly in operational system





How do we Improve the Process across the Enterprise?

- NESDIS Office of Systems Architecture and Advanced Planning (OSAAP) will develop and maintain systems engineering policy, define and manage enterprise-level configuration control, and coordinate and communicate NESDIS enterprise solutions across NOAA and to external end users of the data.
- OSAAP is working with the NESDIS Office of Satellite Ground Services (OSGS), Office of Satellite and Product Operations (OSPO), Center for Satellite Applications and Research (STAR), JPSS, and GOES-R to establish a Common Algorithm Change Management Process that can be tailored for every program.
- The processes used by POES, JPSS, GOES, and GOES-R are the basis for developing a common process that can be tailored for use in all NESDIS Missions.
- Lessons Learned on Heritage Missions provide insight into inefficiencies and how they can be resolved or avoided.



Lessons Learned (1/2)

- A Kaizen Event was conducted to evaluate the JPSS Algorithm Change Management Process in January 2013.
 - Kaizen Events are independently facilitated meetings where a team involved in a work process spend a week focused on analyzing how to improve the work process.
 - Goal was to reduce the processing time (while maintaining product integrity) for completing changes and improve communication and coordination among participating organizations.
 - Team members selected from JPSS Ground Project, NOAA JPSS Office, OSPO, GOES-R Ground Segment Project, and STAR.
 - The Current State and Ideal State were documented, and problems identified.
 - Analyses and changes performed on different operational baselines.
 - Delivered Algorithm Packages lacked reproducibility and were not complete.
 - Working environments differed from operational environment.
 - Outcome:
 - Quality Control of Delivered Algorithm Packages (DAPs) improved and content standardized.
 - Work towards limiting differences between working and operational environments.
 - OSPO included in review and prioritization of potential changes.



Lessons Learned (2/2)

- Communication between and amongst participating organizations is key element of success.
- NESDIS organizations (STAR, OSPO, Program personnel and their Ground and Flight Contractors) can work shoulder-to-shoulder to make changes.
 - Types of change determine who does the bulk of the work, but all three groups are involved to some degree in each.
 - Contractual relationships should be structured to allow for technical interchange as needed to support mutual success.
- Algorithm Review Board (ARB) retains review and approval of science changes with the Subject Matter Experts and Organization accountable for Data Product Quality.
 - Provides early communicate of change to all stakeholders to assess impact prior to implementation.
 - Forum of people focused only on data product performance.
- Consistent application of DAP definition eases movement across organizational boundaries.



How do we Accommodate Differences between Satellite Programs?

- JPSS and GOES-R have differing organizational structures, but the need for the Cal/Val Scientists, Users, Program Personnel, and OSPO Personnel to collaborate to resolve issues is identical.
 - GOES-R is following the JPSS lead by establishing an Algorithm Review Board to review and approve all science-related baseline changes.
 - The Delivered Algorithm Package (DAP) for GOES-R will be similar to that used for the initial science algorithm deliveries to the Program, which was tailored for S-NPP/JPSS.
- Tailoring for each Program will be needed to accommodate each separate Ground System.
 - Testing of DAP by Program prior to ARB review eliminated for GOES-R with STAR access to GS Development Environment.
 - GOES-R system ability to update algorithms without full software release may speed implementation of minor algorithms modification.
- Roles in the Process are filled by the appropriate position based on Program Accountability/Responsibility.
 - ARB Chair is the entity accountable for Data Product Quality during the specific phase of the program.
 - JPSS: Data Products and Algorithms Lead/Algorithm Project Lead
 - GOES-R: Program Systems Engineering/Program Scientist
 - Both will transition to OSPO when systems handed over to OSPO.
 - Data Product Lead is the owner of the algorithm and recommends changes to the ARB chair
 - JPSS: STAR personnel lead the Cal/Val teams and transition to Long-Term Monitoring support to OSPO in operations.
 - GOES-R: Instrument vendor responsible for algorithm development/issue resolution during Cal/Val, Program personnel and OSPO will facilitate collaboration between Calibration Working Group (CWG) and instrument vendors.



How do we move towards a Common Process?

- Cal/Val Teams and Data Users will report, prioritize, resolve, and verify potential changes in the same way.
 - GOES-R is working with OSPO to update the legacy OSPO CM process to a new, consolidated process that will accommodate both new systems.
 - One type of “algorithm trouble ticket” will be used across all systems.
 - Original type of “configuration change request” will be used across all systems.
 - GOES-R is adopting the JPSS prioritization scheme, based on product priority and severity of discrepancy.
- All Programs will move towards a common vocabulary.
- Tools will be used across Programs.
- New Programs will tailor the established Algorithm Change Process for their systems.



How do we benefit from an Enterprise Change Management Process?

- No need to “reinvent the wheel” with every new mission, but tailoring allows individual project needs to be addressed.
- Easier for developers to understand what is needed to transition new science into operations and training minimized across programs.
- Costs for implementing changes are decreased with increased efficiency.
- Common use of vocabulary and tools will ease participation across multiple missions.
- Changes are implemented more quickly, resulting in improved data for user applications.
- Data quality is maintained for the end users.