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# AIRS Product Development

## The AIRS Software Development System

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## Topics

- **AIRS Software Development Activities: V6 Specific**
  - CM Processes
  - Development and Testing
- **AIRS Computing Facility Status**
- **Impact of System Intrusion on AIRS Activities**
- **V6 Completion Phasing**



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# AIRS Software Development Activities - CM Processes

- **AIRS uses the same successful software development process it started with:**
  - Science Team develops code
  - JPL integrates, builds and tests code
  - JPL delivers “production code” to GES DISC
- **Code packages are configuration managed - Harvest CM System**
  - One change per package
  - Packages can be backed-out from the configuration
  - Several packages typically collected into a build
  - Each build is tested/evaluated against standard test dataset
  - Significant builds are “verified” or “validated” with extended test sets and correlative data



# AIRS Software Development Activities - Development Status

- **Version 6 development began on 2007-07-11 w/ V5.1.0.0**
    - Since then more than 45 builds
    - Several significant tests conducted to assess our progress
    - Current V6 development version is V5.7.5.0
      - V5.1.7.0 - 2007-10-02 - MW RTA an tuning
      - V5.3.0.0 - 2008-02-27 - AMSU-A Ch4 quick-fix (still using)
      - V5.3.2.0 - 2008-09-20 - Surface emissivity hinge-points
      - V5.4.0.0 - 2009-01-26 - Improved CO2, surface retrieval
      - V5.4.5.0 - 2009-05-20 - ECMWF as climatology startup opt.
      - V5.4.14.0 - 2009-12-14 - Remove AMSU-A Ch 4,5 from MW and final retrievals
      - V5.5.1.0 - 2010-02-25 - Incorporate SCCN as startup option
      - V5.6.2.0 - 2010-07-19 - Stability parameters
      - V5.6.3.0 - 2010-07-17 - New Regression
      - V5.7.0.0 - 2010-10-07 - MODIS Emissivity, New var. freq. RTA, cloud phase
- ALL MAJOR V6 COMPONENTS!**



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## AIRS Software Development Activities - Testing Status

- **A few more builds, getting us to another benchmark test:**
  - **Testing Start-up options...**
    - Cloudy-Regression (tried and true)
    - Climatology (AIRS Climatology)
    - SCCN
      - *ECMWF as startup previously dismissed*
- **Large test dataset produced**
  - Focus Days (24-day cycle) for full mission
  - RaObs Match-ups every 5-days for most of mission
  - Special topical Match-ups: Desert and GPS
- ***Start-up of these efforts affected by system intrusion***
  - ***Most products produced by April 1***



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## AIRS Computing Facility Status

- The AIRS Team Leader Science Computing Facility (TLSCF) is aging and reaching “*End of Service Life*”
  - Maintaining the TLSCF beyond this point is not viable without an upgrade... too expensive!
  - Previous system replacement took place more than 5 years ago
  - It is time to rebuild the TLSCF for the next 5-years.
- TLSCF System Replacement Plan formulated
  - Leverages technology improvements since last upgrade
  - More compute power and storage
  - No additional energy footprint (electricity and cooling)
- For hardware, this is a natural evolutionary process!



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## AIRS Computing Facility Status - Historical Perspective

- **Pre-launch configuration:**
  - Monolithic SGI processors (2) - approx. 2.2x capability
  - Data archive 500 GB disk archive upgraded to 1.5 TB  
all with tape backup for data not on disk
- **Current configuration:**
  - TLSCF “cluster” 20 dual processors running Linux (5-10x)
  - Supported and appended to by many quad and eight-CPU systems, enhancement to “science computers”
  - Data archive is now 120 TB and soon to be 200+ TB  
still with tape backup for data not on disk  
but... not all data can be housed in the tape enclosure



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## AIRS Computing Facility Status, cont'd.

- **Future Configuration**
  - Multiple 16+ processors per server unit
  - Data archive consisting of 200 - 500 TB disk plus next-generation tape archive system inevitably, not all tapes will fit in the tape enclosure
- **First system components have been replaced this year**
  - Other hardware is in-house but not installed due to V6 activity
  - Additional replacements in key systems planned soon
- **Goal is to replace necessary systems without:**
  - Service interruptions
  - Extending the AIRS version improvement schedule
  - Incurring excessive costs overall and in any given year



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## AIRS/PEATE System Intrusion

- Hackers broke into AIRS email server on December 12, 2010
  - gaining access via recently identified vulnerability in server
- 2010-12-13 - Intrusion detected by AIRS System Administrator
  - Affected systems blocked from internet - *good and bad aspects*
    - *blocks hacker access*
    - also cripples desired external network traffic
    - allows local processing to continue
  - 25 servers/workstations affected
  - JPL Computer Security and NASA Inspector General's Office begin investigation
- 2010-12-14 to 2011-01-03 - forensic analysis
  - Systems pulled 1 by 1 by JPL Computer Security and NASA



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## AIRS/PEATE System Intrusion (cont'd.)

2010-12-27 to 2011-01-04 Systems are released after forensics  
(one at a time)

2010-01-07 All affected systems taken offline

2011-01-07 to 2011-01-12 Restoration of critical systems

2011-02-16 Last affected system restored to operation

2011-02-22 to 2011-03-16 Restoration of data archive

2011-02-22 Recommenced data processing operations



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## AIRS/PEATE System Intrusion

- **Impacted both AIRS and NPP PEATE Projects**
  - 6-week schedule slip for PEATE
    - AIRS schedule impact TBD, but at least 6 weeks
  - Individual work efforts hampered
  - More than 900 work hours expended to rebuild the system!
  - Impact assessment for NASA IG under way
  - Net impact of intrusion estimated to be more than \$585,000
- **In the end, since intrusion was almost immediately detected**
  - No loss/corruption of data or source code!
  - Hackers left back-door entry points, SPAMBots, loggers
    - all removed during restoration
  - The original point of access was removed with upgrade patch
  - *Fast action saves the day!*



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## Back to V6

- We've been working on V6 for quite some time...

- We are close to making some major decisions

and

We are close to moving beyond V6

- There is still much to be accomplished!



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## Remaining V6 Goals

- We may have decided which start-up state to use...  
*but other V6 decisions still needed to be made.*
  - Further improvement of boundary layer retrievals (?)
  - Refinement of QC and other status information
  - Incorporation of back-end features  
(cloud properties, trace gases, ...)
  - Level 3, possibly new Level 3 climate products



- **AIRS Project Goals**
  - V6 must meet AIRS Project's and Science Team's goals
  - Deliver V6 to GES DISC before end of FY11
- **To accomplish this task...**
  - Concur on which start-up state to use
  - Determine whether Key V6 goals have been attained
    - agree to fix what we can
    - possibly defer some goals to V7
- **Milestones...**
  - June 30 - L2 must be completed
  - August 1 - Testing ends
  - August 23 - Documentation and code to GES DISC



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## Backup Materials





## Upcoming V6 Milestones

- **V6 Concluding Timeline**
  - **JUN 30** - Final “final” L2 V6 coding/mods incorporated
  - **JUL 25** - Final L3 coding mods
  - **Mid-JUN** - Testing and checkout begins (incl. SciTeam)
  - **AUG 1** - Testing/checkout ends
  - **AUG 9** - Final Build and checkout
  - **AUG 23** - Hand-off to GES DISC, code and documents
  - **SEP 28** - Public Release V6 Data Products
- *This schedule allows for some minimal adjustments to be made during the testing period. Schedule risk is involved!*