Hardware Status and AIRS Calibration Activities

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AIRS Status
AIRS Operational Status

• AIRS is in excellent health

• All available engineering parameter plots versus time are either flat or changing extremely slowly—no concerns

• Cooler A status remains unchanged since the anomaly of March 2014
  – Cooler does not update engineering telemetry or respond to commands
  – Compressor is running and focal plane temperature is as desired
  – Science data quality remains excellent

• A new detector gain table was uploaded on March 23, 2015
Number of AIRS channels with NEΔT < 1K
AIRS Chopper Drive Current

AIRS CHDRIVECURRVA for 20020901-20151006
AIRS Scan Mirror Temperature
AIRS Choke Point Heater Current for 20020901-20151006

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AIRS Cooler B Drive Level

AIRS Cooler B Drive Level for 20020901-20151006

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AIRS Focal Plane Temperature

Graph showing AIRS Focal Plane Temp for 20020901-20151006.
AMSU-A Status
AMSU-A Operational Status

• AMSU-A mechanical parts and most of the electronics are in good health
• All engineering parameter trends are slow
• The A1-1 and A1-2 scanner currents are rising, but very slowly and are not alarming
• 9 of the 15 channels are healthy, but
  – Channel 4 failed in 2007 (declared non-operational on October 1 2007)
  – Channel 5 is now too noisy to contribute to Level 2
  – Channel 7 noise has exceeded specs since launch and has never been used for L2
  – Channel 6 has been degrading since 2008, but is still a good channel
  – Channel 1 began degrading in January 2012, seemed to recover, but is now degrading again
  – Channel 9 experienced occasional small bursts of noise early in the mission and is now experiencing them again
AMSU-A1-1 RF Shelf Temperature
AMSU-A Channel 6 NEΔT

AMSU Ant 11 NeDT[6] for 20020725-20151005

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AMSU-A Channel 1 NEΔT
Aqua Status
And
Anomalies
Aqua Spacecraft Health Status

- Aqua is in very good health
- Several anomalies have occurred over the years, but none have impacted operations yet
  - **Solar array**
    - Potentiometers used for orientation are noisy
    - Thermistor failure on one panel
    - Solar cell arrays
      - have lost 11 strings of solar cells (out of 132 on the spacecraft)
      - there is no impact to mission operations at this time
  - **FMU/SSR hardware timeouts**
  - **Battery**
    - Pressure too high early in mission but now in control
    - Power from one cell behaved erratically for several years but now seems OK
    - Temperature of one cell was high for part of a day
  - **Computer memory bit errors**
Aqua Fuel Supply

- Occasional drag make up burns use only a very small amount of fuel
- Most fuel usage takes place in orbital inclination adjustment maneuvers, needed to keep Aqua properly aligned with other A-train instruments and to tightly control our 1:30 pm crossing time
  - Three or four such maneuvers are planned every year, near the vernal equinox
  - The most recent estimate of future fuel usage indicates that the hydrazine should last at least until 2021, and possibly longer
  - The plot on the next page was made before the Spring 2015 inclination adjustments, but it is the most recent available
Projected Aqua Fuel Usage

Aqua spacecraft has sufficient fuel to maintain its current orbit within the Afternoon Constellation through early 2021 and possibly beyond.
AIRS Calibration Status
Calibration overview

- The AIRS radiances exceed the pre-launch requirements in both accuracy and stability
- We would like to push both accuracy and stability as far as we can, to improve the utility of AIRS for climate studies, cloud properties, and atmospheric dynamics studies
- A number of easy-to-implement improvements are being made for V7
- There are several bigger-ticket items that will be listed in the next two slides
  - (Probably interrelated) issues that are being actively worked
  - Issues that remain on the back burner because of resource limitations
Issues being actively worked

- **IR radiance trends**
  - *Trends have been observed in the short-wave channels for warm scenes*
  - *Trends in window channels differ from channel-to-channel, day vs night, and with latitude*
- **Systematic differences between A detectors and B detectors seen in modules 5–10 with by far the largest effects in M8**
- **$C_{ij}$ problems and possible ways to reduce their impact**
- **Spectral calibration changes with time**
- **Detailed comparisons with IASI and CrIS**
- **Vis/NIR calibration changes**—old Gaiser correction to Vis channel 1 is clearly no longer valid as degradation has slowed
  - *Mirror surface—effects are largest for the blue channel*
  - *Lamp illumination and stability—based on Aumann’s comparisons with DCCs, it looks like lamps are surprisingly stable*
  - *Detector changes—still under investigation*
Issues on the back burner

• Pagano and Overoye have shown that intrinsic uncertainty in AIRS radiances should be on the order of 50 to 100 mK, but L2 optimal estimation results imply much larger errors
  – Knowledge of the spectral calibration?
  – RTA?
  – Cloud clearing issue?
• Mirror polarization characterization
  – Witness samples were sent for measurement, but the results were disappointing and this effort is on hold
• Disagreements among overlap channels (channels at similar frequencies but in different detector modules)
  – L1C is being used to reduce the effects
• Handling of space views in the L1B software
  – Spaceview #3 (closest to Earth’s limb) may not be a reliable sample of cold space
Reminder

- The various calibration issues described are dealing with effects below the specification levels to which the instrument was designed and built.

- That is, we are pushing hard to make the instrument not just meet its requirements but beat them.