



**AIRS ON-ORBIT LEVEL 1B EVALUATION/MONITORING
BY THE
AIRS CALIBRATION TEAM**

Thomas S. Pagano

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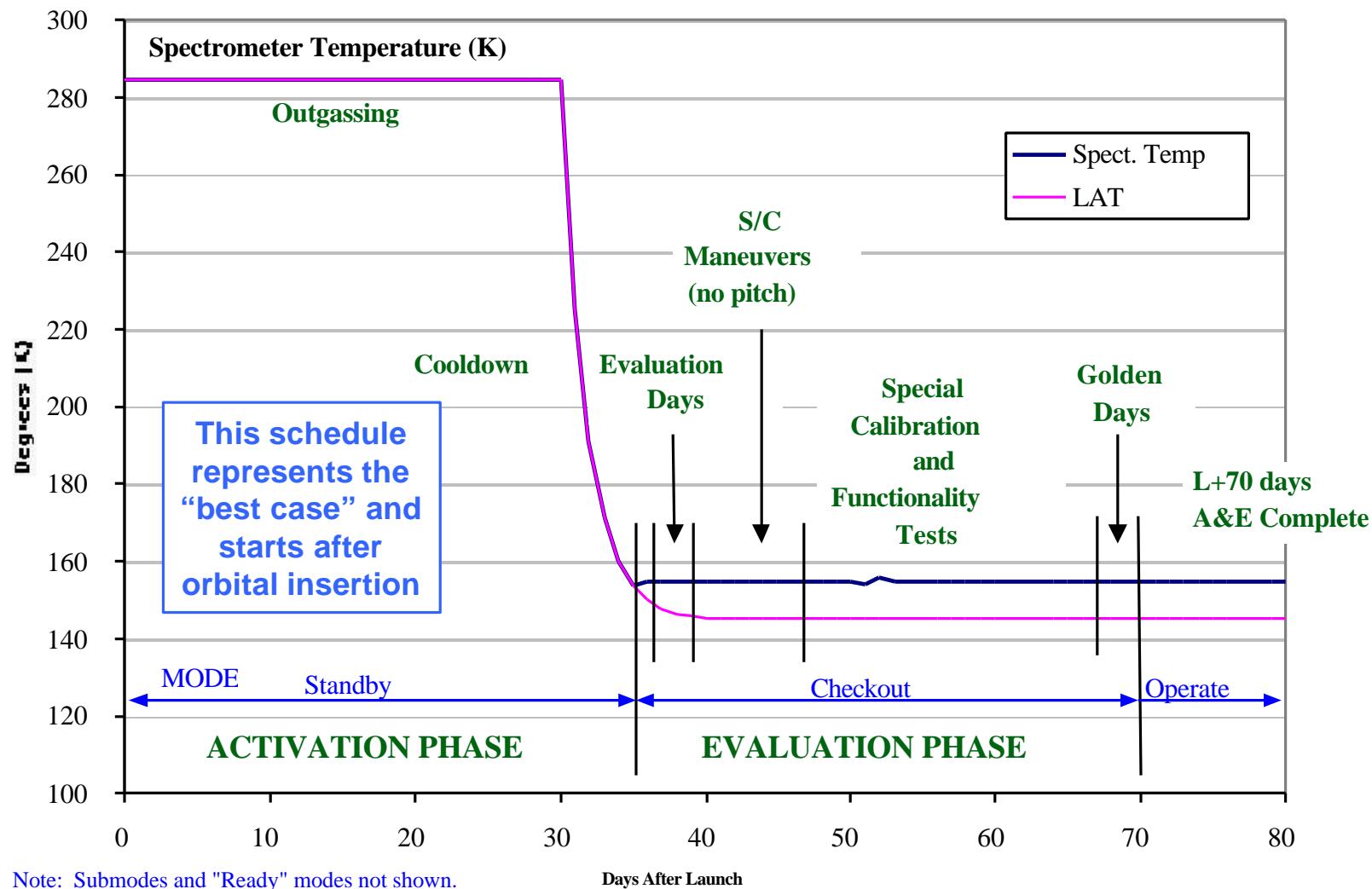
FLIGHT PLANS FOR CALIBRATION



- **L+2 Months:** Activation and Special Tests Complete
- **L+3 Months:** First Look at Calibration Complete
 - *Special Test Data Analyzed*
 - *Quicklook at Earth Scene for Calibration*
 - *Calibration Coefficients Updated*
 - *Test data set for one entire day acquired*
 - *Instrument reasonably stable after this point. Software not yet stable*
- **L+4 Months:** Requirements for L1B Updated
- **L+5 Months:** Update to L1B implemented at the TLSCF
 - *Level 1B Software should be reasonably stable after this point*
- **L+7 Months:** Update to L1B at the DAAC



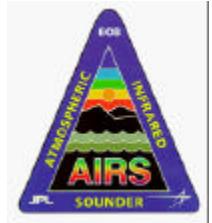
ON-ORBIT SPECIAL TESTS TO BE PERFORMED IN-FLIGHT DURING A&E PHASE





CALIBRATION PROPERTIES FILE IDENTIFIES CRITICAL DETECTOR PERFORMANCE

See ADF 485: "IR Calibration Properties for L1B; Version 1.3"



Column	Name	Source	Description
1	LMID	LM T/V Test Data	Standard channel assignment as used by LM during T/V testing. First channel is 0, last is 2377
2	L2ID	L. Strow	Re-numbering based on spectral
3	Vc	L. Strow	Spectral Centroid
4	dV	L. Strow	Spectral Width
5	Q_spec	L. Strow	Quality Indicator. 1=good, 2=OK but some problems, 3 = poor, 4 = useless
6	nedt(K)	special_test/nedts/results/pf_nedts/1881_1882_nedts.txt	NEdTs per channel as obtained while viewing OBC BB during guard tests
7	N>4sig	special_test/sv_nse/results/pf_sv_nse/3sigma/1877_1878_sv_nse_opt.txt	Number of events greater than 4 sigma encountered in 30000 points. Anything greater than 2 is Non-Gaussian.
8	pops	special_test/sv_nse/results/pf_sv_nse/1877_1878_sv_nse_opt.txt	Number of "pops", encountered. A pop is where we get 4 transitions of amplitude > 3 sigma of the same sign in a row.
9	resid(K)	rad_coefs/with_pol_corr/ABsides40deg/resid_calc.txt	Residual radiometric error encountered at 40 degree scan angle during T/V testing
10	PF	pol_coefs/pol_coefs.txt	AIRS polarization factor as calculated for L1B version 1.0 radiometric calibration.
11	Azcent(deg)	56X.cij.d.dat	Azimuth Centroids obtained during 56X testing at LM Sanders
12	Elcent(deg)	56X.cij.d.dat	Elevation Centroids obtained during 56X testing at LM Sanders
13	AB_State	/special_test/ab_opt/results/pf_ab_opt/1881_42ABstate.txt	Defines the AB detector used in the gain table and the quality of the selection



L1B MONITORING BY ACT



- L1B Starts flowing in Month 3 (After Special Tests and Stabilization)
- QA will be tracked and debugged during this time
 - *Temperature limits updated*
 - *Cal Flag limits updated*
 - *Spectral and Radiometric algorithms checked for robustness*
 - *DCR evaluated*
 - *Effects of moon in space viewport evaluated*
- Scene Radiances will be evaluated
 - *Correlated noise, fixed pattern or 1/f noise*
 - *Scan Angle Dependence (Polarization Effects, Mirror contamination (if any), etc.)*
 - *Climatologies selected for spectral calibration*



CAL FLAGS ARE KEY TO IDENTIFYING VALID DATA



- **AUTOMATIC QA FIELD**
 - *Determines overall quality of a granule based on state*
 - *Depends on state flag which says if data are valid or invalid and identifies valid and invalid conditions of CalGranSummary*
- **CAL_FLAG FIELDS**
 - *Provide necessary information on the calibration*
 - *bitfield: Gains, offsets, noise events, saturation, spectral*

Summary Level	QA Name	Number Per Granule
Granule	CalGranSummary	1
Channel	CalChanSummary	N_chan
Scan	CalScanSummary	N_scan
Scans & Channels	CalFlag	N_chan x N_scans

- *Higher levels synthesized from lower levels*



CALIBRATION FLAG DETAILS



Cal Flag (2378 / Scan)

Bit	Name	How Set (Per scan decision)	Dependency
7	scene	overflow/underflow on scene occurred	90 earthview dn's per scan
6	offset	overflow/underflow on SV occurred	4 spaceview dn's per scan
5	gain	overflow/underflow on OBC BB view occurred	BB dn per scan out of limits.
4	pop detected	SpaceViewDelta exceeds N_width_report *	SpaceViewDelta NEdN
3	DCR Occurred	Apply high to this bit for scan in granule identified by DCR_scan	DCR_scan
2	Moon in View	Flag as defined in section 6.2.1.4	spaceview_selection
1	telemetry	Out of limit condition for telemetry in Table 5	See Table 5
0	Reserved		

CalChanSummary (2378 / Granule)

CalGranSummary (1 / Granule) = "or" over "Good" Chans

Bit	Name	How Set (Per granule)	Dependency
7	scene	overflow/underflow on scene occurred	input_scene_counts
6	offset	overflow/underflow on SV occurred	input_space_counts
5	gain	overflow/underflow on OBC BB view occurred, BB temperature out of range, BB side error	input_bb_counts, input_bb_temp, bb_temp_side
4	pop detected	max of input_space_diff exceeds N_width_report. x NE_DN.	input_space_diff
3	high noise	NEN Exceeds Limits for granule	NEN
2	spectral bad	Spectral fit failed or fit residuals too high	See sections 7.1.5.3 and 7.1.5.4
1	telemetry	Out of limit condition for telemetry in Table 5	See Table 5
0	Reserved		

L1B QA Parameters

Per Granule Data Fields

Primarily From L1A

Name	Section	Name	Section
processing_level	Fixed	CalGranSummary	4.2
instrument	Fixed	CalChanSummary	4.2
DayNightFlag	1A	ExcludedChans	4.2
AutomaticQAFlag	4.2	NeN	6.5.3
NumTotalData	4.2	DCR_scan	6.2.3
NumProcessData	4.2	input_scene_counts	6.1.3
NumSpecialData	4.2	input_space_counts	6.2.3
NumBadData	4.2	input_space_diffs	6.2.3
NumMissingData	1A	input_bb_counts	6.4.3
NumLandSurface	1A	input_spec_counts	6.4.3
NumOceanSurface	1A	input_bb_temp	6.4.3
node_type	1A	input_bb_temp1	6.4.3
start_year	1A	input_bb_temp2	6.4.3
start_month	1A	input_bb_temp3	6.4.3
start_day	1A	input_bb_temp4	6.4.3
start_hour	1A	input_spec_temp	5
start_minute	1A	input_ir_det_temp	5
start_sec	1A	input_grating_temp_1	5
start_orbit	1A	input_grating_temp_2	5
end_orbit	1A	input_entr_filt_temp	5
orbit_path	1A	input_opt_bench_temp_2	5
granule_number	1A	input_opt_bench_temp_3	5
num_scansets	1A	input_scan_mirror_temp	5
num_scanlines	1A	input_chopper_phase_err	5
start_Latitude	1A	PopCount	N/A
start_Longitude	1A	offset_stats	6.2.3
start_Time	1A	gain_stats	6.4.3
end_Latitude	1A	rad_stats	6.1.3
end_Longitude	1A	NumRefChannels	9
end_Time	1A	RefChannels	9
eq_x_longitude	1A	rad_scan_stats	6.1.3
eq_x_tai	1A	DCRCount	N/A
orbitgeoqa	1A		
num_satgeoqa	1A		
num_glintgeoqa	1A		
num_moongeoqa	1A		
num_ftptgeoqa	1A		
num_zengeoqa	1A		
num_demgeoqa	1A		
num_fpe	1B		
LonGranuleCen	1A	cij_CO2_R_Branch_M2b_chan	8
LatGranuleCen	1A	cij_CO2_R_Branch_M1b_chan	8
LocTimeGranuleCen	1A		
granules_present	1A		

Primarily Spatial

cij_window_M1a_chan	8
cij_window_M2a_chan	8
cij_water_M8_chan	8
cij_water_M9_chan	8
cij_CO2_R_Branch_M2b_chan	8
cij_CO2_R_Branch_M1b_chan	8

Per Scan Data Fields

Per Scan Data Fields

Per Footprint Data Fields

Section	Name	Section	Name	Section
7.1.6	satheight	1A	scanang	1A
7.1.6	satroll	1A	ftptgeoqa	1A
7.1.6	satpitch	1A	zengeoqa	1A
7.1.6	satyaw	1A	demgeoqa	1A
7.1.6	satgeoqa	1A	satzen	1A
7.1.6	glintgeoqa	1A	satazi	1A
7.1.6	moongeoqa	1A	solzen	1A
7.1.5	nadirTAI	1A	solazi	1A
7.1.5	sat_lat	1A	sun_glint_distance	1A
7.1.5	sat_lon	1A	topog	1A
7.1.5	scan_node_type	1A	topog_err	1A
7.1.2	glintlat	1A	landFrac	1A
7.1.4	glintlon	1A	landFrac_err	1A
7.1.4	CalScanSummary	4.2	state	1A
7.1.4	CalFlag	4.2	cij_window	8
7.1.5	SpaceViewDelta	6.2.3	cij_water	8
7.1.5	spaceview_selection	6.2.3	cij_CO2_R_Branch	8
7.1.4	OpMode	1A	Scenelnhomogeneous	8
7.1.2	DpCircCount	5		
7.2.4	DpCircBasThr	5		

The requirement for the parameter can be found in the section after each QA parameter in the **L1B Requirements Document**:

“Atmospheric Infrared Sounder (AIRS), Level 1B Visible, Infrared and Telemetry Algorithms and Quality Assessment (QA) Processing Requirements”, June 22, 2001, Version 1.0, ADF 525



RADIOMETRIC QA INDICATORS TRACK SIGNAL LIMITS, GAIN AND NOISE PERFORMANCE

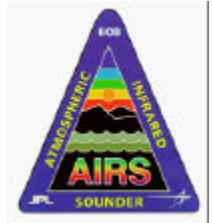


Name	Requirement	Description
CalGranSummary	Require	Summaries collect out-of-limit states
CalChanSummary	Limits	Channel listing
ExcludedChans	Require	NENs trended
NeN	Require	DCR events monitored
DCR_scan	Require	Look for saturation events
input_scene_counts	Limits	Compares 4 space views to allow space view selection
input_space_counts	Limits	Look for saturation events
input_space_diffs	Limits	Look for saturation events
input_bb_counts	Limits	Temperatures critical to calibration
input_spec_counts	Limits	Used to set Calibration Flags
input_bb_temp	Limits	Some trended, and some used as dependent parameters for others
input_bb_temp1	Limits	Chopper phase critical to calibration of PC
input_bb_temp2	Limits	Used to set Cal Flag
input_bb_temp3	Limits	Offsets trended to monitor drift and DCR process
input_bb_temp4	Limits	Gain trended to look for transmission degradation
input_spec_temp	Limits	Average radiances may provide insight into radiometric biases
input_ir_det_temp	Limits	Number of Reference Channels and their ID
input_grating_temp_1	Limits	Scan angle dependence of radiances
input_grating_temp_2	Limits	
input_entr_filt_temp	Limits	
input_opt_bench_temp_2	Limits	
input_opt_bench_temp_3	Limits	
input_scan_mirror_temp	Limits	
input_chopper_phase_err	Limits	
PopCount	Require	
offset_stats	Require	
gain_stats	Require	
rad_stats	Require	
NumRefChannels	Require	
RefChannels	Require	
rad_scan_stats	Require	
DCRCOUNT	Require	

**PLEASE REFER
TO IN-FLIGHT
CALIBRATION PLAN
FOR DETAILS
OF HOW
QA INDICATORS
USED**



PER SCAN L1B FLAGS (NOT INCLUDING THOSE PASSED FROM L1A)



CalScanSummary	Per Scan QA Flags
CalFlag	
SpaceViewDelta	Gives magnitude of “pops”
spaceview_selection	Bitwise description of space view selected
OpMode	Mode of instrument
DpCircCount	
DpCircBasThr	Circumvention monitoring

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USED



SPECTRAL QA INDICATORS TRACK SPECTRAL ALIGNMENT AND FOCUS



spectral_TAI	Monitored: indicates time of last successful spectral cal
spectral_TAI_prev	Constant, from the current focal plane map
nominal_freq	Used by Level-2
spectral_freq	Used when current spectral cal fails
spectral_freq_unc	Monitored and trended: change indicates need to review focal plane map (and nominal frequencies)
spectral_freq_prev	Monitored and trended: increase indicates need to review upwelling features list
spectral_freq_prev_unc	Array dimension specification
spec_shift_upwell	Mean and stddev monitored and trended: review upwelling features and focal plane map if needed
spec_shift_unc_upwell	Mean and stddev monitored and trended: review upwelling features if needed
spec_fl_upwell	Monitor and trend: increase means possible problems with upwelling features
spec_fl_unc_upwell	Used to improve upwelling features
SpectralFeaturesUpwell	
spec_feature_shifts_upwell	As above (but with parylene instead of upwelling)
spec_feature_corr_upwell	
spec_feature_sharp_upwell	
spec_feature_resid_upwell	
spec_iter_upwell	
spec_feature_contrast_stats	
spec_clim_select	
spec_shift_pary	
spec_shift_unc_pary	
spec_fl_pary	
spec_fl_unc_pary	
SpectralFeaturesPary	
spec_feature_shifts_pary	
spec_feature_corr_pary	
spec_feature_sharp_pary	
spec_feature_resid_pary	
spec_iter_pary	
ave_pary_spectrum	Included for completeness (research products?)

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POST-PROCESSING REQUIREMENTS DEFINED IN IF CAL PLAN



- See AIRS In-Flight Calibration Plan
 - **4.2 Radiometric**
 - 4.2.1 Space view Offset and DC Restore
 - 4.2.2 Radiometric Offset, a_o (Polarization)
 - 4.2.3 OBC BB Telemetry
 - 4.2.4 Gain Tracking
 - 4.2.5 Noise Monitoring
 - **4.3 Spectral**
 - 4.3.1 Reference Spectrum Selection
 - 4.3.2 Cloud-free Feature Identification
 - 4.3.3 Upwelling Feature Fitting
 - 4.3.4 OBS (Parylene) Feature Fitting
 - 4.3.5 Focal Plane Fitting
 - 4.3.6 Channel Spectra Determination
 - **4.4 Spatial Calibration and Scene Uniformity**
 - **4.5 VIS/NIR Radiometric Calibration (See ATBD part 2)**
 - **Microwave Requirements TBD**

“Atmospheric Infrared Sounder (AIRS) Visible and Infrared In-Flight Calibration Plan”, Version 2.0, May 2001, ADF 412A



SUMMARY AND CONCLUSIONS



- AIRS Calibration Team will monitor L1B closely during first use period
 - *Monitor calibrated radiances*
 - *Update limits for calibration flags*
- All necessary QA parameters embedded in L1B QA product
- ACT will trend key QA parameters throughout the life of the mission
- Recommend becoming familiar with Calibration Flags
- Contact ACT for any questions regarding L1B usage