Summary of JPSS-1 VIIRS Pre-Launch Radiometric Performance

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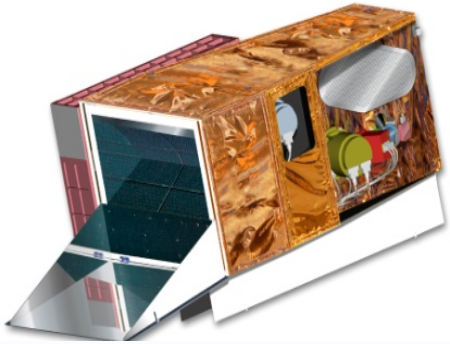

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NOAA-STAR Annual Science Team Meeting
August 9th, 2016

Acknowledgements:

Government Data Analysis Working Group (DAWG), NASA VIIRS On-site Instrument Team

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- J1 VIIRS Pre-launch Testing
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  - ✓ SNR/NEdT, Lmax, Polarization, NFR, RVS, RSR
- Status of J2 VIIRS Ambient Testing
- Summary/Conclusion

VIIRS Bands and Products

VIIRS 22 Bands:
16 M-Band, 5 I-Band and 1 DNB

	Band	λc(nm)	Δλ(nm)	Spatial Resolution (m)	MODIS Equivalent Band
VisNIR	DNB	700	400	750	
	M1	**412**	**20**	**750**	B8
	M2	**445**	**18**	**750**	B9
	M3	**488**	**20**	**750**	B3-B10
	M4	**555**	**20**	**750**	B4-B12
	M5	**672**	**20**	**750**	B1
	I1	640	80	375	B1
	M6	746	15	750	B15
	M7	**865**	**39**	**750**	B2
	I2	865	39	375	B2
SMWIR	M8	1240	20	750	B5
	M9	1378	15	750	B26
	M10	1610	60	750	B6
	I3	1610	60	375	B6
	M11	2250	50	750	B7
	I4	3740	380	375	B20
	M12	3760	180	750	B20
	M13	**4050**	**155**	**750**	B21-B22-B23
LWIR	M14	8550	300	750	B29
	M15	10763	1000	750	B31
	I5	11450	1900	375	B31-B32
	M16	12013	950	750	B32

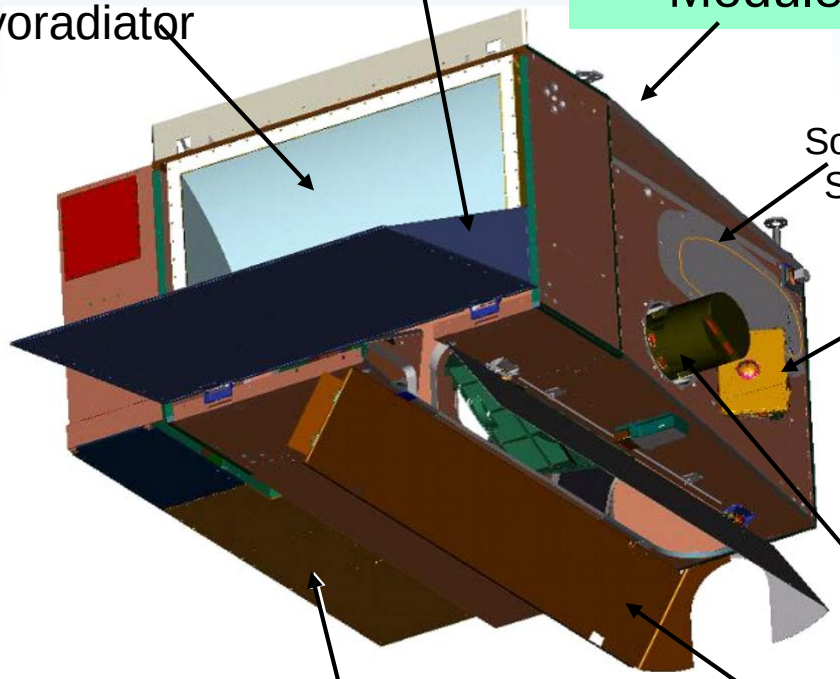
Dual Gains

VIIRS 22 Environmental Data Products
(EDRs)

Land	
1- Active Fires	2- Snow Cover
3- Land Surface Albedo	4- Vegetation Index
5- Land Surface Temperature	6- Surface Type
7- Ice Surface Temperature	8- Net Heat Flux
9- Snow Ice Characterization	
Ocean	
1- Sea Surface Temperature	2- Ocean Color/Chlorophyll
Imagery and Clouds	
1- Imagery and low light imaging	2- Cloud Top Height
3- Cloud Optical Thickness	4- Cloud Top Temperature
5- Cloud Effective Particle Size	6- Cloud Base Height
7- Cloud Top Pressure	8- Cloud Cover/Layers
Aerosol	
1- Aerosol Optical Thickness	2- Aerosol Particle Size
3- Suspended Matter	

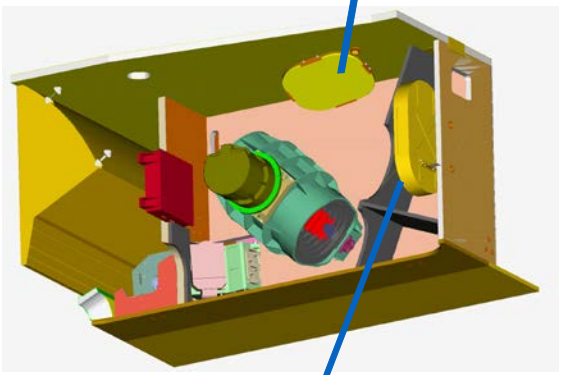
- 14 reflective solar bands (RSB): 0.4-2.2 μm and 1 day night band (DNB)
- 7 thermal emissive bands (TEB): 3.7-12.0 μm
- Dual gain bands: M1-M5, M7, and M13

VIIRS Sensor & On-board Calibrators



SDSM

Solar Diffuser



Blackbody (BB)

- ***Proven design through SNPP mission***
- ***Comprehensive pre-launch testing, and on-orbit predictions***

Pre-Launch Testing Objectives

- **Radiometric, Spectral and Spatial testing**
  - Ambient, TV (cold, nominal, hot), HAM sides, E-sides, detectors, etc.
- **Ensure sensor performance meets design requirements**
  - Compliance, Waivers
- **Capability to generate sensor performance parameters for on-orbit operation and calibration**
- **Support modeling and predictions to ensure overall science objectives are met**
- **Development and implementation of potential mitigation strategies to address artifacts and noncompliance issues**

Overview of J1 Pre-launch Testing

Performance Testing:

- Radiometric (SNR/NEdT, detector calibration, dynamic range)
- Spectral (IB and OOB RSR)
- Spatial and geometric (BBR, MTF, and pointing)
- Others
  - Polarization sensitivity
  - Response versus scan-angle
  - Stray light and Near-field response
  - BB/SD/SDSM characterization
- Thermal testing
- Vibration testing
- Electromagnetic interference
- Special testing (ETPs)

Testing Phases:

- **Component/Sub-system Testing**
- **Sensor Level Testing**
  - ✓ Ambient: *08/24/2013 - 01/19/2014*
  - ✓ TVAC: *07/16/2014 - 10/30/2014*
  - ✓ Sensor Delivery: *02/06/2015*
- **Observatory Level Testing:**
  - ✓ Sensor Integrated to J1: *02/20/2015*
  - ✓ Environmental Testing: *April-September 2016*
- **JPSS-1 Launch:**
  - ✓ Mid-March, 2017

Testing & Performance Teams

- **Test data independently analyzed and reviewed by**
  - Sensor Vendor (Raytheon)
  - Government Team
    - NASA
    - NOAA
    - Aerospace
    - U. of Wisconsin
- **Test results reviewed by**
  - Data Review Board (DRB): results primarily from sensor team
  - Data Analysis Working Group (DAWG): results primarily from gov. team
  - Technical Interchange Meetings (TIMs)
  - Regular briefings at NOAA-led VIIRS SDR meetings

General Agreement on the good quality of J1 VIIRS test data, and instrument performance

J1 Instrument Improvements

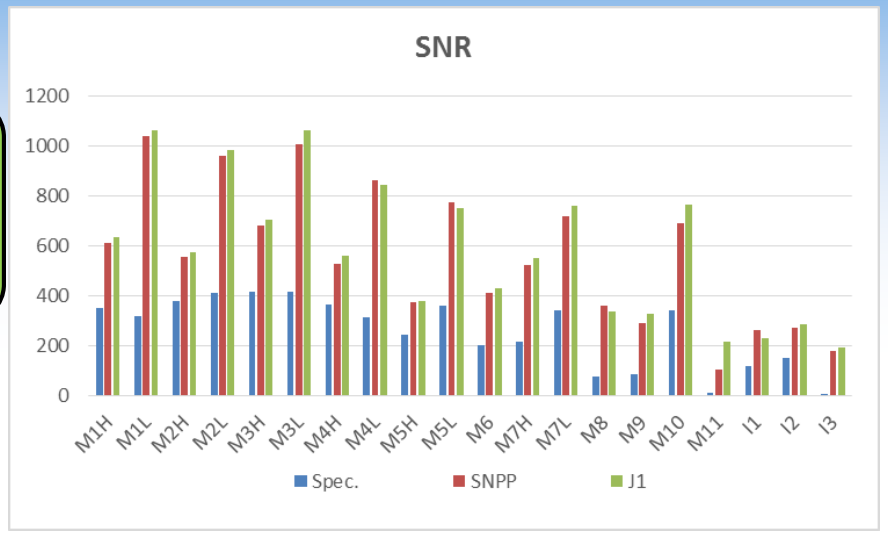
- **RTA Mirrors Changed from Ni coated to VQ**
  - Improved spatial stability with temperature
- **Dichroic 2 Coatings Redesigned**
  - Improved spatial performance between SMWIR & LWIR
- **Eliminated Throughput Degradation Due to Tungsten**
  - Improved radiometric sensitivity
- **Enhanced VisNIR Integrated Filter Coating Change**
  - Improved crosstalk, OOB, and RSR performances
  - Higher polarization sensitivity: Bands M1 – M4

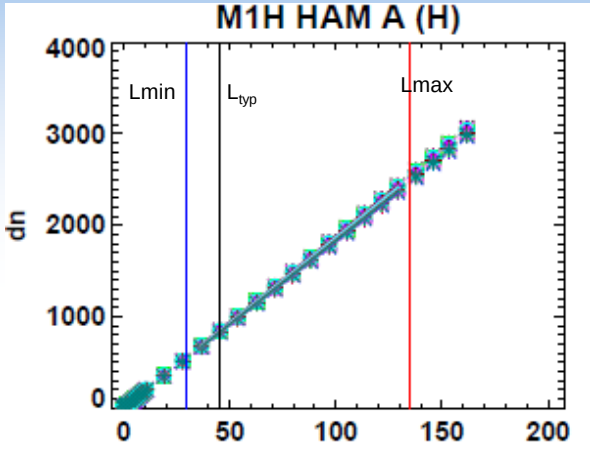
Other changes were also included but not expected to make substantial change in the sensor performance

RSB Radiometric Performance

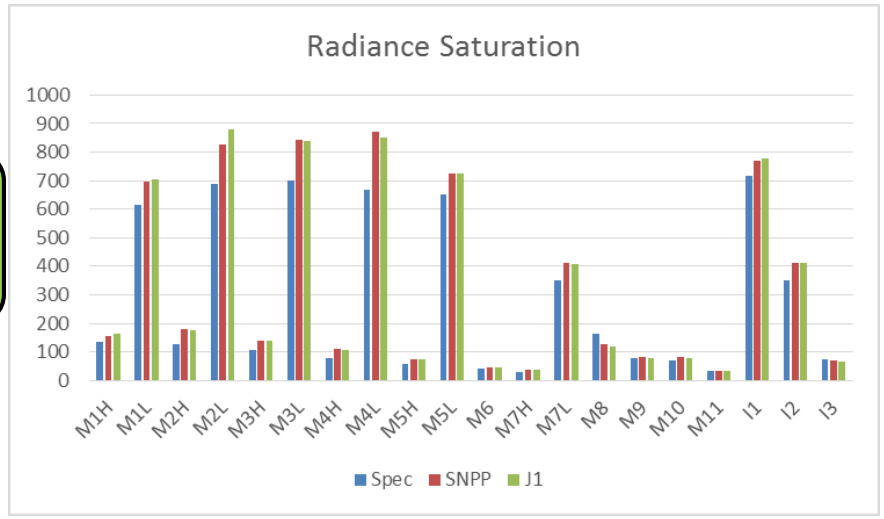
J1 SNR compliant with margin

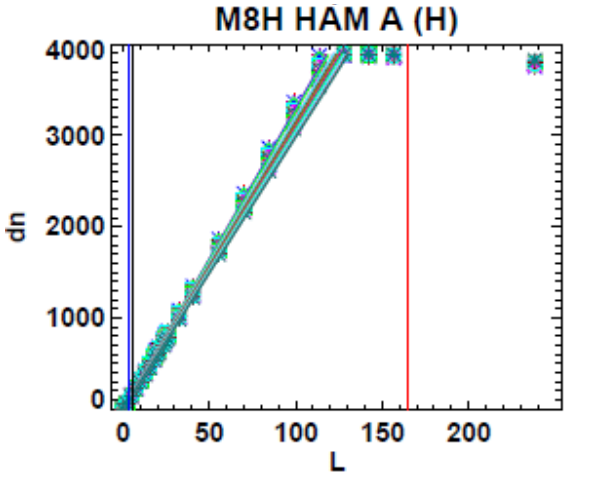
I3 Det4 noisy





Minor Dynamic range non-compliance (M8, I3)

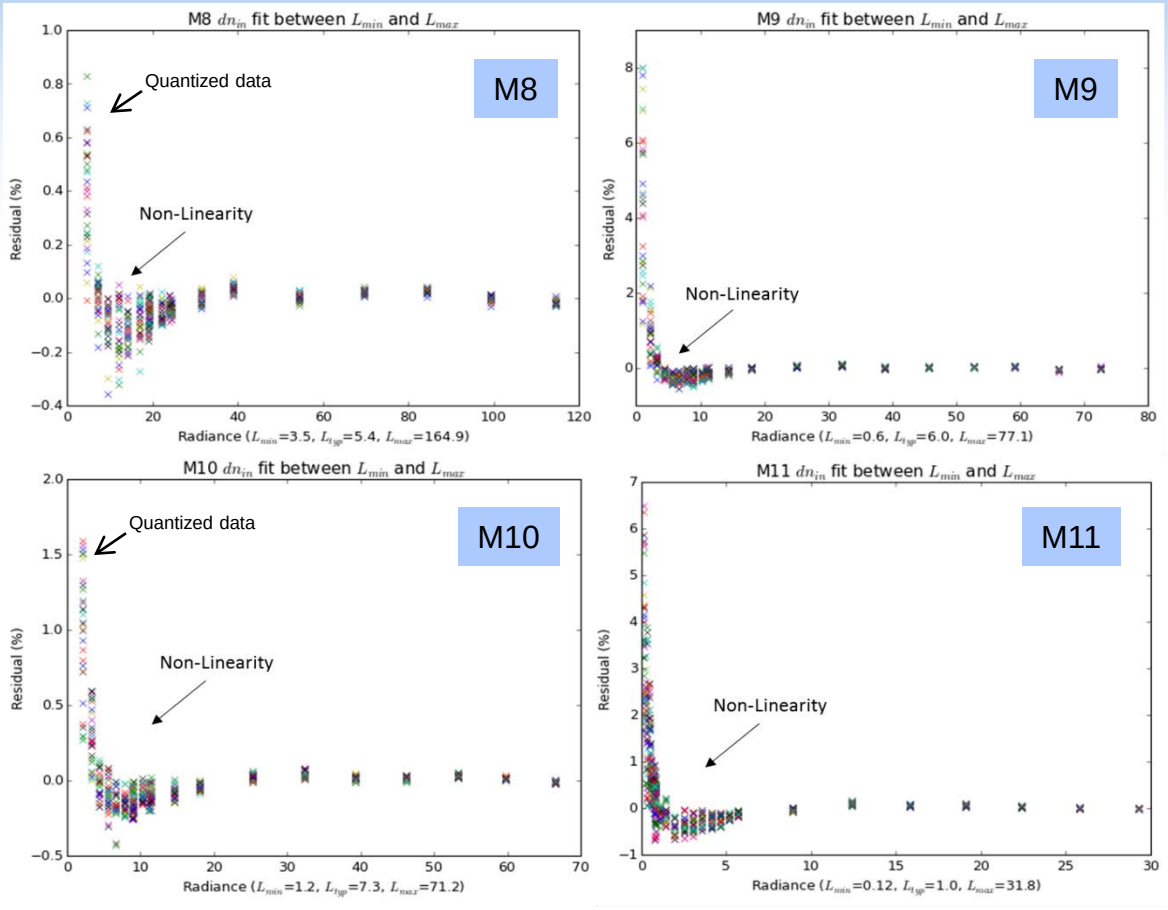




- **J1 Radiometric performance is quite similar to SNPP**
- **Higher than expected non-linearity seen in SWIR bands and DNB**

SWIR Radiometric Performance

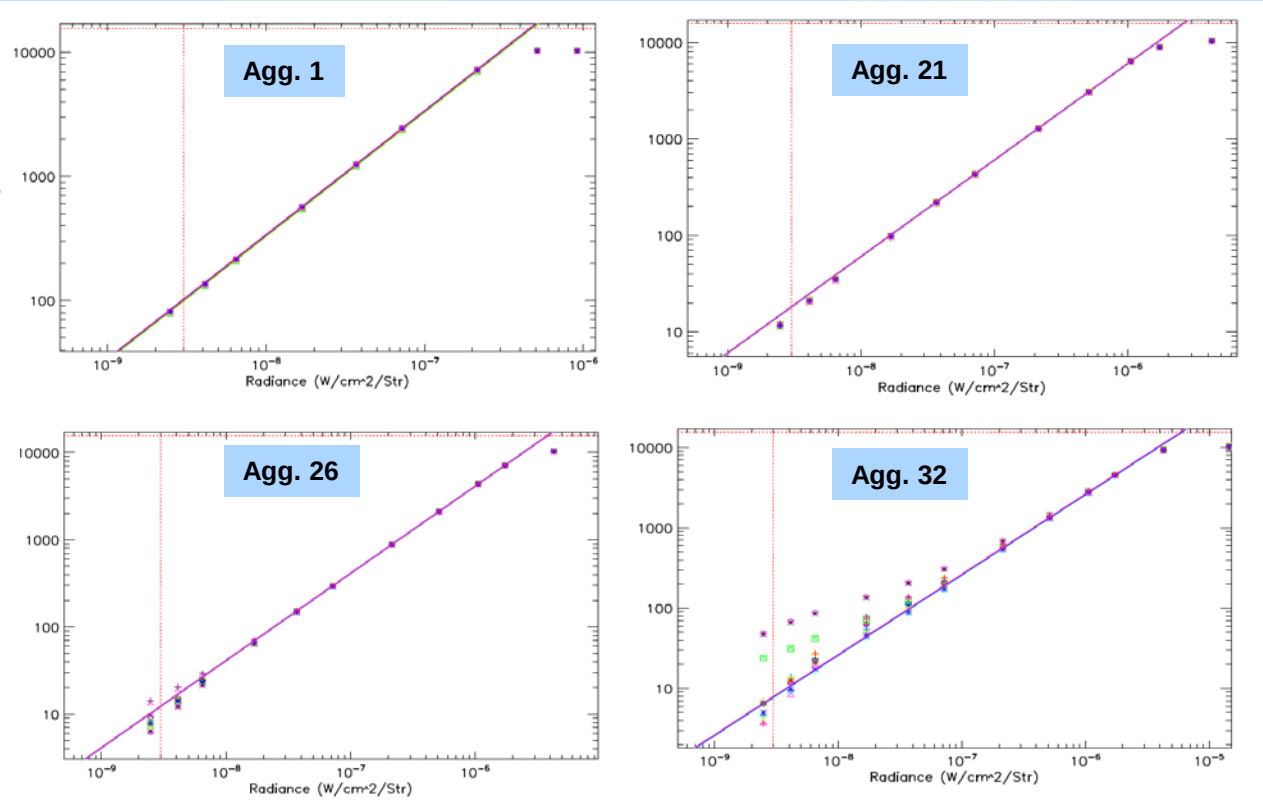
SWIR Non-Linearity Issue (Low Radiance)



- **Issue characterized and root cause identified (electronics Voltage)**
- **Plan to mitigate in the SDR software (3rd degree equation, or other options)**

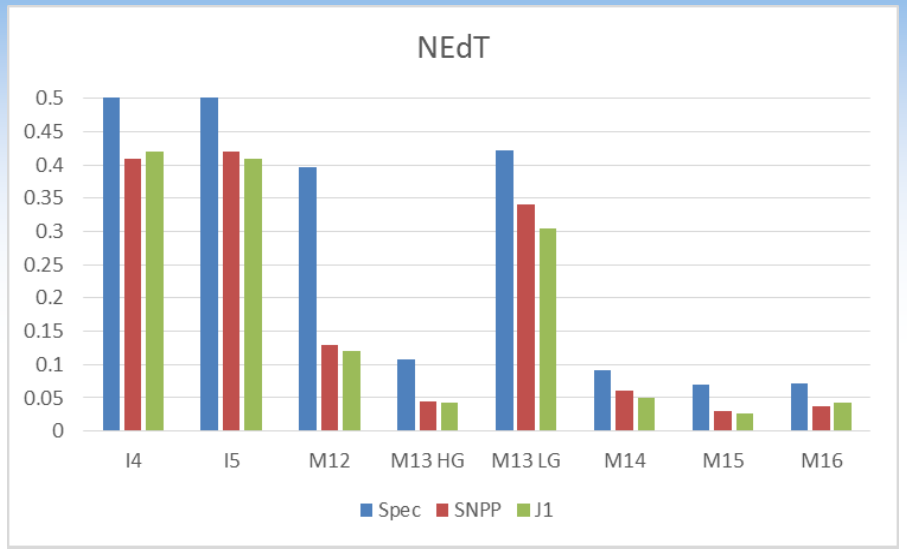
DNB Radiometric Performance

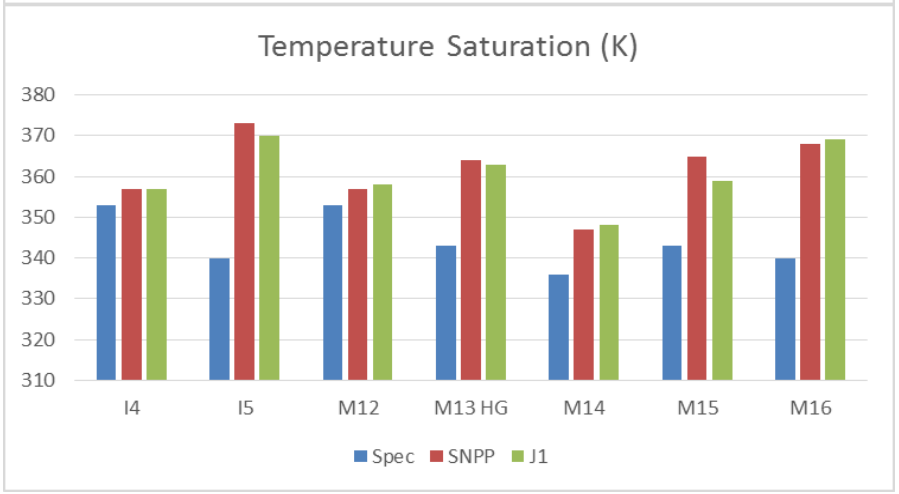
DNB Non-Linearity Issue (Low Radiance)

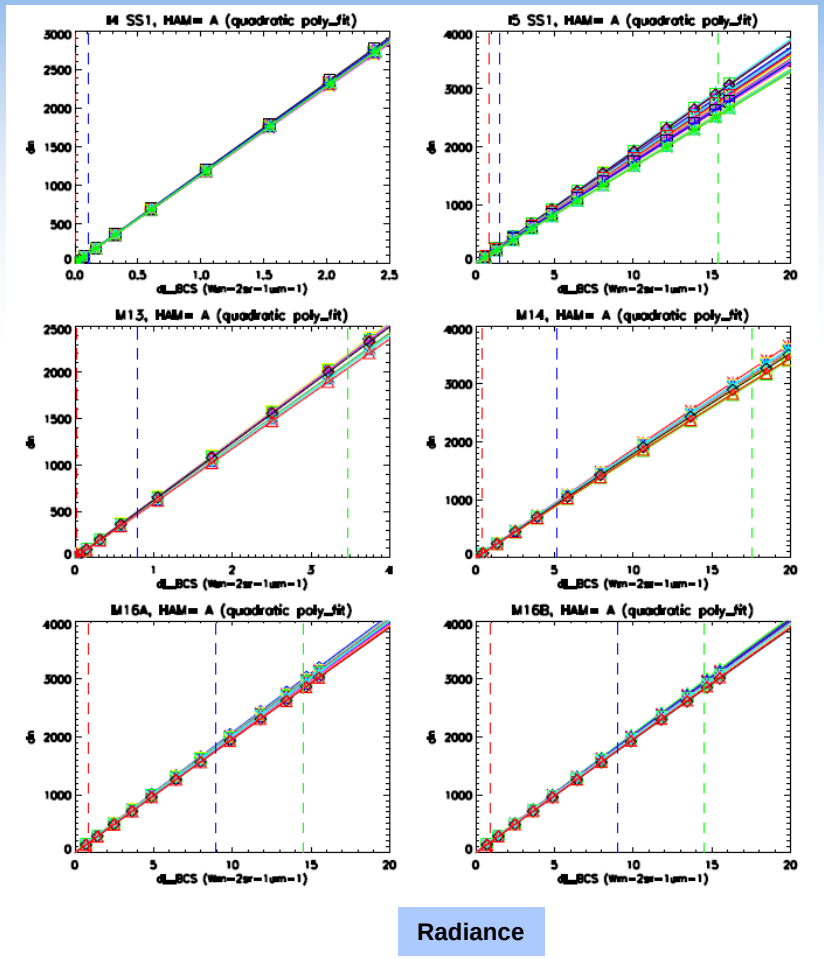


- Limited to agg. modes at the end of scan (22-32)
- Issue characterized and root cause identified (timing card setting)
- Resolved using Option21 approach at the expense of spatial resolution

TEB Radiometric Performance





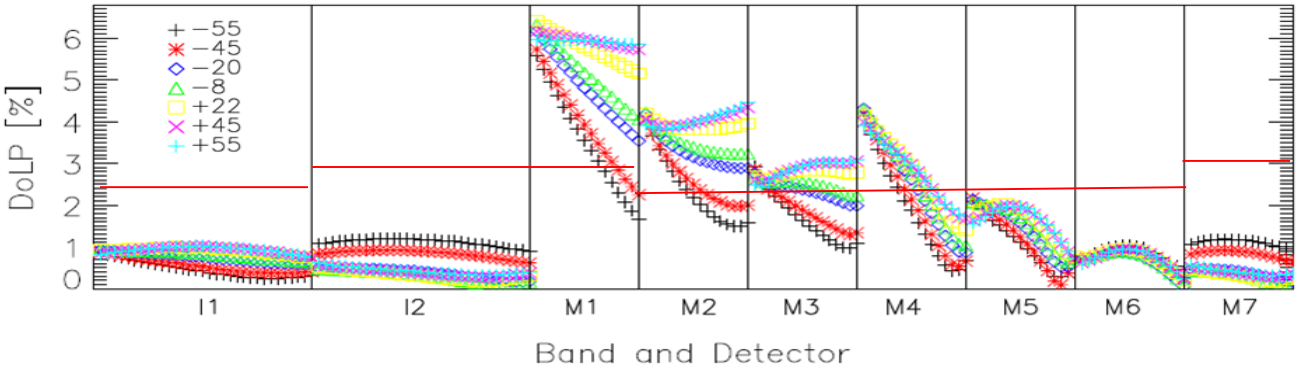


Radiance

- J1 TEB calibration performance is very good, similar to SNPP performance.
- Minor non-compliances observed: T_{MIN} for I4 and M14; M13 gain transition radiance.
  - Impact to science is expected to be small.

VisNIR Polarization Sensitivity

- **Bands M1–M4 were non-compliant with the polarization sensitivity requirements**
- **A series of telecons were held with NASA/NOAA SMEs**
  - Provided impact assessments for Ocean, Land , and Atmosphere disciplines
  - Correction methodologies available to enhance EDR products
- **Additional testing was requested after TVAC**
  - Additional scan angles were measured using a broadband source
  - Limited measurements performed with a laser source for model validation

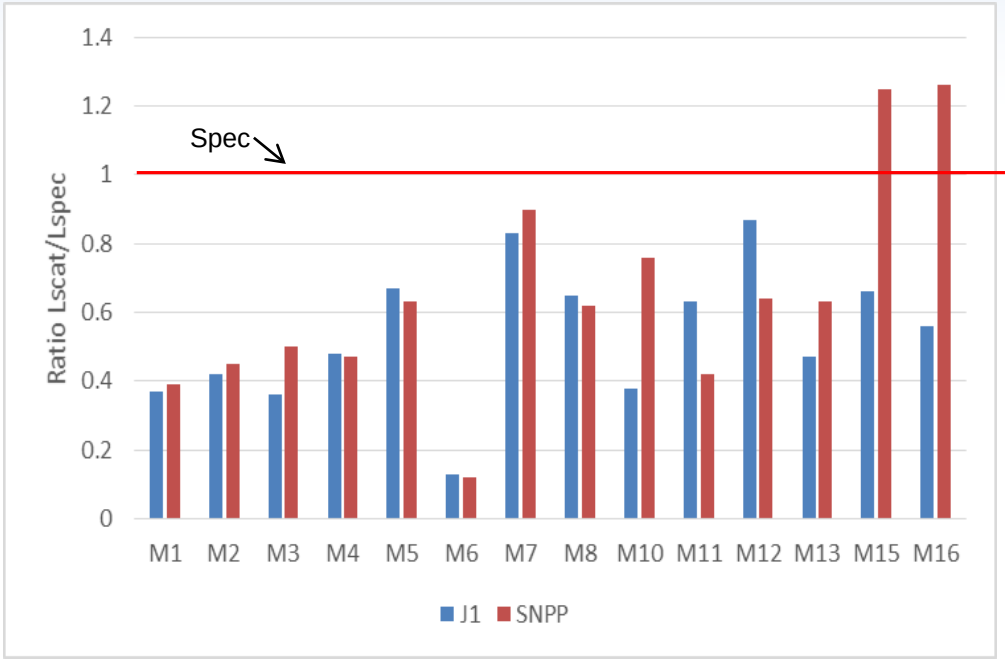


Successful and comprehensive J1 polarization testing was completed

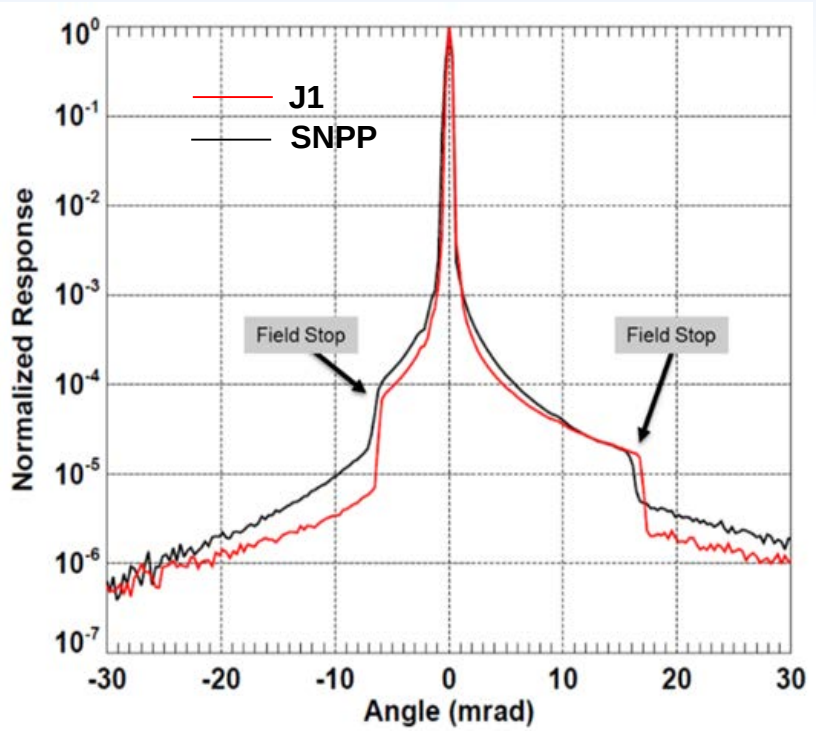
- Uncertainty less than (0.4%), Repeatability within 0.13%

Near-Field Response (NFR) Performance

J1 NFR Performance at Beginning of Life (BOL)



Band M5 (672 nm) detector 8

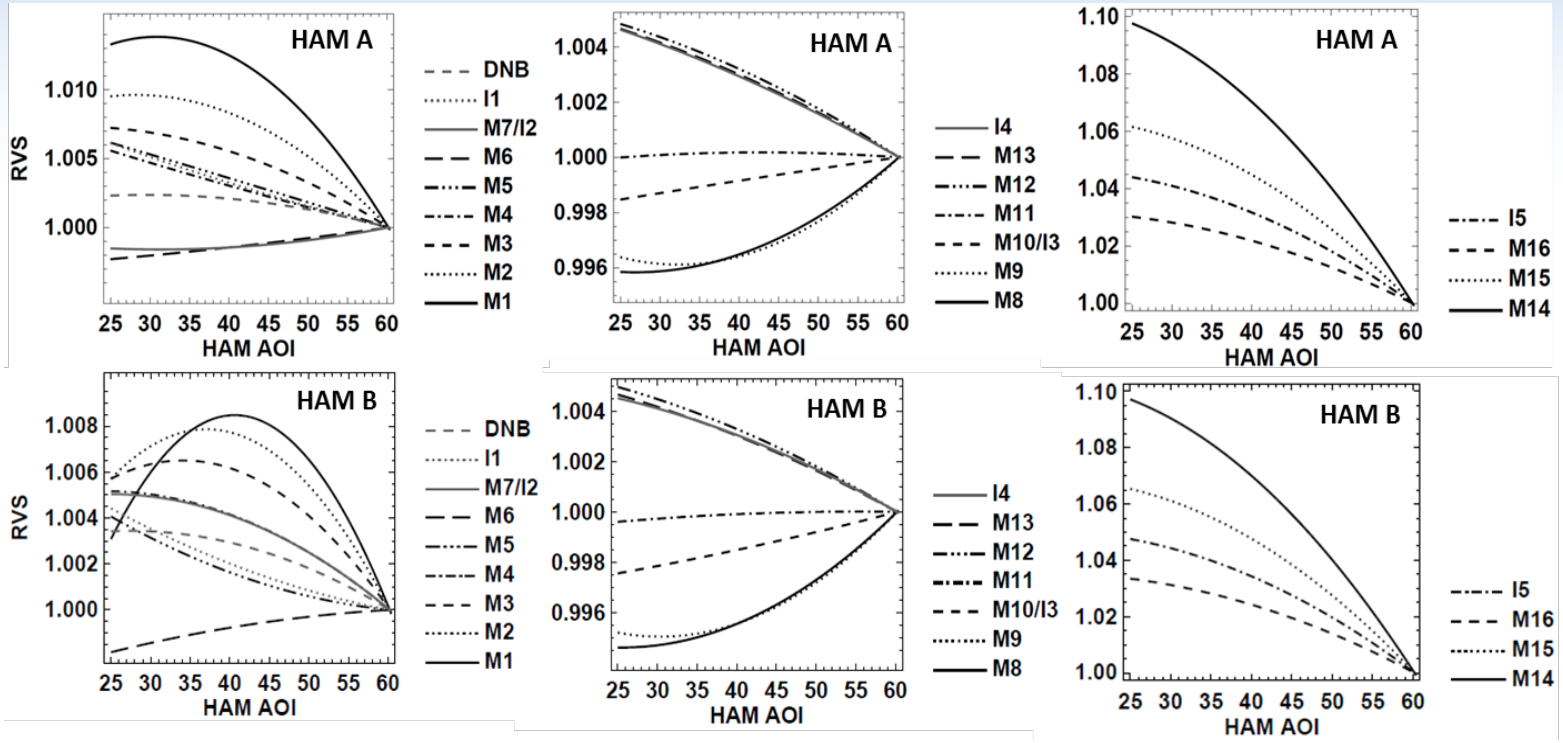


J1 NFR requirements are met for all bands

Response vs. Scan (RVS)

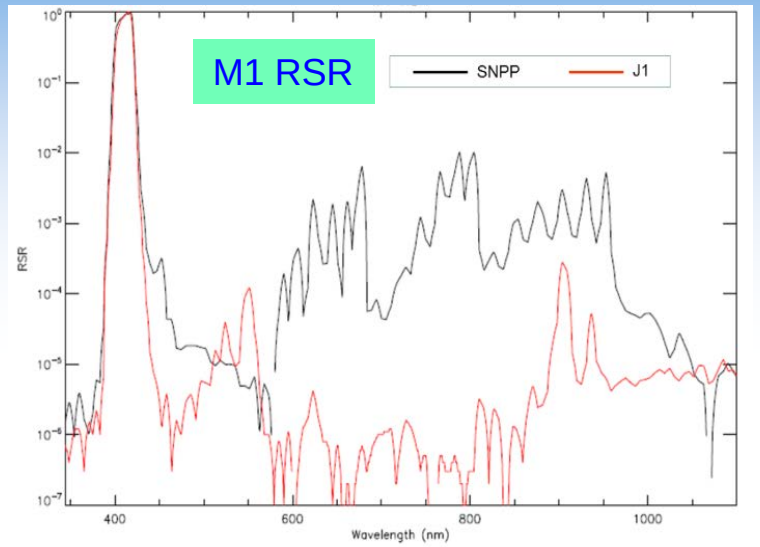
RVS is the HAM reflectance as a function of HAM Angle of incidence (AOI)

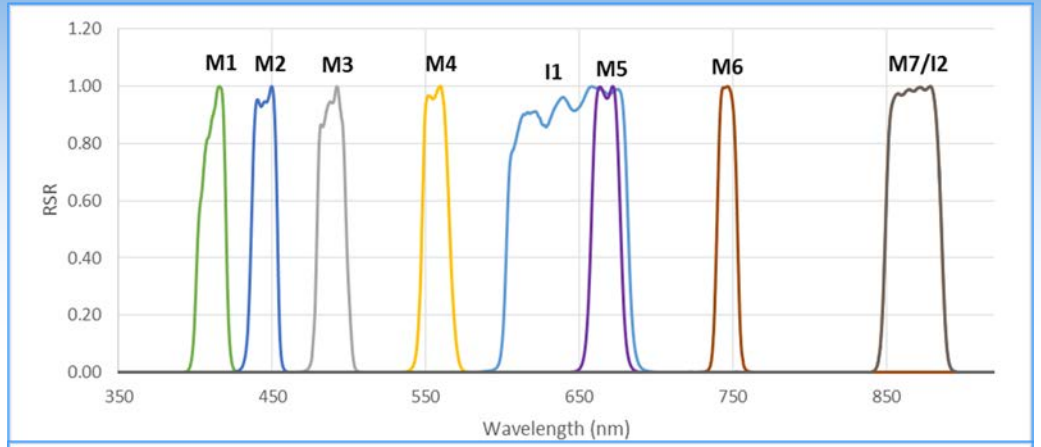
VisNIR | S/MWIR | LWIR

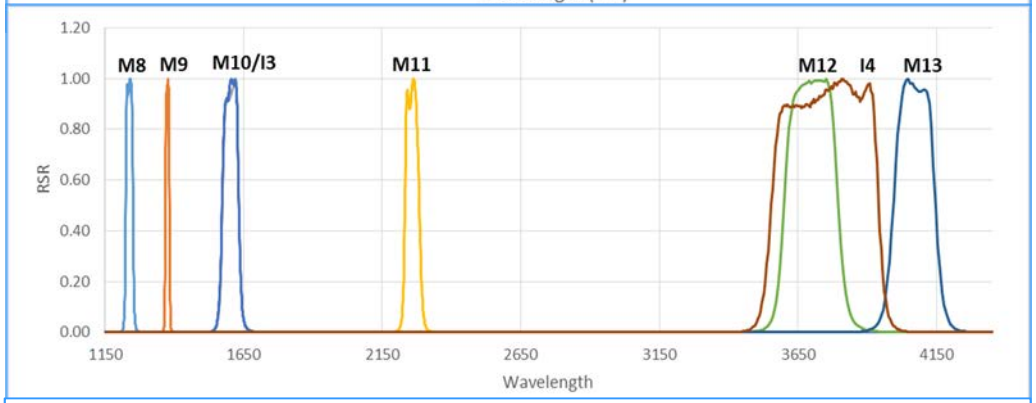


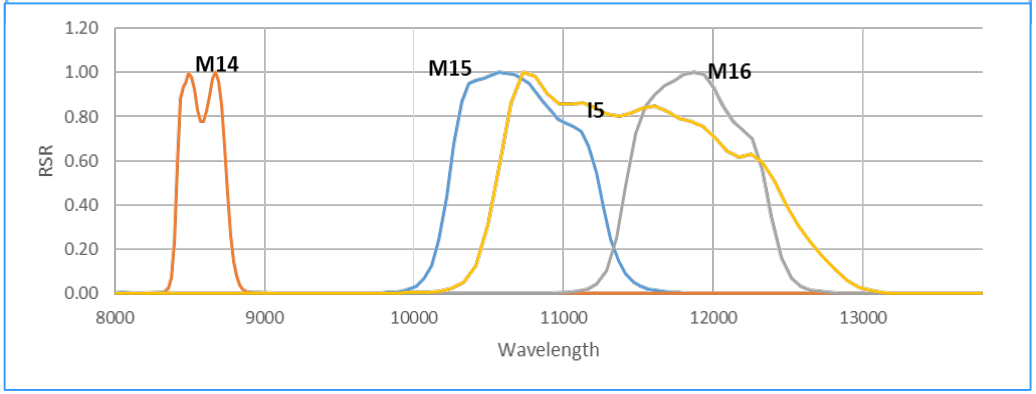
- **Excellent J1 RVS performance characterization, Similar to SNPP**
  - **RSB uncertainty under 0.06% (Spec 0.3)**
  - **TEB uncertainty under 0.15 % (Spec 0.2)**

Spectral Performance









- **J1 spectral performance testing was completed successfully for all bands**
- **Combination of best quality data from monochromator and laser is used for J1**
- **Overall spectral performance is expected to be better than SNPP.**

J1 VIIRS Performance Waivers

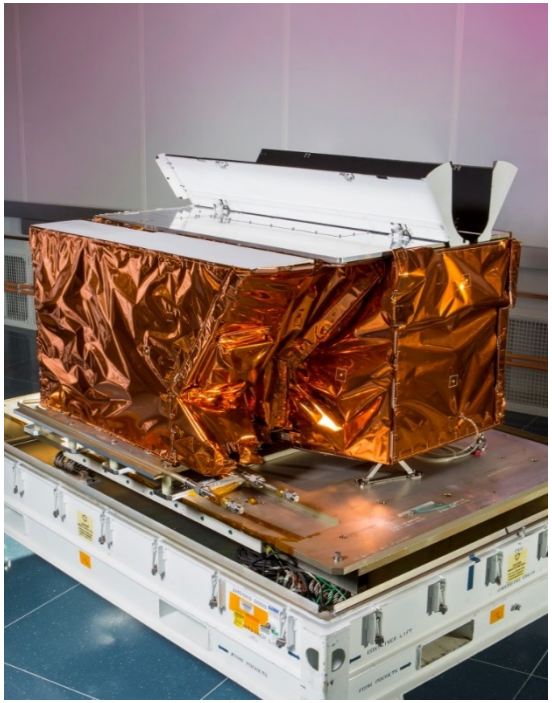
Raytheon Waiver #	Title	Status
RDW_148	J1 Relief against reflective band absolute radiometric calibration uncertainty requirements for bands M1-M3	Approved
RDW_149	J1 Relief against reflective band absolute radiometric calibration uncertainty requirements for band M11	Approved
RDW_150A	J1 Relief for DNB stray light in certain viewing geometries and related impacts on sensitivity and radiometric calibration	Approved
RDW_151	J1 relief against maximum radiance requirement for bands M8, I1 and possibly M1LG and I3.	Approved
RDW_166	J1 relief agains maximum polarization sensitivity requirement for bands M1 to M4.	Approved
RDW_153	J1 relief against electrical and optical crosstalk. Stringent requirements and testing artefacts are leading to non-compliances	Approved
RDW_150A	J1 relief against the sensor modulated transfer function (MTF)	Approved
RDW_161	J1 relief against the relative spectral response (RSR) requirements. Band center (M5, M16), Band width (M1,M8,M14,DNB), 1% limit (I5,DNB), IOOB (M16)	Approved
RDW_168	J1 relief against near field response (NFR). Non-compliance for (M7, M13, M16A and I3)	Approved
RDW_171	J1 relief from emissive relative radiometric reponse calibration uniformity (M12-M14 at high temp) and characterization uncertainty (I5 and M12).	Approved
RDW_172	J1 relief from reflective band characterization uncertainty (all bands non-compliant except M4HG and M5HG, and M7HG), and uniformity characterization (all bands non-compliant except M1-M7 high gain and M6)	Approved
RDW_173	J1 relief from band-to-band registration for I bands (non-compliance for I1-I3, I2-I3, I1-I4, I2-I4, I1-I5, I2-I5, I3-I5, I4-I5)	Approved
RDW_174	J1 relief from DNB SNR, uniformity and RCU.	Approved
RDW_175	J1 relief from spatial dynamic field of view (DFOV). All M bands and I5 not compliant	Approved
RDW_177	J1 DNB relief from dynamic range (LGS)	Approved

- **All 15 waivers were approved by NASA/NOAA review board**
- Completed a series of telecons (half-dozen) with NASA and NOAA SMEs to review each waiver
- Compliance is against end-of-life (EOL) performance
- All of non-compliances have mitigation plans, or will lead to acceptable impact.

JPSS VIIRS Future Enhancements

- **DNB On-orbit Stray light Issue Investigation**
  - **Observed in SNPP on-orbit, but root-cause still to be identified.**
- **Eliminate SWIR and DNB non-linearity at low radiance**
  - **Both issues resolved for J2 VIIRS**
- **Algorithm changes to reduce stripping effect due to sensor calibration artifacts (M15-M16, I3 Det4)**
- **Finalize List of J1 lessons learned, and Hardware/Software Improvements to be implemented for future builds (JPSS-2,3,4)**
  - **Testing enhancements, adding a water vapor band, electronics noise, radiance roll-over, etc.**

JPSS-2 VIIRS:
Initial Radiometric Performance



JPSS-2 VIIRS Status

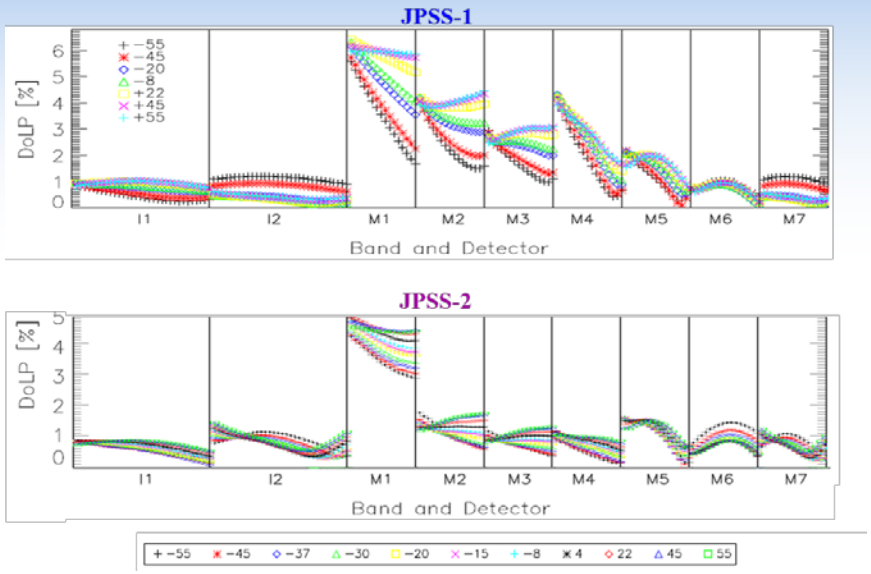
- **JPSS-2 VIIRS is the 3rd unit of VIIRS sensors,**
  - **Ambient Phase**: April-August 2016
  - **Thermal Vacuum**: June-August 2017
  - **Expected Launch Date**: January, 2021

- **JPSS-2 VIIRS is similar to its two predecessors, with multiple performance enhancements, including:**
  - The redesign of the VisNIR IFA filter to reduce polarization sensitivity, and changes to the AOA fold mirror #2.
  - SWIR and DNB non-linearity issues seen in J1 were eliminated
  - JPSS-2 test program included numerous lessons-learned:
    - Better efficiency and cost reduction (e.g. enhanced stray light testing, shorter crosstalk testing, etc.)

J2 Radiometric Performance

Preliminary assessments based on Ambient testing

Polarization

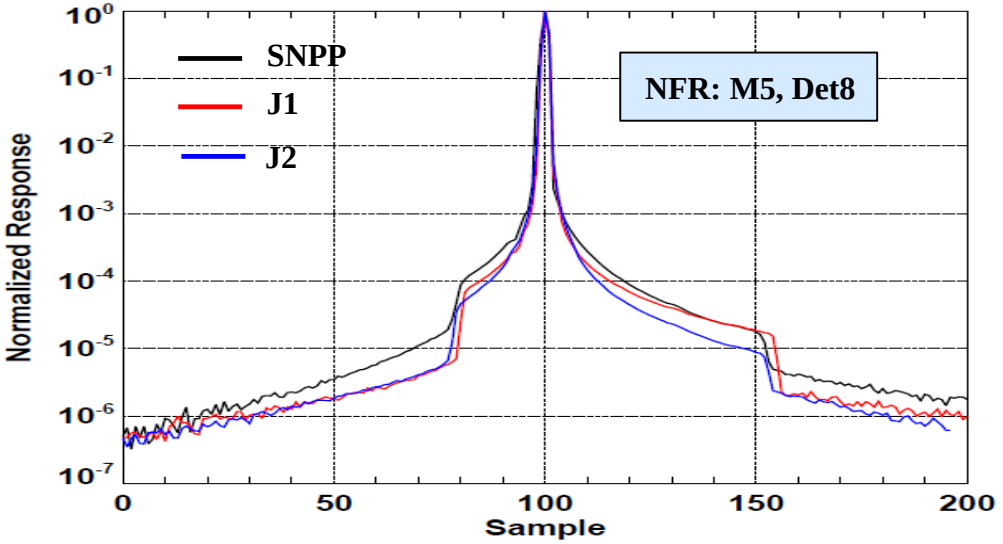


A-Side Elec.

Gain	Band	SNR spec	SNR HAM A	SNR HAM B	Lmax spec	Maximum radiance HAM A	Maximum radiance HAM B
HG	M1	352	732	752	135	164.8	164.8
	M2	380	702	701	127	169.5	169.1
	M3	416	861	851	107	126.1	126.0
	M4	362	683	672	78	98.9	98.9
	M5	242	359	359	59	81.0	81.0
	M6	199	567	571	41	53.4	53.4
	M7	215	654	658	29	37.5	37.4
	M8	74	302	292	164.9	158.2	158.1
	M9	93	177	176	77.1	131.9	131.9
	M10	342	767	749	71.2	98.1	98.0
	M11	90	237	235	31.8	33.1	33.0
	I1	119	208	204	718	969.2	969.1
	I2	150	372	372	349	455.6	455.1
	I3	6	200	199	72.5	100.7	100.7
LG	M1	316	1090	1099	615	508.7	508.7
	M2	409	1124	1128	687	844.3	841.9
	M3	414	1064	1065	702	894.4	894.7
	M4	315	819	851	667	775.2	774.7
	M5	380	665	660	651	949.5	949.4
	M7	340	1427	909	349	411.1	410.7

J2 radiometry is very good as expected

- SNR compliance with significant margin
- Lmax compliant except for M8 (95%)
- Better polarization performance than J1
- Near Field Response comparable to J1



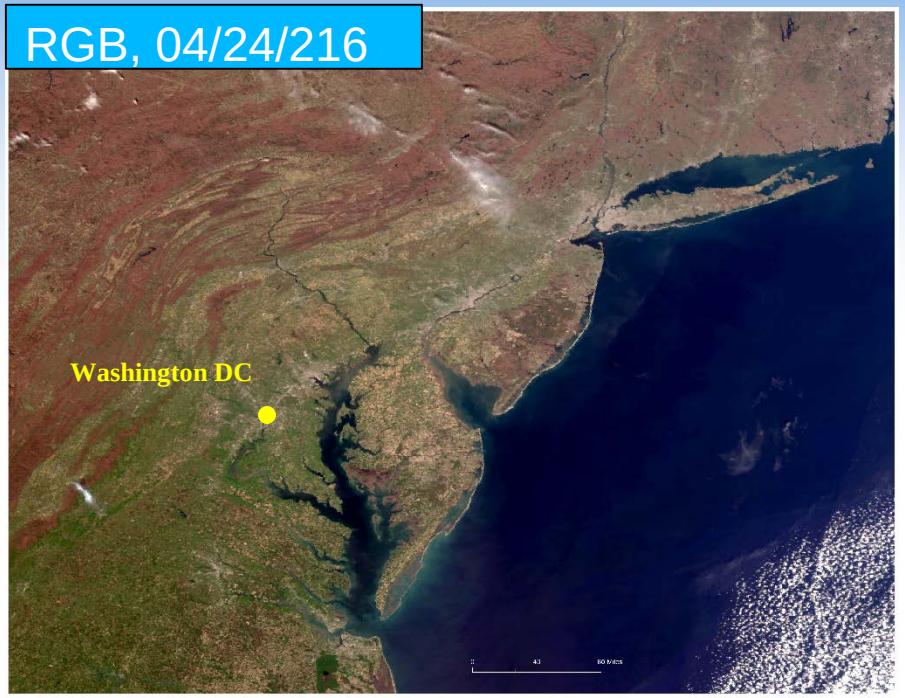
Summary & Conclusion

- **J1 VIIRS test program was completed successfully**
- **Provided an extensive amount of high quality data to assess sensor performance**
- **VIIRS performance exceeds requirements with few non-compliances**
  - Non-compliances have been reviewed, impacts have been assessed, and mitigation plans are being prepared for on-orbit processing
  - J1 VIIRS spacecraft testing is expected to be completed by September 2016
  - J1 LUTs needed for on-orbit calibration are being finalized.
  - J1 SDR software is ready, changes include DNB Option21 mitigation approach.
- **J2 VIIRS initial ambient testing has shown good performance**
  - Good initial radiometric and spatial performance (i.e. SNR, NFR, polarization, RVS and spatial)
  - J2 VIIRS TV testing will provide complete set of performances.
- **J3/J4 VIIRS contract complete and approved, and sensor parts are being selected from spares or in development,**
  - Taking advantage of lessons learned from previous sensors (i.e. SNPP, J1 and J2)

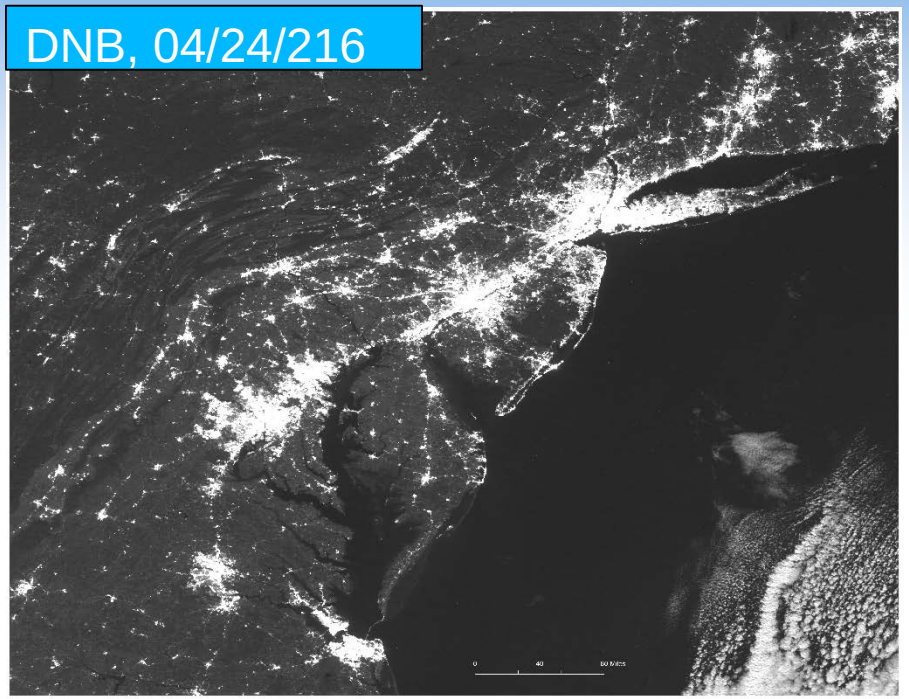
SNPP VIIRS Imagery

Eastern Seaboard

RGB, 04/24/216



DNB, 04/24/216



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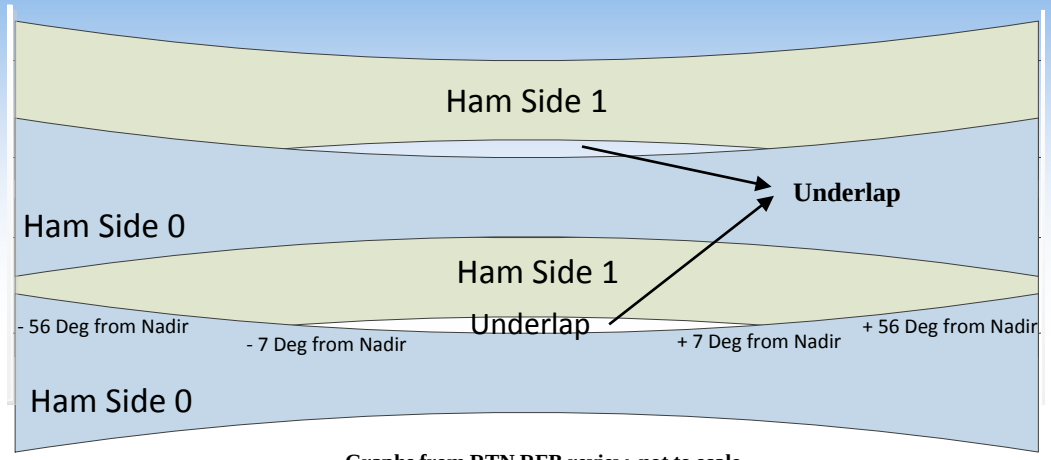
J1 VIIRS is also expected to deliver high quality radiance and environmental data products

Thanks!

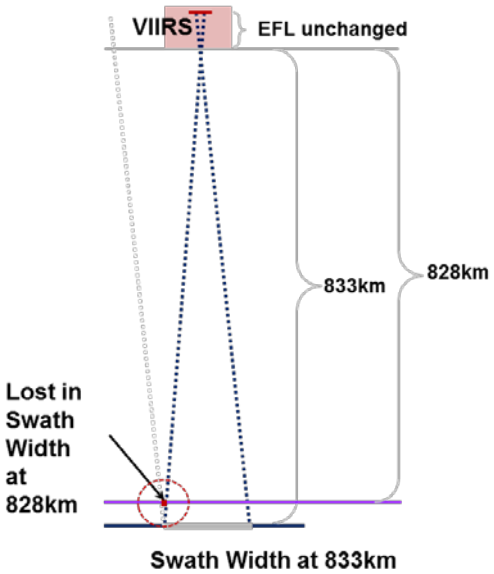
Backup

J2 Scan Underlap Issue

- Underlap is defined as non-overlapping VIIRS swath projections on the ground in track extent
- Underlap will be seen on every other swath pair with current J2 as built tolerances
- **Combination of facts led to this Issue,**
  - **1) Requirement change from 833 to 828km,**
  - **2) HAM misalignment exceeded tolerance.**



Graphs from RTN RFB review, not to scale



- Scan Overlap is driven by the following parameters:
  - **Altitude** – as altitude gets lower, projection on the ground gets smaller
  - **HAM Alignment** – alignment between A & B drives spacing between successive scans on the ground
  - **Scan Rate** – matched to EFL for BBR purposes, but drives the number of scans we get in one orbit
  - **Orbital velocity** – drives the number of scans we get in one orbit
  - **System EFL** – as EFL gets longer, projection on the ground gets smaller
  - **Spacecraft Jitter** – moves the LOS randomly between scans

The ongoing effort to adjust J2 HAM alignment is expected to eliminate this issue

J2 VIIRS Performance Testing

- **J2 VIIRS Ambient phased is planned for April to September 2016**
  - **Radiometric:** *SNR, NEdT, Lmax*
  - **Spatial:** *LSF/MTF, BBR, pointing*
  - **Spectral:** *RSRs using GLAMR (NASA)* *(In progress)*
  - **Special testing:** *polarization, RVS, NFR, Stray Light, Xtalk.*

Tests in Green means completed

J2 Ambient Preliminary Performance is as Expected

J1 Spectral Performance

SNPP

Band	Band center	Bandpass (FWHM)	Lower 1% point	Upper 1% point	MIOOB
'M1'	pass	pass	pass	pass	FAIL
'M2'	pass	FAIL	pass	pass	pass
'M3'	pass	pass	pass	pass	FAIL
'M4'	FAIL	pass	pass	pass	FAIL
'I1'	pass	pass	pass	pass	pass
'M5'	pass	pass	pass	pass	FAIL
'M6'	pass	pass	pass	pass	FAIL
'I2'	pass	pass	pass	pass	FAIL
'M7'	pass	pass	pass	pass	pass
'M8'	pass	FAIL	pass	pass	pass
'M9'	pass	pass	pass	pass	pass
'I3'	pass	pass	pass	pass	pass
'M10'	pass	pass	pass	pass	pass
'M11'	pass	pass	pass	pass	pass
'I4'	pass	pass	pass	pass	pass
'M12'	pass	pass	pass	pass	pass
'M13'	pass	pass	pass	pass	pass
'M14'	pass	FAIL	pass	pass	FAIL*
'M15'	pass	pass	pass	pass	FAIL*
'I5'	pass	pass	pass	FAIL	FAIL*
'M16A'	FAIL	pass	pass	pass	FAIL*
'M16B'	FAIL	pass	pass	pass	FAIL*
DNBLGS	pass	pass	pass	pass	pass

J1

Band	Band center	Bandpass (FWHM)	Lower 1% point	Upper 1% point	MIOOB
'M1'	pass	FAIL	pass	pass	pass
'M2'	pass	pass	pass	pass	pass
'M3'	pass	pass	pass	pass	pass
'M4'	pass	pass	pass	pass	pass
'I1'	pass	pass	Pass	pass	pass
'M5'	pass	pass	pass	pass	pass
'M6'	pass	pass	pass	pass	pass
'I2'	pass	pass	pass	pass	pass
'M7'	pass	pass	pass	pass	pass
'M8'	pass	FAIL	pass	pass	pass
'M9'	pass	pass	pass	pass	pass
'I3'	pass	pass	pass	pass	pass
'M10'	pass	pass	pass	pass	pass
'M11'	pass	pass	pass	pass	pass
'I4'	pass	pass	pass	pass	pass
'M12'	pass	pass	pass	pass	pass
'M13'	pass	pass	pass	pass	pass
'M14'	pass	FAIL	pass	pass	pass
'M15'	pass	pass	pass	pass	pass
'I5'	pass	pass	pass	FAIL	pass
'M16A'	FAIL	pass	pass	pass	pass
'M16B'	FAIL	pass	pass	pass	pass
DNBLGS	pass	pass	pass	pass	pass

- J1 RSR showing good performance as expected. Minor non-compliances are small risk
- J1 RSR version 2 (V2) was released to the science community in February, 2016

*High noise floor in LWIR out-of-band response test

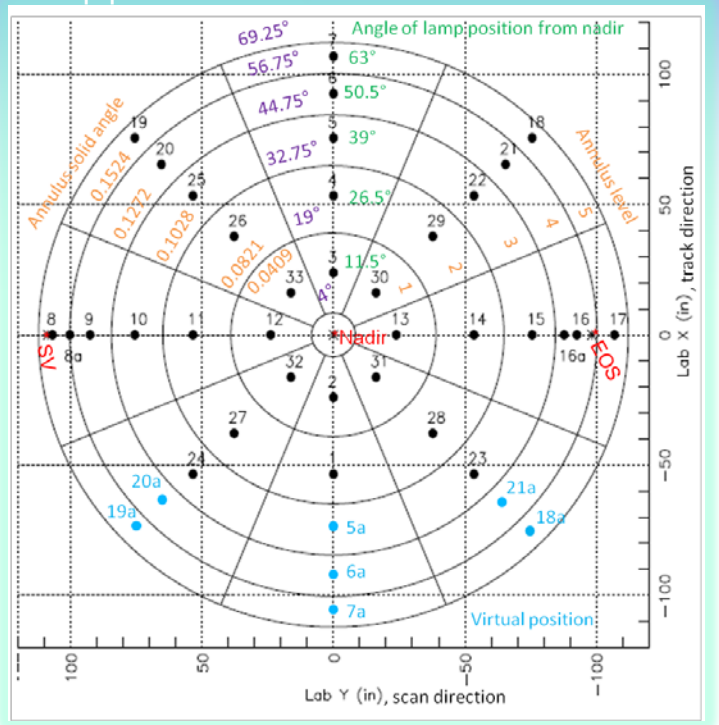
Stray Light Response (SLR) Performance

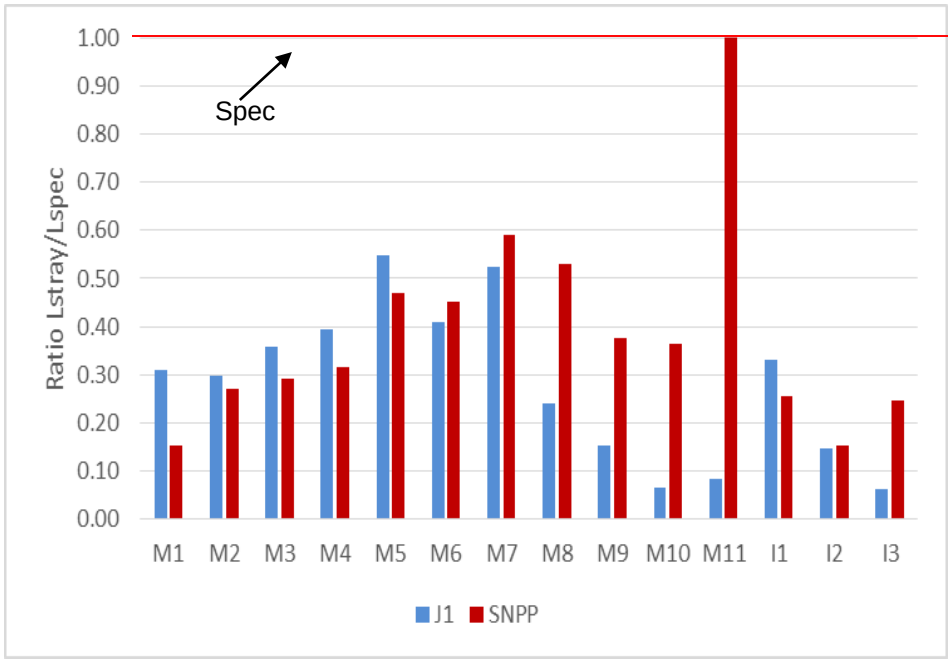
J1 SLR performance is comparable to SNPP. The right hand side shows a couple of examples (out of 336) of simulated views from detectors.

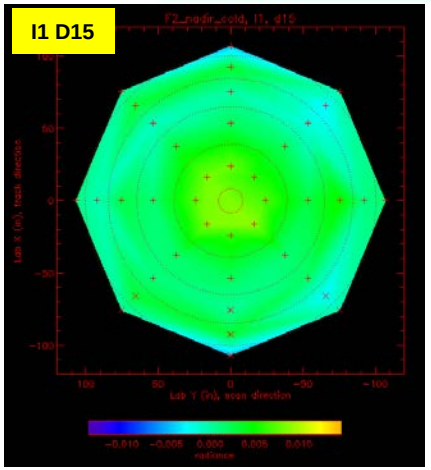
All RSB detectors meet SLR specification at Beginning of Life (BOL) (plot below).

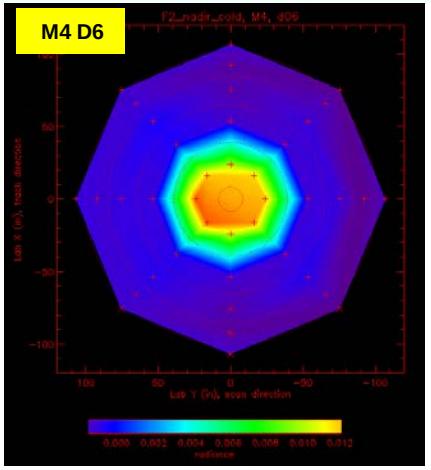
Bands M5 and M7 are predicted to fail Spec at the End of Life (EOL), while M6 will become marginal.

Lamp position chart

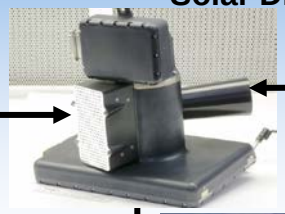








VIIRS Operation & Data Flow



Solar Diffuser Stability Monitor, Once per Orbit

Solar Diffuser View, Once per Orbit

Sun

Attenuation Screen (w/ earthshine rejection)

+159°

360° Scan every 1.8 sec.

+100°

Blackbody View, Once per Scan

RTA

HAM

Earthview

Nadir

+56.1°

-56.1°

-65.7°

Space View Once per Scan

Earth

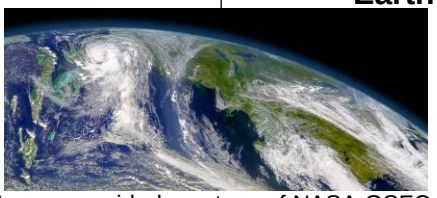


Image provided courtesy of NASA GSFC

Imager

Beam-splitter

Beam-splitter

Cold FPA Dewar

S/MWIR (8 bands)

LWIR (4 bands)

Radiative Cooler/ Earth Shield

DNB/VNIR (10 bands)

Focal Plane Electronics Readout & A/D Conversion

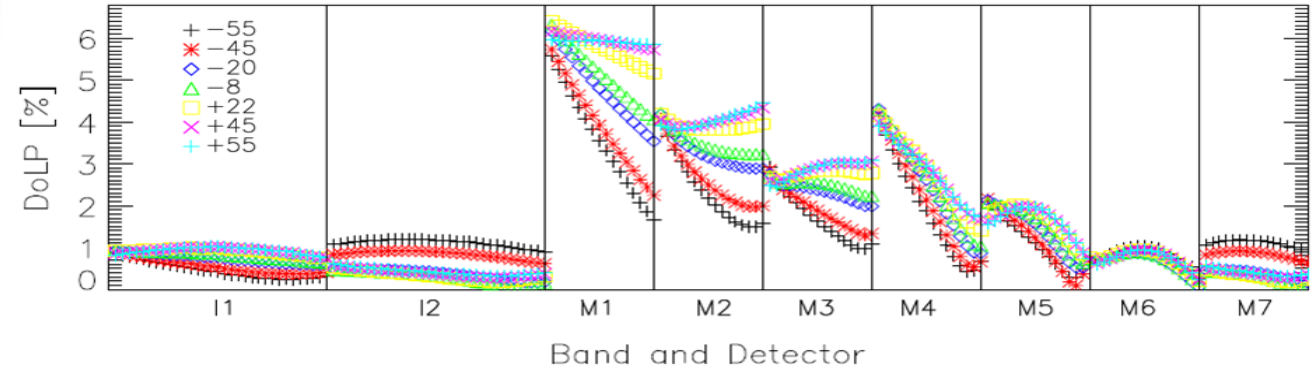
Formatter Buffer Compression

CCSDS Spacewire (SpW) Data

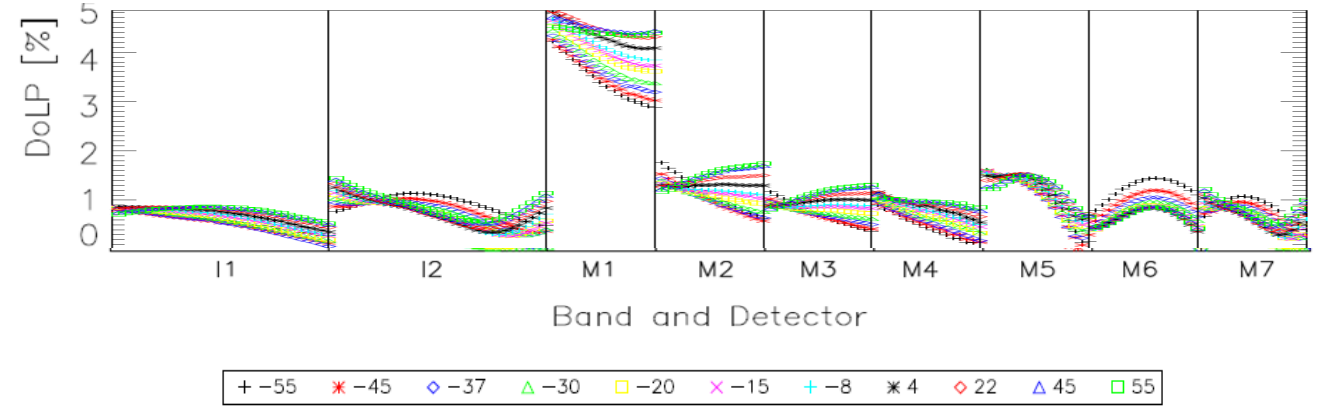
J2 Polarization Performance

- **JPSS-1 has shown non-compliance for 4 bands, M1-M4**
  - Root cause understood, a combination of filter and Dichroic effect
- **JPSS-2 has shown non-compliance for one band: M1**
  - Filter redesigned, but improved performance for on M2-M4, not M1

JPSS-1

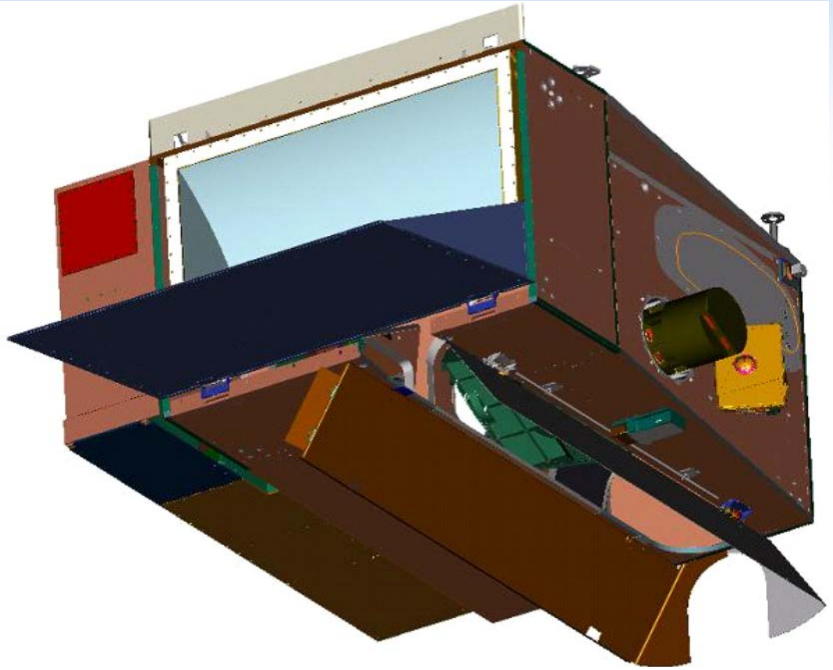


JPSS-2



VIIRS Flight Units

- 1st Flight Unit (S-NPP) – On-Orbit
  - Integrated onto BATC Spacecraft
  - Sumoi NPP (S-NPP) Satellite Mission
  - Launched October 2011
  - Delta-2 Rocket from Vandenburg AFB
- 2nd Flight Unit (J1) – Integrated to Bus
  - JPSS-1 Satellite Mission
  - Launch Date January 2017
  - Delta-2 Rocket from Vandenburg AFB
- 3rd Flight Unit (J2) – Subassembly Integrat
  - Currently at Component/Sub-System build
  - JPSS-2 Satellite Mission
  - Spacecraft built by Orbital
  - Launch Vehicle TBD

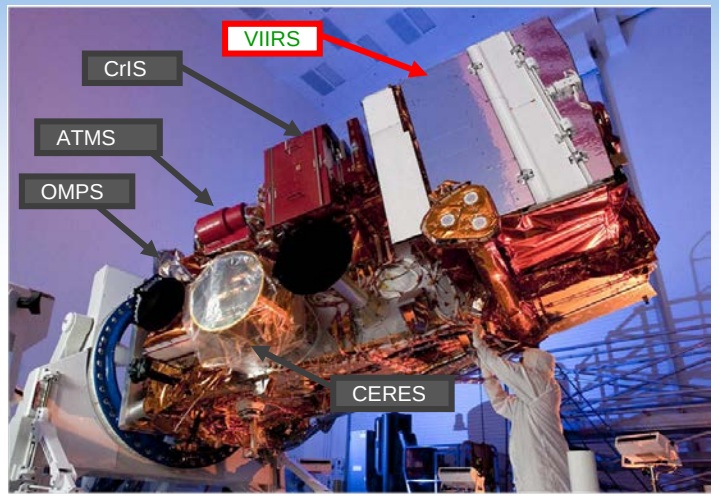


VisNIR Polarization Factor (%)

Band	Sensor	Scan Angle											Max Pol.	Spec
		-55	-45	-37	-30	-22	-15	-8	4	20	45	55		
I1	SNPP	1.5	1.24	~	~	0.93	~	0.85	~	0.7	0.64	0.62	**1.24**	2.5
	J1	0.81	0.74	0.75	0.73	0.73	0.79	0.76	0.8	0.82	0.85	0.85	**0.85**	2.5
I2	SNPP	0.29	0.27	~	~	0.34	~	0.37	~	0.47	0.51	0.51	**0.51**	3
	J1	0.73	0.62	0.54	0.47	0.36	0.37	0.37	0.43	0.5	0.61	0.66	**0.62**	3
M1	SNPP	2.99	2.63	~	~	1.95	~	1.79	~	1.42	1.21	1.4	**2.63**	3
	J1	5.13	5.26	5.35	5.52	5.54	5.56	5.65	5.7	5.66	5.51	5.37	**5.7**	3
M2	SNPP	2.11	1.97	~	~	1.63	~	1.53	~	1.28	1.17	1.29	**1.97**	2.5
	J1	3.72	3.79	3.85	3.95	3.9	3.89	3.94	3.95	3.9	3.99	4.04	**3.99**	2.5
M3	SNPP	1.2	1.14	~	~	0.9	~	0.82	~	0.61	0.7	0.8	**1.14**	2.5
	J1	2.89	2.85	2.83	2.85	2.73	2.69	2.68	2.63	2.62	2.8	2.84	**2.85**	2.5
M4	SNPP	1.05	1.1	~	~	1.19	~	1.16	~	1	0.88	0.84	**1.19**	2.5
	J1	3.61	3.9	4.08	4.16	4.17	4.22	4.18	4.18	4.04	3.89	3.8	**4.22**	2.5
M5	SNPP	1.19	1.02	~	~	0.85	~	0.84	~	0.76	0.73	0.69	**1.02**	2.5
	J1	1.9	1.86	1.9	1.86	1.82	1.85	1.79	1.83	1.81	1.8	1.8	**1.9**	2.5
M6	SNPP	0.99	0.96	~	~	0.94	~	0.94	~	0.88	0.82	0.76	**0.96**	2.5
	J1	1.62	1.32	1.13	0.99	0.86	0.85	0.79	0.75	0.73	0.75	0.76	**1.32**	2.5
M7	SNPP	0.17	0.19	~	~	0.25	~	0.28	~	0.38	0.42	0.41	**0.42**	3
	J1	0.73	0.62	0.54	0.46	0.36	0.36	0.32	0.39	0.45	0.55	0.6	**0.62**	3

- **Polarization using Broadband source was of high quality**
  - Uncertainty less than (0.4%), Repeatability within 0.13%
- **Polarization using Spectral source (T-SIRCUS): M1 and M4**
  - Agreement between Broadband and Spectral to within ~0.3 %
- **General agreement for high quality polarization testing**

VIIRS Integrate on J1 Spacecraft



- ✓ J1 VIIRS is the follow on sensor after SNPP VIIRS
- ✓ J1 VIIRS completed successfully its sensor level testing program
- ✓ Sensor Shipped from Raytheon to Ball (spacecraft) on 2/6/15
- ✓ Sensor installed on spacecraft on 2/20/15
- ✓ J1 VIIRS completed its initial ambient testing on 03/17/2015.
- ▪ J1 VIIRS TV testing (as-you-fly), expected June 2016.
- ▪ J1 VIIRS Launch Janaury 2017

J1 VIIRS Sensor Integration to Spacecraft and Initial Performance Trending were Completed Successfully

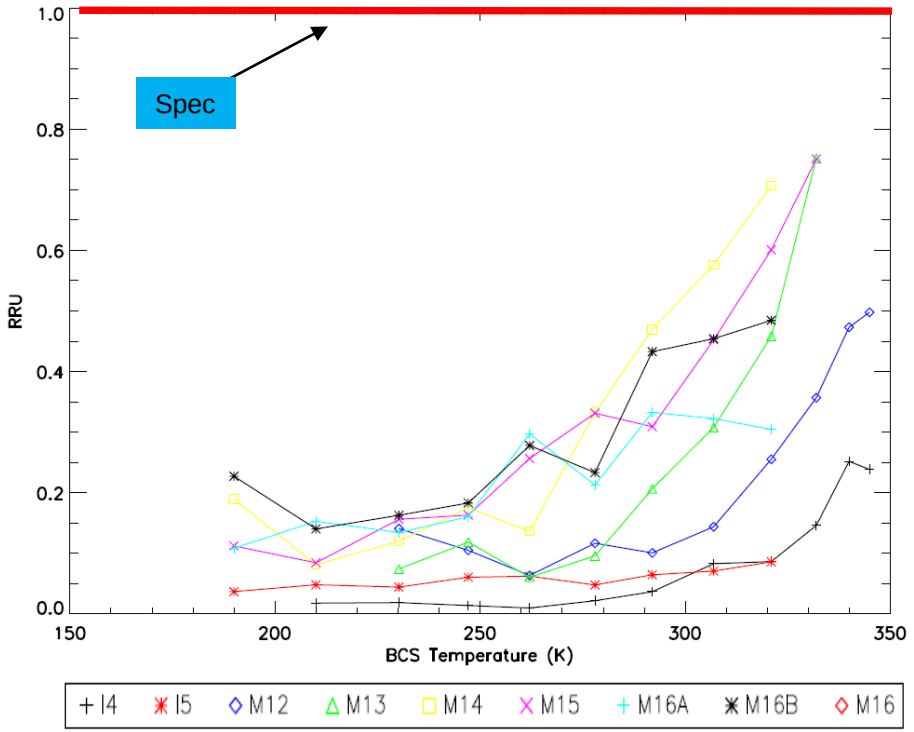
TEB Radiometric Performance

Absolute Radiometric Uncertainty (ARD): Nominal

ARD Performance (%)								
Temp (K)	I4	I5	M12	M13	M14	M15	M16A	M16B
190	~	~	~	~	0.68	0.29	0.17	0.25
230	~	~	7.60	2.95	0.11	0.07	0.08	0.04
267	0.48	0.10	~	~	~	~	~	~
270	~	~	0.24	0.15	0.08	0.05	0.04	0.04
310	~	~	0.25	0.17	0.11	0.06	0.03	0.04
340	~	~	0.27	0.18	0.09	0.05	0.03	0.03
ARD Specification (%)								
Temp (K)	I4	I5	M12	M13	M14	M15	M16A	M16B
190	~	~	~	~	12.30	2.10	1.60	1.60
230	~	~	7.00	5.70	2.40	0.60	0.60	0.60
267	5.00	2.50	~	~	~	~	~	~
270	~	~	0.70	0.70	0.60	0.40	0.40	0.40
310	~	~	0.70	0.70	0.40	0.40	0.40	0.40
340	~	~	0.70	0.70	0.50	0.40	0.40	0.40

J1 ARD requirements met with margins

Uniformity – Det. Striping Nominal



- **J1 TEB calibration shows very good performance for ARD and uniformity (striping).**
  - **ARD is below ~0.3 % except at low temperatures for the MWIR (as expected).**
  - **Detector-to-detector uniformity shows some small potential for striping at high temperatures in bands M12 – M14 (similar to SNPP).**

T-SIRCUS Polarization Measurements

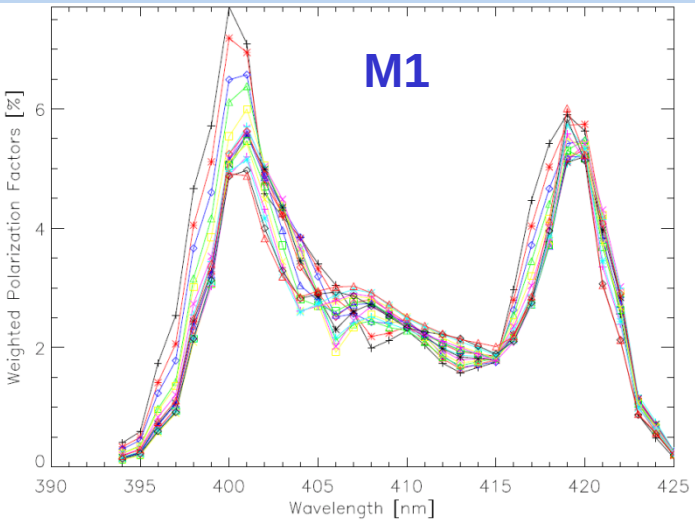
T-SIRCUS polarization measurements were performed in December 2014.

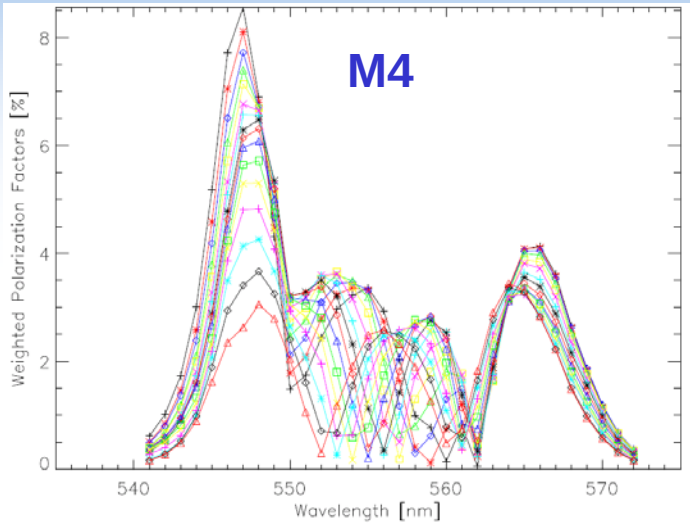
Limited number of measurements made in terms of scan angle, HAM side, and wavelength.

FRED model data compared to measurement results:

1) Good agreement on general shape of wavelength dependence
2) Largest contributor to the polarization sensitivity comes from the edges of the bandpass
3) Some phase shifts in the center of M4 bandpass unexplained by model

Measurement





FRED model