

Status of VIIRS on NPP/NPOESS

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and the NPP/NPOESS team*

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Mission Success

The NPP Mission Success is determined by its capabilities

- *to provide continuation of a group of earth system observations initiated by the Earth Observing System (EOS) Terra, Aqua and Aura missions and*
- *by its ability to reduce the risks associated with its advance observational capabilities as they are being transitioned from the NASA research program into the NPOESS operational program in support of both the Department of Defense (DoD) and NOAA*
 - ✓ **These include pre-operational risk reduction demonstration and validation for selected NPOESS instruments, and algorithms, as well as ground data processing, archive and distribution.**



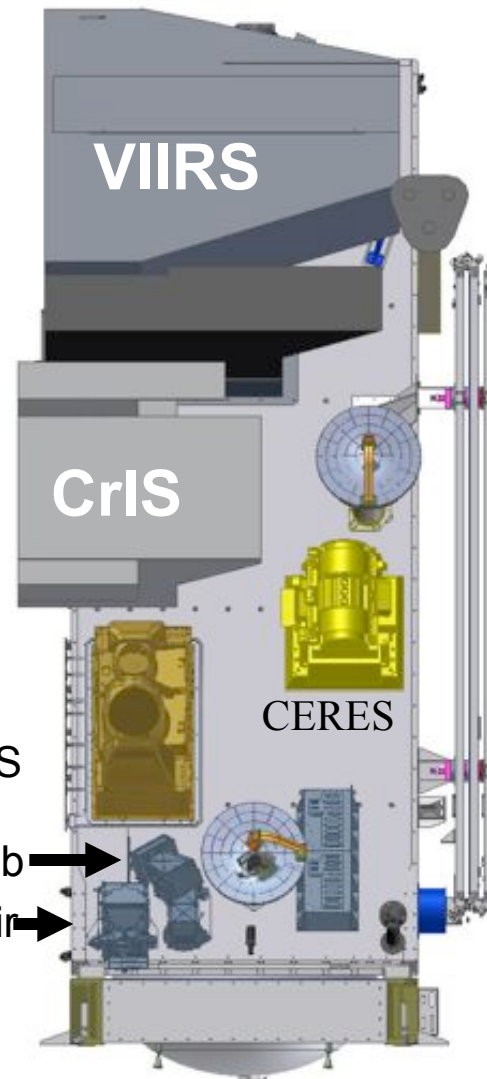
What instruments are on NPP?

**VIIRS – Medium resolution
Visible & Infra-red Imager**

**CrIS – Fourier Transform
Spectrometer for IR
Temperature and
Moisture sounding**

**ATMS – Microwave
sounding radiometer**

**OMPS – Total Ozone
Mapping and
Ozone Profile
measurements**



**CERES – Earth
Radiation
Budget
measurements**

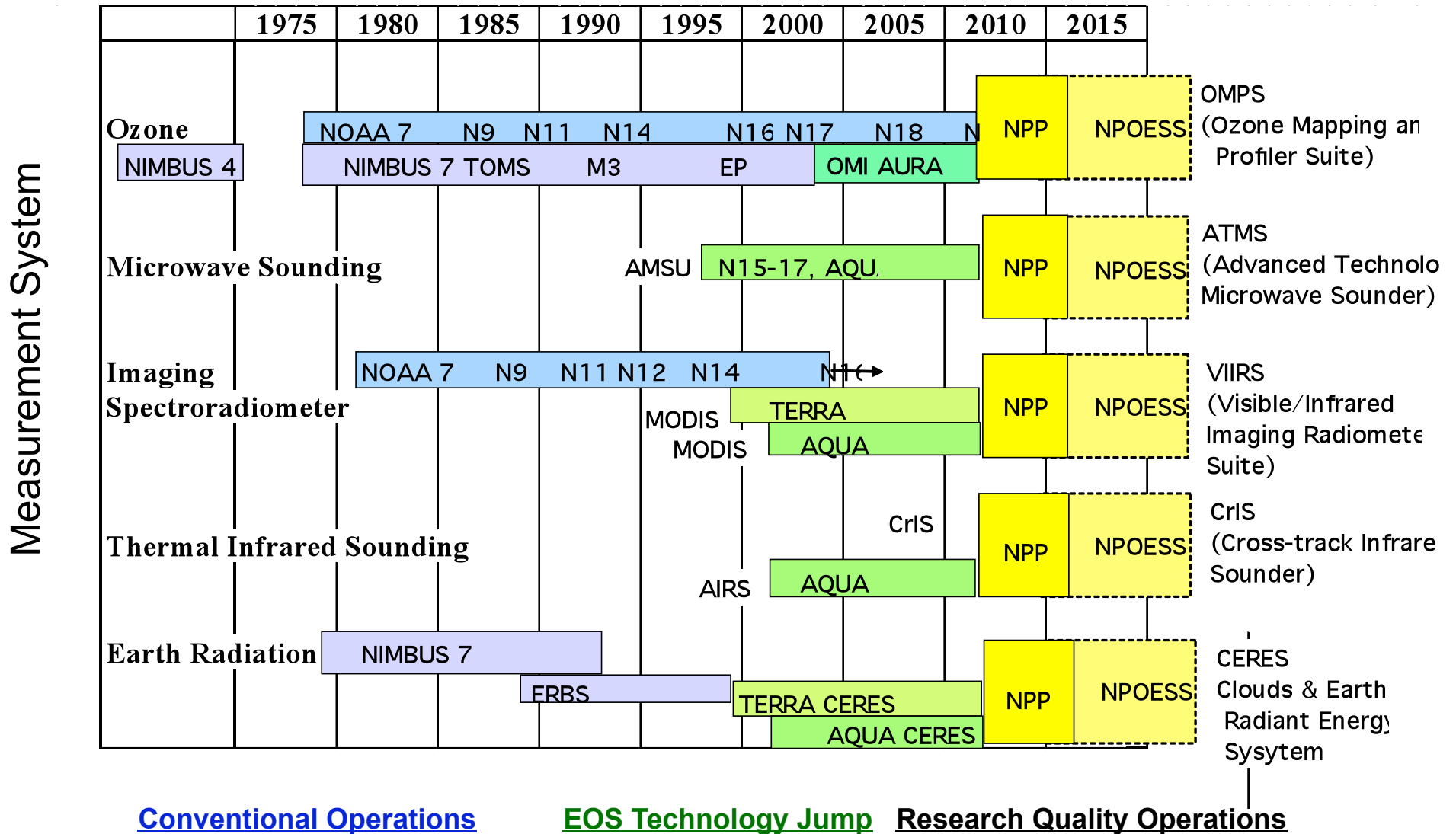


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NPP Continues Data Time Series

Year



VIIRS Bands and Products

VIIRS 22 Bands:

16 M_Band, 5 I_Band and 1 DNB

VIIRS Band	Spectral Range (um)	Nadir HSR (m)	MODIS Band(s)	Range	HSR
DNB	0.500 - 0.900				
○ M1	0.402 - 0.422	750	8	0.405 - 0.420	1000
○ M2	0.436 - 0.454	750	9	0.438 - 0.448	1000
○ M3	0.478 - 0.498	750	3 10	0.459 - 0.479 0.483 - 0.493	500 1000
○ M4	0.545 - 0.565	750	4 or 12	0.545 - 0.565 0.546 - 0.556	500 1000
I1	0.600 - 0.680	375	1	0.620 - 0.670	250
○ M5	0.662 - 0.682	750	13 or 14	0.662 - 0.672 0.673 - 0.683	1000 1000
M6	0.739 - 0.754	750	15	0.743 - 0.753	1000
I2	0.846 - 0.885	375	2	0.841 - 0.876	250
○ M7	0.846 - 0.885	750	16 or 2	0.862 - 0.877 0.841 - 0.876	1000 250
M8	1.230 - 1.250	750	5	SAME	500
M9	1.371 - 1.386	750	26	1.360 - 1.390	1000
I3	1.580 - 1.640	375	6	1.628 - 1.652	500
M10	1.580 - 1.640	750	6	1.628 - 1.652	500
M11	2.225 - 2.275	750	7	2.105 - 2.155	500
I4	3.550 - 3.930	375	20	3.660 - 3.840	1000
M12	3.660 - 3.840	750	20	SAME	1000
○ M13	3.973 - 4.128	750	21 or 22	3.929 - 3.989 3.929 - 3.989	1000 1000
M14	8.400 - 8.700	750	29	SAME	1000
M15	10.263 - 11.263	750	31	10.780 - 11.280	1000
I5	10.500 - 12.400	375	31 or 32	10.780 - 11.280 11.770 - 12.270	1000 1000
M16	11.538 - 12.488	750	32	11.770 - 12.270	1000

VIIRS 24 EDRs

Land, Ocean, Atmosphere, Snow

Name of Product	Group	Type
Imagery *	Imagery	EDR
Precipitable Water	Atmosphere	EDR
Suspended Matter	Atmosphere	EDR
Aerosol Optical Thickness	Aerosol	EDR
Aerosol Particle Size	Aerosol	EDR
Cloud Base Height	Cloud	EDR
Cloud Cover/Layers	Cloud	EDR
Cloud Effective Particle Size	Cloud	EDR
Cloud Optical Thickness/Transmittance	Cloud	EDR
Cloud Top Height	Cloud	EDR
Cloud Top Pressure	Cloud	EDR
Cloud Top Temperature	Cloud	EDR
Active Fires	Land	Application
Albedo (Surface)	Land	EDR
Land Surface Temperature	Land	EDR
Soil Moisture	Land	EDR
Surface Type	Land	EDR
Vegetation Index	Land	EDR
Sea Surface Temperature *	Ocean	EDR
Ocean Color and Chlorophyll	Ocean	EDR
Net Heat Flux	Ocean	EDR
Sea Ice Characterization	Snow and Ice	EDR
Ice Surface Temperature	Snow and Ice	EDR
Snow Cover and Depth	Snow and Ice	EDR

○ Dual gain band

* Product has a Key Performance attribute



VIIRS Spectral and Radiometric Preliminary Performance Derived from Cold TV testing

Reflective Bands													
Band ID		Center Wavelength (nm)		Bandwidth (nm)		L _{typ}		L _{max}		L _{sat}		SNR at L _{typ} , Nadir	
MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS
---	DNE	---	700*	---	400*								
B8	M1H	412	412*	12	20*	44.9	44.9	175	135	195.0	120.0	950	1283
B9	M2H	442	445*	10	18*	41.9	40.0	133	127	140.0	136.0	1167	1028
B10	M3H	487	488*	11	20*	32.1	32.0	101	107	107.0	124.0	1099	1115
B12	M4H	547	555*	10	20*	21.0	22.0	64	78	66.7	87.4	998	976
B13, B14	M5H	667, 677	672*	10, 11	20*	9.5, 8.7	10.0	32, 31	59	33.9, 32.8	61.0	677, 718	606
B15	M6	746	746*	10	15*	10.2	9.6	26	41	27.9	49.2	753	703
B16	M7H	866	865*	16	39*	6.2	6.4	16	29	27.4	23.0	713	927
B5	M8	1242	1238	25	26	5.4	5.4	110	165	96.1	132.0	148	480
B26	M9	1382	1374	36	14	6	6.0	90	77	96.0	85.5	231	449
B6	M10	1629	1599	30	59	7.3	7.3	70	71	69.2	78.0	483	1097
B7	M11	2114	2255	53	46	1	0.12	22	32	20.50	40.00	62	29
B1	I1	647	640	42	80	21.8	22.0	685	718	733.1	768.0	175	423
B2	I2	857	865	39	39	24.7	25.0	285	349	254.8	350.0	430	541
B6	I3	1629	1600	30	59	7.3	7.3	70	73	69.2	73.0	403	281

B8	M1L	412	412*	12	20*	44.9	155.0	175	615.0	195.0	694.0	950	2116
B9	M2L	442	445*	10	18*	41.9	146.0	133.0	687.0	140.0	845.0	1167	1889
B3	M3L	466	488*	18	20*	29	123.0	593.0	702.0	623.0	912.0	1318	1876
B4	M4L	554	555*	20	20*	29.0	90.0	518.0	667.0	542.0	867.0	362	1689
B13, B14	M5L	667, 677	672*	10, 11	20*	9.5, 8.7	68.0	32, 31	651.0	33.9, 32.8	703.0	677, 718	1420
B16	M7L	866	865*	16	39*	6.2	33.4	16.0	349.0	27.4	350.0	713	1918

- All VIIRS bands meet SNR requirements (overall, VIIRS SNR is better than MODIS)
- All VIIRS bands meet dynamic Range except:
 - M1 High Gain transition to Low Gain before L_{max}
 - M8 saturation observed before L_{max}
 - I2-I3 Dynamic range met specification without enough margin

* Performance not yet available. These are specification values.

Values in orange: Dual gain bands M1-M5 and M7 are expected to transition to Low gain at L_{sat}

VIIRS Spectral and Radiometric Preliminary Performance Derived from Cold TV testing

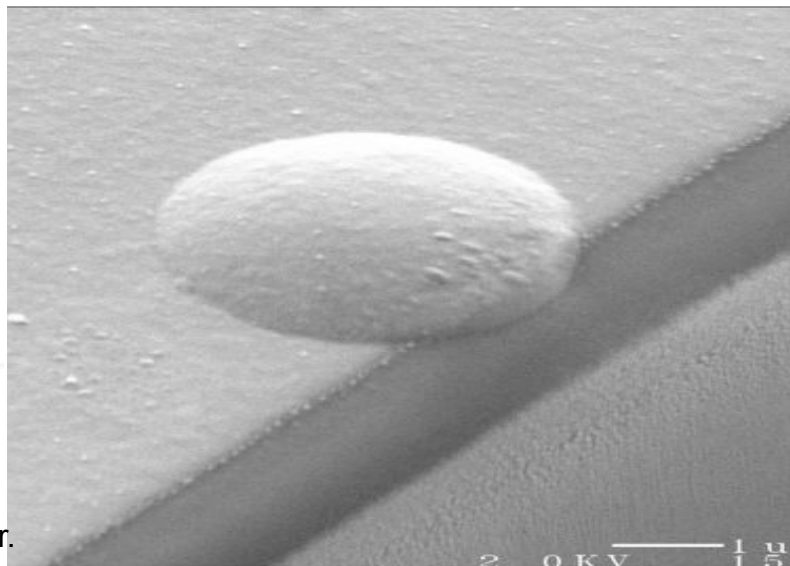
Emissive Bands													
Band ID		Center Wavelength (nm)		Bandwidth (nm)		Ttyp		Tmax		Lsat		NeΔT at Ltyp/Nadir	
MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS	MODIS	VIIRS
B20	M12	3788	3700	183	192	300	270	335	353	337	347	0.027	0.0595
B23	M13H	4057	4050	88	158	300	300	328	343	330	364	0.025	0.0237
B29	M14	8524	8550	369	341	300	270	324	336	330	345	0.02	0.0346
B31	M15	11014	10763	510	1014	300	300	324	343	392	365	0.026	0.0162
B32	M16	12028	12013	494	919	300	300	324	340	386	366	0.039	0.0208
B20	I4	3788	3740	183	380	300	270	335	353	337	347	0.027	0.2021
B31, B32	I5	11014, 12028	11450	510, 494	1882	300, 300	210	324, 324	340	392, 386	380	0.026, 0.039	0.2113
B21	M13L	3992	4050	86, 88	158	335	380.0	500	634.0	479	---	0.155	---

- All VIIRS bands meet NeΔT requirements
- All VIIRS Emissive bands meet dynamic range except:
 - I4 and M12 saturate slightly lower than Lmax
 - M13L will be measured at Hot Performance plateau, right after Nominal plateau.

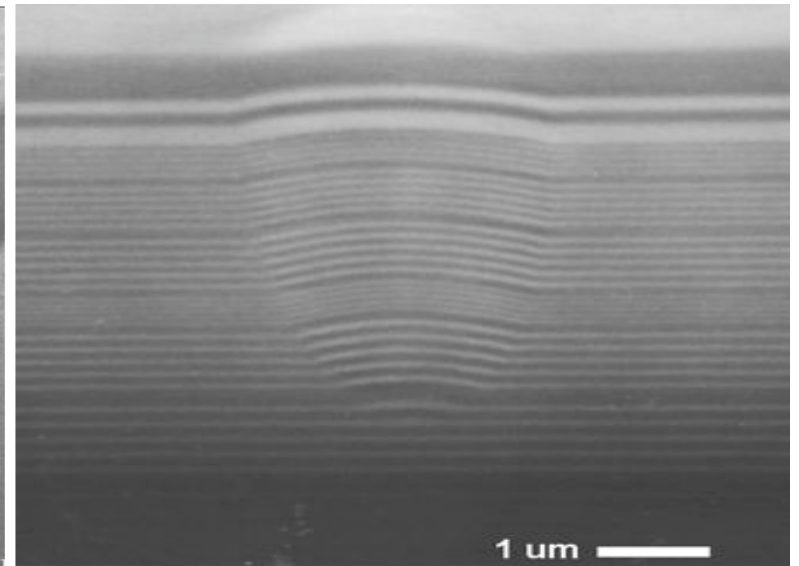
Dominant VISNIR Xtalk

- **Optical:** linear with signal, spectral and spatial component. Believed to be largely due to filter defects.
- Magnitude primarily depends on number of defects in spectral filters ('spits'). Defects cause large angle scattering

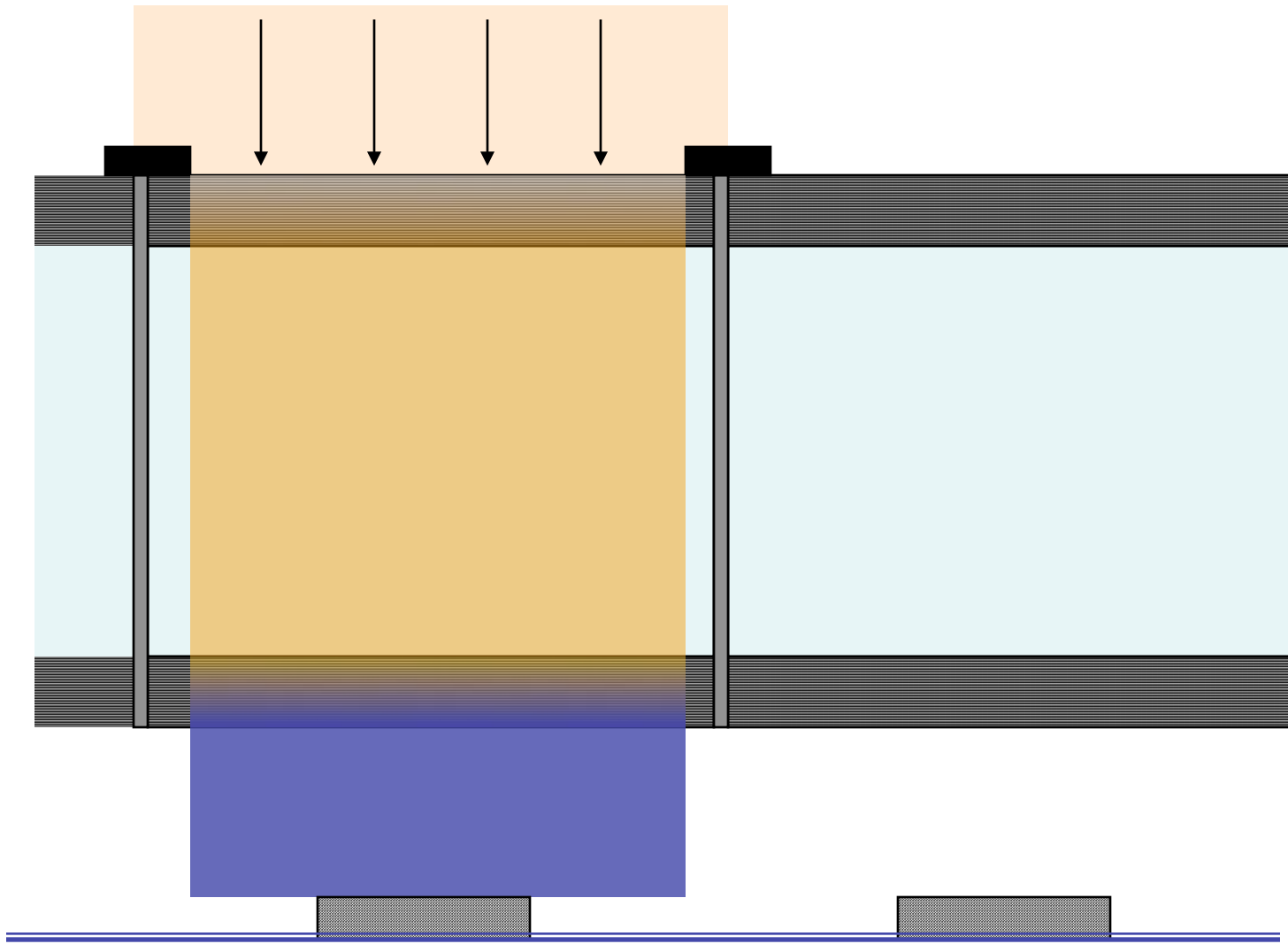
Micrograph
of a spit in
cross-
section



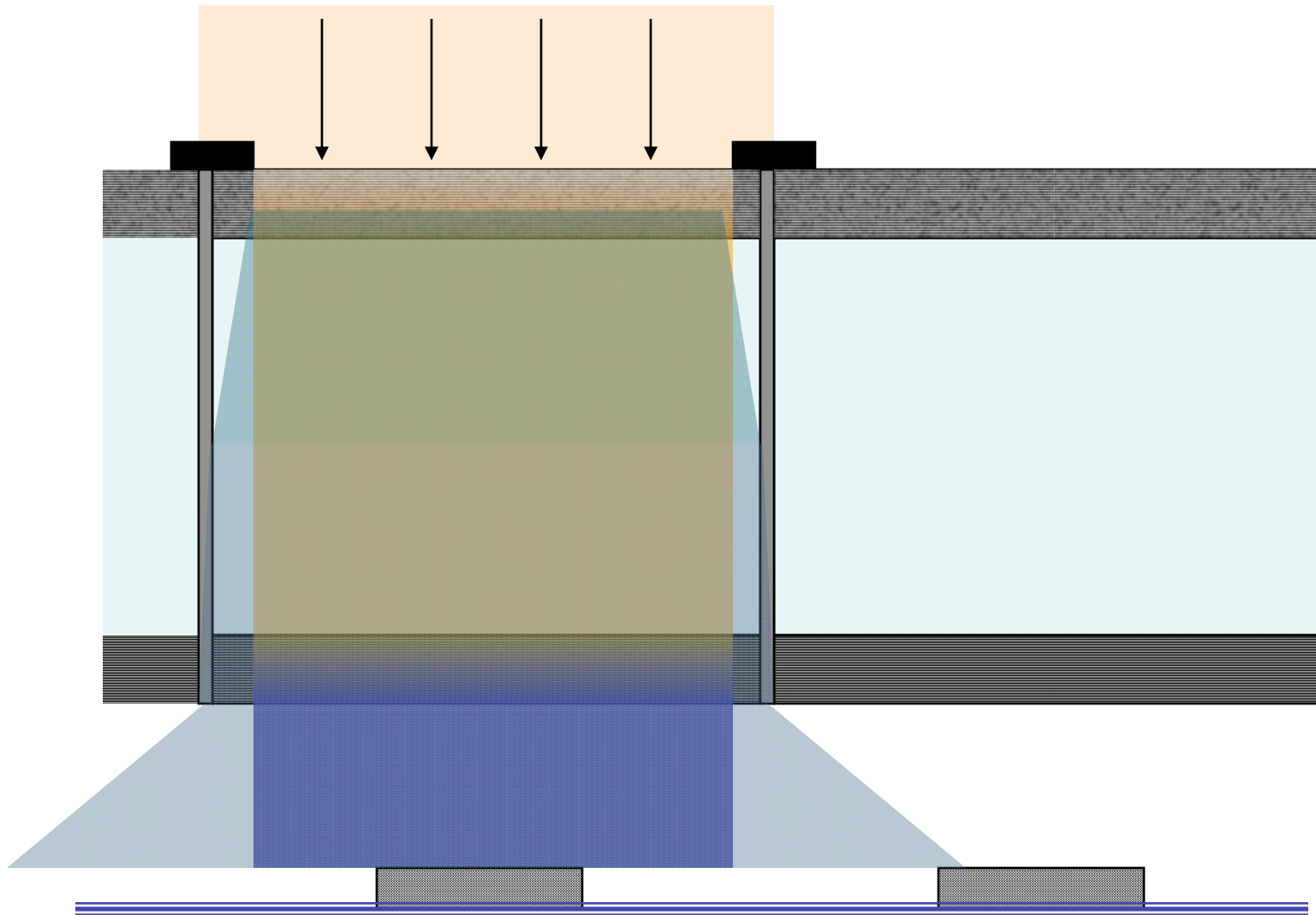
Courtesy: Aerospace
Corp and Chris Moeller.



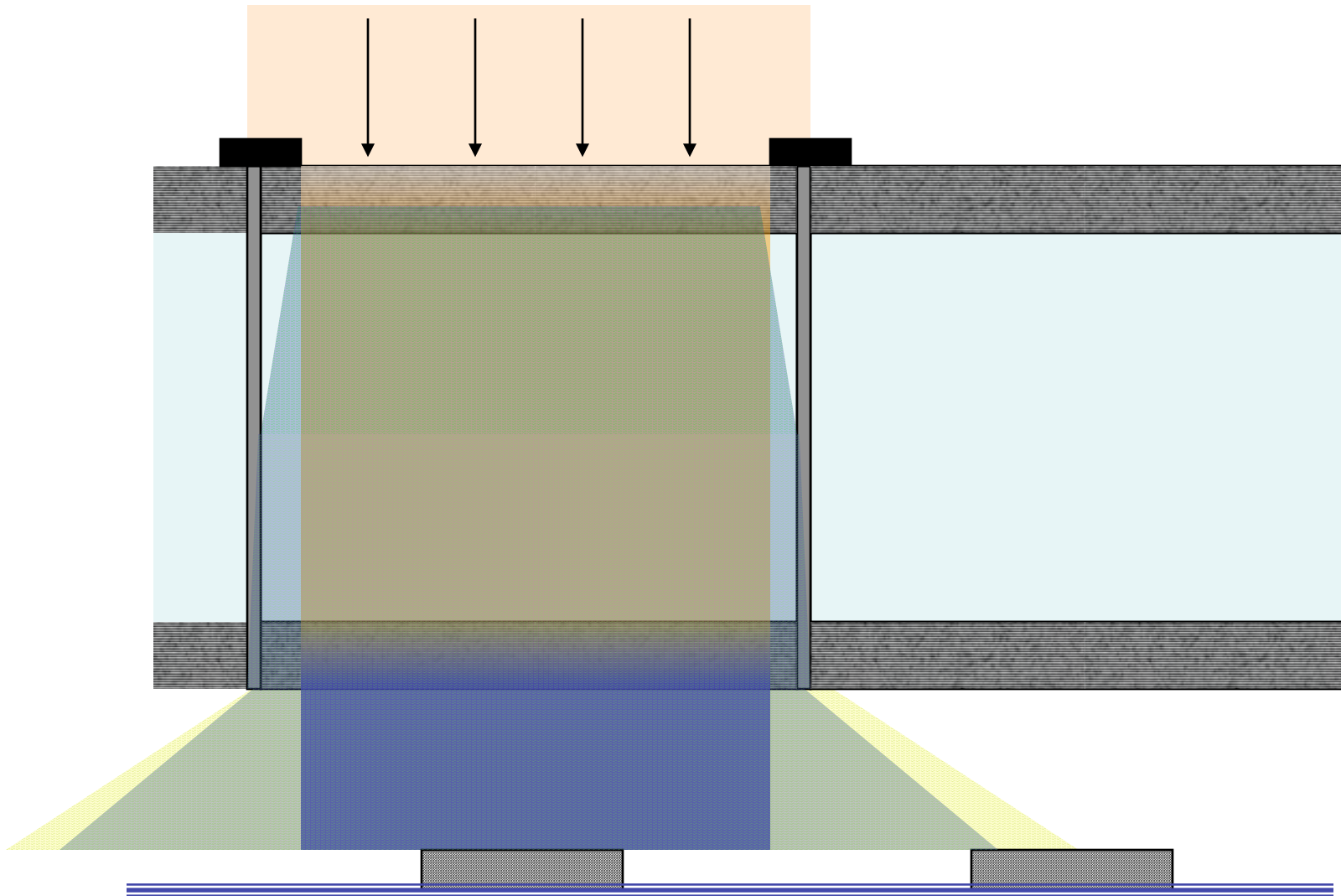
Ideal Filtering



Quality of Coatings, Top of IFA



Quality of Coatings, Bottom of IFA



From XtalkTim5_Mills.ppt by Steve Mills (NGST); Courtesy: Chris Moeller.

Crosstalk Non-Compliances from FP-15

		Sender Band																																							
		M1	M2	M3	M4	M5	M6	M7	M8	M8	M9	M9	M10	M10	M11	M11	M12	M12	M13	M13	M14	M14	M15	M15	M16A	M16A	M16B	M16B	I1	I2	I3	I3	I4	I4	I5	I5					
Receiver Band	M1	X																																							
	M2	Red	X																																						
	M3			X																																					
	M4				X																																				
	M5					X																																			
	M6						X																																		
	M7							X																																	
	M8								X	X																															
	M9									Red	Red	X	X																												
	M10													X	X																										
	M11														Red	Red	X	X																							
	M12																	X	X																						
	M13																		X	X																					
	M14																				X	X																			
	M15																						X	X																	
	M16A																									X	X														
	M16B																											X	X												
	I1 S1																																								
	I1 S2																																								
	I2 S1																																								
	I2 S2																																								
	I3 S1																																								
	I3 S2																																								
	I4 S1																																								
	I4 S2																																								
	I5 S1																																								
	I5 S2																																								

Red = Positive crosstalk exceeding the requirement

Blue = Negative crosstalk exceeding the requirement

Solid = all detectors, Lines = some detectors

Light Grey = unavailable due to band substitution



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January 27, 2010
NASA/GSFC



Crosstalk Non-Compliances from FP-16

		Sender Band																																										
		M1	M2	M3	M4	M5	M6	M7	M8	M8	M9	M9	M10	M10	M11	M11	M12	M12	M13	M13	M14	M14	M15	M15	M16A	M16A	M16B	M16B	I1	I2	I3	I3	I4	I4	I5	I5								
Receiver Band	M1	X																																										
	M2		X																																									
	M3			X																																								
	M4				X																																							
	M5					X																																						
	M6						X																																					
	M7							X																																				
	M8								X	X																																		
	M9									X	X																																	
	M10											X	X																															
	M11												X	X																														
	M12													X	X																													
	M13														X	X																												
	M14																X	X																										
	M15																		X	X																								
	M16A																				X	X																						
	M16B																											X	X															
	I1 S1																																											
	I1 S2																																											
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I3 S1																																												
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I4 S1																																												
I4 S2																																												
I5 S1																																												
I5 S2																																												

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Preliminary Results of VIIRS Xtalk effects on Aerosol EDR Performance

- *The final xtalk influence coefficients from NICST are still in progress.*
- *However, based upon the preliminary assessments of xtalk impact on SDR (i.e., reflectance), there is a good probability to continue the MODIS aerosol data records.*



Summary

- **The primary objective of the NPP mission is to provide continuation of the EOS data records.**
- **According to the preliminary results of VIIRS TV testing, aerosol products have higher probability to achieve the mission goal.**
- **The current targeted launch date for NPP is September 2011. These NPP/NPOESS products could be complementary to the ACE mission, in terms of providing global daily coverage of aerosol and cloud data sets.**

