Section 8

Science Validation Process

Science Validation Team

- ***Instrument Team***
  - *Validate/re-establish and refine pre-launch characterizations*
  - *Provide technology validation*
  - *Participate on Science Validation Team*
- ***NASA Selected Investigators***
  - *Conduct scene based instrument performance characterizations*
  - *Measure ability of instruments to make Landsat-like observations*
  - *Assess capability for addressing earth remote sensing applications*
  - *Assist in technology validation*
  - *Facilitate Commercial Applications (CRSP/SSC)*
- ***International Collaborators***
  - *Argentina, Australia, Canada, Italy, Japan, Singapore*

If scientists supply accurate and reliable information, policy makers can make intelligent and responsible decisions to preserve an acceptable quality of life for our children and grandchildren.

Characterization & Validation

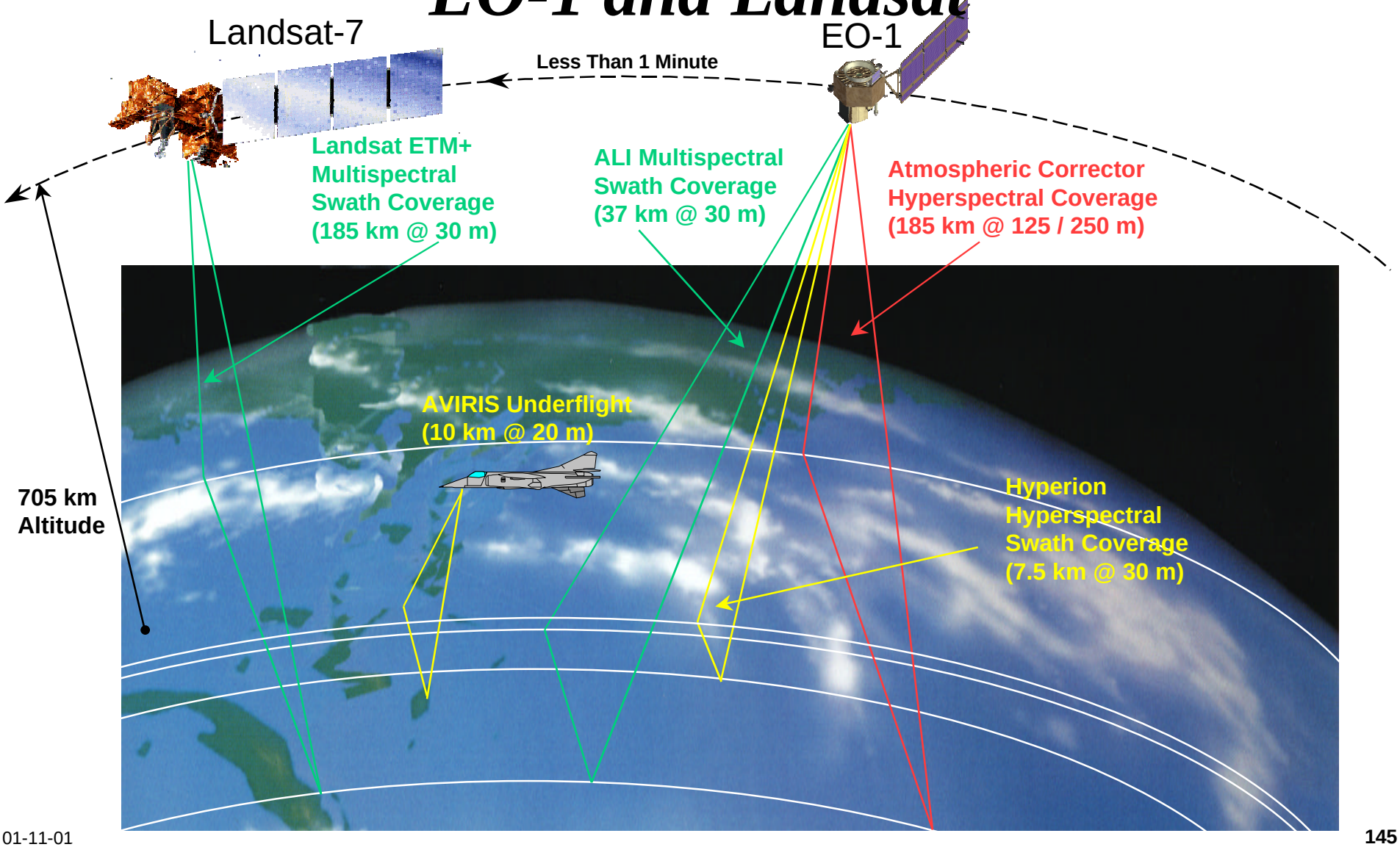
- ***Characterization*** *quantitatively describes how the three EO-1 instruments respond to incident radiation (light) under a variety of operating conditions.*

- ***Validation*** *assesses the EO-1 instrument measurements by comparing them against ground "truth". We also assess performance.*

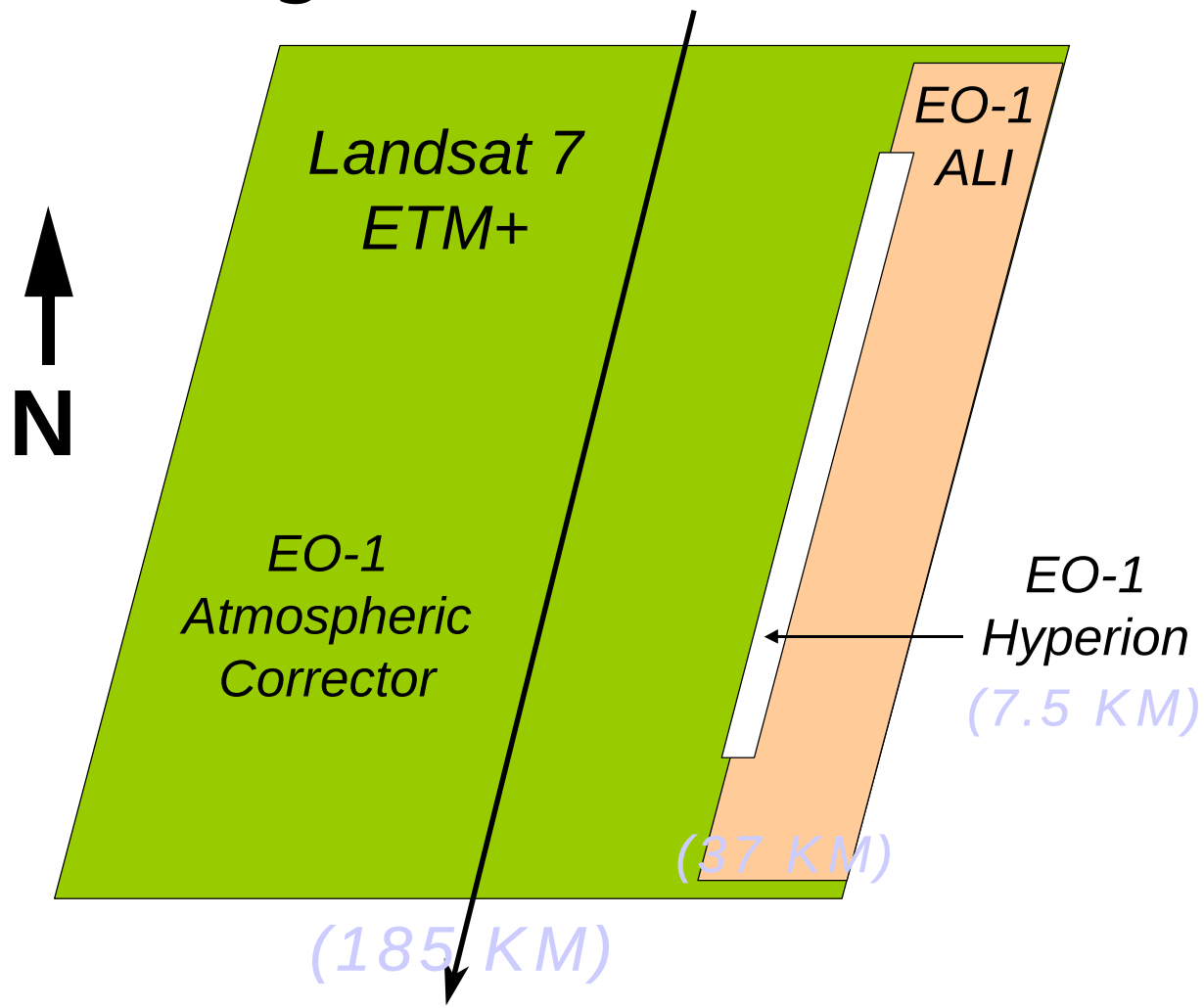
What's So Exciting About Calibration?

- ***Calibration is the stuff you do to insure accurate and repeatable measurements with the EO-1 instruments Ho hum!***
- ***Calibration can be used to provide a common basis for inter-comparing global measurements across a variety of earth satellite observing systems with profound ramifications!***

EO-1 and Landsat



EO-1 and Landsat 7 Descending Orbit Ground Tracks



EO-1 Instrument Overviews

Parameters	Landsat 7 ETM+	EO-1 ALI Multispectral	EO-1 HYPERION	EO-1 AC
Spectral Range	0.4 - 2.4 µm *	0.4 - 2.4 µm	0.4 - 2.5 µm	0.9 - 1.6 µm
Spatial Resolution	30 m	30 m	30 m	250 m
Swath Width	185 Km	37 Km	7.5 Km	185 Km
Spectral Resolution	Variable	Variable	10 nm	3 - 9 nm **
Spectral Coverage	Discrete	Discrete	Continuous	Continuous
Pan Band Resolution	15 m	10 m	N/A	N/A
Total Number of Bands	7	10	220	256

** Excludes thermal channel*
*** 35 cm^{-1} constant resolution*

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Hyperspectral Analysis derives from the use of contiguous spectral channels, allowing the use of derivatives and sophisticated analysis techniques. The large number of bands allows more complex systems to be addressed without the under sampling inherent in multispectral systems.

Investigator Research Topics

Research Topic	*Principal Investigator*
Forest Logging in Amazonia	***Asner, G. P.,*** *University of Colorado*
Desertification	***Asner, G. P.,*** *University of Colorado*
Forest Composition & Function	***Martin, M.,*** *University of New Hampshire*
Inter-Sensor Calibration	***Huete, A. R.,*** *University of Arizona, Tucson*
Arid Vegetation Abundance	***Mustard, J. F.,*** *Brown University.*
Tropical Forest Burn Scars	***Liew, S. C.,*** *National University of Singapore*
Forest Composition/Structure	***Townsend, P. A.,*** *University of Maryland*
Land Cover/Land Use	***White, W. A.,*** *University of Texas at Austin*
Sustainable Forest Development	***Goodenough, D. G.,*** *Natural Resources Canada*
Monitoring Forest & Rangeland	***Gong, P.,*** *University of California, Berkeley*
Non-Native Plant Species	***McGwire, K.*** *Desert Research Institute*

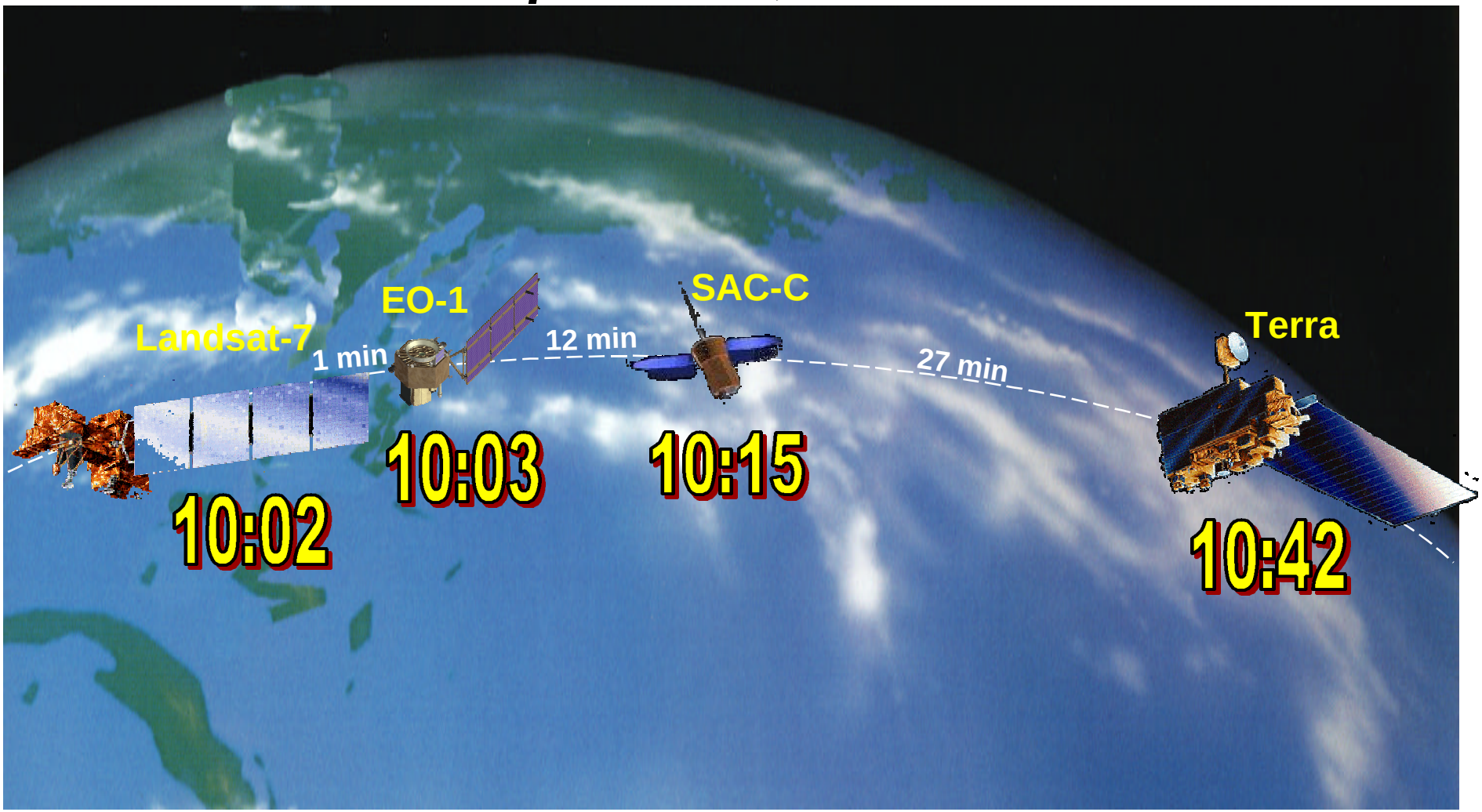
Investigator Research Topics *(continued)*

Research Topic	*Principal Investigator*
Invasive Plants: Chinese Tallow	***Ramsey III, E. W.,*** *USGS, Denver*
Invasive Leafy Spurge	***Root, R.,*** *USGS*
Agricultural Monitoring	***Liang, S.,*** *USDA, Maryland*
Inter-Satellite Comparison	***Moran, M. S.*** *USDA, Tucson, Arizona.*
Fire Hazard Assessment	***Roberts, D. A.,*** *University of California, Santa Barbara*
Geologic Validation of Hyperion	***Kruse, F. A.,*** *AIG, Boulder, Colorado*
Volcanic Debris flow Hazards	***Crowley, J. K.,*** *USGS, Reno, Nevada*
Analysis of Hot Spots	***Flynn, L.,*** *University of Hawaii.*
Environmental Monitoring of Coastal/Inland Water in Japan	***Matsunaga, T.,*** *Tokyo Institute of Technology.*
Oceanography, Pollution and Urban Mapping	***Abrams, M. J.,*** *JPL, California;* ***R. Bianchi and L. Alberotanza,*** *NRC, Italy.*
Glaciological Applications	***Bindschadler, R.,*** *NASA/GSFC, Maryland*

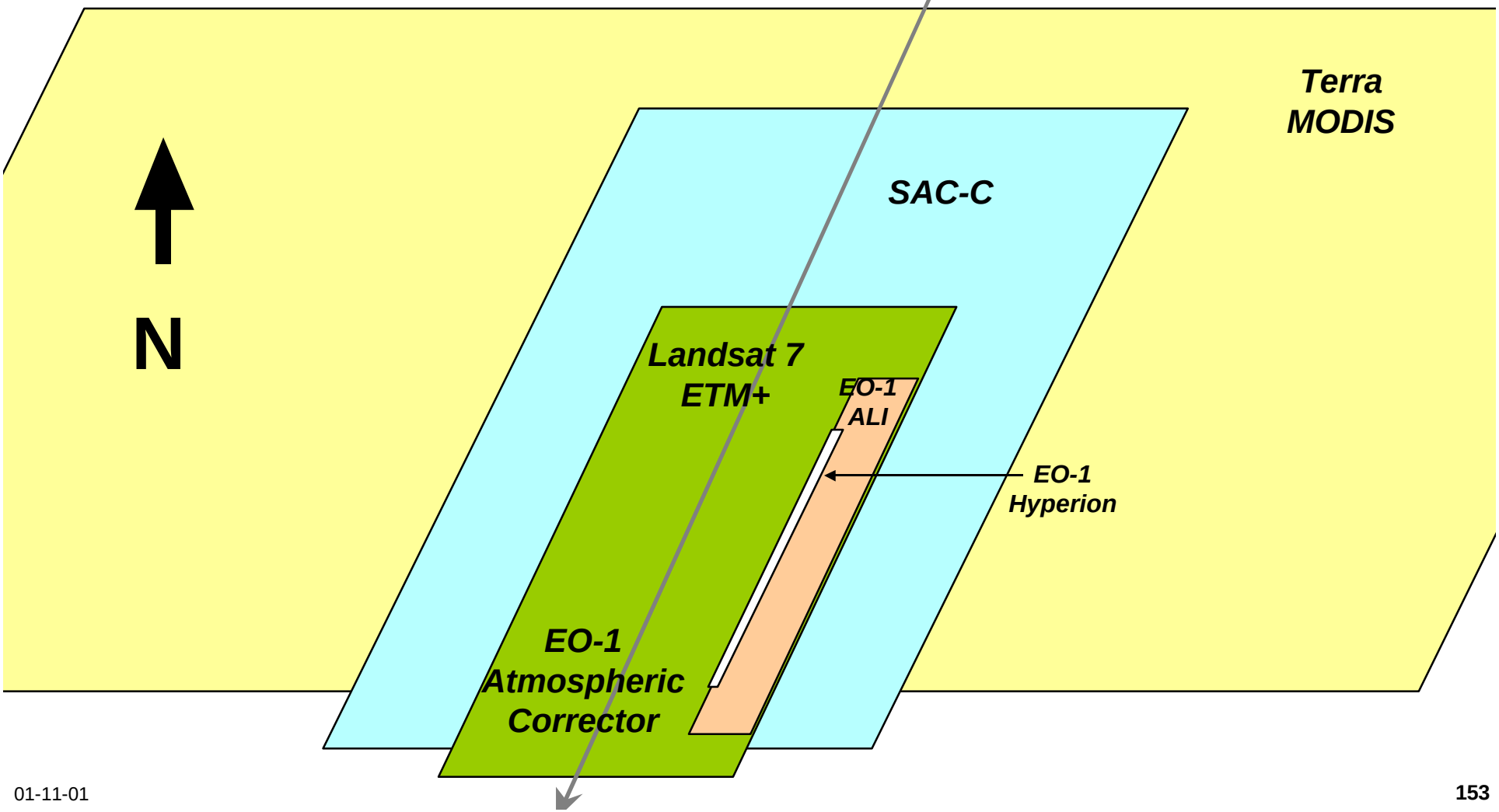
Investigator Research Topics *(continued)*

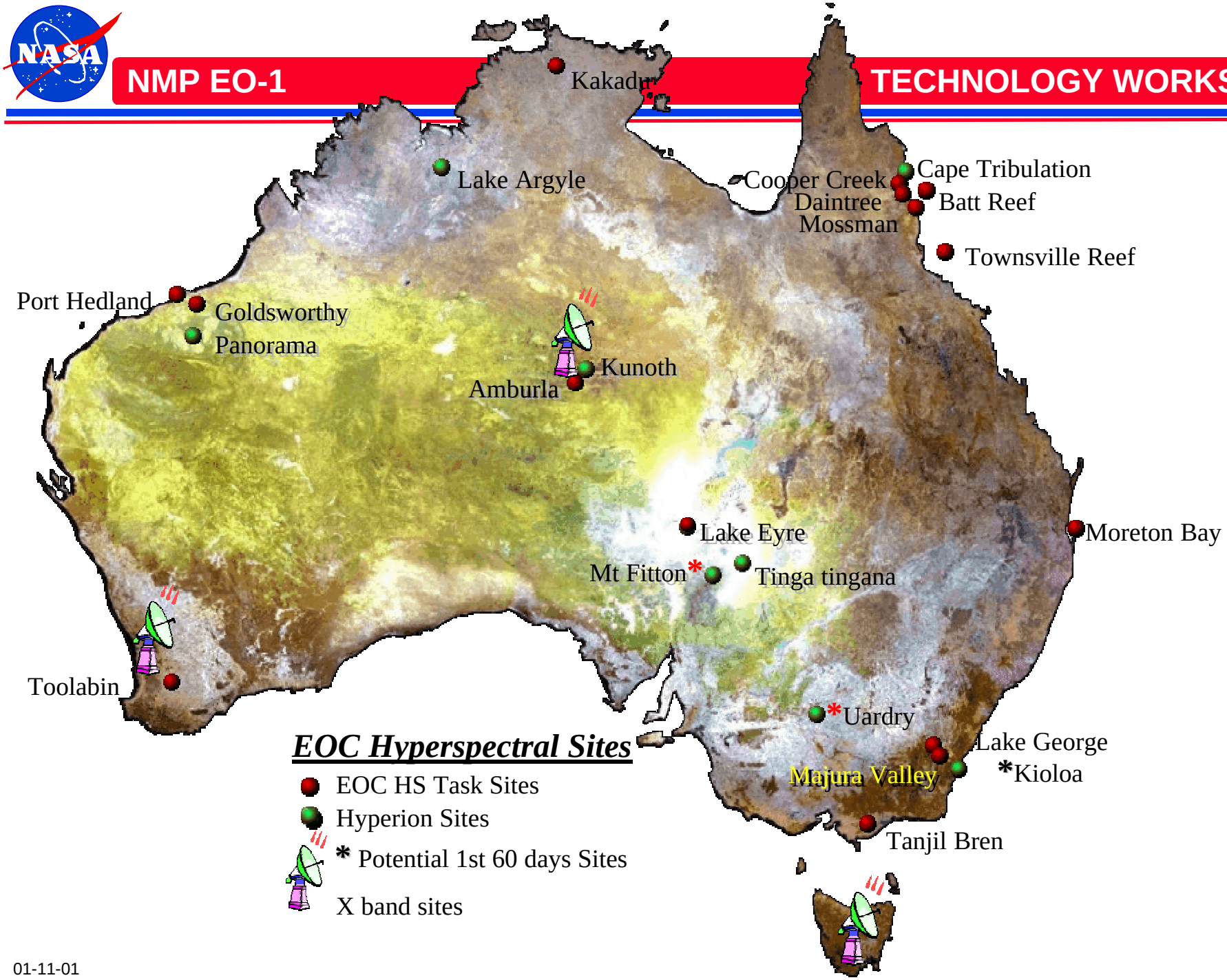
Research Topic	*Principal Investigator*
Ecological Applications in Yellowstone National Park	***Boardman, J. W., AIG,*** *Colorado*
Commercial Applications	***Cassady, P. E.,*** *Boeing, Washington*
Radiometric and Spatial Evaluation of ALI and Hyperion	***Biggar, S. F.,*** *University of Arizona*
Atmospheric Correction	***Carlson, B. E.,*** *NASA /GISS, New York*
Atmospheric Correction and Sparse Vegetation Mapping	***Goetz, A. F. H.,*** *University of Colorado*
Australian Hyperspectral Calibration and Validation Sites	***Jupp, D. L. B.,*** *CSRIO, Australia*
Integrated Assessment of EO-1 and Landsat Instrument Suites	***Meyer, D. J.,*** *EDC, South Dakota*
Canopy Temperature Estimation	***Smith, J. A.,*** *NASA GSFC, Maryland*
Lunar Calibration	***Kieffer, H.,*** *USGS, Flagstaff, AZ*

The EOS AM Constellation Alignment for March, 2001



AM Constellation Descending Orbit Ground Tracks

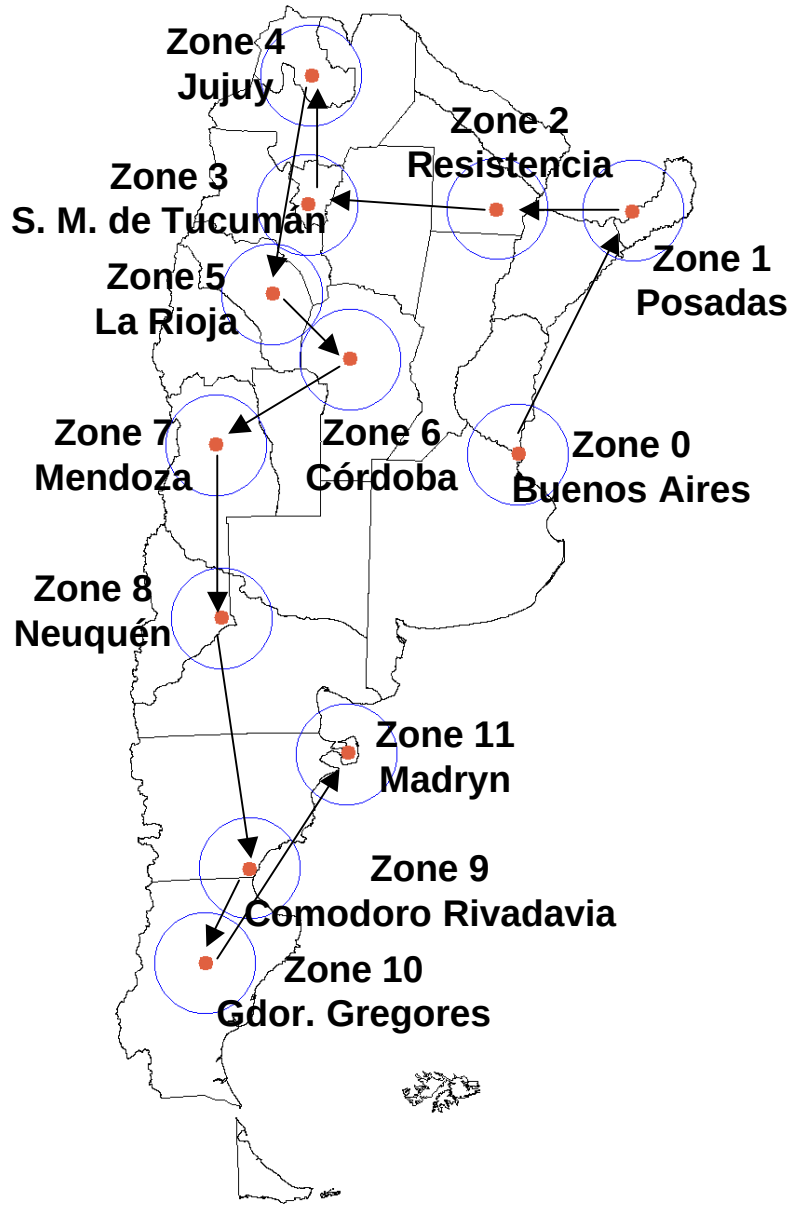



Kakadu
Lake Argyle
Cooper Creek
Cape Tribulation
Daintree
Batt Reef
Mossman
Townsville Reef
Port Hedland
Goldsworthy
Panorama
Kunoth
Amburla
Lake Eyre
Moreton Bay
Mt Fitton*
Tinga tingana
Toolabin
*Uardry
Lake George
Majura Valley
*Kioloa
Tanjil Bren
EOC Hyperspectral Sites
EOC HS Task Sites
Hyperion Sites
* Potential 1st 60 days Sites
X band sites

CSIRO
Earth Observation Centre
Tinga Tingana Cal_Val Site

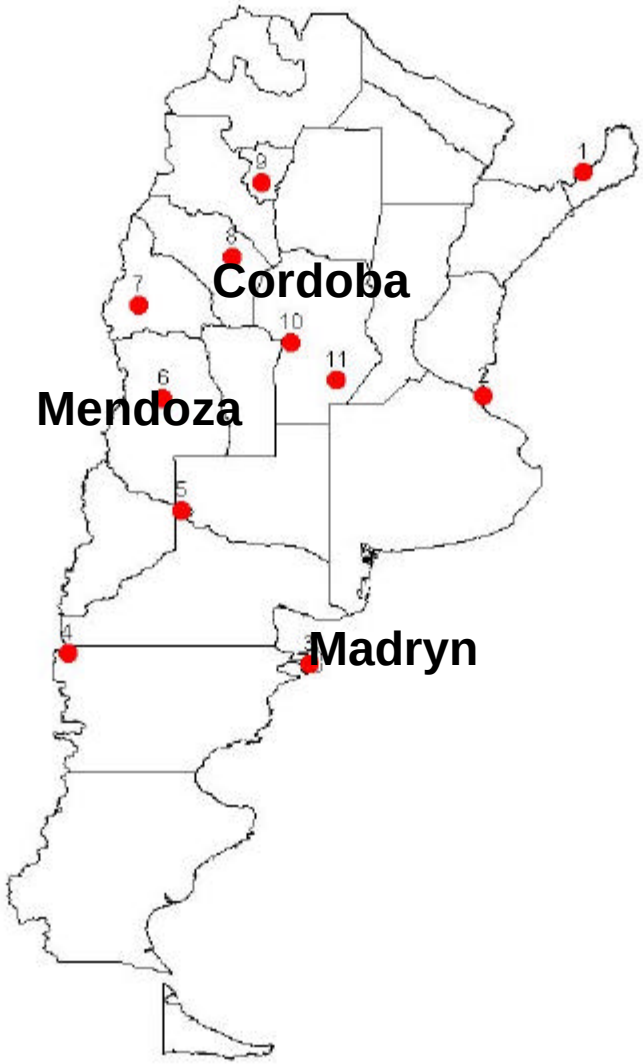
Argentina Validation Site Zone Map

for AVIRIS and EO-1/SAC-C overflights

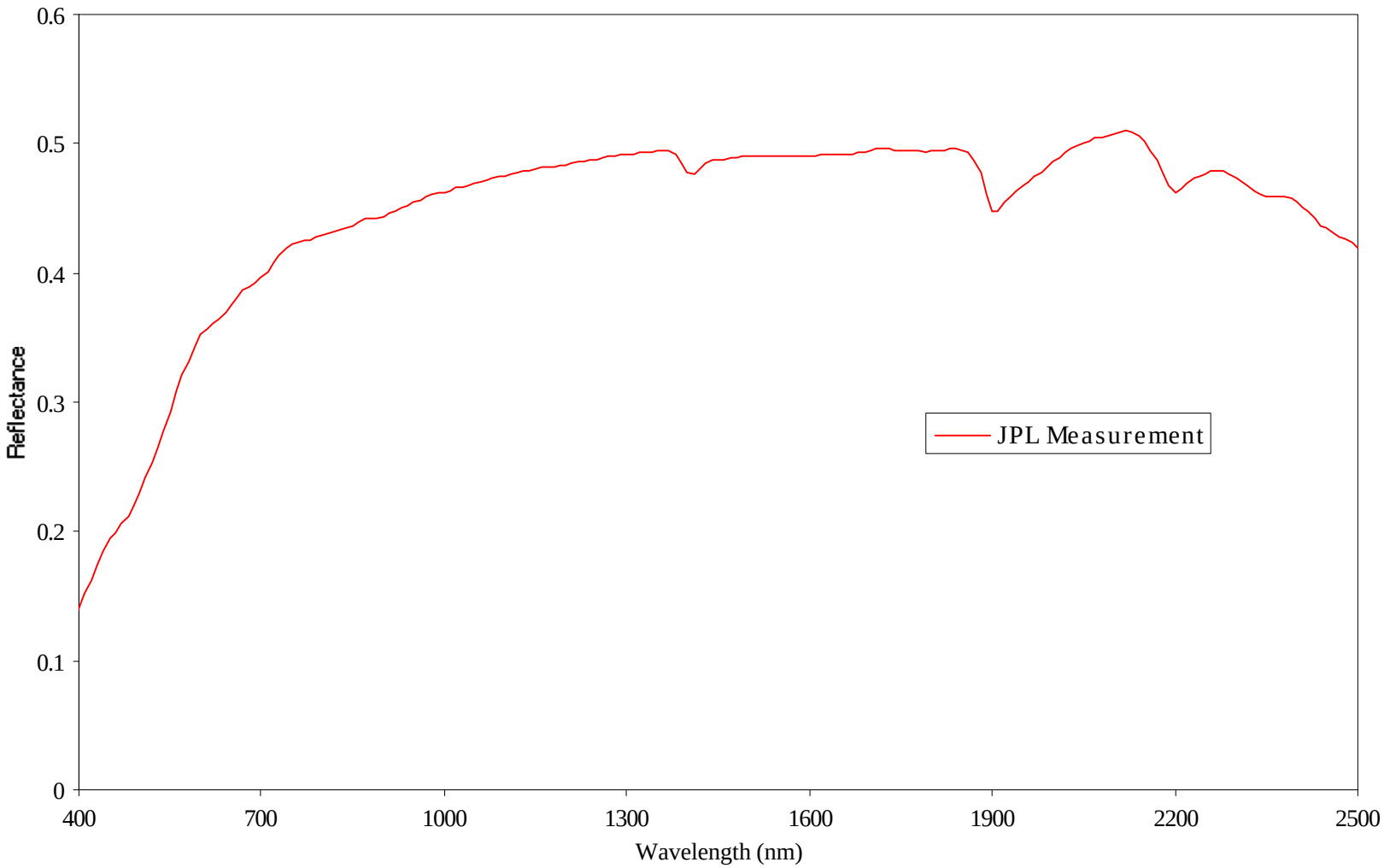


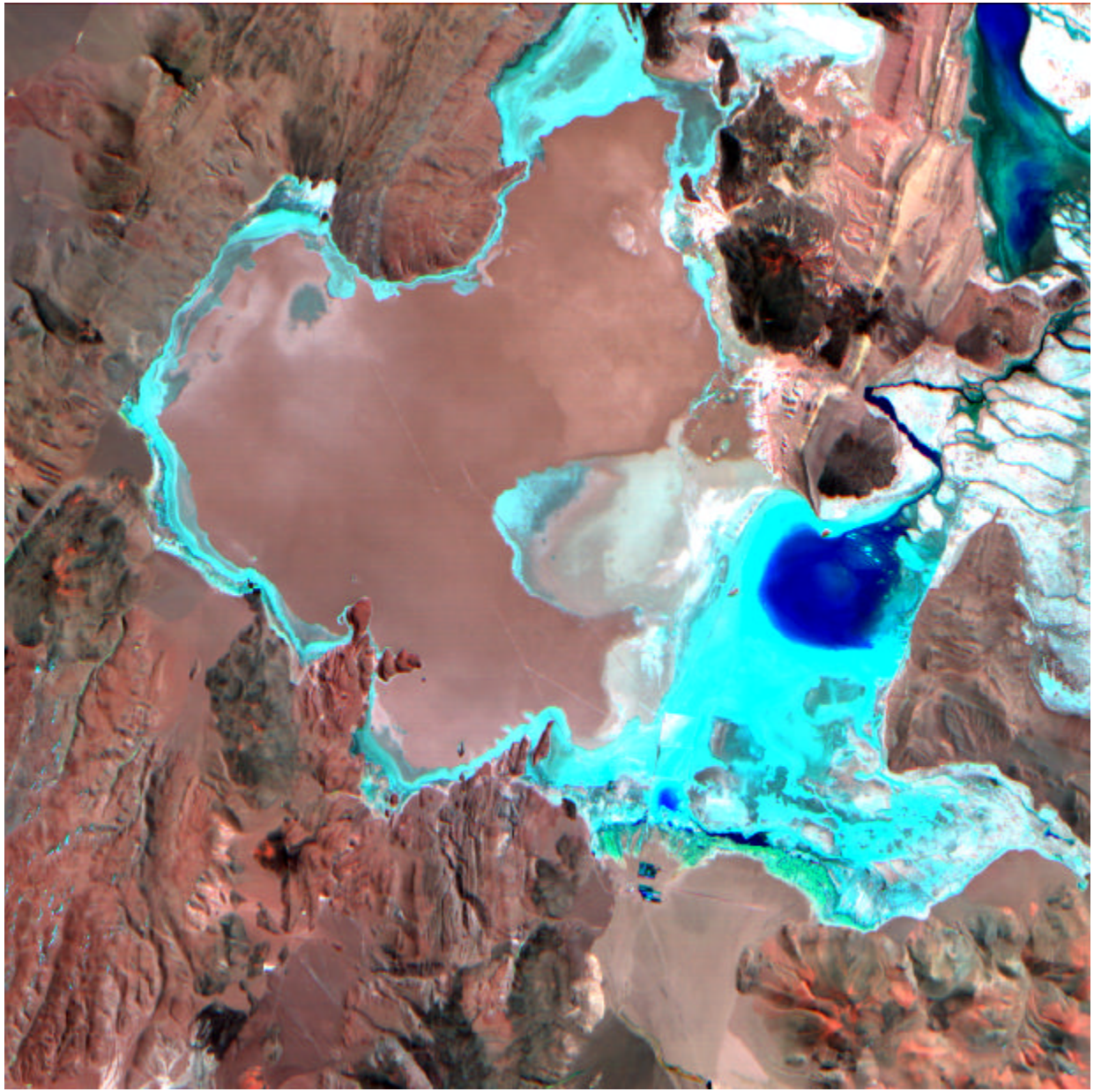
Zone	#	Flight Line Name	Start Lat	min	Start Lon	min	End Lat	min	End Lon	min	Hours
0) Buenos Aires	1	pergamino-v	-33	53.580	-60	34.020	-34	3.000	-60	34.020	2.5
	2	Pergamino-h	-33	58.020	-60	39.000	-33	58.020	-60	28.980	0.5
	3	Capital Federal-1	-34	32.000	-58	26.000	-34	40.500	-58	31.500	0.5
	4	Capital Federal-2	-34	41.330	-58	30.000	-34	33.000	-58	24.000	0.5
	5	Delta	-34	22.020	-58	1.980	-34	13.020	-58	24.000	0.5
	6	Magdalena	-34	58.980	-57	35.760	-35	7.020	-57	24.360	0.5
		TRANSIT									4.0
1) Posadas	1	Libertad	-25	55.320	-54	37.560	-25	56.230	-54	18.480	0.5
	2	Eldorado 1	-26	19.610	-54	38.550	-26	34.770	-54	41.230	0.5
	3	Eldorado 2	-26	20.730	-54	40.710	-26	35.810	-54	43.450	0.5
	4	Oberá 1	-27	17.280	-55	17.450	-27	25.810	-55	13.200	0.5
	5	Oberá 2	-27	17.250	-55	6.800	-27	32.650	-55	5.010	0.5
	6	Iberá	-28	3.000	-56	49.980	-28	5.520	-57	0.480	1.0
		TRANSIT									4.0
2) Resistencia	1	Campo del Cielo 1	-27	31.020	-61	34.980	-27	45.000	-61	49.020	0.5
	2	Campo del Cielo 2	-27	2.280	-61	17.916	-27	29.646	-61	39.282	0.5
	3	Campo del Cielo 3	-27	30.636	-61	38.772	-27	23.286	-61	17.670	0.5
	4	Santiago del Estero 1	-27	24.264	-61	17.058	-27	31.530	-61	38.370	0.5
	5	Santiago del Estero 2	-27	32.682	-61	37.902	-27	25.284	-61	16.764	0.5
	6	Chaco	-27	26.310	-61	16.314	-27	33.684	-61	37.482	0.5
		TRANSIT									6.0
3) Tucumán	1	San Miguel	-27	0.000	-65	34.980	-27	10.020	-65	25.020	4.5
	2	Monteros	-27	0.000	-65	6.000	-26	28.020	-65	18.000	0.5
	3	Farallon Negro 1	-27	21.660	-66	38.350	-27	15.520	-66	33.180	0.5
	4	Farallon Negro 2	-27	19.620	-66	25.920	-27	25.430	-66	17.500	0.5
	5	Farallon Negro 3	-27	20.880	-66	29.920	-27	19.620	-66	25.920	0.5
		TRANSIT									4.0
4) Jujuy	1	Arizaro 1	-24	50.000	-67	42.000	-25	10.000	-67	42.000	2.5
	2	Arizaro 2	-24	58.000	-67	30.000	-24	58.000	-67	50.000	1.0
	3	Arizaro 3	-25	0.000	-67	48.000	-25	10.000	-67	38.000	1.0
	4	Arizaro 4	-24	54.000	-67	5.000	-24	54.000	-67	35.000	1.0
	5	Arizaro 5	-24	50.000	-67	42.000	-25	10.000	-67	42.000	2.5
	6	Calilegua	-23	31.200	-64	45.000	-23	33.600	-64	39.600	0.5
		TRANSIT									4.0
5) La Rioja	1	La Antigua	-29	49.980	-66	4.980	-30	4.980	-66	4.020	0.5
	2	Ciudad	-29	19.980	-66	49.980	-29	40.020	-66	34.980	1.0
	3	Talampaya 1	-29	42.100	-68	18.600	-29	58.200	-68	9.000	0.5
	4	Talampaya 2	-29	53.400	-68	5.400	-30	2.400	-67	51.600	0.5
		TRANSIT									2.0
6) Córdoba	1	Chancaní 1	-31	22.000	-65	22.000	-31	22.000	-65	32.000	0.5
	2	Chancaní 2	-31	23.355	-65	22.000	-31	23.355	-65	32.000	0.5
	3	Chancaní 3	-31	24.708	-65	22.000	-31	24.708	-65	32.000	0.5
	4	Chancaní 4	-31	26.061	-65	22.000	-31	26.061	-65	32.000	0.5
	5	Manfredi	-31	31.260	-64	27.960	-31	50.640	-64	10.740	0.5
	6	Las Perdices	-32	50.340	-64	31.980	-32	37.020	-64	12.300	0.5
	7	Rio Cuarto Craters	-32	52.000	-64	14.000	-33	8.000	-64	21.000	0.5

Argentine Test Sites



NM EO-1 Calibration Target at Barreal Blanco, Argentina





"First Light" Image of Alaska

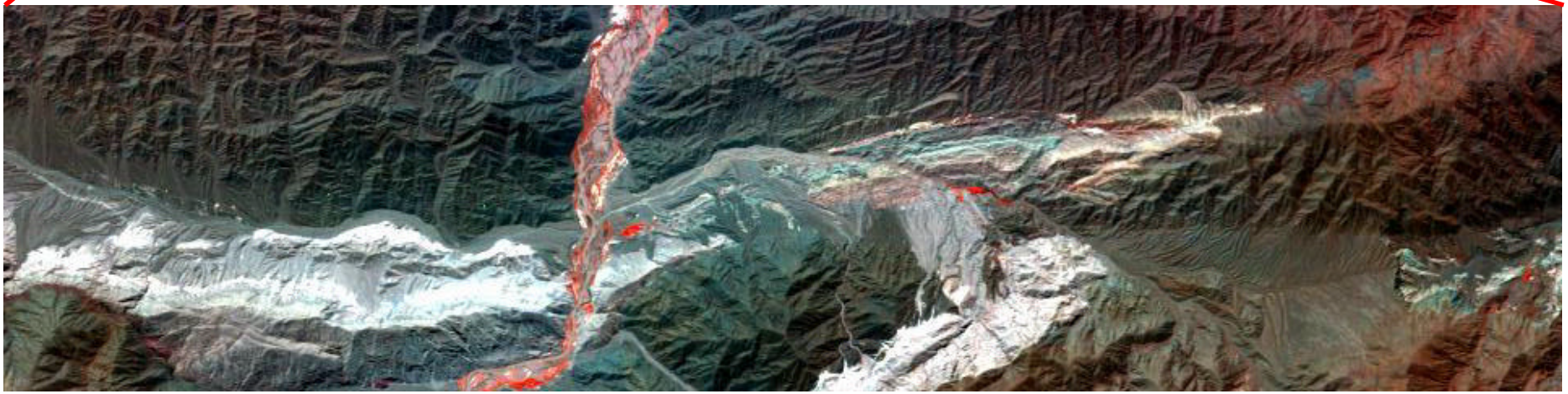
Why Is the ALI Pan Band Better Than the ETM+ Pan Band?

- ***Improved Radiometric resolution***
  - ***Superior signal-to-noise***
  - ***12-bit versus 8-bit representation of dynamic range***
- ***Inherently higher contrast measurement***
  - ***ALI pan restricted to 480 – 490nm VIS spectral interval***
  - ***ETM+ spans vegetation transition rise (520 – 900nm)***
- ***Smaller pixel size (IFOV)***
  - ***ALI pan IFOV is 10 meters***
  - ***ETM+ is nominally 15 meters (effectively 18 meters)***

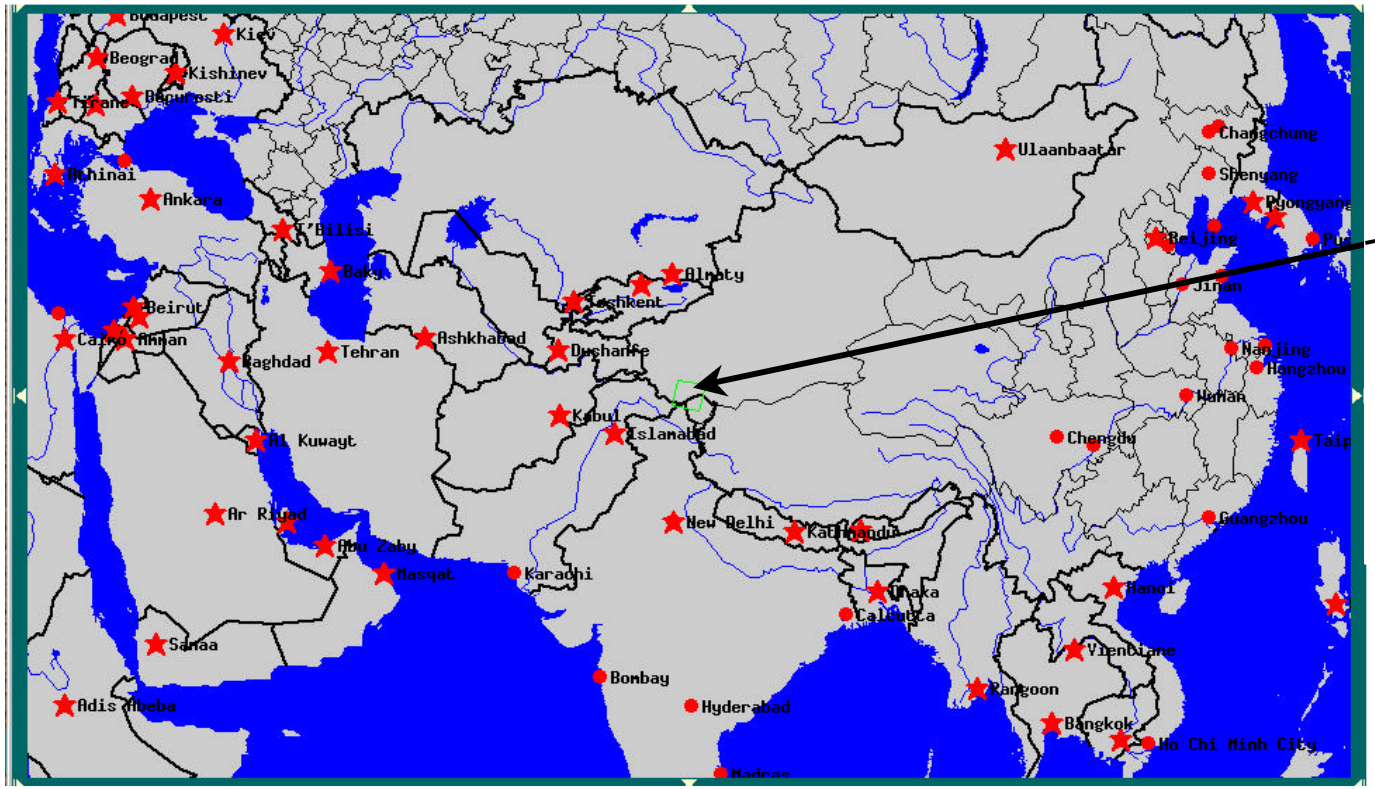
Hyperion Image - Argentina

Hyperspectral DCE Acquired Dec 1, 2000
Color image produced using 3 bands in visible
Blue = band 14 (488 nm)
Green = band 20 (549 nm)
Red = band 38 (731 nm) (red shows areas of new spring growth)

Image No. EO12000336_002002C_r1_image0su
Approx. 7.5 km wide x 65 km long
NORTH



Area of First Hyperion Image Collection (Green Square)



Area of First Image