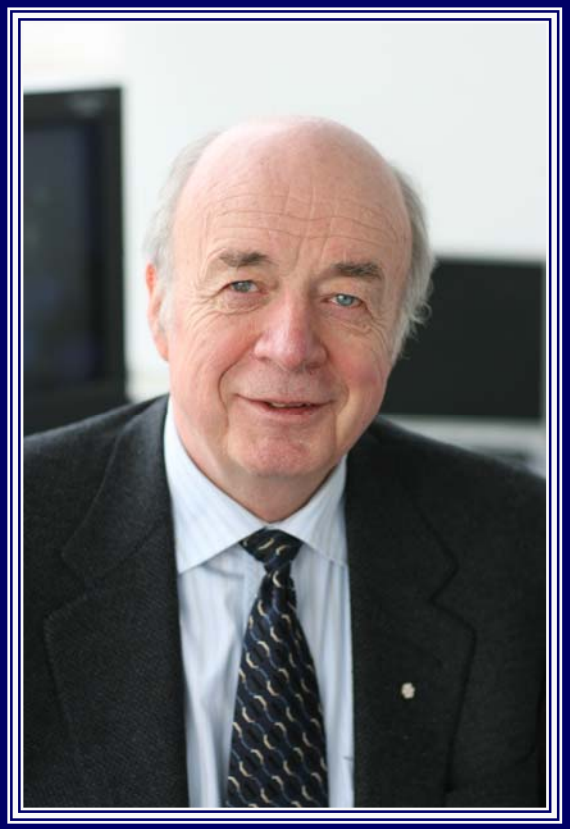
A Review of the Contributions of Dr. Alexander F. H. Goetz to Imaging Spectrometry

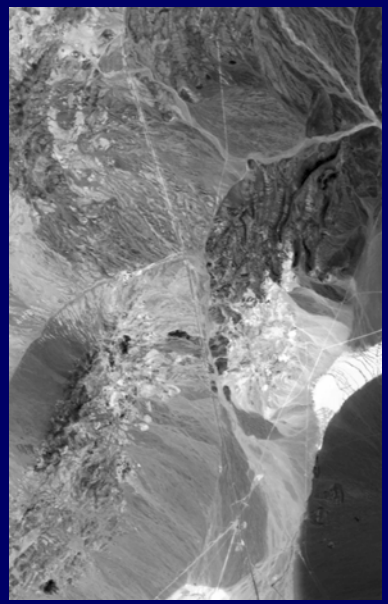


John MacDonald

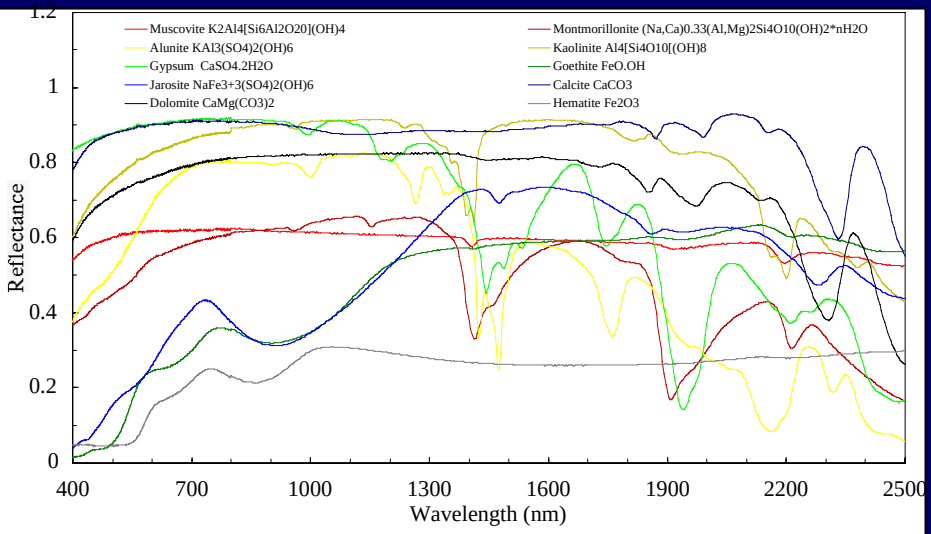
John MacDonald, (Day4 Energy, Burnaby, BC Canada),
Susan L. Ustin (UC Davis, USA), and
Michael Schaepman (Wageningen University, Wageningen, The Netherlands)

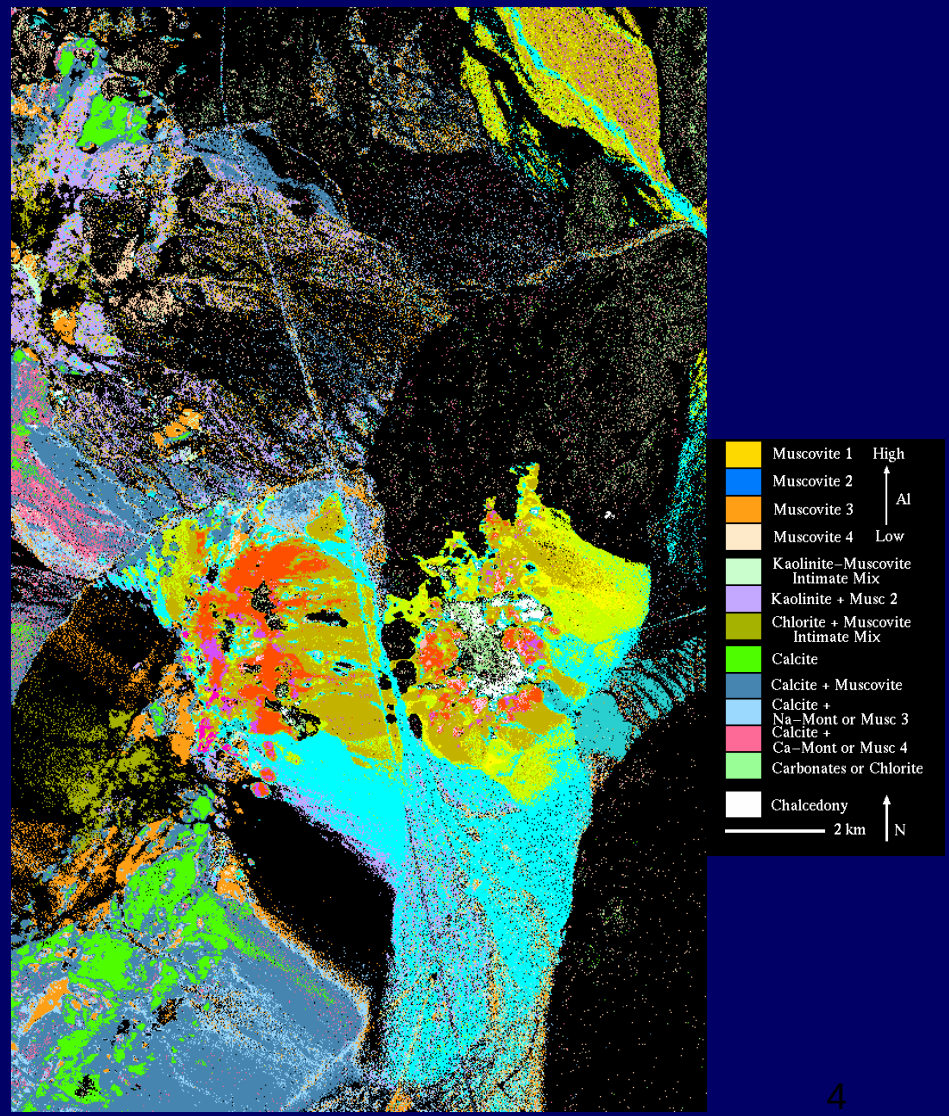
Dr. Alexander F. H. Goetz

Imaging Spectroscopy of Cuprite, NV

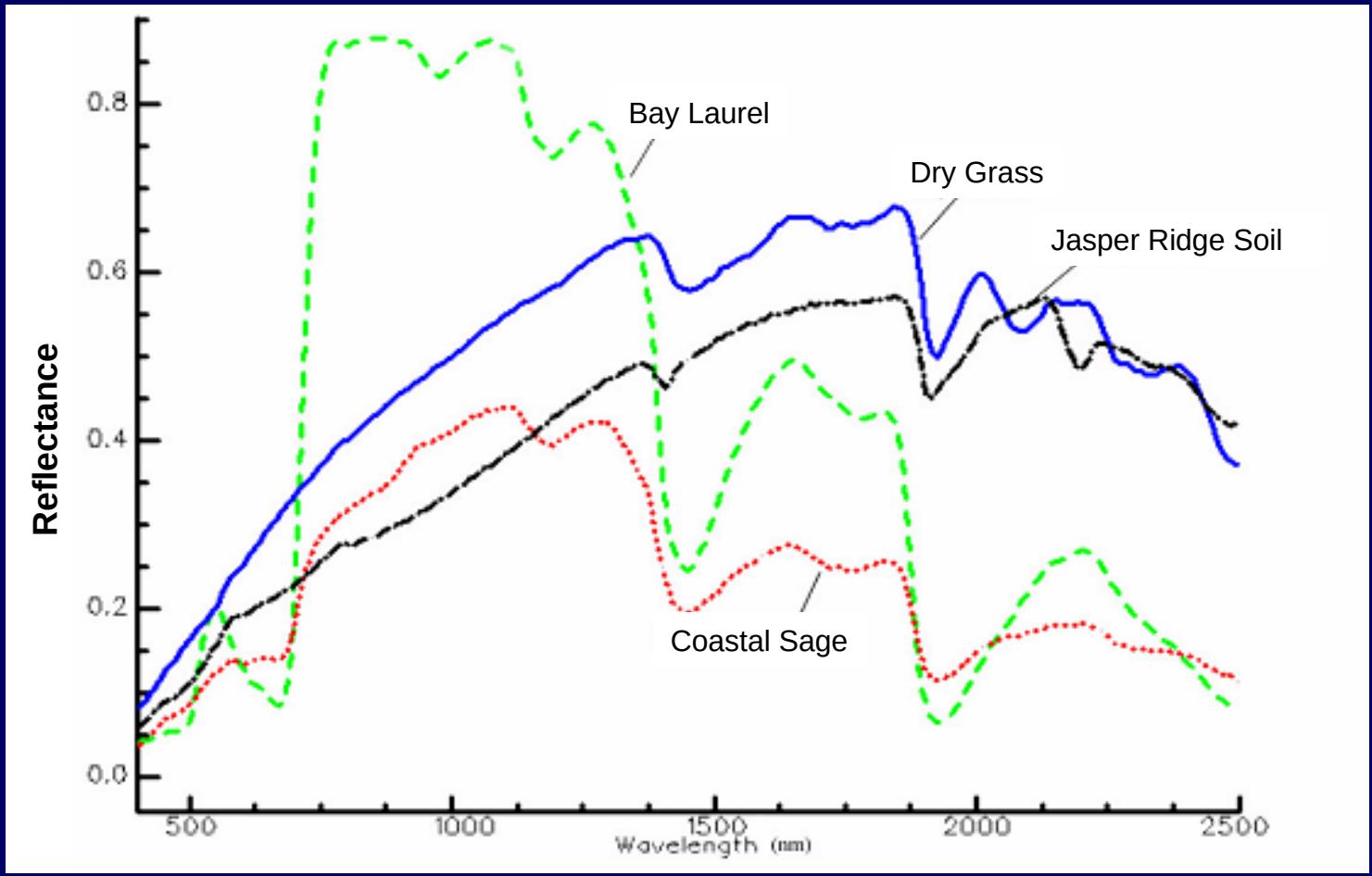


Spectroscopic identification of surface mineralogy

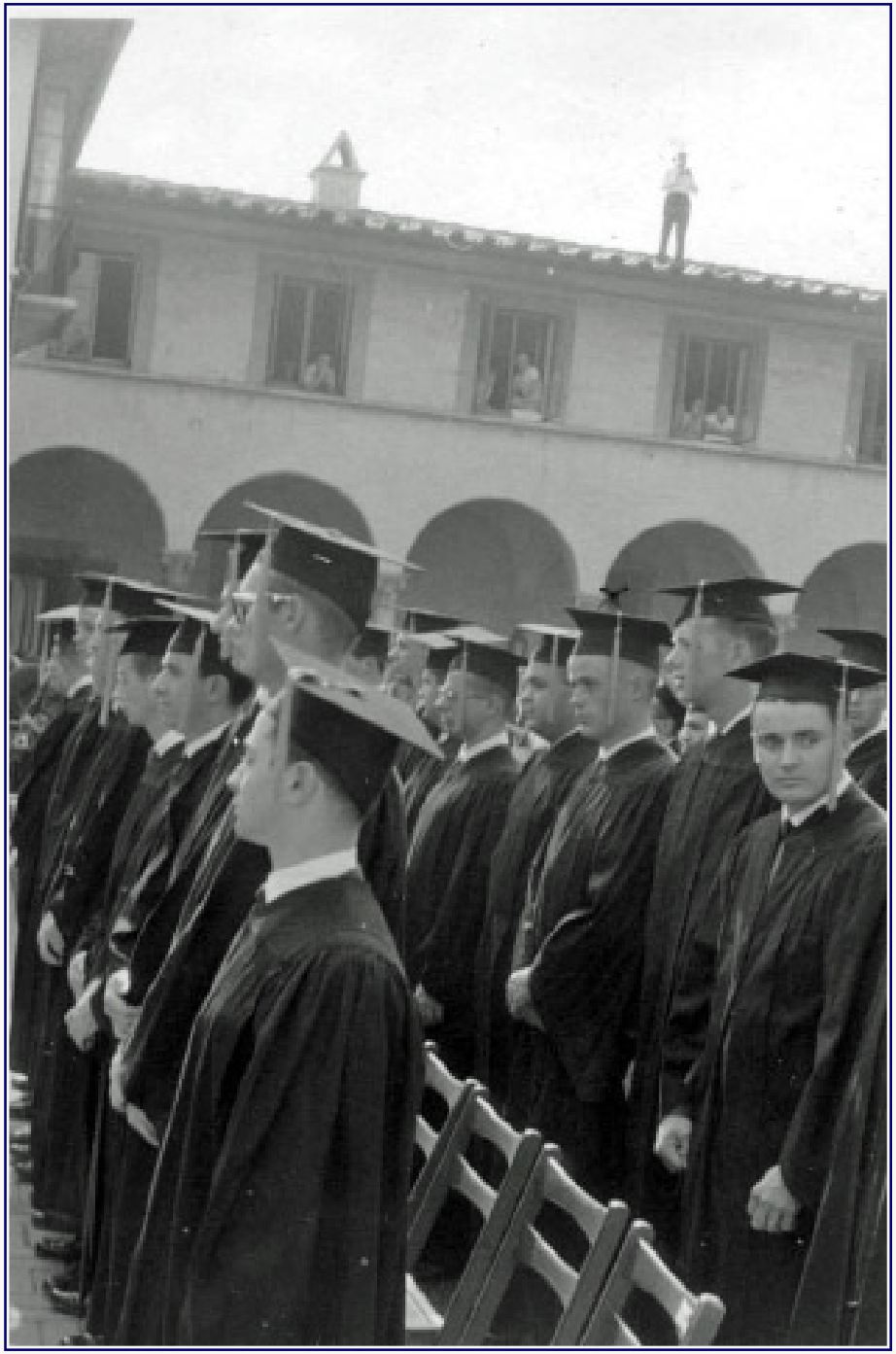




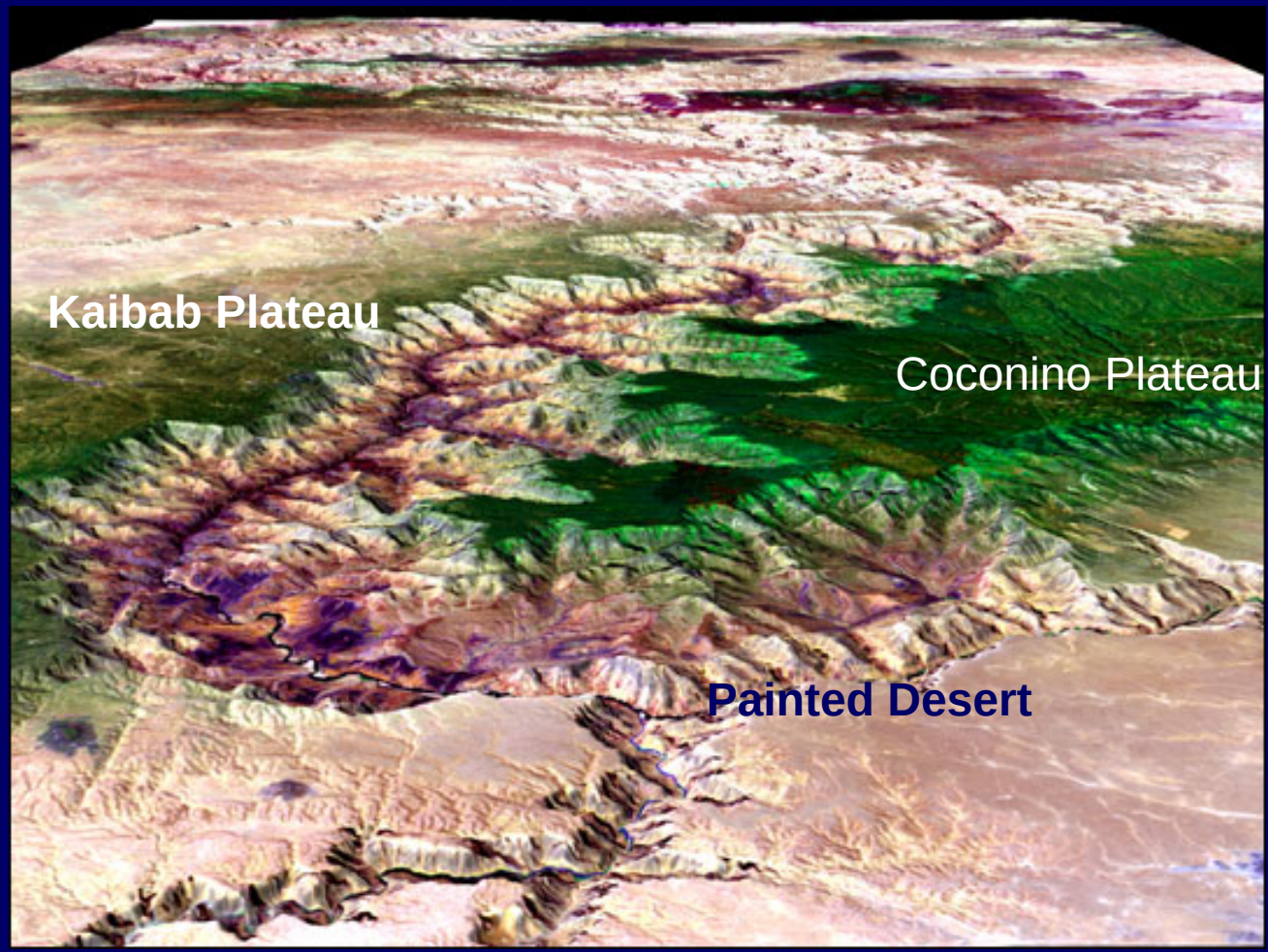
R. Clark, USGS


Reflectance
0.0
0.2
0.4
0.6
0.8
500
1000
1500
2000
2500
Wavelength (nm)
Bay Laurel
Dry Grass
Jasper Ridge Soil
Coastal Sage

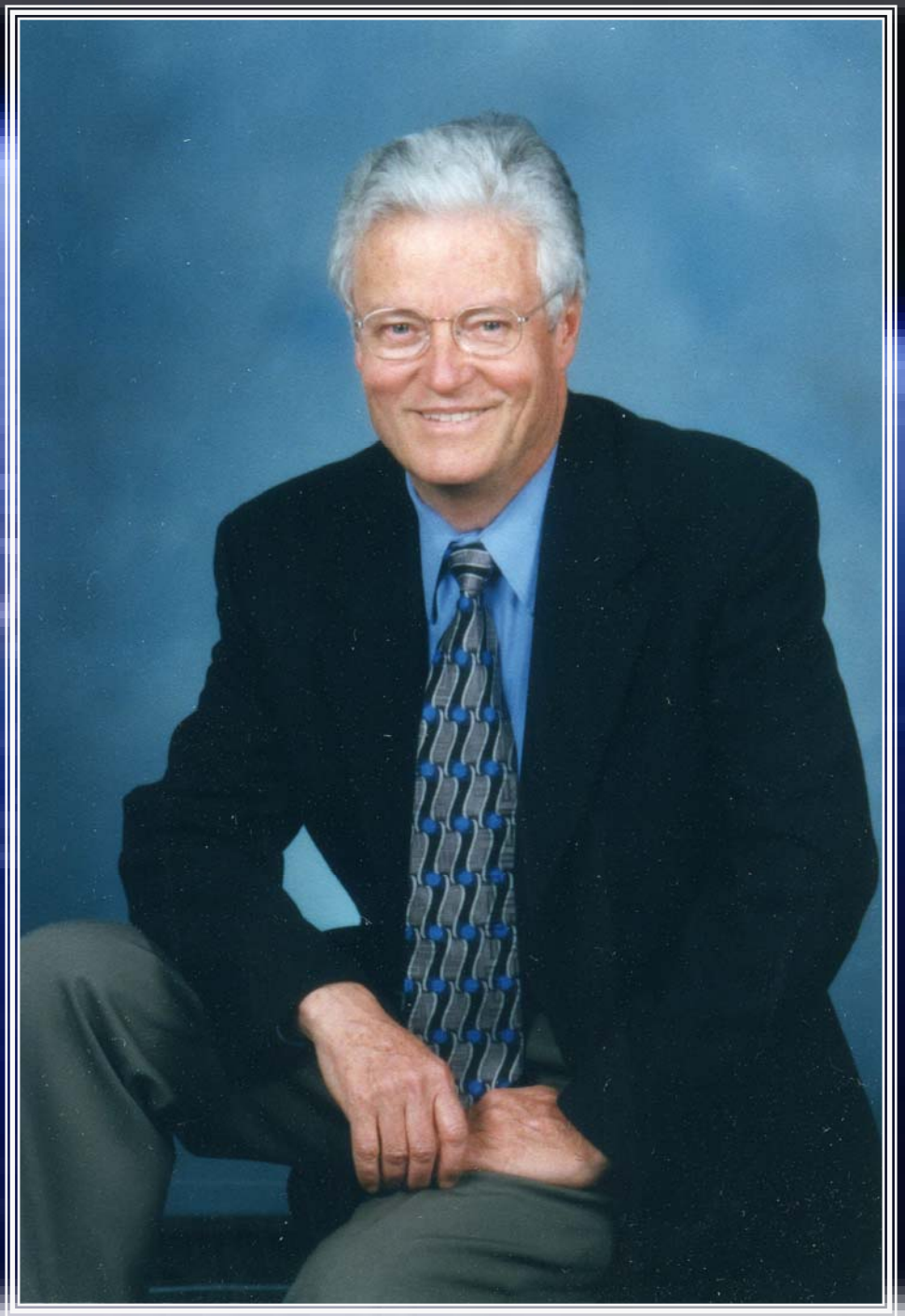

RCA VICTOR
TELEVISION
MODEL 21-S-501

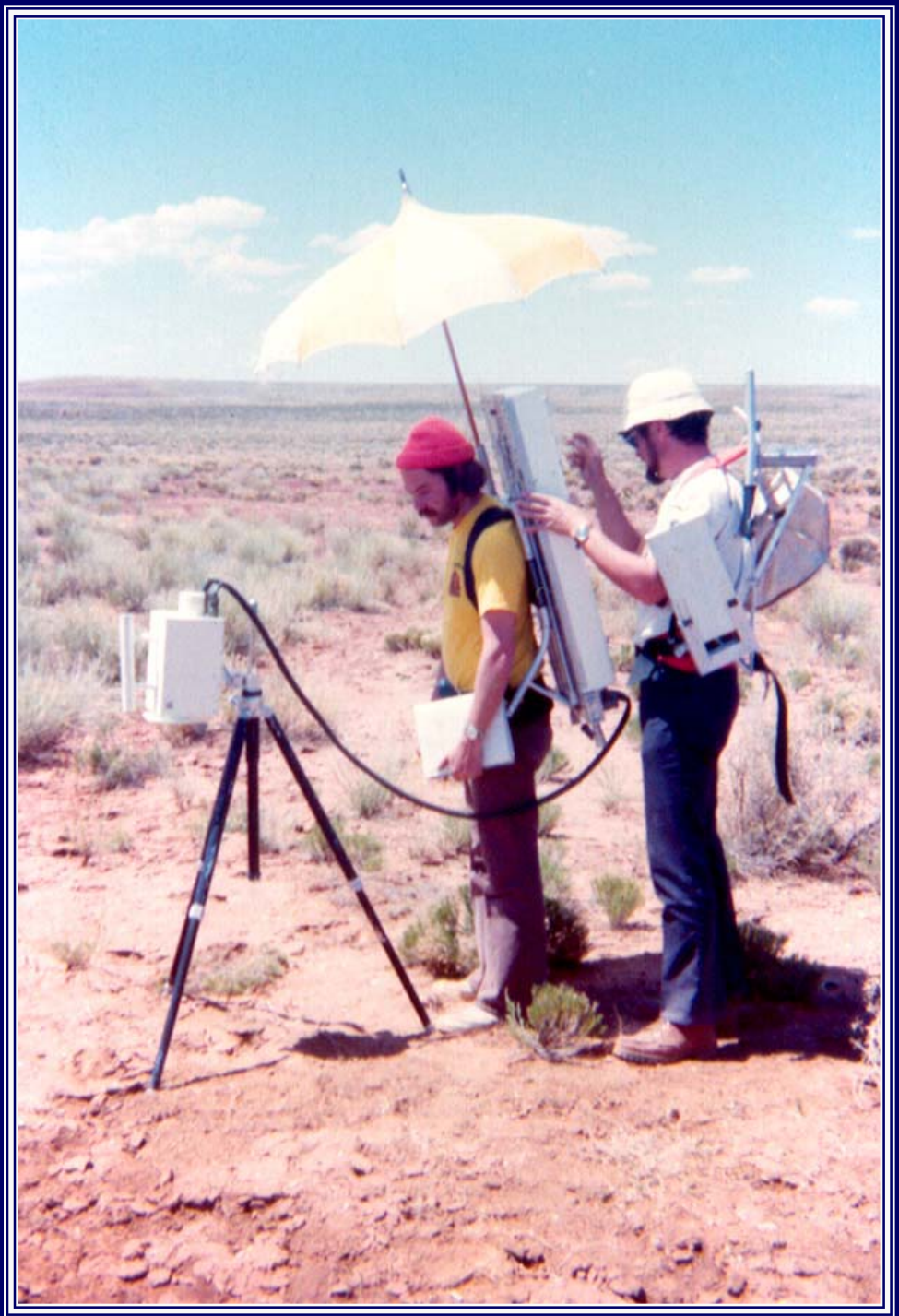


Grand Canyon of the Colorado
Landsat

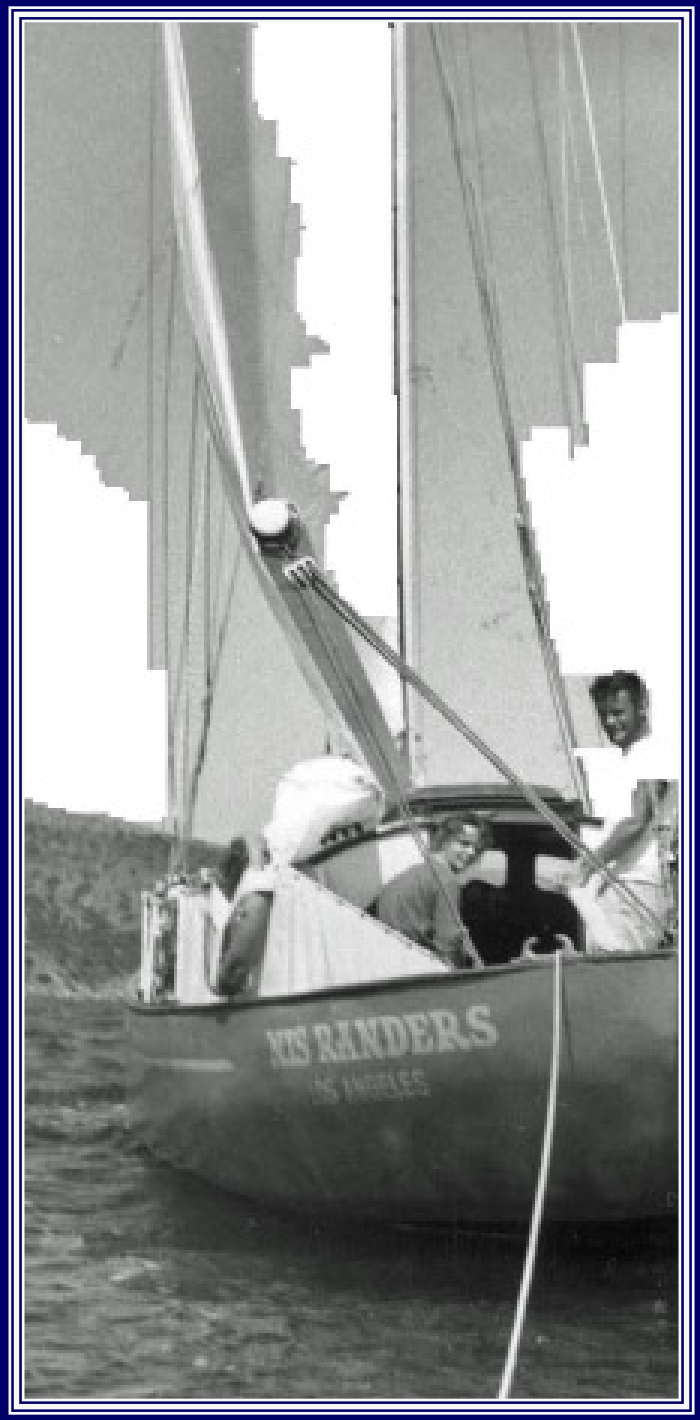


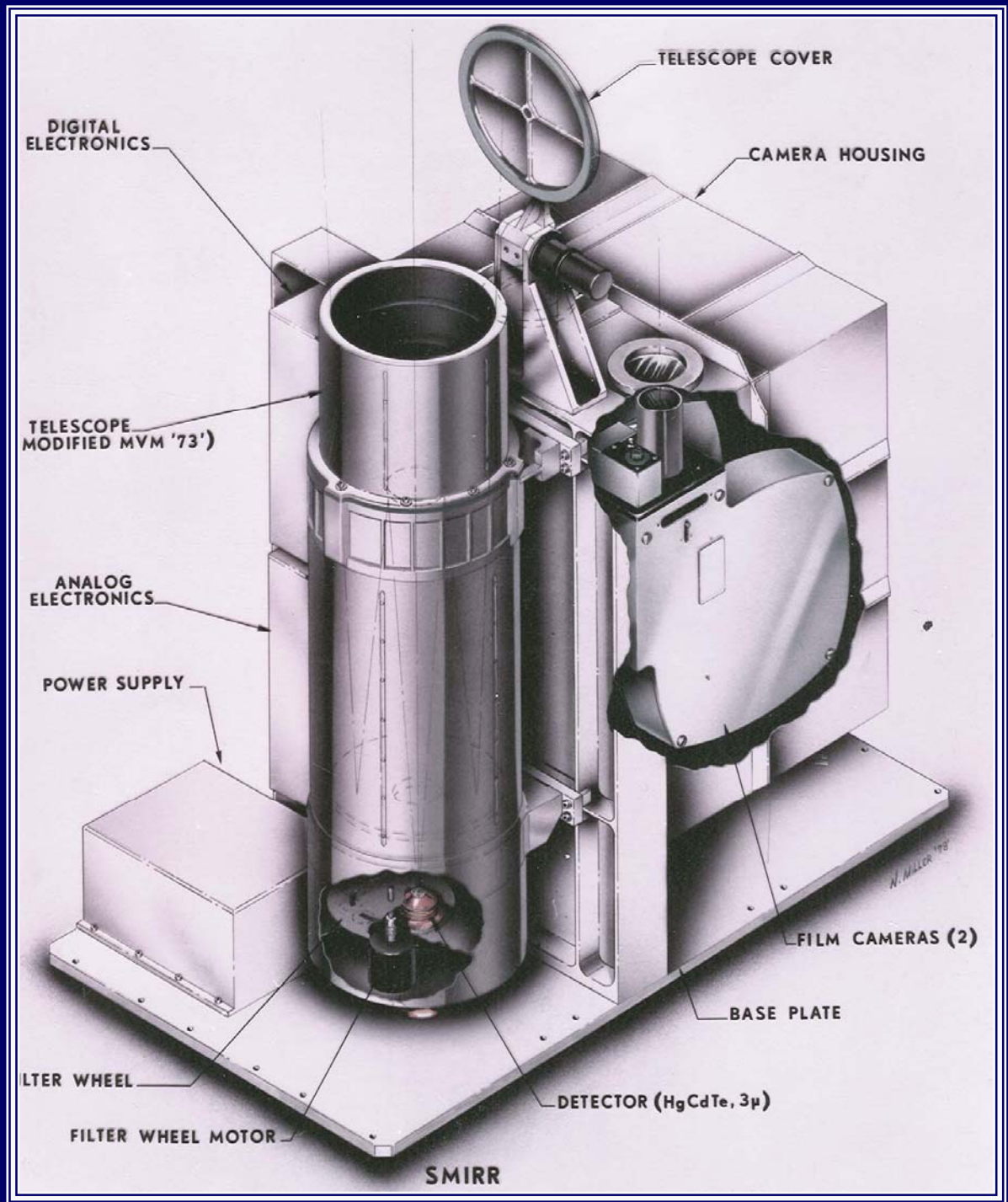
Little Colorado





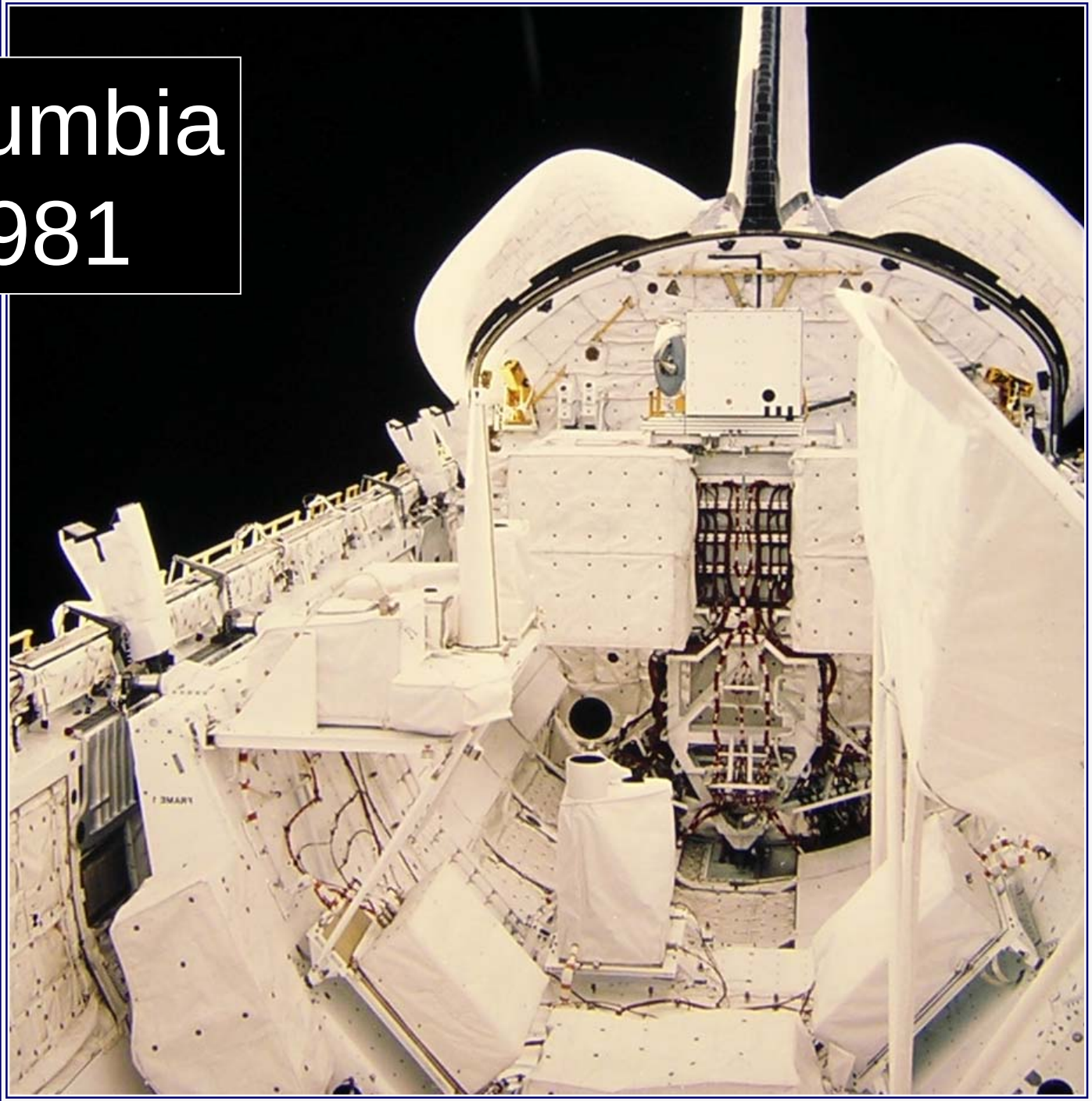
PFRS
1974

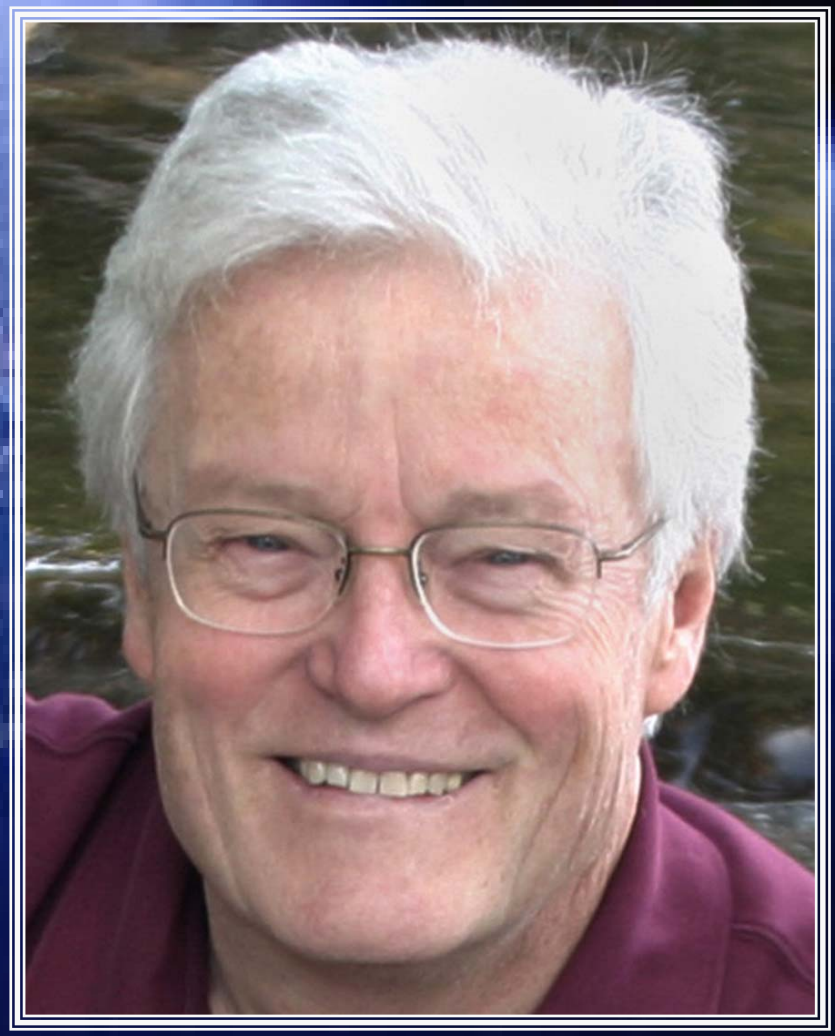

VIS RANDERS

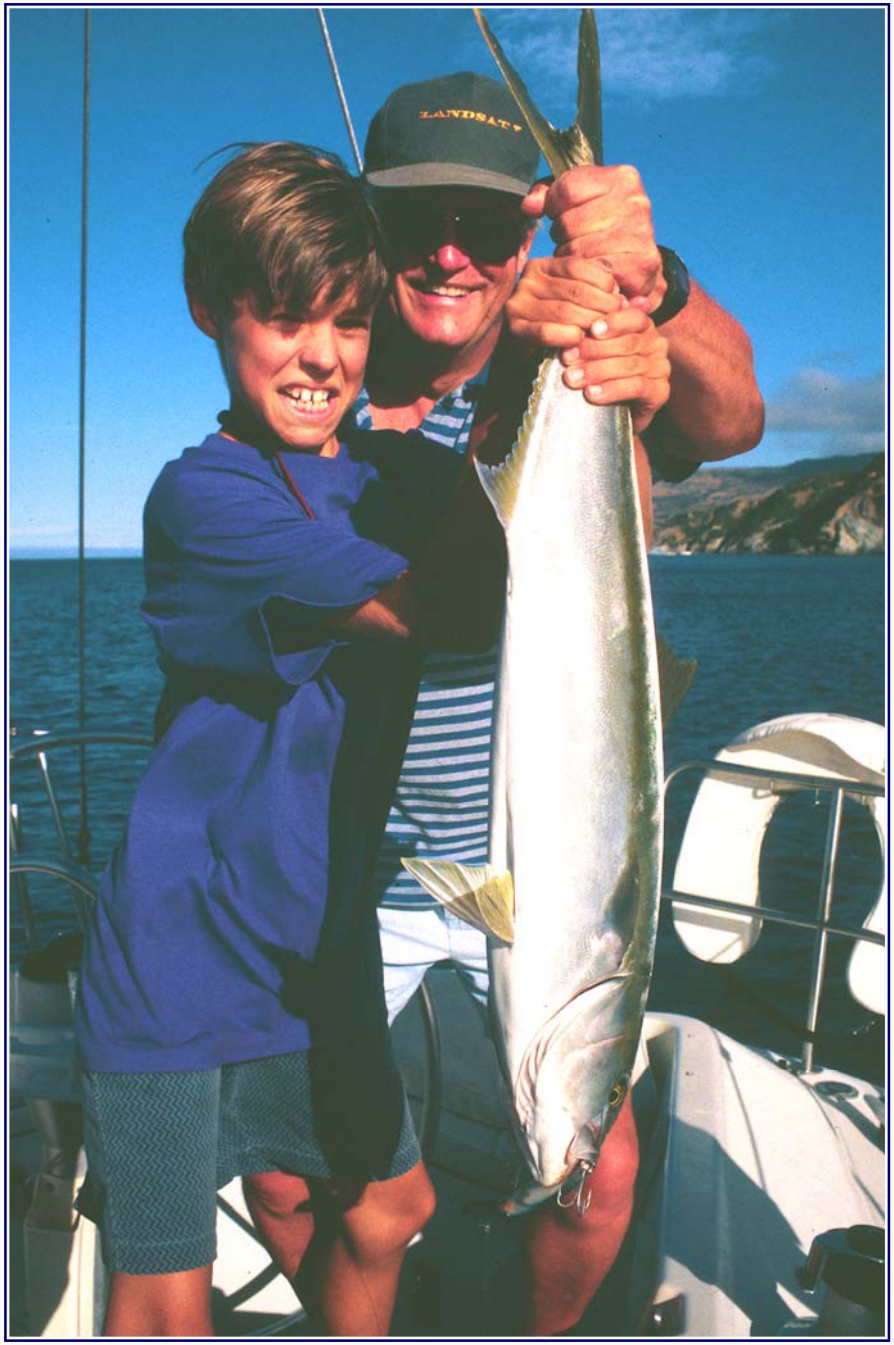

TELESCOPE COVER
DIGITAL ELECTRONICS
CAMERA HOUSING
TELESCOPE MODIFIED MVM '73')
ANALOG ELECTRONICS
POWER SUPPLY
FILM CAMERAS (2)
BASE PLATE
LTER WHEEL
DETECTOR (HgCdTe, 3μ)
FILTER WHEEL MOTOR
SMIRR

SMIRR 1981

Columbia 1981






LANDRATS


Tropicana
PURE PREMIUM
HOMESTYLE

AIS 1983

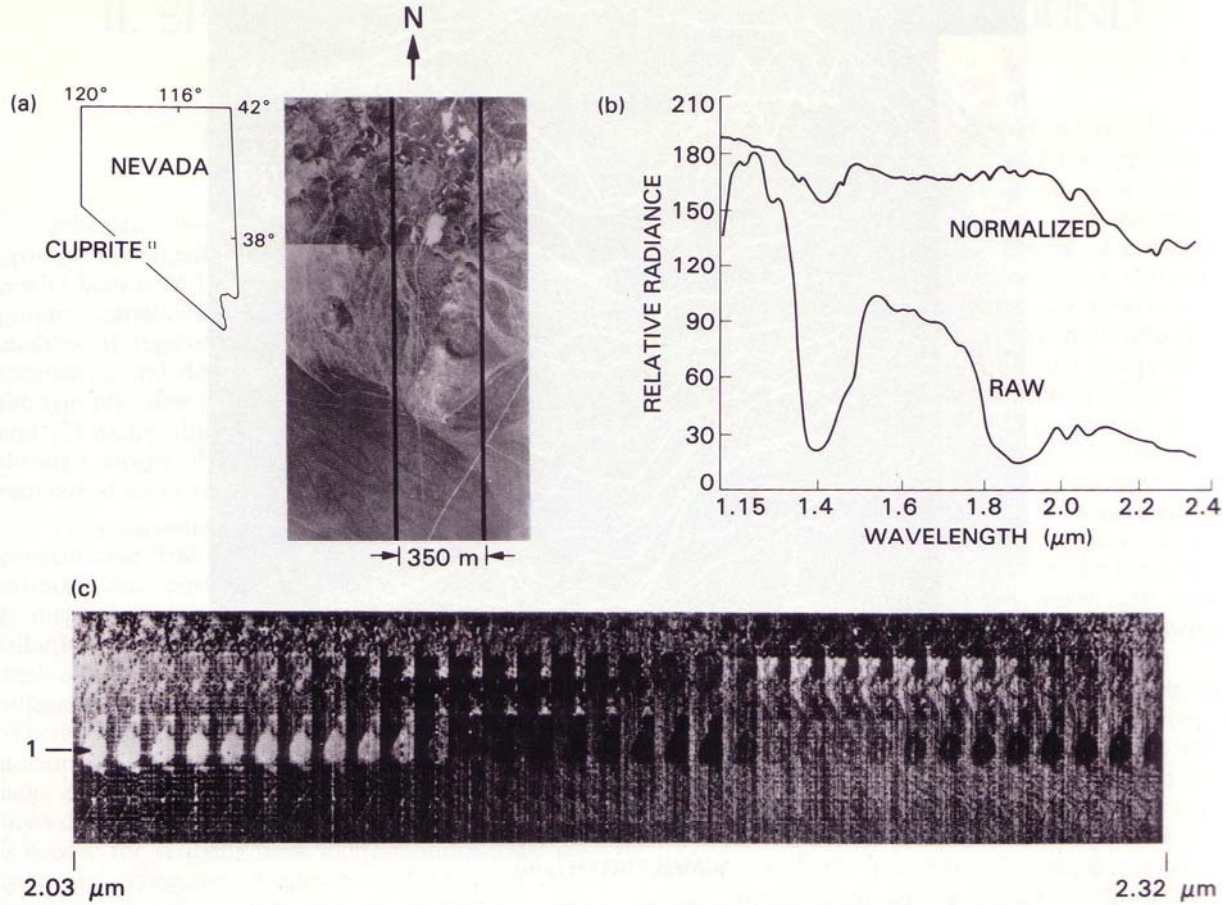


Figure 5. (a) Air photo of a portion of the Cuprite mining district in Nevada, superimposed with the AIS coverage. (b) Spectra (128 channels) derived from a 5×5 pixel area in the AIS–1 image of the Cuprite mining district. The normalized spectrum approximates the ground spectral reflectance. (c) A set of 32 AIS spectral images over Cuprite taken at 9.3–nm intervals between 2.03 and 2.32 μm in which each pixel spectrum has been normalized to produce an equal area under the reflectance curve. The differing reflectance characteristics as a function of wavelength are clearly visible (location 1).

Table 1. Performance Characteristics of AIS–1 and AIS–2

Parameter	AIS–1	AIS–2
IFOV	1.91 mrad	2.05 mrad
GIFOV (at 6 km altitude)	11.4 m	12.3 m
FOV	3.7°	7.3°
Swath width (at 6 km altitude)	365 m	787 m
Spectral sampling interval	9.3 nm	10.6 nm
Data rate	394 kbit/sec	1,670 kbit/sec
Spectral sampling		
"Tree" mode	0.9–2.1 μm	0.8–1.6 μm
"Rock" mode	1.2–2.4 μm	1.2–2.4 μm

Note: AIS–1 was flown in 1982, 1983, 1984, and 1985. It was replaced by AIS–2 in 1986.

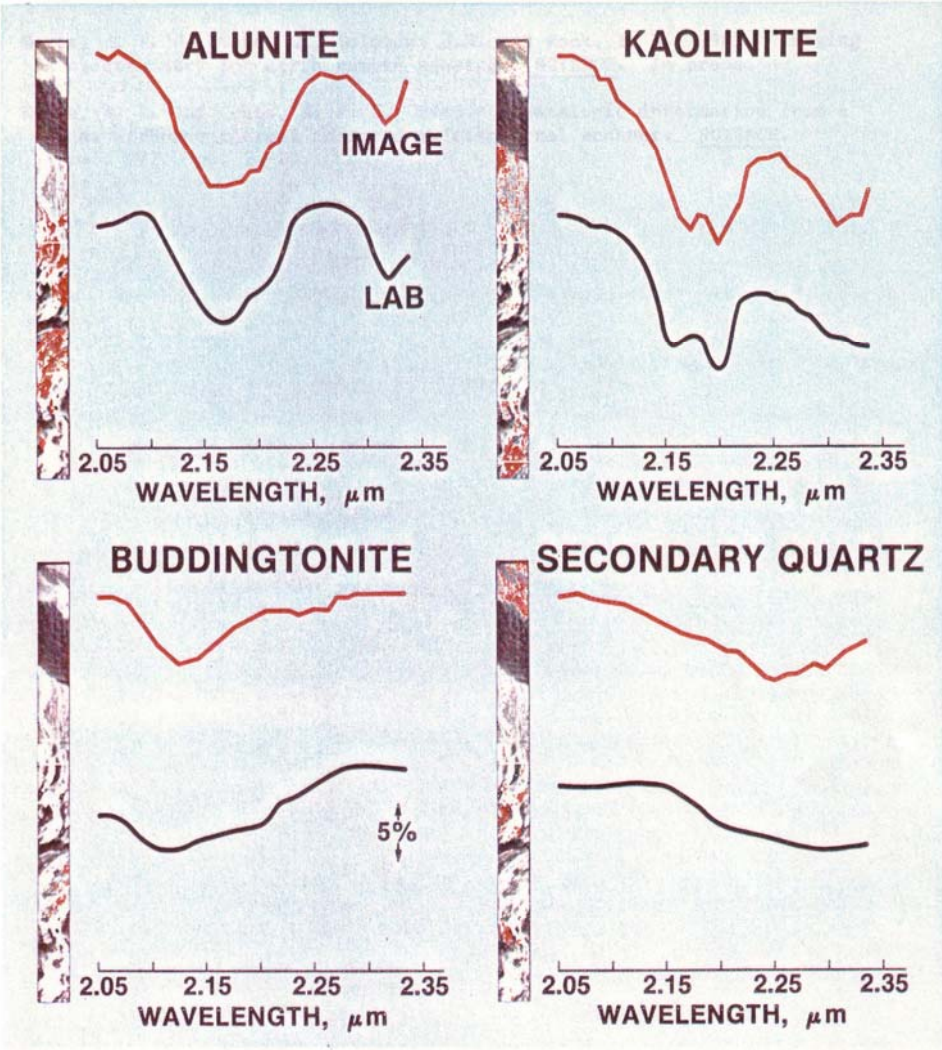


Figure 5. AIS coverage of Cuprite, with south at the top, covering the track with a "dogleg" shown in Fig. 1. The upper curves are the 3-by-3 pixel spectra of the red area in the respective images. The lower curves are laboratory spectra of samples collected in the red areas. The individual mineral maps were made using the SPAM program by selecting representative regions for the four spectral types shown and searching the images for similar spectral types. In each image, the regions of similar spectral types are shown in red.

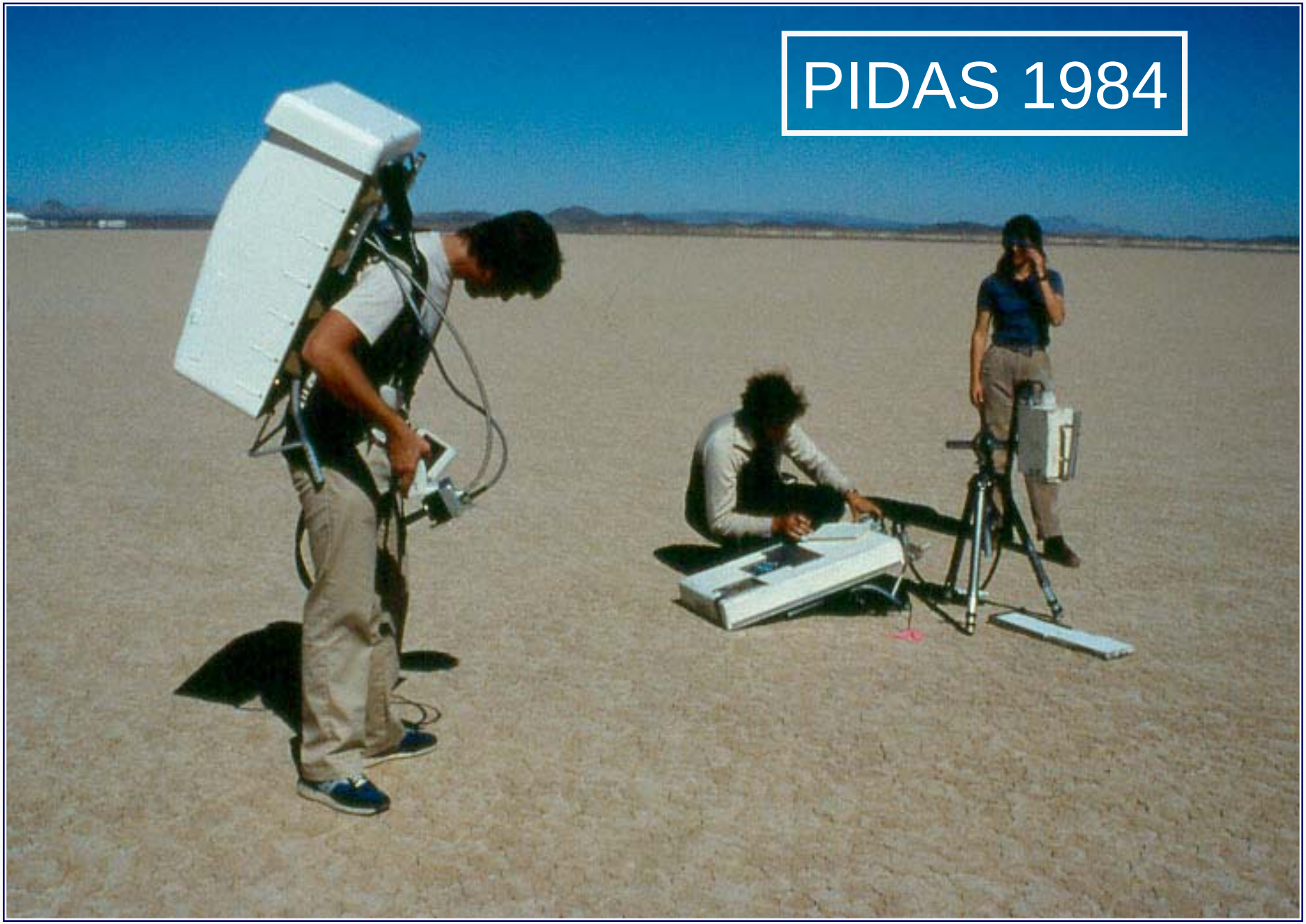

PIDAS 1984

Fig. 1. PIDAS during field trials in Cuprite, Nevada.

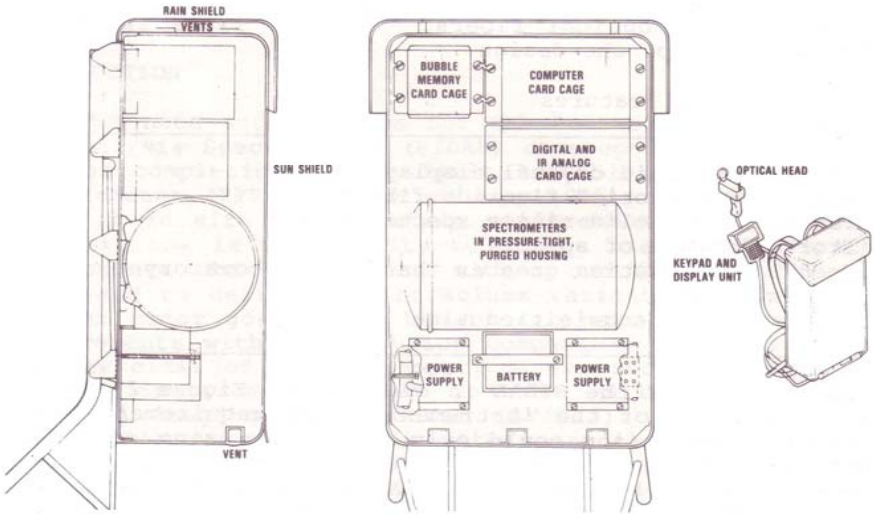


Fig. 2. PIDAS configuration.

PIDAS

3rd AIS Workshop, 1987

PIDAS Spectrometer

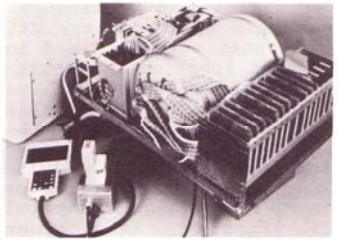


Fig. 4. PIDAS with cover removed showing the pressurized container housing the spectrometers, the hand-held display unit and the fore-optics head.

Fig. 5. VNIR spectrometer assembly.

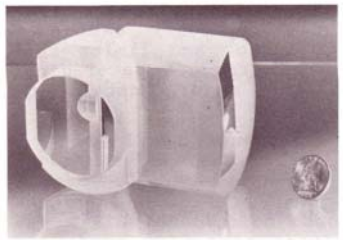


Fig. 6. Solid Schmidt SWIR spectrometer optics.

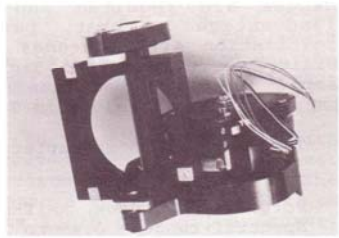


Fig. 7. SWIR grating drive assembly.

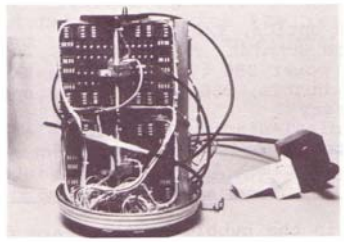
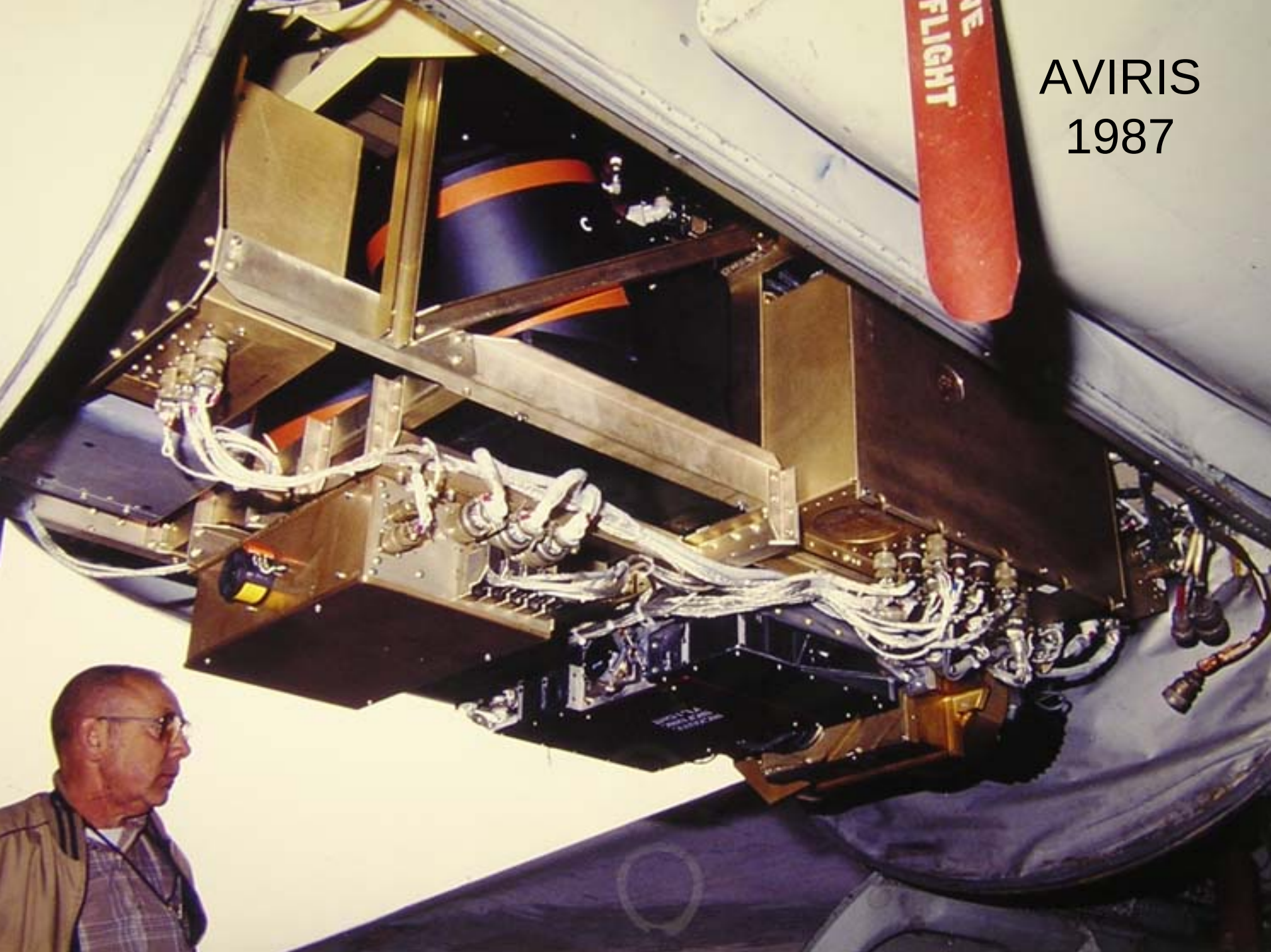
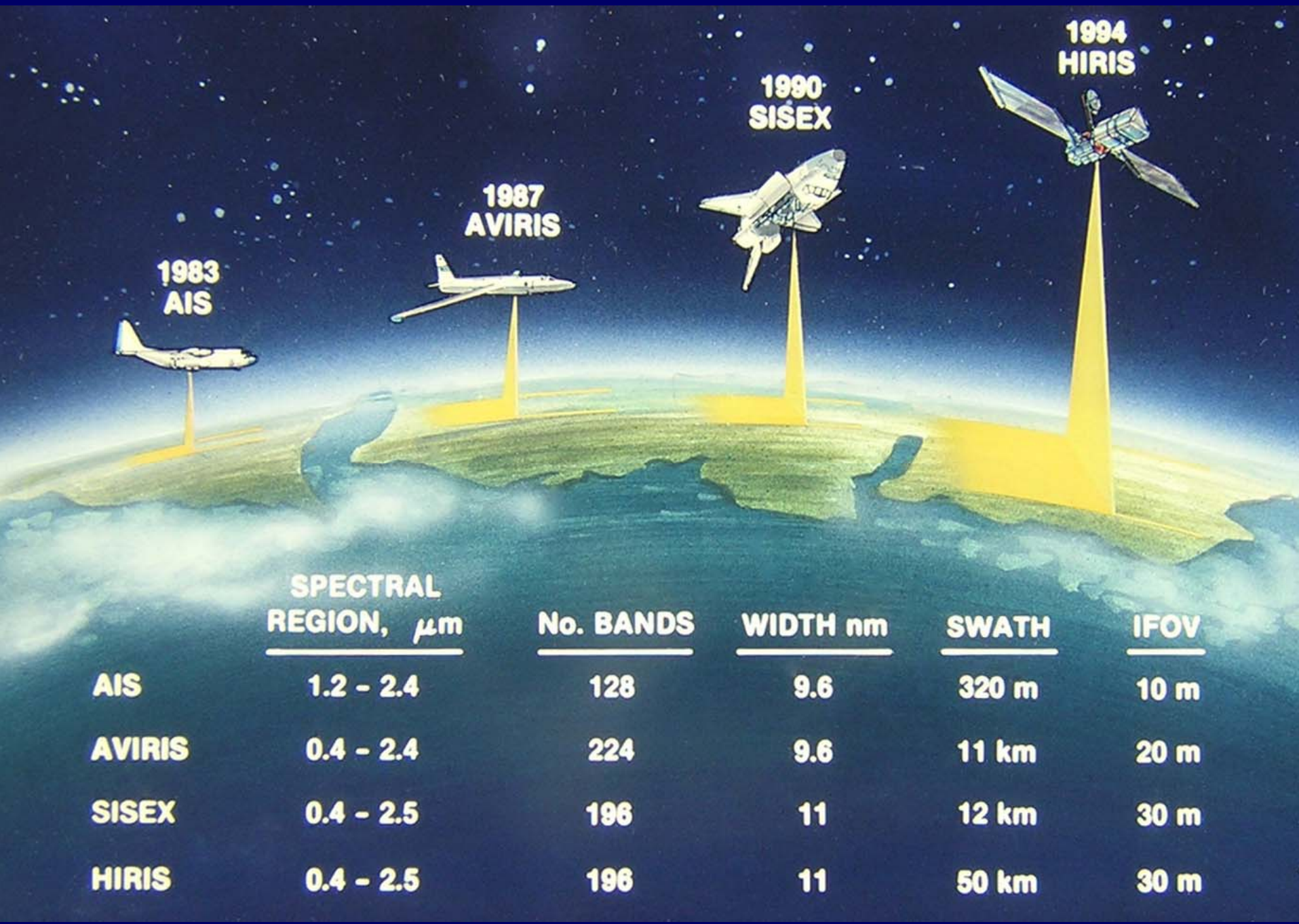
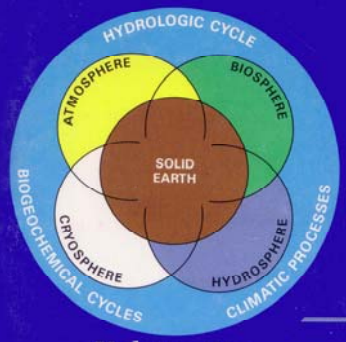


Fig. 8. Pressure vessel with the housing removed showing the detector preamplifier boards.


AVIRIS
1987



	SPECTRAL REGION, μm	No. BANDS	WIDTH nm	SWATH	IFOV
AIS	1.2 - 2.4	128	9.6	320 m	10 m
AVIRIS	0.4 - 2.4	224	9.6	11 km	20 m
SISEX	0.4 - 2.5	196	11	12 km	30 m
HIRIS	0.4 - 2.5	196	11	50 km	30 m

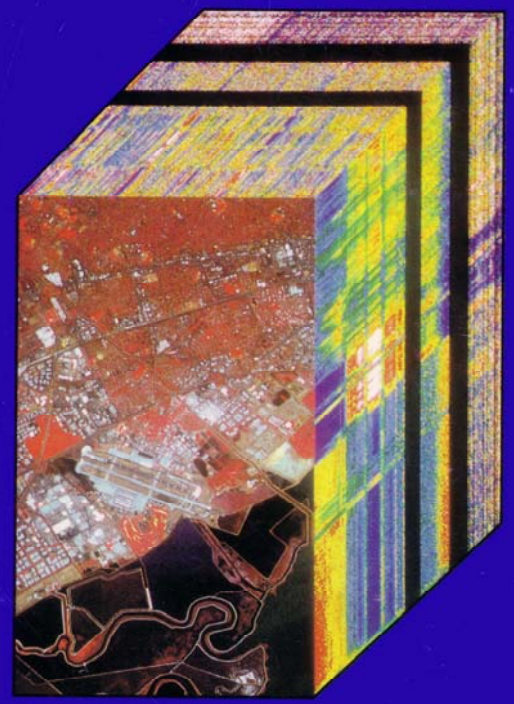


Volume IIc

HIRIS

High-Resolution Imaging Spectrometer: Science Opportunities for the 1990s

EARTH OBSERVING SYSTEM

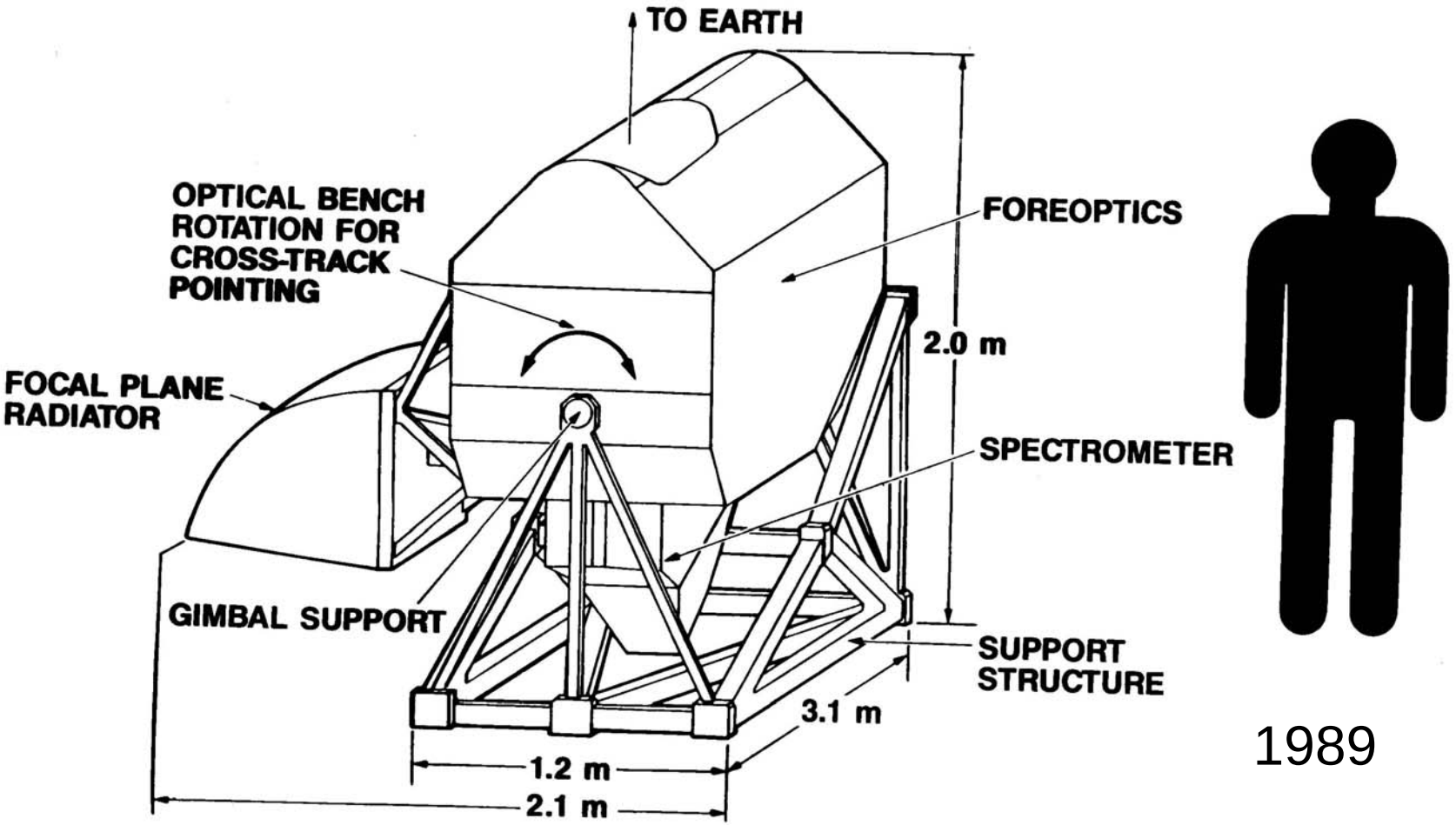


Instrument Panel Report

NASA
National Aeronautics and Space Administration

JPL

HIRIS
CONCEPTUAL LAYOUT



1989

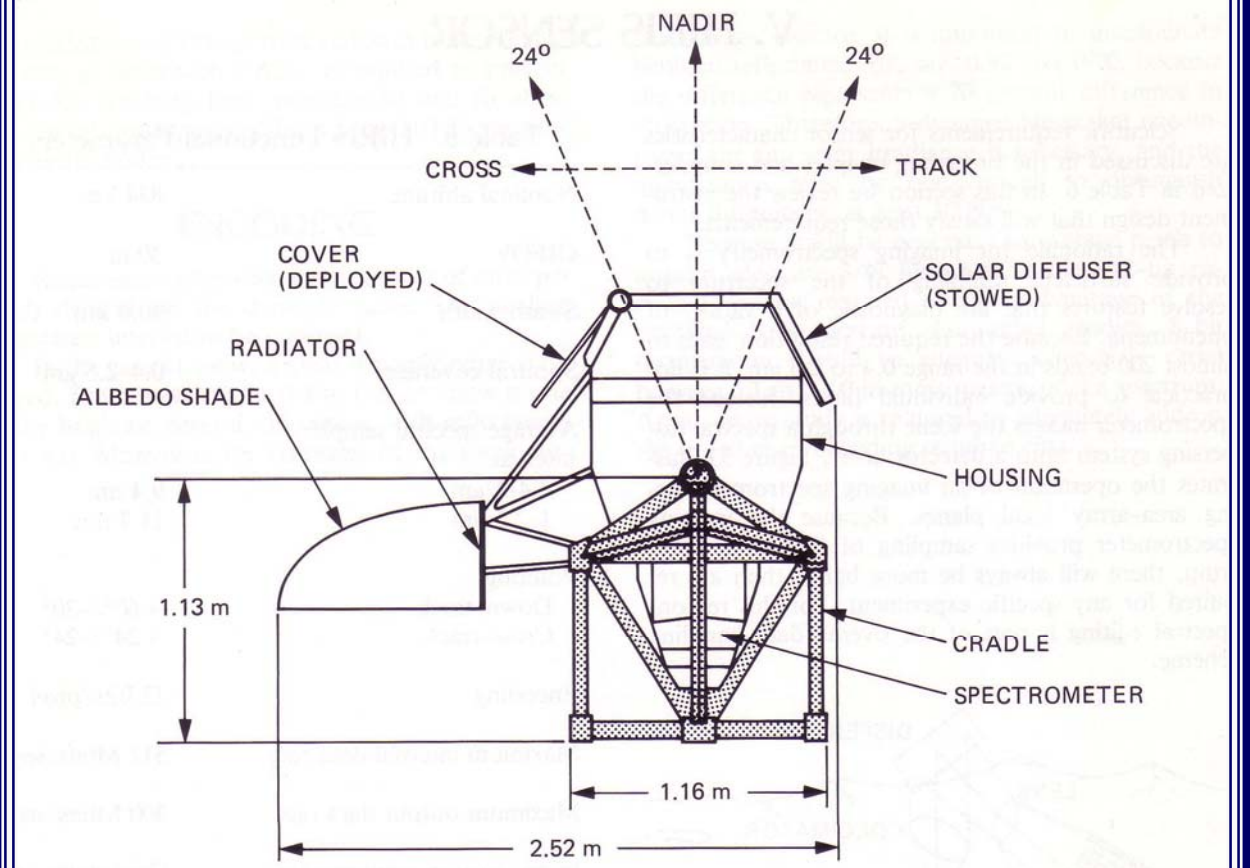


Figure 34. Conceptual layout of HIRIS, phase-A baseline.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JPL PUBLICATION 85-41

Proceedings of the Airborne Imaging Spectrometer Data Analysis Workshop

April 8, 9, 10, 1985

Editors
Gregg Vane
Alexander F.H. Goetz
Jet Propulsion Laboratory

June 15, 1985

NASA
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Attendees, First Airborne Imaging Spectrometer Data Workshop, 1985

Abrams, Mike	JPL
Adams, John	University of Washington
Adams, Steven	JPL
Albee, Arden	California Institute of Technology
Allen, Jim	NSI
Bailey, Jeff	Australian Mineral Industry Res. Assn., Australia
Balick, Lee	EG & G Energy Measurement Inc.
Banninger, Cliff	Inst. Image Proces. & Comp. Graphics, Graz Austria
Barge, Lisa	JPL
Barney, Terry	University of Missouri, Columbia
Berry, Wade	University of California, Los Angeles
Blad, Blaine	University of Nebraska
Blake, Pamela	University of Hawaii
Brown, Hal	General Electric Space Division
Conel, Jim	JPL
Curtis, Brian	California Institute of Technology
Dickenson, Stan	NASA/Ames Research Center
Donis, Paul	Self
Dystra, Jon	Earth Satellite Corporation
Elvidge, Chris	JPL
Evens, Carla	NASA/Goddard Space Flight Center
Evans, Diane	JPL/NASA Headquarters
Feldman, Sandra	Mackay School of Mines, U. Nevada
Ford, John	JPL
Fownes, Jim	University of Wisconsin, Madison
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Henderson, Fred	Geosat Committee
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Higgins, Robert	NSI
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Huntngton, Jon	CSIRO, North Ryde, New South Wales, Australia
Jordan, Bob	Lockheed Missiles & Space Company
Kahle, Ann	JPL
Krohn, Dennis	U.S.G.S., Reston
Kruse, Fred	U.S.G.S., Denver
Laity, Julie	California State University, Northridge
Lang, Harold	JPL
Lawton, Wayne	JPL
Lyon, Ron	Stanford University
MacDonald, John	MacDonald Detweiler & Assoc., Vancouver, BC,
Mahoney, Colin	JPL
Martucci, Louis	Battele Northwest Laboratories
Mason, Robert	NASA/Ames Research Center
McFaland, Williams	University of Missouri, Columbia
Meesong, Lee	JPL
Michael, Richard	Earth Satellite Corporation

Continued: First Airborne Imaging Spectrometer Data Workshop

Milton, Nancy	U.S.G.S., Reston
Monson, Richard	NASA Headquarters
Morris, Bob	NASA/Ames Research Center
Mouat, David	Stanford University
Murphy, Robert	NASA Headquarters
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Nemani, Ramakrishna	University of Montana, Missoula
Ocampo, Adriana	JPL
Olson, Charles, Jr.	University of Michigan, Ann Arbor
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Paylor, Earnie	JPL
Peterson, Dave	NASA/Ames Research Center
Pieters, Carle	Brown University
Podwysocki, Mel	U.S.G.S., Reston
Reimer, John	JPL
Ridd, Merrill	University of Utah
Rinker, Jack	U.S. Army Topographic Laboratory
Ripple, William	ERSAL, Oregon State University
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Rode, Jon	Rockwell International
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Runquist, Don	University of Nebraska
Ruzek, Martin	JPL
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Settle, Mark	ARCO Oil & Gas Company
Singer, Bob	University of Hawaii
Smith Milt	University of Washington
Smythe, William	JPL
Solomon, Jerry	JPL
Spanner, Mike	NASA/Ames Research Center
Steinkraus, Ron	JPL
Strhler, Alan	Hunter College of C.Y.N.Y.
Taranik, Jim	Mackay School of Mines, University of Nevada
Tucker, Deanne	JPL
Ustin, Susan	University of California, Davis
Vanderbilt, Vern	Purdue University
Vane, Gregg	JPL
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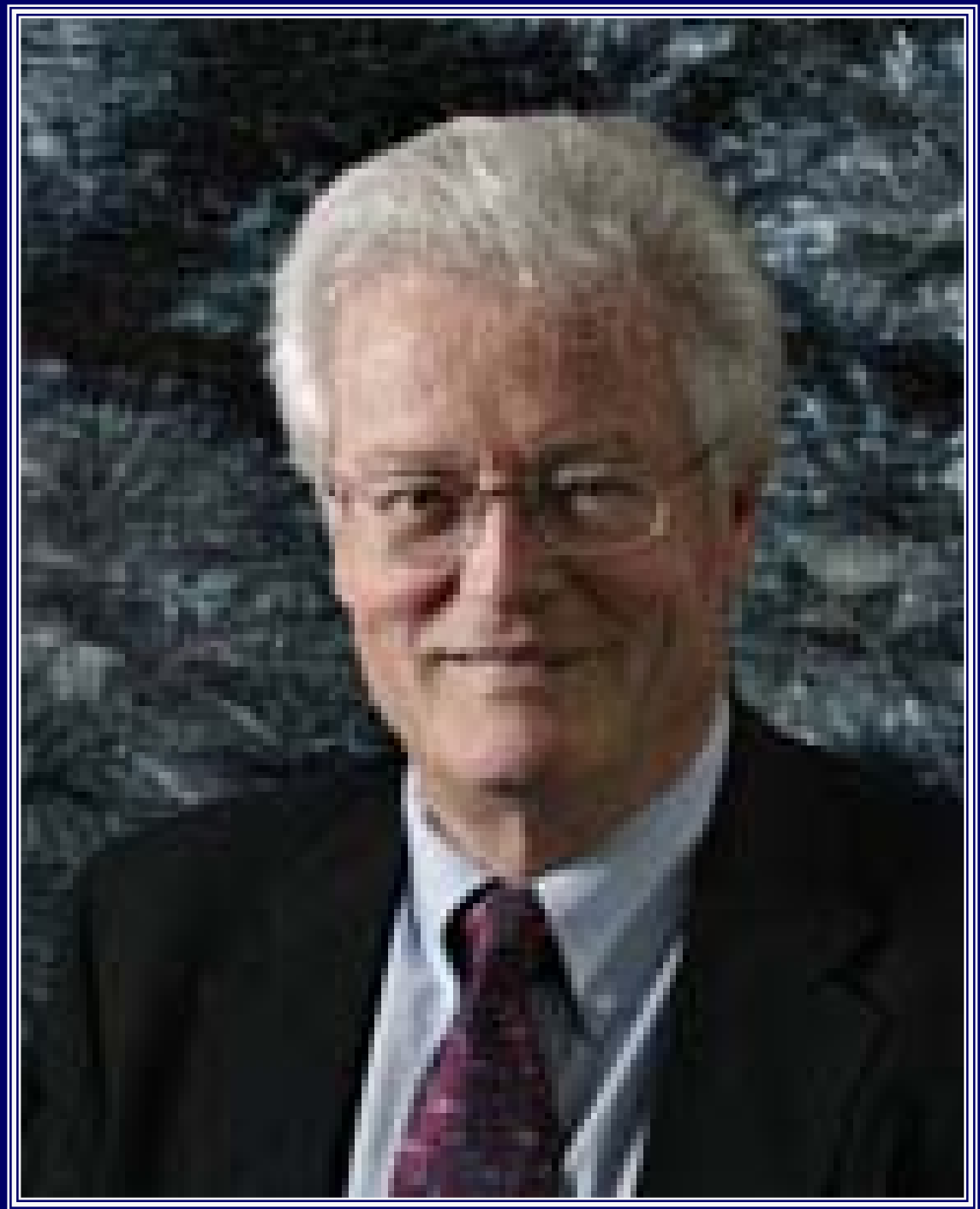
Westman, Walt	Technicolor Government Services
Wickland, Diane	JPL/NASA Headquarters
Wilson, Peter	CSIRO, Perth, Australia
Wood Byron	NASA/Ames Research Center
Wukelic, George	Battele Northwest Laboratories
Yamaguchi, Yasushi	Geology Survey of Japan/Stanford University
Yool, Steve	University of California, Santa Barbara
Zak, Alex	JPL



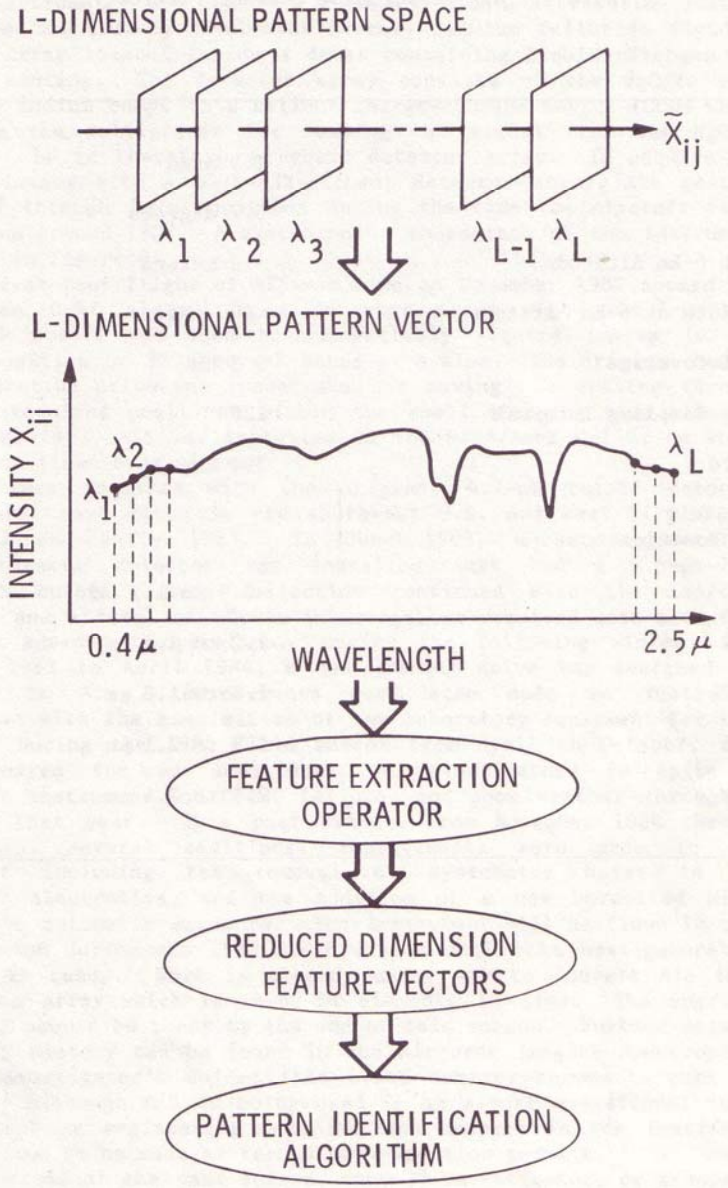
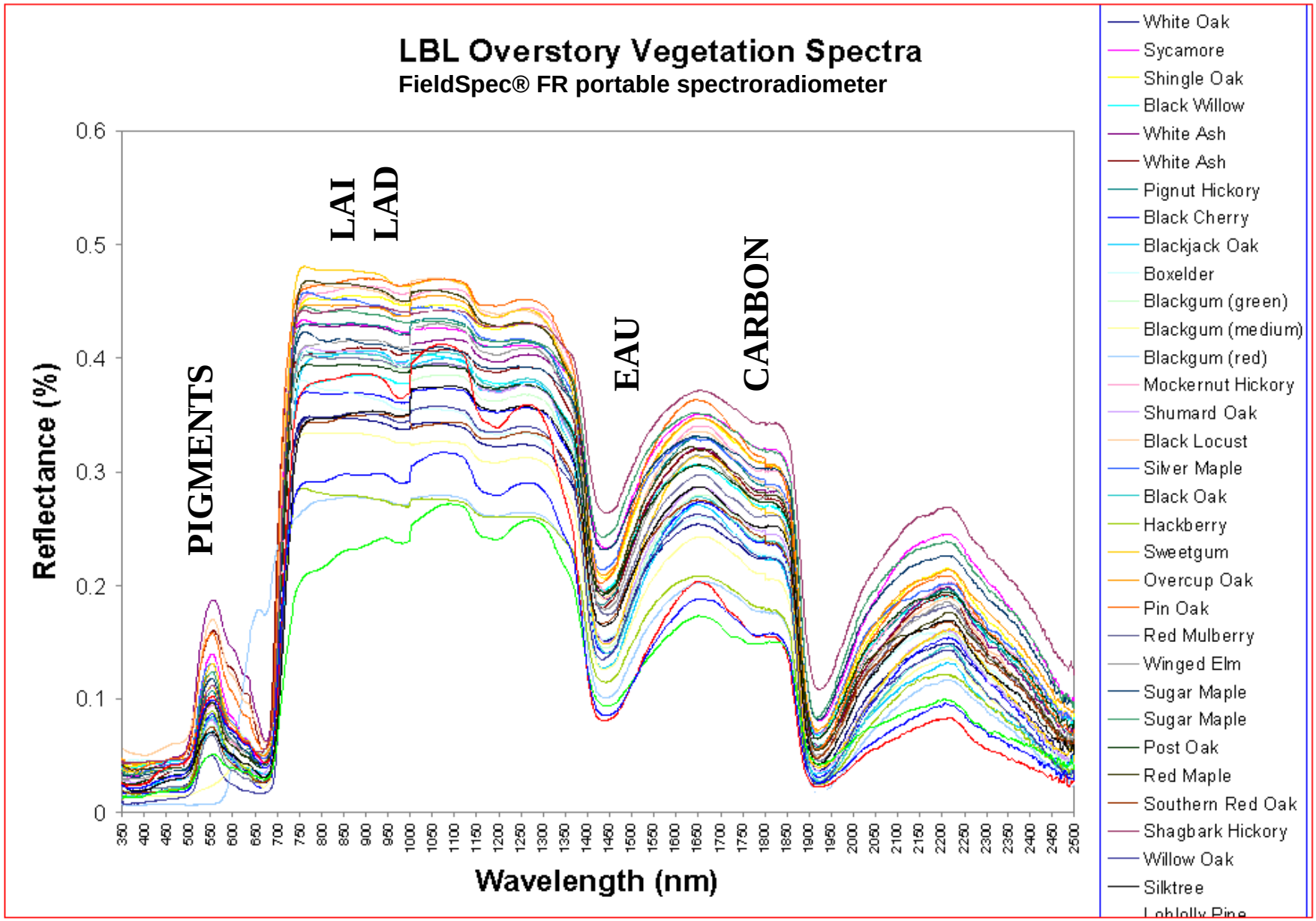
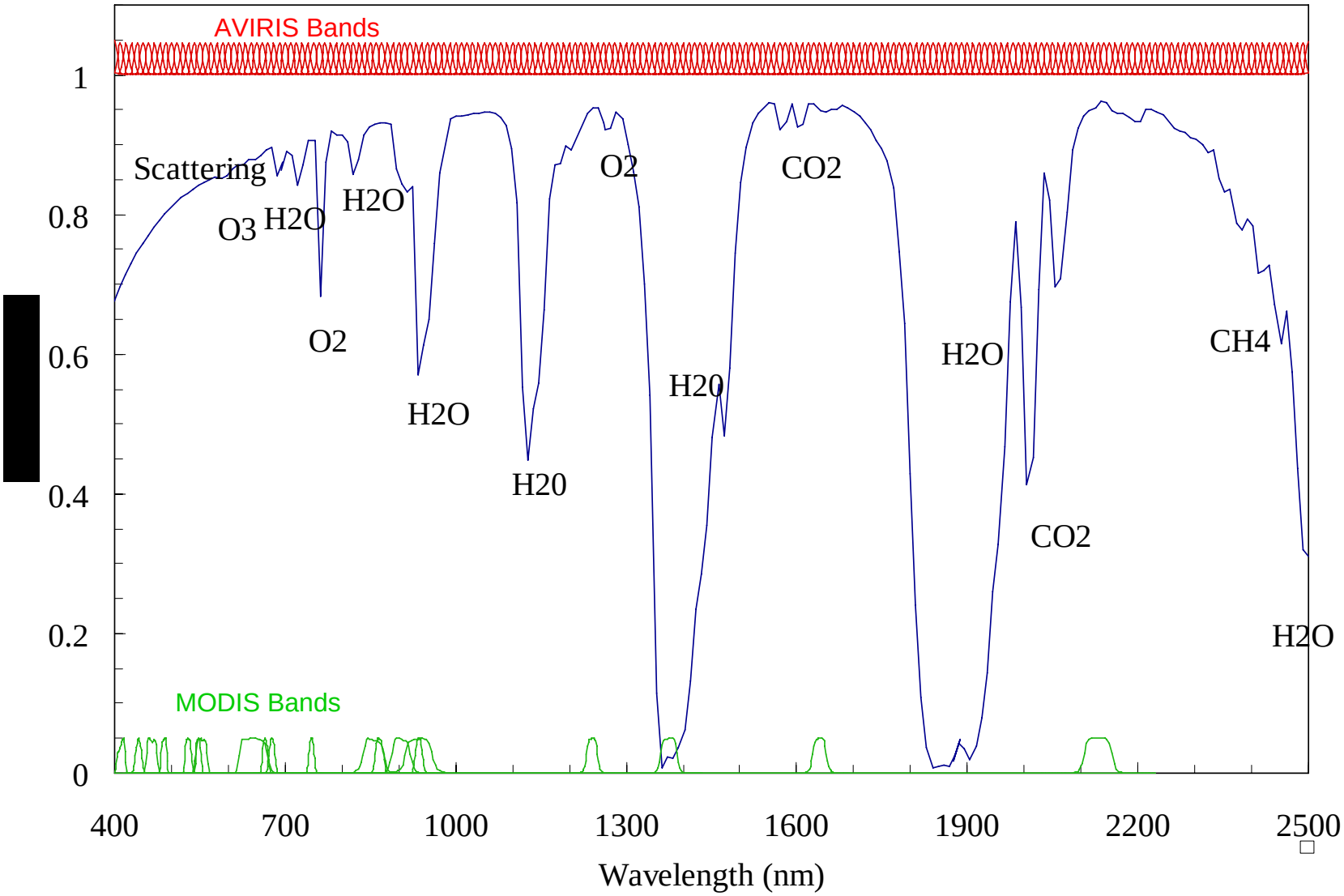


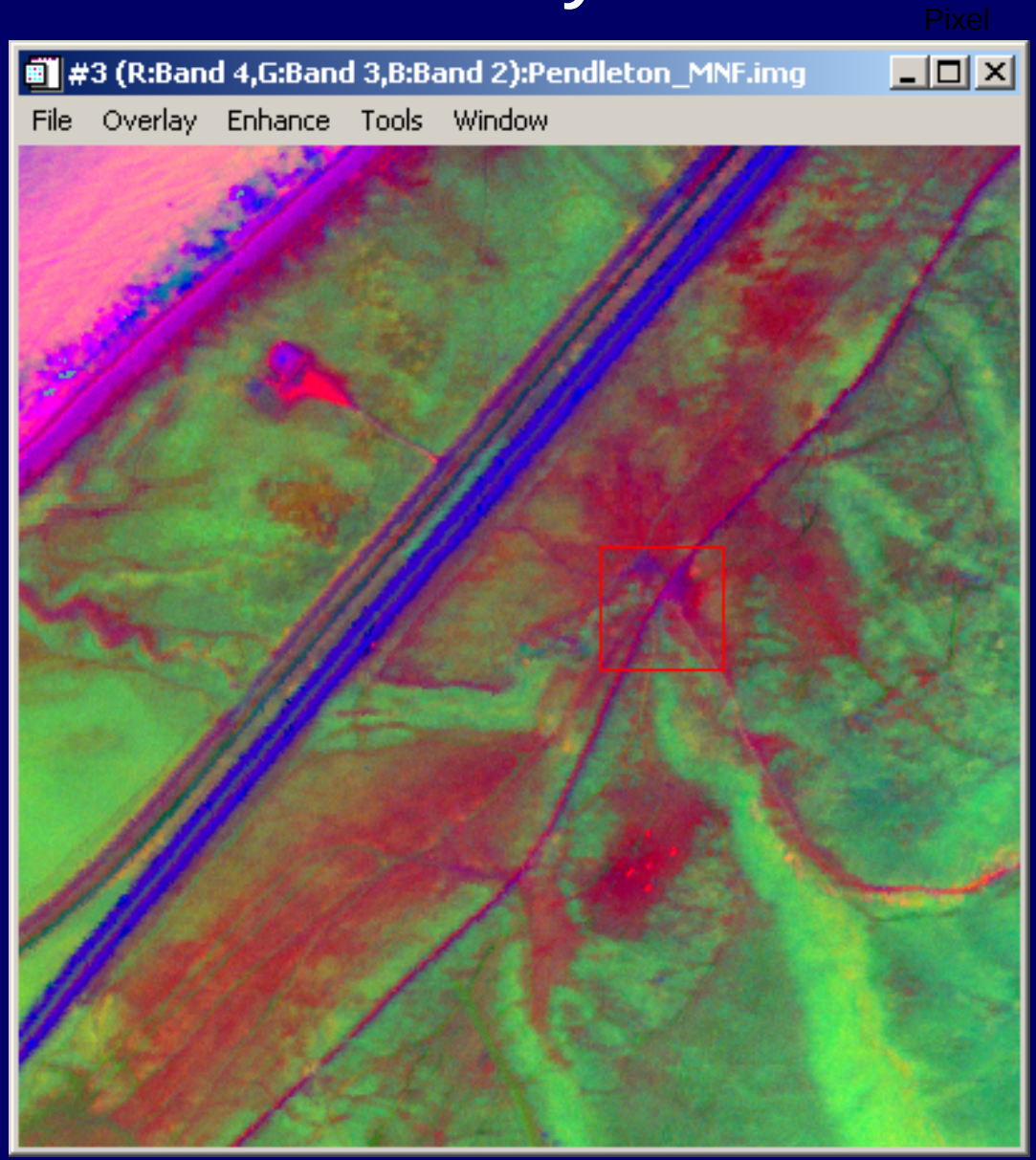
Figure 8. Generalized approach to the multispectral classification problem.

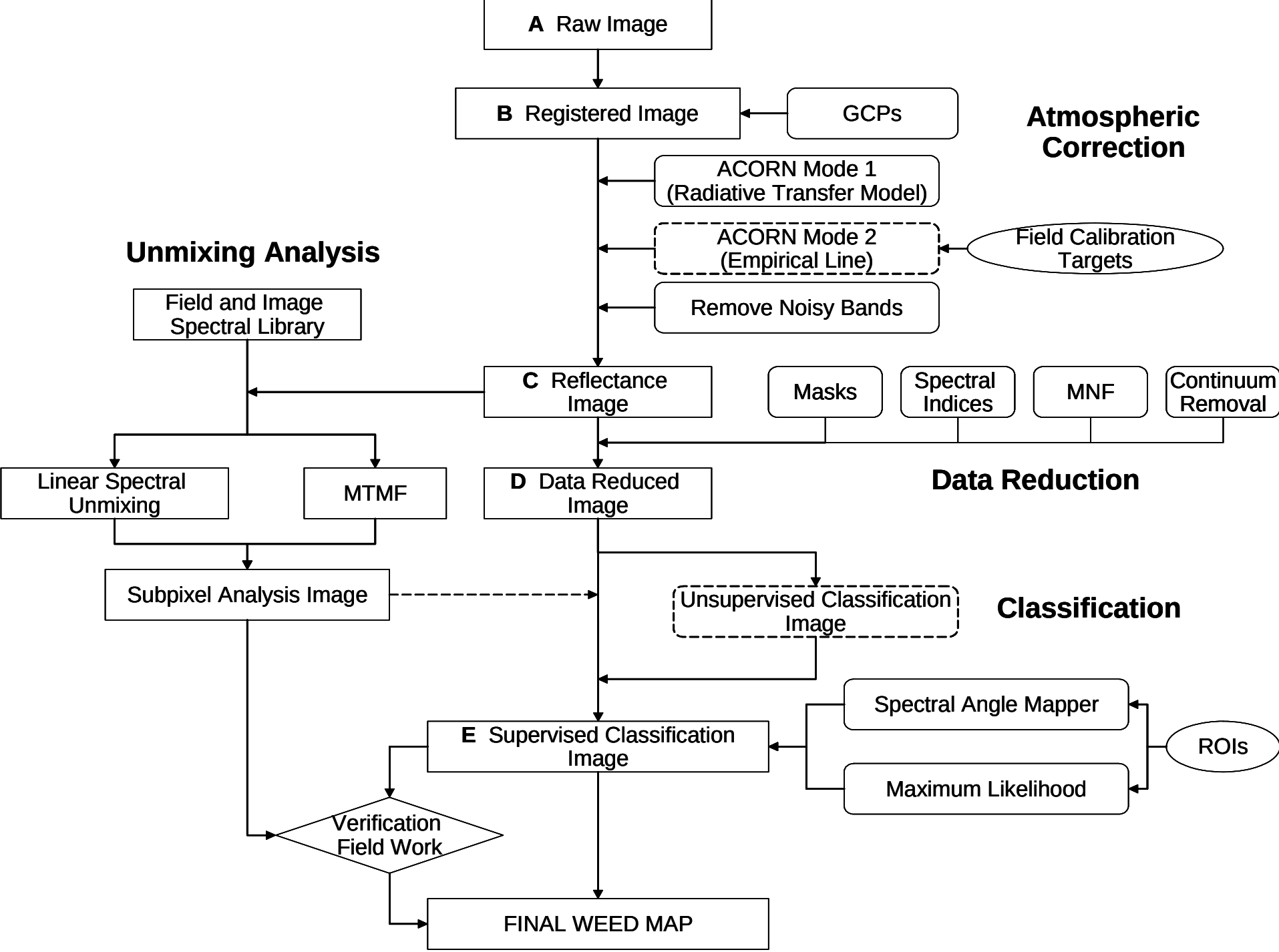

LBL Overstory Vegetation Spectra
FieldSpec® FR portable spectroradiometer
Reflectance (%)
Wavelength (nm)
PIGMENTS
LAI
LAD
EAU
CARBON
White Oak
Sycamore
Shingle Oak
Black Willow
White Ash
White Ash
Pignut Hickory
Black Cherry
Blackjack Oak
Boxelder
Blackgum (green)
Blackgum (medium)
Blackgum (red)
Mockernut Hickory
Shumard Oak
Black Locust
Silver Maple
Black Oak
Hackberry
Sweetgum
Overcup Oak
Pin Oak
Red Mulberry
Winged Elm
Sugar Maple
Sugar Maple
Post Oak
Red Maple
Southern Red Oak
Shagbark Hickory
Willow Oak
Silktree


AVIRIS Bands
MODIS Bands
Scattering
O3
H2O
H2O
O2
H2O
H20
O2
H20
CO2
H2O
CO2
CH4
H2O
1
0.8
0.6
0.4
0.2
0
400
700
1000
1300
1600
1900
2200
2500
Wavelength (nm)

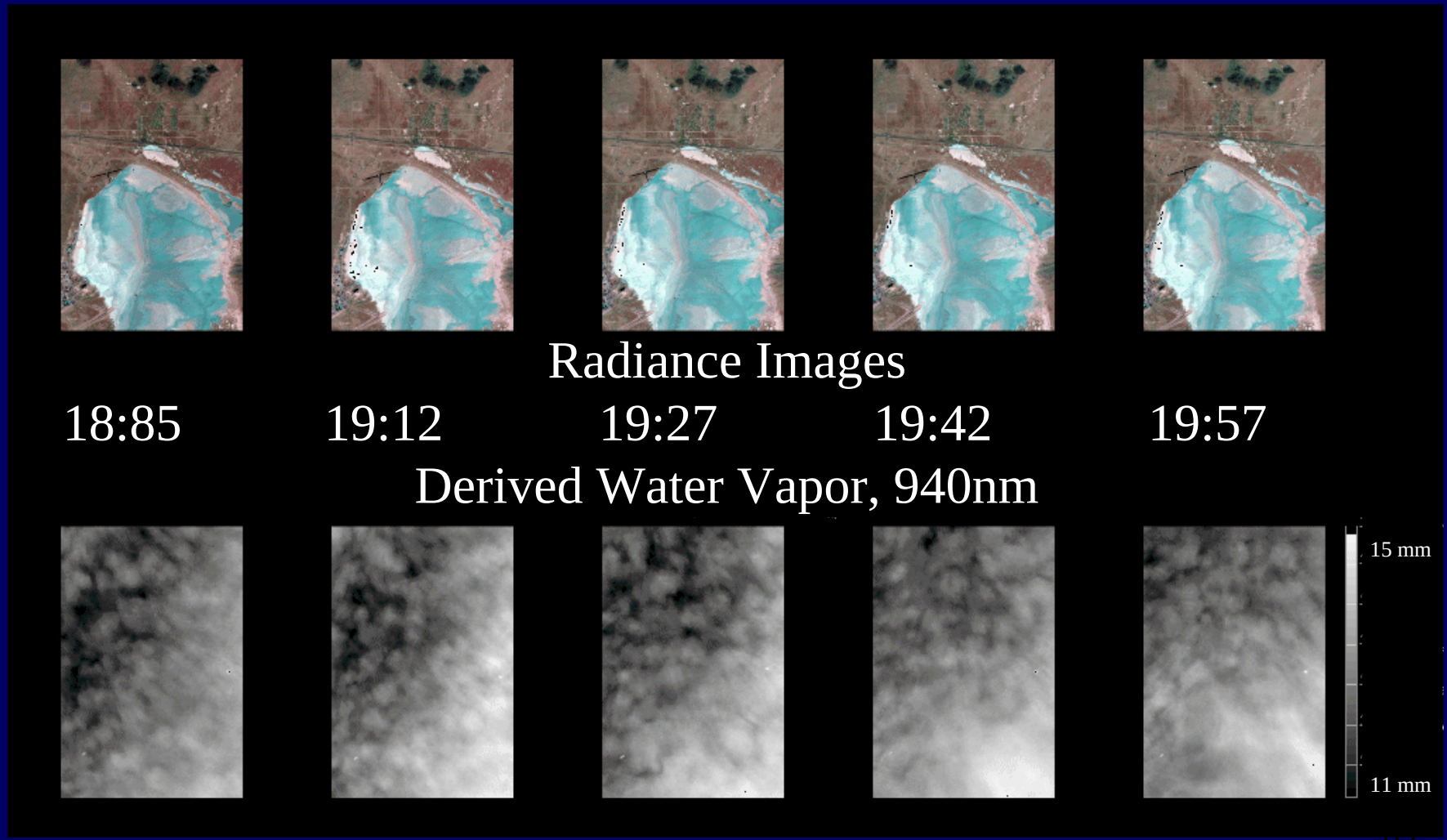
Salar de Arizaro

Pixel Purity Index




A Raw Image
B Registered Image
GCPs
Atmospheric Correction
ACORN Mode 1 (Radiative Transfer Model)
ACORN Mode 2 (Empirical Line)
Field Calibration Targets
Remove Noisy Bands
Unmixing Analysis
Field and Image Spectral Library
C Reflectance Image
Masks
Spectral Indices
MNF
Continuum Removal
Linear Spectral Unmixing
MTMF
D Data Reduced Image
Data Reduction
Subpixel Analysis Image
Unsupervised Classification Image
Classification
Spectral Angle Mapper
E Supervised Classification Image
ROIs
Maximum Likelihood
Verification Field Work
FINAL WEED MAP

AVIRIS Water Vapor at Rogers Dry Lake, CA



Robert O. Green

NASA EO-1 Hyperion: First Spaceborne Earth-Imaging Spectrometer

An Early ASD
1994

PS-II
1991

INTA fin Wenfredi, Argentina


SERVICIO
Tome
Coca-Cola
Coke
OFICINA
SKATE
WORLD

Graduation
2006