

## High-Accuracy Hyperspectral Ground Truth Reflectance Techniques – Field Methods, Analysis Tips, and Theoretical Considerations.

The MISR (Multi-angle Imaging Spectro-Radiometer aboard Terra) Calibration and Validation team at JPL employs a suite of ground-based radiance measurements to derive multi-angle TOA (Top Of Atmosphere) radiance predictions. Collected during Terra overflights and concurrently with visible & near IR downwelling radiance and upwelling hemispherical BRF measurements, hyperspectral nadir ground reflectance is a key parameter. Driven by a requirement of 3% on-orbit radiometric accuracy, techniques have been developed to routinely ensure 1-2% error of in-situ reflectance measurements of large homogeneous ground targets such as playas and pans. From the care and feeding of reflectance standard panels to the whys and wherefores of field methodology, the author will present the various steps taken by MISR Cal/Val both in the field and during analysis that contribute to overall reflectance certainty, as well as the theory behind them.

# MISR/JPL Portable Ground Truth



Anytime...

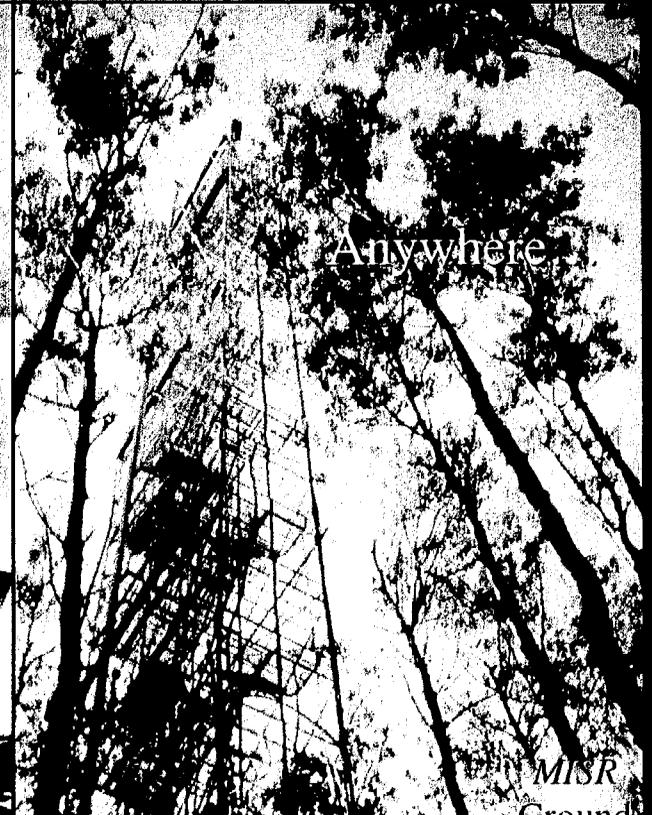
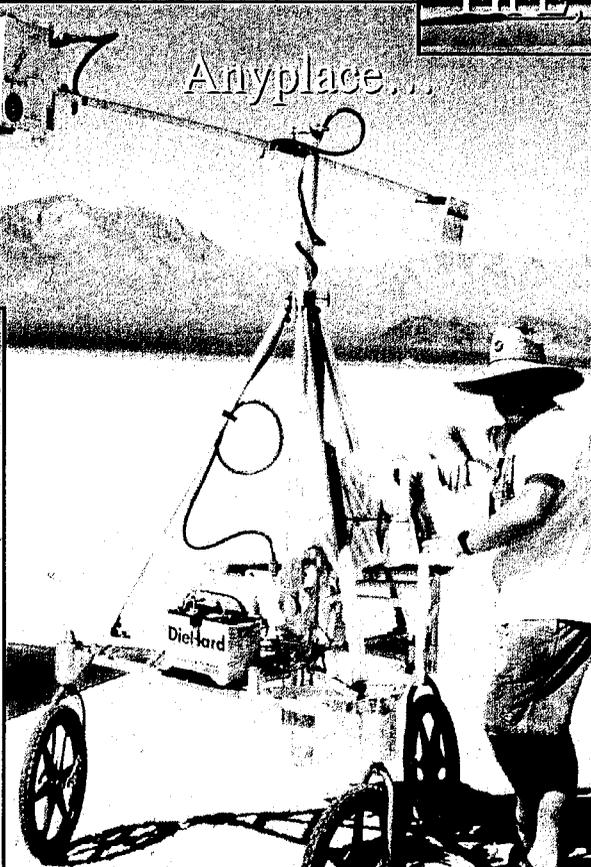
Campaign Heritage:  
EIFF, BOREAS, SAFARI 2000

Anyplace...

Decade+ of Experience  
Domestic & Foreign Ops

Anywhere

Anything...



Experimental Heritage: AVIRIS, Landsat, ASAS, AirMISR/MISR, AIRS

MISR  
Ground  
Truth

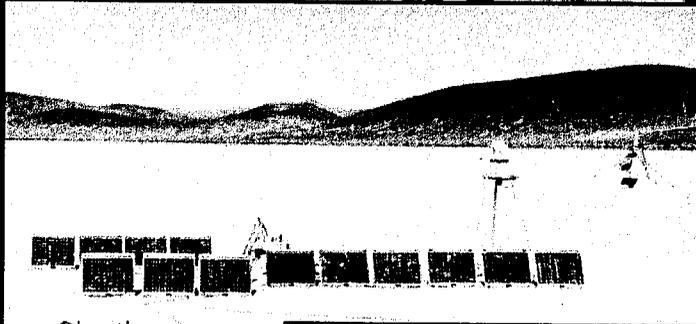
# Logistic Capabilities



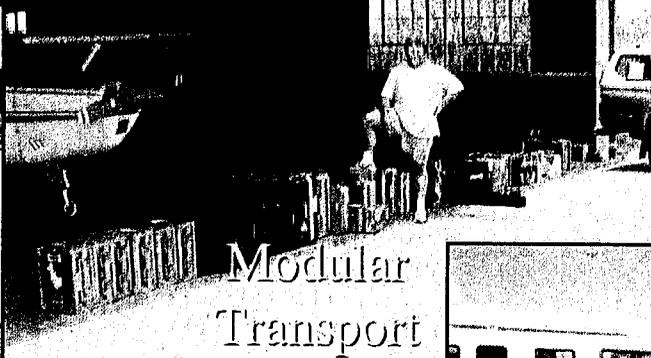
Deployment Flexibility



Self-Contained



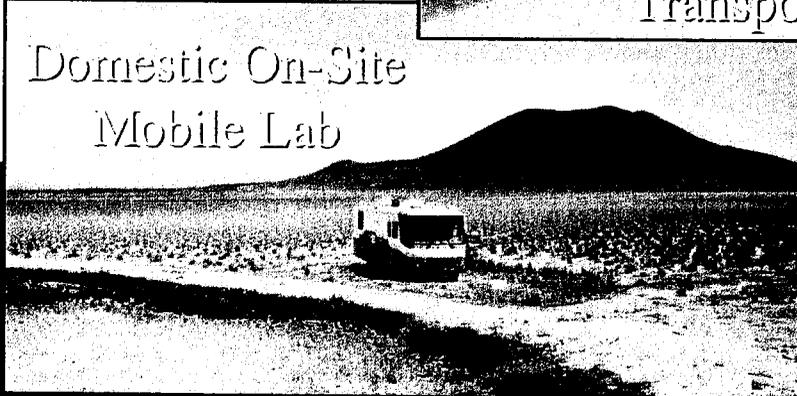
Solar Power



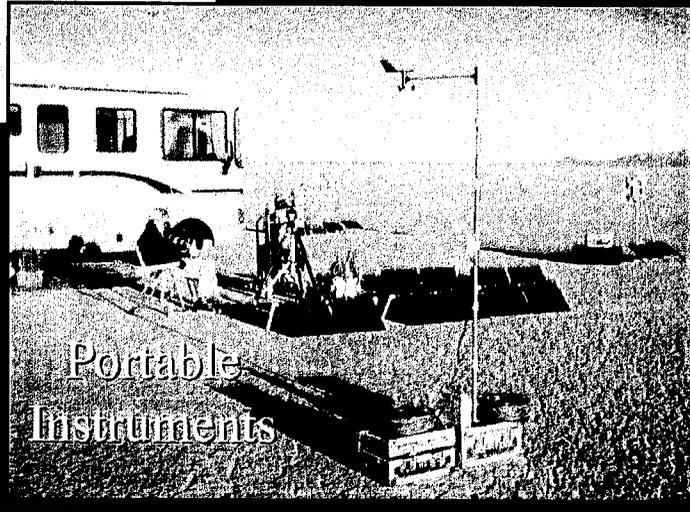
Modular Transport



Autonomous Operation



Domestic On-Site Mobile Lab



Portable Instruments

MISR  
Ground  
Truth

# Some Operational Solutions



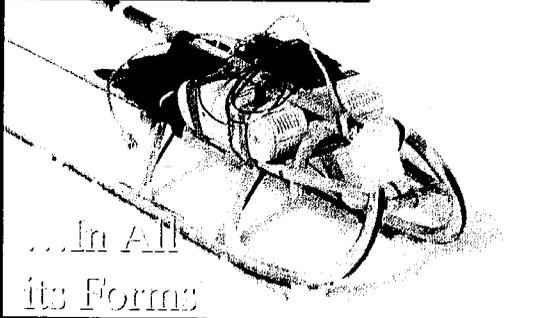
Handling H<sub>2</sub>O



Outreach = Local Goodwill



... Overall Safety ...



... In All its Forms



Mobility Over Large Targets



... and Cooperation



MISR  
Ground Truth  
Local Wildlife

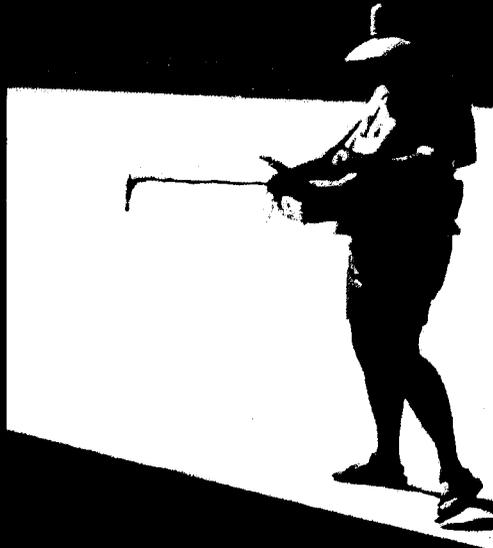


Local Wildlife Control



Sometimes  
All That's  
I Needed is  
Pedal  
Power!

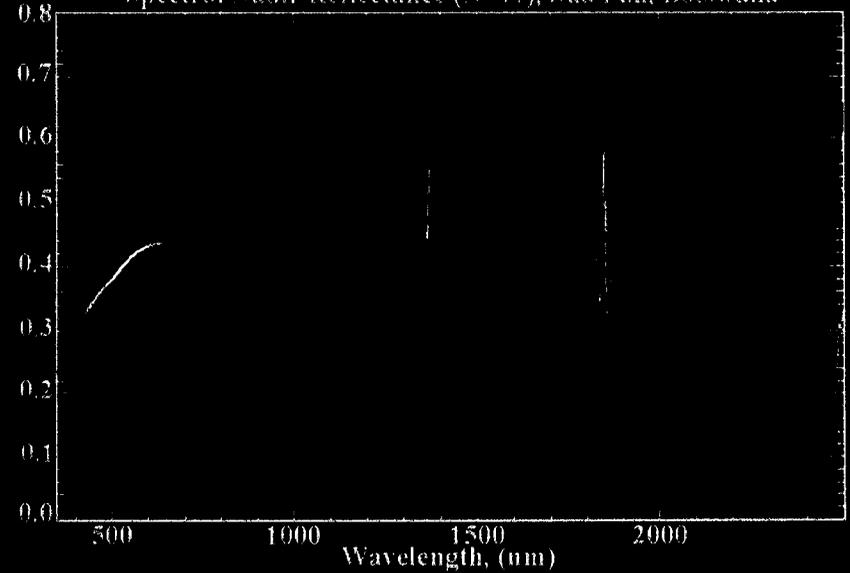
ASD Field Spectrometer



# Instruments & Data Products

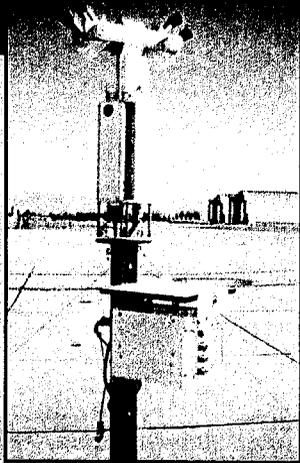
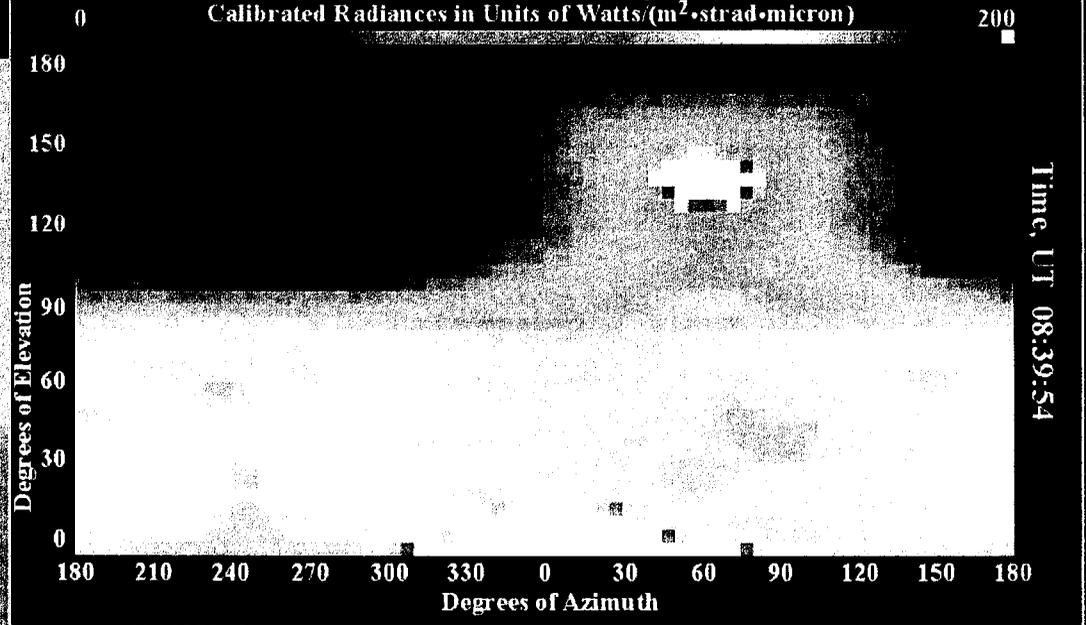
Spectral Nadir Reflectance  
350 to 2500nm,  
2% Radiometric Accuracy  
~1m Scale Over Km<sup>2</sup>

Spectral Nadir Reflectance (N=77), Sua Pan, Botswana



PARABOLA Spherical Scan of Sua Pan, Botswana, 860nm

Calibrated Radiances in Units of Watts/(m<sup>2</sup>·strad·micron)



PARABOLA  
Sphere-Scanning  
Radiometer



MISR  
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Truth

Spherical Radiance & HDRF,  
5° Angular Resolution, 8 Bands, 440 to 1650nm

# Instruments & Data Products

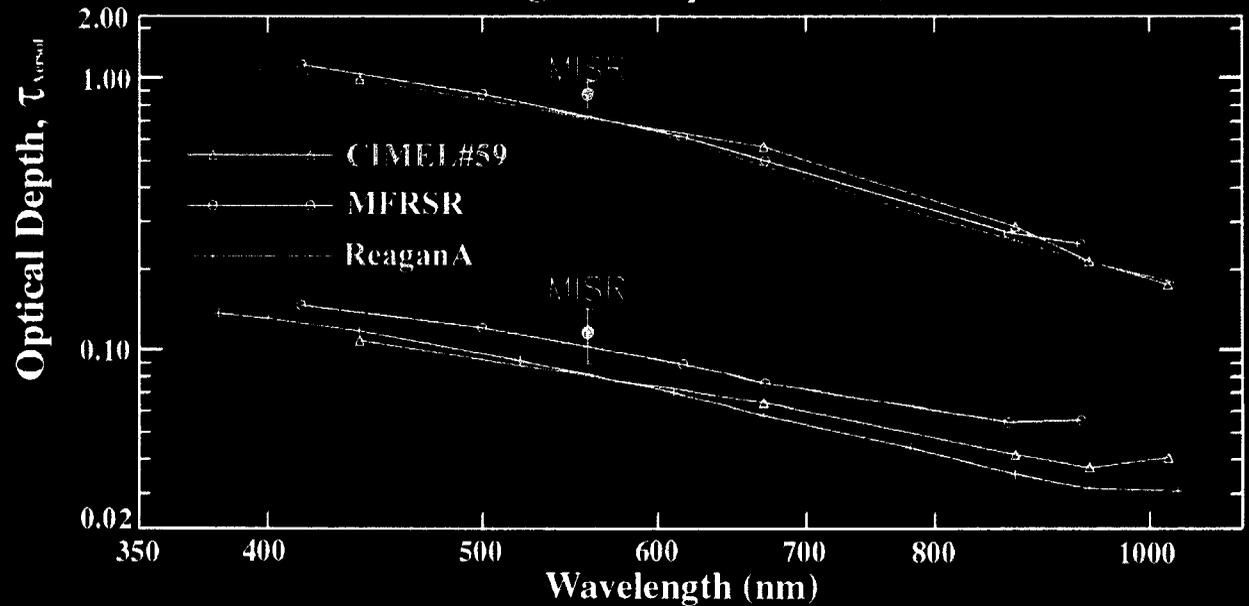
Met Package Measures:  
Ambient Temperature, Humidity,  
Wind Speed & Direction



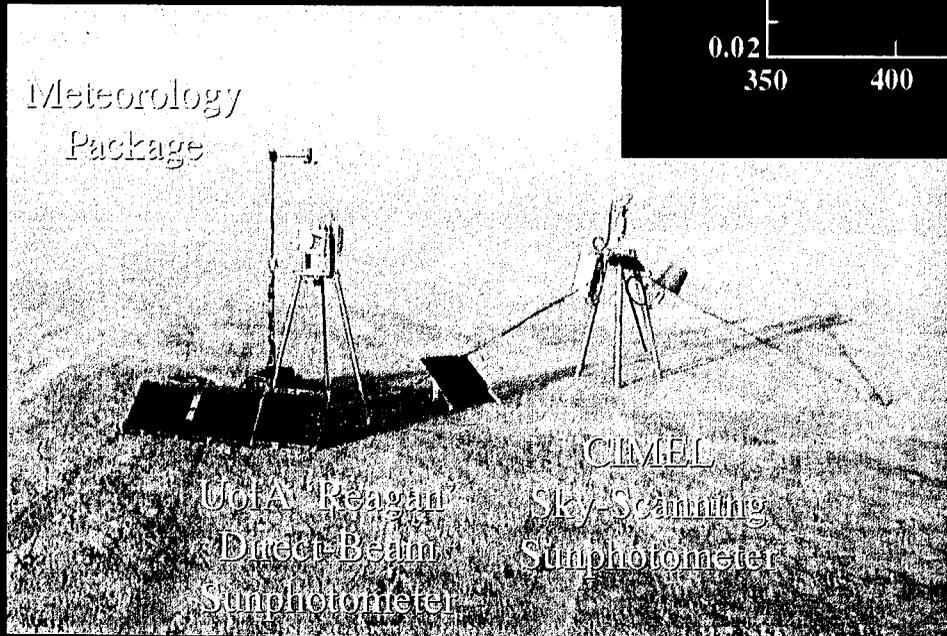
YES Shadowband Radiometer

YES MFRSR Measures:  
Total & Diffuse Sky Radiance,  
Direct/Diffuse Ratio,  
7 Bands, 440 to 880nm

## SAFARI 2000, 27Aug & 03Sep, Sua Pan, Botswana



Meteorology  
Package



UofA 'Reagan'  
Direct-Beam  
Sunphotometer

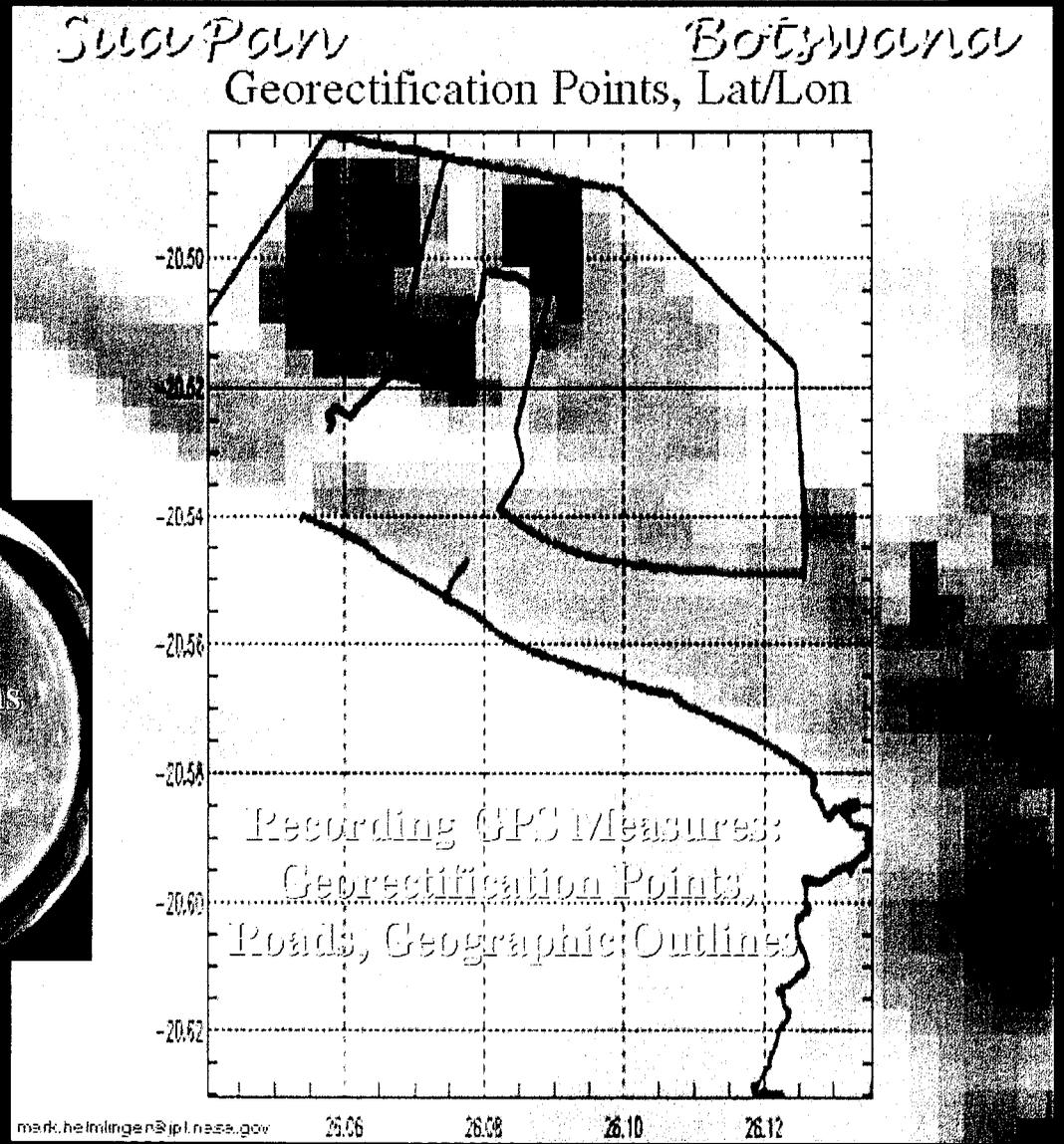
CIMEL  
Sky-Scanning  
Sunphotometer

CIMEL (#59 of AERONET) Measures:  
Optical Depth, Sky Radiance Map,  
9 bands, 440 to 880nm,  
& 3 Polarizations @ 880nm

UofA 'Reagan' Measures:  
Direct-Beam Optical Depth,  
10 Bands, 380 to 1030nm  
(Three Instruments Available)

MISR  
Ground  
Truth

# Instruments, Data, Support, & Services



- Support Hardware / Software Includes:  
PC & MacOSX (UNIX) Laptops  
100Gb+ Storage Capacity  
IDL Processing & Analysis Code  
Digital Video & Photo Documentation  
Worldwide Satellite Voice & Text Comm.

• Experimental Design Consultation,  
Advisory Support, & Training are Also Available



