LA JORNADA Prototype Validation Experiment , May 1997 (PROVE '97)

Experimental plan (working document)

Contributors: Faiz Rahman, Wim van Leeuwen, Jeff Privette, Wolfgang Wanner, Greg Asner,

SCOPE

Scientists from three different instrument teams of EOS (Earth Observing System, NASA), i.e., MODIS (Moderate-resolution Imaging Spectrometer), MISR (Multi-angle Imaging Spectro Radiometer) and ASTER (Advanced Space-borne Thermal Emission & Reflectance Radiometer) will have a joint 10-day prototype field validation campaign at La Jornada basin in New Mexico in late May, 1997 (tentative dates are May 20-30). This month coincides with a rather extensive USDA-LTER (United States Department of Agriculture- Long Term Ecological Research) biophysical and surface flux data collection efforts in 1995 and 1996 from the same basin. It also coincides with their (USDA and LTER) planned AVIRIS (Airborne Visible/Infrared Imaging Spectrometer) and possibly TIMS (Thermal Infrared Mapping Spectrometer) flights over the same basin this year (1997). Airborne simulators for MISR and MODIS (i.e., AirMISR and MAS, respectively) will be flown with the planned Jornada AVIRIS flight. It appears that personnel from all these teams (MODIS, USDA, LTER, ASTER and MISR) can converge on the site at this time, and extensive ground- and aircraft-based radiometric and biophysical and data can be collected. Considering the need for a standardized and valid data collection strategy for a globally distributed set of EOS test sites, this proposed exercise is critically important and it will serve the purpose of prototyping the EOS validation techniques for all other sites.

This is an evolving document that will address planning, coordination and logistical issues mostly related to the ground and low aircraft measurement strategies. Based on the increased interest from many institutes, some coordinated plan needs to be implemented that will allow us to reach our main goal: prototyping remote sensing and biophysical ground measurement strategies to validate MODIS, MISR and ASTER LAND products (surface reflectance, vegetation index, albedo, BRDF, LAI, fAPAR, land cover) at 250 m and 1 km scale.

This document will become a collection of experiment designs and descriptions of measurements and methodologies to be executed by the involved investigators. The scope of this document is to identify all investigators and indicate their contribution to this validation effort. A preliminary list of instruments and measurements have been identified in previous meetings (USDA, MODIS) among most of the participants and are incorporated in this document.

The University of Arizona will coordinate the low aircraft radiometry, ground radiometry and fAPAR transects and would like to coordinate these measurements with the LAI measurements (destructive and with LAI-2000) already planned by the USDA/ARS (Las Cruces, NM) represented by Kris Havstad. Also, Jeff Privette (NASA-GSFC) will coordinate Cimel sunphotometer measurements along the same transects.

All experiments will be appended to this document using a format that is recommended to be used by everybody involved (title of experiment, product to be validated, investigators, point of contact, objectives, methodologies and experimental design, collaboration etc.)

INTRODUCTION

Site description

The Jornada Experimental Range is in a very large valley (~ 800 sq. km.) in southwestern New Mexico, 23 miles north of Las Cruces (figure 1). Although bounded on the east and west by mountains, the valley is extremely flat. This area is slowly undergoing a landcover change from grassland to shrubland (predominantly mesquite). Probable cause for this change is overgrazing near the turn of the century. Some areas continue to be grazed today. Because of this landcover change, three distinct areas exist: grassland, shrubland, and transitional areas (mixed grassland and shrubland). Currently there are approximately 8000 ha of grassland mostly in the southern part of the range, 12000 ha of transitional land in the middle part and 35000 ha of brushland in the north. Grassland is dominated by black gramma species. In the brushland area, approximately 70% is mesquite, 20% creosote, and 10% tarbush-dominated. The mesquite area, which is "most transformed" from the original grassland state, contains sand dunes in and around all shrubs. These dunes are 2 to 3 meters high - making this particular section difficult for field work.

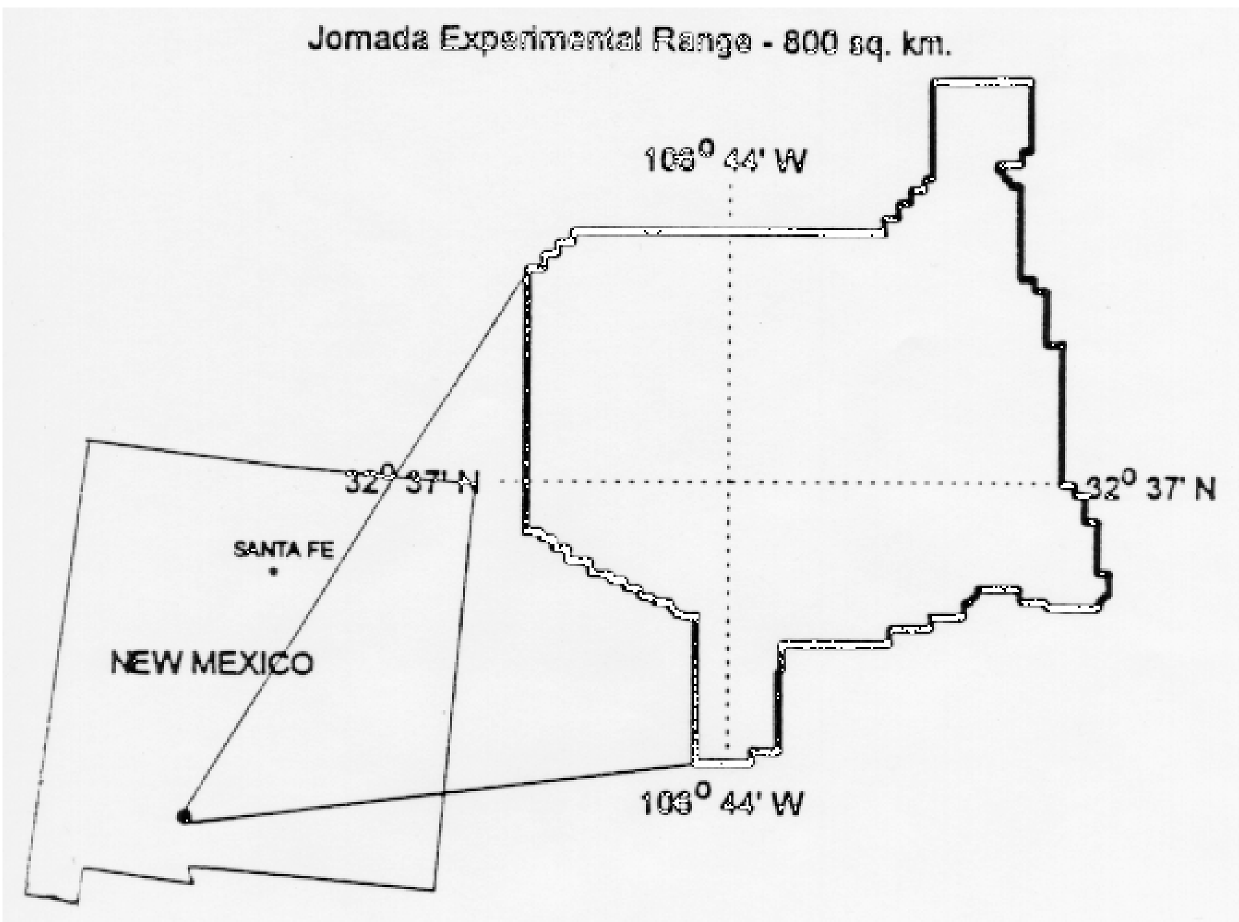

Figure 1: Jornada Experimental Range in New Mexico, 23 miles north of Las Cruces

The climate of this area is semi-arid and as such both the grasses and shrubs are sparse, and the average leaf area index is low (~0.5 average). As is typical of such environments, the woody-to-herbaceous ratio is relatively high. Driest season is spring when green LAI is lowest. The vegetation of the area assumes its highest LAI values in September following the late summer monsoons. There are virtually no man-made structures in the whole area, except for a few unpaved roads, some data towers, and some fences. Thus, contributions from non-target components in remote sensing data should be very small. A road map to the site is shown in figure 2.

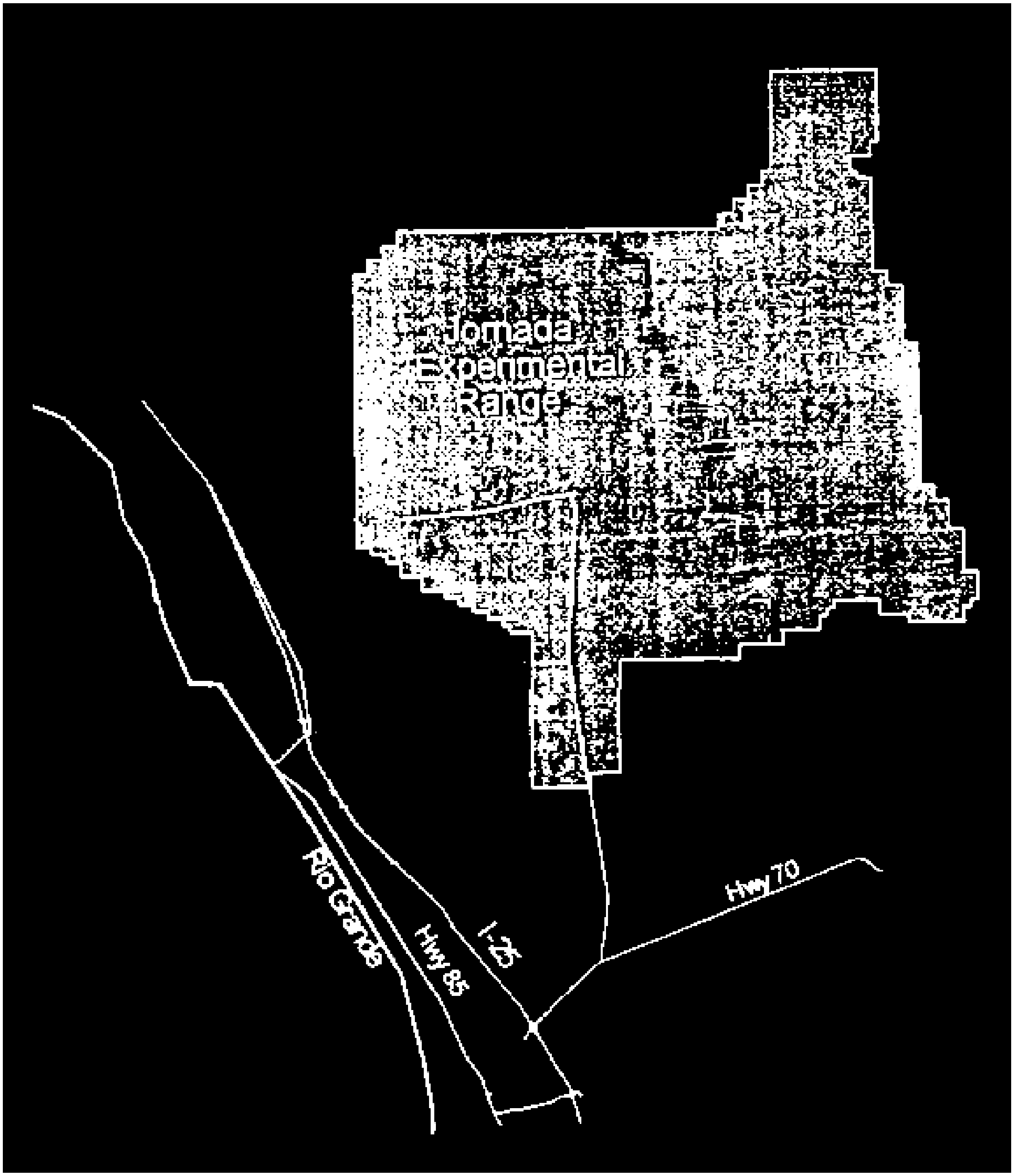

Figure 2: Road map to the experimental site. Inside the site there are a few unpaved roads that lead to different water wells and flux towers.

EOS Prototype Validation Exercise.

After a preliminary MODLAND visit to La Jornada, the shrubland site was deemed too heterogeneous to work effectively, particularly given the sand dunes associated with the shrubs. The grassland site appeared very reasonable for field work and the transitional site appeared a possible, although riskier site. In combination, the transitional and grassland sites would span a range from a difficult (more experimental) to a easier (more conventional) site in terms of data collection, reduction, analysis and validation.

We proposed that a short but reasonably intensive data collection effort be conducted collaboratively among MODIS, MISR, ASTER, USDA-ARS and LTER personnel in May, 1997. In this effort, we would collect remote sensing data over different spectral, angular and spatial ranges with AirMISR, MAS, AVIRIS, an Exotech radiometer (small aircraft) and possibly TIMS. These data sets could be collected over most of the Jornada area, and should adequately address issues of scaling, etc. Second, we proposed that a CIMEL sunphotometer be mounted at the top of the 100-foot flux tower located at the transitional site, and a second CIMEL be mounted on a cherrypicker at the grassland site. A PARABOLA instrument provided by MISR would be co-located on the cherrypicker. The horizontal and vertical mobility of the cherrypicker should allow an extremely valuable opportunity to assess the tower measurement strategy, plus extensive comparison between data from CIMEL, PARABOLA, AVIRIS, MAS and AirMISR. Finally, ground-collected collecting LAI, fAPAR and surface reflectance data (with Exotech radiometer) along transects at the two study sites can be used in combination with the aircraft and tower data to help validate sampling and scaling strategies. Various data for atmosphere characterization would also be collected.
A large number of photographs of these sites were taken and some are now available at http://pratmos.gsfc.nasa.gov/~justice/modland/valid.html. While the plan clearly cannot contain significant detail at this point, we request that every collaborator review this proposal and reply to this email with their comments. Any of the above-listed personnel can be contacted for further details. Site-specific questions may be best addressed to Kris Havstad (LTER & USDA Jornada Experimental Range) at khavstad@nmsu.edu, Al Rango (USDA Hydrology Lab, Beltsville, MD) at alrango@hydrolab.arsusda.gov, Bill Kustas (USDA Hydology Lab, Beltsville, MD) at bkustas@hydrolab.arsusda.gov, or Jerry Ritchie (USDA Hydrology Lab, Beltsville, MD) at jritchie@hydrolab.arsusda.gov.

Focus sites:
Site 1: grassland area.
Site 2: transitional area.

General approach for the whole experiment:

- Collect BRDF data (CIMEL and PARABOLA) at different heights from cherrypicker at **Site 1**, while ground crews conduct LAI, fAPAR and radiometry transects.
- Collect BRDF (CIMEL) and radiometry data from **Site 2** tower, while ground crews conduct LAI, fAPAR and radiometry measurements.
- Collect energy and CO_2 flux data from tower at **Site 2** for NPP evaluation.
- Release radiosonde for atmosphere characterization.
- Collect low altitude (aircraft) radiometry data over both sites and extended areas for scaling and site characterization
- Collect high altitude (ER-2) MISR and MODIS simulator and AVIRIS data over the whole area.
- Acquire Landsat-TM, AVHRR and GOES satellite images.

TEAMS and INSTRUMENTS

This section describes the required instruments for validation of surface reflectance, vegetation indices, BRDF, albedo, LAI, fAPAR and NPP. Also the measurements that will be taken with those instruments and the science teams who will bring along these instruments for this campaign are listed here (inside the bracket at the end of each line)

Site 1 (grassland) :

<u>105' mobile cherrypicker truck</u>
CIMEL sunphotometer - BRDF, surface reflectance (NASA - GSFC)
Sensit PARABOLA - BRF, BRDF, HDRF, BHR, surface reflectance (JPL)
albedometer - spectral albedo (JPL)

<u>ground transects</u>
Licor LAI-2000 - LAI, (LTER)
Licor LAI-3000 - LAI destructive validation (LTER/USDA-ARS)
ceptometer - fAPAR, (UA)
portable Exotech radiometer - surface reflectance, VI, (UA)
Spectron spectrometer - surface reflectance, VI, (UA)
standing biomass balance - NPP (LTER/USDA-ARS)

Bowen ratio + CO2 IRGA - NPP (ARS) { discussion with Dr. Running needed}

Site 2:

<u>100' fixed tower</u>
Insulated thermal radiometer - surface temperature (ARS)
CIMEL sunphotometer - BRDF, surface reflectance (NASA)
broadband pyranometer - albedo (BU)
EC flux instruments - NPP (ARS) - {discussion with Dr. Running}

<u>ground transects</u>
Licor LAI-2000 - LAI (LTER)
ceptometer - APAR (UA-MODIS)
portable Exotech radiometer - surface reflectance, VI, (UA)

<u>radiosonde -</u> atmospheric measurements (JPL,UA-ASTER)

Both sites:

ASD spectrometer - VI, LAI, fAPAR (NASA, UA-ASTER)
GPS receivers/ Cameras (?)
cellular phones/ walkie-talkies (?)

Remote sensing platforms needed for this experiment and the instruments that will be mounted on those platforms are described below. Also the names of the responsible agencies are given inside brackets.

ER-2 aircraft will carry AirMISR and MAS - basic instrument simulators (JPL) .
Cessna low flying aircraft will carry Exotech radiometer with tiltable mount (UA-MODIS).
Pilotless ASD airplane will carry spectrometer (NASA-GSFC).
ER-2 AVIRIS (ARS).

Satellite Images that will be acquired and the responsible agencies are listed below:

Landsat 5 TM - (UA-ASTER)
SPOT HRV - (UA-ASTER)
GOES - (NASA-GSFC)

Table 1: **Teams joining the campaign**, - institutions, contact persons and the team members.

Institution	Contact person	Team members
1) USDA-ARS	Kris Havstad khavstad@nmsu.edu	
2) UA-MODIS	Faiz Rahman faiz@ag.arizona.edu	Wim, Karim, Tomoaki, Alfredo, Gerardo, Faiz.
3) UA-ASTER	Kurt Thome kurt.thome@opt-sci.arizona.edu	
4) NASA-GSFC	Jeff Privette privette@gsfc.nasa.gov	
5) LTER		
6) NCAR/CU	Greg Asner asner@hypatia.colorado.edu	two undergrad students
7) BU-MODIS	Wolfgang Wanner wanner@crsa.bu.edu	Andrew, Mike, Alan, Jan-Peter
8) JPL	James Conel @	
9) MSU	Steve Running @	

Tentative pre-study activities/timeline

January 31 - Decision to conduct a May/June study
February 15 - satellite data ordering
March 1 - aircraft coordination and commitments
March 15 - instrument order/procurement (any missing from above list - pyranometers?)
March 31 - mount CIMEL sunphotometer/BRDF on fixed tower
April 15 - campaign definition, strategy, participation document (draft)
May 1 - LAI/fAPAR sampling strategy coordination

EXPERIMENTS

1. Low aircraft- and ground-based surface reflectance measurements (UA)

Investigators:
Alfredo Huete
Wim van Leeuwen
Faiz Rahman

Collaboration:
Tower Cimel (Jeff Privette), remote controlled airplane ASD (Eric Vermote)

Product validation: Vegetation index.

Objectives:
Measure surface reflectance in space and time to evaluate the response of vegetation indices to sun and view angle effects for different vegetation types and evaluate sensitivity of VIs to FAPAR and LAI

Site locations: Sites 1 and 2.

Experiment design:

Ground-based reflectance data will be collected with Exotech radiometers with 15° field of view and also with Spectron SE590 spectro-radiometer. Spectron will provide 46 bands, from 0.4um to 0.9um, each band having 0.01um width. The four Exotech wavebands included Landsat TM1 (0.45-0.52um),TM2 (.52-.60 um), TM3 (0.63-0.69 um) and TM4 (0.76-0.90 um) bands. The Exotech will be mounted on a light-weight yoke (BACKPACK), 2 m above the surface forming a target pixel of about 45 cm diameter. One Exotech radiometer will measure reflectance of a horizontal Barium Sulphate reference panel continuously from a nadir view angle during the time of surface measurements. Spectral reflectance of surface will be measured every 5 meters along the subsite transects. The sampling scheme for the different pixel sizes are depicted in figure 3. Ground transects in each site will be 1 km long and four in number, creating a 4 by 4 250 m grid. Air transects will be 3 km long, keeping the ground transect pixel in the middle (figure 3). The reflectance factors will be calculated by ratioing the target response and the interpolated response of the reference plate at the time of the actual transect readings. The Exotech radiometers and Spectron will be cross-calibrated over the same reference panel.
Low flying aircraft will carry two Exotechs, one looking nadir and other with changeable view angles (can be changed during flight). The changeable view angles will be 15º, 30º, and 45º. For each view angle of the changeable Exotech, the aircraft will fly once forward and once backward along the flight transect. Ground and air measurements will be made during the May period as well as in the peak green season (Sept.) in the mornings till noon time for different view zenith and azimuth angles and solar zenith angles during the clear sky conditions.

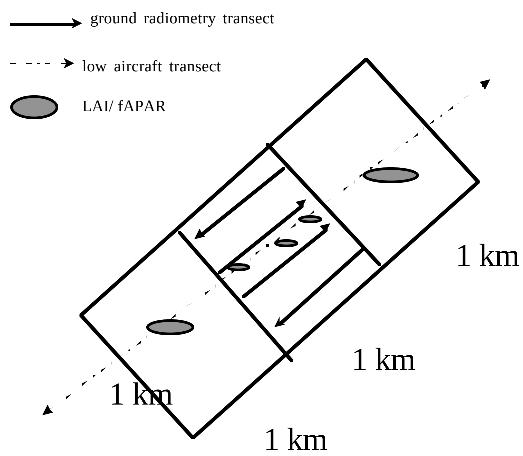

Figure 3: Schematic diagram of ground and aircraft radiometry transects for both sites.

On May 23rd , 25th and 26th (25th being the TM overpass date), the first set of aircraft transects will be flown from 7:30 AM to 8:00 AM. Solar zenith at that time will be ~70^0. The second set of aircraft transects will be flown from 9:45 to 10:45 AM (solar zenith being 48^o to 36^o . The third set of aircraft transect will be flown from 11:30 AM to 12:00 noon. This will give a wide range of solar zenith angle for BRDF studies over the vegetation. Also fAPAR measurements will be conducted from 8:00 A. M. to 12:00 noon. Site 1 will be covered on the 23rd and site 2 on the 26th. On the 25th, aircraft transects will be done over both sites from 9:45 to 10:45 AM, to bracket the TM overpass time (~10:15 AM) and ground fPAR measurements will be taken from 8:00 AM to noon time. LAI from both sites will be collected during these three days (not time specific).

At a speed of 150 km/hr, the aircraft would take ~20 seconds to fly across the 1 km pixel. At an altitude of 100m above ground level (AGL) and 15^o field of view (FOV) of exotechs, the ground swath will be ~30 m wide. Since the most homogeneous sites will be selected as targets, both aircraft and ground radiometer data will be representing virtually the same target after data reduction by averaging of the measurements (averaging scheme has to be outlined).

Table 2: Solar azimuth, zenith and elevation during the light aircraft radiometry on 25th May, ’97.

Local Stand. Time	**Solar Azimuth (deg)**	**Solar Zenith (deg)**	**Solar Elevation (deg)**
07:30	75.06	73.62	16.38
08:00	78.60	67.47	22.53
08:30	82.14	61.24	28.76
09:00	85.78	54.97	35.03
09:30	89.62	48.66	41.34
10:00	93.86	42.35	47.65

10:30	98.76	36.07	53.93
11:00	104.79	29.89	60.11
11:30	112.85	23.91	66.09
12:00	124.78	18.36	71.64

2. Biophysical measurements

Ground -based fAPAR measurements
Experiment design: Along the central ground transect (figure 3) 3 locations will be selected for this purpose. Also one more location will be selected at each of the outer 1 km pixels along the aircraft transect. These locations will be selected to be representative of the sites . Ceptometer will be used for the fAPAR measurements.

Ground-based LAI measurements
Collaboration: ARS/LTER, MODLERS
Experiment design: Along the central ground transect (figure) 3 locations will be selected for this purpose. Also one more location will be selected at each of the outer 1 km pixels along the aircraft transect. These locations will be selected to be representative of the sites . These sites might be same as the ones used for fAPAR measurements. Both destructive and non-destructive methods will be used for LAI measurements.

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3. Albedo measurements (BU)

OBJECTIVES.

Two questions will be investigated:
1) Given AirMISR angular sampling, which is similar to EOS MODIS/MISR angular sampling, and given the need for full atmospheric correction of AirMISR data, can land surface albedo be correctly retrieved from AirMISR multiangular reflectance observations on a per-pixel basis?
2) Given that ground-based albedo validation faces a large mismatch between the small scale of a local albedo measurement, for example at a tower site, and the full square kilometer of an EOS MODIS/MISR footprint, how does local point albedo relate to the albedo of a much larger footprint, how many point measurements are needed to characterize the albedo of a square kilometer, and how much does albedo vary inside the square kilometer satellite footprint area?

MEASUREMENTS.

Three types of measurements will be made:
1) Characterization of the albedometers.
   a) Comparison with other albedometers/pyranometers in the field.
   b) Sensitivity to horizontal obstruction (mountains) and level placing.

c) How far does the operator have to walk away?
d) Experimentation with lambertian panel etc.
Time: 2 days

2) Diurnal albedo cycle.
Mount the albedometers to a fixed location and run the whole day.
a) grassland site
b) dune/brush site
Time: 2 days

3) Transects.
a) transect across the grass-dune/brush transition
b) transect across the grazed/ungrazed boundary
c) transect across the grass-invaded-by-bushes/grass-kept-free-of-bushes boundary
d) point measurements: road, pavement, conspicuous spots
Time: 3 days, including overflight day

If the stereo camera pair should be in the field we'd also be able to do 3D vegetation structural characterization. If the PSII spectroradiometer should be in the field we'd also be able to do vegetation and soil spectral characterization.

PERSONNEL.

Main team:
Andrew Hyman, Mike Barnsely
ahyman@crsa.bu.edu, M.Barnsley@swansea.ac.uk
Support:
Wolfgang Wanner, Alan Strahler, Jan-Peter Muller

INSTRUMENTS.
1 Kipp+Zonen CM14 albedometer with clear dome (shortwave broadband)
1 Kipp+Zonen CM14 albedometer with RG695 dome (NIR broadband)
1 Trimble Geoexplorer II GPS
possibly (still under negotiation): 1 PSII spectroradiometer
1 stereo-pair of cameras

COORDINATION.
The following measurements need to be coordinated with the teams carrying them out, best along the same transects/st the same locations:
- radiometry of the soil
- PARABOLA BRDF observations
- LAI determination
- general land surface and vegetation characterization

TIMETABLE.
Overflight day + 7 days. Contingency of overflight +/- 3 days for shift in case of overcast skies.

				OVERFLIGHT ‖				
Wed.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tues.	Wed.	Thurs.
May 21	‘22	‘23	‘24	‘25	‘26	‘27	’28	‘29
-4	-3	-2	-1	0	+1	+2	+3	

MEASUREMENTS

instr.	diur-	tran-	tran-	tran-	tran-	diur-	instr.
char.	nal	sect	sect	sect	sect	nal	char.
b) c)	a)	c)	d)	a)	b)	b)	a) d)
			‖			‖	‖
			drop if			drop if	drop if
		delay			delay	delay	

PERSONNEL

Andrew – Andrew -- Andrew --- Andrew --- Andrew --- Andrew – Andrew ---

---	---	--	Wolfg.	Wolfg.	---	---	---	---
---	---	Alan	Alan	Alan	---	---	---	---
Mike	Mike	Mike	Mike	Mike	Mike	Mike	Mike	---
---	---	---	Peter	Peter	Peter	Peter	Peter	

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4. Spectral mixture / BRDF measurements (CU) :

PRELIMINARY OBJECTIVES

My primary objectives will be:

1) Test new spectral mixture analysis/canopy BRDF inversion techniques using a combination of AVIRIS and MAS data, supported with ground measurements of leaf optical properties, soil reflectance, fractional PAR absorption (fAPAR), and leaf area index (LAI).

2) Test a new BRDF/biogeochemical modeling interface. This requires measurements from (1) and a series of canopy and soil chemical measurements. This will allow us demonstrate the model's ability to simulate key ecological and biogeochemical variables, constrained by remote sensing measurements. Key variables to model will be NPP, LAI, carbon and nitrogen cycles.

MEASUREMENTS.
Three types of measurements will be made:

1) Leaf, litter and stem full-range (400-2500 nm) hemispherical reflectance and transmittance measurements for all major woody and herbaceous species.
Time: 2 days

2) LAI and fAPAR spot measurements supplementing planning transect measurements by other group members
Time: 2 days

3) Collect foliar, root, and soil samples for carbon, and nitrogen analysis at Colorado
Time: 1 day

PERSONNEL.
2 undergraduate field/research assistants from the University of Colorado

INSTRUMENTS.
1 LAI-2000
1 Li-cor line quantum sensor
1 Li-cor continuous PAR point sensor
1 ASD full spectral range (400-2500 nm) spectrometer
1 Full-range integrating sphere

COORDINATION.

Would like to coordinate leaf/stem optical property sampling with vegetation structure and scene element BRDF groups.

Would like to coordinate point fAPAR and LAI measurements with fAPAR/LAI transect groups.

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5. Radiometry / Biophysical / Energy Flux data collection (USDA-ARS)

Sevilleta/Jornada Experiment May/June 1997
It appears that everything has come together for the
Sevilleta/Jornada Experiment for May/June 1997.

I am sure some of these may change but the schedule of Activities
as I see them now are:

LANDSAT COVERAGE
May 25 Landsat overpass at Jornada
June 1 Landsat overpass at Sevilleta

NASA AIRCRAFT COVERAGE
May 20-30 NASA/ARS MODIS/MISR Test flights at Jornada
May 20-30 AVIRIS flight at Jornada and Sevilleta

ARS AIRCRAFT COVERAGE
May 31-June 2 ARS Aircraft reflectance flights at Sevilleta
June 3 ARS Aircraft laser altimeter flights at Sevilleta
and Jornada

GROUND DATA COLLECTION

May 20-30 NASA MODIS/MISR data collection at Jornada
May 23-27 Hydrology Laboratory and Jornada Crew data collection at
Jornada(LAI 2000, Vegetation Surveys, TIR radiometers,
Exotech or Spectrometer measurements, Engineering Surveys,
micromet measurements)
May 29-June 4 Hydrology Laboratory data collection at Sevilleta

These are definite dates for the ARS Aircraft and the Hydrology Laboratory field activities.
The following people will likely be in the field or on the ARS aerocommander for the two experiments:
Al Rango(Beltsville) - Jornada May 21-28, Sevilleta May 29-June 4
Jerry Ritchie(Beltsville) - Jornada May 22-27, Sevilleta May 28-June 5
Koli Leach(Beltsville) - Jornada May 22-27, Sevilleta May 28-June 4
Frank Schiebe(Durant) - Jornada/Sevilleta May 27-June 4
Rene Davis(Weslaco) - Jornada/Sevilleta May 30-June 4
Fred Gomez(Weslaco) - Jornada/Sevilleta May 30-June 4
Marco Micozzi(Norman) - Jornada May 23-27, Sevilleta May 28-June4
Karen Humes(Norman) - Sevilleta May 31-June 2

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6. Sunphotometer/BRDF data collection (NASA-GSFC)

PRELIMINARY OBJECTIVES.
Primary objectives will be:
1) Comprehensively test the adequacy of the CIMEL sunphotometer for BRDF collection from remote towers. This will include sampling the BRDF continuously from the top of the tower at the transitional site, and sampling the BRDF at differentpositions (laterally and vertically) from the cherrypicker at the grassland and shrubland sites, and comparing results to those from the co-located PARABOLA III (J. Conel), and various aircraft and spacecraft bidirectional data. Under what heterogeneity conditions will it work or not work?

2) Characterize ability of fixed tower-based radiometry data to represent larger areas; possibly develop useful methods for extrapolation based on aircraft data.

3) Help characterize the vegetation structure using digital photography, LIDAR imager and profiler data, and transect data. This will include developing relationships between indirect and destructive measurements.

MEASUREMENTS.
Three types of measurements will be made:
1) Characterization of the CIMEL for BRDF collection
   a) Comparison with PARABOLA and aircraft data
   b) Effects of 1 deg. IFOV on sampling heterogeneous area
   c) Retrieving BRDF values from sampling radiance over 4pi.
   Time: 5 days
2) Digital Photography (probably coordinated w/Rama)
   a) take horizontal and vertical images of individual species
   b) take vertical pictures from cherrypicker to characterize below-tower area
   Time: 2 days

PERSONNEL.
Coordinating with Wolfgang, Wim and Rama, and working with
Jim Conel, Greg Asner, Brent Holben/AERONET.

INSTRUMENTS.

2 LAI-2000s will be brought/coordinated with Doug Muchoney's needs
1 ASD spectrometers
2 CIMEL sunphotometers (one mounted for duration of summer)
3 2-way radios (probably have one at each site or w/transect groups)

possibly.
1 digital camera
1 SE590 on boom (via Walter-Shea)

can bring but don't need:
1 ASD spectrometer
thermal radiometer
other things probably -- call me.

COORDINATION.
Would like to coordinate sampling of vegetation structure, fAPAR with others such that we can see how conditions *under* tower (in view of CIMEL) relate to those away from tower.

Pre-campaign coordination: I assume we have most things taken care of. If you anticipate needing something but don't yet have it (data, instruments, people, methods), please call me ASAP!

TIMETABLE.

T.B.D.

				OVERFLIGHT ‖				
Wedn.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tues.	Wedn.	Thurs.
May 21	‘22	‘23	‘24	‘25	‘26	‘27	‘28	‘29
-4	-3	-2	-1	0	+1	+2	+3	
MEASUREMENTS								
PERSONNEL								

APPENDIX

Remote Sensing Data to be Collected.

Table 1. Remote Sensing Data To Be Collected During Grassland PROVE

Sensor	Altitude (m)	Nom. Spatial Res. (m)	View Zenith Angle Range (°)	Min. Wave-length (µm)	Max.Wave-length (µm)	No. Bands	IFOV (°)	Digiti-zation
Exotech	2	0.5	0	0.48	0.84	4	15	
SE590	3	0.8	-60 to +60	0.4	0.9	46	15	
CIMEL	30	0.6	-70 to +70	0.44	1.02	2	1.2	
PARA-BOLA III	30	2.6	-70 to +70	0.44	11	8	5	
Air ASD	100?	?	0	0.4?	1.1?	?	?	?
Air Exotech	100	30	-45 to +45	0.48	0.84	4	15	
AVIRIS	20,000	20	-15 to +15	0.41	2.45	224		12
AirMISR	20,000	5	-70 to +70	0.44	0.87	4		10
MAS*	20,000	50	-43 to +43	0.55	14.2	50	2.5	12
TM	>1e5	30	-7.5 to +7.5	0.45		7		
AVHRR	>1e5	1100	-55 to +55	0.64	12.0	5	1.3	10
GOES	>1e6	1000	fixed	0.65	12	5		10
SPOT	>1e5	20	-27 to +27	0.55	0.84	3		8
POLDER	>1e5	7000	-51 to +51	0.44	0.91	4		12

* Tentative.

Equipment and Instruments Being Brought to Jornada

Equipment for PROVE campaign: May 20-30, 1997				
	has as of:	needed	status	comments
University of Arizona				
Faiz 520-621-9187				
3 Exotech radiometers				
Spectron SE590 spectro-radiometer				
yoke				
Ceptometer				
? LAI-2000		needs		

Boston University		
Wolfgang 617 353 8033		
CM14 albedometer (with clear dome)		ordered
CM14+RG695 dome		ordered
GPS		ordered
? spectroradiometer		likely
? stereopair of cameras		likely
Landcover		
Doug 617-353-8829		
2 Li-Cor LAI-2000	see NASA-GSFC	
Trimble Geo-Explorer GPS	4/14	
SE-590 radiometer	4/14	
University of Colorado		
Greg 303-492-0532		
Li-cor LAI-2000 4/14		
Li-cor line quantum sensor 4/14		
Li-cor continuous PAR pt. sensor	4/14	
ASD spectrometer (400-2500nm)	4/14	
Full-range integrating sphere	4/14	
USDA-ARS		
Kris 505-646-4842		
LAI-2000		
TIR radiometers		
? Exotech Radiometer		
? Spectrometer		
USDA Beltsville/Rango		
Craig		
LAI-2000	4/18	
? LAI-2000		available
2 Everest Thermal Rods field	4/18	
2 Everest Thermal Rods plane	4/18	
? Spectrometer SE590		available
Karen Hume		
? Spectrometer		may bring
? Data loggers		may bring
University of Montana		
Rama 406-243-4326		
digital camera	4/14	
ceptometer	4/14	
NASA-GSFC	4/14	

2 LAI-2000	4/14		
1 ASD spectrometer	4/14		
thermal radiometer	4/14		
2 CIMEL sunphotometers	4/14		
3 2-way radios	4/14		
? digital camera possibly			
? SE590 on boom possibly			
Communication			
Radios in Jornada trucks &base	4/18		
4 Cellular Phones	4/18	available	BRING YOURS

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