APPENDIX A - LIST OF PARTICIPANTS

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APPENDIX B - WORK PLAN FOR JURY-WARD AIRCRAFT MISSION OVER ZAMBIA

With 20 hours of flight time available from SA funding (including 5 from Jury) and another 20 hours from USFS funds, it is intended that the Aerocommander JRA be utilized in the period 13-22 September 2000 in support of SAFARI2000. The following equipment will be needed:

- full suite of air chemistry (gas and aerosol) measurements as employed in the Petersburg missions, with additional equipment of Ward. Inflows need to be regulated so that data above the CBL can be collected.
- full suite of meteorological variables including U,V,W wind, temperature, and specific humidity; capable of eddy covariance turbulent flux estimates.
- 1 sec. resolution data would be averaged over 30 sec. bins together with aircraft position, height and time.
- data processing support from the SAWB is needed with appropriate corrections applied. Data would be represented with a 1:100 height-distance ratio in analyses. A senior student from the Univ Zululand will develop Jury's results into a thesis, together with reports and research papers generated by the PIs.

The flight plan consists of N-S vertical sections to obtain wall volume fluxes from data on gas and aerosol transport and mixing. The flights will base from Kasane (18S). The N-S sections will be comprised of successive 1:30 ascents and descents in the 1 - 5 km layer (reaching just above the CBL). From Kasane we overfly the Mongu flux tower (15S), heading north on 24E over the sun photometer network, extending to the northern border of Zambia (12 S). The return leg southwards will collect data in a similar manner along the Kaoma photometer network lying further east (25E). With staggered sampling, data of uniform density could be collapsed onto a single vertical section. In some cases, differences between west and east sections could be contrasted, where fires occur in-between. The entire mission will be completed in 4 hours. To analyse the diurnal cycle, flights are planned for early morning and mid-afternoon on three days (with shorter flights on alternate days). The intention is to construct morning and afternoon composites. The sample size for the Jury component of the Zambian mission should be sufficient for this purpose.

During the Ward component of the Zambian mission, a more meso-scale flight track will be employed. The USFS flight plan is designed for satellite validation and includes profiles over the photometer sites, flights further east to Ndola and box patterns around planned burns. The two flight plans are designed to be complimentary.

The N-S section will intercept much of the pyrogenic emissions from tropical southern Africa according to AVHRR data (Swap et al, pers comm) and industrial sources from the Ndola copper belt. The typical weather pattern over Zambia is steady ESE winds and clear skies. Apart from logistic arrangements in Kasane, other needs include a fully operational Aerocommander with pilot, data technician, Jury and Ward representatives on-board.

It would be useful for the UK C-130 to fly along a N-S track west of Angola along the 10E longitude at the same time the Aerocommander is flying along 25E. It is suggested they use a similar sawtooth pattern (to higher levels) to catch the exit of pyrogenic emissions from the continent.

APPENDIX C - SAWB DATA BANK FACILITIES

Hardware

The Databank in Pretoria has three NT servers, two LINUX Intel based servers, and one SUN enterprise dual processor server. The SUN system is used for data preprocessing and archiving and also by Climate researchers and developers for QC software development. The NT servers are used as domain controllers and a Microsoft SQL database server.

Historical Data Bank

The databank is responsible for the archiving of all weather data received and generated by the Weather Bureau. The following datasets are available:

- Climate surface data on the main synoptic hours (1930-current)
- Upper air data (1930-current)
- Marine Data - Ship, Buoy
- Hourly data
- Raw 5 - minute Automatic Weather Station data (1990-current)
- Satellite images (Last two years)
- Forecast and some GTS data messages (last two years)
- CLIMOS - (Climate monitoring system - preliminary data)

General

Two main database systems are used, viz. Climos and the historical dataset.

Climos

The CLIMOS system running on a SQL server database is used for day to day climate queries and contains current data extracted in almost real time from meteorological surface messages (SYNOP, METAR) and telephonic reports from casual observers (mostly rainfall). This dataset is considered as preliminary and is used for most of the day to day queries by the media and general public. The system compiles various standard climate reports that are emailed to the media and other clients. The reports are also published to the SAWB WEB server (http://www.sawb/gov/za).

The Historical Dataset

All the long term data are stored on two LINUX servers. The data are available to internal staff via Windows 98/NT client software. All the software was developed by the weather bureau software

developers using C++ software. The Weather Bureau are currently planning the migration of these data from the internal developed propriety software to a RDBMS system like ORACLE.

(Information supplied by Louis Botha, louis@sawb.gov.za)

APPENDIX D - REGIONAL DATA FOR SAFARI 2000 (MARCH 2000)

Data summaries for the following regional data sets is provided in this Appendix:

- Olson's Major World Ecosystem Complexes Ranked by Carbon in Live Vegetation
- Wilson, Henderson-Sellers' Global Vegetation & Soils, 1-Degree
- ISRIC-WISE Global Data Set of Derived Soil Properties on a 1/2 x 1/2 degree grid

Olson's Major World Ecosystem Complexes Ranked by Carbon in Live Vegetation, Southern Africa Subset

Olson's Major World Ecosystem Complexes Ranked by Carbon in Live Vegetation is a computerized database, used to generate a global vegetation map of 44 different land ecosystem complexes (mosaics of vegetation or landscapes) comprising seven broad groups. The map is derived from patterns of pre-agricultural vegetation, modern Arial surveys, and intensive biomass data from research sites. Work on the database was begun in 1960 and completed in 1980.

Ecosystem complexes are defined for each 0.5-degree grid cell, reflecting the major climatic, topographic, and land-use patterns. Numeric codes are assigned to each vegetation type. Classifications include natural as well as human managed/modified complexes such as mainly cropped, residential, commercial, and park. The complexes are ranked by estimated organic carbon in the mass of live plants given in units of kilograms of carbon per square meter. Counting the cells of each type and adding their areas give total area estimates for the ecosystem complexes. Multiplying by carbon estimates gives corresponding estimates of global carbon by ecosystem complex. The results help define the role of the terrestrial biosphere in the global carbon cycle.

ISRIC-WISE Data Set of Derived Soil Properties

The data set consists of a southern African study area subset of to ISRIC-WISE global data set of derived soil properties.

The World Inventory of Soil Emission Potentials (WISE) database currently contains data for over 4300 soil profiles collected mostly between 1950 and 1995. This database has been used to generate a series of uniform data sets of derived soil properties for each of the 106 soil units considered in the Soil Map of the World (FAO-UNESCO, 1974). These data sets were then linked to a 1/2 degree longitude by 1/2 degree latitude version of the edited and digital Soil Map of the World (FAO, 1995) to generate GIS raster image files for the following variables:

- Total available water capacity (mm water per 1-m soil depth)
- soil organic carbon density (kg C/m**2 for 0-30cm depth range)
- soil organic carbon density (kg C/m**2 for 0-100cm depth range)
- soil carbonate carbon density (kg C/m**2 for 0-100cm depth range)
- soil pH (0-30 cm depth range)
- soil pH (30-100 cm depth range)

Wilson, Henderson-Sellers' Global Vegetation & Soils, 1-Degr, Southern Africa Subset

The Wilson, Henderson-Sellers' Global Vegetation and Soils data set is an archive of soil type and land cover data derived for use in general circulation models (GCMs). The data were collated from natural vegetation, forestry, agriculture, land use, and soil maps. The data are archived at 1 degree latitude x 1 degree longitude resolution and include data for soil, soil reliability, primary vegetation, secondary vegetation, and land cover reliability. There are approximately fifty land cover classifications that include categories for agricultural and urban uses. The inclusion of secondary vegetation type is particularly useful in areas with cover types which may have a fragmented distribution, such as urban development. The soil type data are classified using climatically important properties for CGMs and provide color (light, medium, or dark), texture, and drainage quality of the soil. The land cover data are compatible with the soils data forming a coherent and consistent data set. Reliability data rank the land cover data on a 1 to 5 scale from high to low reliability. The soil reliability is ranked as one of the following: high, good, moderate, fair, or poor.

Recommendations for the use of these data as well as more detailed information can be found in: Wilson, M.F. and A. Henderson-Sellers, 1985. A Global Archive of Land Cover and Soils Data for Use in General Circulation Climate Models. Journal of Climatology, Vol.5, 119-143.

APPENDIX E - DATA INFORMATION SHEETS

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Project Title	SAFARI-2000		
Duration of Field Sample Collection:	Start Date: Aug 13, 2000 End Date: Sept 22, 2000		
Field Sampling Locations	University of Washington Convair-580 aircraft campaign based out of Pietersburg (SA), Lusaka (Zambia), and Walvis Bay (Namibia)		
Preliminary Data Location	ftp://cargsun2.atmos.washington.edu/safari/		
Raw Data Archive	GSFC or Langley DAAC (to be determined)		
Estimated Date of Data Availability to other S2K Investigators	Summer 2001		
Estimated Date of Data Availability to the public	Summer 2002		
Additional Data Needed to Analyse own Datasets	Terra, ER-2, Ground-based sunphotometer network		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	see http://cargsun2.atmos.washington.edu/sys/research/safari/instrumentation/TabSAFARI.htm		
Temporal Frequency:	Every few days		
Data Products:	(1) Aerosol concentrations and size distributions. (2) Same information as aerosol composition. (3) Gas concentrations. (4) Up and down broadband radiation fluxes. (Plus products from guest instruments aboard CV-580 to be provided by guest investigator)		
Data Type:	Numeric		
Data Format:	ASCII		
Estimated Data Volume:	5 MB/hr of flight time for above data products		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
http://cargsun2.atmos.washington.edu/sys/research/safari/instrumentation/TabSAFARI.htm			
Estimated Data Volume	10-15 MB per hour of flight time for all data		

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Project Title	South African Weather Bureau Raw Meteorological Data		
Duration of Field Sample Collection:	Continuous throughout campaign		
Field Sampling Locations	Meteorological raw data of southern Africa and the Eta Numerical Weather Products		
Preliminary Data Location			
Raw Data Archive			
Estimated Date of Data Availability to other S2K Investigators	ASAP		
Estimated Date of Data Availability to the public			
Additional Data Needed to Analyse own Datasets			
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	Eta Weather Prediction Model, Automatic Weather Station; Weather Office; Upper Air Raw Radiosondes; 1st, 2nd and 3rd Order Climate Stations and Rainfall Stations; Meteostat Satellite Imagery		
Temporal Frequency:	Eta Model: 0h00, 12h00 and runs Automatic weather station and weather offices: 3 hourly Upper air data: 12 hourly 2nd and 3rd order climate and rainfall - 1 monthly Meteosat Imagery - 0.5 hourly		
Data Products:	Eta NWP predictions		
Data Type:	Eta Numeric and image		
Data Format:	Eta: GRIB, WMO ASCII data sets		
Estimated Data Volume:	Considerable amount. Continuous delivery of data		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

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Science Team			
Project Title	Botswana Soil Chemistry (Aeolian Pan Input) Sua Pan Brine Chemistry		
Duration of Field Sample Collection:	**Start date:** July 1999 **End data:** August / Sept 2000		
Field Sampling Locations	Kalahari, Sua Pan		
Preliminary Data Location	Not determined		
Raw Data Archive	Not determined		
Estimated Date of Data Availability to other S2K Investigators	December 2000		
Estimated Date of Data Availability to the public	-		
Additional Data Needed to Analyse own Datasets	None		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	No *in situ* analyses, various Lab analyses		
Temporal Frequency:	Soil - once Water - twice (wet and dry season)		
Data Products:	Spreadsheet		
Data Type:	Numeric		
Data Format:	ASCII, EXCEL		
Estimated Data Volume:	2 Mb		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

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Science Team	CV-580, Aerosol and Radiation	
Project Title	Airborne Sunphotometry and Integrated Analyses	
Duration of Field Sample Collection:	**Start Date:** 13 Aug 2000 **End Date:** 22 Sept 2000	
Field Sampling Locations	Walvis Bay aircraft campaign, Pietersburg aircraft campaign and Zambia aircraft campaign	
Preliminary Data Location	NASA Ames web site (email above for exact address)	
Raw Data Archive	as above	
Estimated Date of Data Availability to other S2K Investigators	Preliminary data in real time, during and after campaign. Archived data set available 1 year after campaign.	
Estimated Date of Data Availability to the public	18 months	
Additional Data Needed to Analyse own Datasets	Data needed only for the calibration/validation studies: (1) TOMS ozone and aerosol (2) Terra aerosol, water vapour and ozone (3) SeaWifs aerosol	
SPECIFIC DATA INFORMATION:		
Instruments / Sensors / Sources:	Airborne sunphotometer on CV-580	
Temporal Frequency:	3 Hz to 0.3 Hz during CV-580 flights	
Data Products:	**Product A:** NASA Ames 14-channel airborne tracking sunphotometer (AATS-14) data acquired from aboard the CV-580; included are aerosol optical depth at 13 wavelengths, water vapour and ozone columns. One file for each flight. Included in the fields will be the following: – Time – Aircraft latitude, longitude, altitude – Atmospheric pressure – Detector outputs – Water vapour column content – Absolute uncertainty in water vapour column content – Ozone column content – Absolute uncertainty in ozone column content – Aerosol optical depth at 13 wavelengths between 354 and 1558 – Absolute uncertainty in aerosol optical depth at the same 13 wavelengths **Product B:** AATS-14 data acquired from aboard the CV-580; included are aerosol extinction at 13 wavelengths and water vapour density profiles. Only during suitable up or down spirals. One file per spiral. Included in file will be the following: – Time – Aircraft latitude, longitude, altitude – Atmospheric pressure – Water vapour density	

	– Absolute uncertainty in water vapour density – Aerosol extinction at 13 wavelengths between 354 and 1558 nm – Absolute uncertainty of aerosol extinction at the same 13 wavelengths **Product C:** Aerosol size distributions. Selected cases.		
Data Type:	Numeric		
Data Format:	Column oriented ASCII files, with header information		
Estimated Data Volume:	2 MB per CV-580 flight		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

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Project Title	Met. Office C-130 measurements for Safari 2000		
Duration of Field Sample Collection:	**Start Date:** Sept 3 2000 **End Date:** Sept 18 2000		
Field Sampling Locations	Windhoek aircraft campaign		
Preliminary Data Location	ftp anonymous login email.meto.gov.uk inter/pub/mrf/safari		
Raw Data Archive	To be determined. Have used Langley DAAC in the past, e.g. TARFOX		
Estimated Date of Data Availability to other S2K Investigators	The majority within 6 months		
Estimated Date of Data Availability to the public	As required		
Additional Data Needed to Analyse own Datasets	Surface sun-photometer data and products, other ground-based site radiometer data, surface albedo characteristics, MODIS aerosol retrieval products, SSRF data from CV580 and ER-2, sun photometer data from CV-580		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	See report attached as Appendix E		
Temporal Frequency:			
Data Products:			
Data Type:			
Data Format:			
Estimated Data Volume:			
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
See report attached as Appendix E			
Estimated Data Volume	50 Mbytes per flight		

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Project Title	Validation of Aerosol Retrievals over Dark Targets		
Duration of Field Sample Collection:	**Start Date:** 13 Sept 2000 **End Date:** 22 Sept 2000		
Field Sampling Locations	Walvis Bay		
Preliminary Data Location	http://www-asapdata.arc.nasa.gov or http://www-misr.jpl.nasa.gov		
Raw Data Archive	same as above		
Estimated Date of Data Availability to other S2K Investigators	Ground truth data available within 3 months of acquisition		
Estimated Date of Data Availability to the public	(1) Regional met data (2) Terra data: MODIS and MISR (3) MAS/AirMISR/S-HIS data (4) Cimel data (if functioning in area) (5) UW CV-580 data		
Additional Data Needed to Analyse own Datasets			
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	ASD field radiometer Microtops sun photometer		
Temporal Frequency:	For validation purposes: data acquisition coincide with ER-2 and/or Terra overpass. Additional sun photometer data may be collected (weather permitting)		
Data Products:	(1) Spectral aerosol optical thickness (2) Columnar water vapour (3) Remote sensing reflectance		
Data Type:	Numeric		
Data Format:	ASCII		
Estimated Data Volume:	Less that 1 MB for period at Walvis Bay		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

PROJECT DETAILS:			
Name	Mark Hemlinger		
Affiliation	JPL		
E-mail	mch@jord.jpl.nasa.gov		
Science Team	MISR Science Team		
Project Title	Multi-Angle-Imaging Spectorradiometer, BRF Validation, Aerosol Validation and Calibration Experiments		
Duration of Field Sample Collection:	**Start Date:** Aug 12 2000 **End Date:** Sept 24 2000		
Field Sampling Locations	Skukuza Airport and Tower (KNP), Sua Pan Salt Mine, Magkadigkadi (Botswana)		
Preliminary Data Location	http://www-misr.jpl.nasa.gov/mission/valid.html		
Raw Data Archive	Project web site		
Estimated Date of Data Availability to other S2K Investigators	December 2000		
Estimated Date of Data Availability to the public	February 2000		
Additional Data Needed to Analyse own Datasets	(1) MISR (Terra) Level 2 data (2) Misc. met data from sites and near sites (3) Geo. ref points (4) LAI/FPAR sampling (5) Concurrent radiometry for calibration comparisons In situ aerosol sampling and any other overflights		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:			
Temporal Frequency:			
Data Products:			
Data Type:			
Data Format:			
Estimated Data Volume:			
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Reagan sunphotometers A,B,C	optical depth	ASCII	Daily
Cimel sunphotometer	optical depth, size distribution, etc.	ASCII	Daily
Manval sunphotometer	optical depth	ASCII	Occasional
Met packages (2)	wind, temp., pressure, etc.	ASCII	Daily
Parabola III	BDRF/Sky rad	ASCII	Daily
MFRSR	optical depth, dirdiff rat	ASCII	Daily
Broadband albedo	Kipp and Zonen	ASCII	Daily
GPS	Latitude and longitude	ASCII	Occasional
ASD	Spectral reflectance	ASCII	Semi-daily
Digital camera	Site documentation	GIF/JPEG	Occasional
Field notes	Experiment documentation	ASCII	Daily
EPPLY	Broadband downwelling		Daily
Estimated Data Volume	10 MB per day of dry season campaign		

PROJECT DETAILS:			
Name	Diner, Bruegge, Conel, *et al*.		
Affiliation	JPL		
E-mail	djd@jord.jpl.nasa.gov, cjb, jconel		
Science Team	MISR Science Team		
Project Title	All MISR Overflights of S. Africa (place-holder for MISR Safari Data)		
Duration of Field Sample Collection:	**Start Date:** December 1999 to present **End Date:** December 1999 to present		
Field Sampling Locations			
Preliminary Data Location	Langley DAAC		
Raw Data Archive			
Estimated Date of Data Availability to other S2K Investigators	Uncertain (contact djd@jord.jpl.nasa.gov)		
Estimated Date of Data Availability to the public	Uncertain (contact djd@jord.jpl.nasa.gov)		
Additional Data Needed to Analyse own Datasets	Regional data		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	MISR		
Temporal Frequency:	9-day coverage		
Data Products:	Various		
Data Type:	Numeric, images		
Data Format:	HDF-EOS		
Estimated Data Volume:	MB each day		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
N/A			
Estimated Data Volume			

PROJECT DETAILS:			
Name	Diner, Bruegge, Conel, *et al*.		
Affiliation	JPL		
E-mail	djd, cjb, jconel@jord.jpl.nasa.gov		
Science Team			
Project Title	All AirMISR data for Safari 2000 (Placeholder for AirMISR Safari Data)		
Duration of Field Sample Collection:	**Start Date:** 12 Aug 2000 **End Date:** 24 Sept 2000		
Field Sampling Locations	To be determined		
Preliminary Data Location	Web site		
Raw Data Archive	Project web site		
Estimated Date of Data Availability to other S2K Investigators	3 months after		
Estimated Date of Data Availability to the public	6 months after		
Additional Data Needed to Analyse own Datasets	In situ ground truth		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	AirMISR		
Temporal Frequency:	To be determined		
Data Products:	Optical depth, BRF, etc.		
Data Type:	Numeric and images		
Data Format:	HDF, HDF-EOS? (contact cjb@jord.jpl.nasa.gov)		
Estimated Data Volume:	MB for dry season campaign		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
N/A			
Estimated Data Volume			

PROJECT DETAILS:			
Name	Fatima Ferraz		
Affiliation	Anglo American Technical Services		
E-mail	fatima@gsd.is.co.za		
Science Team			
Project Title	Integrated Study on Pollution Monitoring over an Environmentally Sensitive Area Located Adjacent to a Currently Active Industrial Setting		
Duration of Field Sample Collection:	**Start Date:** Depend on ASTER collection **End Date:**		
Field Sampling Locations	Springs (S 26.449°, E 28.387° to S 26.175°, E 28.595°) Olifants-Witbank (S 26.366°, E 28.785° to S 25.669°, E 29.972°)		
Preliminary Data Location			
Raw Data Archive			
Estimated Date of Data Availability to other S2K Investigators			
Estimated Date of Data Availability to the public			
Additional Data Needed to Analyse own Datasets	General site information Terra Ground into - groundwater, temperature (to be collected during ASTER overpass)		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:			
Temporal Frequency:			
Data Products:			
Data Type:			
Data Format:			
Estimated Data Volume:			
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

PROJECT DETAILS:			
Name	Steven Platnick		
Affiliation	UMBC, NASA GSFC		
E-mail	platnick@climate.gsfc.nasa.gov		
Science Team	MODIS Airborne Simulator (MAS), ER-2		
Project Title	Remote Sensing of Cloud, Aerosol and Water Vapour from MAS		
Duration of Field Sample Collection:	**Start Date:** 13 Aug 2000 **End Date:** 24 Sept 2000		
Field Sampling Locations	Throughout southern Africa		
Preliminary Data Location	ltpwww.gsfc.nasa.gov/MAS		
Raw Data Archive	GSFC DAAC		
Estimated Date of Data Availability to other S2K Investigators	1 month (preliminary cal.); 6 months (final cal.)		
Estimated Date of Data Availability to the public	6 months		
Additional Data Needed to Analyse own Datasets	Terra data Regional data		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	MAS		
Temporal Frequency:	During ER-2 flights		
Data Products:	Radiometrically calibrated imagery		
Data Type:	Numeric and images		
Data Format:	HDF-EOS		
Estimated Data Volume:	~10 Gbytes/day		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
MAS	imagery (50 channels) and numeric		ER-2 flights
Estimated Data Volume	~10 Gbytes/day		

PROJECT DETAILS:			
Name	M D King	C K Gatebe	
Affiliation	NASA	NASA	
E-mail	king@climate.gsfc.nasa.gov	gatebe@climate.gsfc.nasa	
Science Team	MODIS		
Project Title	Cloud Absorption Radiometer (CAR)		
Duration of Field Sample Collection:	**Start Date:** 13 Aug 2000 **End Date:** 22 Sept 2000		
Field Sampling Locations	Flying out of Pietersburg / Kasani / Lusaka (Aug 13 to Sept 9) Flying out of Walvis Bay (Sept 13-22)		
Preliminary Data Location	ltpwww.gsfc.nasa.gov/CAR		
Raw Data Archive	GSFC DAAC		
Estimated Date of Data Availability to other S2K Investigators	Quick look images will be available immediately		
Estimated Date of Data Availability to the public	3 months after the campaign		
Additional Data Needed to Analyse own Datasets	GPS and navigational data		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	Cloud Absorption Radiometer (CAR)		
Temporal Frequency:	1.67 Hz during the period of the flight		
Data Products:	(1) BRDF (2) surface reflectance (3) sky radiance (4) aerosol optical depth (5) cloud radiance distribution		
Data Type:	Numeric and images		
Data Format:	HDF-EOS		
Estimated Data Volume:	250 Mbytes per day (assuming 4 hours of flying time per day)		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
CAR	imagery	numeric	Flying CV-580
Estimated Data Volume	250 Mbytes per day (assuming 4 hours of flying time per day)		

PROJECT DETAILS:			
Name	Michael D. King		
Affiliation	NASA Goddard Space Flight Centre		
E-mail	king@climate.gsfc.nasa.gov		
Science Team	MODIS		
Project Title	Remote sensing of cloud, aerosol, water vapour from MODIS		
Duration of Field Sample Collection:	**Start Date:** 13 Aug 2000 **End Date:** 24 Sept 2000		
Field Sampling Locations	Southern African region		
Preliminary Data Location	http://modis-atmos.gsfc.nasa.gov		
Raw Data Archive	GSFC DAAC		
Estimated Date of Data Availability to other S2K Investigators	Acquisition plus 7 days		
Estimated Date of Data Availability to the public	Acquisition plus 7 days		
Additional Data Needed to Analyse own Datasets	Terra data		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	MODIS / Terra		
Temporal Frequency:	Daily		
Data Products:	(1) Radiometrically calibrated and geolocated measurements (level-1b) (2) Aerosol product (optical thickness, size index-ocean) (3) Cloud products (optical thickness, effect ratios, cloud top height, cloud top temperature) (4) Water vapour (column and profiles) (5) Cloud mask		
Data Type:	Numeric (and images)		
Data Format:	HDF-EOS		
Estimated Data Volume:	Large files - see modis-atmos.gsfc.nasa.gov for file sizes		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
MODIS	MOD06 MOD05	HDF-EOS	5 min granule
Estimated Data Volume	Very large		

PROJECT DETAILS:			
Name	Gerhard Lachmann		
Affiliation	Potchefstroom University for CHE, Potchefstroom, SA		
E-mail	CHEGL@PUKNET.PUK.CA.ZA		
Science Team	PUECHE, ESKOM, WITS		
Project Title	Air Quality Measurement in Mpumalanga highveld		
Duration of Field Sample Collection:	**Start Date:** 13 Aug 2000 (2 days in time slot flexible) **End Date:** 24 Aug 2000		
Field Sampling Locations	Mpumalanga Highveld (Secunda, Witbank)		
Preliminary Data Location	ask at CHEGL@PUKNET.PUK.CA.ZA		
Raw Data Archive	Excel File		
Estimated Date of Data Availability to other S2K Investigators			
Estimated Date of Data Availability to the public			
Additional Data Needed to Analyse own Datasets			
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:			
Temporal Frequency:			
Data Products:			
Data Type:			
Data Format:			
Estimated Data Volume:			
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

PROJECT DETAILS:			
Name	Hartmut Winkler		
Affiliation	Vista University		
E-mail	wkler-h@sorex.vista.ac.za		
Science Team	MPI/Wits/Vista collaboration		
Project Title	(Sunphotometer measurements)		
Duration of Field Sample Collection:	**Start Date:** continuous throughout dry season campaign **End Date:**		
Field Sampling Locations	Sutherland, De Aar (RSA)		
Preliminary Data Location	Probably MPI and Wits University websites		
Raw Data Archive	Probably MPI and Wits University websites		
Estimated Date of Data Availability to other S2K Investigators	within a week (Sutherland), a day (De Aar)		
Estimated Date of Data Availability to the public	within a week (Sutherland), a day (De Aar)		
Additional Data Needed to Analyse own Datasets	Any data covering sunphotometer sites would be useful		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	MFSR - 7 channel (Sutherland) Cimel sunphotometer (De Aar)		
Temporal Frequency:	Daily (Sutherland), with data points spaced at 1 min intervals De Aar - like other AERONET sites		
Data Products:	Sutherland - 415, 501,615,678, 868, 940 nm direct and diffuse radiation - 1 data point per minute De Aar - like other AERONET sites		
Data Type:	Numeric		
Data Format:	Can be converted to ASCII or Excel on request (Sutherland)		
Estimated Data Volume:	Sutherland - 31 kB per day De Aar - like other AERONET stations		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Estimated Data Volume			

PROJECT DETAILS:			
Name	Bruce Doddridge		
Affiliation	Department of Meteorology, University of Maryland (UMd)		
E-mail	bruce@atmos.umd.edu		
Science Team	UMd/UVa SAWB Aerocommander 690A		
Project Title	Southern African Fire/Atmosphere Regional Initiative 2000 (SAFARI 2000): Integrated Aircraft Study *UMd proposal to NSF Atm. Chem. (pending)*		
Duration of Field Sample Collection:	**Start Date:** August 13, 2000 **End Date:** September 13, 2000		
Field Sampling Locations	Pietersburg aircraft campaign		
Preliminary Data Location	ftp://ftp.meto.umd.edu/pub/outgoing/bruce/S2K *(check with P.I. for updates/changes)*		
Raw Data Archive	TBD *(probably S2K project Web site)*		
Estimated Date of Data Availability to other S2K Investigators	Quick-look: next day; Validated: early 2001		
Estimated Date of Data Availability to the public	*(Prefer)* Early 2002		
Additional Data Needed to Analyse own Datasets	TBD *(probably weather data; selected surface site and other aircraft data*		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	O_3, NO, CO, SO_2, H_2O, CO_2, aerosol size distribution, absorbing and scattering aerosols		
Temporal Frequency:	Aircraft flight assimilated and time/position-stamped data file including all scalars listed above		
Data Products:	Per aircraft flight		
Data Type:	Numeric		
Data Format:	ASCII data in MS Excel CSV format		
Estimated Data Volume:	Approx. 0.5 Mb per flight		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
TEI 49C	O_3 (1 ppbv)	Numeric	10 s
custom TEI 42C	NO (50 pptv)	Numeric	10 s
modified TEI 48	CO (20 ppbv)	Numeric	1 min
modified TEI 43C	SO_2 (30 pptv)	Numeric	1 min
LI-COR LI-6262	CO_2 (0.2 ppmv)	Numeric	1-10 s
LI-COR LI-6262	H_2O (0.002 kPa)	Numeric	1-10 s
modified Rad. Res. PSAP	b_{ap} (0.9×10^6 m^{-1})	Numeric	1 min
modified TSI 3934L	$dN/dlogD_p$ (N/A)	Numeric	5-7 min
modified TSI 3563	b_{scat} ($0.1\text{-}0.4 \times 10^6$ m^{-1})	Numeric	1 min
Estimated Data Volume	Approx. 0.5 Mb per flight		

PROJECT DETAILS:			
Name	Hal Maring		
Affiliation	Rosenstiel School of Marine and Atmospheric Science, University of Miami (UM)		
E-mail	Hmaring@rsmas.miami.edu		
Science Team	UM/UVa SAWB Aerocommander 690A		
Project Title	Southern African Fire/Atmosphere Regional Initiative 2000 (SAFARI 2000): Vertical Distribution of Aerosol Physical and Optical Properties *UM proposal to NSF Atm. Chem. (pending)*		
Duration of Field Sample Collection:	**Start Date:** August 13 2000 **End Date:** September 13 2000		
Field Sampling Locations	Pietersburg aircraft campaign		
Preliminary Data Location	Data supplied upon request to hmaring@rsmas.miami.edu (*check with P.I. for updates/changes)*		
Raw Data Archive	TBD *(probably S2K project web site)*		
Estimated Date of Data Availability to other S2K Investigators	Quick look data: next day; Validated data: early 2001		
Estimated Date of Data Availability to the public	*(Prefer)* Early 2002		
Additional Data Needed to Analyse own Datasets	TBD (*probably weather data; selected surface site and other aircraft data)*		
SPECIFIC DATA INFORMATION:			
Instruments / Sensors / Sources:	Aerosol size distribution, nucleation particle concentration, absorbing and scattering aerosols		
Temporal Frequency:	Per aircraft flight		
Data Products:	Aircraft flight assimilated and time/position-stamped data file including all scalars listed above		
Data Type:	Numeric		
Data Format:	ASCII data in MS Excel CSV format		
Estimated Data Volume:	Approximately 0.5 Mb per flight		
Instrument:	**Variable Name:**	**Data Type:**	**Temporal Frequency:**
Modified TSI 3934L	$DN/dlogD_p$ (N/A)	numeric	5 - 7 min
TSI 3025	DN (N/A)	numeric	1 min
Modified TSI 3563	b_{sp} (0.1-0.4 x 10^6 m^{-1})	numeric	1 min
Modified Rad. Res. PSAP	b_{ap} (0.9 x 10^6 m^{-1})	numeric	1 min
Estimated Data Volume	Approximately 0.5 Mb per flight		

APPENDIX F - METEOROLOGICAL RESEARCH FLIGHT, W2 HERCULES, Summary of Capability

METEOROLOGICAL RESEARCH FLIGHT

W2 HERCULES

Summary of Capability

MRF Technical Note No. 21

9 December 1997

Minor updates: 11 Jan 1999, 21 Apr 1999, 24 Feb 2000

Meteorological Research Flight

Building Y46
DERA
FARNBOROUGH
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Document prepared by D. Anderson
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Summary of Capability
W2 Hercules

This summary is provided as a general guide to the W2 Hercules and its instrumentation. The details about instrumentation (particularly accuracy) are typical values and users should check critical variables.

Details about instrumentation owned or partially owned by outside collaborators is included for completion but no guarantees are given for their availability or the accuracy of the details.

This document may be referenced by Meteorological Research Flight Technical Note No. 21.

Contents:

1 W2 Hercules Summary

2 Aircraft Instrumentation Specifications

3 Dropsonde Instrumentation Specifications

4 Basic Meteorological Measurements

5 Aerosol and Cloud Physics Measurements

6 Chemical Sampling - Instruments owned by MRF

7 Chemical Sampling - Instruments NOT owned by MRF

8 Application Information

9 MRF C-130 Equipment Installation

10 Contact Points

1 W2 Hercules Summary (also referred to as MRF C-130)

Description:

- *Crew* Two pilots, navigator, flight engineer and loadmaster

- *Scientists* Maximum of fourteen project participants

- *Length* 36.6 m

- *Wingspan* 40.6 m

- *Weight* 70 316 kg maximum

- *Engines* Four Allison T56-A-15, 4 508 equivalent h.p. each

- *Base* DERA, Boscombe Down, Salisbury, Wilts, UK

Performance:

- *Altitude* 10 000 m (typical working maximum)

- *Range* 5 500 km (at 7 000 m cruise altitude)

- *Endurance* 12 hours maximum with IFR reserves

- *Speed* 150 ms^{-1} (typical cruise), 100 ms^{-1} (typical measurement speed)

- *Payload* 17 600 kg with full fuel load

Sensors:

- Temperature, humidity, pressure

- Gustprobes

- Aerosol and Cloud Physics Instrumentation

- Radiometers (Visible, Infrared, and microwave wavelengths)

- Remote Radiometric Surface Temperature
- Video (Still photography is available via Hand-held camera)
- Atmospheric Trace Gases
- 3 cm Weather Radar

Applications:

- Experiments requiring versatile measurement capability at short notice over land and sea around the UK
- Campaigns in the UK and abroad requiring intensive measurement periods or long endurance
- Short notice campaigns overseas
- Radiative Transfer Studies in clear and cloudy air
- Cloud Physics and Dynamic Studies
- Dynamics of mesoscale weather systems
- Boundary Layer studies
- Tropospheric Chemistry measurements
- Remote sensing: verification of ground based instruments
- Satellite Ground Truth - Radiometric measurements and winds
- Satellite Instrument test-bed
- Radar ducting studies

The aircraft can perform a number of manoeuvres designed to get the most accurate measurements possible of the atmospheric phenomena being observed. These include:

- profile descents (or ascents) at constant airspeed and rate of descent (ascent). Minimum altitude ≅ 15 m (50 feet) where permitted.
- straight and level runs at constant height and airspeed (or groundspeed). Minimum altitude 30 m (100 feet).
- - 'orbits' and spiral ascents/descents round a fixed point.
- - reference point can be fixed over the ground or within an air mass.

2 Aircraft Instrumentation Specifications

Meteorological Research Flight **Aircraft Type: W2 Hercules**	**Aircraft No: X**

Variable Measured	**Instrument Type**	**Manufacturer and Model No.**	**Combined Performance of Transducer, Signal Conditioning and Recorder**		
			Range	**Accuracy**	**Resolution**
Aircraft Vertical Velocity	Inertial Navigation Unit	Honeywell H423	±30 ms^{-1}	±0.3 ms^{-1}	0.019 $^{-1}$
Aircraft Ground Speed Components	" " "	" "	±250 ms^{-1}	±0.75 ms^{-1}	0.019 $^{-1}$
Aircraft True Heading	" " "	" "	0° to 360°	±0.1° r.m.s.	0.006°
Aircraft Pitch Angle	" " "	" "	±90°	±0.07° r.m.s.	0.006°
Aircraft Roll Angle	" " "	" "	±180°	±0.07° r.m.s.	0.006°
Angle of Attack	Potentiometric Wind Vane	Penny & Giles E23001	±10°	±0.5° offset	±0.005°
Angle of Sideslip	Potentiometric Wind Vane	Penny & Giles E23001	±10°	±0.5°offset	±0.005°
Geometric Altitude	Radar Altimeter	Honeywell YG9000D1	0-1525 metres (0-5000 feet)	greater of ±3% or ±1.5 m	0.4 m

Aircraft Instrumentation Specifications (continued)

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Aircraft Latitude (GPS)	Global Positioning System‡	Navstar XR5	0± to 90 N or S	±50 m *	±0.1 m
Aircraft Longitude (GPS)	" " "‡	" "	0 to 180 E or W	±50 m *	±0.1 m
Aircraft Altitude (GPS)	" " "	" "	exceeds aircraft flight envelope	±50 m *	±0.06 m
GPS Horizontal Velocity	" " "	" "	" " " "	±1.6 ms^{-1} *	±0.1 m^{-1}
GPS Vertical Velocity	" " "	" "	" " " "	±2.6 ms^{-1} *	±0.03 m^{-1}
Precipitation Location	Radar Altimeter	Ecko 290	±15° radar tilt angle, 260 km maximum range	dependent on range	3° beam width, 300 metre resolution within 32 km rar

‡ using **WGS84 Map Projection**
* subject to degradation by US Department of Defense

** OMEGA system was discontinued from 30 September 1997: Flight A581

Aircraft Latitude (OMEGA) **	Omega Navigation System	Litton LTN-211	0° to 90° N or S	<2 km radius by day and <4 km by night	0.000 086°
Aircraft Longitude (OMEGA) **	" " "	" "	0° to 180° E or W	<2 km radius by day and <4 km by night	0.000 086°

Aircraft Instrumentation Specifications (continued)

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Static Pressure	Variable Capacitance	Rosemount 1201F	1030-100 mb	better than ±0.3% full scale pressure i.e. ±3 mb	0.25 mb
Pitot-Static Pressure	Variable Capacitance	Rosemount 1221F	0-125 mb	better than ±0.3% full scale pressure i.e. ±0.5 mb	0.03 mb
Total Air Temperature (de-iced)	Platinum resistance (50Ω)	Rosemount 102BL	-80°C to +40°C	±0.3°C (de-icing heater off)	0.06°C
Total Air Temperature (non de-iced)	Platinum resistance (50Ω)	Rosemount 102AL	-80°C to +40°C	±0.3°C	0.06°C
In Cloud Temperature Probe (ICTP)	4.3μ m CO_2 Absorption Band Thermometer	UK Met Office developed	-50°C to +30°C	±0.1°C at +30°C ±1°C at -50°C	0.025°C

Aircraft Instrumentation Specifications (continued)

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Dew Point T_D	Thermoelectric Hygrometer	General Eastern 1011B	-60 °C to + 50 °C	±0.25°C at T_D > ±0°C reducing to ~ ±1.0°C at T_D = -60°C (sluggish)	0.03°C
Absolute Humidity	Lyman-α absorption and fluorescence hygrometer (FWVS)	UK Met Office developed	Abs:- 30°Cto+30°C Fluo: -80°Cto-25°C	±1°C	0.5°C
Total Water Content	Lyman-α absorption hygrometer	UK Met Office developed	0 - 20 g kg^{-1}	±0.15 g kg^{-1}	0.005 g kg^{-1}
Liquid Water Content	Hot wire	Johnson-Williams LWH	0 - 3 gm^{-3}	±10%	0.001 gm^{-3}
Radiometric Surface Temperature	Pyro Electric Detector 8μ m to 14μmλ	HEIMANN KT 19.82	-50°C to +50°C	±0.5°C	from 0.1°C at +20°C 0.3°C at -50°C
Nevzorov Ice and Water Content	Hot Wire	Sky Tech Research Inc. IV0-2a	0.003 - 3 gm^{-3}	±10%	

Aircraft Instrumentation Specifications (continued)

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Broadband Infrared Radiation (Hemispheric f.o.v. upper and lower)	Pyrgeometers 4µm →50µm (silicon dome)	UK Met Office developed	-500 → + 500Wm^{-2}	±10 Wm^{-2}	0.24 Wm^{-2}
Broadband Solar Radiation (Hemispheric f.o.v. upper and lower)	Pyranometers 0.3µm →3µm (WG295 clear dome)	Eppley PSP	-40 → + 1400Wm^{-2}	±3% for direct irradiance ±2% for diffuse irradiance	0.35 WM^{-2}
Broadband Solar Radiation (Hemispheric f.o.v. upper and lower)	Pyranometers 0.7µm →3µm (WG715 red dome)	Eppley PSP	-40 → + 700Wm^{-2}	±3% for direct irradiance ±2% for diffuse irradiance	0.18 WM^{-2}
Visible and Infrared Radiation	Scanning Airborne Filter Radiometer (SAFIRE) 0.5µm →15µm (16 bands or 4 bands scanning field of view)	UK Met Office developed	0.5 → 3.5µm 3.7 → 15 µm	1% 0.1K	Shortwave signal/noise rati 1000:1 Thermal resolution <0.1K

Aircraft Instrumentation Specifications (continued)

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Microwave Radiation	**M**icrowave **A**irborne **R**adiometer **S**canning **S**ystem (MARSS) (89, 157, 183±1, ±3, ±7) GHz	UK Met Office LMD developed	9 upward views + 9 downward views	~1K over land	0.4 → 0.7K
Microwave Radiation	Deimos 23.8, k50.1 GHz Vert + Horz polarisations	UK Met Office developed	5 downward views	~1.3 K over land	0.5 K
Infrared Radiation	**A**irborne **R**esearch **I**nterferometer **E**valuation **S**ystem (ARIES)	BOMEM MB200/UK Met Office developed	3.3 → 16.7μm (600 cm^{-1} → 3000 cm^{-1})	NEΔT ≤ 0.2K when viewing a 280K Black Body for 1 minute at 1000cm^{-1} (1cm^{-1} resolution) NEΔT ≤ 0.2K when viewing a 280K Black Body for 2 minutes at 2700cm^{-1} (1cm^{-1} resolution)	0.48 cm^{-1} sampling bin (ca degraded)

The above instruments are maintained by the Remote Sensing Branch (RS) of the Met Office at Farnborough.

For further details on ARIES contact Dr. Jonathon Taylor For further details on MARSS & DEIMOS contact Tim Hewison.

For details of address, E-mail and telephone numbers see section 8.

Aircraft Instrumentation Specifications (continued)

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Aerosol Light Scattering	3 wavelength Nephelometer (450, 550 & 700nm) Backscatter and Total scatter measurements	TSI Model 3563	Software adjustable sensitivity ~10^{-7} m^{-1} using 30 second averaging	±10%	0.024% of range
Cloud Condensation Nuclei (CCN)	Saturation gradient chamber	UK Met Office developed	>0.2µm particle diameter with 10 saturation ranges	±5% (provisional)	
Condensation Particle Counter (CNC)	Ultrafine Condensation Particle Counter	TSI INC Model 3025A	50% detection at 3nm 90% detection at 5n m	±10% up to 9.99×10^{4} cm^{-3}	
Optical absorption by black carbon	Dual Path integrating plate Quartz filter. Absorption coefficient at λ = 565nm.	Radiance Research Particle Soot Absorption Photometer (PSAP) (aka SOOTY)	0-5X10^{-5} m^{-1}	±10%	0.024% of range
Counterflow Virtual Impactor (CVI) (containing: CNC - 3010 (TSI) PCASP 0.1µm to 9µm Filters - see Chemistry Section)	Collects cloud droplets by removing them from the airflow and evaporating the water to leave a residual particle and water vapour	Developed by University of Stockholm/UK Met Office	Min cut-off 4µm		

3 Dropsonde Instrumentation Specifications

Type: VAISALA RD93 Dropsonde

Variable Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recorder		
			Range	Accuracy	Resolution
Air Temperature	Capacitive bead	2.5 s at 20 °C 3.7 s at -40 °C	-90°C → +40 °C	±0.2 °C	0.1 °C
Humidity	HUMICAP thin-film capacitor (dual sensor)	0.1 s at 20 °C 10 s at -40 °C	0% →100% RH (U)	±2% RH	0.1% RH
Pressure	BAROCAP silicon sensor	< 0.01 s	20 hPa →1060 hPa	±0.5 hPa	0.1 hPa
Winds	GPS codeless Doppler-shift measurement technique	N/A	0 →150 ms^{-1}	±0.5 ms^{-1}	0.1 ms-1 temporal resoluti 0.5 s

Two fall rate versions available: RD93 fall rate 12 ms^{-1} at Mean Sea Level
RD93L fall rate 5 ms^{-1} at Mean Sea Level

4 Basic Meteorological Measurements

Parameter	Absolute Accuracy	Resolution	Primary Instrumental Source	Remarks
Horizontal wind component	±0.5 ms^{-1}	0.06 ms^{-1}	Pitot-static system, angle of sideslip vane, INU, GPS, OMEGA*	Assumes full corrections made, including removal of INU drift
Vertical wind component	±0.1 ms^{-1}	±0.03 $^{-1}$	Angle of attack vane, pitot-static system, INU	Assumes low frequency errors removed by reference to changes in static pressure
Immersion Temperature	±0.3°C in clear air	0.06°C in clear air	Rosemount resistance thermometers, pitot-static system	Rosemounts corrected for kinetic heating
Radiative Temperature	±0.1°C → 1.0°C	0.025°C	In Cloud Temperature Probe (ICTP)	ICTP used in cloud
Humidity mixing ratio	±0.3 g kg^{-1}	0.02 g kg^{-1}	Total water content probe (TWC), Rosemount thermometers, pitot-static system, Fluorescence Water Vapour Sensor (FWVS), dew point hygrometers	Figures quoted refer to the lower altitudes in the atmosphere
Geometric Altitude	±3%	0.4 m	Radar altimeter	Does not work at heights >125 m (5,000 feet)
Pressure	better than ±3 mb	0.25 mb	Compensated static pressure ports	

(*OMEGA system was discontinued from end of September 1997 - data may still be used for flights before this date.)

5 Aerosol and Cloud Physics Measurements

Parameter	Device	Size Range (diameter: **d**)	Remarks
Number densities of cloud particles	FSSP	0.5 µm<***d*** < 8 µm 1 µm < ***d*** < 16µ m 2 µm < ***d*** < 32µ m 2 µm < ***d*** < 45 µm	Choice of ranges, sizing correct for water droplets only.
Number densities of cloud particles	Cloud particle probe (2D-C)	25µm < ***d*** < 800µm	Provides shape information for larger particles of ice and water.
Number densities of precipitation particles	Precipitation probe (HVPS)	200µm < ***d*** < 6400µm	See 2D-C.
Number densities of aerosol particles	PCASP	0.1µm < ***d*** < 3µm	Size calibration for spherical particles.
Cloud scope	Hallett Cloud Scope (Desert Research Institute)		Water drop/ice crystal images recorded on video tape.
Cloud condensation nuclei	Cloud condensation nuclei counter	CCN concentrations up to 4 000 cm^{-3} . Supersaturations of up to 1.5%	Discrete air samples drawn in via the alleviator.
Liquid water concentrations	Johnson-Williams meter	≈ 100% of 10µm to 30µm diameter drops collected. ≈50% only of 500µm ***d*** drops.	Bulk measurement, larger droplets shed by wire.
Aerosol Chemical Composition	Variation of Aerosol Chemical Characteristics (VACC) (University of Sunderland)	3 nm < ***d*** < 3 µm	Gives size distribution with some chemical information.

6 Chemical Sampling - Instruments owned by MRF

Variable Measured	Method	Type/Model	Remarks
Ozone O_3	UV Photometric	TECO 49	Range 0-1000 ppb Sensitivity 2 ppb Modified for aircraft use.
Peroxy Acetyl Nitrate (PAN)	Electron capture gas chromatograph	MRF developed 3 channels	Detection limit approx. 50 ppt . Calibration under development.
Particulate matter	Millipore Filters, 2 channels. Up to 3 filters each inlet.	MRF/Mainz developed. Isokinetic inlets	Filters supplied by user. Ion or SEM analysis by user. Possible to detect Ca^{++}, Mg^{++}, Na^{+}, NH_4^{+}, K^{+}, Cl^{-}, NO_3^{-}, SO_4^{--}
Grab samples	Stainless steel flasks	7 bar max fill pressure	48 1.6 litre bottles available at MRF. Laboratory analysis by user. e.g. FID GC for NMHC, ECGC for Halocarbons
Grab samples	Tedlar bags/metal bellows pump	bags supplied by user	Analysis by user laboratory 1 litre to 25 litre bags may be used.

Variable Measured	**Instrument Type**	Model etc.	Instrument owner/operator	Remarks
J NO_2	4π solid angle UV photometer	Juelich developed	Juelich/not required	NO_2 Photolysis rate. Fitted as replacement for B
J O^1D	4π solid angle UV photometer	University of Leicester developed	UL/not required	Ozone Photolysis rate. Fitted as replacement fo BBR.
Carbon Monoxide CO	Resonance Fluorescence	Juelich developed	Juelich/MRF or Juelich	Continuous, fast response.
Nitrogen Oxides $NO/NO_2/ NO_Y/NO_Y$ -HNO_3	4 channel NO/O_3 chemiluminescence	NOAA/UEA developed	UEA/UEA	NO_Y channels use gold tube catalytic converte presence of CO to NO.NO_2 uses photolytic conversion to NO
Peroxides H_2O_2	Fluorimetric	UEA developed	UEA/UEA	2 channel wet chemistry, total peroxides and orga peroxides
Formaldehyde HCHO	Fluorimetric	UEA developed	UEA/UEA	1 channel wet chemistry
Sulphur Dioxide/Dimethyl sulphide SO_2/DMS	APCI Mass Spectrometer	Max Planck developed	Owner/owner or MRF	Atmospheric Pressure Chemical Ionisation, continuous fast response
PFC Tracers	Dual Trap Analyser GC	BNL developed	Owner/MRF	Requires release of PFC tracer for plume detecti

8 Application Information

Typical information required when considering projects requiring the MRF Hercules.

- Summary of scientific programme.
- Proposed flight operations, to include:
  - Flying periods,
  - Number of flights, duration, and times of day,
  - Operating base,
  - Altitude and range,
  - Weather conditions and an indication of the likelihood of such suitable conditions,
  - Number of scientific staff or observers needing to fly,
  - Instruments needed on the flight,
  - Need for real time display of data,
  - Co-ordination with any other ground or airborne system
- Data processing requirements, to include:
  - Data required on standard format MRF data disks and tapes,
  - Data required in non-standard format,
  - Special data processing needs.
- Requirements for air to ground or air to air communication requirements.
- Name, address etc. of any collaborators including, if necessary, a scientific contact within the Met. Office.

9 MRF C-130 Equipment Installation

MRF have a rolling programme of installations on the C-130, many of which are minor changes or upgrades to existing equipment. However, new equipment is installed when required to meet the needs of users, either on a permanent basis or for particular campaigns.

Because the aircraft is a military aircraft, installations have to meet military standards; amongst the most stringent of these is the 16g deceleration forward emergency landing case. Although airworthiness inspectors prefer the structural strength of the equipment, including the mounting points, to be certified as conforming to Hercules stress requirements on MoD Form 100, often this will not be possible, and each installation will have to be agreed with the airworthiness authorities at Boscombe Down.

MRF are willing to consider the feasibility of any new installation; discussions should be held at an early stage as the design and embodiment of installations can (depending on the complexity of the task) take some time.

10 Contact Points

For further information please contact the following:

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EU contracts/proposals should contact:-

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Universities, HEIs and NERC/SERC institutes should contact:-

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