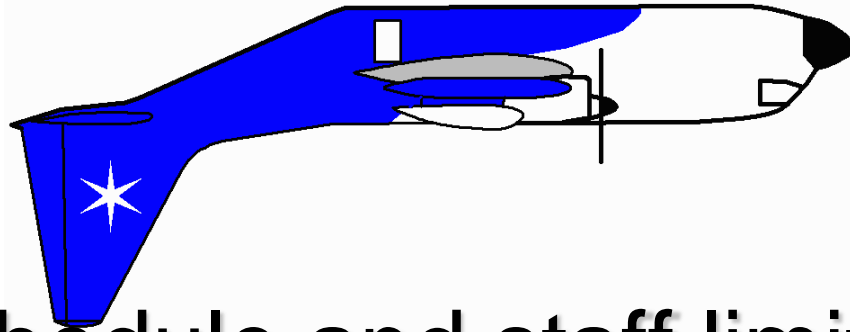


C-130 and instrumentation for RICO



Flight schedule and staff limitations

Hardpoint allocation and cabin layout

Time synchronization

Flight issues – expectation around
convection

Sensor groups and expected performance

Flight schedule and staff limitations

161 mission flight hours

5 week deployment

32 hours per week = 4 flights of 8 hours

(Aircraft limits are 35 flight hours per week)

=> Not much time for instrument maintenance
PI's should consider extra maintenance
staff

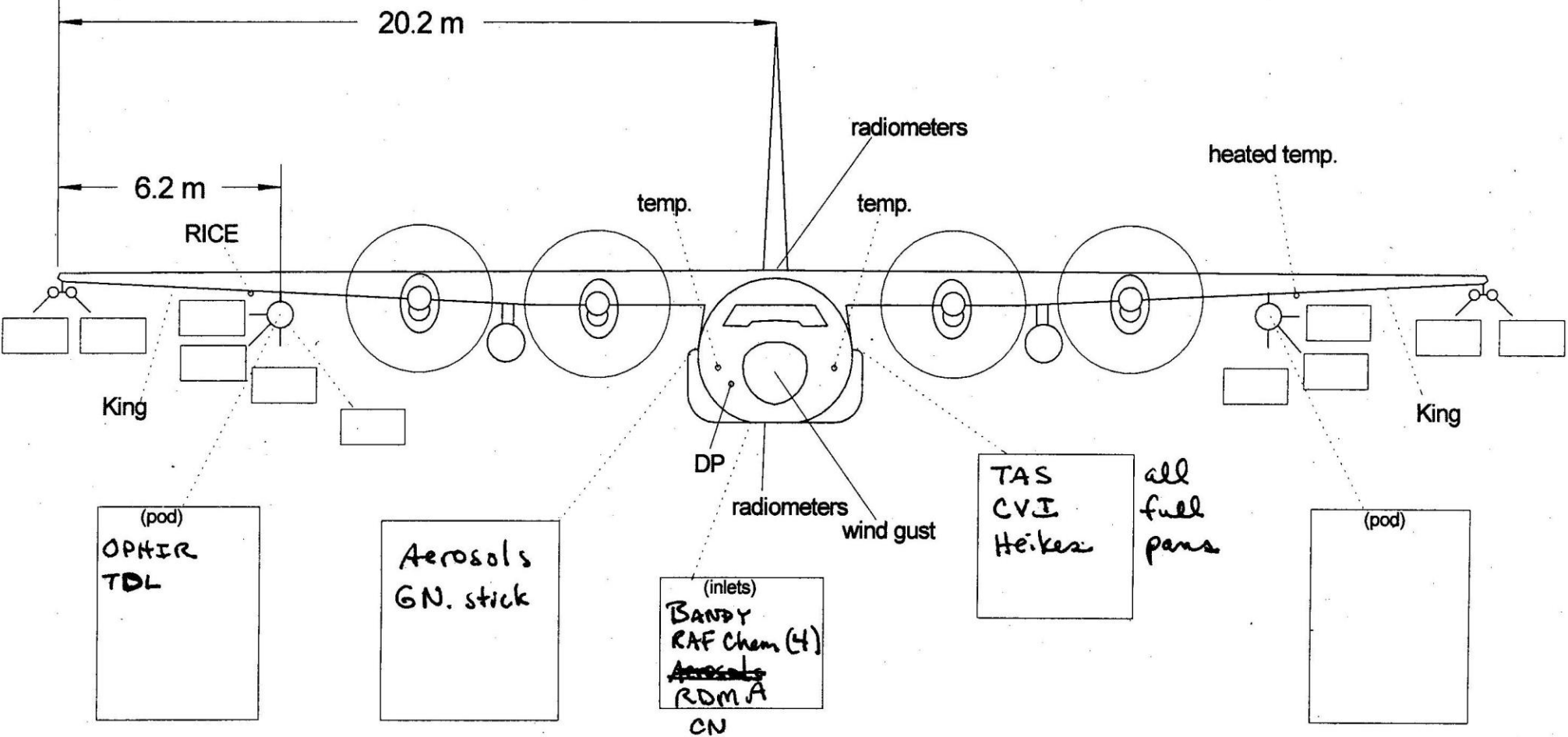
1 hard down day per week.

3 technicians + 3 mechanics allocated to RICO

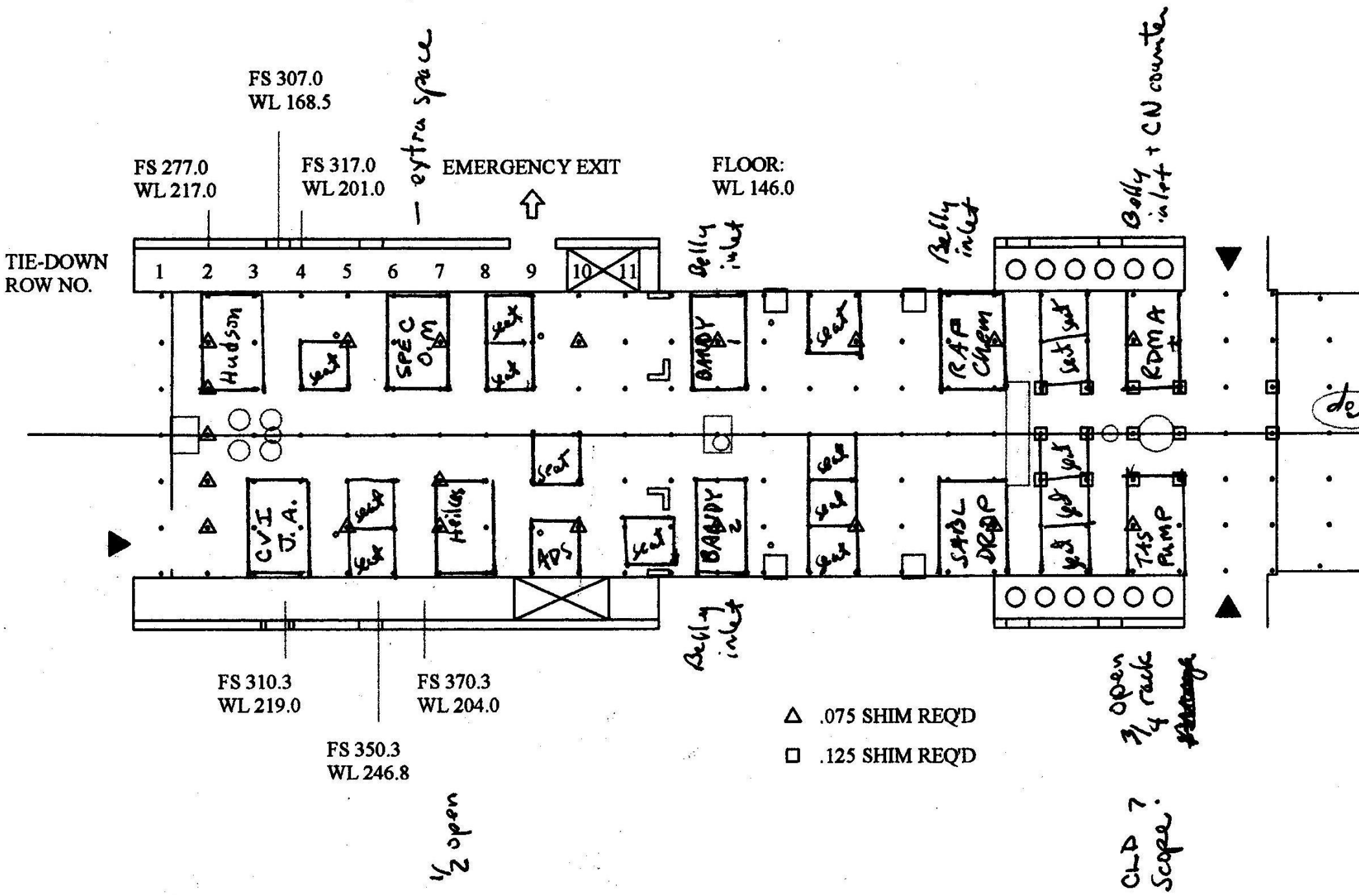
Hardpoint allocation and cabin layout

c130_front_template.skf 22-August-2002

Project: RICO Strawman



Rico Strawman Layout



Time synchronization

Strong need for synchronization between many instruments and the C-130 data logger.

C-130 can provide time as:

- IRIG-B

- NTP (Network Time Protocol)

- 1 Hz serial ASCII string

Please, please ensure that high time accuracy is built

into your systems – trace gas, microphysics probes, etc.

Flight issues – expectation around convection

Multi-aircraft flights

IFR

Radio communication essential

Flight tracking systems: TCAS

ION

Low level flight to 100 ft over the ocean

Passes in heavy precipitation to 500 ft agl or higher

SABL lidar has 1000 m eye-safe distance (unaided)

Sensor groups and expected performance

1. Pressure and winds:

Mean winds

Turbulence spectra - questions about $4/3$ ratio of longitudinal vs. lateral and vertical spectra

Potential for water ingestion

Consider circles before multiple cloud penetrations?

Sensor groups and expected performance

2. Temperature:

Rosemount

Cooling due to wetting likely in excess of 2 degC

Ophir

Rebuilt by Stuart Beaton in 2003

Effective path for 200 drops per cc of 12 micron radius: approx. 10 m (1 e-fold length)

Wet-bulb temperature sensor? (Under investigation, not promised)

Sensor groups and expected performance

3. Humidity:

Cooled mirror

Lyman-alpha

Referenced to cooled mirror sensors

Potential for temperature determination assuming saturation?

TDL (Under development, not promised)

Wet-bulb temperature sensor? (Under investigation, not promised)

Sensor groups and expected performance

4. D-value:

Radar altitude – pressure altitude

Useful for determining surface pressure, convective initiation, etc.

Fluctuations probably valid to +/- 2 m or better.

Expect natural variability of 5 m (0.6 mb) or larger.

Sensor groups and expected performance

5. RAF particle sensors:

CN counter: TSI-3010	0.01 μm	< d	
RDMA	0.008 μm	< d <	0.13 μm
PCASP	0.1 μm	< d <	3.0 μm
SPP FSSP-100	0.5 μm	< d <	47
μm			
260X	40 μm	< d <	620 μm
2D-C	50 μm	< d <	800 μm
2DP	200 μm	< d <	6400 μm
(HVPS	200 μm	< d <	25600
$\mu\text{m})$			

Sensor groups and expected performance

6. RAF radiation

UV/Vis/IR up/down fluxes (Eppley)
Remote sky and surface temperature
(Heimann)

SABL

Crew issues (19 total):

2 pilots + 1 flight engineer

CVI

Peroxides

RAF tech

DMS

Ozone, CO

Fast FSSP, X-probe

doppler

TAS

PI

CCN

Giant Nuclei

SO₂

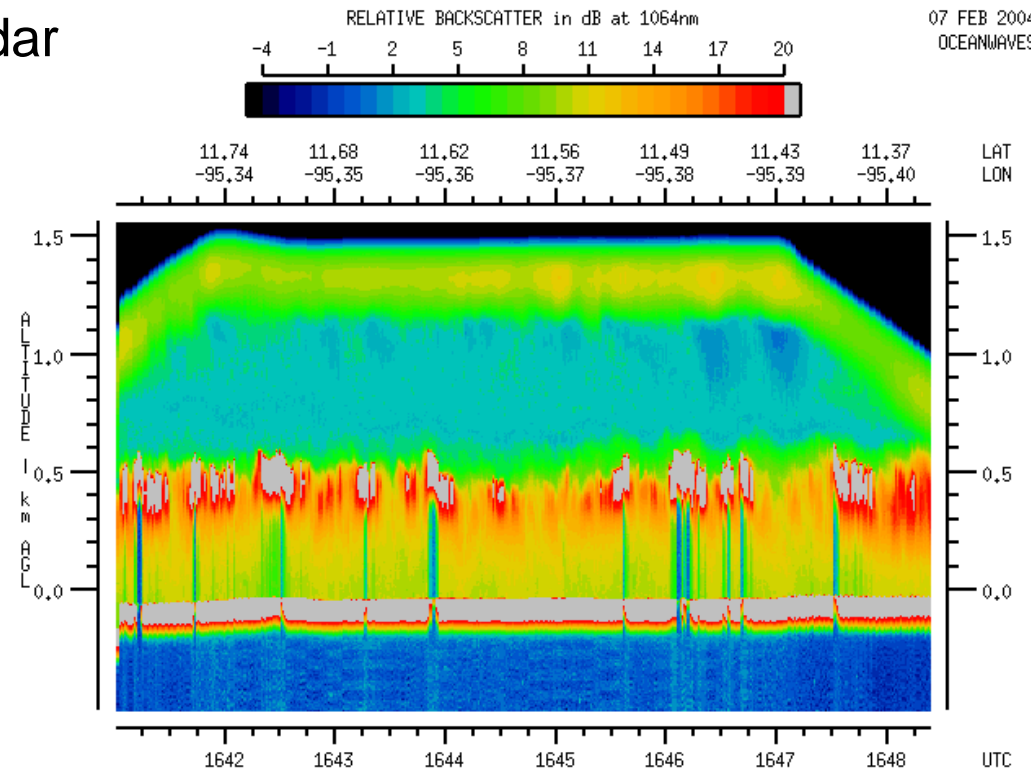
2D-S

Phased

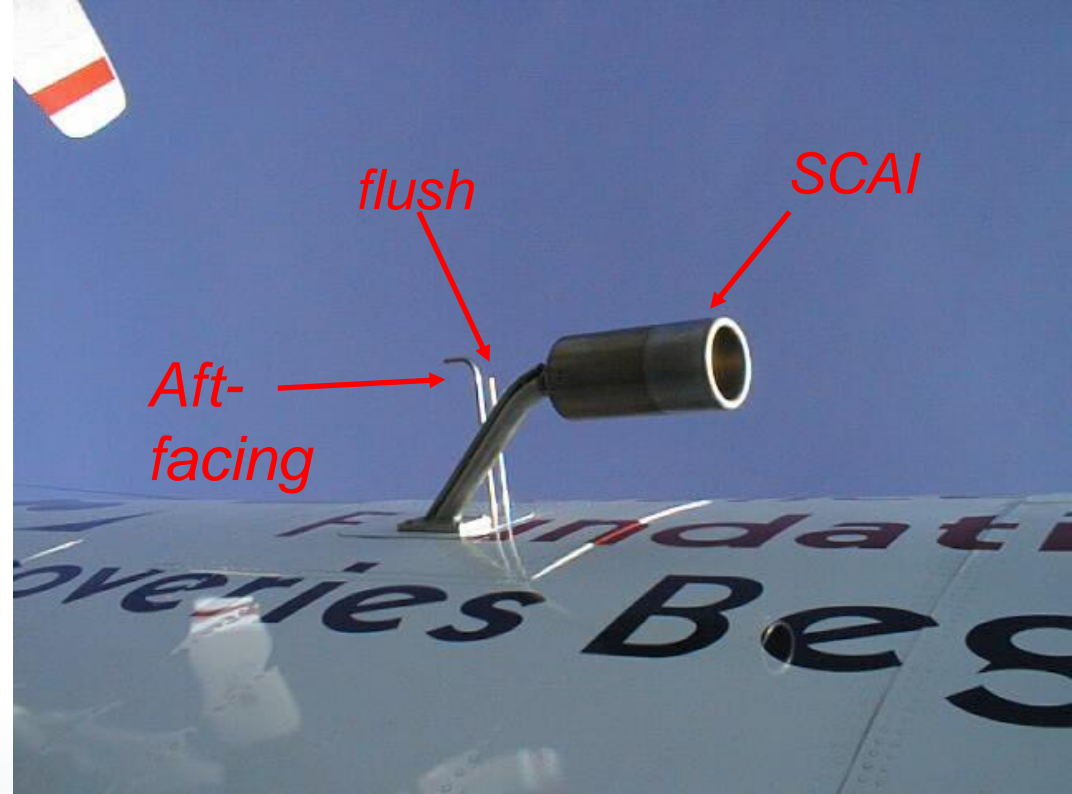
SABL: Scanning Aerosol Backscatter Lidar

07 FEB 2004
OCEANWAVES

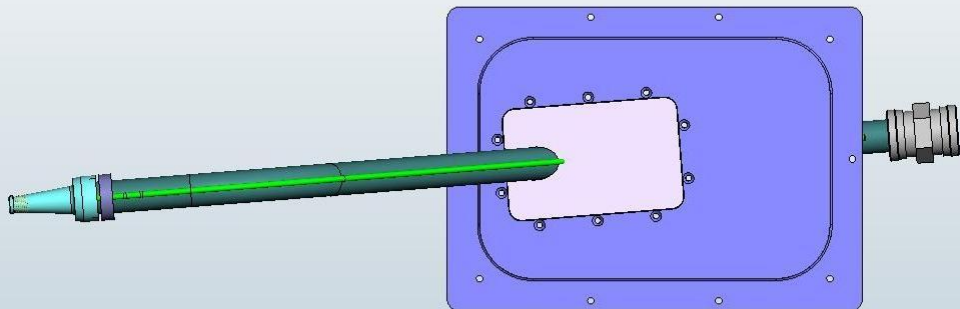
Wavelengths	1064 nm and 532 nm
Vertical resolution	3.75 m
Pulse repetition freq.	20 Hz
Along track resolution	5 m (at 100 m/s)
Sample volume size	20 cm x 3 m at 1 km
Eye-safety	Beyond 1 km range
Minimum range	About 400 m
Pointing directions	Up or down



counterflow virtual impactor



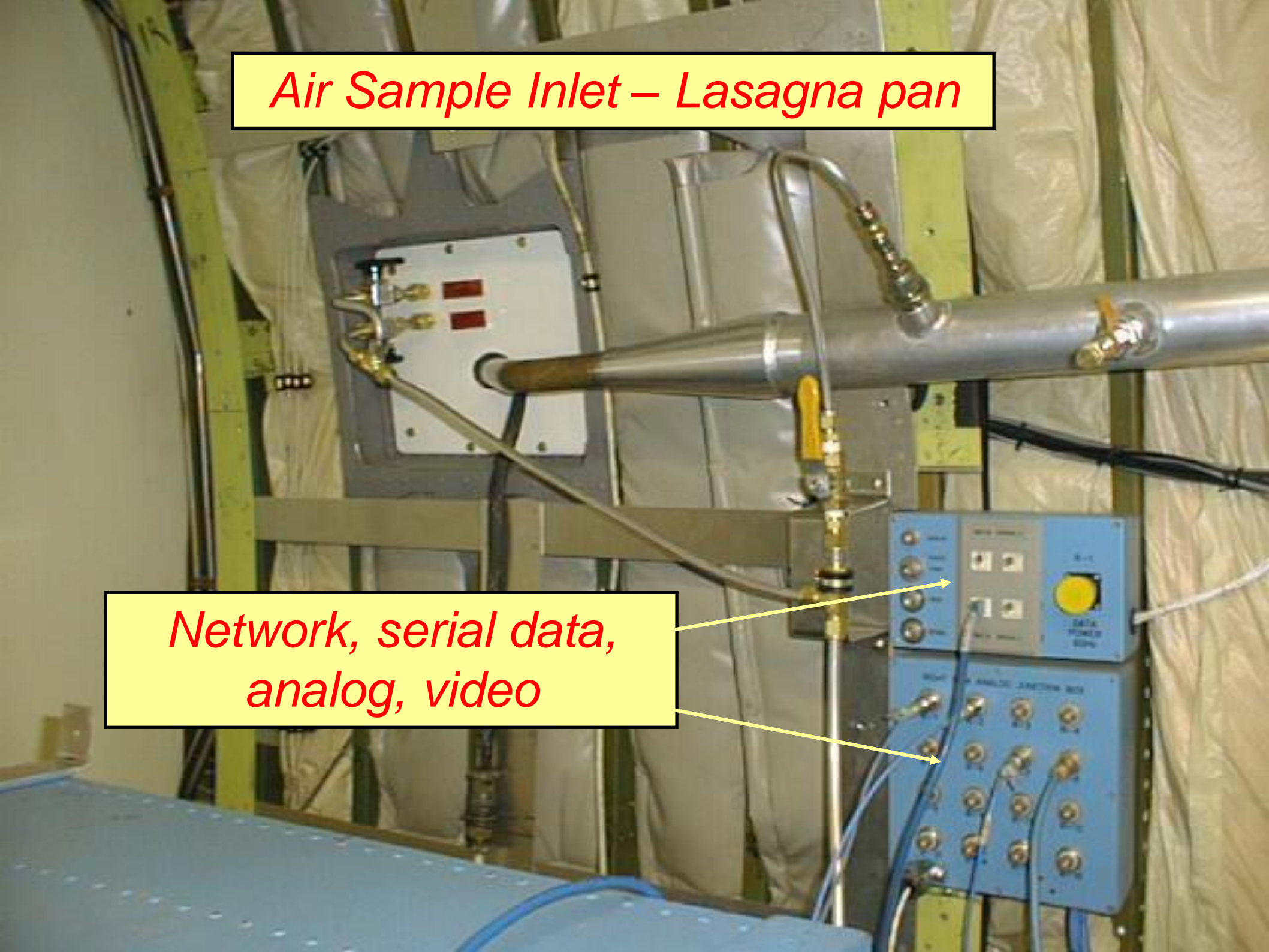
anti-iced diffusing inlet



Air Sample Inlets

Air Sample Inlet – Lasagna pan

*Network, serial data,
analog, video*



Investigator instruments

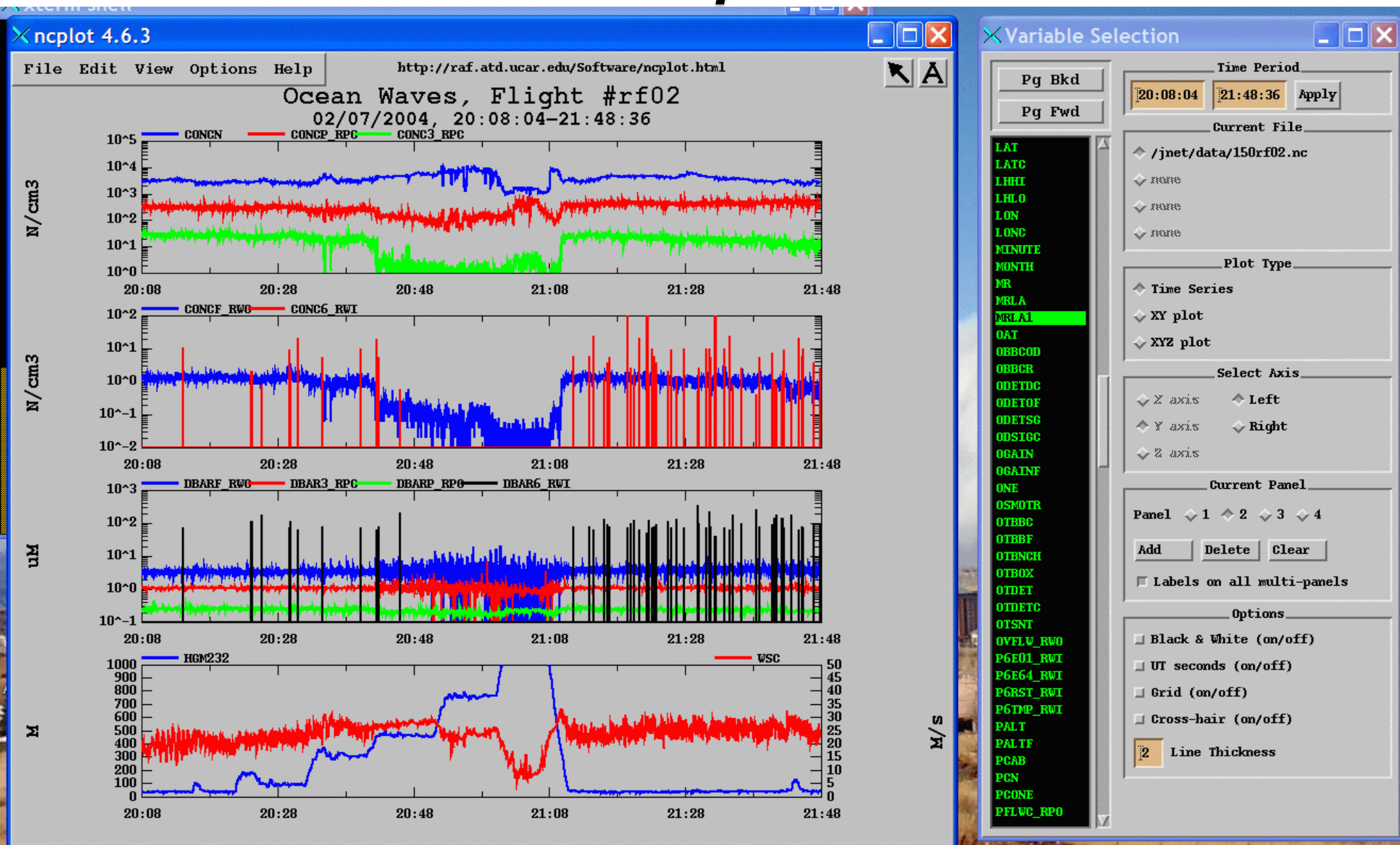
- mount in RAF racks,
PMS cans or pod*
- requirements for safety
and flight worthiness*

*ATD can provide design &
fabrication support*

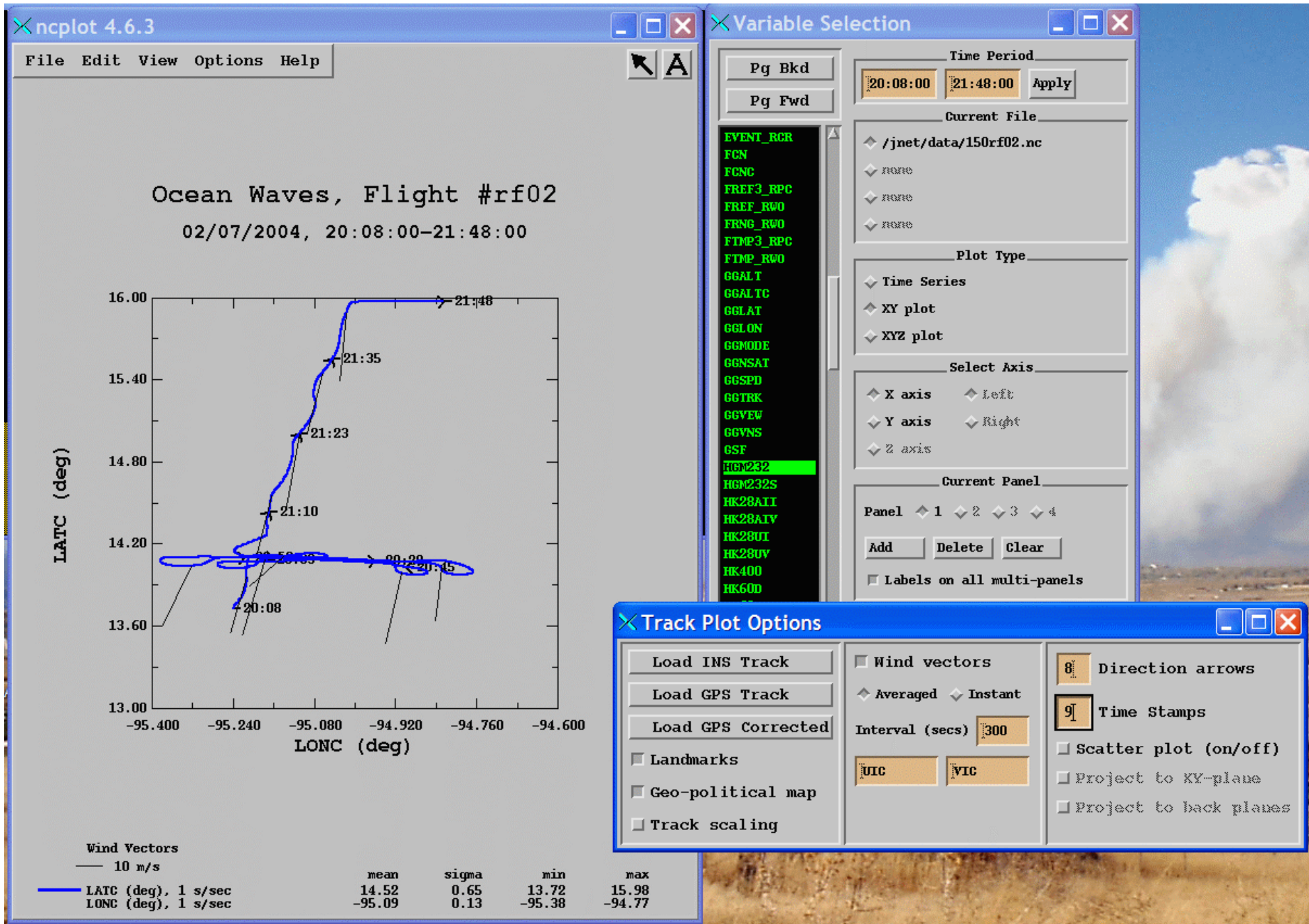


RAF data analysis software – free

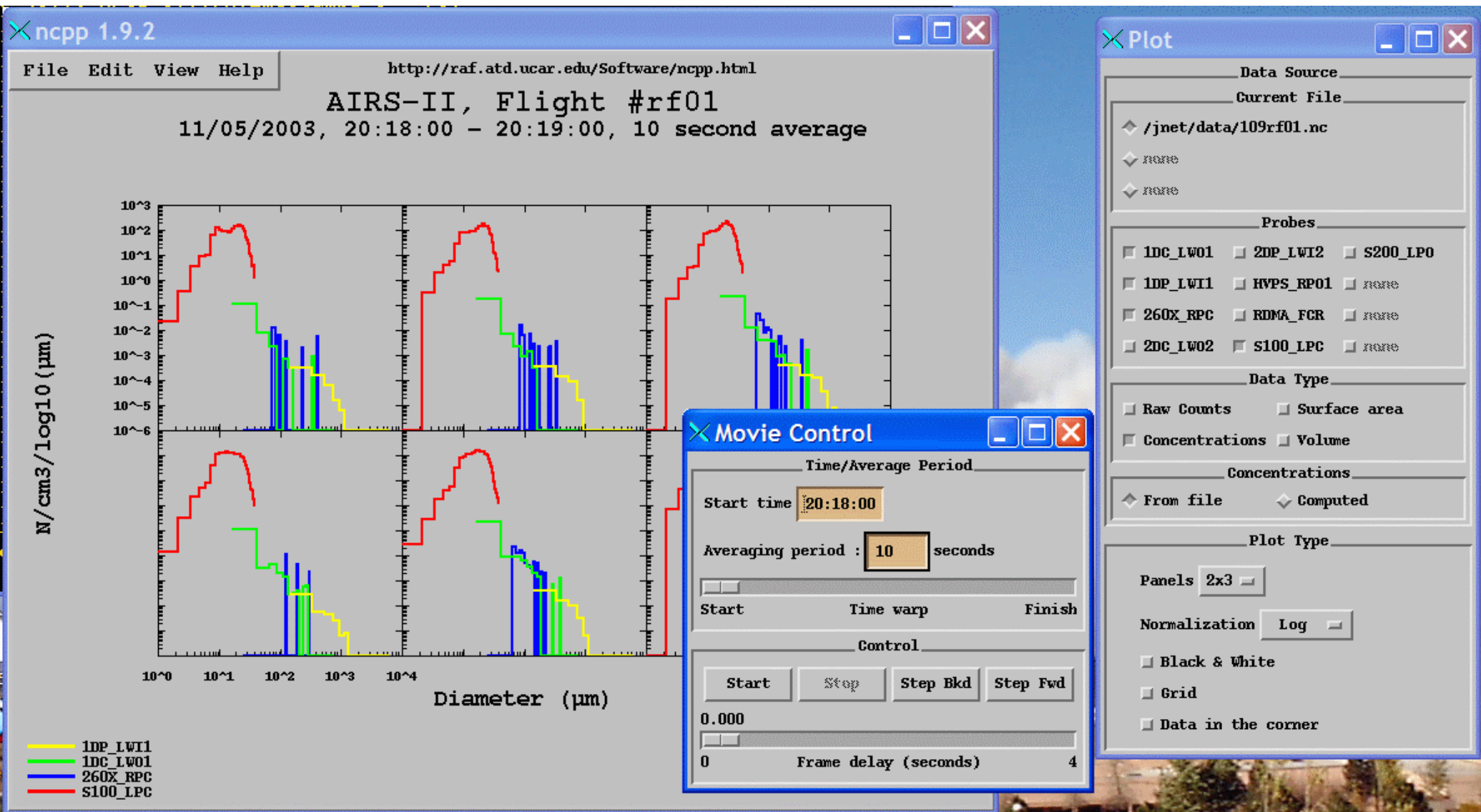
!



Flight track



Particle size distributions



Particle images

The screenshot displays the xpms2d 2.2.1 software interface. The main window shows a series of particle images (red and green dots) with associated data for each frame. The data includes time, TAS, overload, nParticles, elapsed time, timeBarTotal, percentage, sv: act, used, area, conc, lw, and z. A 'Probe Selection' dialog box is open in the foreground, allowing users to select a time period, probes, and density for analysis.

File View Options Help 109, rf01 - 11/05/2003

20:10:02.455, TAS=120.1, overload= 0.000, nParticles = 47, elapsed time =25.259, timeBarTotal = 28.217 111.7% 111.7%
sv: act = 148.04L, used = 4.570L, area = 1.20mm2, conc = 0.292N/L, lw = 0.003g/M3, z = -3.987db

20:10:30.693, TAS=121.1, overload= 0.000, nParticles = 50, elapsed time =28.238, timeBarTotal = 29.904 105.9% 105.9%
sv: act = 166.85L, used = 4.693L, area = 0.85mm2, conc = 0.277N/L, lw = 0.002g/M3, z = -6.770db

20:10:51.236, TAS=122.1, overload= 0.000, nParticles = 47, elapsed time =20.543, timeBarTotal = 24.393 118.7% 118.7%
sv: act = 122.36L, used = 3.727L, area = 1.14mm2, conc = 0.333N/L, lw = 0.003g/M3, z = -2.928db

20:11:09.732, TAS=123.0, overload= 0.000, nParticles = 47,
sv: act = 111.06L, used = 2.517L, area =

20:11:21.541, TAS=125.0, overload= 0.000, nParticles = 51,
sv: act = 72.03L, used = 1.827L, area = 0

20:11:31.384, TAS=126.0, overload= 0.000, nParticles = 59,
sv: act = 60.51L, used = 0.546L, area = 0

20:11:35.568, TAS=126.0, overload= 0.000, nParticles = 55,
sv: act = 25.72L, used = 0.337L, area = 0

20:11:38.922, TAS=126.0, overload= 0.000, nParticles = 60, elapsed time = 3.354, timeBarTotal = 3.658 109.1% 109.1%
sv: act = 20.62L, used = 0.220L, area = 0.21mm2, conc = 3.800N/L, lw = 0.008g/M3, z = -0.735db

20:11:41.771, TAS=126.0, overload= 0.000, nParticles = 55, elapsed time = 2.849, timeBarTotal = 3.133 110.0% 110.0%
sv: act = 17.52L, used = 0.215L, area = 0.77mm2, conc = 3.900N/L, lw = 0.057g/M3, z = 13.820db

Probe Selection

Time Period

Start time [20:10:02]

Start Time warp Finish

Start Stop Step Bkd Step Fwd

0.000

0 Frame delay (seconds) 4

Probes

- 2D-C_LW0
- 2D-P_LWI
- 2D-H_RP0
- none

Method

- None
- Entire-in
- Center-in
- Reconstruct

Density

- Water (1.0)
- Ice (0.916)
- Graupel (0.5)
- Snow (0.12)

C-130 Data

Data acquisition

- *Network on aircraft*
- *Analog, serial, special*
- *1 Hz – 10 kHz*

Real-time display

- ION (web-based)

Data analysis software - *free !*

<http://raf.atd.ucar.edu/Software/index.html>

Data archives

JOSS - <http://www.joss.ucar.edu/>

ATD/RAF - <http://raf.atd.ucar.edu/>