Overview of Advances in Instrumentation for Field Observations

S.R. Springston

Special Thanks to: L. Nunnermacker, Y.-N. Lee, J. Weinstein-Lloyd, F. Brechtel, D. Imre, D. Worsnop, J. Hubbe

Platform:	Ground Site, Aircraft
Status:	Planned, In Progress, Laboratory, Field Ready
Areas:	Gas-Phase, Aerosol
Integration	

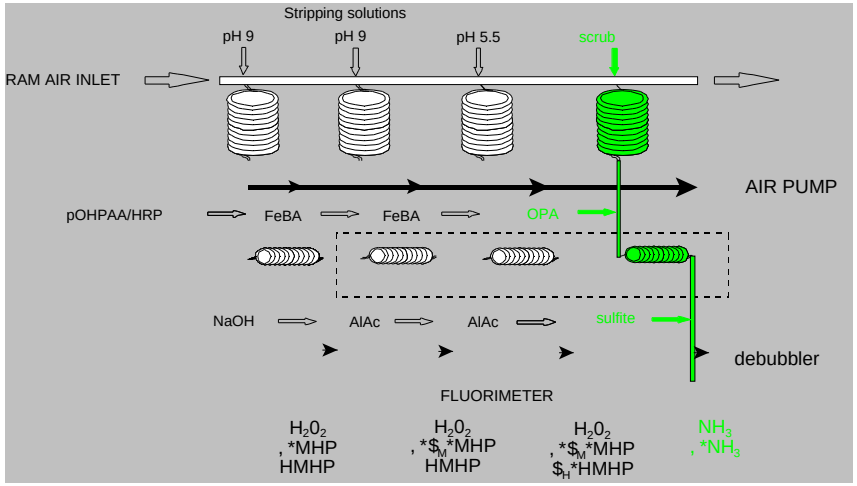
BROOKHAVEN NATIONAL LABORATORY

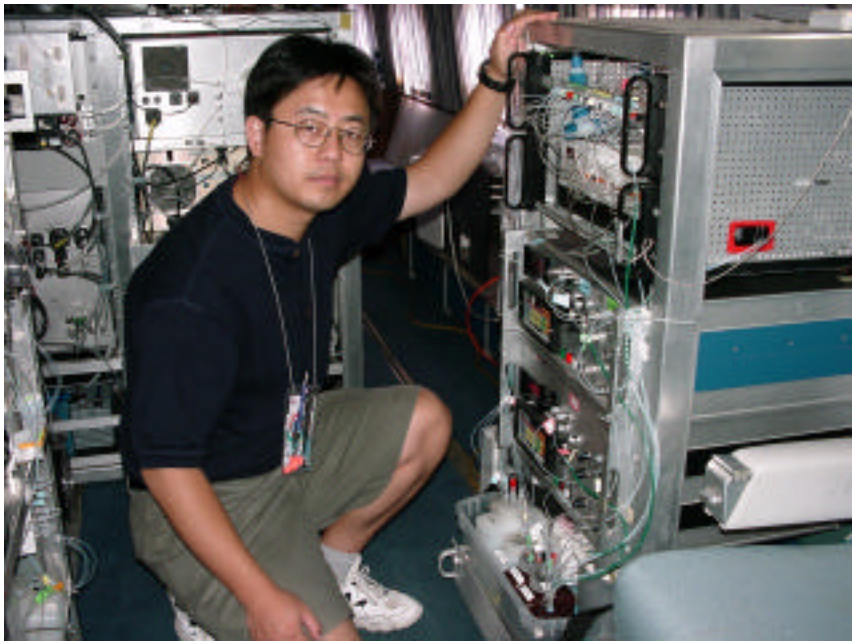
Previous Year

- Aircraft Measurements
  - Phoenix 2001
  - 13 flights, 45 h sampling
  - ftp://aerosol.das.bnl.gov/pub/phoenix01

- Ground Site
  - NE-OPS 2001
  - ~2 weeks continuous data
  - ftp://aerosol.das.bnl.gov/pub/philadelphia01
  - http://lidar1.ee.psu.edu/

NH_3 / SO_2 Measurement





Fast O_3 Measurement

TEI 49-100

- τ ~20 s
- L.O.D. ~2-4 ppbv
- Wt = 35 lbs

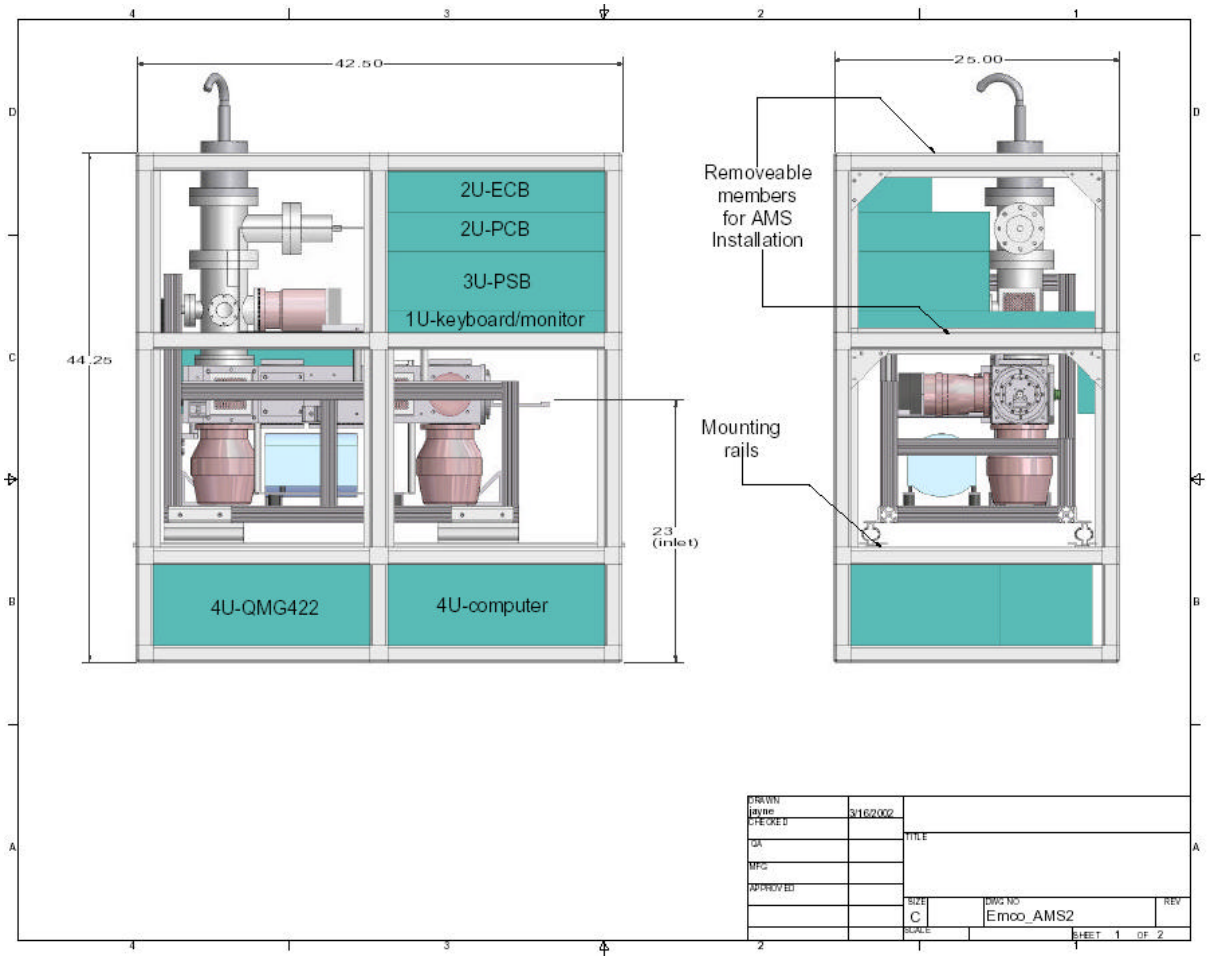
O_3 Chemiluminescent Detection

- t < 1 s
- L.O.D. ~ 1 – 4 ppbv
- Wt ~ 25 lbs
- NO reagent

Real-Time Aerosol Composition I

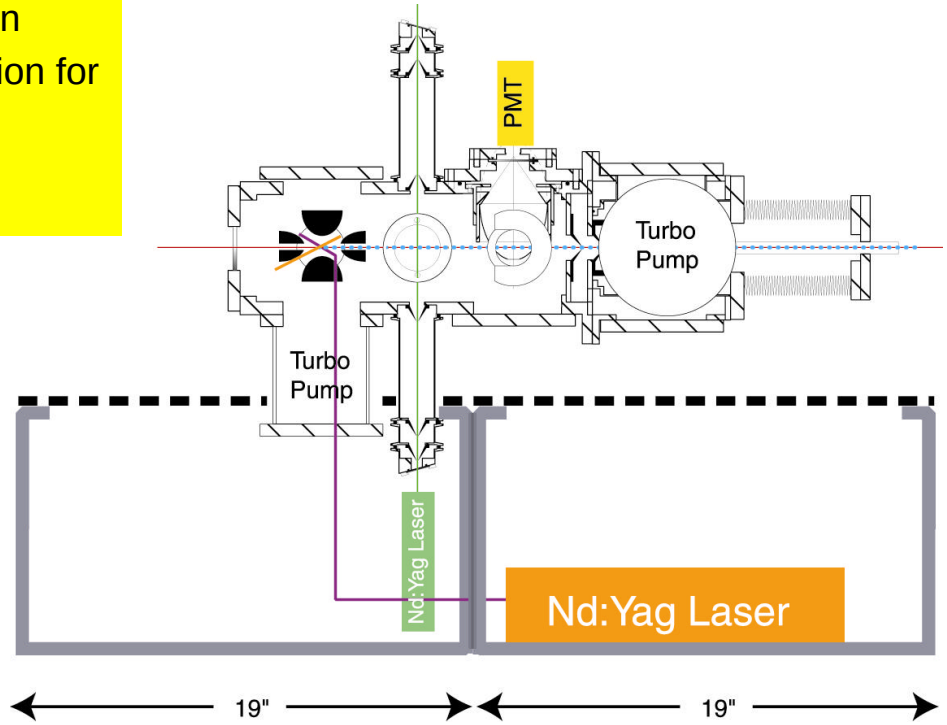
- PILS
  - t = 2 – 3 min
  - Anions
    - Cl^-, NO_3^-, SO_4^{2-}
  - Cations
    - NH_4^+, Na^+, K^+, Ca^{2+}
- TOC

Real-Time Aerosol Composition II



Real-Time Aerosol Composition III
Airborne Single-Particle MS

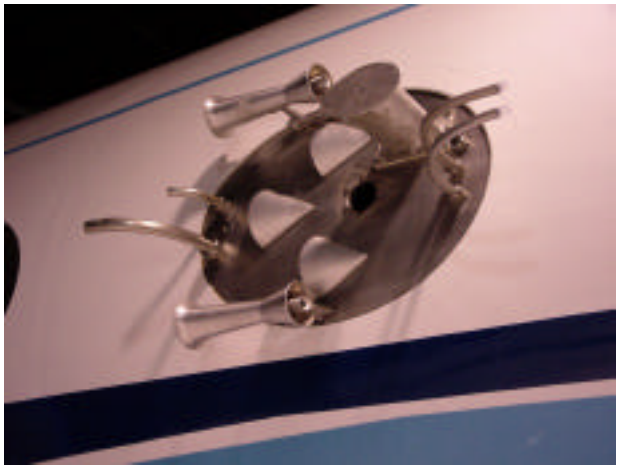
- Single particle size and composition
- 30 Particles/sec
- 50nm – 3.5micron
- Chemical ionization for organics
- MS-MS

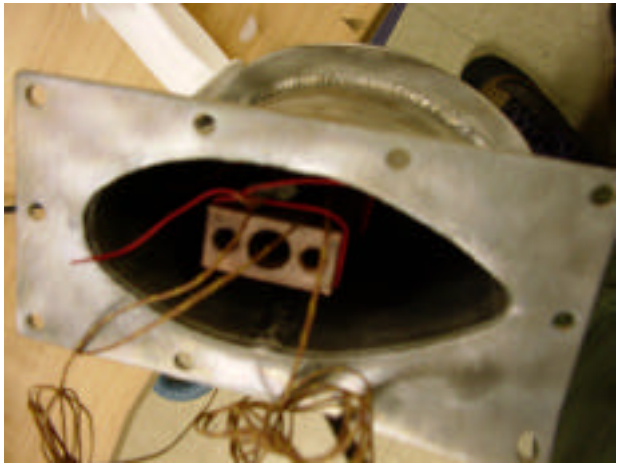


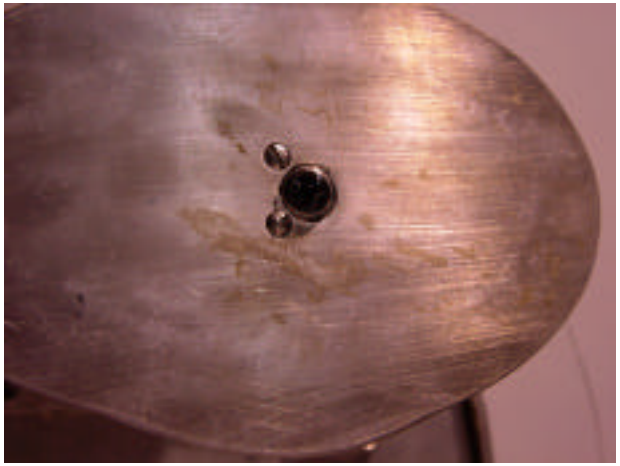
Real-Time Aerosol Composition IV

New Aerosol Inlet & Manifold
Turbulent _ Laminar Flow
    1” _ 2” o.d. tubing
Isokinetic sub-sampling ports
    Computer controlled flow
T, P, R.H. @ 2 different points
Possible 2-stage deceleration

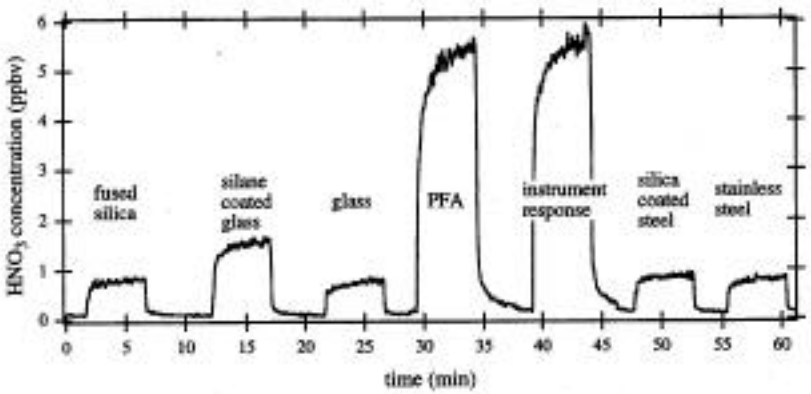
NO_y Inlet

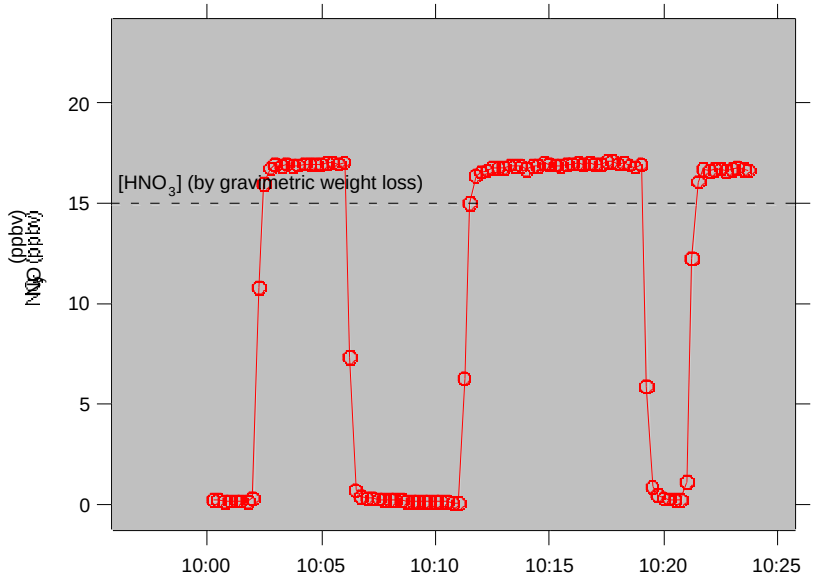






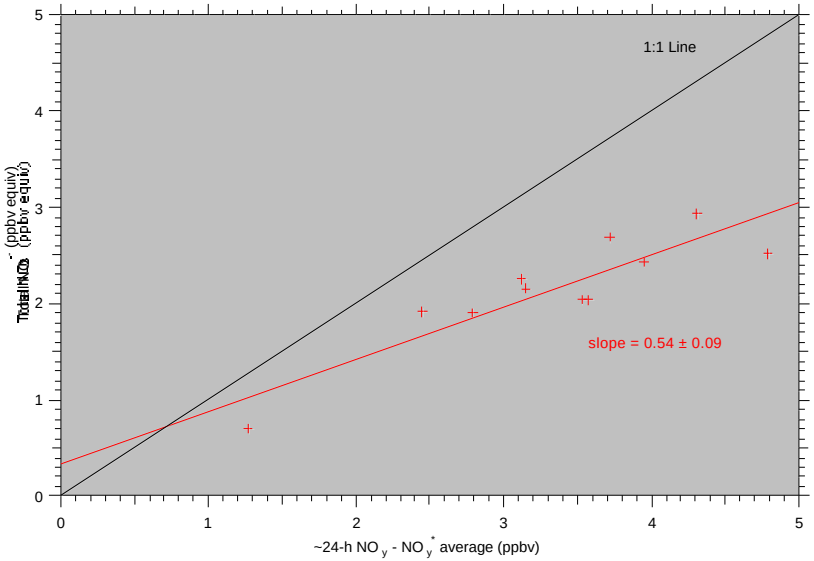
HNO_3 Response Time



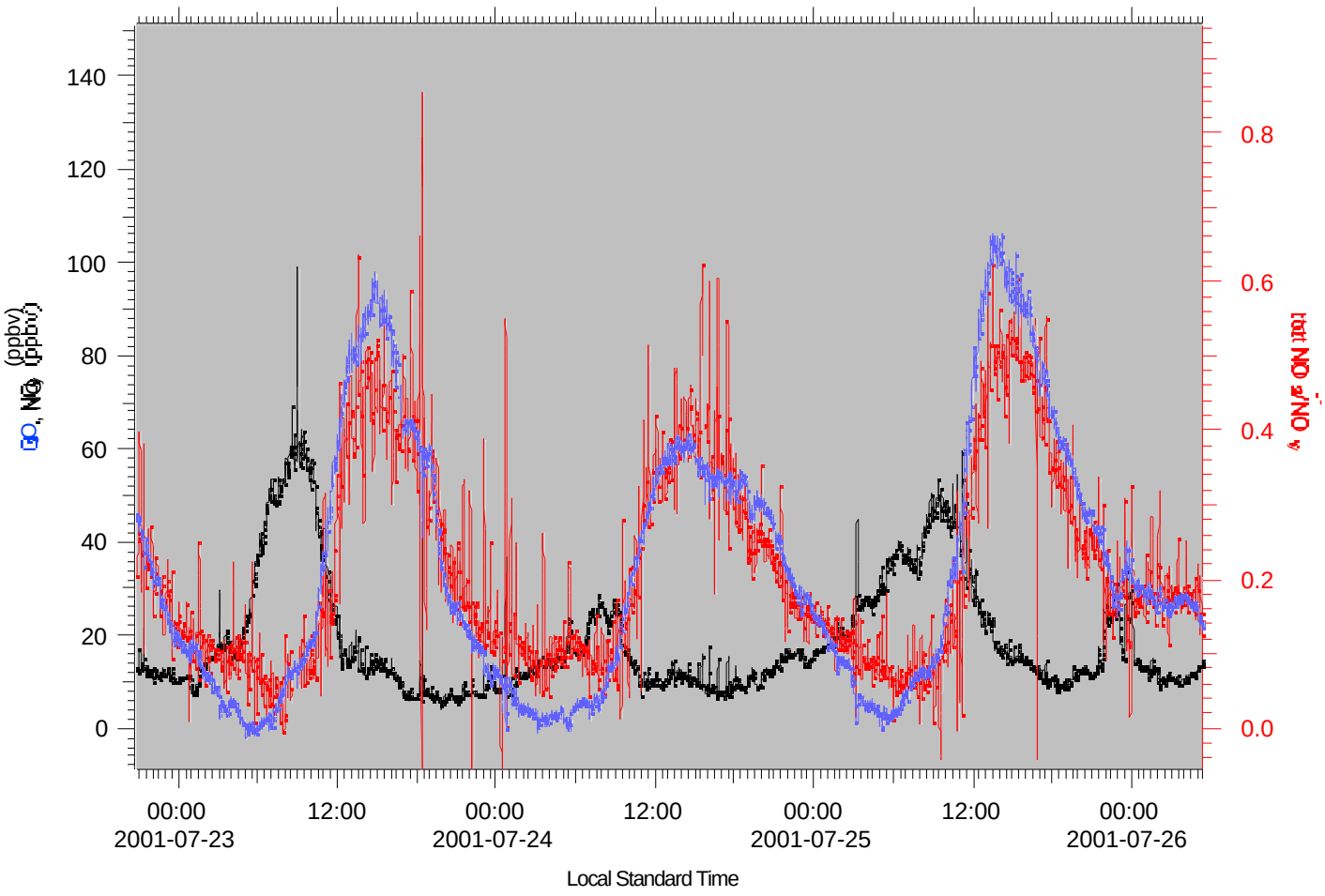


- Neuman, et. al. ***Environ. Sci. Technol.*** **1999, *33***, 1133-6.

NO_y/NO_y^*



Total NO_3^-


140
120
100
80
60
40
20
0
0.8
0.6
0.4
0.2
0.0
00:00
2001-07-23
12:00
00:00
2001-07-24
12:00
00:00
2001-07-25
12:00
00:00
2001-07-26
Local Standard Time

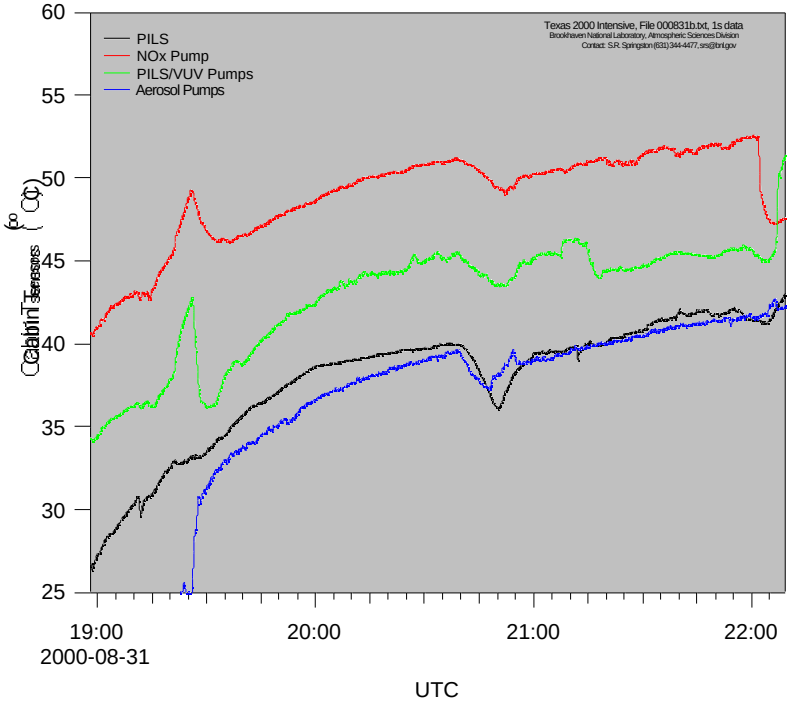
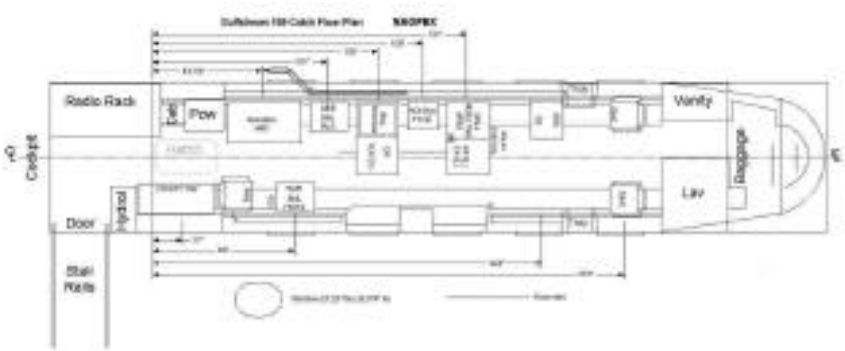
Instrument Integration

Weight: 1 lbs instrument = -1 lbs fuel

Heat: 1 VA instrument = 1 W heat

Power: 8 kVA available

Size: ~360” X 19” rack space



Planar Geometry