Advanced Whole Air Sampler

Elliot Atlas, RSMAS, University of Miami
Rich Lueb, RSMAS and NCAR
Roger Hendershot, NCAR ACD
Steve Gabbard, NCAR

Others TBD

AWAS science focus

- Use of tracers of different origins, source distributions, and lifetimes
  - Evaluate air mass sources to the UT/LS
  - Better define the role of short-lived organic trace gases
  - Evaluate transport rates and routes
  - Define chemical composition of air in the UT/LS
    - **Focus on halogen budgets**

Selected trace gases measured from whole air sampler

	Yrs	Source
Chlorofluorocarbons		
CFC-11	50	A
CFC-12	102	A
CFC-113	85	A
CFC-114	300	A
CFC-115	1700	A
Halons		
CFC-12b1 (Halon 1211)	20	A
CFC-13b1 (Halon 1301)	65	A
CFC-114b2 (Halon 2402)	20	A
Hydrochlorofluorocarbons/ Hydrofluorocarbons		
HCFC-22 (CHF2Cl)	13	A
HCFC-141b (CH3CFCl2)	9.4	A
HCFC-142b (CH3CF2Cl)	19.5	A
HFC-134a (C2H2F4)	14	A
Solvents		
Carbon Tetrachloride)	40	A
Methyl Chloroform	4.8	A
Tetrachloroethylene	0.3	A
Methylene Chloride	0.3	A
Chloroform	0.4	A
Trichloroethylene	0.02	A
Methyl Halides		
Methyl Bromide	0.8	A/N/B
Methyl Chloride	1.5	N/B
Methyl Iodide	0.01	N
Methylene Bromide	0.4	N
CHxBryClz	0.1	N
Bromoform	0.1	N

	Yrs	Source
Organic Nitrates		
Methyl nitrate(CH3ONO2)	0.08	A/N
Ethyl nitrate(C2H5ONO2)	0.04	A/N
Propyl nitrates(C3H7ONO2)	0.03	A/N
Butyl nitrates (C4H9ONO2)	0.02	A
Pentyl nitrates (C5H11ONO2)	0.02	A
Non-Methane Hydrocarbons		
Ethane (C2H6)	0.2	A
Ethyne (C2H4)	0.06	A/B
Propane(C3H8)	0.04	A
Isobutane(C4H10)	0.02	A
n-Butane (C4H10)	0.02	A
Isopentane (C5H12)	0.01	A
n-Pentane (C5H12)	0.01	A
Isoprene (C5H10)	hrs	N
Benzene (C6H6)	0.04	A/B
Toluene (C7H8)	0.01	A/B
C2-Benzenes (C8H10)	<.01	A
a-Pinene (C10H20)	hrs	N
Other		
Methane (CH4)	9	A/N/B
Carbon Monoxide (CO)	0.4	A/N/B
Nitrous Oxide (N2O)	115	N
Carbonyl Sulfide (COS)	30	N/A/B
Dimethyl Sulfide (C2H6S)	<.01	N

A = anthropogenic/industrial

N = natural/marine

B = biomass burning

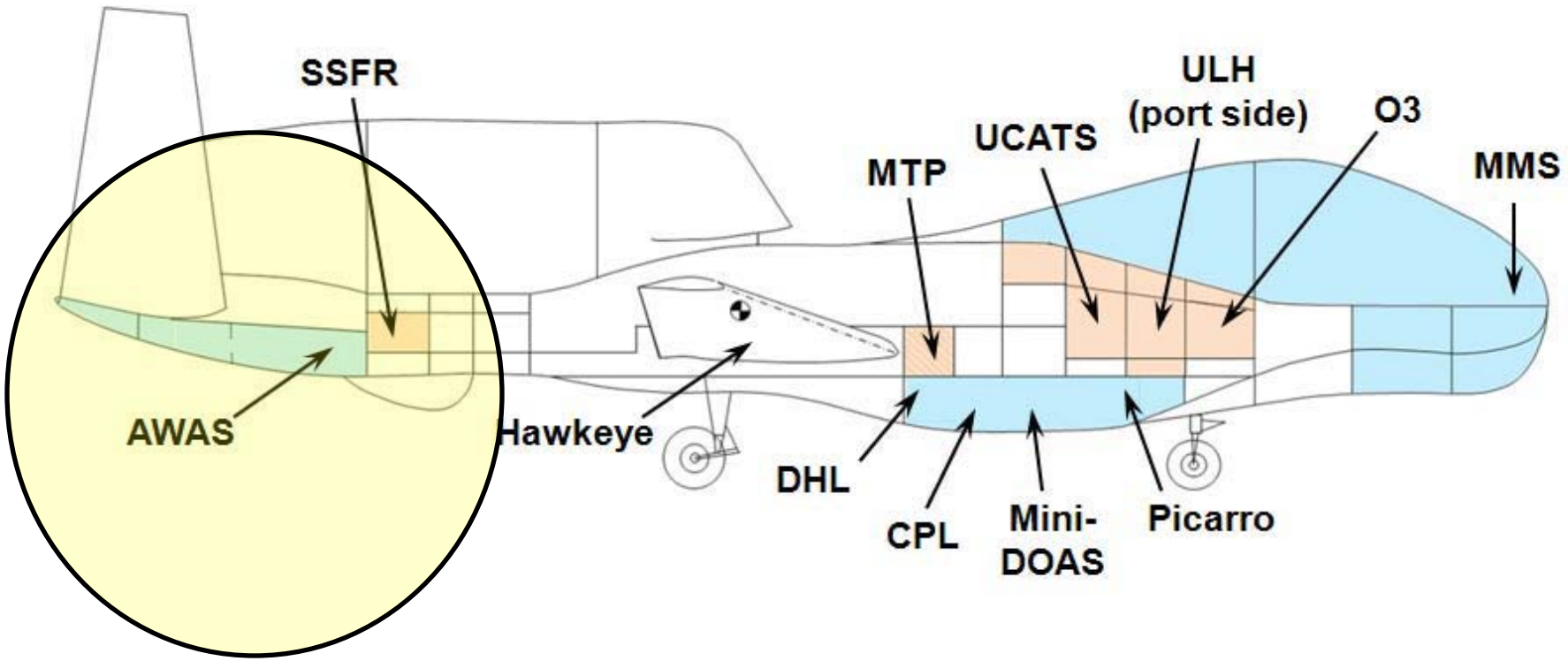
Many previous versions of the WAS

- ER-2
  - Nose, superpod, belly tank (14 – 49 samples)
- WB-57
  - 0.5 pallet (40 – 50 samples)
- NSF GV
  - 1 rack (60 samples)
  - (modified for P3: 72 samples)

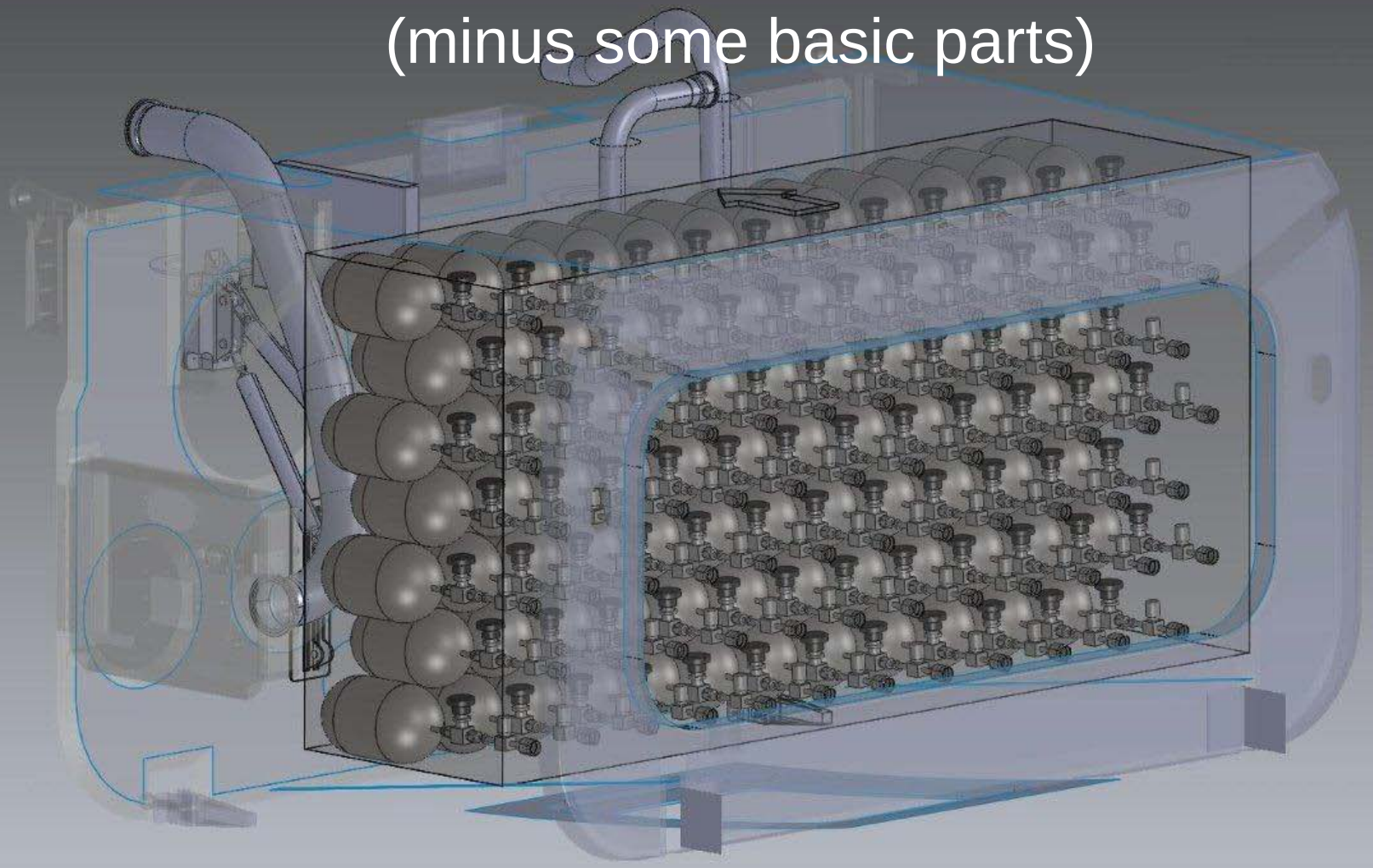
WB-57 Whole Air Sampler

WAS installation in NOAA P3 (wing pod)

WAS location in Global Hawk



WAS initial concept for GH (84 canisters) (minus some basic parts)



Current WAS status for GH

- Optimize canister configuration for Area 61 space/weight limitations
  - Expect between 80 – 100 canisters (1.3 liter)
  - Total weight: 200 – 225 lbs
  - Other components *(modification/duplication of existing):*
    - Computer control
    - 4 stage compressor(s)
    - Manifold/exhaust system
    - Inlet
  - Sample integration times: 30 – 150 sec (alt dependent)

Other considerations

- Sample strategy
  - Hope to sample most frequently along vertical profiles, less frequent in level legs
- Sample analysis
  - For remote sites (Guam/Darwin) plan to analyze samples on site. Need some lab space/power availability