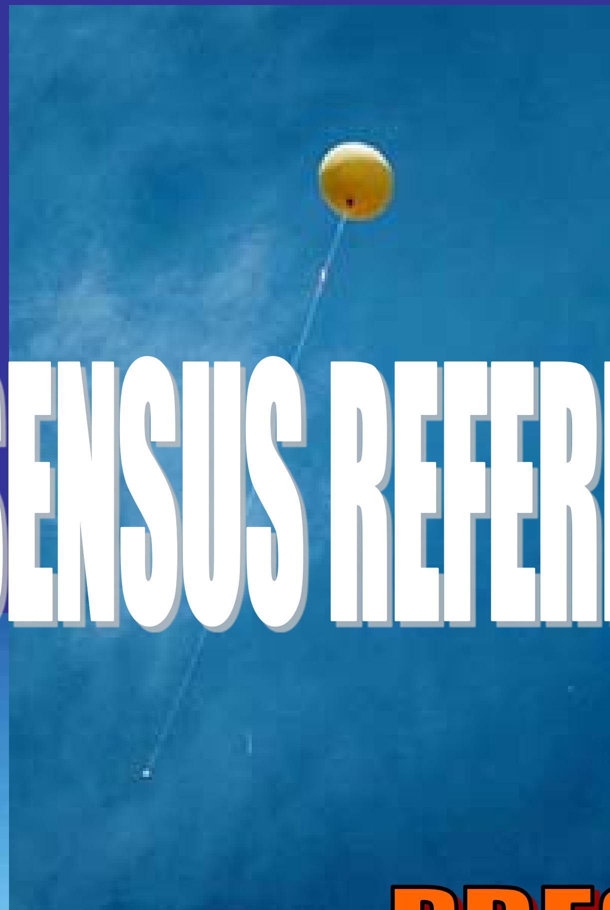
CONSENSUS REFERENCE CONCEPT



PRESENTED BY:
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NOAA/NWS

Definition

- *Consensus Reference Testing: A preponderance of evidence derived from a suite of technologies converging on a statistical and repeatable set of acceptable thresholds.*

- *Corollary: No one technology is viewed as absolute <u>truth</u> since all technologies have error characteristics; rather, each contributes some facet to a more <u>complete</u> understanding of the atmospheric variable or parameter under review.*

GENERAL CONCEPT

- Integrate both objective and subjective methods to evaluate radiosondes in a holistic manner
- Develop scientific methods for linking the various technologies with radiosondes,
  - Determine the error characteristics of each technology and then inter-compare
- Report the findings as “concensus” rather than as “absolutes” based on the deliberations of a select group of scientists

Consensus Reference Examples

Chamber Tests

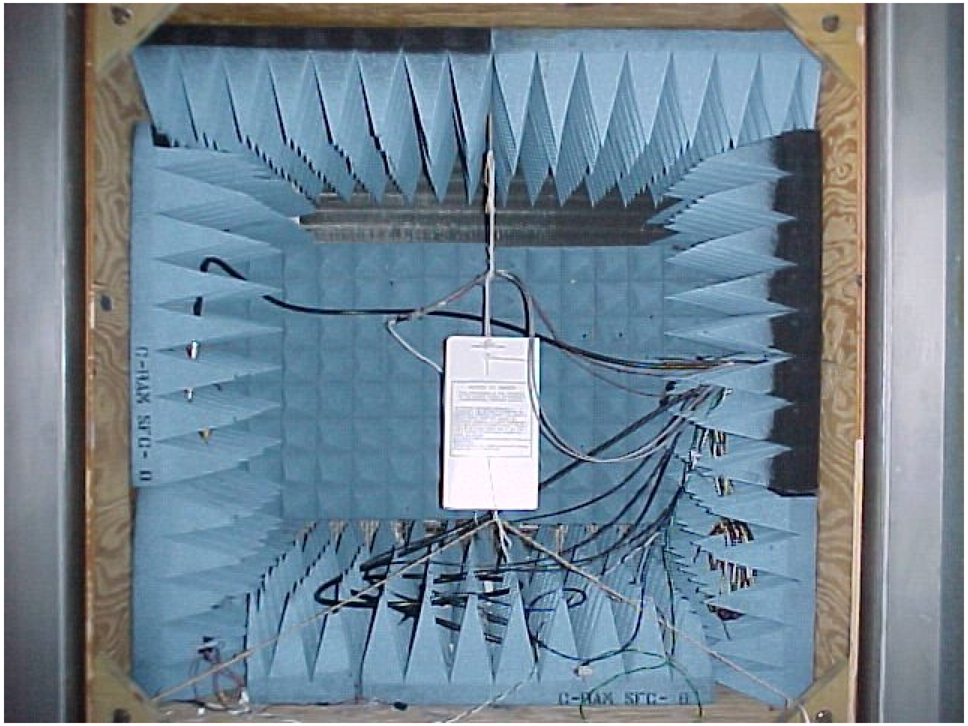




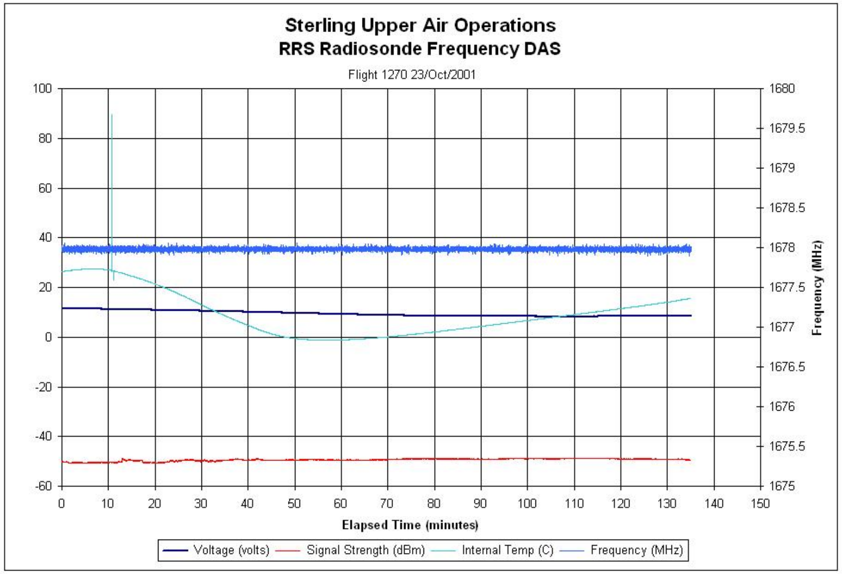
Flight Similitude Tests

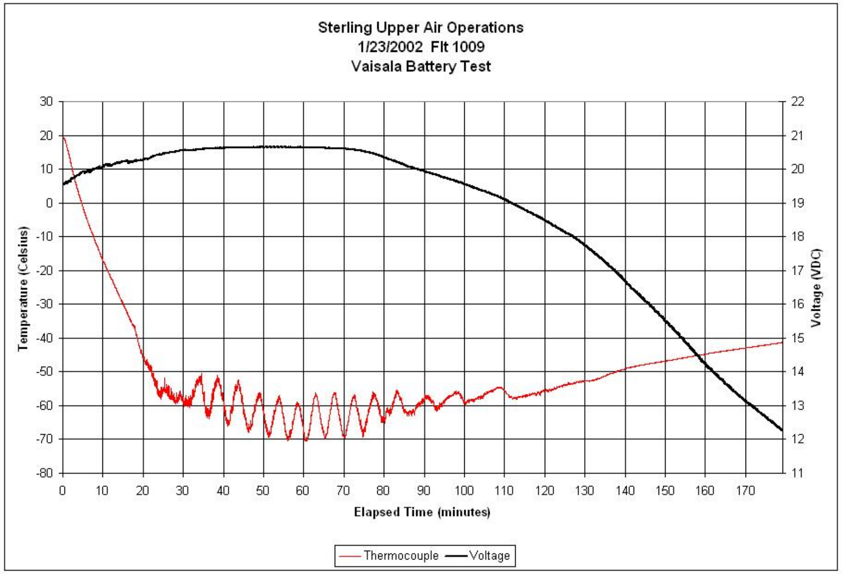
Why do we conduct Flight Similitude Tests:

- Enables NWS to evaluate radiosonde performance without expending a lot of resources
- Evaluate performance of meteorological sensors
- Evaluate performance of GPS measurements
- Characterize performance engineering parameters

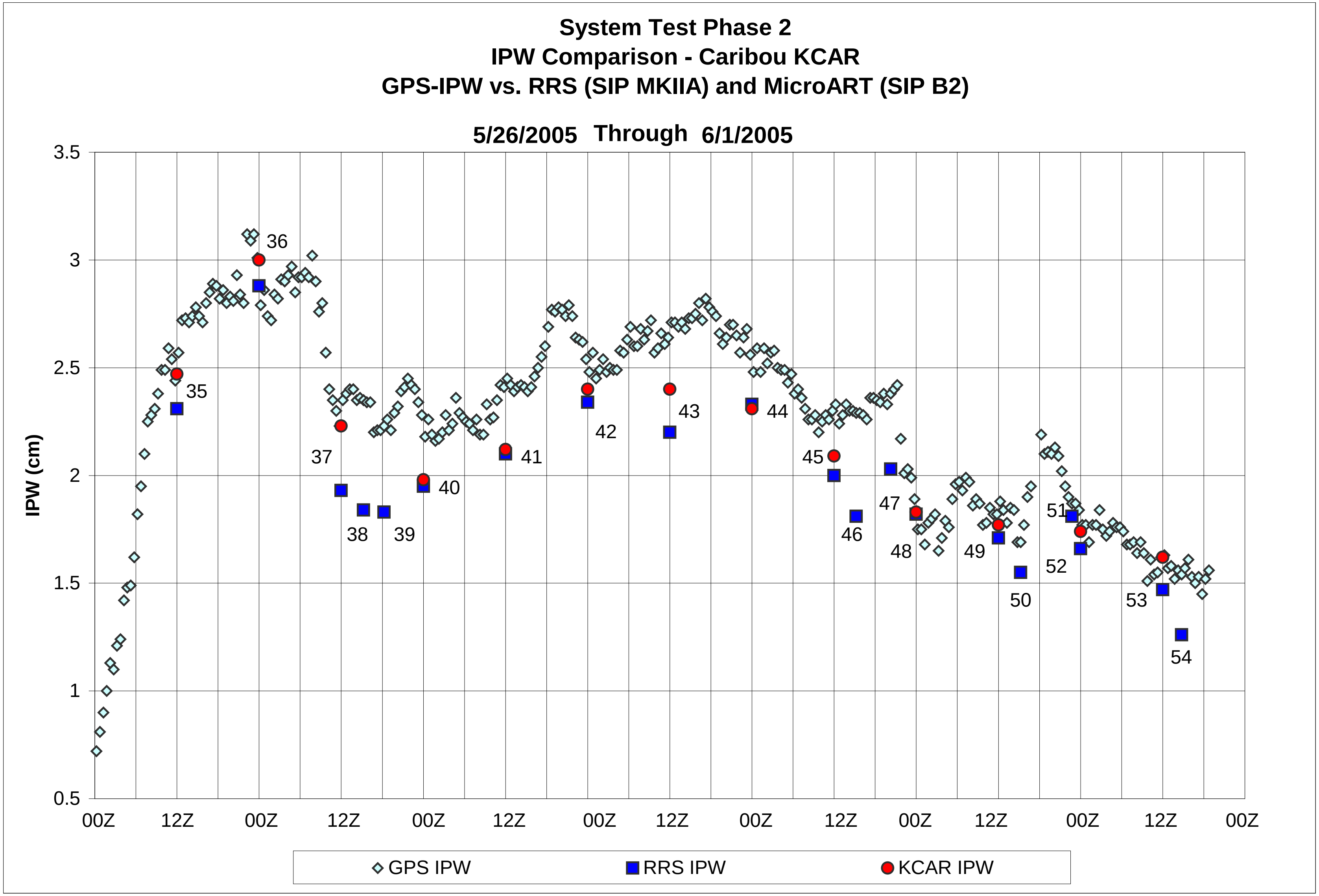


Sample Plots from Chamber Tests

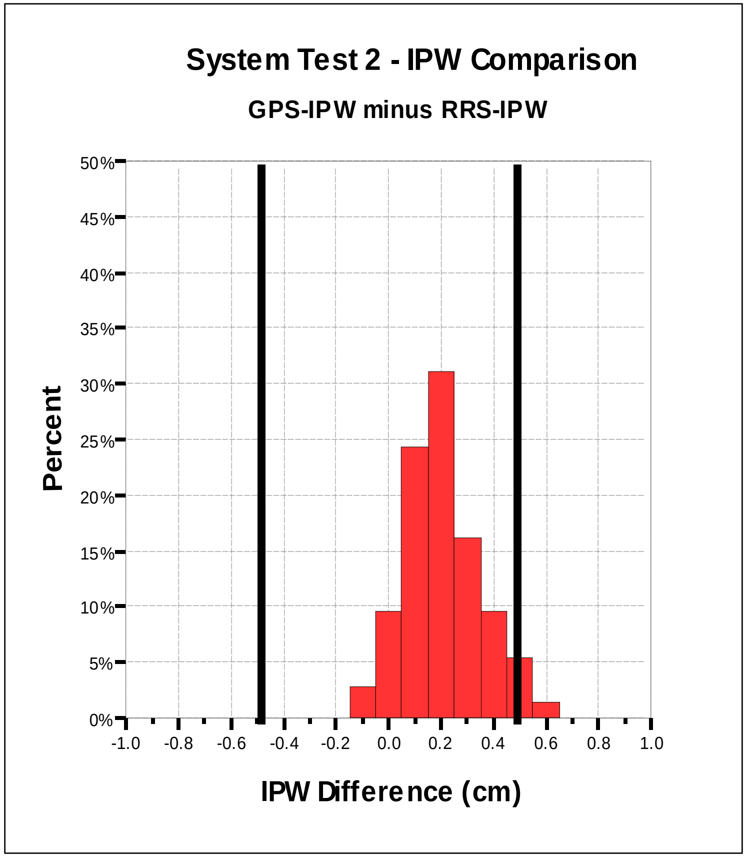


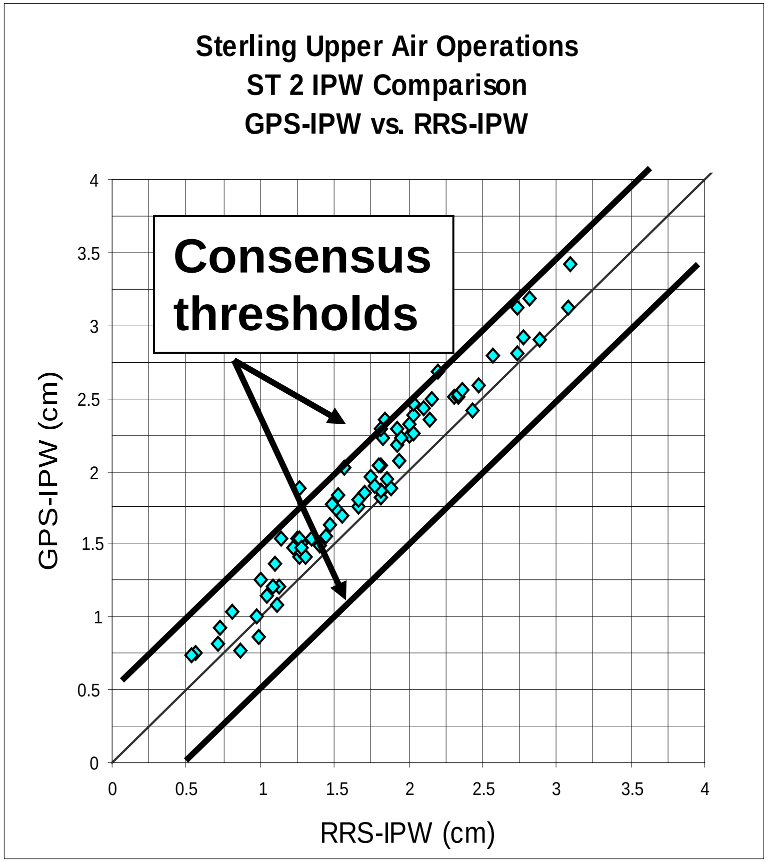


GPS IPW Comparison



Consensus View

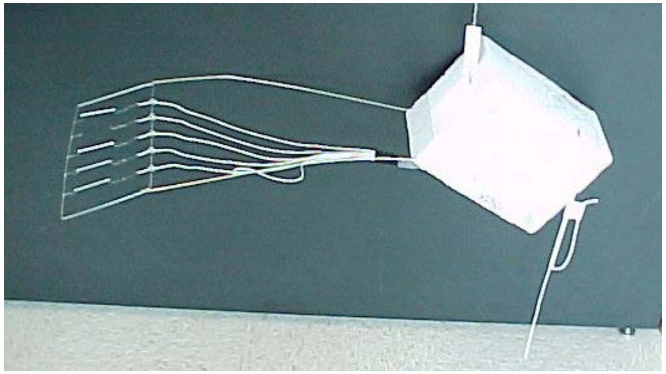


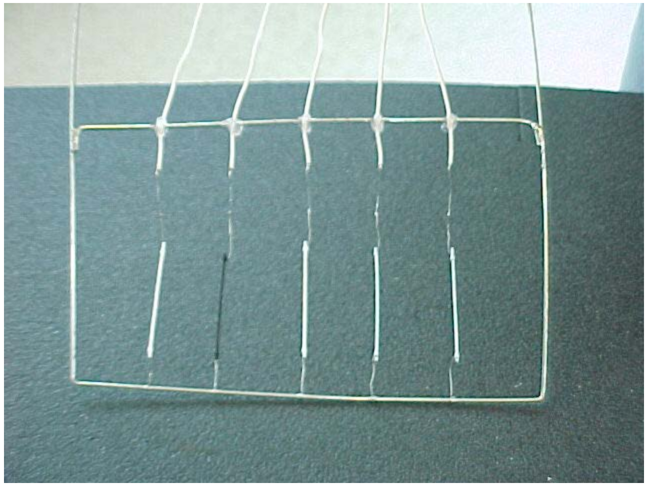


In this context, consensus is achieved when most of the measurements fall within a statistically-defined threshold and its bias characteristics are delineated, e.g., 98% fall within 0.5 cm and has an RMSD of 0.2 cm. A set of regression values can also be determined from the base of data collected.

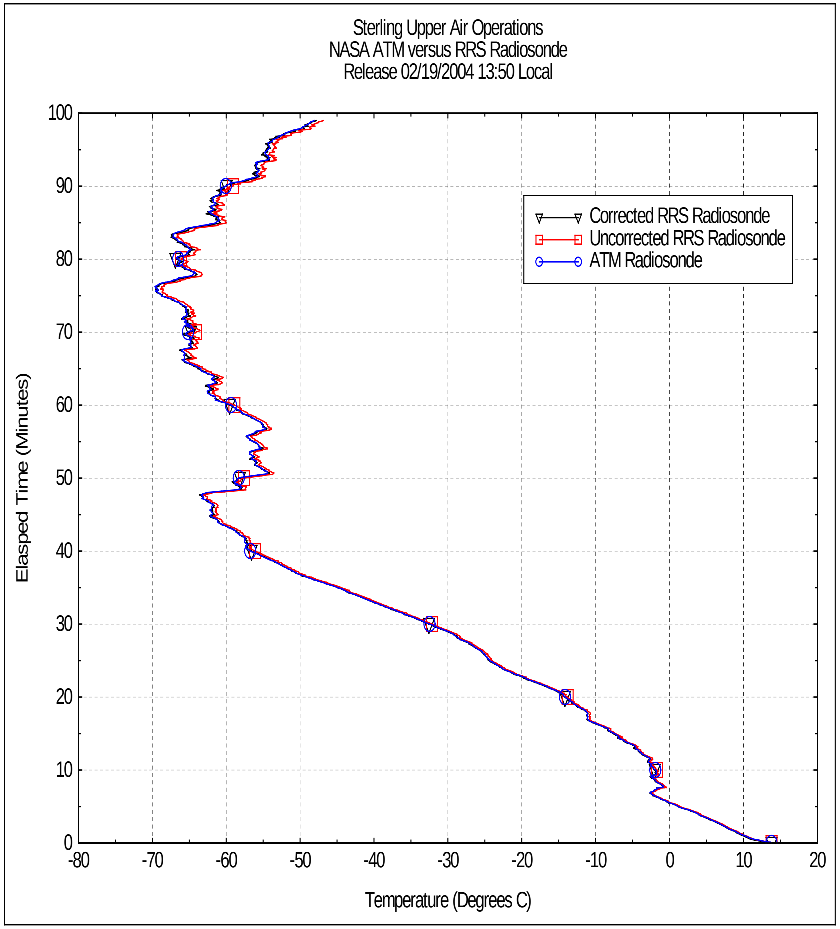
Comparison with Temperature Reference

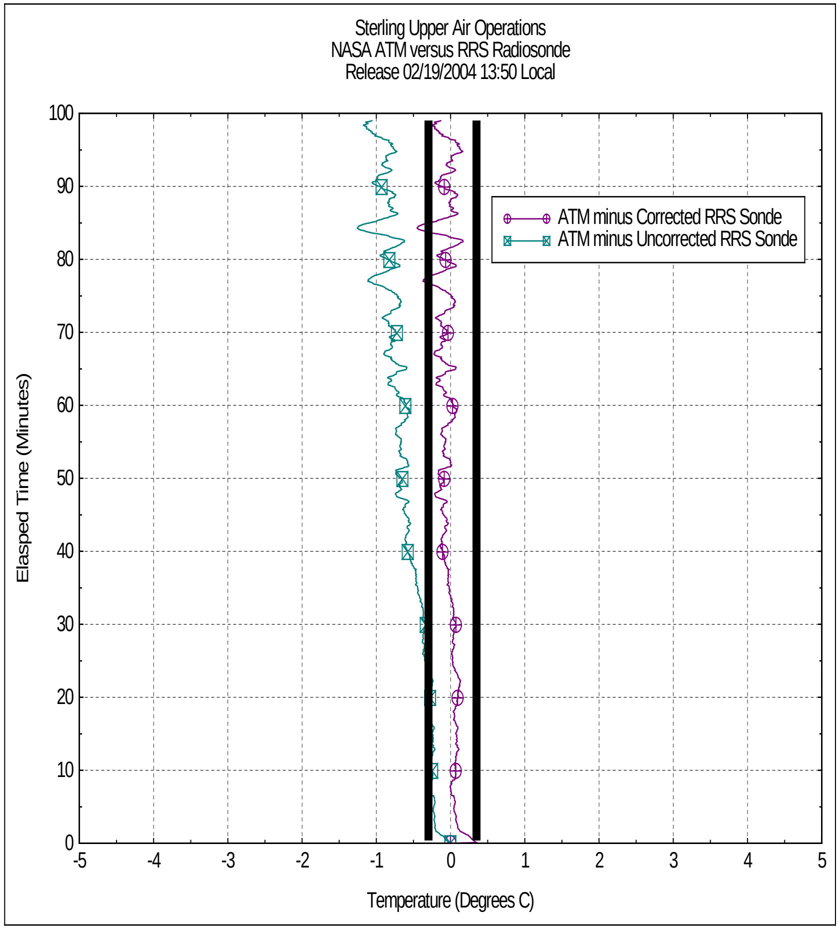
- Cooperative effort with NASA
  - Multi-Thermistor Radiosonde
    - A modified Sippican Mark II Loran
    - ATM 5 is a standard for upper air temperature measurements
    - Uses a minimum of three temperature sensors.
      - White
      - Aluminum
      - Black
    - Used for evaluating radiosonde solar radiation correction
    - Tracked by a modified Sippican W9000 Loran ground station



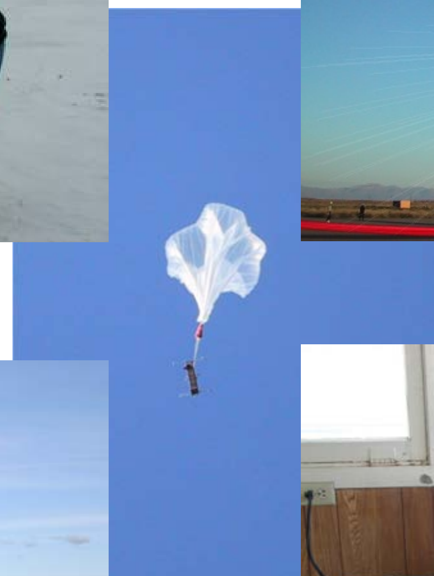


How NASA/ATM is Used to Evaluate Radiosonde Data

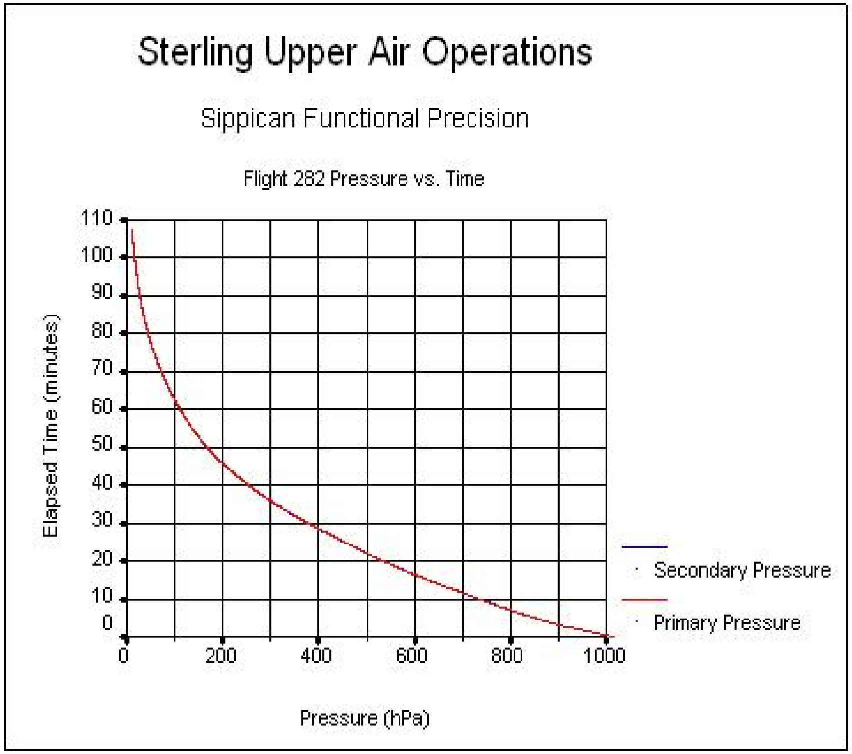


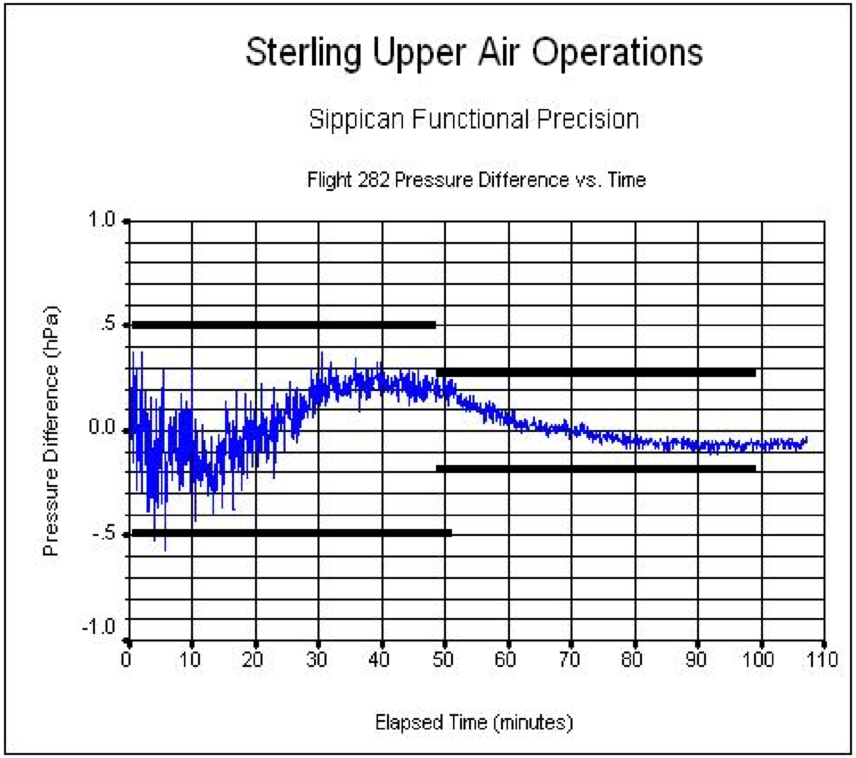


Field Tests

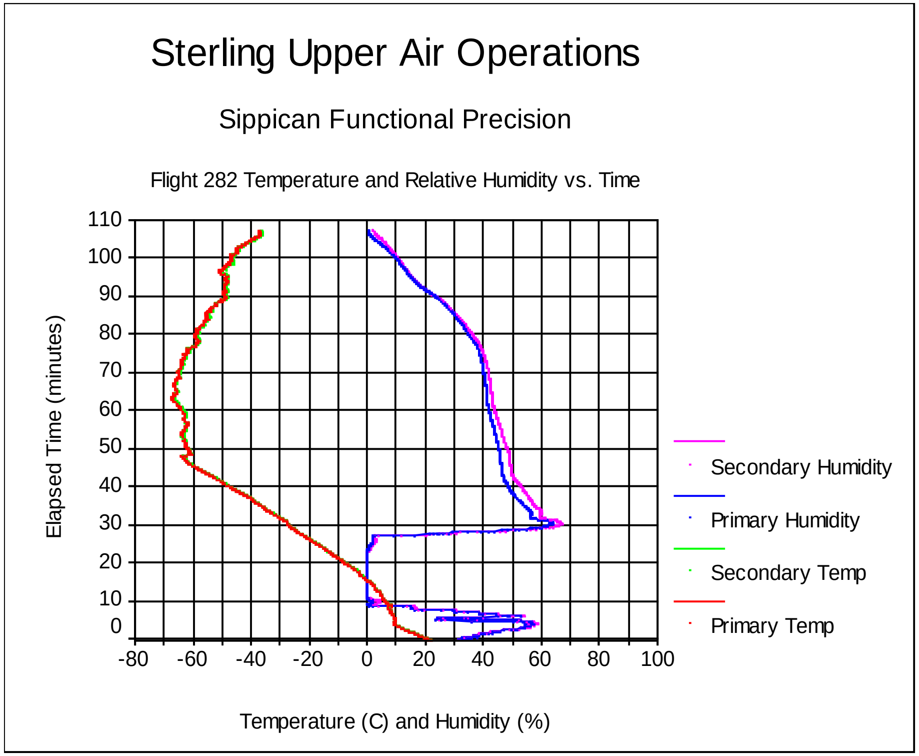


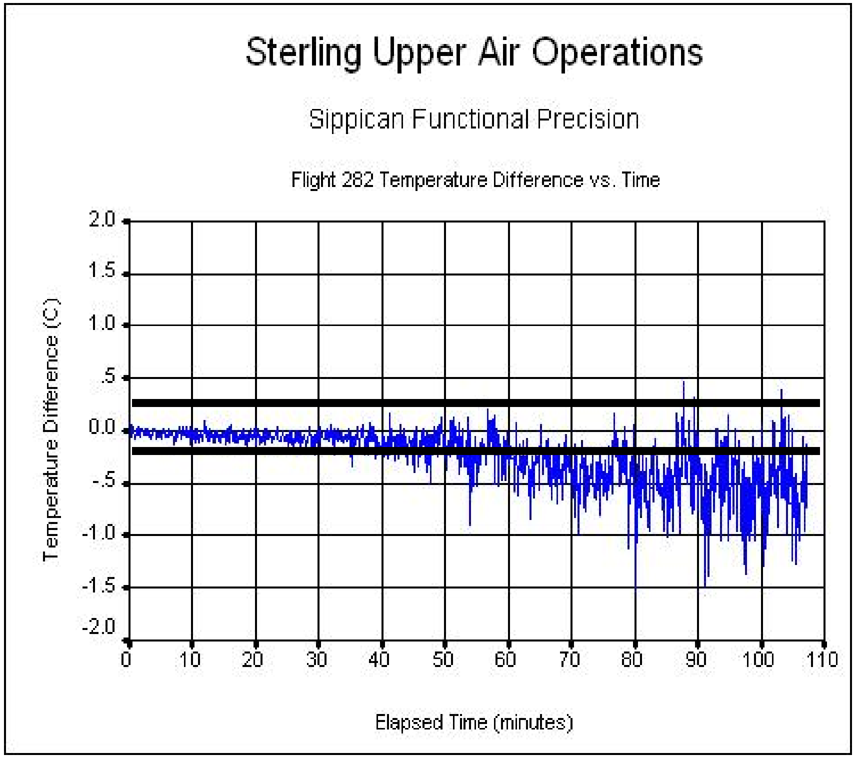
Functional Precision
Pressure



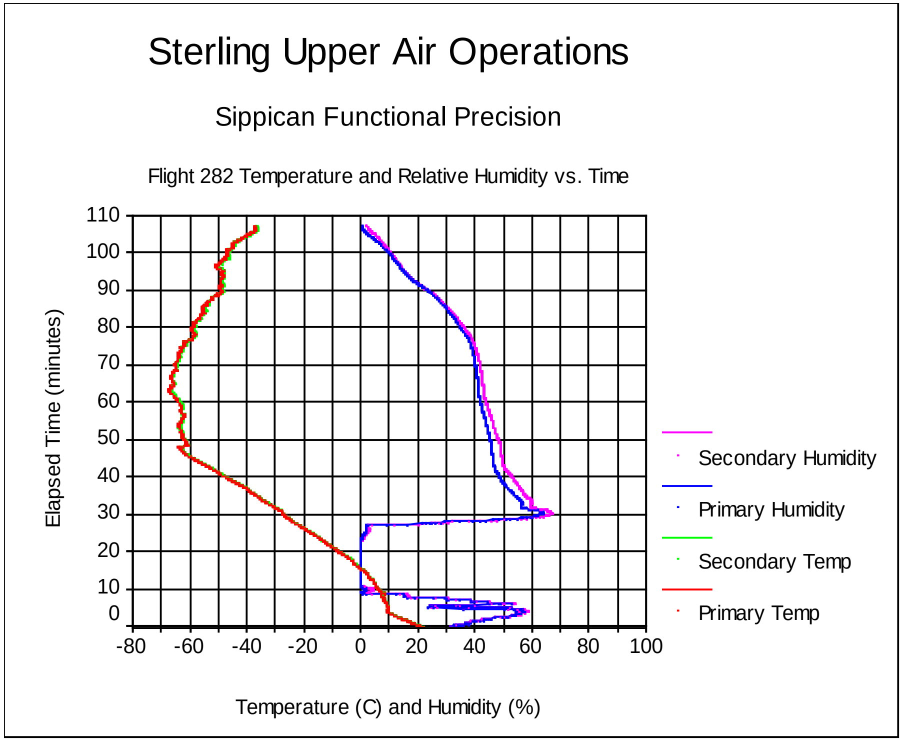


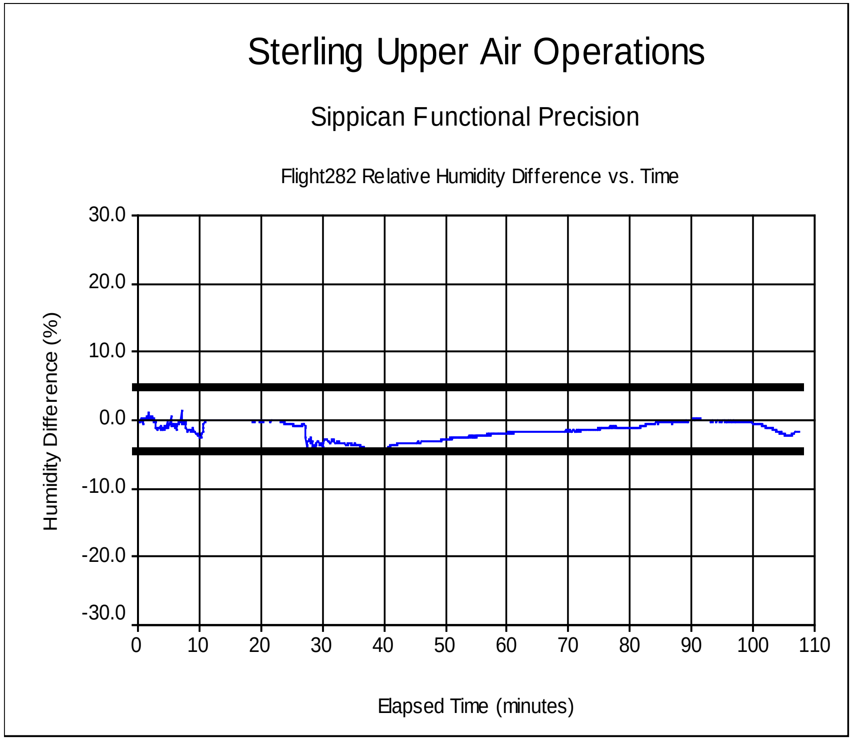
Functional Precision Temperature



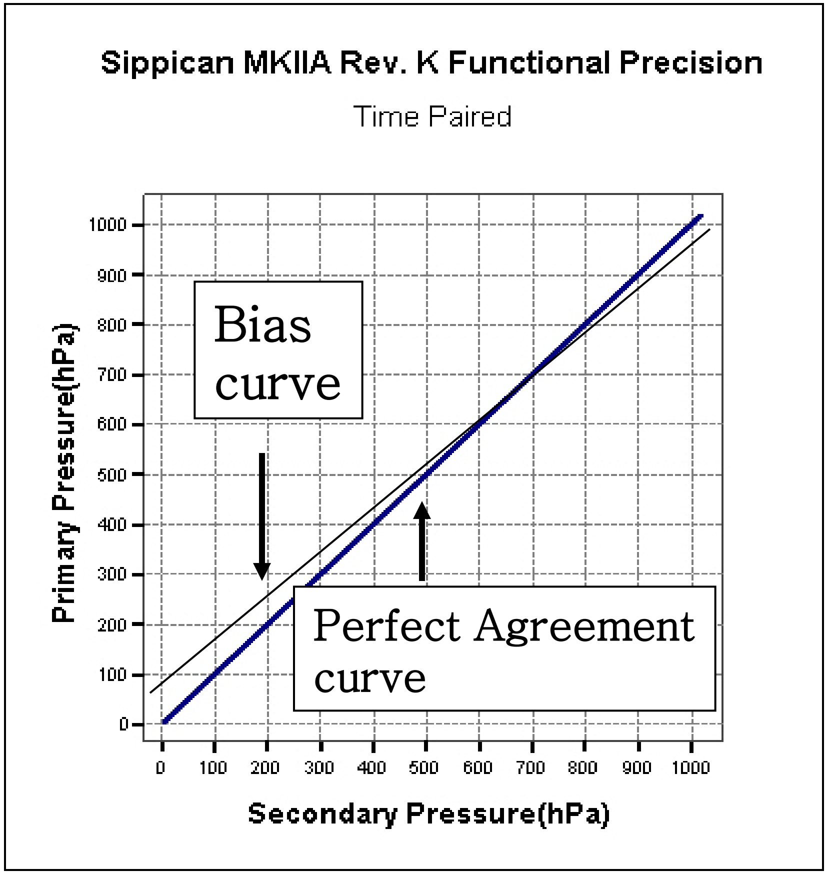


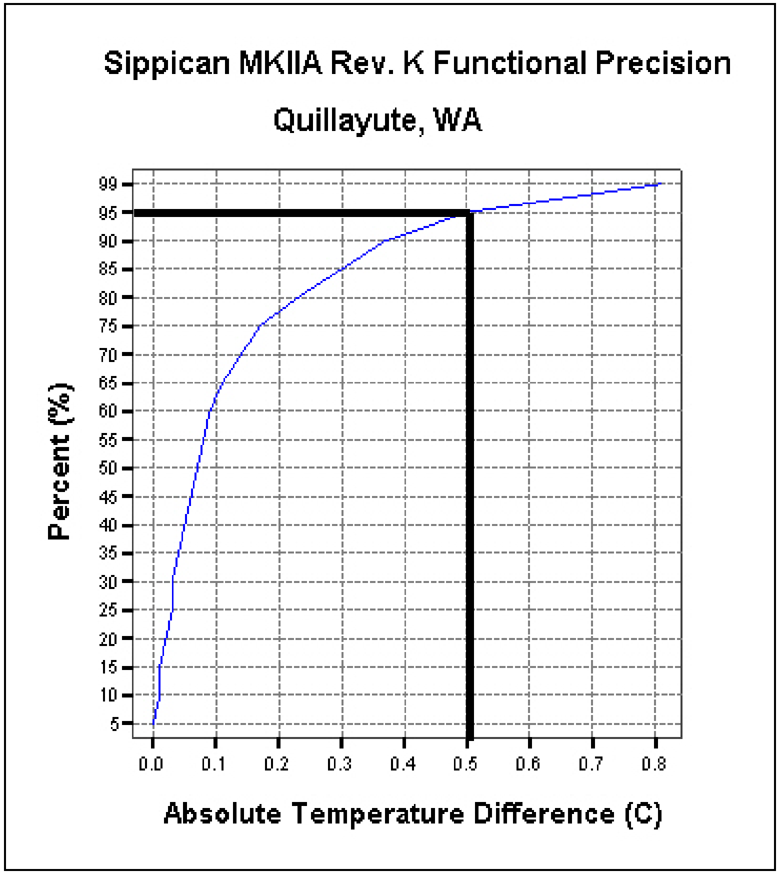
Functional Precision Relative Humidity





Grouped Flights

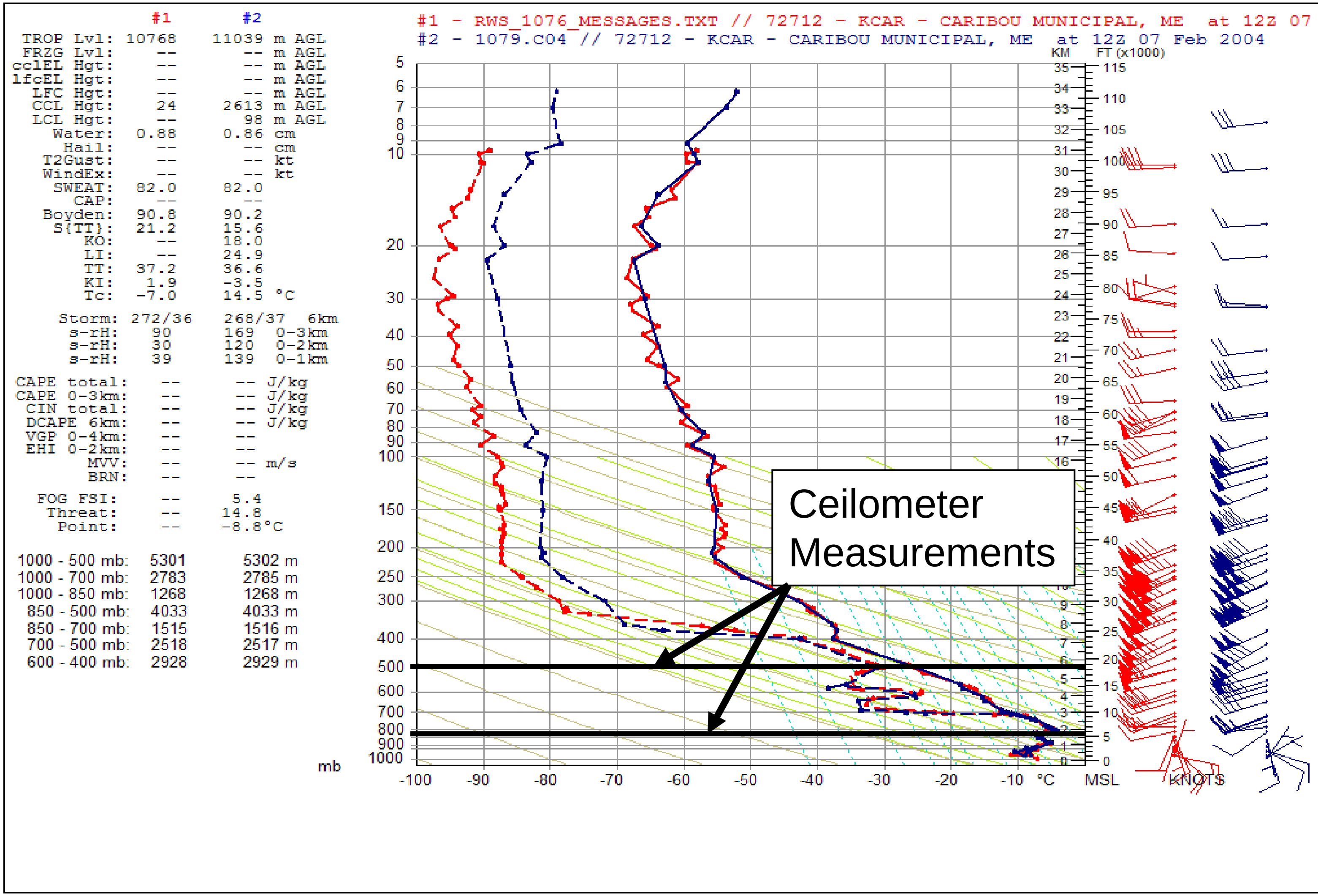




Grouped Statistics

Time Paired Humidity Difference Statistics					
Intervals (hPa)	N Sample	Min	Max	Mean	RMSD
19.9 to 0	8773	-4	6.4	0.36	2.21
49.9 to 20	10569	-8.6	9.4	1.42	3.85
99.9 to 50	8541	-12.4	7.6	1.18	5.28
199.9 to 100	8747	-13.9	6.7	0.68	3.99
299.9 to 200	4675	-5	7.9	0.69	2.86
499.9 to 300	6537	-10.9	9.3	0.51	3.39
849.9 to 500	7934	-14.5	12.6	-0.03	4.07
1070 to 850	3018	-5.9	4.8	0.25	1.42
ALL	58794	-14.5	12.6	0.70	3.75
400 to 4	44881	-13.9	9.4	0.87	3.83
SFC to 400	13913	-14.5	12.6	0.17	3.51

Radiosonde vs. Ceilometer Cloud Bases



HUAO

Methodology

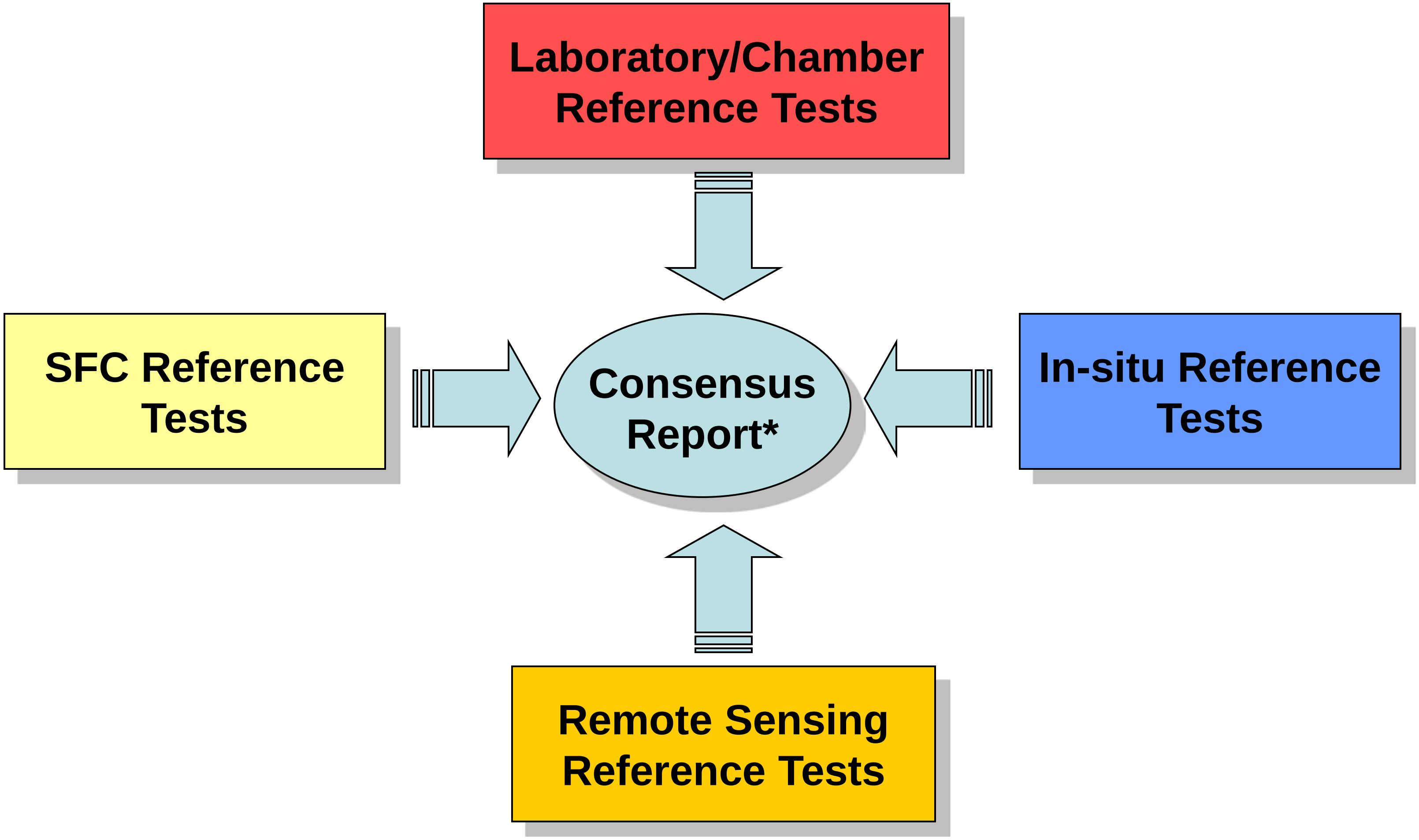
Convergence Cycle

DEVELOP/MODIFY REFERENCE TEST
PROCEDURES & STANDARDS

DEVELOP
CONSENSUS
WITHIN
CLIMATE
COMMUNITY
ON RESULTS

CONDUCT
CONSENSUS
REFERENCE
TESTS

General Approach



*Consensus report contains a compilation of statistics/graphs illustrating the degree of consensus found.

Resources

- NOAA, NASA, NCAR, and Howard University could have these technologies available for this application
  - HU may also provide scientific support as well as NCAR
- Financial resources to upgrade equipment, conduct further research or staff tests would be needed
- Resources to prepare plans, test reports, etc. would also be needed
- Scientists would constitute the Consensus Reference Review Board responsible for steering the tests and approving the final consensus report
  - Report depicts the degree of consensus
  - Would be used to determine Climate-quality instrumentation

Workshop Consideration

- Obtain agreement on approach for GCOS & establish CRRB
- Define specific tests under each Consensus Reference Test area
- Define consensus thresholds, i.e., statistical thresholds for each test
- Further define the meteorological/climatic conditions
- Develop plan and test specification/process

BACK UP SLIDES

Chamber Layout

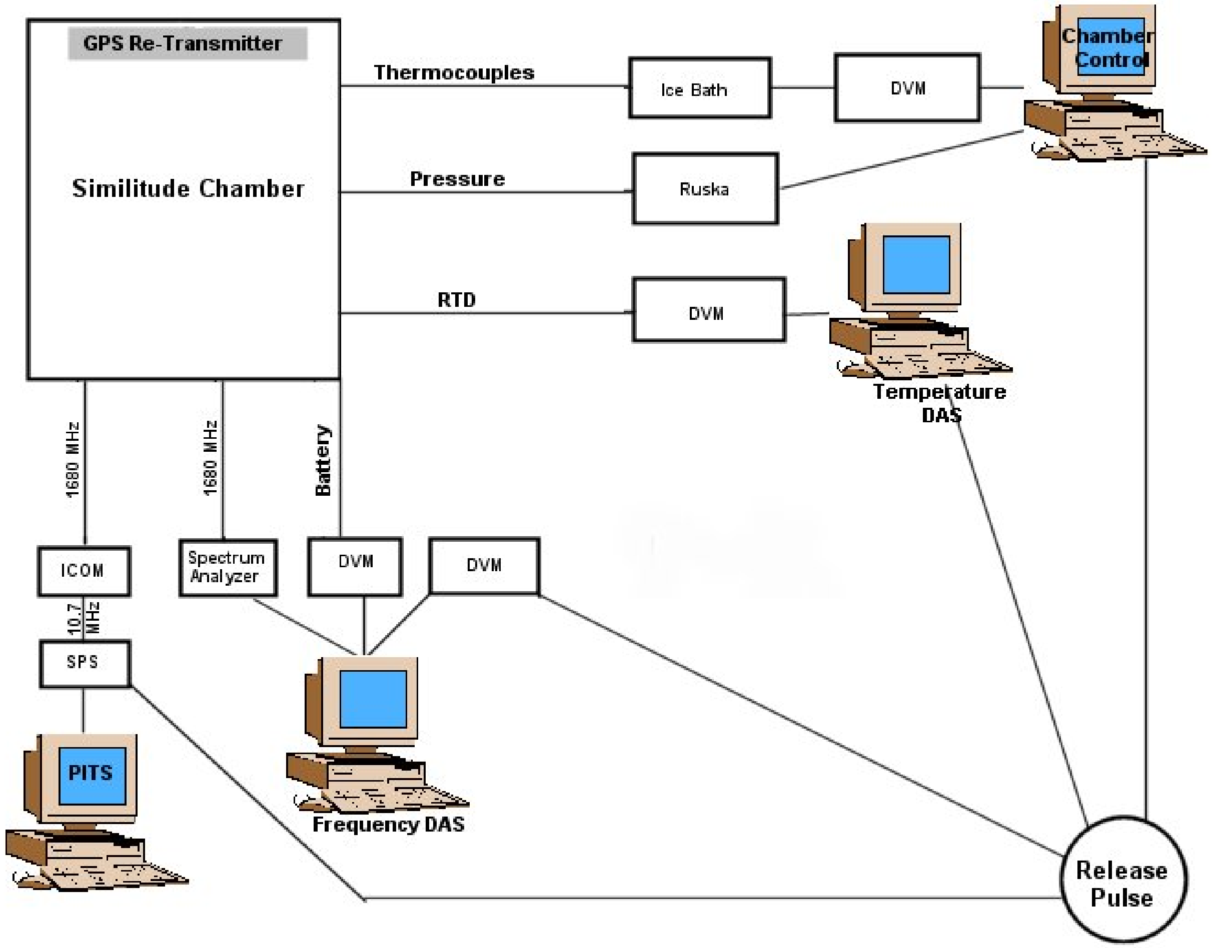
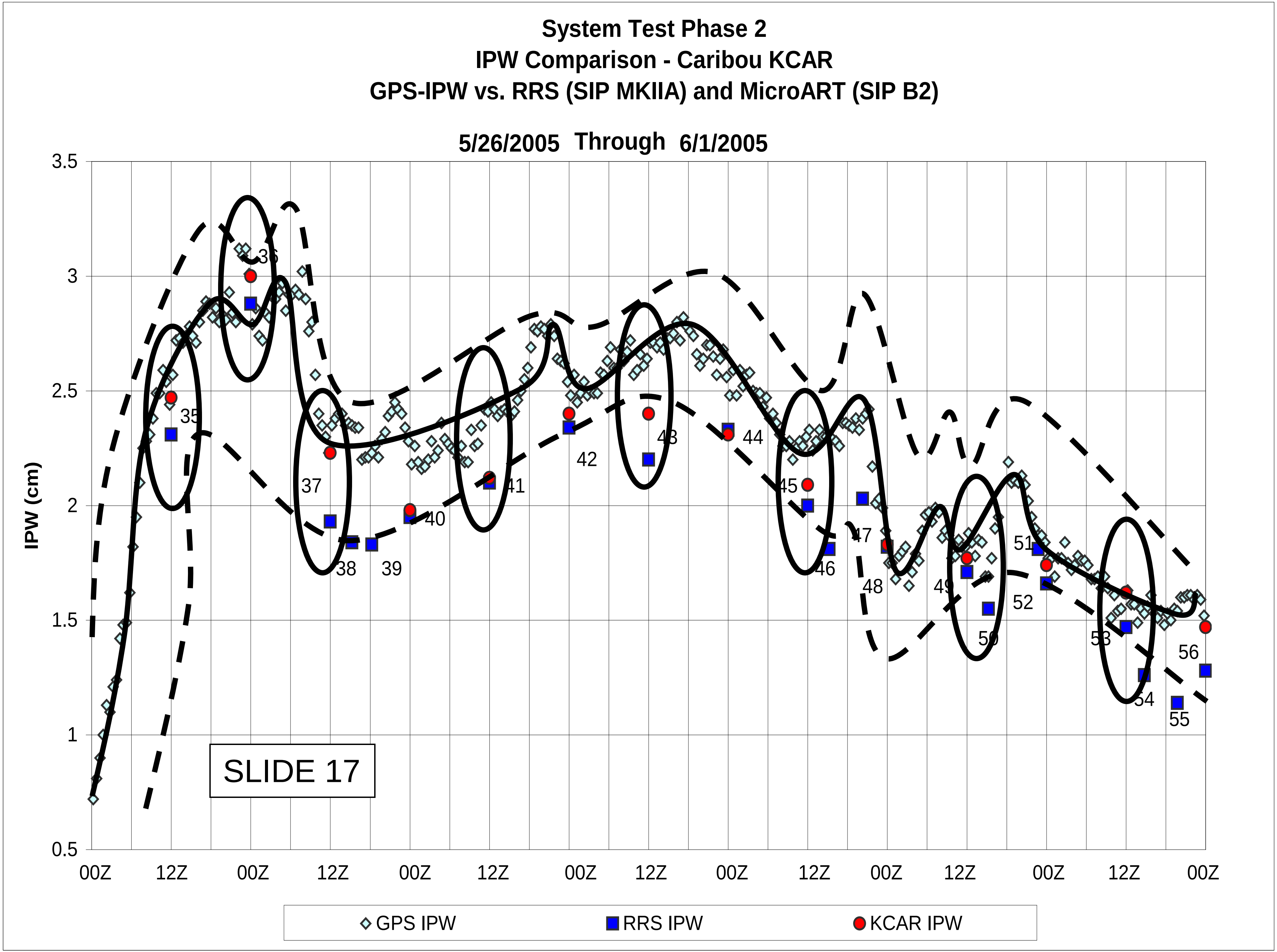
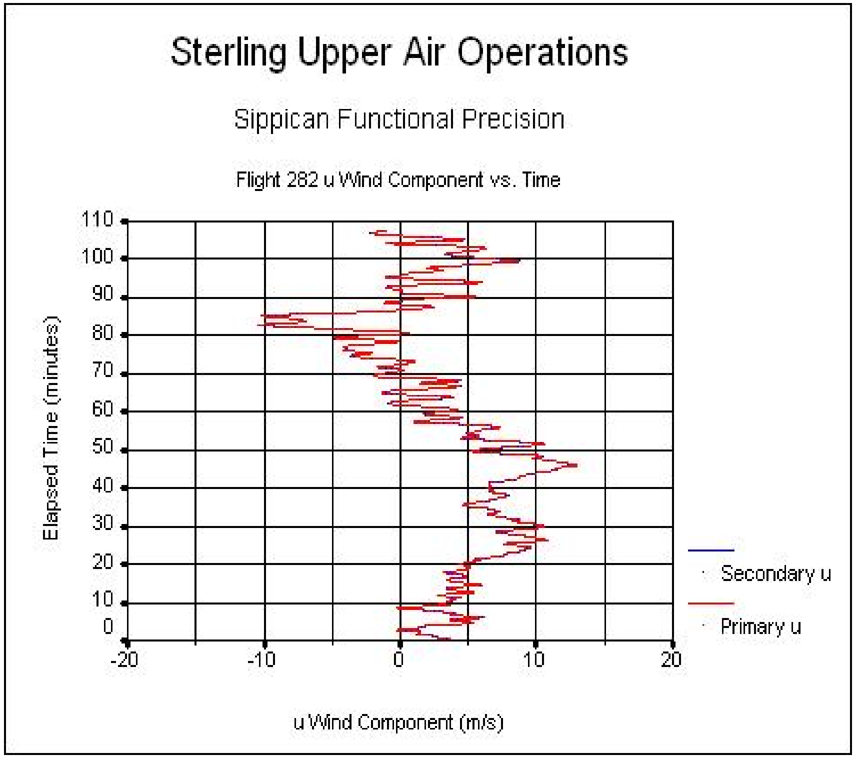
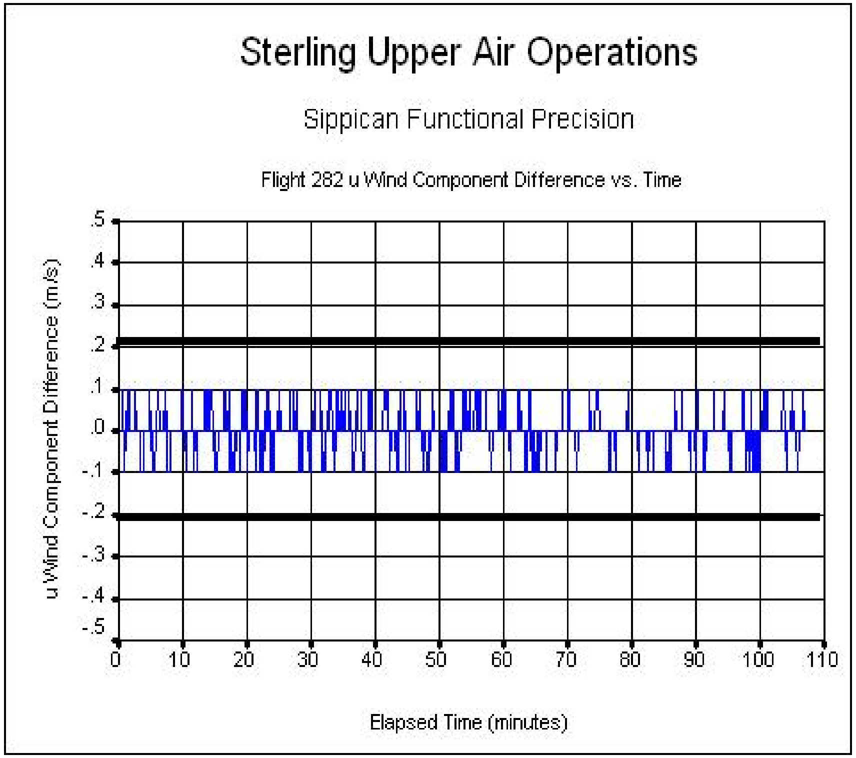


Figure 1: Similitude Chamber Setup

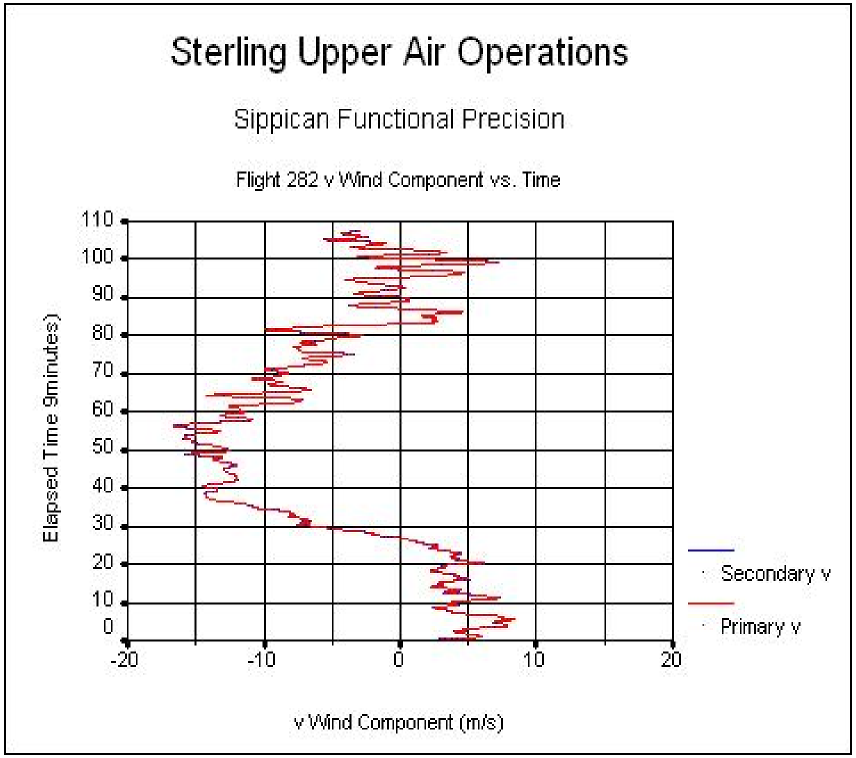

System Test Phase 2
IPW Comparison - Caribou KCAR
GPS-IPW vs. RRS (SIP MKIIA) and MicroART (SIP B2)
5/26/2005 Through 6/1/2005
IPW (cm)
3.5
3
2.5
2
1.5
1
0.5
00Z
12Z
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
SLIDE 17
GPS IPW
RRS IPW
KCAR IPW

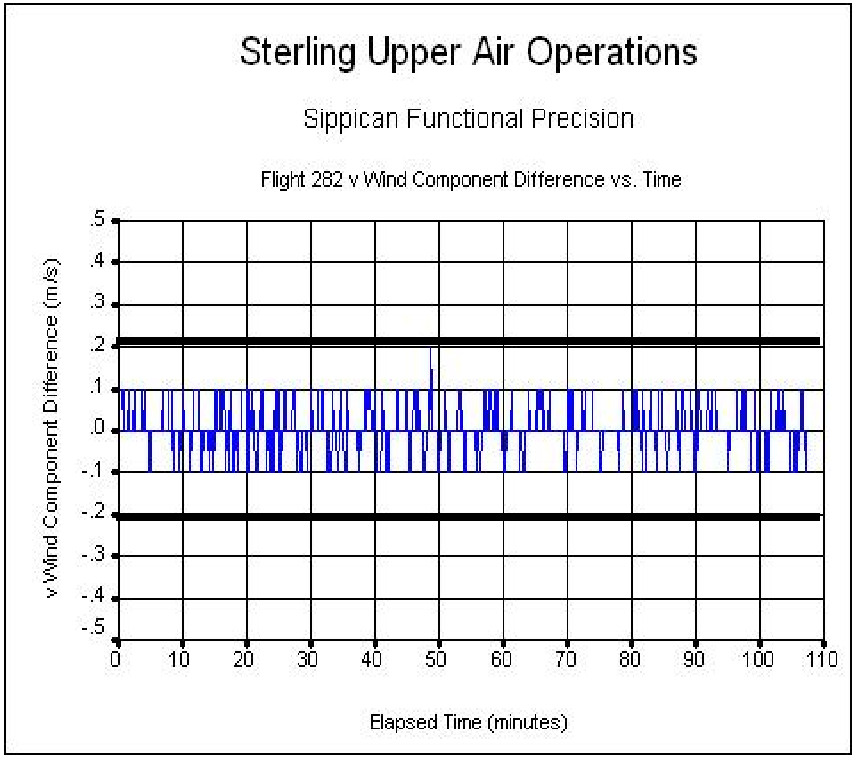
Functional Precision
u Wind Component



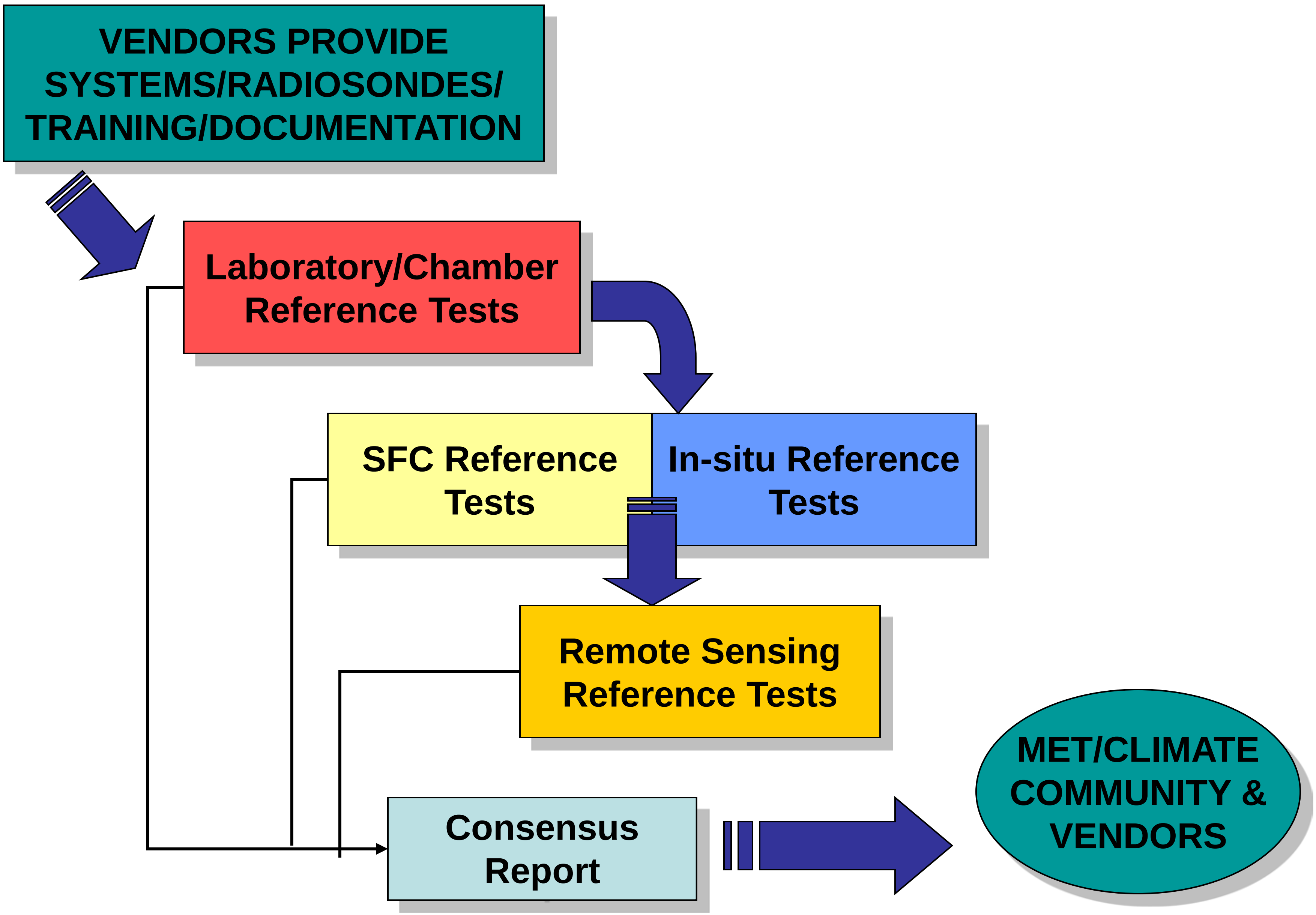


Functional Precision
v Wind Component





Test Process



Candidate Reference Systems

- Surface/Chamber:
  - ASOS
  - Precision Digital barometer
  - Launch point: temperature/relative humidity/wind
  - Net radiometer
  - Laboratory/Chamber
- Sfc Met Characteristics:
  - Temperature, relative humidity, pressure vs. height, wind accuracy
  - Sky condition
  - Clouds
  - Present Weather
  - Fluxes
  - Similitude

Candidate Reference Systems

- In-situ:
  - NASA/ATM
  - Same Sonde for Functional Precision
  - Snow White
  - Laser Diode Water Vapor Sensor
  - Independent GPS

- U/A Met Characteristics:
  - Temperature accuracy
  - Long/short wave Radiation
  - Relative humidity/water vapor accuracy
  - Functional precision inter-comparisons
  - Pressure/height calculations & corrections

Candidate Reference Systems

- Remote sensing:
  - GPS-IPW
  - RAMAN LIDAR
  - Wind Profiler
  - Radiometers

- U/A Met Characteristics:
  - Water Vapor inter-comparisons
  - Wind Inter-comparisons
  - Cirrus Cloud bases

Meteorological/Climatic Conditions

METEOROLOGICAL*

- Types of Conditions:
  - Mid-latitudes (ML)
  - Tropical (T)
  - Arctic (A)
  - Marine (MA)
  - Desert/Very Dry (D)

*Includes all types of weather events.

CLIMATIC

- Types of Conditions:
  - Day/Night Radiation
  - Planetary Boundary Layer (PBL)
  - Lower Troposphere RH Tropopause Upper Tropospheric humidity Stratospheric temperature/humidity