ANALYSIS OF TIMS PERFORMANCE SUBJECTED TO SIMULATED WIND BLAST.

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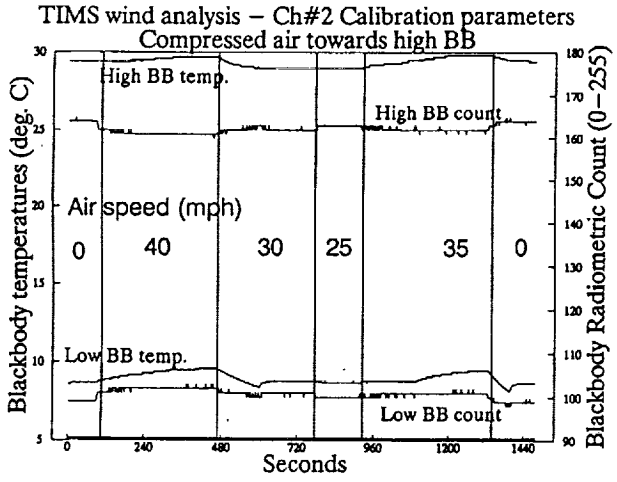
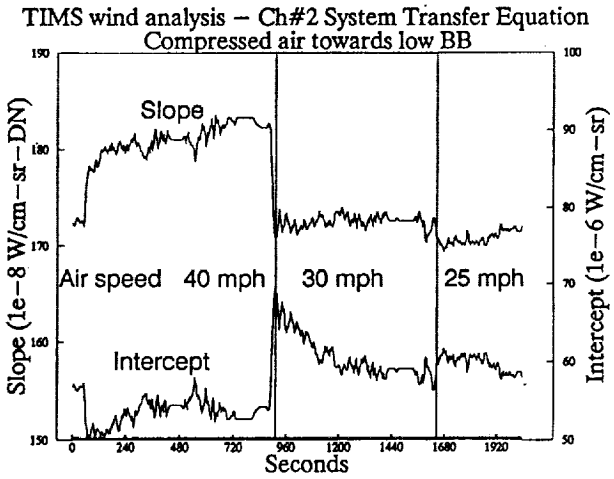
Summary

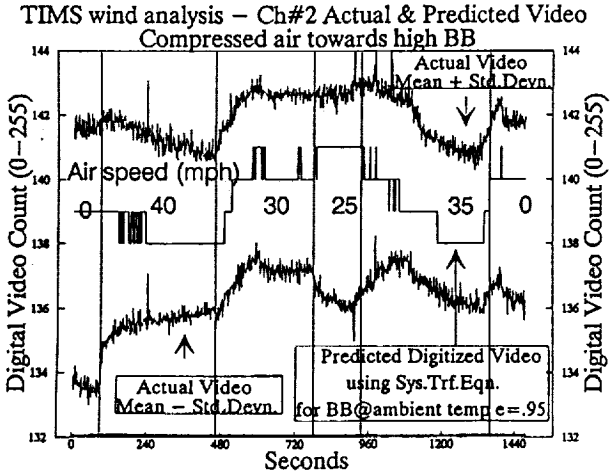
This report describes the results of the performance of the TIMS when it is subjected to various wind conditions in the laboratory. Various wind conditions were simulated using a 24" fan or combinations of air jet streams blowing toward either or both of the blackbody surfaces. The fan was used to simulate a large volume of air flow at moderate speeds (up to 30 mph). The small diameter air jets were used to probe TIMS system response in reaction to localized wind perturbations. The maximum nozzle speed of the air jet was 60 mph. A range of wind directions and speeds were set up in the laboratory during the test. The majority of the wind tests were conducted under ambient conditions with the room temperature fluctuating no more than 2 °C. The temperature of the high speed air jet was determined to be within 1 °C of the room temperature. TIMS response was recorded on analog tape. Additional thermistor readouts of the blackbody temperatures and thermocouple readout of the ambient temperature were recorded manually to be compared with the housekeeping data recorded on the tape. Additional tests were conducted under conditions of elevated and cooled room temperatures. The room temperature was varied between 19.5 to 25.5 °C in these tests.

The calibration parameters needed for quantitative analysis of TIMS data were first plotted on a scanline-by-scanline basis. These parameters are the low and high blackbody temperature readings as recorded by the TIMS and their corresponding digitized count values. Using these values, the system transfer equations were calculated. This equation allows us to compute the flux for any video count by computing the slope and intercept of the straight line that relates the flux to the digital count. The actual video of the target (the lab floor in this case) was then compared with a simulated target. This simulated target was assumed to be a blackbody at emissivity of °.95 and the temperature was assumed to be at ambient temperature as recorded by the TIMS for each scanline. Using the slope and the intercept the flux corresponding to this target was converted into digital counts. The counts were observed to have a strong correlation with the actual video as recorded by the TIMS.

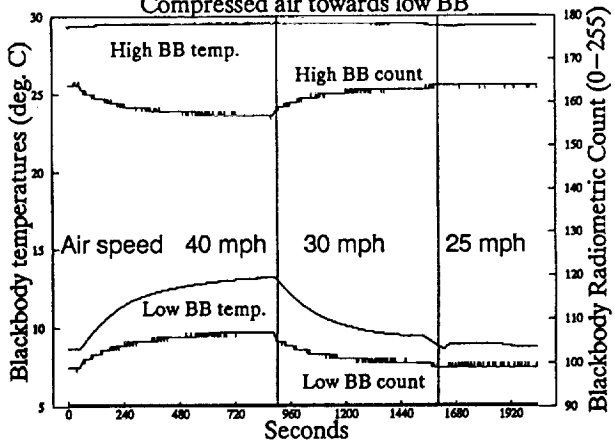
The attached graphs describe the performance of the TIMS when compressed air is blown at each one of the blackbodies at different speeds. The effect of blowing a fan and changing the room temperature is also being analyzed. Results indicate that the TIMS system responds to variation in wind speed in real time and maintains the capability to produce accurate temperatures on a scan line basis.


TIMS wind analysis – Ch#2 Calibration parameters
Compressed air towards high BB
High BB temp.
High BB count
Air speed (mph)
0
40
30
25
35
0
Low BB temp.
Low BB count
Blackbody temperatures (deg. C)
Blackbody Radiometric Count (0–255)
Seconds

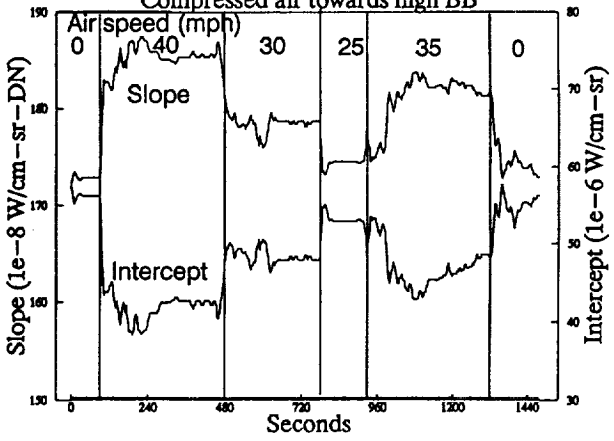

TIMS wind analysis – Ch#2 System Transfer Equation
Compressed air towards low BB
Slope
Air speed 40 mph
30 mph
25 mph
Intercept
Slope (1e–8 W/cm–sr–DN)
Intercept (1e–6 W/cm–sr)
Seconds


TIMS wind analysis – Ch#2 Actual & Predicted Video
Compressed air towards high BB
Actual Video
Mean + Std.Devn.
Air speed (mph)
0
40
30
25
35
0
Actual Video
Mean – Std.Devn.
Predicted Digitized Video
using Sys.Trf.Eqn.
for BB@ambient temp e=.95
Digital Video Count (0–255)
Seconds

TIMS wind analysis – Ch#2 Calibration parameters
Compressed air towards low BB



TIMS wind analysis – Ch#2 System Transfer Equation
Compressed air towards high BB



TIMS wind analysis – Ch#2 Actual & Predicted Video
Compressed air towards low BB