

Quarterly Report #3

Development of Hand-held Thermographic Inspection Technologies RI06-038

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End Date: February 28, 2009

Reporting period: August – November, 2007

Summary of Accomplishments and Activities

Work this quarter continued on Task 1, *Preliminary Study Development*. Several portions of this initial task have been completed. Efforts on Task 2, Controlled Testing of Concrete Test Specimen, are presently ongoing and results to date will be presented in this report

1. Development of Field Data Acquisition System (FDAS)

The development of a field data acquisition system (FDAS) has continued this quarter, though efforts in this area have been limited to finalizing the web resource for weather reporting, making final selections of hardware and enclosures for the device, and finalizing design. Based on previous discussions in quarterly teleconferences, a single prototype FDAS is being manufactured. This system will provide an evaluation platform for study participants to explore the utility of this device. This prototype can be easily replicated, and may even be improved through some field experience. The final cost of the FDAS is approximately \$1500 when utilizing a cellular modem for communications.

Figure 1 shows the FDAS in near-final configuration. An aluminum base plate on shock absorbing mounts is used to mount hardware within a pelican case. The tablet PC and power supply, a USB bus and cellular modem are mounted to the plate as shown. The camera will also be mounted in the case, but the cameras have not yet arrived. A power strip providing 12 volt power from a vehicle lighter outlet is mounted beneath the plate, hidden from view in figure 1. The power strip will provide the necessary power for operating the tablet PC and charging the infrared camera in the field.

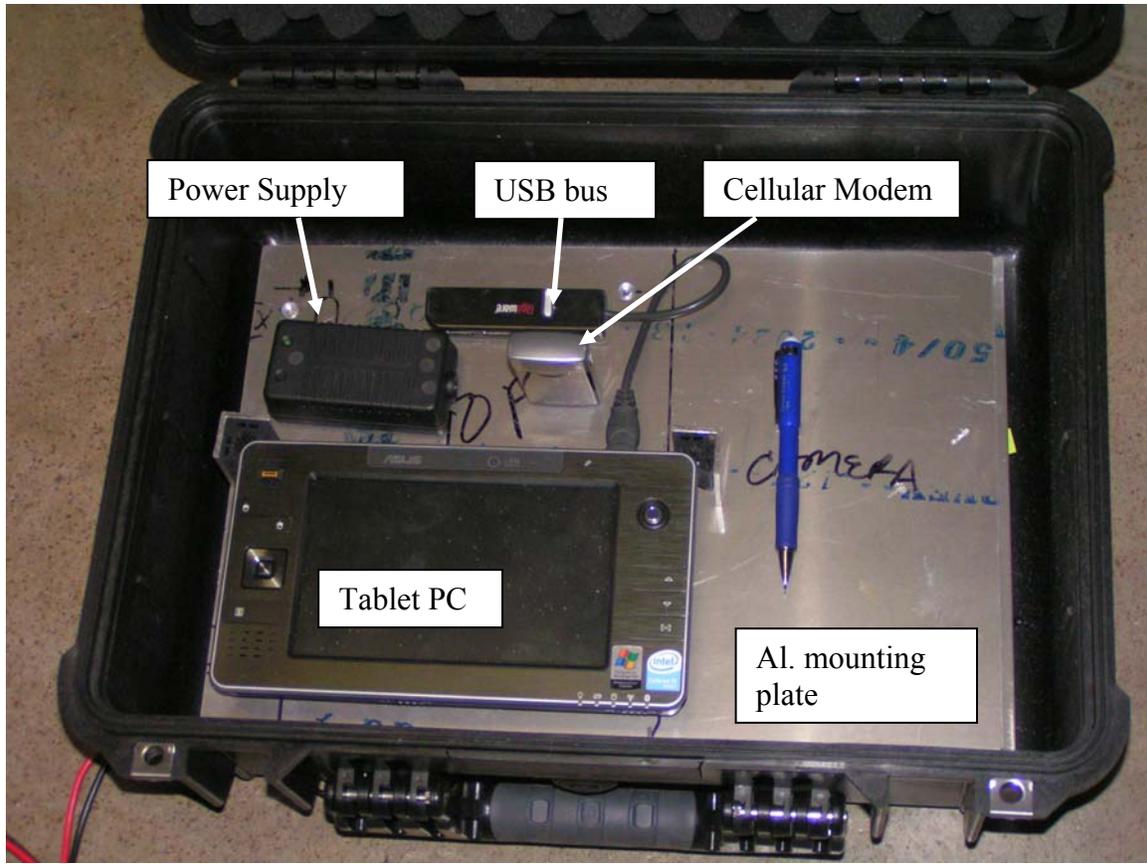


Figure 1. Photograph of the prototype FDAS showing the tablet PC, USB bus, power supply and cellular modem.

2. Test Block

The construction of the test block is complete, and testing is ongoing. Methods for handling the significant amount of data that is being generated are being developed. The interpretation and understanding of the data being produced is in its early stages, but it appears that the test block will provide a wealth of information about the environmental conditions required for effective IR inspections.

Some example data from the test block is shown in the following figures. The data that is being examined at this time includes the solar radiation, the wind speed, ambient temperature, relative humidity, and the temperature readings from the thermal couples embedded in the concrete block. The infrared camera mounted in the test house collects an image every 10 minutes, 24 hours a day.

Data is processed offline. Specific data being examined presently includes the temperature differentials that appear in an infrared image and from a pixel located directly above an embedded target and a pixel located in the acreage of the test block.

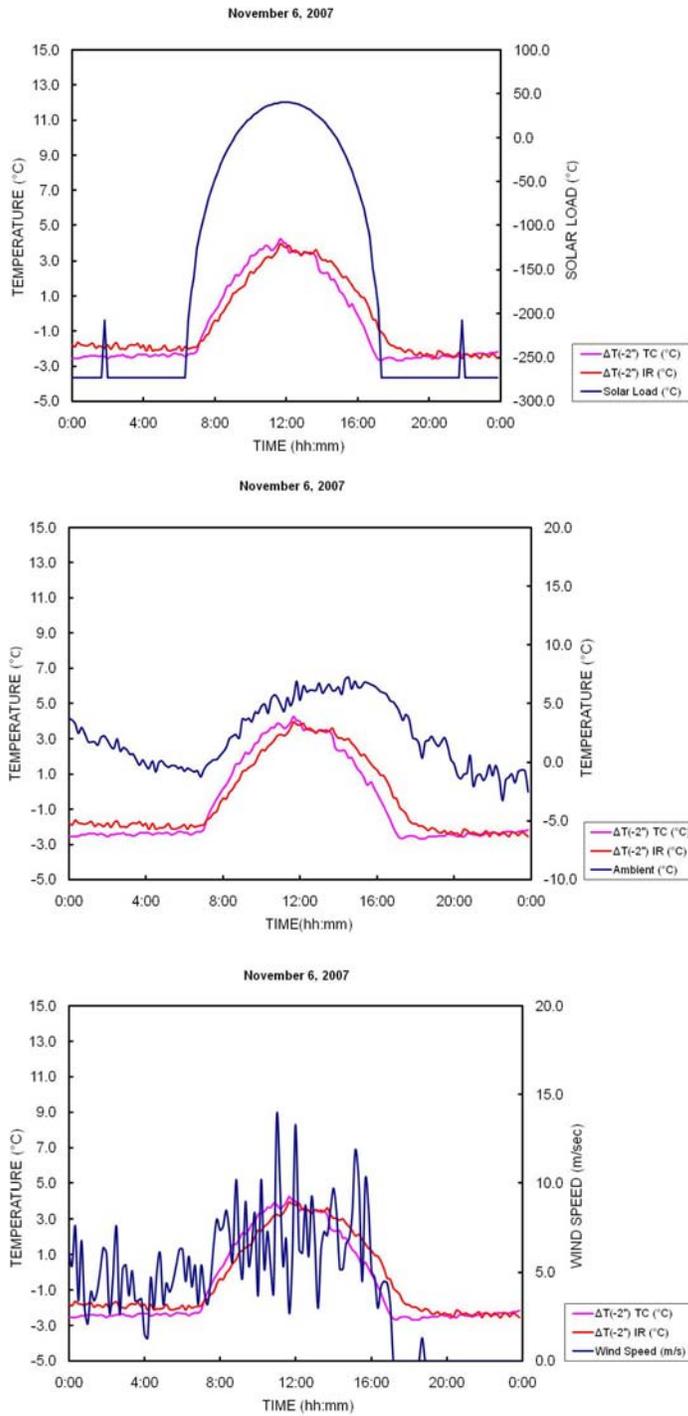


Figure 2. Test block data for November 6, 2007 showing solar input (A), ambient temperature (B) and wind speed (C).

Figure 2A shows the temperature differential from the thermal image, measured temperature differentials for the embedded thermal couples and the solar loading measured at the on-site weather station. Figure 2B shows the thermal differentials and the ambient temperature variations over the 24 hour period, and figure 2C shows the wind speed. This data will enable us to quantify the weather conditions that provide the largest contrast (shown as temperature differentials, $\Delta T(-2^{\circ})$ IR in figure 2).

3. Cameras

The initial cameras that were procured through the contract included the S65 camera used to monitor the test block, and a hand-held EX300 hand-held IR camera for use in the field by inspectors. During the course of the initial research conducted, it became apparent that a new version of the hand-held camera (EX-300) was becoming available that provided improvements to the ergonomic design of the camera, additional data processing and imaging features, and improved documentation options. As a result of discussions with project participants, it was decided to procure this new camera, model B400, for the study. As a result of this decision, a total of four hand-held cameras will be purchased under the study, rather than the three originally anticipated. Some delay in procuring the cameras was experienced as a result of this decision process, and as such there have been some delays in getting the cameras procured and distributed to the study participants. These cameras have been ordered from the manufacturer (FLIR), and the anticipated delivery date is during the week of December 17, 2007.



Figure 3. Photograph of hand-held IR camera.

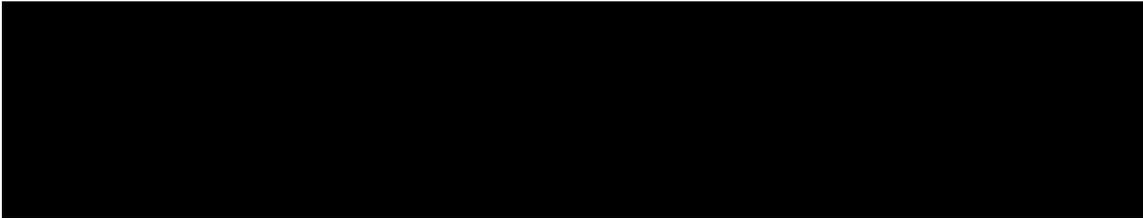
4. Issues or Problems that need to be addressed.

There has been an impact on the overall budget as a result of procuring four hand-held cameras rather than the three originally planned. This issue may need to be addressed in the future, when the effect on the scope of the project, if any, can be understood.

Schedule

The project is presently approximately 2 months behind the original schedule. At this point, this delay is not expected to effect the completion date for the project.

Table 1. Summary of project schedule.



% of Budget Expended: Approximately 70% of the funding provided by the participating States has been expended. Approximately 70% of the University-provided funded has been expended. Less than 10% of the University Transportation Center budget has been expended, because it has only recently become available.