LARS Information Note 081467
Purdue University

LABORATORY FOR AGRICULTURAL REMOTE SENSING

Truck Instrumentation and Capabilities

The basic field data instrumentation is designed to be mounted as a complete unit in the field van such that all field data can be collected in the natural environment of the sample to be measured with a minimum of external equipment and a minimum of set-up and take-down time. As a self-contained unit, the field van contains all the necessary measuring equipment and its own power source. Provisions are included for operating the data collecting instruments from either the field van roof or the cherry-picker bucket (up to 50 feet from the ground surface). The general instrument schematic is shown in Fig. 1.

This instrumentation includes the sensing instruments and the necessary recording equipment. The recording equipment consists of three basic types--the Ampex SP-300 seven-channel (1/2 inch) FM or direct tape recorder, the Honeywell 24-channel strip recorder, and the operator's data sheet. The Ampex SP-300 seven-channel tape recorder is used to record the output signals (interferograms) and the digitizing signals (clock signals) from the Block interferometers. The output signals from the Block interferometers are recorded in the FM mode in order to eliminate the reproduced signal amplitude variations inherent in a direct mode tape recording device, while the clock signals are recorded in the direct mode because of the frequency limitations of the FM mode. Provisions are included for a voice channel for recording identification numbers and other pertinent information if it is desired. The Honeywell 24-channel strip recorder is used to record in a sampled form on paper the slowly-varying signals from thermocouples measuring the ground and/or ambient temperatures at various levels, the output signal from the Eppley pyrheliometer used for indicating the quantity of incident solar energy contained in four wide wavelength bands, the output of the Barnes PRT-4 radiometer for measuring

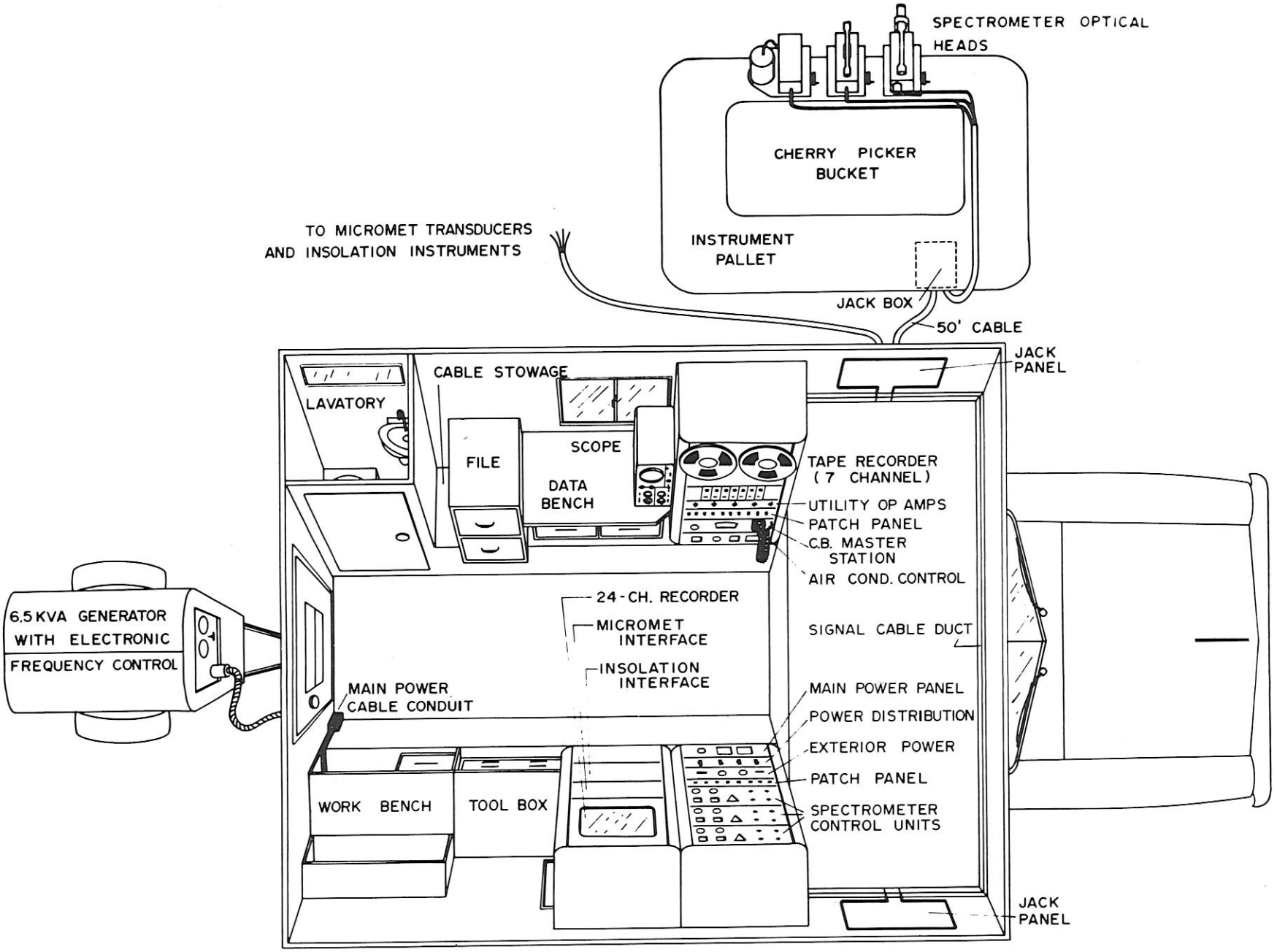

Figure 1 The field van - cherry picker instrumentation arrangement.

the apparent temperature of the scene examined, and the output of the ISCO spectroradiometer for indicating the spectral distribution of the incident solar energy. This recorder is a universal 5mv recorder for indicating sampled values of slowly varying conditions pertinent to the experiment. The operator data sheet indicates the information necessary for tying together the data recorded on the other recorders. This includes information such as the run identification numbers, the tape position indicator values for the stop and start of each run, the time of day, various instrument settings, and photograph number if photos were taken.

Other accessory equipment is required for operation as a self-contained unit. This includes the 6.5KW gasoline (or gaseous fuel) driven Kohler frequency stabilized MG set for supplying instrument and lighting power, the 3KW truck engine driven generator for supplying power to the air conditioner and tools which are apt to cause line transients that interfere with data collection, the tranceiver gear for communications between the operator of the sensing equipment and the recording equipment operator, and miscellaneous tools and instruction manuals for field maintenance.

At the present time most of the sensing and recording equipment and all of the accessory equipment has been installed and used on several data collecting missions. The remainder of the equipment is in the process of being installed and continued improvements are being made on the existing installation.

The installation of the accessory equipment is complete and in operational status. The frequency stabilized 6.5KW generator attaches as a trailer with connecting cables to the field van and has a frequency stabilization sufficient to maintain constant recorder speeds. The 3KW generator connects to the truck engine when needed and the voltage level and frequency are controlled from the van. The communications gear is rack mounted and is used both for data recording and for unloading the data from the truck to the analog-to-

digital converter. Tools and manuals are in permanently mounted cases and file cabinets in the van. Because of the weight distribution in the van it has been found necessary to equip the truck with heavy duty springs which are now being obtained.

The Ampex SP-300 tape recorder and the Block 195T and 195E interferometer electronics are rack mounted in the van. Figure 2 shows the recorder in its mount in a preliminary set-up. Cabling has been made with interface panels for operating the interferomatic optical heads either on top of the van as shown in Figure 3 or in the cherry-picker as shown in Figure 4 and Figure 5. At the time of these photos, the truck interface panels were not installed. The cabling and interface panels allow for simultaneous operation of the Block 195E and 195T interferometers. Operation from the van roof is made by mounting the optical heads on a tripod set on the aluminum grid platform and connecting cables from the optical heads to the interface panel. Operation from the cherry-picker is made using an instrument platform mounted on the bucket. The optical heads are mounted on geared pan heads fixed to this platform. A fifty foot cable connects the optical heads to the truck interface panel. The long cables have not noticeably affected the quality of the output signals. The output of instrument electronics in the van are connected via interface panels on the instrumentation rack and on the recorder rack to the respective recording channels. The input and recorded signals are monitored on an oscilloscope for instrument and recorder level adjustments.

The Honeywell 24-channel recorder is in the process of being mounted in its rack in the van. Connections will be made from the recorder to the outside of the van. The sensing equipment for this recorder are, for the most part, portable and are set up outside the van either on the ground, on the truck roof, or in the cherry-picker as the experiment requires.

In a typical data-collecting mission using the cherry-picker and the

Figure 2 At the tape recorder inside the truck.

Figure 3 Measuring crop radiance in the 2 to 16μ band from the field van roof.

Figure 4 Measuring corn field radiance in the 2 to 16μ band from the cherry picker during a NASA flight mission.

Figure 5 Measuring soybean radiance in both the 1 to 6μ band (195E) and the 2 to 16μ band (195T) from the cherry picker.

Block 195E and 195T interferometers, three operators are required. About 15 minutes are required in order to set-up and adjust the recording levels, optical heads, and cabling. For the 195E interferometer, liquid nitrogen is transferred from the large dewar in the truck to the small vacuum bottle mounted with the optical head. A proper flow of liquid nitrogen must be obtained in order to assure cooling of the detector. The run procedure requires that one operator in the cherry-picker aims the optical heads at the desired scene of view while the other operator records the run number, description, etc., on the data sheet. A minimum of one minute of data and clock signals are recorded to separate the runs. The third operator installs micromet and insolation gear on location, and takes radiometer readings as required. When all the runs desired at one location are complete, the cable to the cherry-picker bucket platform is disconnected at the platform and the van and cherry-picker move separately to the new location. Take-down time at the end of the day is also on the order of 15 minutes since only the external equipment and cabling must be packed.

The data is transferred to the LARS A/D converter by means of the fifty foot cable and interface panels at the truck and the building. This allows the data to be reproduced from the SP-300 without removing the recorder from the van. The transceiver gear is used in this process for communication between the operator in the van and the operator of the A/D converter in the building.