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1968

9-21-70

Date ---------- Doc. No. ----

MEASURING INSTRUMENTATION SUPPORT

The Instrument Development Branch has been engaged, since 1950, in the research, development, calibration, and installation of measuring instrumentation associated with ground testing of Launch Vehicle Systems and Components.

Also, instrument research and development has been carried out for other Laboratories within the MSFC to support advanced mission type projects. This R&D has included; hydrogen slush instrumentation, bio-medical instrumentation for MOLAB experiments; pressure, flow and temperature instrumentation for Project Thermo, and absolute gravity meter.

A. The Instrument Development Branch can offer instrumentation support in areas such as pressure, force, strain gage application, liquid flow, gas flow, liquid level, acoustics, vibration, seismic vibration, temperature, density, humidity, and heat flux. A brief explanation of capabilities in these fields is given below:

(a). Pressure: Pressure measurements can be supported in the pressure ranges of 10^{-7} torr to 120,000 psi. Facilities are available to evaluate instrument performance in this pressure range. Photograph I illustrates an automatic pressure transducer evaluation and calibration system for range of 0-3500 psi.

(b). Force: Photograph II shows a force calibration system for forces up to 5,000,000 lbs. Force measuring devices can be very accurately calibrated with this system. Smaller calibrators are also available so that full range of 0 to 5,000,000 can be covered.

(c). Strain Gage Application: Photograph III depicts an in-lab strain gage application area. Personnel and equipment are available for strain gage application to field structures.

(d). Photograph IV illustrates a liquid flow facility. This system contains three flow ranges; 0-3000 gpm, 0-750 gpm, and 0-125 gpm. Other flow bench facilities are available for 0-40,000 gpm. The West Area pumping station could be modified to include a flow bench for 280,000 gpm providing a test section having an approximate cross sectional area of three (3) square feet for generating water flow velocities up to 100 knots.

(e). Gas Flow: Photograph V shows a 200 cubic feet bell prover which is utilized for gas flowmeter calibration. Gas flow calibration for air, nitrogen, and helium in the flow range of 0.00035 cubic feet per minute to 5000 standard cubic feet per minute at 3500 psi can be provided.

(f). Liquid Level: Photographs VI and VII show liquid level instrumentation utilized to determine water slosh characteristics.

(g). Acoustics: Sound measurements involved in far field acoustic propagation studies associated with static firing of boosters have been supported with the Acoustics Lab. Photograph VIII shows calibration of a microphone in the Anechoic Chamber.

(h). Vibration: Vibration instrumentation and calibration equipment are available in the range of 5 hertz to 50,000 hertz. This capability could be of value for such measurements as engine vibration levels.

(i). Seismic Vibration: Seismic vibration equipment has been developed in-house for such measurements as test tower sway, and sea going transportation barge pitch and roll measurements.

(j). Temperature: Temperature instrumentation and calibration equipment are available for any range from $-440^{\circ}F$ to $+1900^{\circ}F$. Heat flux measurements can be provided up to 200 BTU/sq. ft./sec.

(k). Density: Considerable research has been carried out to develop accurate density instrumentation utilizing nuclear radiation attenuation. This instrumentation might be of value to compare density of soil samples, density vs. salinity, etc.

(l). Humidity: Photograph IX shows a standard gas humidity generator for dewpoints of $-100^{\circ}F$ to $+100^{\circ}F$.

B. Research has been and is presently being conducted to adapt advanced theoretical concepts to practice in providing new and increased measurement capability. Examples of this type work are: Utilization of the Mössbauer effect for measurement and calibration of extremely small amplitudes in the one angstrom range; Utilization of the laser:

(a). With only slight modifications of the holographic equipment we will be able to perform static and dynamic investigations of structures, shells, domes, and panels, as well as of sonic transducers, to analyze the stress caused by static pressure and vibrational or shock forces. Holographic measurements are possible in situ, in air, and under water at different pressures.

(b). The ultra high density optical storage of coded information can be used for future on-board programming and recording tasks where conventional memories cannot be used because of limited capacity, large size, or transmission links with limited bandwidth.

(c). Application of microminiaturization technology to data acquisition problems.

As indicated, the Instrument Development Branch has a wide variety of experience in the development of instrumentation for unique applications.As a consequence, a continuous research program has been established. This program involves, on an average, ten new projects each year. These projects are aimed at advancing measuring capability, primarily in the areas of pressure, force, flow, temperature, density, vibration, acoustics, humidity, high vacuum measurements techniques, and advanced digital data techniques.