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Sandia Corporation

REPRINT

DIGITAL DATA GATHERING SYSTEM
BLOWDOWN WIND TUNNEL

by
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DIGITAL DATA GATHERING SYSTEM
BLOWDOWN WIND TUNNEL

W. T. Botner, Sandia Corporation

The Sandia 12x12-inch, transonic, blowdown tunnel facility is being equipped with a 10-channel digital data gathering-system. G. M. Giannini & Company, Datex Division, Monrovia, California has been selected to fabricate and install the system in accordance with Sandia specifications.

The system is designed for three basic type of tests of nominal 1.5-inch dia. models (for typical run times of 10 to 20 seconds). These tests are:

1. Three or six component force test utilizing an internal strain gage balance (automatic pitching cycle during a run),
2. Free oscillation dynamic test (the model is automatically deflected three times during a run; i.e., three damping envelopes), and
3. Pressure test at constant angle-of-attack during the run (approximately 30 to 40 model orifices).

The data system samples 10 strip chart recorders simultaneously each 0.6 of a second during free run or each 1.2 seconds when used in single cycle operation. A 24 decimal digit parameter board is also provided. Raw data will be recorded on I.B.M. cards via an IBM 523 card punch. The raw data cards will then be fed directly to a IBM 704 computer or may be processed through an IBM 63 card to tape converter for computation by Elecom. Strip chart recordings will be compared with the IBM cards to ascertain proper functioning of the digital system.

The digital system is shown schematically in the attached sketch. A Giannini C-100 series encoder is mounted on the servo shaft of each self-balancing strip chart recorder. The encoder transmits the percent of full scale deflection of the strip chart recorder pen. Each encoder transmits its signal to a Giannini K-154 control chassis. The K-154 momentarily stores the information and converts it to decimal form. The output of each K-154 is fed to a IBM J-100 junction box. The junction box presents the data in parallel form, from either the 10 strip chart recorders or a 24 decimal digit parameter board, to the IBM 523 summary card punch. The IBM card punch presents the data on cards according to a preselected format.

System controls consist of:

1. "Single cycle" Pushbutton

The single cycle pushbutton causes a one-time sampling of the 10 strip chart recorders.

2. "Free Run" Selector Switch

The free run selector switch causes sampling of the 10 strip chart recorders each 0.6 of a second.

3. "Parameter" Pushbutton

The parameter pushbutton causes sampling of the data set on the parameter board.

4. "End of Run" Pushbutton

This pushbutton is actuated at the end of each run to produce a special end of run card.

5. "Pressure Test" Selector Switch

The pressure test selector switch switches the output of a pressure transducer selector to appropriate strip chart recorder and will arrange the system control chassis to provide the following test program:

Six strip chart recorders are programmed to receive the output of 30 pressure transducers.

A guillotine traps model port pressures to the 30 pressure transducers. The transducer selector switch connects the transducers, six at a time, to the six strip chart recorders until all 30 pressures have been recorded (0.6 sec sampling rate).

An alternate pressure system utilizes a 48 port Scanivalve with guillotine. The output of the Scanivalve is programmed to one strip chart recorder; the sampling rate is one port each 0.6 of a second. For most model pressure surveys the tunnel is blown for 7 or 8 seconds. During this time interval the pressure tubes between model ports and Scanivalve are filled and the guillotine actuated trapping the port pressures to the Scanivalve. The trapped pressures are read out after the tunnel is shut off. The Scanivalve has proven so satisfactory, we expect it to become the primary pressure system for use with the digital equipment.

6. "Dynamic Test" Selector Switch

The dynamic test selector switch arranges the system control circuitry so that when a model is released for a period of free oscillation the data system samples strip chart recorders which are monitoring tunnel flow conditions.

The dynamic data is recorded on a "Dampometer". After the test run, these data, time to damp to - half amplitude and period of oscillation, are then set on the parameter board for recording on punched cards.

7. "Standardize" Pushbutton

The standardize pushbutton will simultaneously standardize all recorders.

8. "Master Power" Switch

The master power switch will shut off the digital system at the operator's convenience.

9. "Master Calibrate" Switch

The master calibrate switch will connect preselected resistors across the input bridge of the strip chart recorders to check span and zero settings.

The tunnel air storage reservoir is being increased from 2600 to 5200 cubic feet. An additional compressor is being purchased to double the present pump-up rate. These additions will approximately double the number of test runs per working shift. The digital data system will greatly reduce the data reduction work-load resulting from the increased frequency of testing.

DIGITAL DATA GATHERING SYSTEM
TRANSONIC BLOWDOWN WIND TUNNEL
SANDIA CORPORATION

3/26/58 - W. T. B.

NOTE:
ALTERNATE PRESSURE SYSTEM
SHOWN WITH DASH LINES

SCANIVALVE
VARIABLE
STEPPING RATE
CONTROLLER

TRANSDUCER OUTPUT

48 PORT
SCANIVALVE

48 PORT
GUILLOTINE

48 INPUT PRESSURES

POWER
SUPPLY

TRANSDUCER
OUTPUTS

TRANSDUCER
SELECTOR

30 TRANSDUCERS
IN TEMP STABILIZED
OVEN

30 CHANNEL
GUILLOTINE

30 INPUT PRESSURES

PRESSURE TEST SELECTOR

EXISTING
INPUT
FACILITIES

S. B. P.
1

C - 100
ENCODER

K - 154

J - 100
I B M
JUNCTION
BOX

SYSTEM
CONTROL
CHASSIS

S. B. P.
6

C - 100

K - 154

S. B. P.
7

C - 100

K - 154

S. B. P.
8

C - 100

K - 154

S. B. P.
9

C - 100

K - 154

S. B. P.
10

C - 100

K - 154

IBM 523
SUMMARY
CARD PUNCH

IBM 63
CARD TO TAPE
CONVERTER

24 DECIMAL
DIGIT
PARAMETER
BOARD

EXISTING STRIP CHART RECORDERS (SELF BALANCING POTENTIOMETERS)

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