

DEVELOPMENT AND FABRICATION OF

ADVANCED DESIGN RATE GYRO

MONTHLY PROGRESS REPORT

NO. 3

For the period

1 September to 30 September 1963

Prepared for

George C. Marshall Space Flight Center  
Huntsville, Alabama

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By

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Great Neck, New York

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1. WORK ACCOMPLISHED BEFORE 1 SEPTEMBER 1963

- 1.1 The experimental gyro model with 0.003 in. thick aluminum transducer diaphragms was assembled, tested and then reassembled with 0.002 in. thick magnesium diaphragms.
- 1.2 The signal preamplifier breadboard was assembled.
- 1.3 The layout for the deliverable engineering model was completed.
- 1.4 Approximately 20% of the required detail drawings were completed.
- 1.5 The design of tools required for assembly was started.
- 1.6 Purchase orders for long lead items were issued.

2. WORK PERFORMED DURING CURRENT REPORT PERIOD

- 2.1 Ninety per cent of the detail drawings of the deliverable engineering model was completed. Two sets of drawings are enclosed with this report.
- 2.2 The design of tools required for assembly was completed. These tools are now being manufactured.

2.3 The experimental gyro model was tested with 0.002 in. magnesium diaphragms. As had been expected, it was more sensitive than it had been with the thicker aluminum diaphragms. There was a large (5 degrees per second) bias output, however, and most of the month's experimental effort was spent pursuing the source of this bias.

It has been established with reasonable certainty that the bias comes from a vibration source at the end of the housing. Either bearing misalignment or coercion from the motor drive causes an angular vibration of the end of the housing which is transmitted at spin frequency through the fluid to the transducers. This causes an output proportional to the generated pressure. The model was modified, adding a cup to stiffen the coupling from the shaft to the outer edge of the housing. This reduced the bias from 5°/second to  $\frac{1}{2}$ °/second and made it possible to observe the model's performance at rates below 1°/second. The remaining bias output is still too high for the engineering model and the design is being reviewed to assure that the same problem can not appear. The waistband motor and the bearing system consisting of three rows, two of which are solidly preloaded, make the engineering model far less susceptible to this trouble. A threshold of 0.05°/second was observed in operating the model on the Genisco Table. This is considerably higher than the required capability of the engineering model and further test will be required to find the reasons for the noise that is present.

2.4 The on-board networks for the transducer excitation and output null adjustment have been designed. The four transducer elements will be excited by the four separated phase quadrants of the excitation frequency. This will be done with the RC bridge arrangement shown on Drawing No. 4211-67379. Whatever residual unbalance remains at the output (signal slip ring rotor) will be adjusted to null by insertion of some resistive or capacitive coupling of one phase or the other of the excitation voltage; this having been passed by wires through the body of the rotor.

3. WORK CONTEMPLATED

3.1 The work will continue as outlined in the original program plan.

4. MAN-HOURS EXPENDED

|                        | 771* | man-hours |
|------------------------|------|-----------|
| Engineering            |      |           |
| Tool Design Labor      | 56   |           |
| Process Engineering    | 2    |           |
| Short Order Shop Labor | 90.6 |           |
| Laboratory Technician  | 95.8 |           |
| Parts Inspection       | 10.6 |           |

\* Actual number of engineering hours spent on this project in September 1963 was 426 hours. The remainder is an inadvertently delayed accounting pick-up from July and August 1963. A careful check has been made to insure that the cumulatives reflecting all inputs are now accurate and inclusive of all hours spent to date.

It should be noted that this project is on schedule and now to our monthly funding budget. Our work and progress to date indicates a prognosis that this project will continue to be on schedule and within budget at delivery time.

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