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MEMORANDUM

5176:SAN:jch

FROM: Code 5176 DATE: 9 May 1968

TO: Code 5170 (ALL PERSONNEL)

SUBJ: R. F. Effects of Gravity Gradient Booms

1. Tests have recently been made in the Anechoic Chamber to study the distortion in omnidirectional coverage by gravity gradient booms.

2. The test model consisted of a half-scale satellite with two (2) hemispherical shells 14 inches in diameter joined by a 3 inch high belly-band. Two (2) turnstile antenna arrays (one in each hemisphere) and three (3) booms were mounted on the model. All booms were mounted on the top consisting of one (1) vertical boom 10 feet long and two (2) horizontal booms, 12 feet long, forming a "V" with an angle of 60 degrees. By using half-scale, double the actual length was simulated so that the equivalent boom lengths were 20 feet and 24 feet respectively. The boom to antenna length ratio was 12 to 1.

3. Over thirty (30) radiation distribution antenna patterns were run in both horizontal and vertical polarizations. Patterns were run without any booms on the model to confirm the half-scale theory. Boom effects investigated include grounding of booms, boom length, location of horizontal booms with respect to the antenna and upper and lower turnstile effects.

4. As a result of these tests, several conclusions and recommendations can be made:

(a) The presence of the vertical boom by itself does not affect the antenna patterns.

(b) The horizontal booms should be grounded. Grounded booms had better patters and were not effected as much by varying other parameters.

(c) The presence of the horizontal booms changed the nulls (maximum variation) from [redacted] with an average of 35% of the pattern area below [redacted]

(d) For the placement of the horizontal booms, with respect to the antennas, the following configurations are listed in the order of preference:

lower turnstile, "V" around antennas
lower turnstile, "V" between antennas
upper turnstile, "V" between antennas
upper turnstile, "V" around antennas

It should be noted that the lower turnstile was not affected as severely by the booms as the upper turnstile, but the upper turnstile had a better pattern in the lower hemisphere which is the most important area when the satellite is properly stabilized. Also the difference between the best and the worst of the

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four cases cited above is not very big. There was a spread for the percentage of the pattern below [redacted] and a spread for the maximum variation from [redacted]

(e) When the boom length was shortened, the patterns tended to become more similar to the patterns of the model without any booms.

5. In conclusion, although the proposed flight configuration is last in the order of preferences, its performance should still be satisfactory. These tests indicate longer booms should be tested to learn more of the effects of the booms; therefore, a one-third scale model is being constructed and tests will be run on it this summer.

[redacted]
CODE 5176