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VIBRATION MEASUREMENTS MADE ON THE USS PHILIPPINE SEA (CV47) DURING STANDARDIZATION AND MISCELLANEOUS TRIALS OF 5 JUNE TO 1 JULY 1947

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by

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Report C-6

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ABSTRACT

Vibration measurements were made on the USS PHILIPPINE SEA (CV47) during the vessel's runs from Portsmouth, Virginia, to Guantanamo Bay, Cuba, in June 1947. The purpose of these tests was to determine the relative effect of four-bladed CLYBEN and NACABS propellers on the vibration of the vessel. Vibration amplitudes were small with both types of propellers but NACABS gave slightly less vibration below 240 RPM.

INTRODUCTION

The David Taylor Model Basin was directed by Reference (1)* to make vibration measurements on the USS PHILIPPINE SEA (CV47) during standardization and miscellaneous trials of June 1947. These measurements were made during the vessel's run from Portsmouth, Virginia, to Guantanamo Bay, Cuba. The purpose of the measurements was to determine the relative effect of four-bladed CLYBEN and NACABS propellers on the vibration of the vessel.

During these measurements, the ship displaced about 36,600 tons; the trim was negligible. The vibration data were obtained with four-bladed CLYBEN propellers 14 feet 7 inches in diameter and with four-bladed NACABS propellers 15 feet 0 inch

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* Numbers in parentheses indicate references on page 5 of this report.

in diameter. The sea was somewhat rougher during the trials with the NACABS propellers than during the trials with the CLYBEN propellers.

TEST PROCEDURE

Vibration measurements were made during constant-speed runs at shaft speeds from 125 RPM to 264 RPM at increments of 10 RPM. A shaft speed of 264 shaft RPM corresponds to full power. Additional measurements were made where necessary to establish critical vibration frequencies. These data were obtained at the following stations:

a. After capstan machinery room at Frame 202; vibrations were measured in the vertical and transverse directions by a TMB pallograph.

b. Engine Room 2; longitudinal vibration at the top of the gear casing were measured by a TMB pallograph.

c. Flight deck; vertical vibration measurements were taken along the centerline of the flight deck, using an Askania vibrograph.

d. Mark 37 gun director on the after part of the island structure; vibration measurements were taken in the vertical, transverse, and longitudinal directions at the base and at the top of the director foundation, at the center of the rangefinder tube, and at the deck of the director housing. The director was trained aft during all measurements. The measurements were made with an Askania vibrograph.

e. Measurements of the vertical acceleration of the bow at the forward perpendicular were made at a speed of 15 knots with NACABS propellers only. Measurements were made with a Type B pallograph, converted to an accelerometer.

ANALYSIS OF DATA

The vertical and transverse vibration amplitudes of the fantail as measured in the after capstan machinery room are plotted against propeller RPM in Figure 1. The vibration was of propeller-blade frequency for all speeds when NACABS propellers were used. When CLYBEN propellers were installed, vibrations of shaft-RPM frequencies were observed at speeds of 225 RPM and above. This may have been due to irregularities in the shape, or unbalance, of the CLYBEN propellers.

Single amplitudes of vertical and transverse hull vibration as recorded with a Consolidated velocity pickup feeding through an integrator and amplifier into a direct-inking Brush oscillograph are plotted against propeller RPM in Figure 2. These measurements were made in order to compare the data as obtained by electrical and mechanical means.

The longitudinal vibration amplitudes measured at the top of the gear casing in Engine Room 2 with a TMB pallograph are plotted against propeller RPM in Figure 3. The NACABS propellers produced somewhat smaller vibration amplitudes at shaft speeds above 180 RPM.

The vertical vibration amplitudes measured on the centerline of the flight deck at Frame 210 with an Askania

vibrograph are plotted against propeller RPM in Figure 4. The NACABS propellers generally produced a somewhat lower level of vibration than the CLYBEN propellers below 240 RPM.

The measurements on the after gun director, Mark 37, made with either CLYBEN or NACABS propellers were of such small magnitude that no preference for either type of propeller could be based on these data. The level of vibration measured was fairly low. The maximum single amplitude measured at the center of the rangefinder tube was 4 mils along the axis of the tube. The maximum single amplitude at the base of the director foundation was 6.5 mils, athwartships. All vibration measured was of propeller-blade frequency. This director should present no difficulties due to vibration.

The acceleration of the bow at the forward perpendicular was measured at a speed of 15 knots with NACABS propellers. The maximum acceleration was found to be ± 0.39 g at a pitching period of 6.65 seconds per cycle.

CONCLUSIONS

In general, the NACABS propellers produced a somewhat lower level of vibration than the CLYBEN propellers, in spite of the fact that the sea was somewhat rougher during the trials with the NACABS propellers. However, the differences in the vibration amplitudes measured at the several locations are considered to be too small and too irregular to draw definite conclusion as to the choice of a propeller from the standpoint of vibration.

REFERENCES

(1) Joint letter BuShips Code 436 CV47(436) InSurv CV47/S8(209-S) S63P45 of 14 March 1947 to TMB and others.

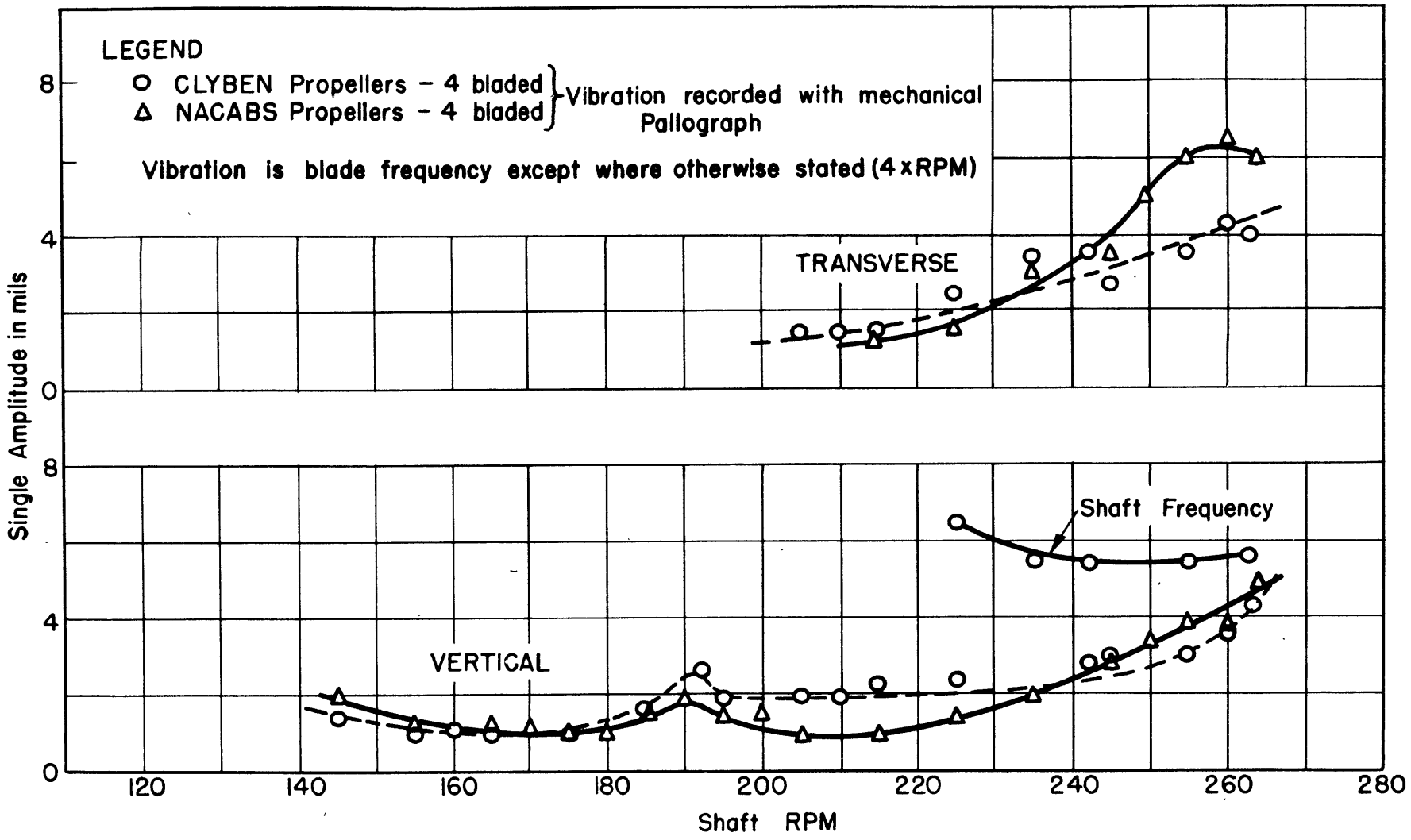

Figure 1 – Vibration Trials – USS PHILIPPINE SEA (CV47)
Amplitudes of Vertical and Transverse Vibrations Measured in the After Capstan Machinery Room at Frame 202 for the CLYBEN and NACABS Propeller Installations.

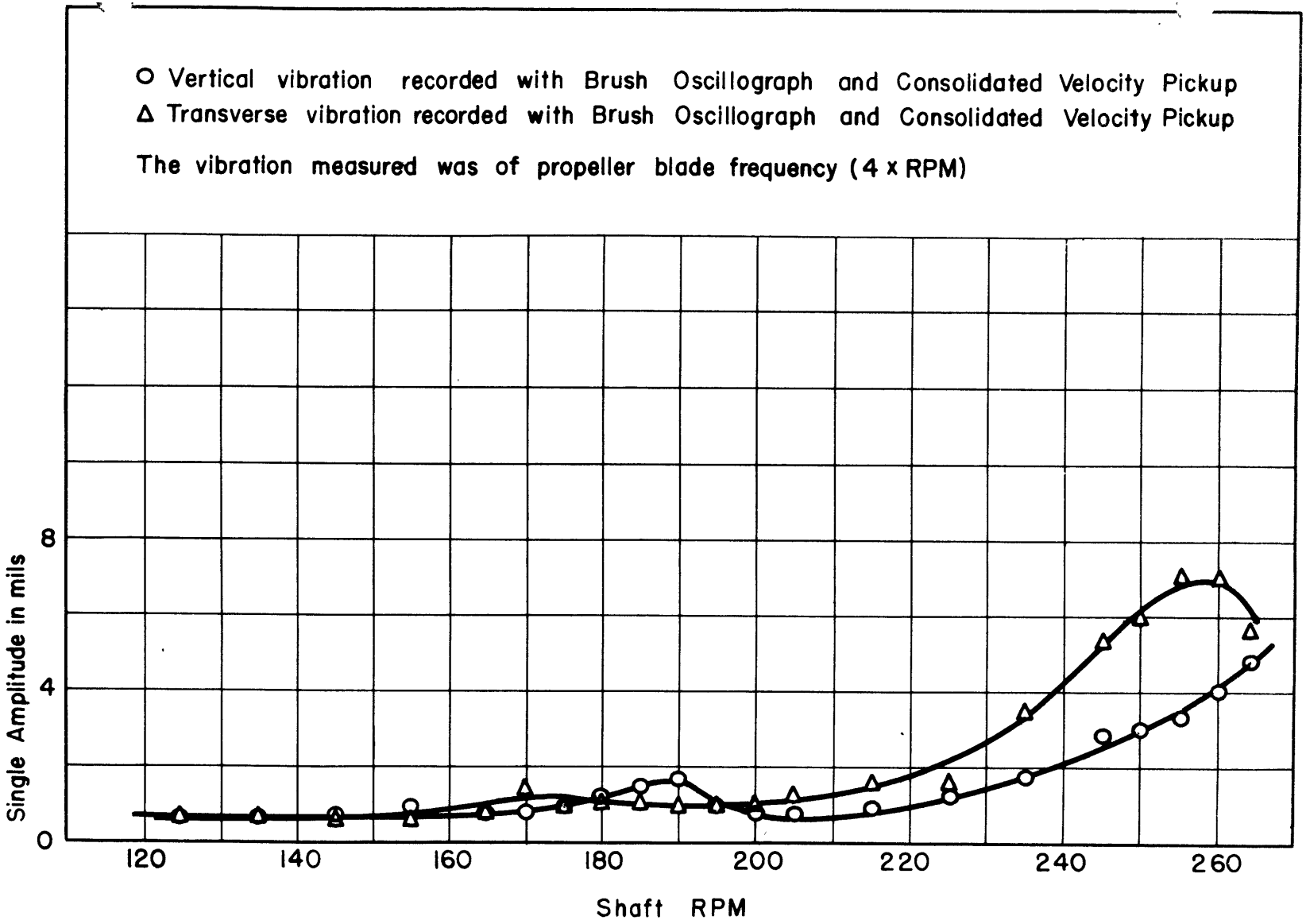

Figure 2 - Vibration Trials - USS PHILIPPINE SEA (CV47)
Amplitudes of Vertical and Transverse Vibration
Measured in the After Capstan Machinery Room at Frame 201,
for the NACABS Propeller Installation

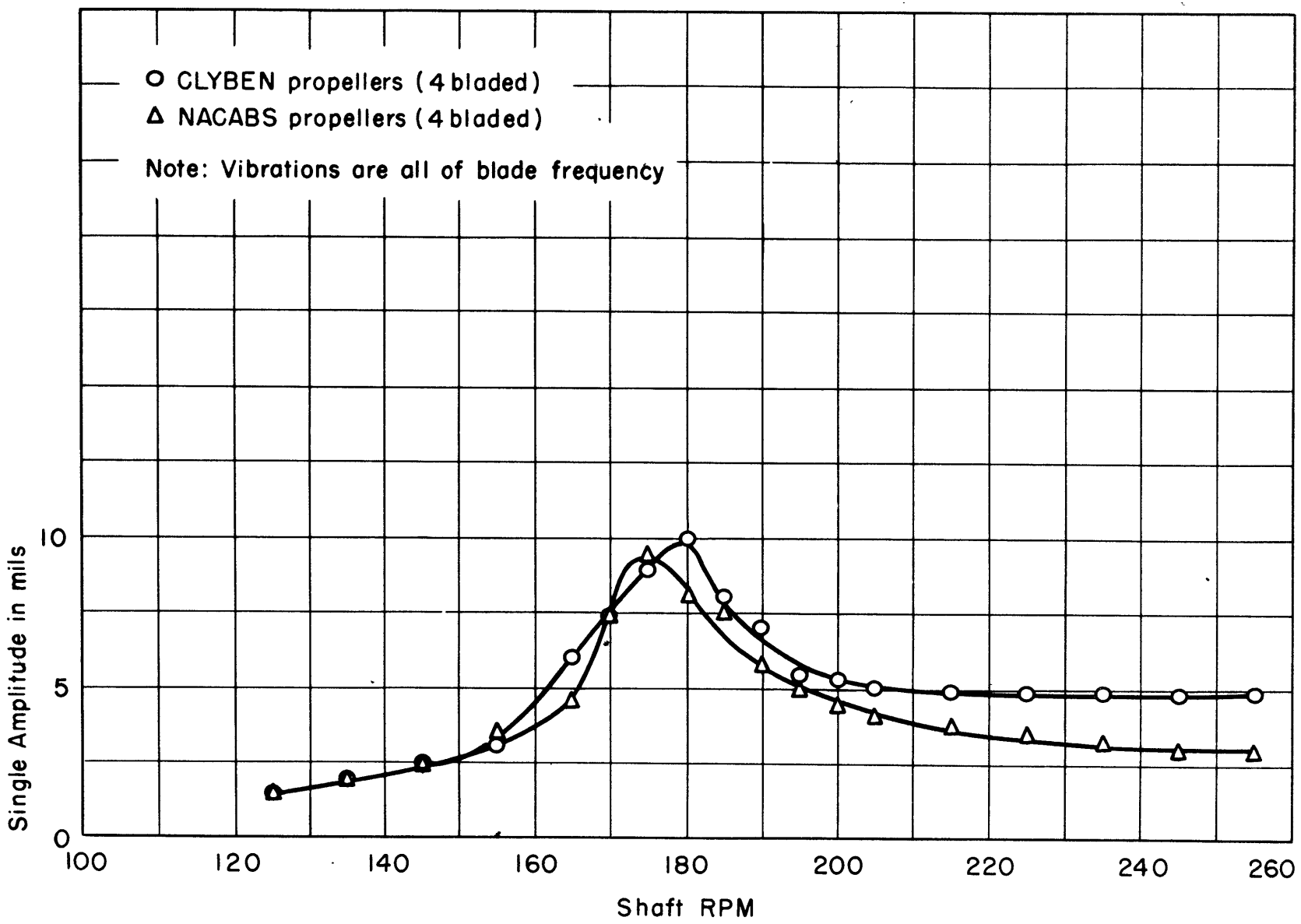

Figure 3 - Vibration Trials - USS PHILIPPINE SEA (CV47)
Engine Room 2 - Longitudinal Vibration
Measured at the Top of the Gear Casing

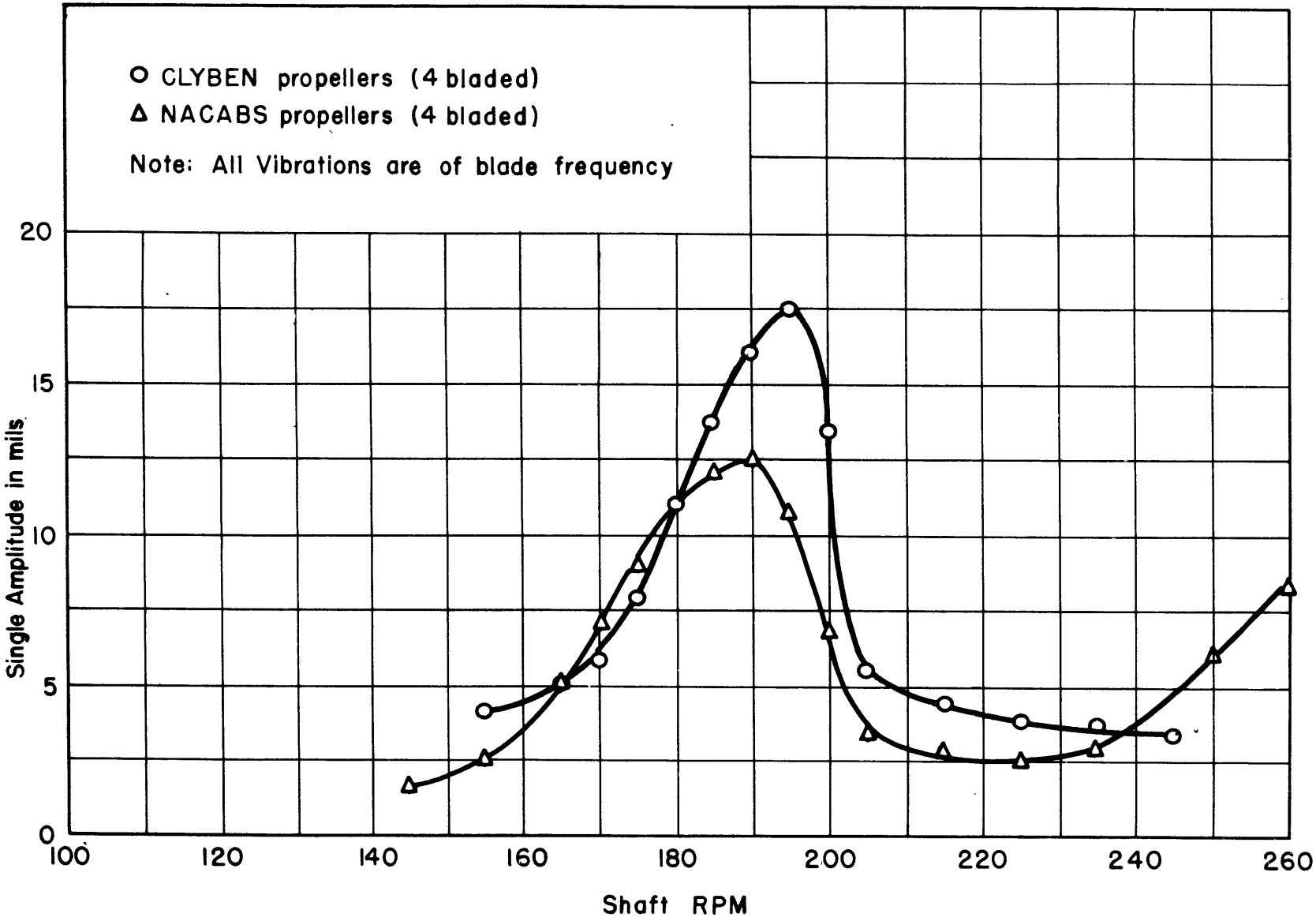

Figure 4 - Vibration Trials - USS PHILIPPINE SEA (CV47)
Amplitudes of Vertical Vibration
Measured on the Centerline of the Flight Deck at Frame 210