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ANALYSIS OF WAKE SURVEY FOR TUNNEL-FIN AND ACCELERATING-FIN CONFIGURATIONS
FOR THE NAVAL AUXILIARY OILER (AO 177) REPRESENTED BY MODEL 5326-1

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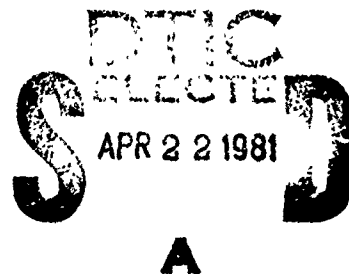
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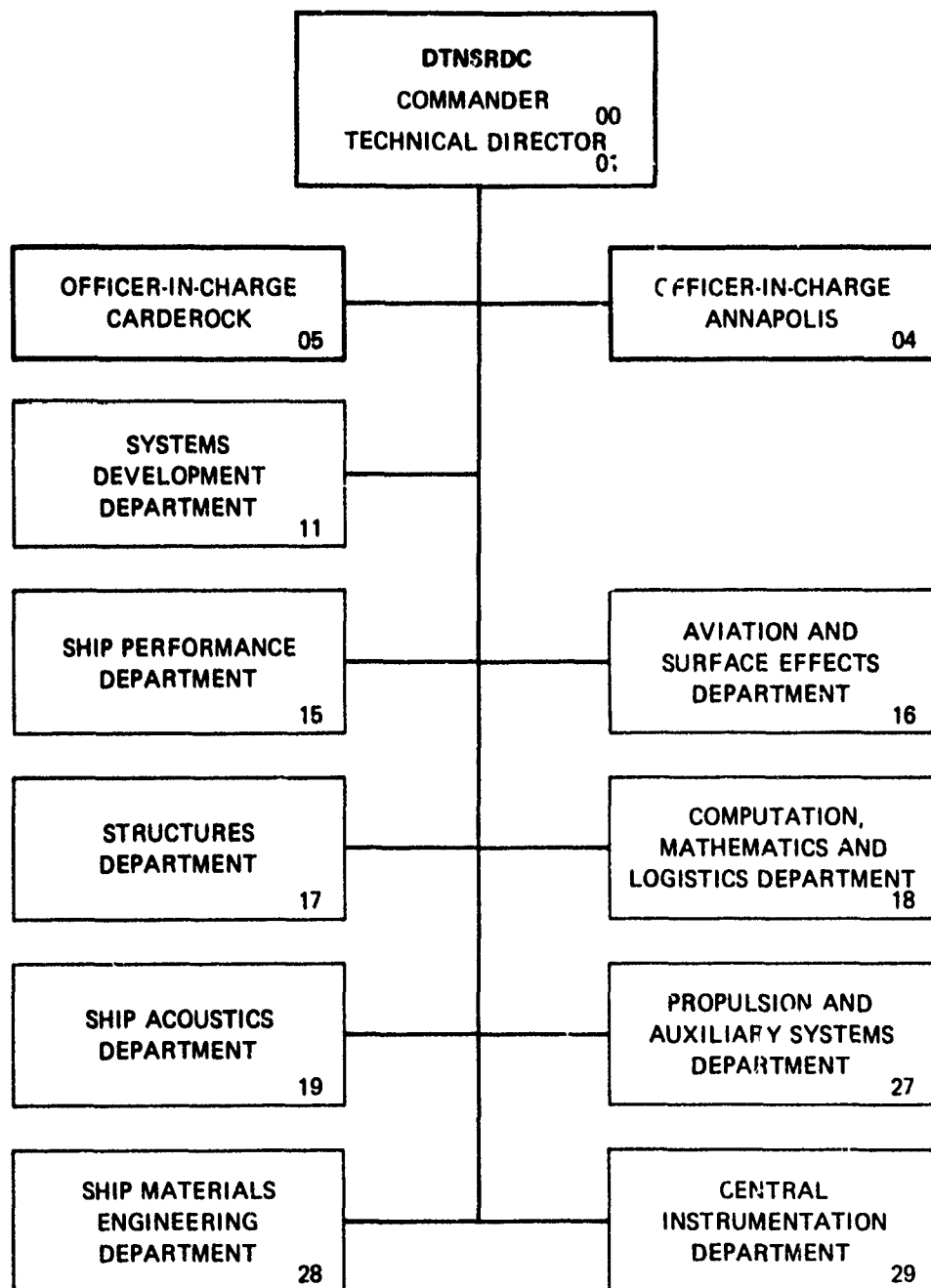
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CONVENTIONAL SYMBOL	SYMBOL APPEARING ON PLOTS	DEFINITION	NOTATION	CONVENTIONAL SYMBOL	SYMBOL APPEARING ON PLOTS	DEFINITION	NOTATION
D	---	Propeller diameter					
J _A	J _A	Apparent advance coefficient J _A = $\frac{V}{nD}$ (dimensionless)					
N	N	Harmonic number					
n	---	Propeller revolutions					
P	P	Pressure					
r/R or x		Distance (r) from the propeller axis expressed as a ratio of the propeller radius (R)					
V	V	Actual model or ship velocity					
V _z (x, θ)	VR	Radial component of the fluid velocity for a given point (positive toward the shaft centerline)					
V _z (x, θ)/V	VR/V	Radial velocity component ratio for a given point					
$\bar{V}_z(x)/V$	VRBAR	Mean radial velocity component ratio for a given radius					
V _z (x, θ)	VT	Tangential component of the fluid velocity for a given point (positive in a counterclockwise direction looking forward)					
V _z (x, θ)/V	VT/V	Tangential velocity component ratio for a given point					
$\bar{V}_z(x)/V$	VTBAR	Mean tangential velocity component ratio for a given radius					
$(\bar{V}_z(x)/V)^N$	AMPLITUDE	Amplitude (A _N for single screw symmetric; C _N otherwise) of Nth harmonic of the tangential velocity component ratio for a given radius					
V _x (x, θ)	VX	Longitudinal (normal to the plane of survey) component of the fluid velocity for a given point (positive in the astern direction)					
V _x (x, θ)/V	VX/V	Longitudinal velocity component ratio for a given point					
V _x (x, θ)/V	VXBAR	Mean longitudinal velocity component ratio for a given radius					
$(\bar{V}_x(x)/V)^N$	AMPLITUDE	Amplitude (A _N for single screw symmetric; C _N otherwise) of Nth harmonic of the longitudinal velocity component ratio for a given radius					

ABSTRACT

Wake survey experiments were conducted with Model 5326-1 to aid in the identification and resolution of the propeller cavitation and airborne noise problem experienced by the Auxiliary Oiler AO-177 and to validate possible remedies. The experimental program involved the evaluation of three tunnel-fin configurations and one accelerating-fin configuration fitted to the stern of the model. The results of the wake survey experiments show that the flow into the propeller plane was improved by the addition of any of the four fins.

ADMINISTRATIVE INFORMATION

This work was funded by the Naval Sea Systems Command (NAVSEA 3213), and was carried out under NAVSEA Project Orders POOR145 and POOR162, and DTNSRDC Work Unit Numbers 1-1532-115-40 and 1-1532-116-40.

INTRODUCTION

At the request of the Naval Sea Systems Command (NAVSEA 3213), a model experimental program was carried out at the David W. Taylor Naval Ship Research and Development Center to help in the resolution of the propeller cavitation and airborne noise problem experienced by the Auxiliary Oiler AO-177.

The AO-177 has a very fine, thin stern, providing a highly reduced longitudinal velocity in the vicinity of the top of the propeller plane. Such a phenomenon is likely to cause unsteady cavitation on the propeller blades, which in turn may cause excessive noise and local vibration problems in the stern area of the ship. One proposed remedy was to improve the flow into the propeller by fins installed at the stern of the ship. It was considered that the fins will guide more flow into the propeller plane, reducing or diffusing the severe nonuniformity of the wake distribution.

Four different fin configurations were designed and an experimental program was carried out to validate their effectiveness. The experiments involved visual flow observations, resistance and propulsion experiments and wake survey experiments. The results of the flow observations were published in reference 1*. This report describes the results of the wake survey experiments. The results of the resistance and propulsion experiments will be published in a following report.

* References are listed on page 6.

MODEL DESCRIPTION

Three tunnel-fin designs were constructed and fitted to an existing model (Model 5326-1) of the AO-177, according to plans furnished by NAVSEA, entitled, "Flow Improvement Fin", and designated Configuration 1 (SK 3213-0026), Configuration 2 (SK 3213-0027), and Configuration 3 (SK 3213-0028). An accelerating fin was constructed by the Swedish Center for Maritime Research (SSPA) according to plans entitled, "U.S. Navy Fleet Oiler Proposal to Stern Fins," File No. 2564. The accelerating-fin is designated as Configuration 4.

Model 5326-1 representing the Auxiliary Oiler AO-177 was previously constructed to a linear scale ratio of 25.682. The model was fitted with the same bilge keel which was on the model during the previous wake survey experiments. Illustrations of the fins and experimental radii are shown in Figure 1 (Configuration 1), Figure 2 (Configuration 2), Figure 3 (Configuration 3) and Figure 4 (Configuration 4). Fitting room photographs of the fins attached to the model are presented in Figures 5 through 8.

EXPERIMENTAL PROCEDURES

During the wake survey, the various velocity components were obtained with DTNSRDC pitot tube rake 8 connected to differential pressure transducers. This rake consists of five 5-hole spherically headed pitot tubes mounted in a foil shaped housing. A photograph of the model stern with the rake attached is shown in Figure 9. The pitot tubes were located in the propeller plane 4.62 feet (1.41 m) in ship scale aft of station 19½. The diameter of the ship propeller is 21 feet. The radial location of the pitot tubes expressed as fractions of the propeller diameter (r/R) are, respectively, 0.359, 0.556, 0.775, 1.017 and 1.178.

The shape of the pitot-tube rake is such that, while the model is being towed, the rake may cause variations in trim at different angular positions. In order to maintain the natural trim throughout each survey, the model was towed at a speed corresponding to 20 knots full scale, free to assume a correct trim with the rake in the zero degree position. The model was then locked in that trim for that particular experiment. Trim values for the wake survey conditions will be included in the resistance and propulsion report.

An apparent advance coefficient (J_v) of 1.01 based on full-scale RPM at 20 knots was used in the calculation of the advance angles. The basin water temperature throughout the survey was 71° F (21° C).

DATA ACCURACY

The accuracy of the wake survey apparatus is estimated to be ± 2 percent in measuring the longitudinal velocity component ratio (V_X/V), except in locations where steep velocity gradients occur. Data accuracy in these locations are expected to be less than in regions of a slowly changing velocity field.

The wake velocity components typically show some slight transverse asymmetry, evident in the circumferential distribution figures. Similar asymmetries can be seen in any full-disc presentations of single-screw model wake data. Such differences are considered to be insignificant.

PRESENTATION OF DATA

It was necessary to confirm the repeatability and also to establish a base on which to correlate the wake survey data for the series of experiments. Therefore, Experiment 1 Repeat (October 1980) was conducted having the same experimental conditions as the previously conducted Experiment 1 (August 1980)². The experimental conditions included a trim of 1 foot (0.305 m) by the bow full-scale, the equivalent full-scale displacement of 26,390 tons (26 810 metric tons) and without fins. These results are presented graphically for each radius in Figures 10 through 14 as composite plots of the velocity component ratios.

Experiment 1 (October 1980) without fins is also compared to tunnel-fin Configuration 1 (NAVY) and accelerating-fin Configuration 4 (SSPA) at a trim of 1 foot (0.305 m) by the bow full-scale and an equivalent full-scale displacement of 26,390 tons (26 810 metric tons). The velocity component ratios are presented in Figures 15 through 19 for each radii.

The wake survey results for the three Navy tunnel-fins, Configuration 1, Configuration 2, Configuration 3 are presented as composite plots in Figures 20 through 24 at the trim of 1 foot (0.305 m) by the bow full-scale and the equivalent full-scale displacement of 26,390 tons (26 810 metric tons) for each experimental radii. Tabulated results of the mean velocity component ratios and other derived quantities for the no fin configuration, Configuration 1 (NAVY, Configuration 2 (NAVY),

Configuration 3 (NAVY) and Configuration 4 (SSPA) are presented in Table 1 (page 46).

Velocity component ratios for tunnel-fin Configuration 1 (NAVY) and accelerating-fin Configuration 4 (SSPA) are compared in Figures 25 through 28 with the model trimmed 3.75 feet (1.143 m) by the stern ship scale and at the equivalent ship displacement of 17,270 tons (17 550 metric tons). The radius of 1.178 is not presented because pitot tube number 5 was out of the water when the model was towed at the equivalent ship speed of 20 knots. Tabulated results of the mean velocity component ratios and other derived quantities are presented in Table 2 (page 48).

A variation in fin alignment was also investigated by conducting an experiment with tunnel-fin Configuration 3 (NAVY) rotated up 2.5 degrees, leading edge raised 0.75 inches (1.91 cm) in model scale. This experiment is compared to tunnel-fin Configuration 3 (NAVY) as normally attached to the model at a trim of 1.0 feet (0.305 m) by the bow full-scale and an equivalent full-scale displacement of 26,390 tons (26 810 metric tons). The velocity component ratios are presented as composite plots in Figures 29 through 33. Tabulated results of the mean velocity component ratios and other derived quantities are presented in Table 3 (page 49).

A listing of the experimental configurations and corresponding ship values is given in Table 4 (page 50).

The results for each of the wake survey experiments are given separately in Appendices A through H, including the following graphs and tables:

- (1) Velocity component ratios at each radius.
- (2) Radial distribution of the mean velocity component ratios.
- (3) Radial distribution of the mean advance angle and the maximum variations of the advance angle.
- (4) A listing of the mean velocity component ratios, the mean advance angle and other derived quantities.
- (5) Harmonic analysis of the longitudinal velocity component ratios at the experimental and interpolated radii.
- (6) Harmonic analysis of the tangential velocity component ratios at the experimental and interpolated radii.

(7) A listing of the input data.

DISCUSSION OF RESULTS

When comparing the results for Experiment 1 Repeat (October 1980, no-fins) with the results for Experiment 1 (August 1980, no-fins), the data is within the expected limits of repeatability, ± 2 percent. In the propeller plane the area of greatest concern is the area where the longitudinal velocity (V_X/V) becomes minimum causing the inflow to be non-uniform. This area is around the zero degree position, (i.e., 12 o'clock position). Based on the longitudinal flow (V_X/V), the addition of any of the four fin configurations improved the flow into the propeller plane in this critical area. The differences in longitudinal velocities (V_X/V) when comparing the results for the different fin configurations are minimal. Thus, instead of showing the results of individual fins, the results of four fins have been averaged and are presented in Figure 34 (page 41) to show a typical wake modification achievable by using any one of the four fins investigated. It is clear from this figure that a fin improves the wake by reducing the velocity defect in the region near the 12 o'clock position. Further analysis and evaluation of the impact of such wake improvement on the propeller cavitation and airborne noise will be reported in a later report.

REFERENCES

1. Hampton, Gary A., "Investigations of Underwater Flow Patterns for Three Tunnel-Fin Configurations for the Naval Auxiliary Oiler (AO-177) Represented by Model 5326-1", DTNSRDC Report SPD-544-17, (February 1981).
2. Wilson, M. B. and Hampton, G. A., "Measurements of the Effect on Trim on the Nominal Wake of the Naval Auxiliary Oiler AO-177", DTNSRDC Report SPD-544-19, (March 1981).

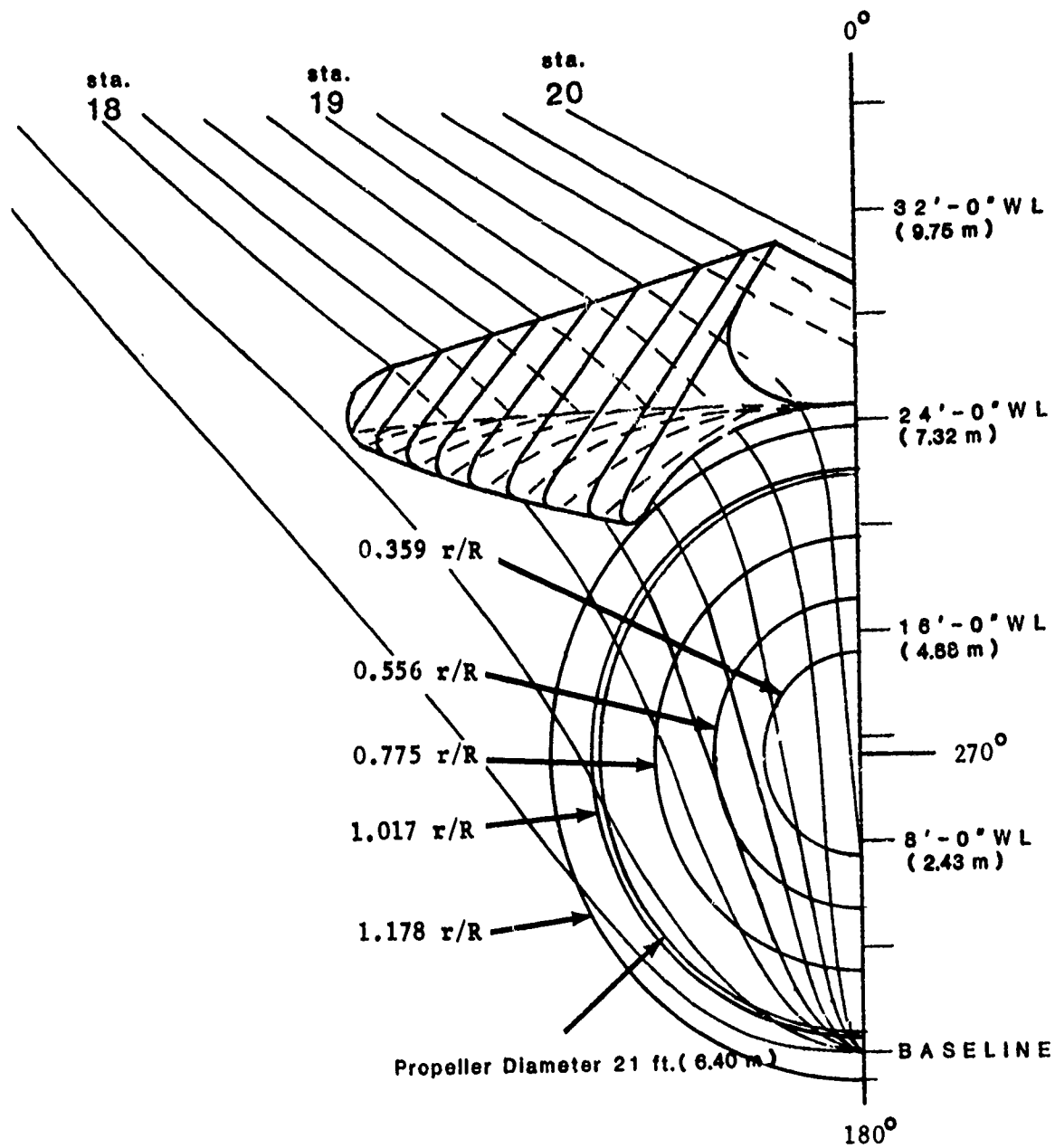


Figure 1 - Body Plan with Tunnel-fin Configuration 1 (NAVY) and Experimental Radii

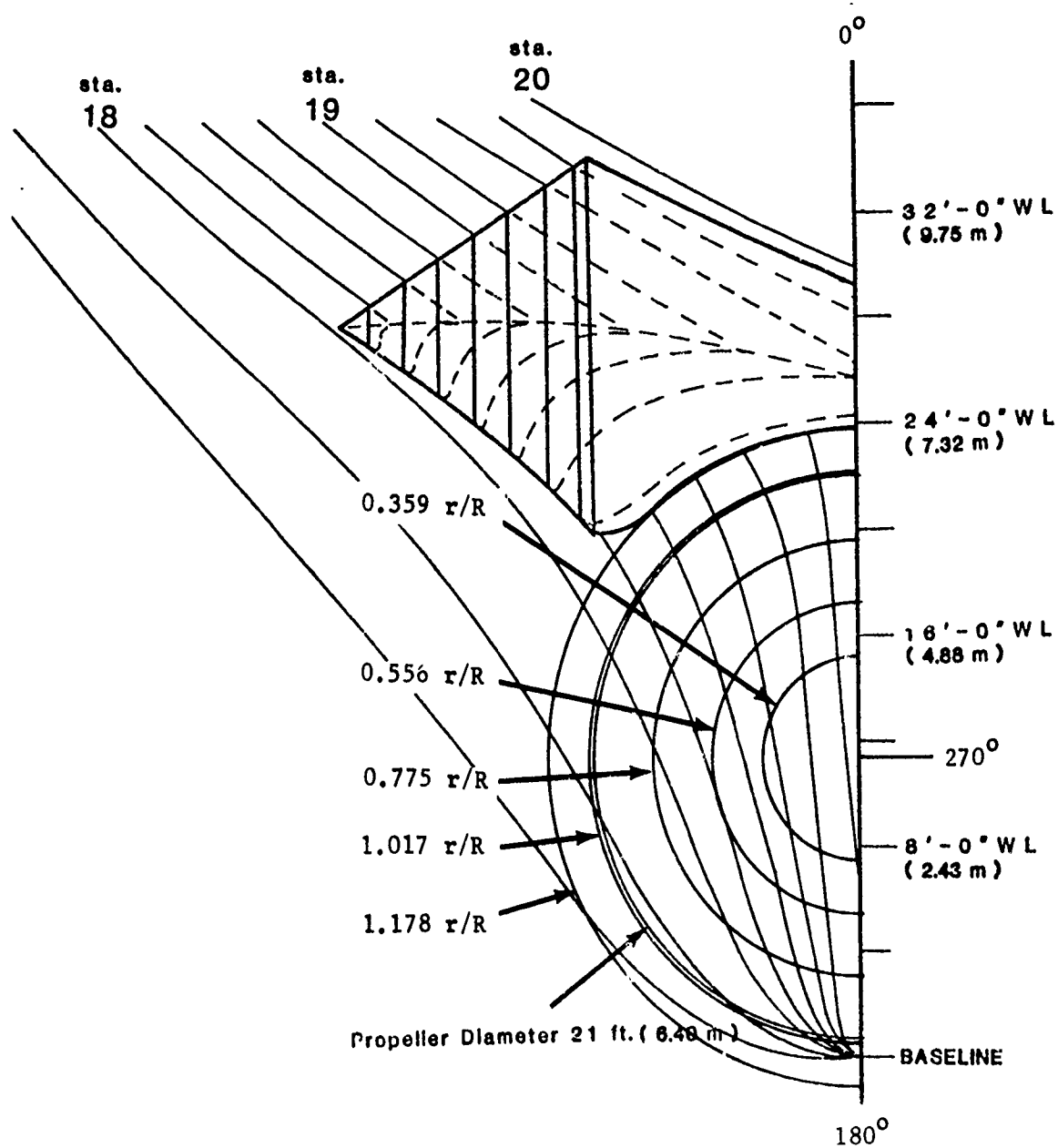


Figure 2 - Body Plan with Tunnel-fin Configuration 2 (NAVY) and Experimental Radii

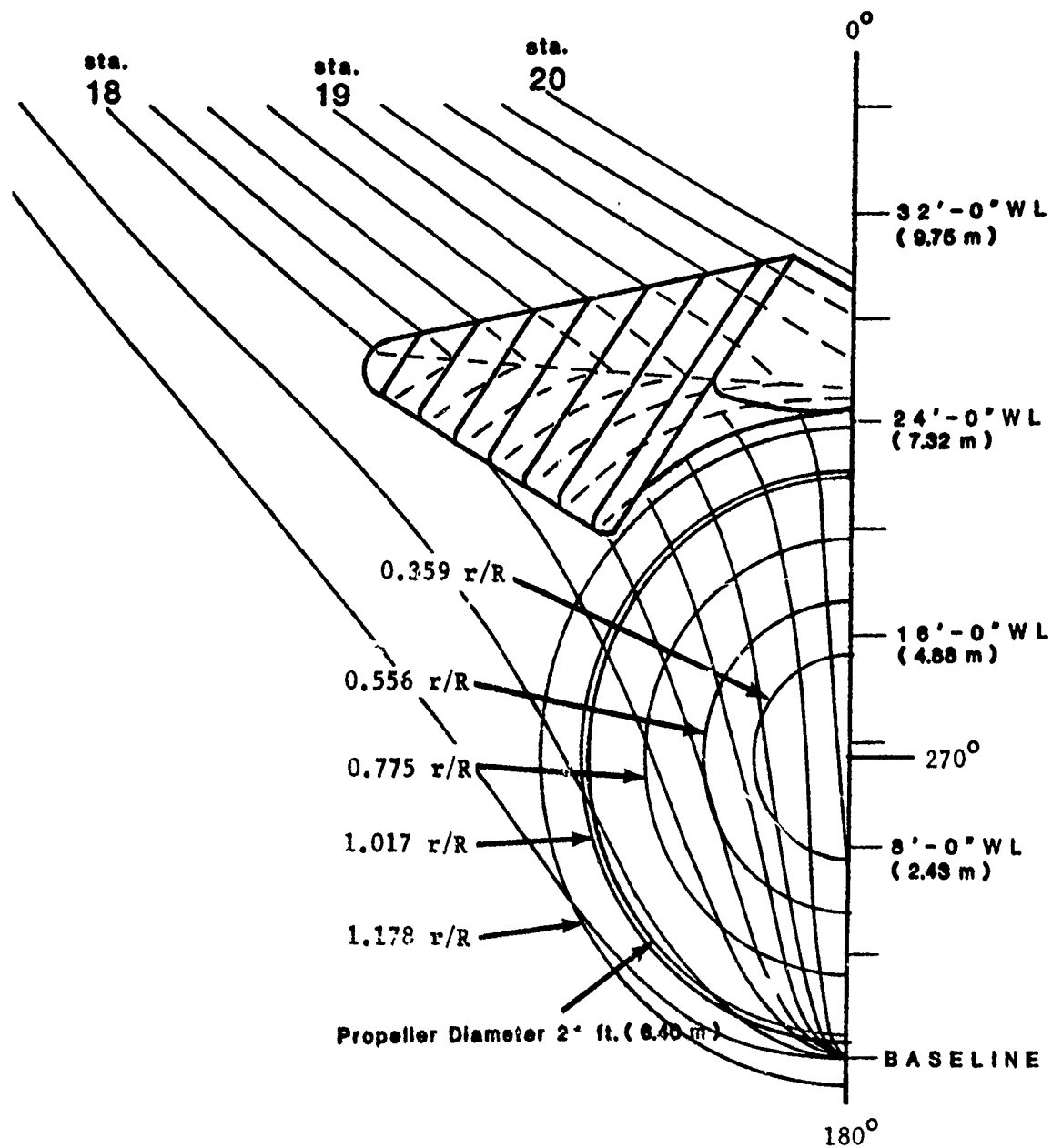


Figure 3 - Body Plan with Tunnel-fin Configuration 3 (NAVY) and Experimental Radii

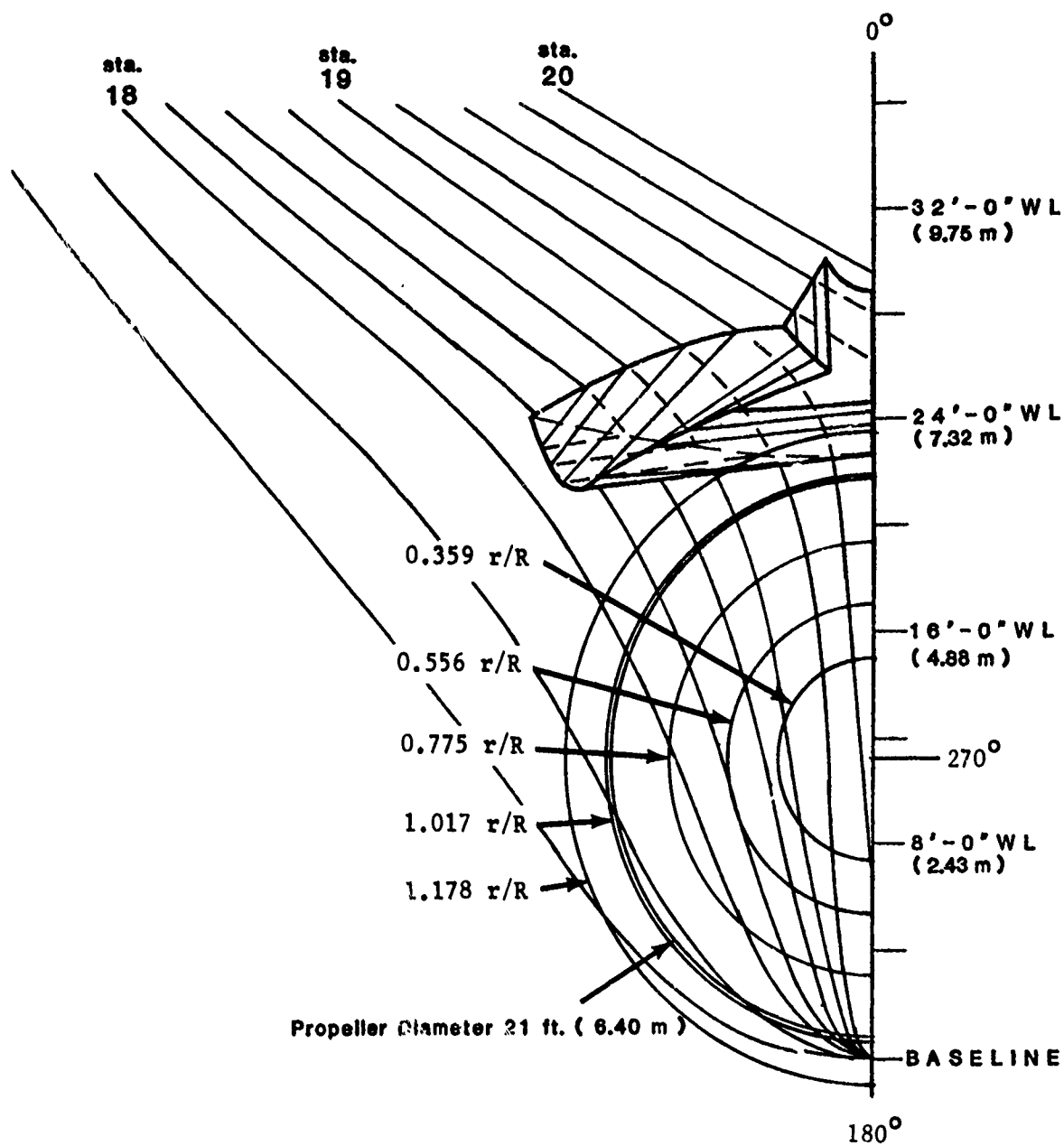


Figure 4 - Body Plan with Accelerating-fin Configuration 4 (SSPA)
and Experimental Radii

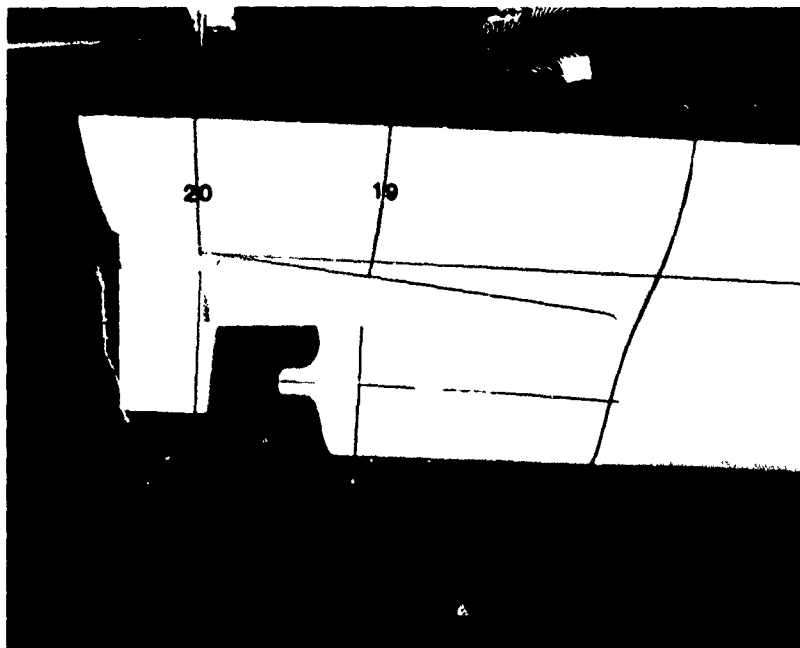


Figure 5 - Fitting Room Photographs of Tunnel-fin Configuration 1
Attached to Model

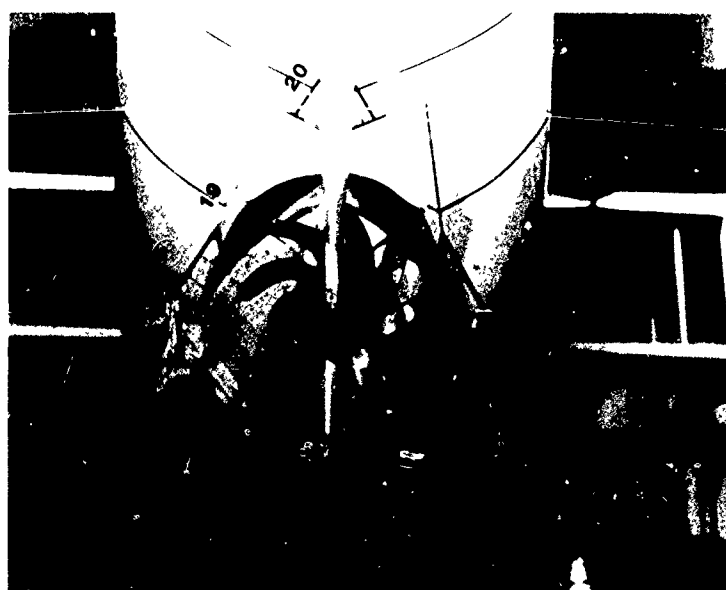
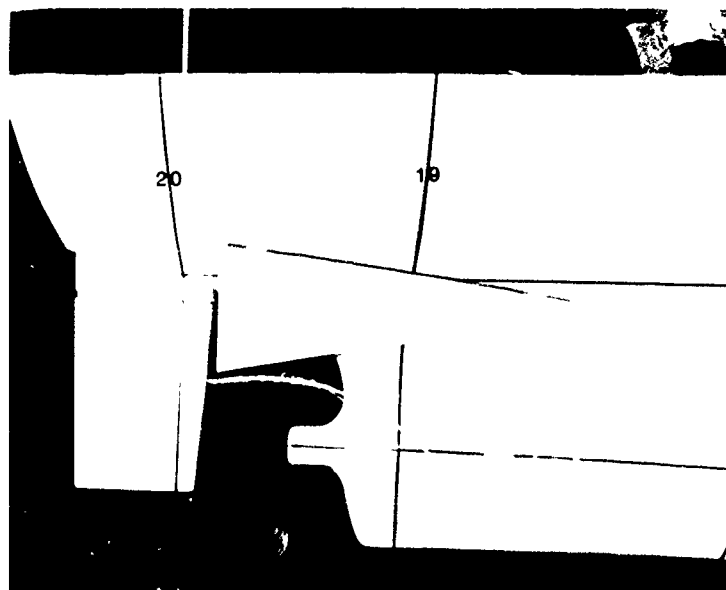


Figure 6 - Fitting Room Photographs of Tunnel-fin Configuration 2
Attached to Model

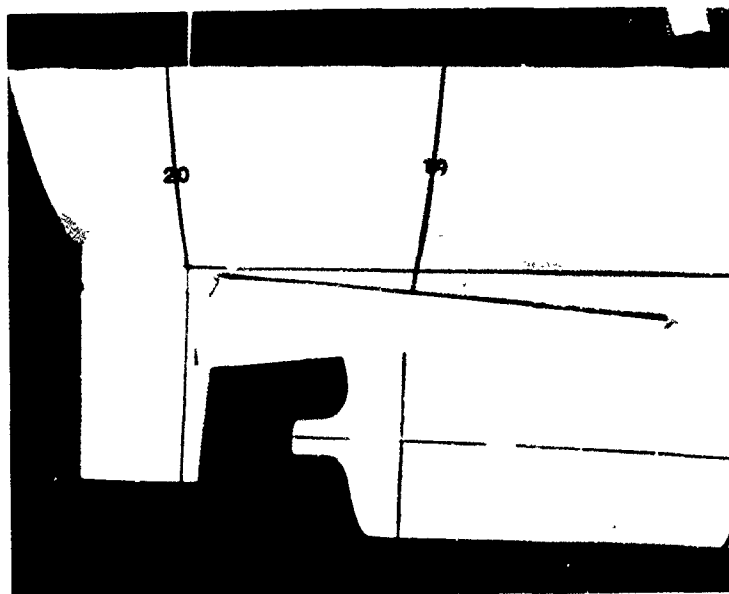


Figure 7 - Fitting Room Photographs of Tunnel-fin Configuration 3
Attached to Model



Figure 8 - Fitting Room Photographs of Accelerating-fin Configuration 4
Attached to Model



Figure 9 - Stern of Model 5326-1 with Rake Attached

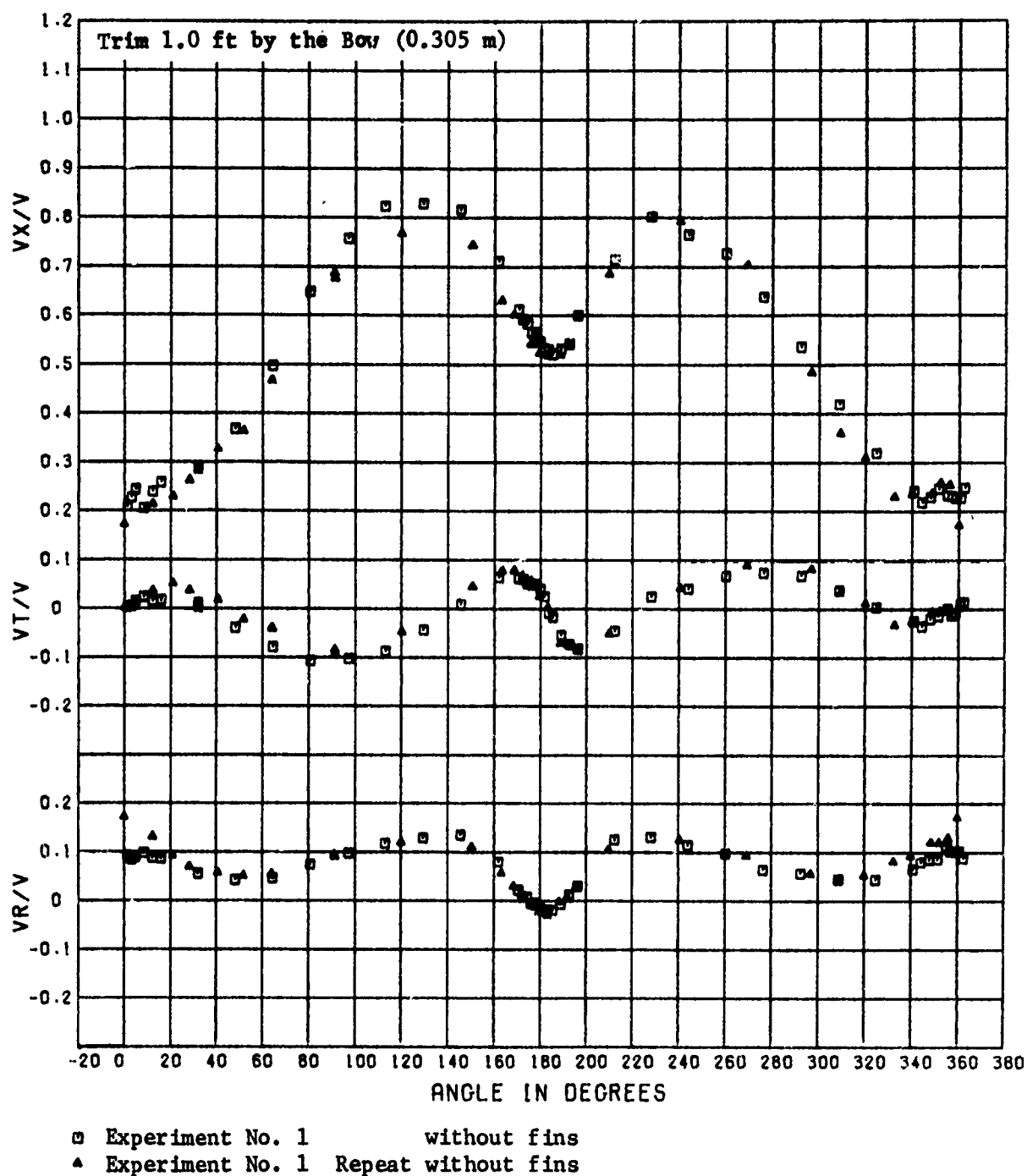


Figure 10 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios without Fins Experiment 1 (8/80) and Experiment 1 Repeat (10/80) at a Radius Ratio of 0.359. Displacement 26,390 tons (26 810 metric tons)

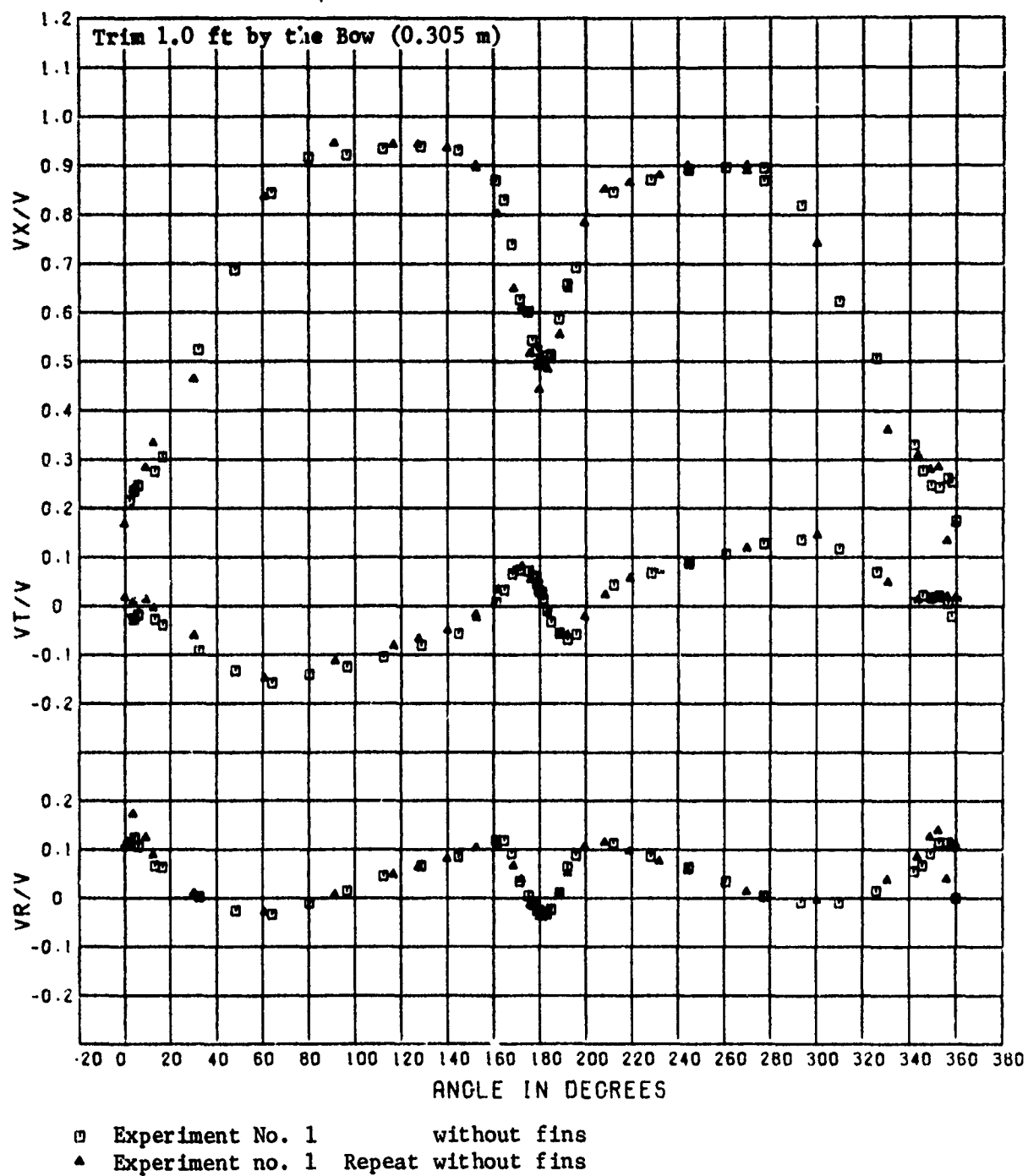


Figure 11 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios without Fins Experiment 1 (8/80) and Experiment 1 Repeat (10/80) at a Radius Ratio of 0.556. Displacement 26,390 tons (26 810 metric tons)

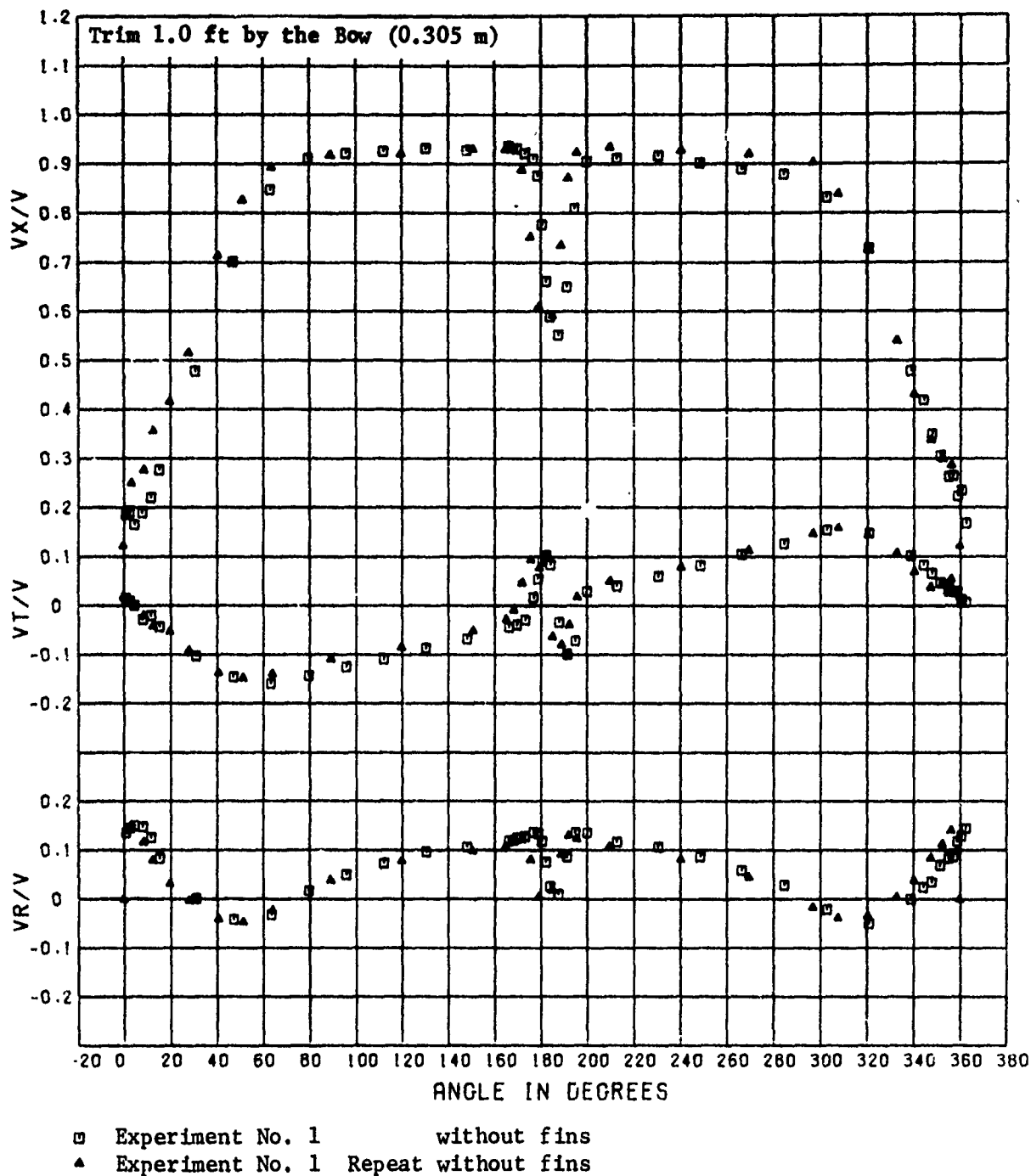


Figure 12 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios without Fins Experiment 1 (8/80) and Experiment 1 Repeat (10/80) at a Radius Ratio of 0.775. Displacement 26,390 tons (26 810 metric tons)

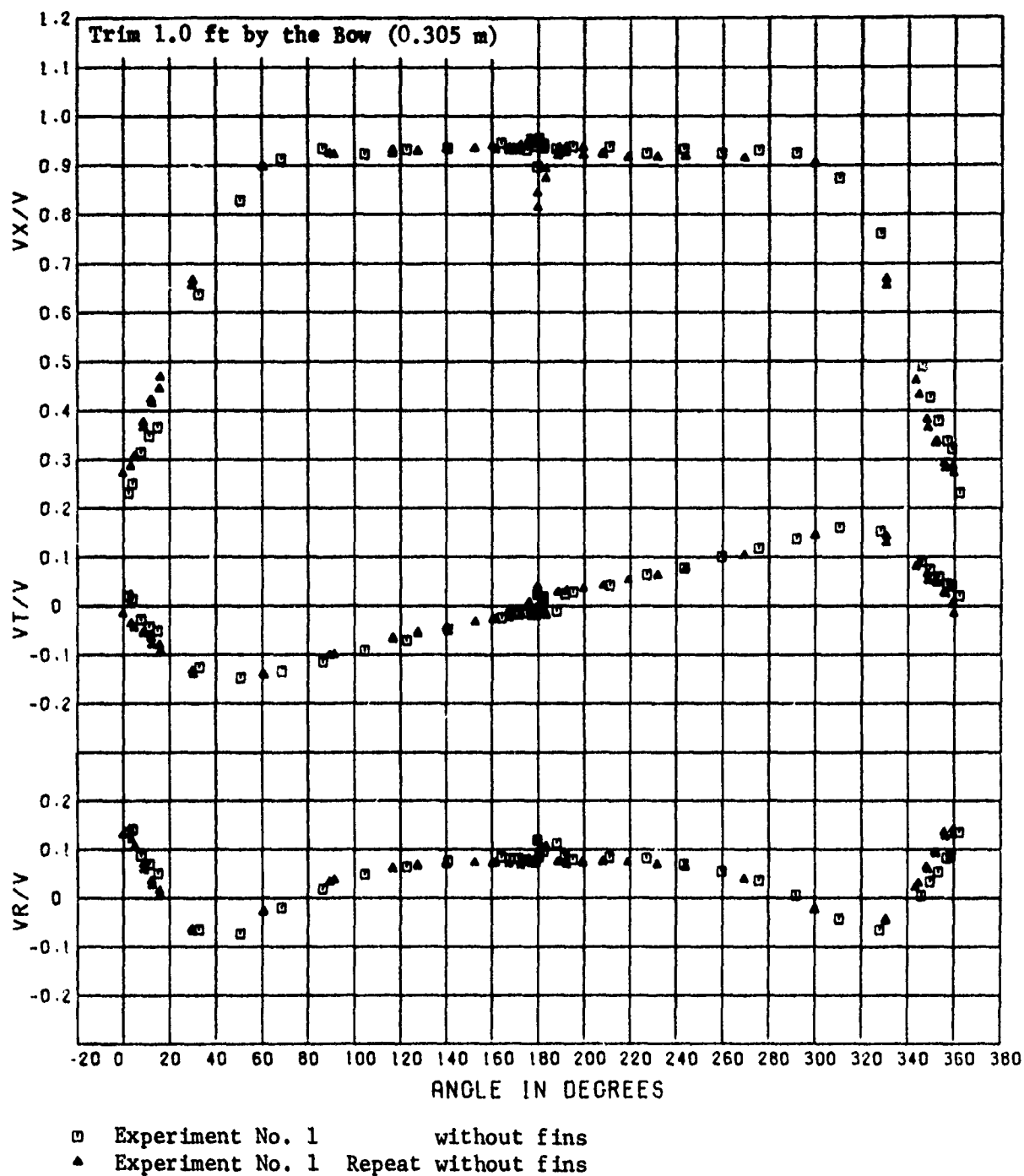


Figure 13 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios without Fins Experiment 1 (8/80) and Experiment 1 Repeat (10/80) at a Radius Ratio of 1.017. Displacement 26,390 tons (26 810 metric tons)

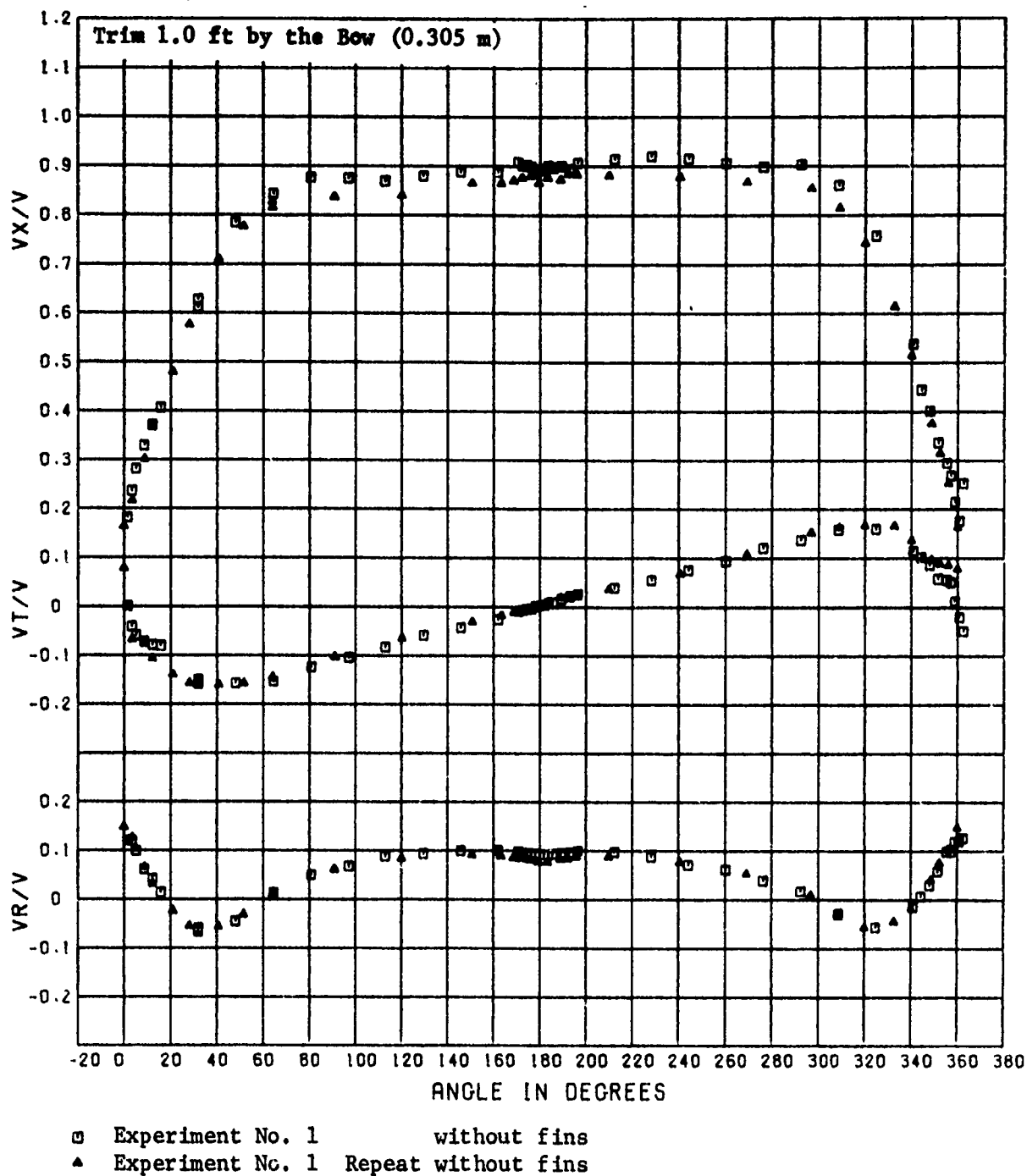


Figure 14 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios without Fins Experiment 1 (8/80) and Experiment 1 Repeat (10/80) at a Radius Ratio of 1.178. Displacement 26,390 tons (26 810 metric tons)

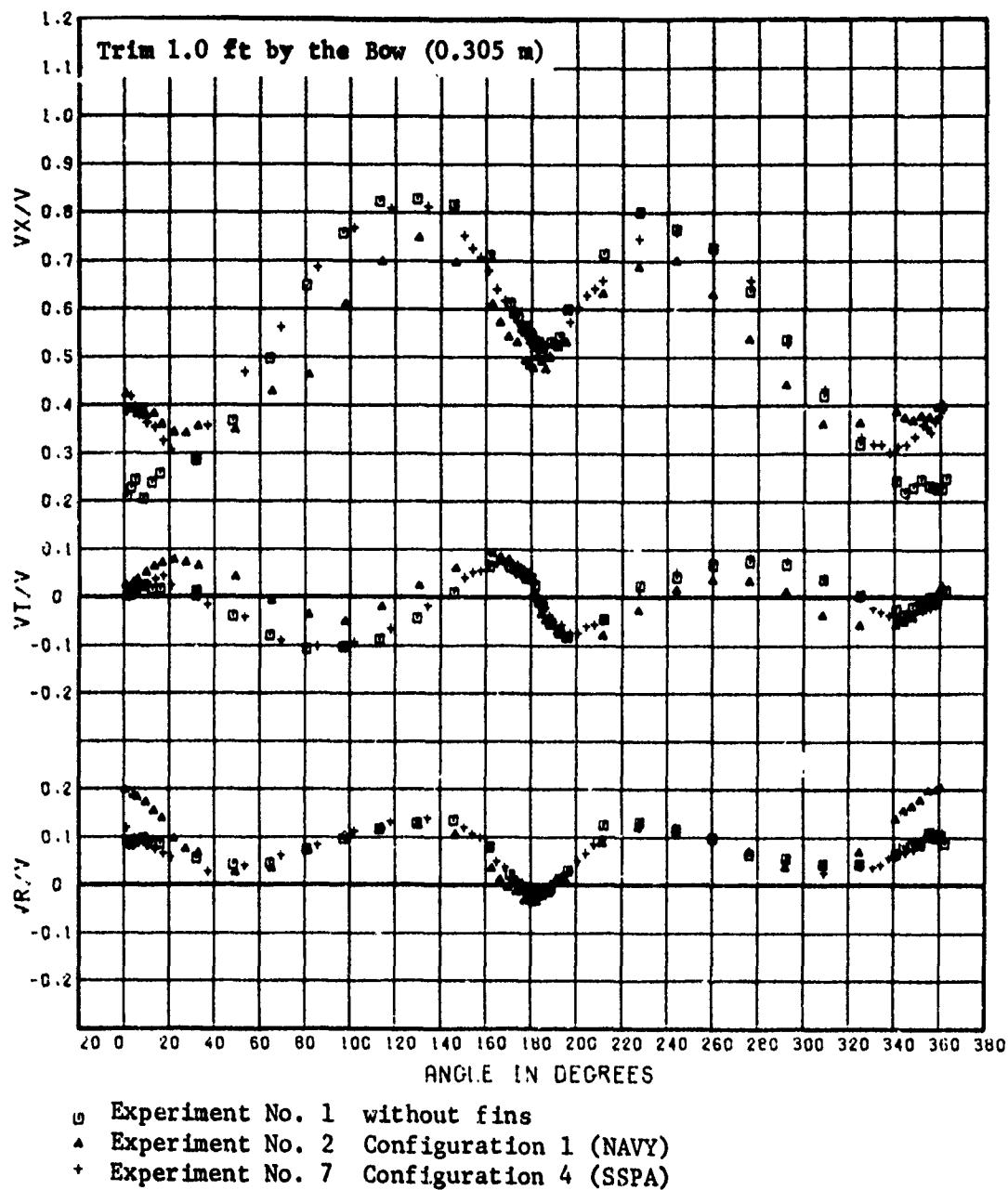


Figure 15 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 4 (SSPA) and also without Fins at a Radius Ratio of 0.359. Displacement 26,390 tons (26 810 metric tons)

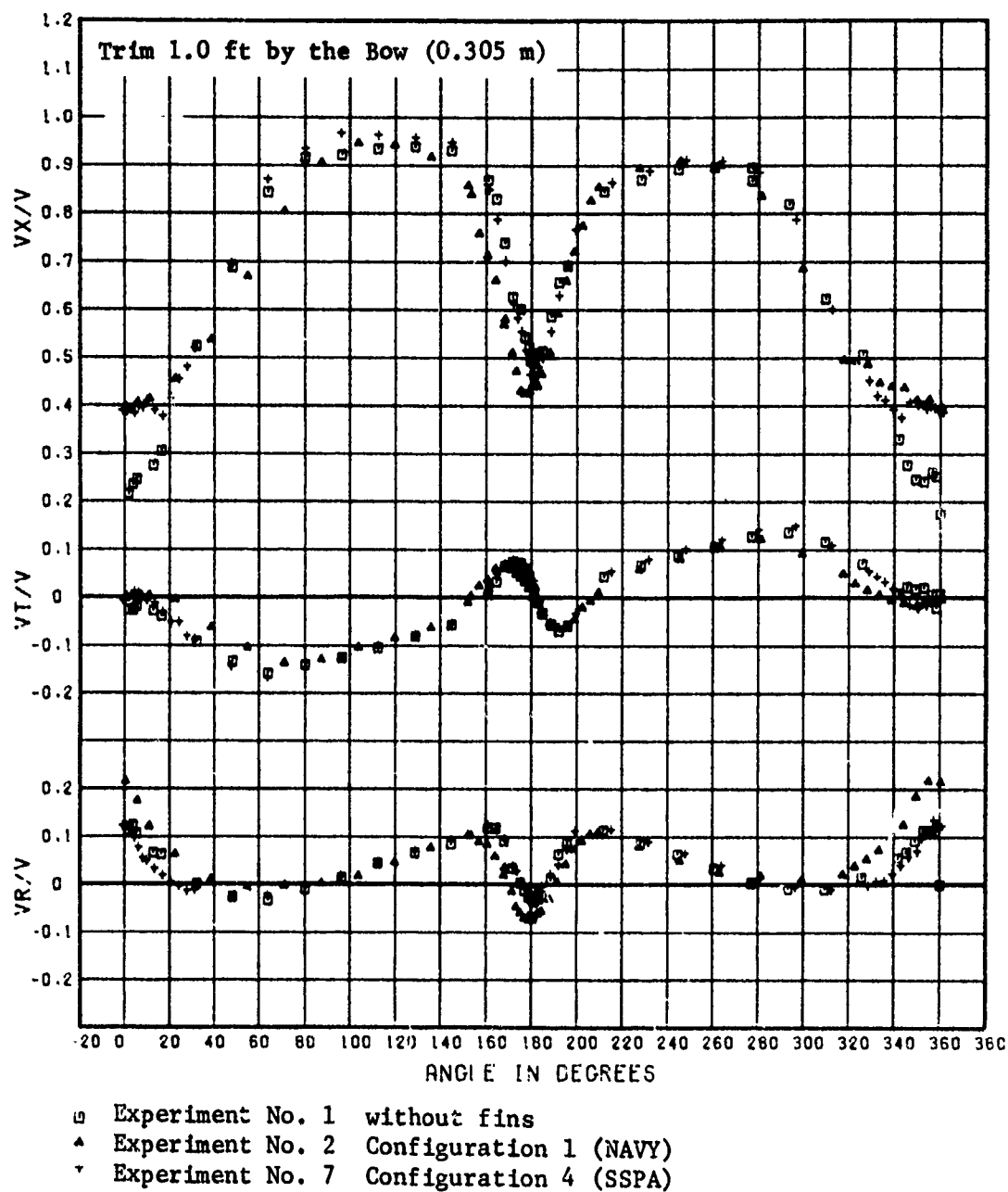


Figure 16 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 4 (SSPA) and also without Fins at a Radius Ratio of 0.556. Displacement 26,390 tons (26 810 metric tons)

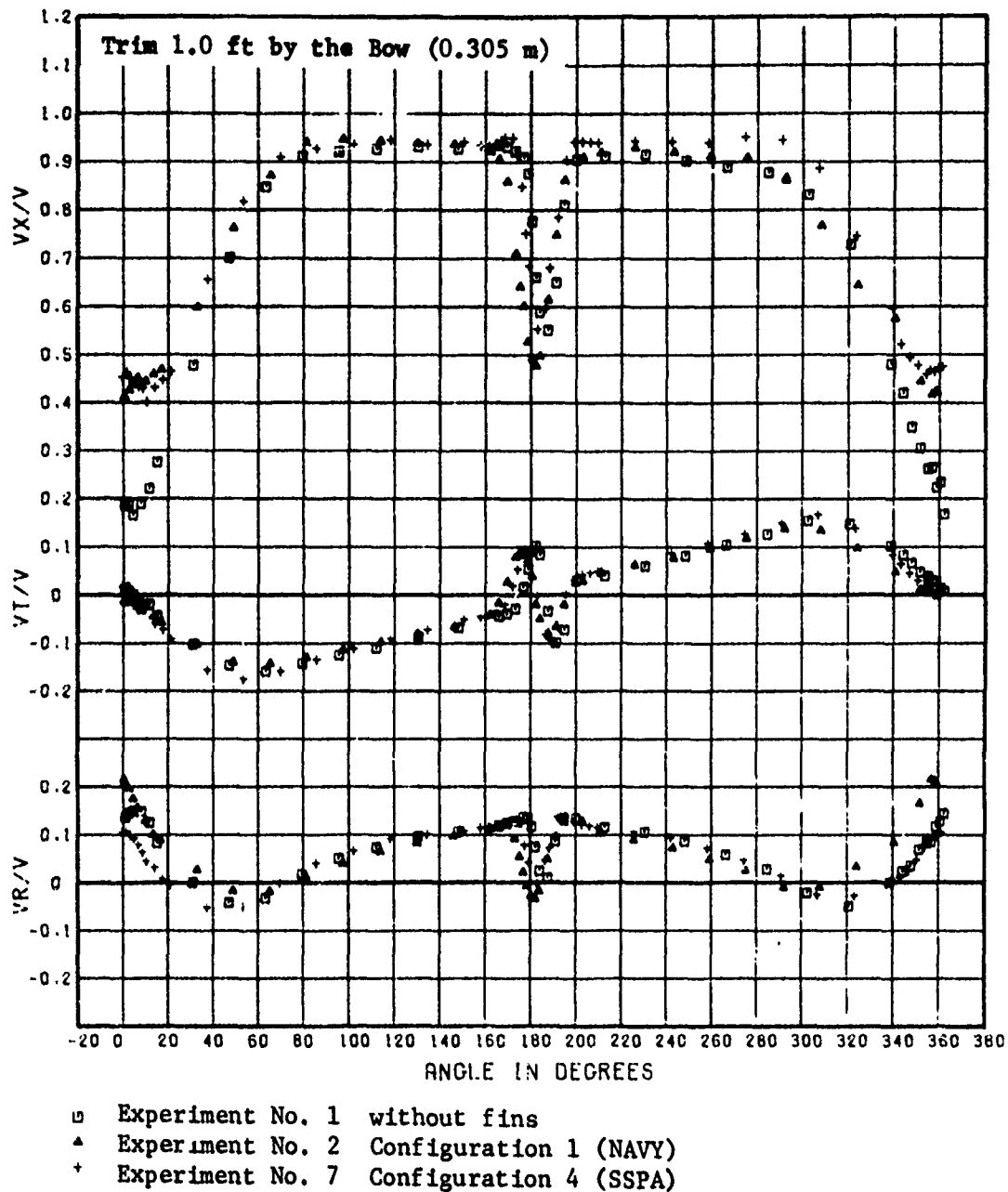


Figure 17 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 4 (SSPA) and also without Fins at a Radius Ratio of 0.775. Displacement 26,390 tons (26 810 metric tons)

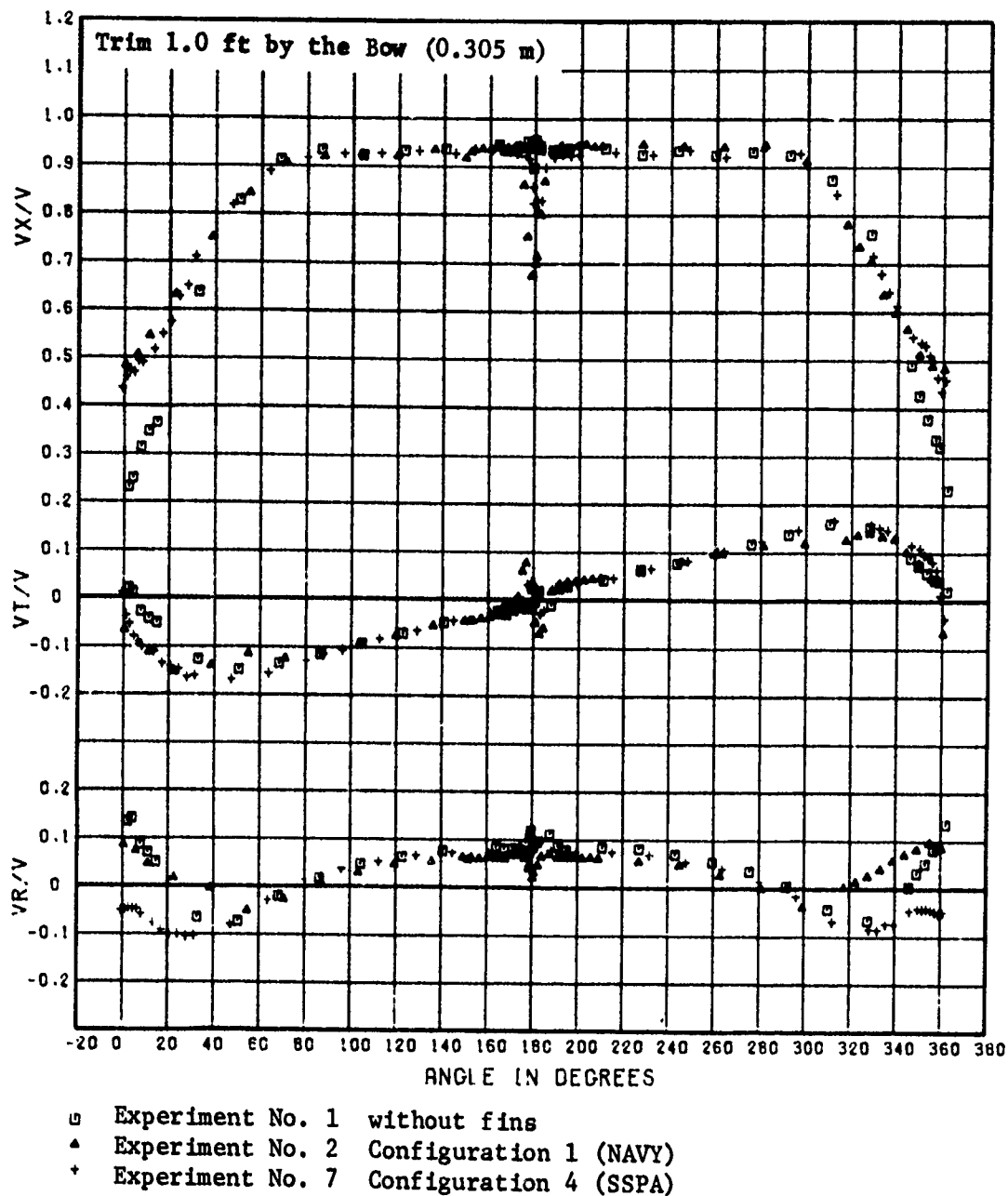


Figure 18 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 4 (SSPA) and also without Fins at a Radius Ratio of 1.017. Displacement 26,390 tons (26 810 metric tons)

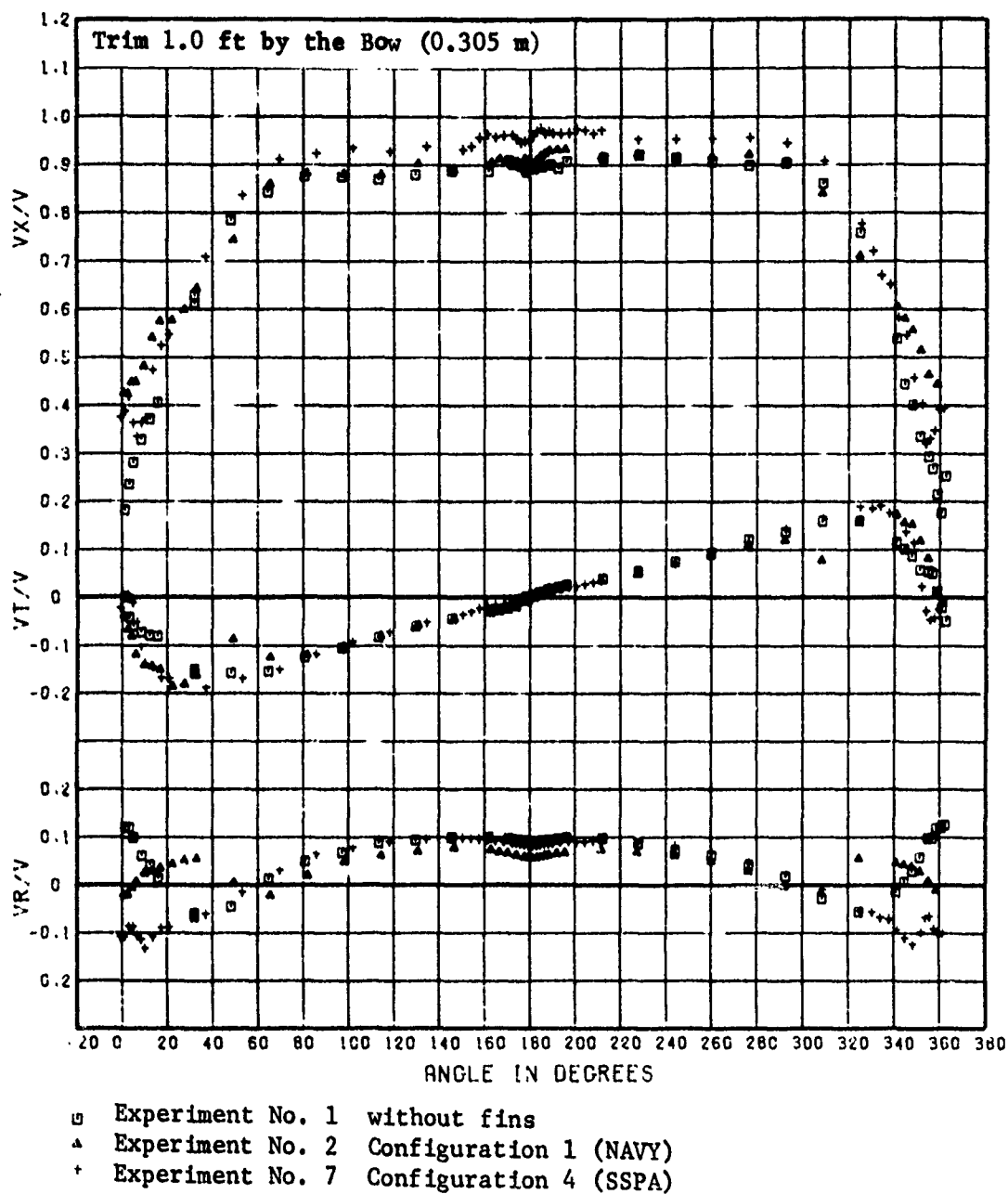


Figure 19 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 4 (SSPA) and also without Fins at a Radius Ratio of 1.178. Displacement 26,390 tons (26 810 metric tons)

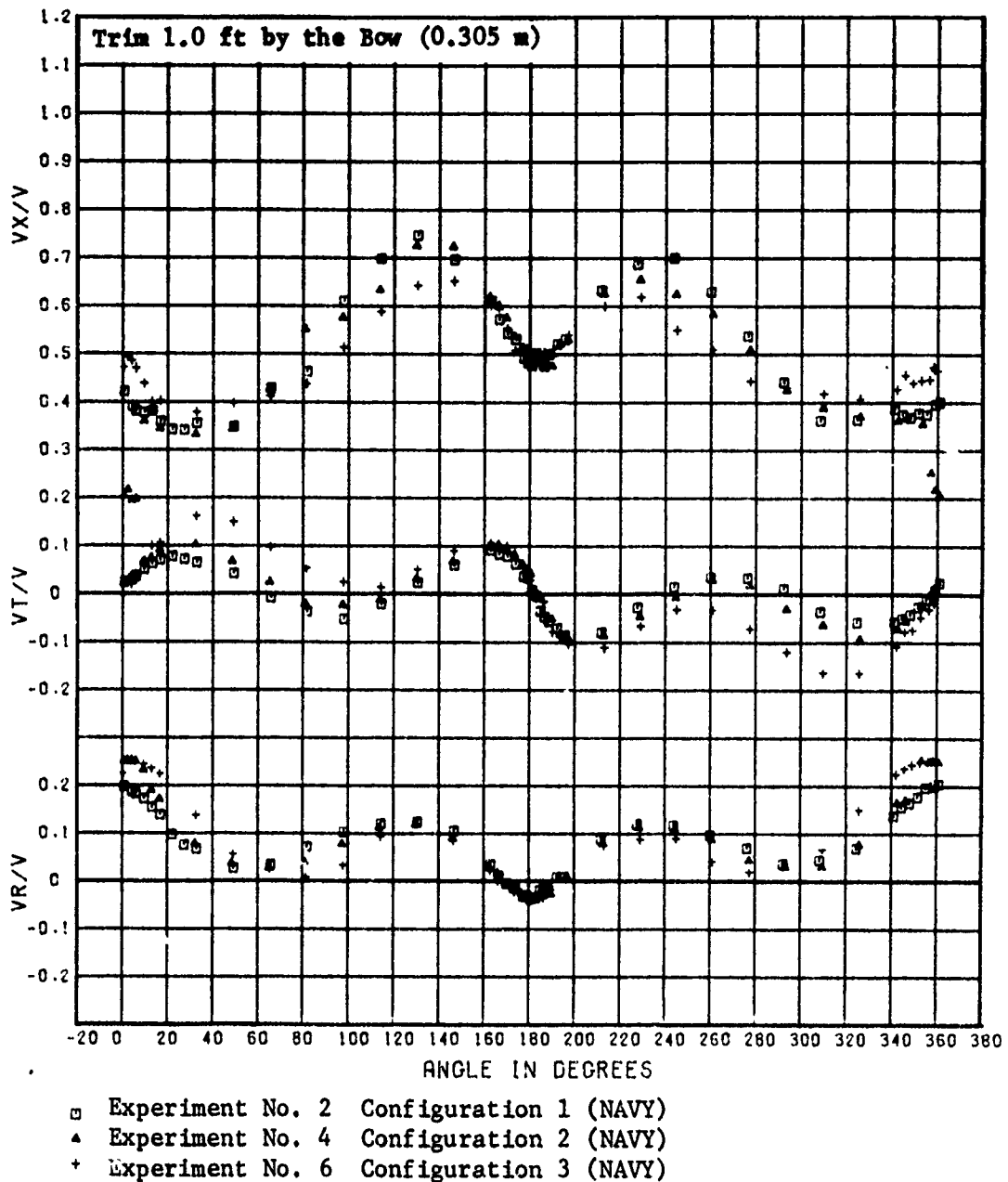


Figure 20 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 2 (NAVY) and Configuration 3 (NAVY) at a Radius Ratio of 0.359. Displacement 26,390 tons (26 810 metric tons)

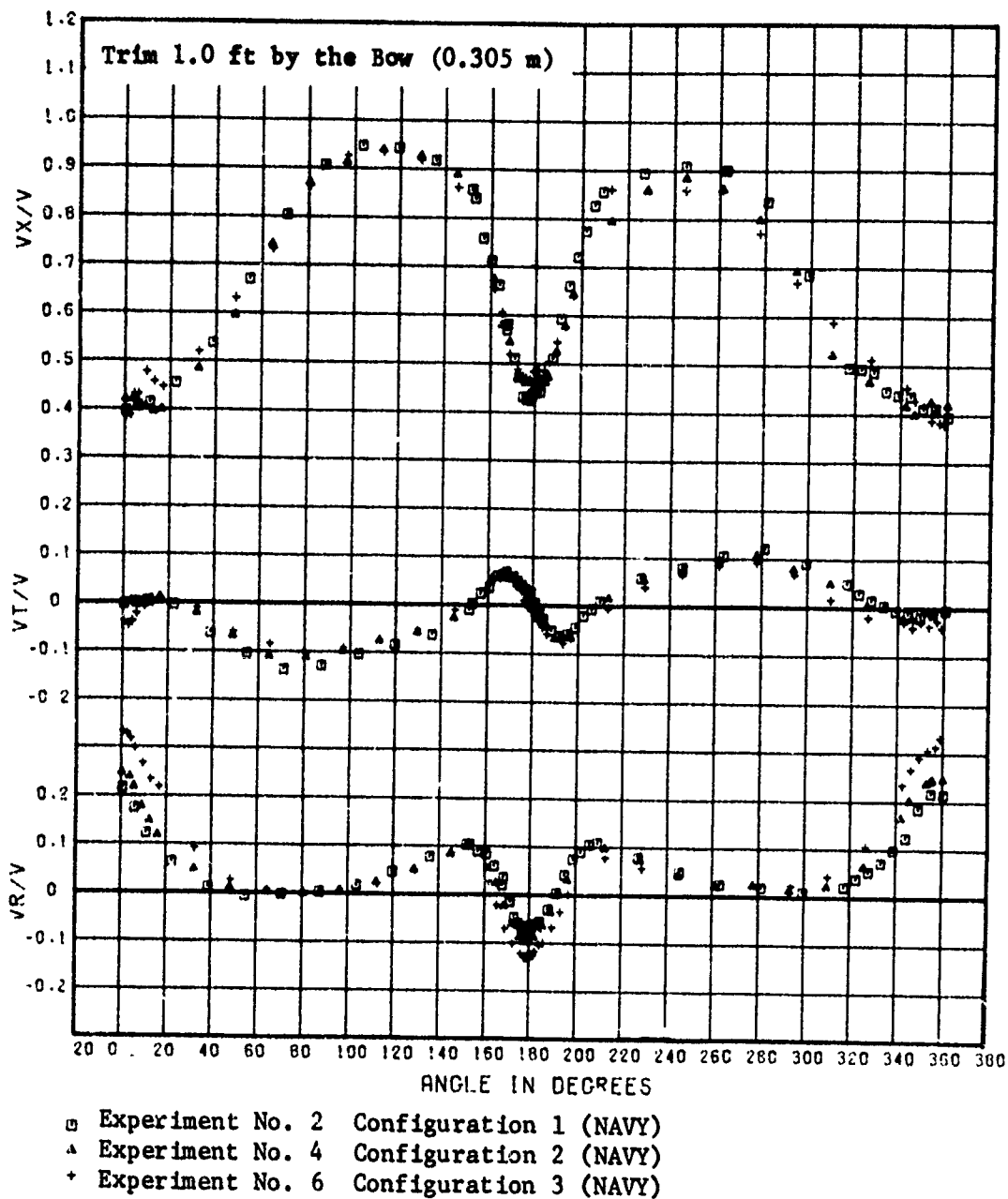


Figure 21 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 2 (NAVY) and Configuration 3 (NAVY) at a Radius Ratio of 0.556. Displacement 26,390 tons (26 810 metric tons)

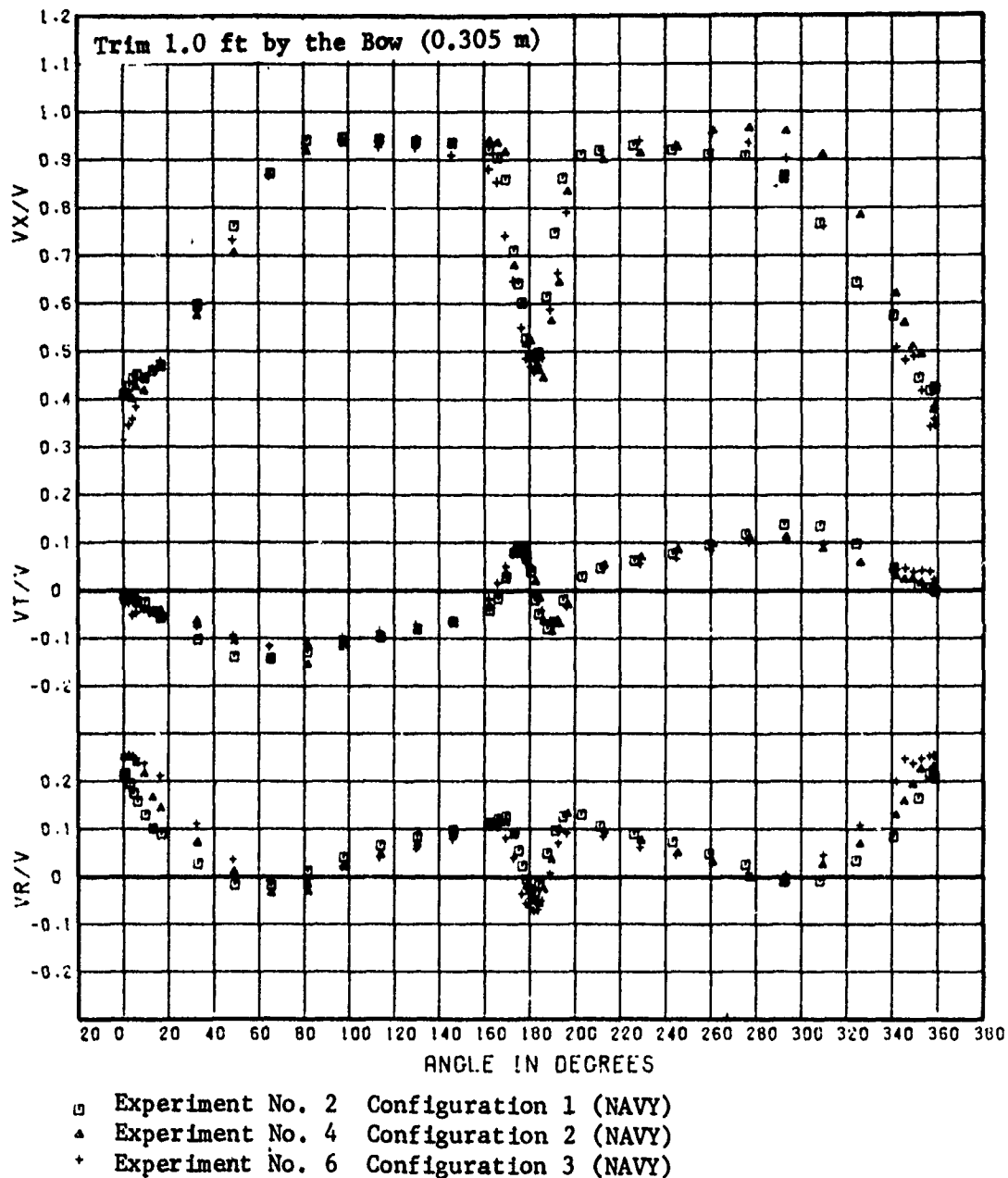


Figure 22 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 2 (NAVY) and Configuration 3 (NAVY) at a Radius Ratio of 0.775. Displacement 26,390 tons (26 810 metric tons)

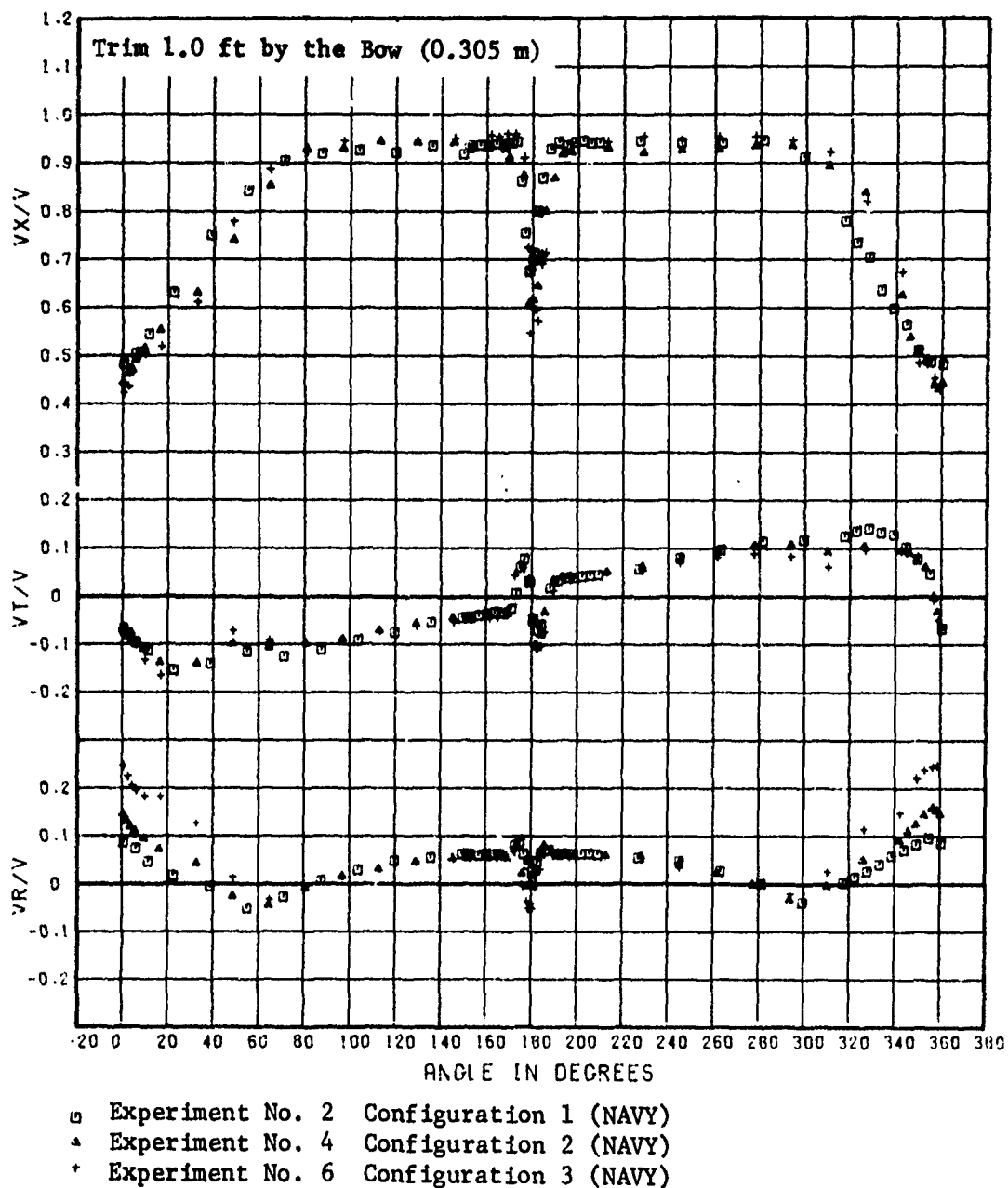


Figure 23 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 2 (NAVY) and Configuration 3 (NAVY) at a Radius Ratio of 1.017. Displacement 26,390 tons (26 810 metric tons)

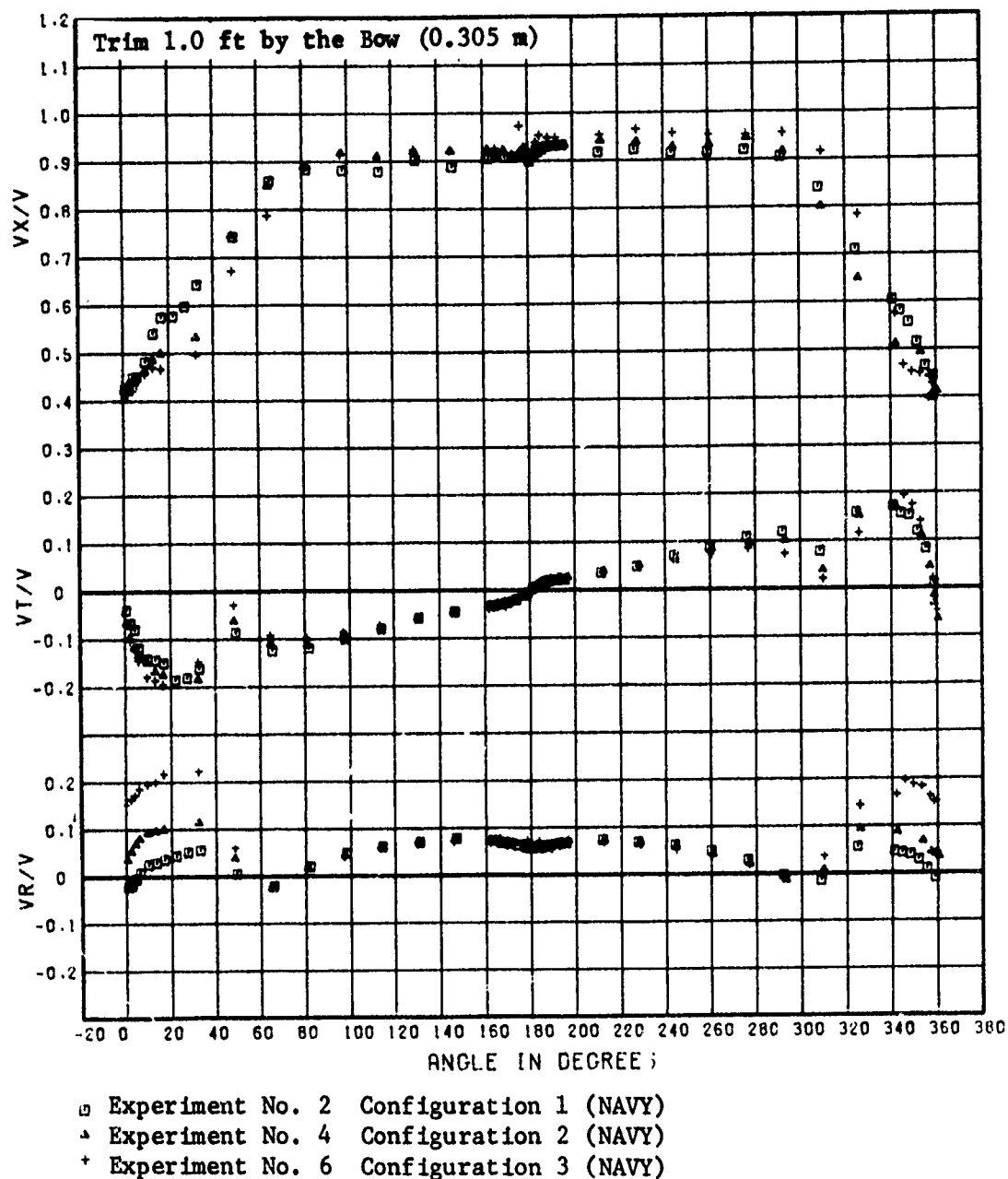


Figure 24 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY), Configuration 2 (NAVY) and Configuration 3 (NAVY) at a Radius Ratio of 1.178 Displacement 26,390 tons (26 810 metric tons)

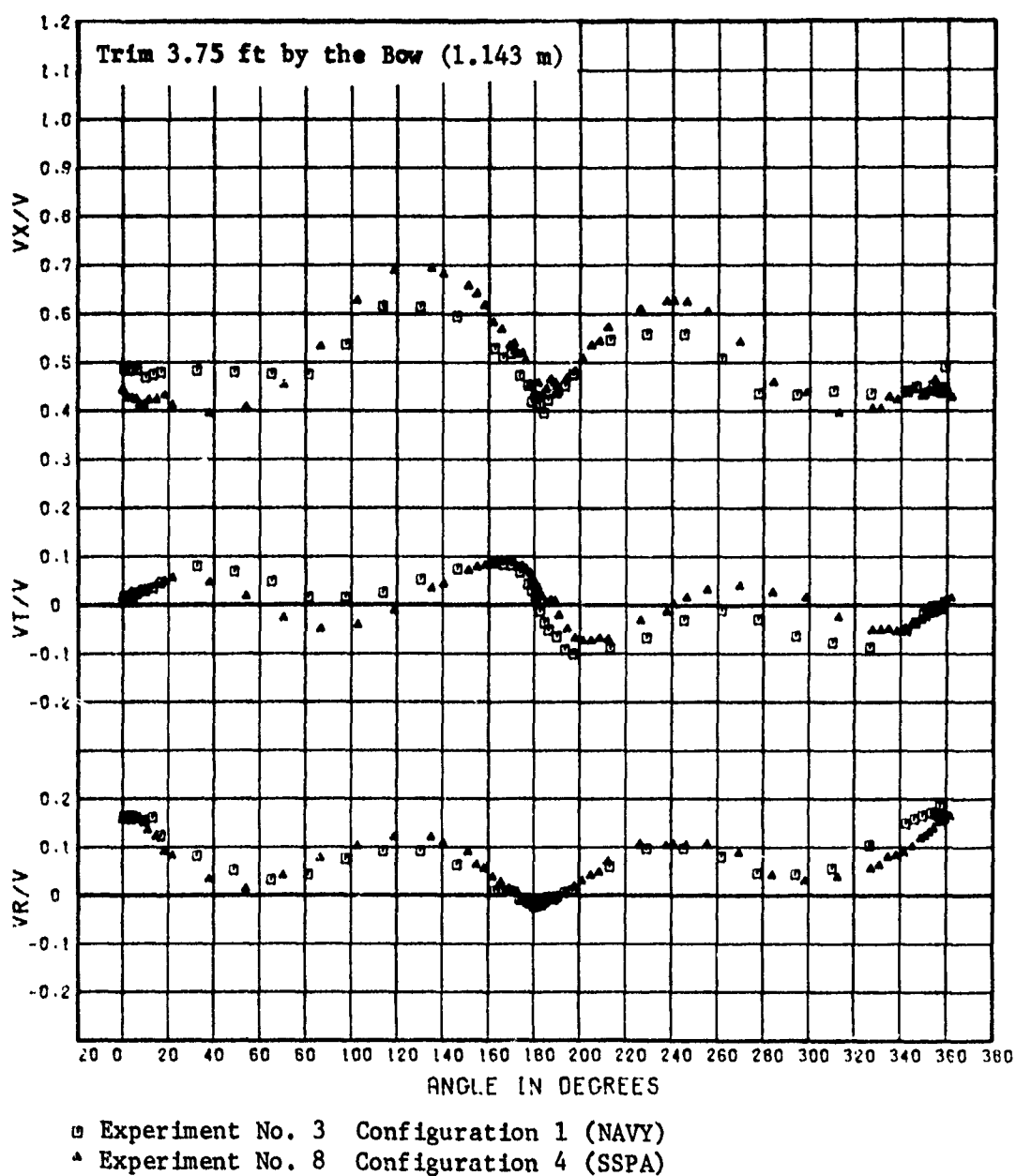


Figure 25 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY) and Configuration 4 (SSPA) at a Radius Ratio of 0.359. Displacement 17,270 tons (17 550 metric tons)

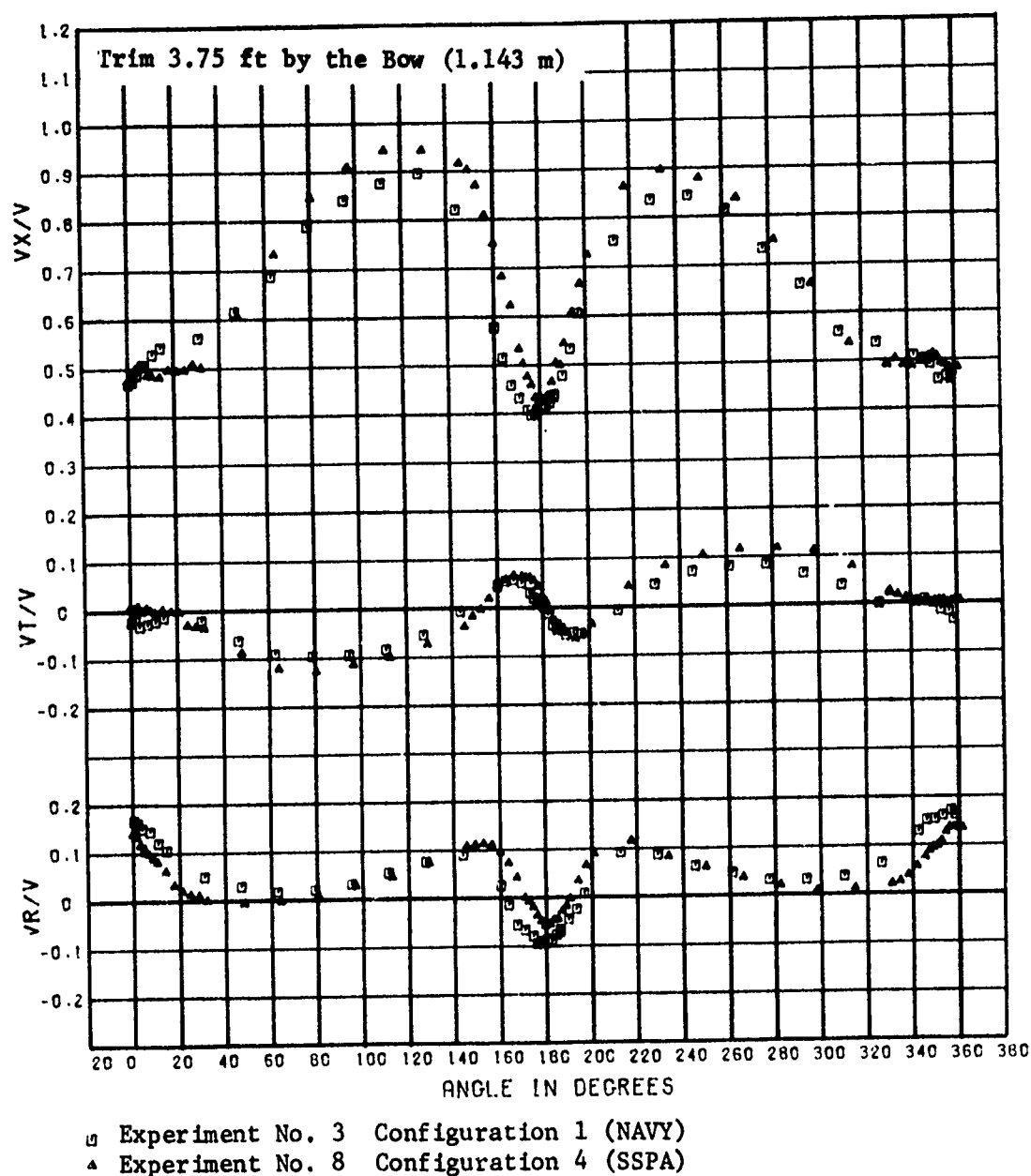


Figure 26 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY) and Configuration 4 (SSPA) at a Radius Ratio of 0.556. Displacement 17,270 tons (17 550 metric tons)

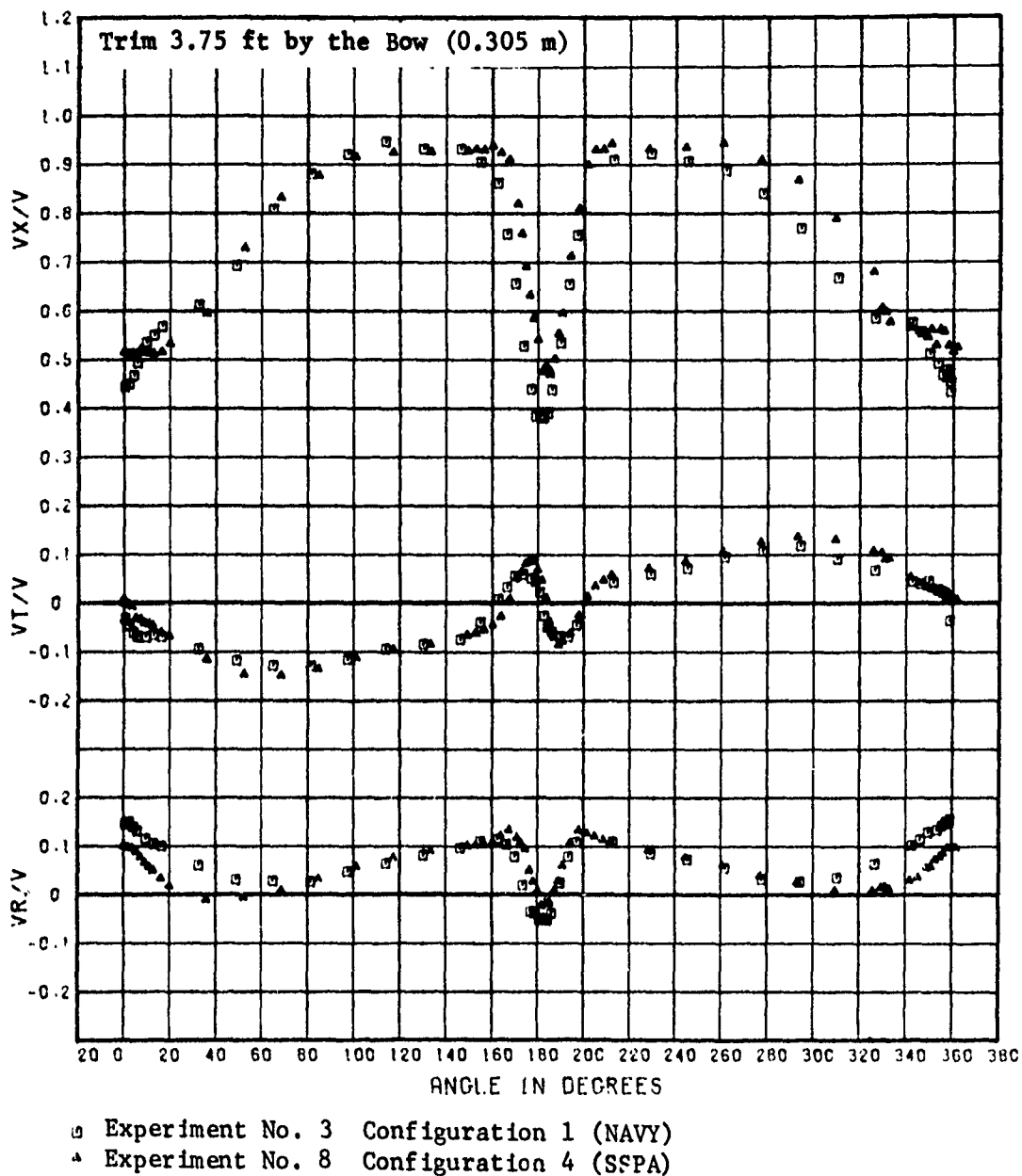


Figure 27 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY) and Configuration 4 (SSPA) at a Radius Ratio of 0.775. Displacement 17,270 tons (17 550 metric tons)

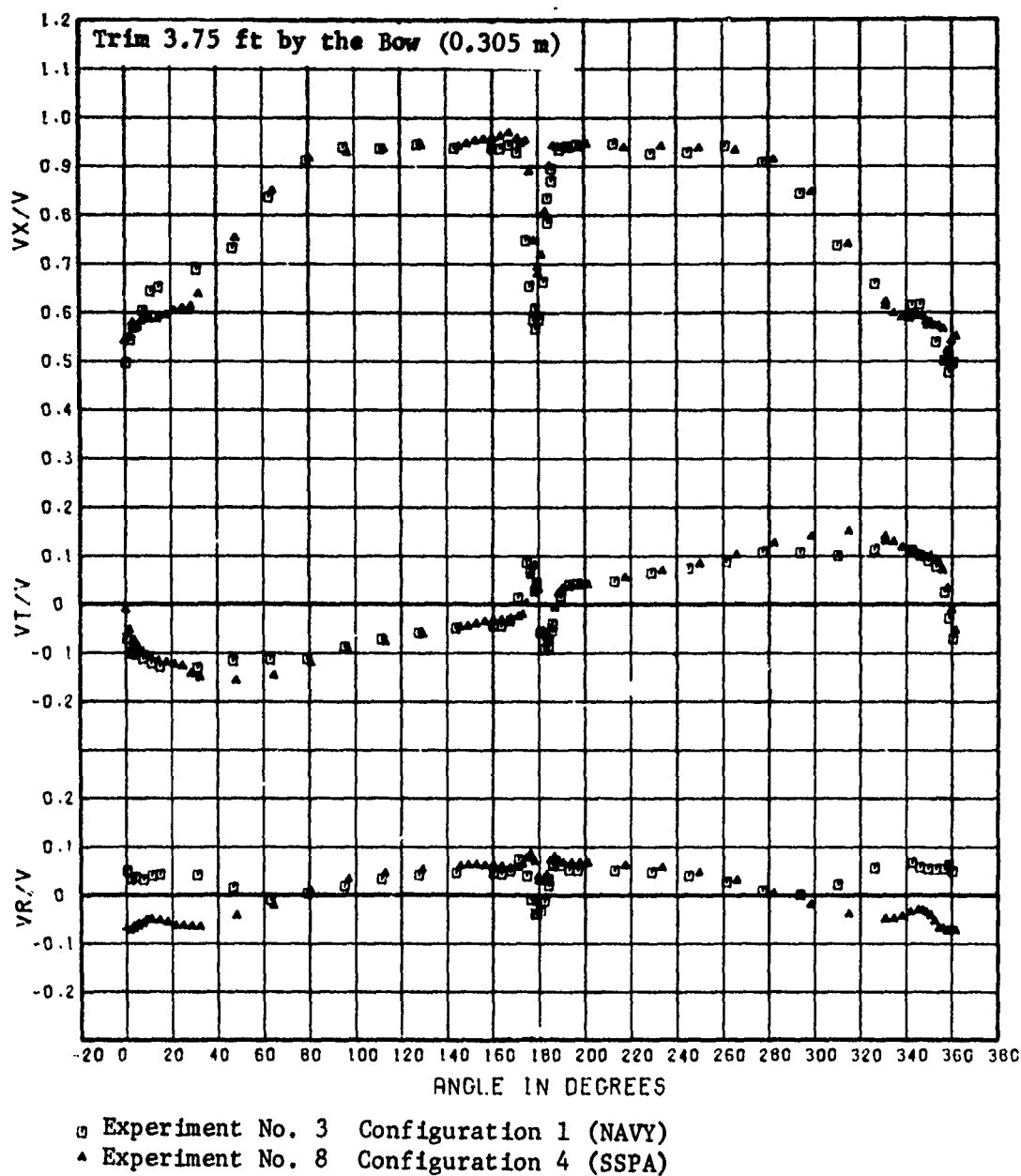


Figure 28 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 1 (NAVY) and Configuration 4 (SSPA) at a Radius Ratio of 1.017. Displacement 17,270 tons (17 550 metric tons)

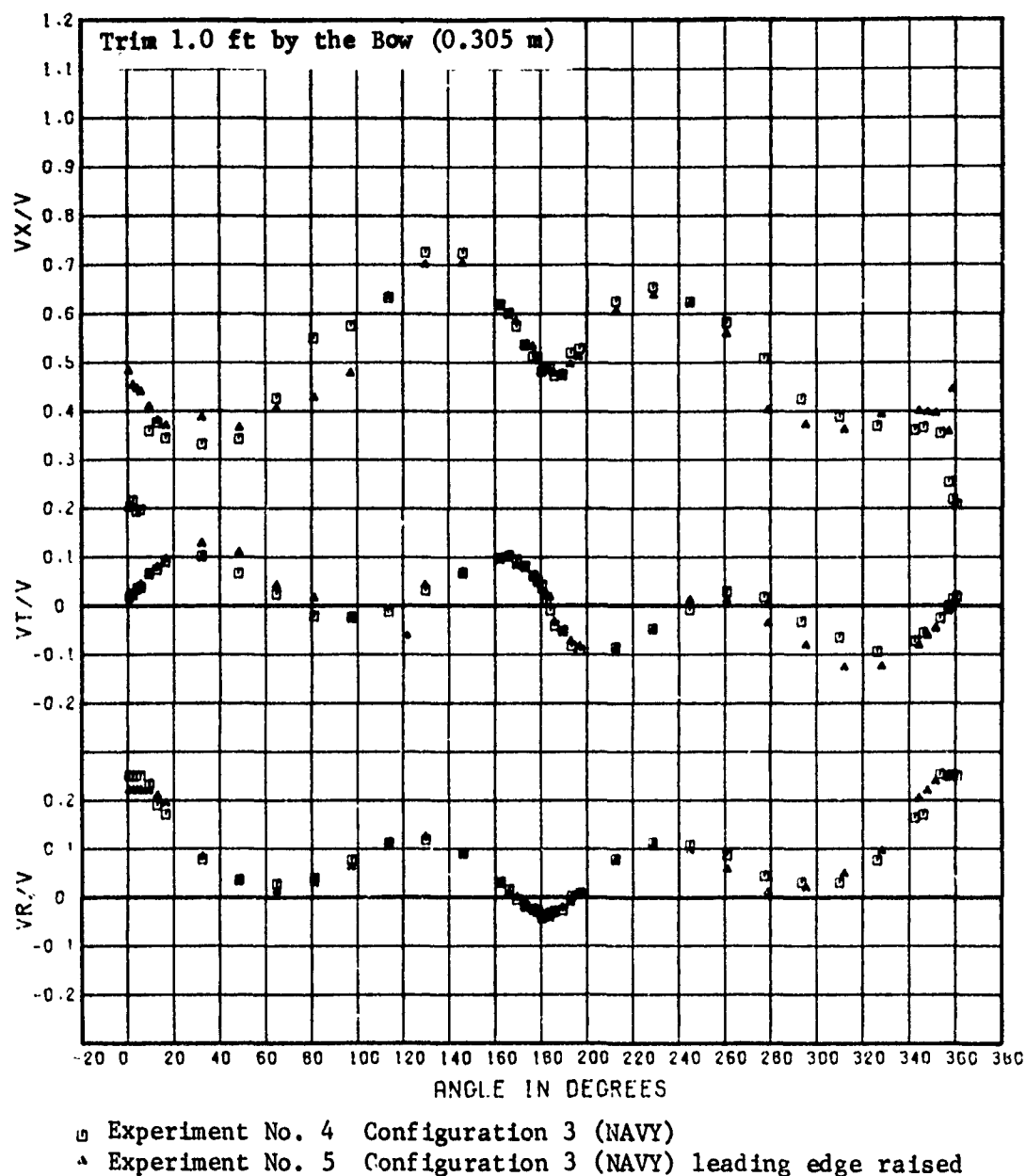
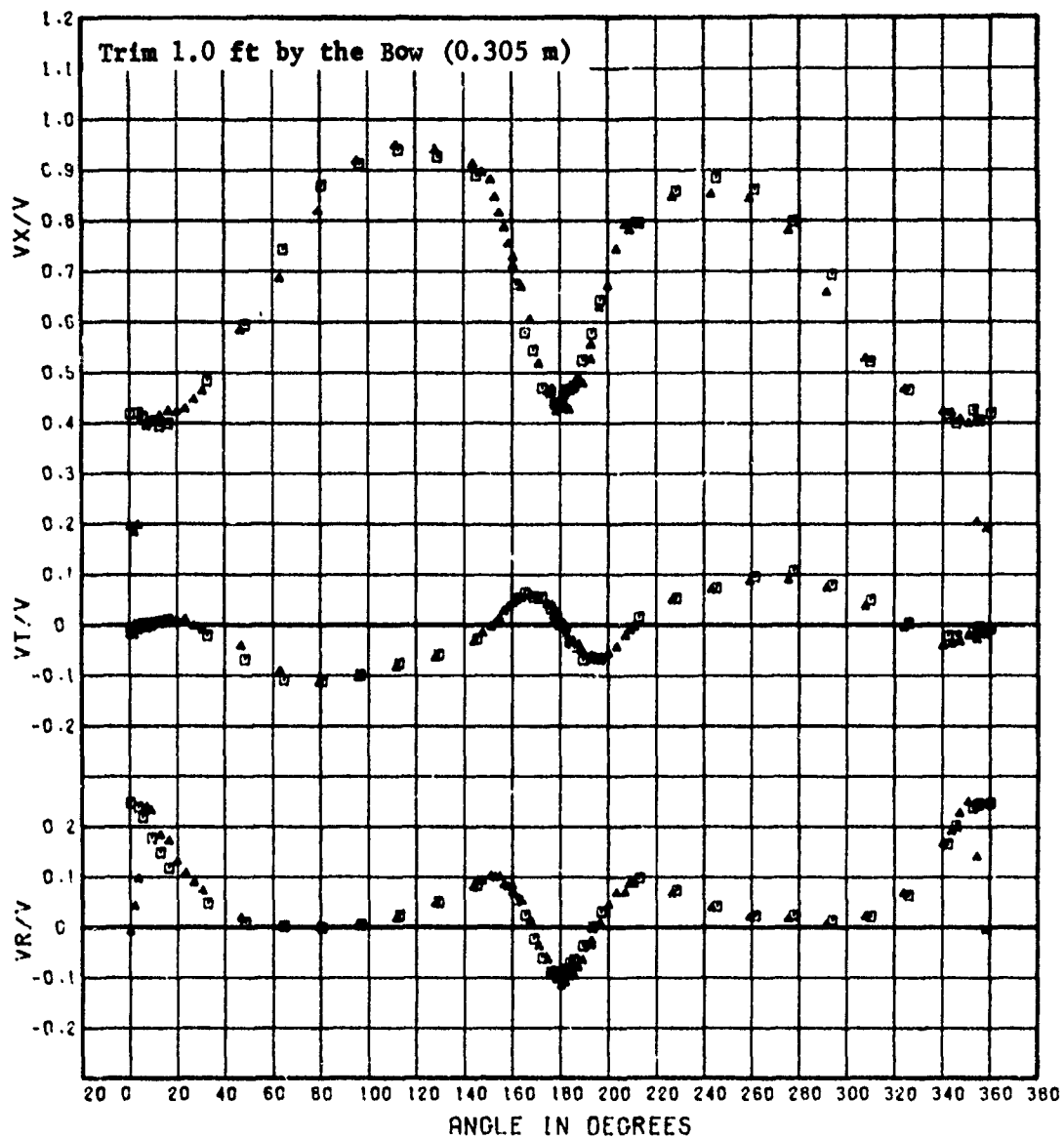


Figure 29 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 3 (NAVY) and Configuration 3 (NAVY) Leading Edge Raised 2.5 Degrees at a Radius Ratio of 0.359. Displacement 26,390 tons (26 810 metric tons)



- Experiment No. 4 Configuration 3 (NAVY)
- △ Experiment No. 5 Configuration 3 (NAVY) leading edge raised

Figure 30 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 3 (NAVY) and Configuration 3 (NAVY) Leading Edge Raised 2.5 Degrees at a Radius Ratio of 0.556. Displacement 26,390 tons (26 810 metric tons)

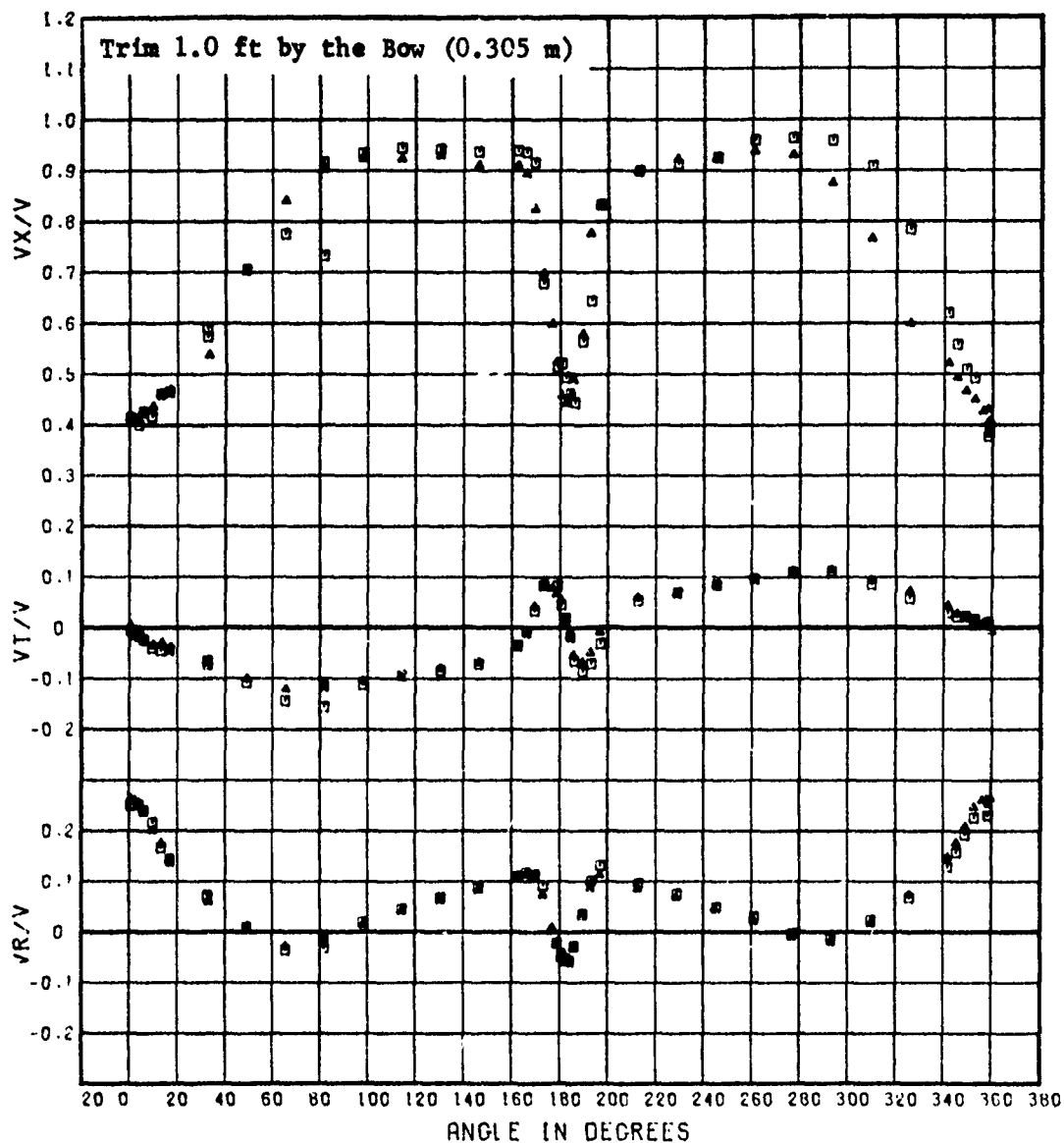


Figure 31 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 3 (NAVY) and Configuration 3 (NAVY) Leading Edge Raised 2.5 Degrees at a Radius Ratio of 0.775. Displacement 26,390 tons (26 810 metric tons)

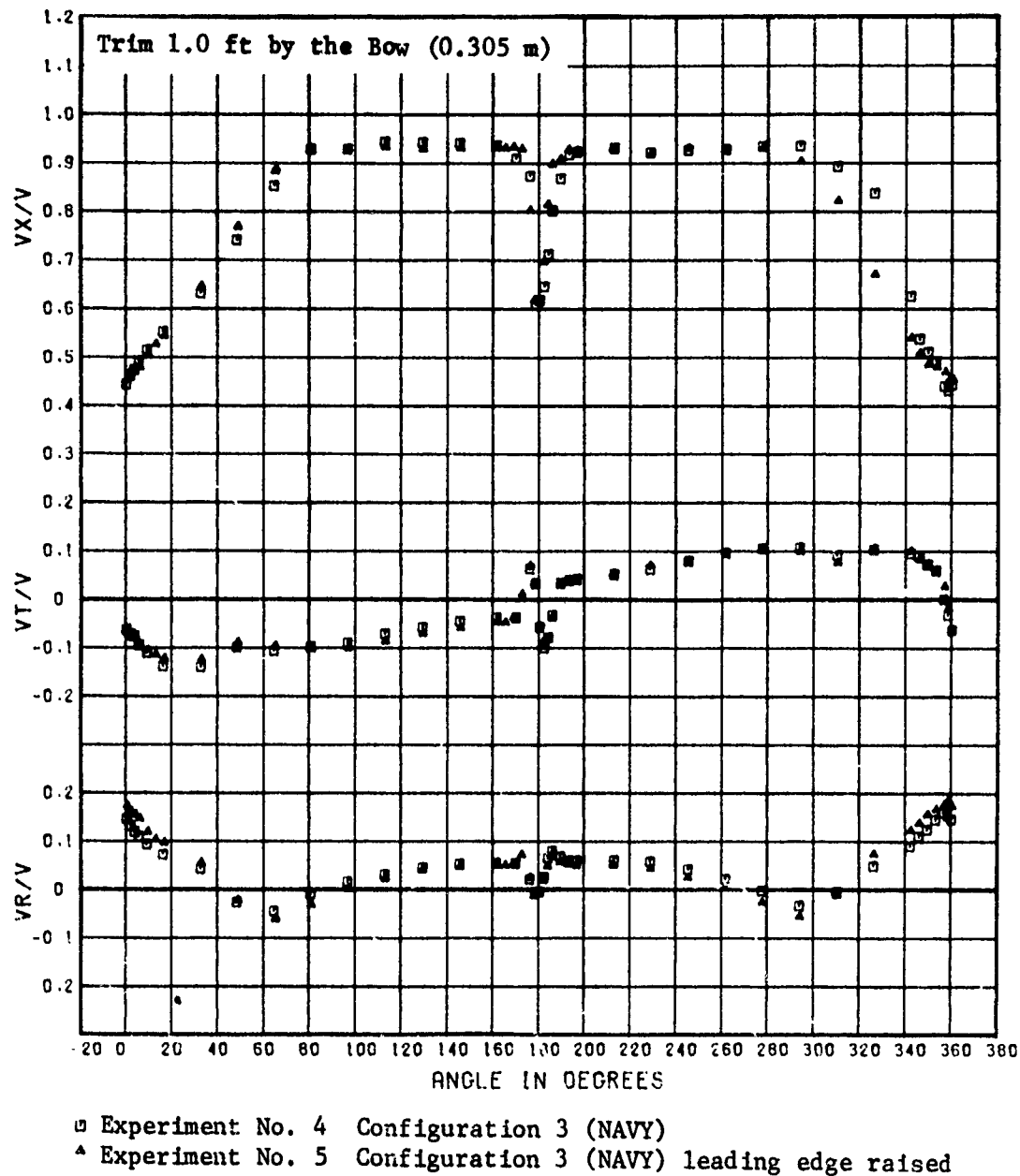


Figure 32 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 3 (NAVY) and Configuration 3 (NAVY) Leading Edge Raised 2.5 Degrees at a Radius Ratio of 1.017. Displacement 26,390 tons (26 810 metric tons)

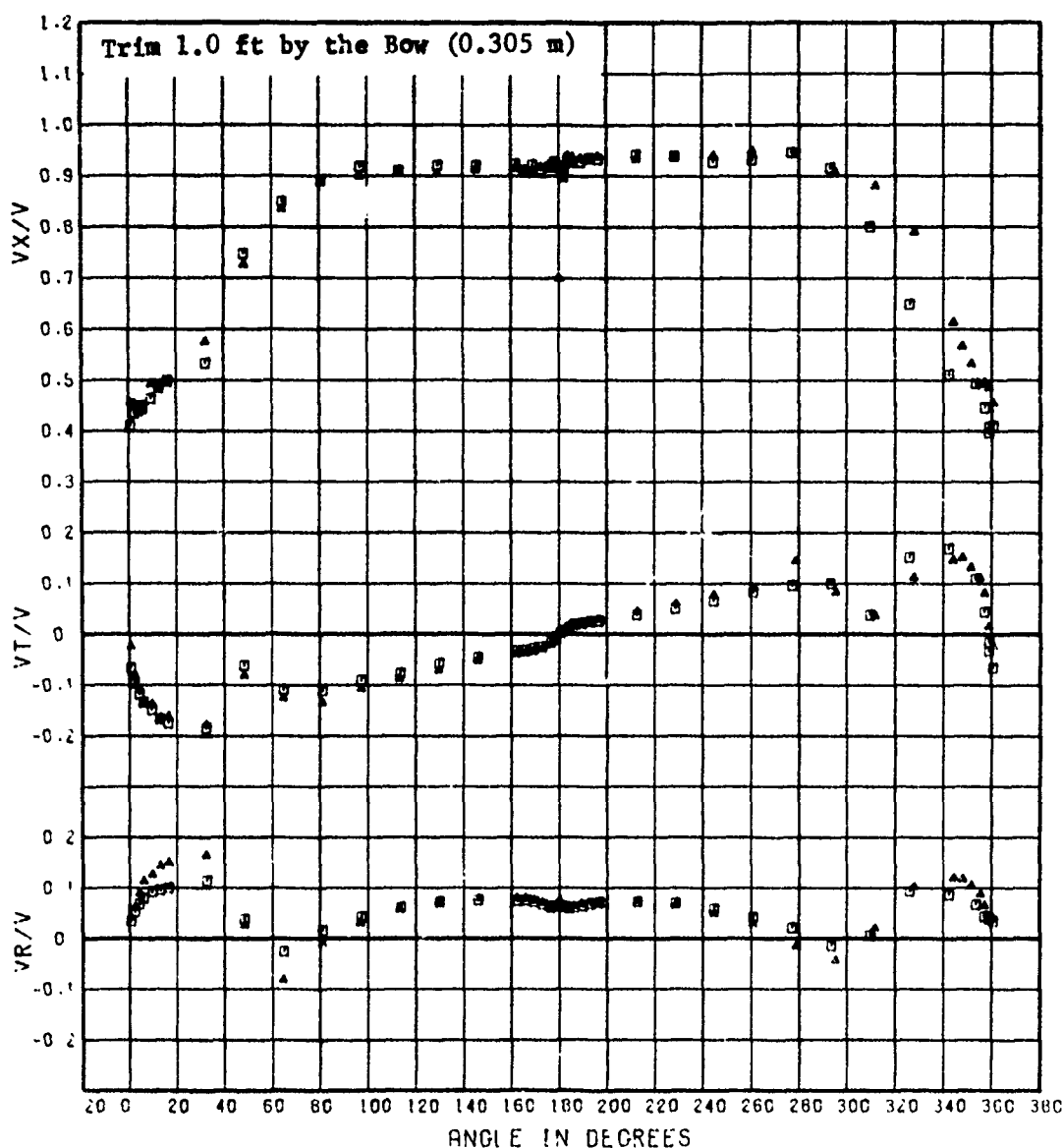


Figure 33 - Composite Circumferential Distribution of the Longitudinal, Tangential and Radial Velocity Component Ratios for Fins Configuration 3 (NAVY) and Configuration 3 (NAVY) Leading Edge Raised 2.5 Degrees at a Radius Ratio of 1.178. Displacement 26,390 tons (26 810 metric tons)

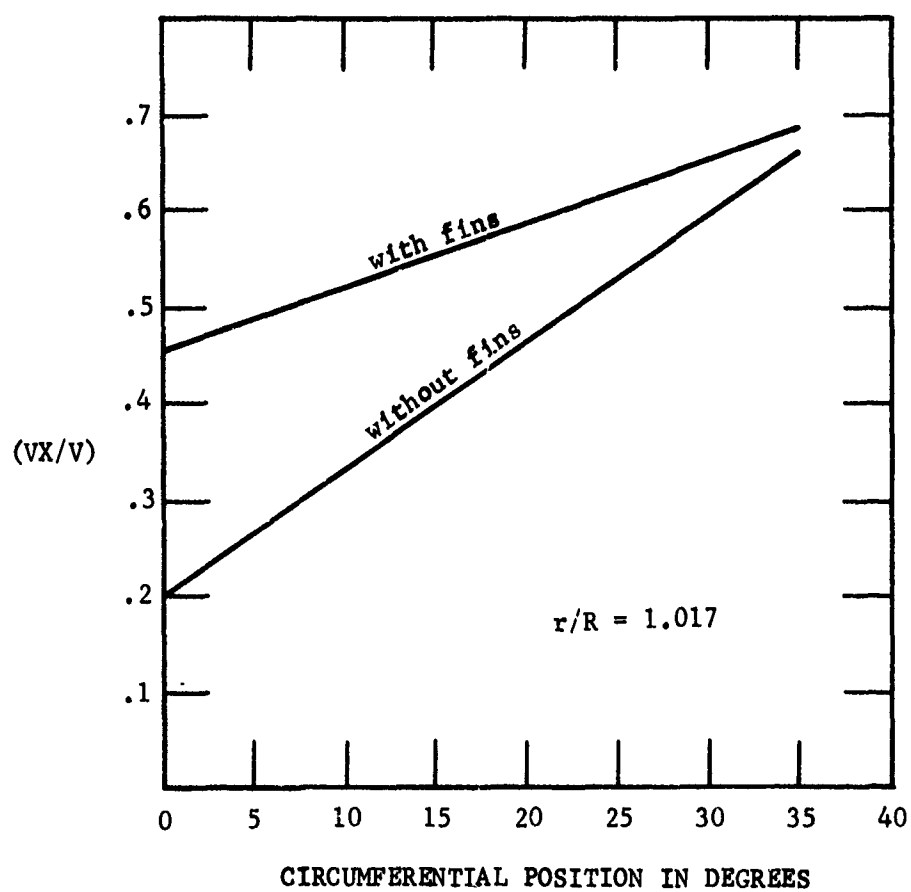


Figure 34 - Typical Improvement of the Longitudinal Velocity (VX/V) with the Addition of Fins

Table 1 - Comparison of the Circumferential Mean Velocity Component Ratios and other Derived Quantities for the without Fins Configuration and with Configuration 1 (NAVY), Configuration 2 (NAVY), Configuration 3 (NAVY), and Configuration 4 (SSPA), Trimmed 1.0 feet (0.305 m) by the Bow. Displacement 26,390 Tons (26 810 metric tons).

Experi- ment No.	Fin	RADIUS	VIBAR	VTBAR	VBAR	1-VIX	BBAR	BPOS	BNEG
1**	NONE	.200*	.360	-.005	.143	.000	30.26	22.05	-38.71
2	1 (NAVY)		.280	-.009	.137	.000	23.88	23.24	-32.61
6	2 (NAVY)		.246	-.007	.118	.000	21.34	27.61	-32.05
4	3 (NAVY)		.293	-.007	.129	.000	24.92	24.67	-39.26
7	4 (SSPA)		.369	-.000	.135	.000	30.68	20.40	-28.80
1	NONE	.300*	.498	-.006	.098	.456	28.27	13.72	-18.38
2	1 (NAVY)		.439	-.003	.099	.380	25.12	9.29	-11.97
6	2 (NAVY)		.412	-.001	.094	.376	23.86	9.06	-11.21
4	3 (NAVY)		.431	-.003	.095	.389	24.70	10.31	-20.69
7	4 (SSPA)		.508	-.002	.095	.458	28.59	11.08	-15.03
1	NONE	.359	.567	-.007	.078	.504	27.05	11.60	-16.94
2	1 (NAVY)		.519	-.001	.081	.438	24.93	8.38	-9.03
6	2 (NAVY)		.496	-.004	.083	.431	24.04	7.02	-7.53
4	3 (NAVY)		.502	-.001	.079	.439	24.20	8.15	-15.07
7	4 (SSPA)		.578	-.003	.077	.509	27.40	10.18	-12.38
1	NONE	.400*	.608	-.008	.066	.516	26.17	10.40	-17.14
2	1 (NAVY)		.569	-.001	.071	.452	24.60	8.32	-8.72
6	2 (NAVY)		.548	-.006	.077	.439	23.88	6.32	-7.04
4	3 (NAVY)		.548	-.000	.070	.447	23.78	8.22	-12.49
7	4 (SSPA)		.621	-.003	.066	.521	26.58	9.58	-12.09
1	NONE	.500*	.690	-.008	.045	.577	24.03	8.13	-16.97
2	1 (NAVY)		.670	-.008	.054	.527	23.36	8.04	-9.08
6	2 (NAVY)		.654	-.009	.066	.512	22.91	7.20	-8.24
4	3 (NAVY)		.644	-.004	.055	.513	22.56	8.00	-9.19
7	4 (SSPA)		.710	-.004	.047	.586	24.58	8.38	-11.76
1	NONE	.556	.723	-.008	.039	.606	22.79	7.26	-16.58
2	1 (NAVY)		.713	-.006	.048	.562	22.48	7.74	-9.61
6	2 (NAVY)		.699	-.010	.063	.548	22.13	7.47	-9.43
4	3 (NAVY)		.690	-.005	.050	.547	21.79	7.79	-8.98
7	4 (SSPA)		.748	-.004	.041	.618	23.44	7.67	-11.20
1	NONE	.600*	.732	-.007	.045	.626	21.49	6.52	-16.12
2	1 (NAVY)		.733	-.006	.054	.589	21.49	6.81	-9.61
6	2 (NAVY)		.719	-.008	.066	.574	21.14	6.58	-9.89
4	3 (NAVY)		.719	-.006	.055	.573	21.12	6.70	-9.46
7	4 (SSPA)		.768	-.004	.046	.641	22.40	6.43	-10.39

Table 1 -- Continued

Comparison of the Circumferential Mean Velocity Component Ratios and other Derived Quantities for the without Fins Configuration and with Configuration 1 (NAVY), Configuration 2 (NAVY), Configuration 3 (NAVY), and Configuration 4 (SSPA), Trimmed 1.0 feet (0.305 m) by the Bow. Displacement 26,390 Tons (26 810 metric tons).

1	NONE	.700*	.753	-.006	.052	.655	.662	19.12	5.12	-14.89
2	1 (NAVY)		.771	-.007	.060	.635	.638	19.55	5.12	-9.22
6	2 (NAVY)		.759	-.036	.070	.617	.623	19.26	5.02	-10.66
4	3 (NAVY)		.773	-.008	.061	.621	.625	19.61	4.82	-9.92
7	4 (SSPA)		.804	-.003	.051	.680	.685	20.30	4.33	-9.88
1	NONE	.775	.769	-.004	.053	.679	.685	17.73	4.27	-13.87
2	1 (NAVY)		.795	-.007	.059	.665	.669	18.29	4.19	-8.68
6	2 (NAVY)		.785	-.006	.070	.649	.655	18.08	4.10	-10.58
4	3 (NAVY)		.803	-.009	.061	.653	.656	18.49	3.81	-9.69
7	4 (SSPA)		.824	-.003	.050	.707	.711	18.89	3.31	-9.25
1	NONE	.800*	.782	-.002	.048	.683	.689	17.46	4.00	-13.34
2	1 (NAVY)		.804	-.006	.054	.673	.676	17.95	3.82	-8.25
6	2 (NAVY)		.798	-.006	.067	.657	.663	17.81	3.76	-10.05
4	3 (NAVY)		.811	-.008	.055	.664	.668	18.10	3.52	-9.33
7	4 (SSPA)		.827	-.002	.042	.715	.718	18.40	3.09	-8.46
1	NONE	.900*	.817	-.003	.035	.709	.714	16.25	3.12	-11.77
2	1 (NAVY)		.832	-.005	.037	.705	.708	16.58	2.67	-7.13
6	2 (NAVY)		.834	-.009	.057	.692	.697	16.64	2.73	-8.40
4	3 (NAVY)		.832	-.005	.039	.699	.702	16.58	2.70	-8.09
7	4 (SSPA)		.837	-.001	.019	.741	.744	16.65	2.41	-7.14
1	NONE	1.017	.830	.005	.031	.732	.736	14.67	2.37	-10.49
2	1 (NAVY)		.843	-.004	.030	.734	.737	14.93	1.85	-6.28
6	2 (NAVY)		.851	-.009	.057	.724	.729	15.09	2.01	-7.20
4	3 (NAVY)		.839	-.004	.035	.729	.731	14.87	2.11	-7.01
7	4 (SSPA)		.845	.000	.010	.764	.767	14.96	1.90	-6.89
1	NONE	1.178	.797	.001	.045	.754	.757	12.27	1.68	-10.13
2	1 (NAVY)		.819	-.003	.041	.760	.762	12.61	1.59	-5.88
6	2 (NAVY)		.827	-.007	.077	.755	.759	12.75	2.35	-6.54
4	3 (NAVY)		.816	-.006	.054	.755	.757	12.58	1.83	-6.36
7	4 (SSPA)		.850	-.002	.030	.786	.788	13.06	1.78	-8.01

* INTERPOLATED
 **EXPERIMENT 1 REPEAT (October 1980)

Table 2 - Comparison of the Circumferential Mean Velocity Component Ratios and other Derived Quantities for Fins Configuration 3 (NAVY), and Configuration 4 (SSPA), Trimmed 3.75 feet (1.143 m) by the Stern. Displacement 17,270 Tons (17 550 metric tons).

Experi- ment No.	F _{in}	RADIUS	VXBAR	VTMR	VRRAR	1-WVX	1-WK	BBAR	RPOS	RNEG
3 8	1 (NAVY)	.200*	.291	.001	.109	.000	.000	25.05	21.04	-21.95
	4 (SSPA)		.270	.001	.116	.000	.000	23.40	20.56	-23.74
3 8	1 (NAVY)	.300*	.430	-.001	.083	.374	.381	24.75	5.31	-6.33
	4 (SSPA)		.432	.002	.085	.367	.371	24.82	5.48	-7.95
3 8	1 (NAVY)	.359	.500	-.003	.071	.425	.431	24.18	4.19	-3.75
	4 (SSPA)		.514	.001	.070	.427	.430	24.69	7.21	-6.30
3 8	1 (NAVY)	.400*	.544	-.004	.064	.440	.443	23.69	5.39	-5.12
	4 (SSPA)		.565	.001	.062	.444	.445	24.39	7.86	-6.35
3 8	1 (NAVY)	.500*	.635	-.006	.054	.505	.508	22.29	6.79	-7.85
	4 (SSPA)		.667	.000	.048	.519	.520	23.21	8.15	-8.24
3 8	1 (NAVY)	.556	.675	-.007	.052	.537	.540	21.41	6.88	-8.54
	4 (SSPA)		.711	.000	.044	.555	.557	22.36	7.73	-8.56
3 8	1 (NAVY)	.600*	.695	-.009	.058	.561	.564	20.51	6.38	-8.81
	4 (SSPA)		.731	-.002	.049	.582	.584	21.42	6.56	-8.72
3 8	1 (NAVY)	.700*	.735	-.011	.065	.606	.610	18.75	5.35	-9.28
	4 (SSPA)		.771	-.004	.055	.632	.634	19.52	4.56	-8.29
3 8	1 (NAVY)	.775	.762	-.012	.066	.636	.640	17.62	4.60	-8.76
	4 (SSPA)		.794	-.004	.053	.663	.665	18.26	3.54	-7.20
3 8	1 (NAVY)	.800*	.770	-.011	.065	.643	.647	17.28	4.35	-8.50
	4 (SSPA)		.800	-.004	.044	.670	.672	17.85	3.32	-6.39
3 8	1 (NAVY)	.900*	.801	-.009	.055	.675	.679	16.01	3.35	-7.00
	4 (SSPA)		.820	-.002	.020	.701	.703	16.34	2.70	-5.39
3 8	1 (NAVY)	1.017	.830	-.003	.033	.707	.711	14.71	2.28	-5.94
	4 (SSPA)		.835	-.001	.011	.730	.732	14.79	2.40	
3 8	1 (NAVY)	1.178	P I T O T	T U B E	O U T	O F	W A T E R	12.91	1.95	-7.13
	4 (SSPA)		.839	-.003	.030	.759	.760			

* INTERPOLATED

Table 3 - Comparison of the Circumferential Mean Velocity Component Ratios and other Derived Quantities for Fin Configuration 3 (NAVY) and Configuration 3 (NAVY) Leading Edge Raised 2.5 Degrees. Trimmed 1.0 feet (0.305 m) by the Bow. Displacement 26,390 Tons (26 810 metric tons).

Experiment No.	Fin Angle (Degrees)	RADIUS	VXBAR	VTBAR	VBAR	1-WVX	1-WX	BBAR	BPOS	BNEG
4	0	.200*	.293	.007	.129	.000	.000	24.92	24.67	-39.26
5	2.5		.289	.014	.129	.000	.000	24.41	32.20	-39.88
4	0	.300*	.431	.003	.095	.375	.389	24.70	10.31	-20.69
5	2.5		.424	.003	.093	.370	.382	24.36	10.62	-10.99
4	0	.359	.502	.001	.079	.427	.439	24.20	8.15	-15.07
5	2.5		.494	-.002	.076	.420	.430	23.89	7.35	-7.30
4	0	.400*	.548	.000	.070	.441	.447	23.78	8.22	-12.49
5	2.5		.538	-.004	.067	.434	.440	23.46	8.03	-10.62
4	0	.500*	.644	-.004	.055	.509	.513	22.56	8.00	-9.19
5	2.5		.631	-.009	.050	.500	.504	22.19	8.76	-15.67
4	0	.556	.690	-.005	.050	.543	.547	21.79	7.79	-8.98
5	2.5		.674	-.010	.046	.533	.537	21.39	8.57	-16.11
4	0	.600*	.719	-.006	.055	.569	.573	21.12	6.70	-9.46
5	2.5		.699	-.008	.051	.558	.562	20.62	7.27	-13.58
4	0	.700*	.773	-.008	.061	.621	.625	19.61	4.82	-9.92
5	2.5		.749	-.004	.058	.606	.610	19.01	5.05	-9.92
4	0	.775	.803	-.009	.061	.653	.656	18.49	3.81	-9.69
5	2.5		.778	-.003	.058	.637	.641	17.90	3.93	-8.29
4	0	.800*	.811	-.008	.055	.664	.668	18.10	3.52	-9.33
5	2.5		.785	-.002	.052	.647	.650	17.52	3.73	-7.89
4	0	.900*	.832	-.005	.039	.699	.702	16.58	2.70	-8.09
5	2.5		.808	-.003	.036	.680	.683	16.12	2.99	-7.21
4	0	1.017	.839	-.004	.035	.729	.731	14.87	2.11	-7.01
5	2.5		.825	0.004	.032	.711	.714	14.64	2.27	-6.58
4	0	1.178	.816	-.006	.054	.755	.757	12.58	1.83	-6.36
5	2.5		.830	-.010	.054	.742	.744	12.80	1.67	-5.81

*INTERPOLATED

TABLE 4 - EXPERIMENTAL CONFIGURATIONS AND CORRESPONDING SHIP VALUES

Experiment No.	Fin Configuration	tons	Displacement metric tons	feet	Trim	meters
1 Repeat	none	26,390	26 810	1' x bow		0.305
2	1 (NAVY)	26,390	26 810	1' x bow		0.305
3	1 (NAVY)	17,270	17 550	3.75' x stern		1.143
4	3 (NAVY)	26,390	26 810	1' x bow		0.305
5	3 (NAVY)*	26,390	26 810	1' x bow		0.305
6	2 (NAVY)	26,390	26 810	1' x bow		0.305
7	4 (SSPA)	17,270	17 550	3.75' x stern		1.143
8	4 (SSPA)	26,390	26 810	1' x bow		0.305

* Leading edge up 2.5 degrees

Ship Speed = 20 knots

Propeller Diameter = 21 feet (6.40 m)

APPENDIX A

EXPERIMENT 1 Repeat 10/80

FIN CONFIGURATION none

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
J _y	1.01

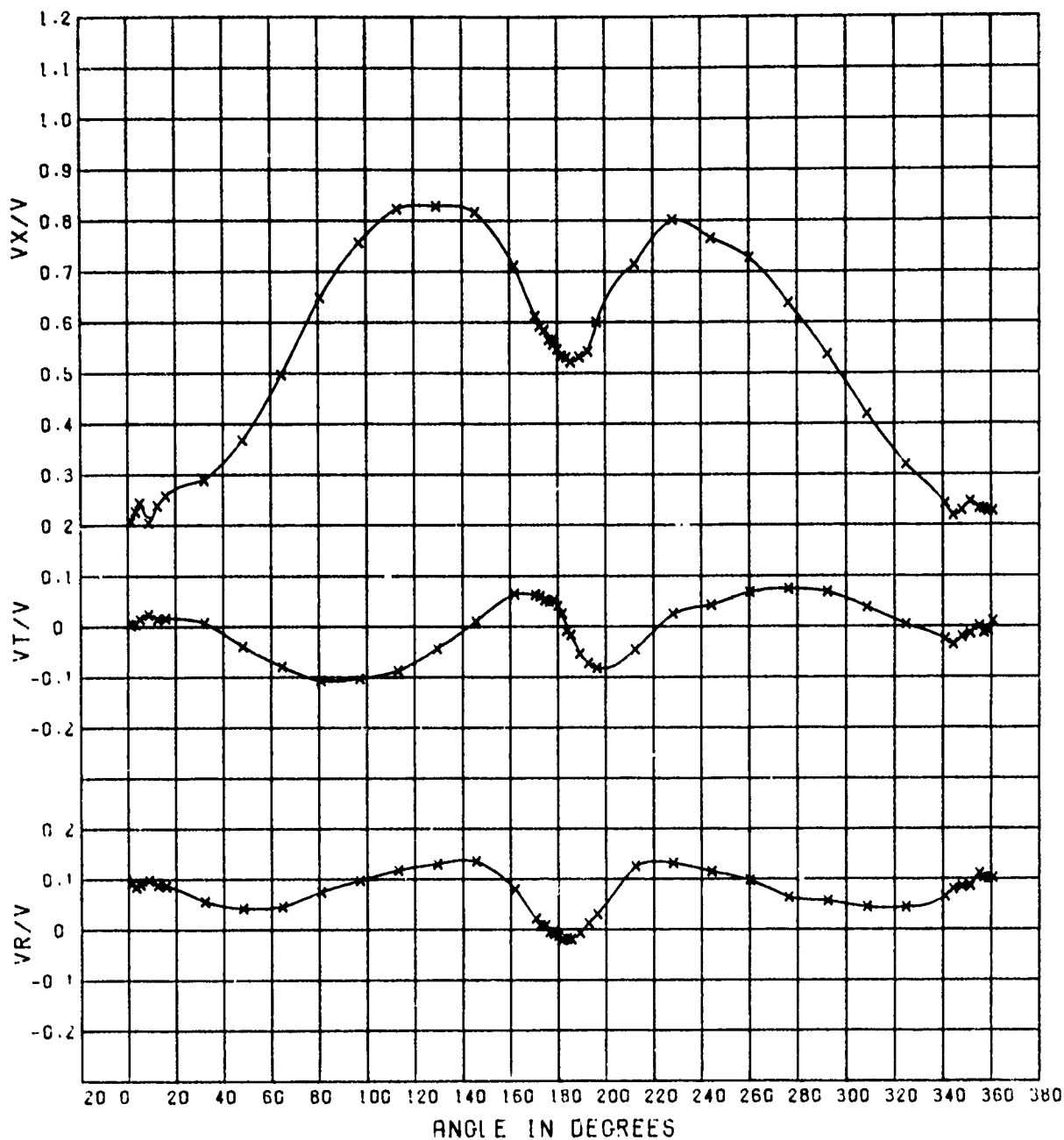


Figure A1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 1 (10/80)
Radius Ratio = 0.359

Fin Configuration None
Displacement 26,390 tons (26 810 metric tons)

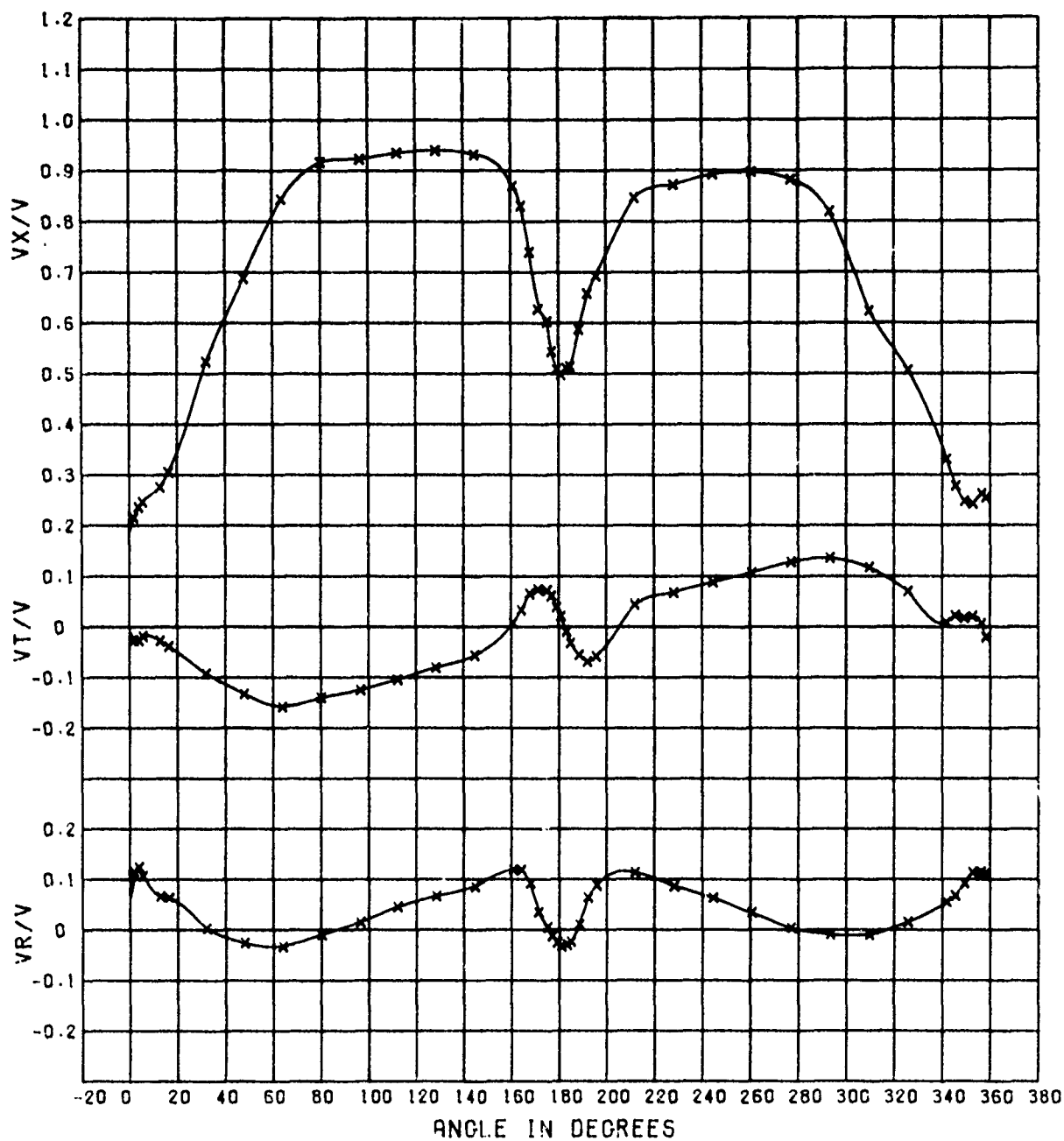


Figure A2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 1 (10/80)
Radius Ratio = 0.556

Fin Configuration	None
Displacement	26,390 tons (26 810 metric tons)

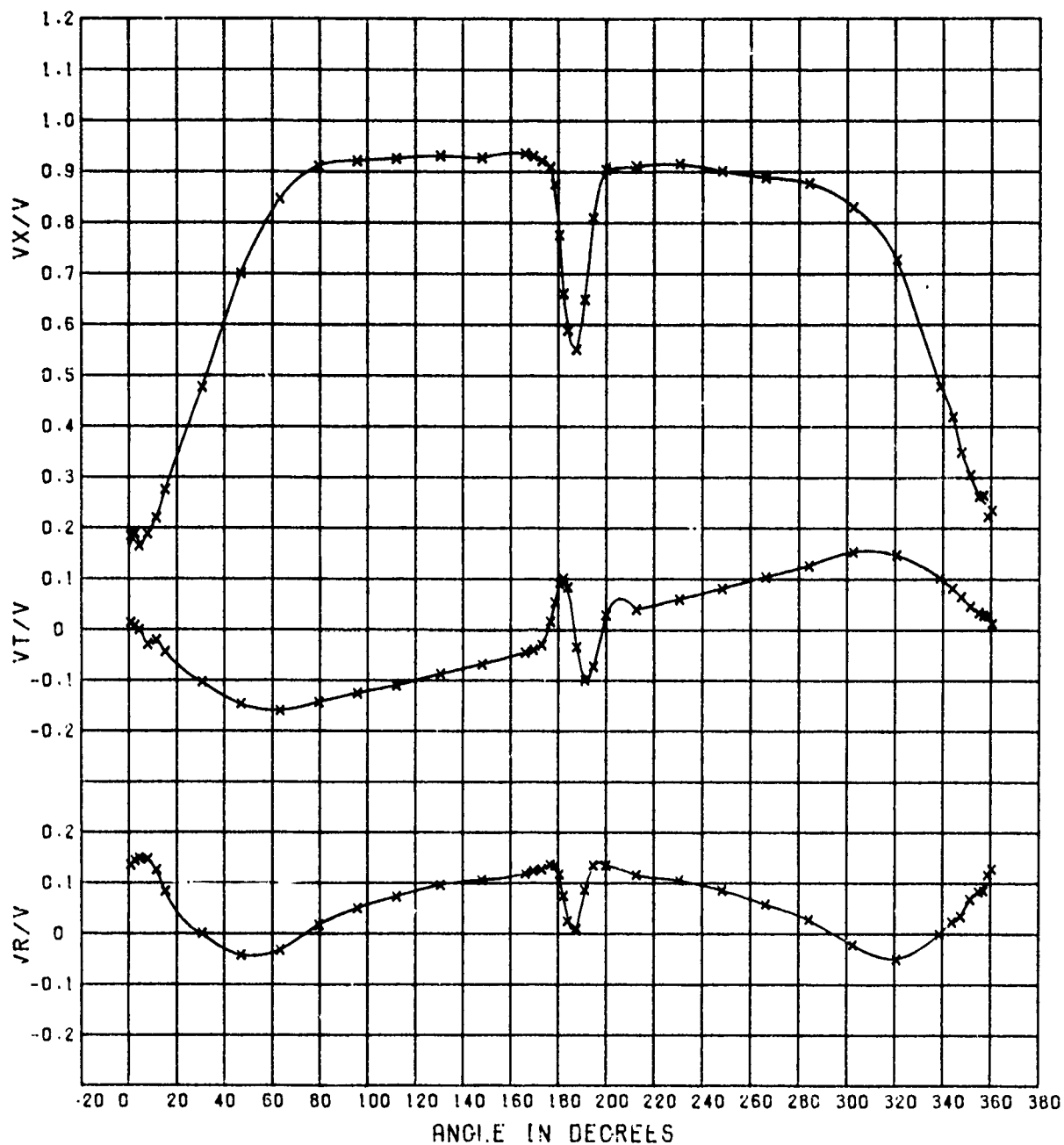


Figure A3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 1 (10/80)
Radius Ratio = 0.775

Fin Configuration None
Displacement 26,390 tons (26 810 metric tons)

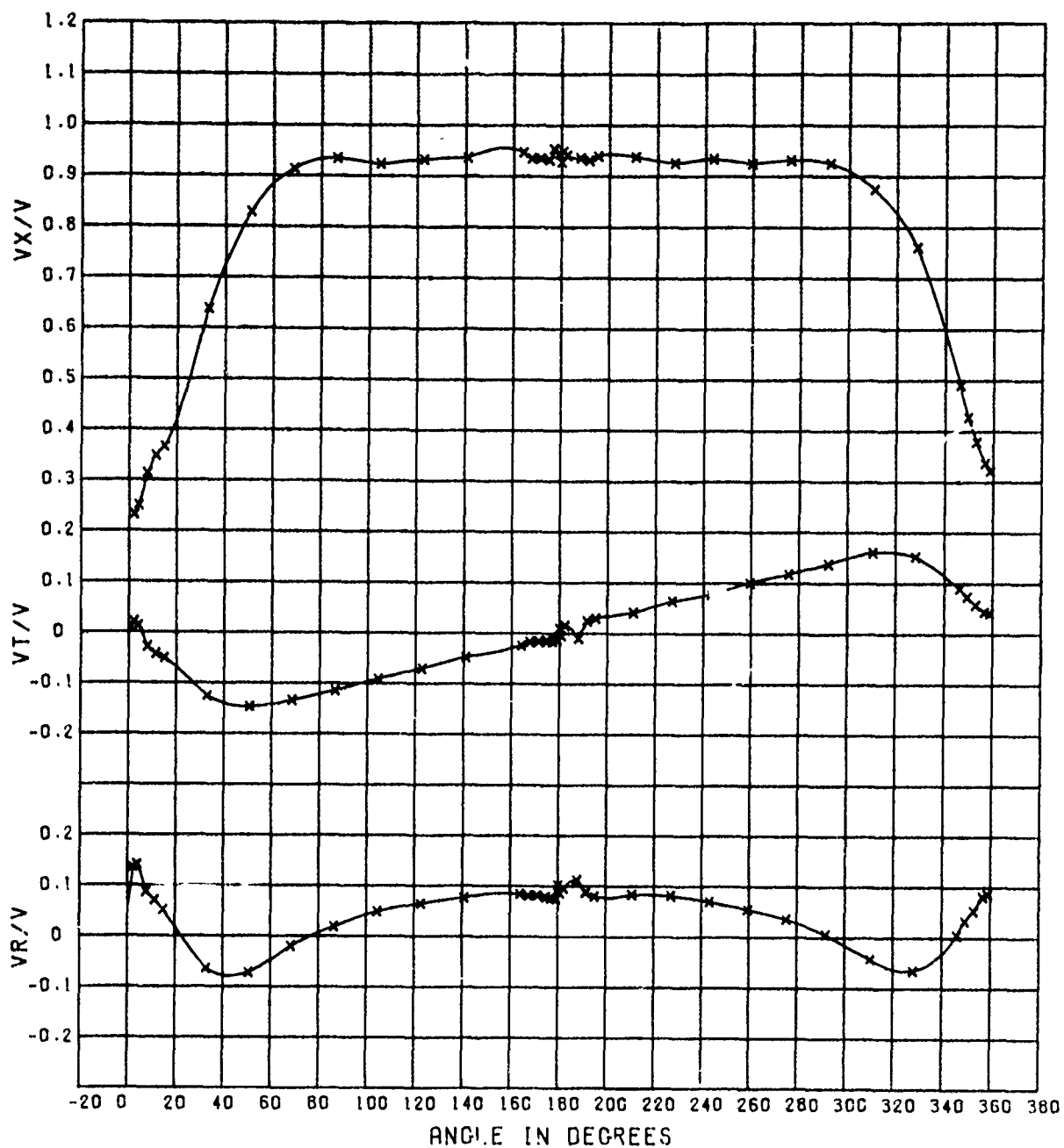


Figure A4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 1 (10/80)
Radius Ratio = 1.107

Fin Configuration None
Displacement 26,390 tons (26 810 metric tons)

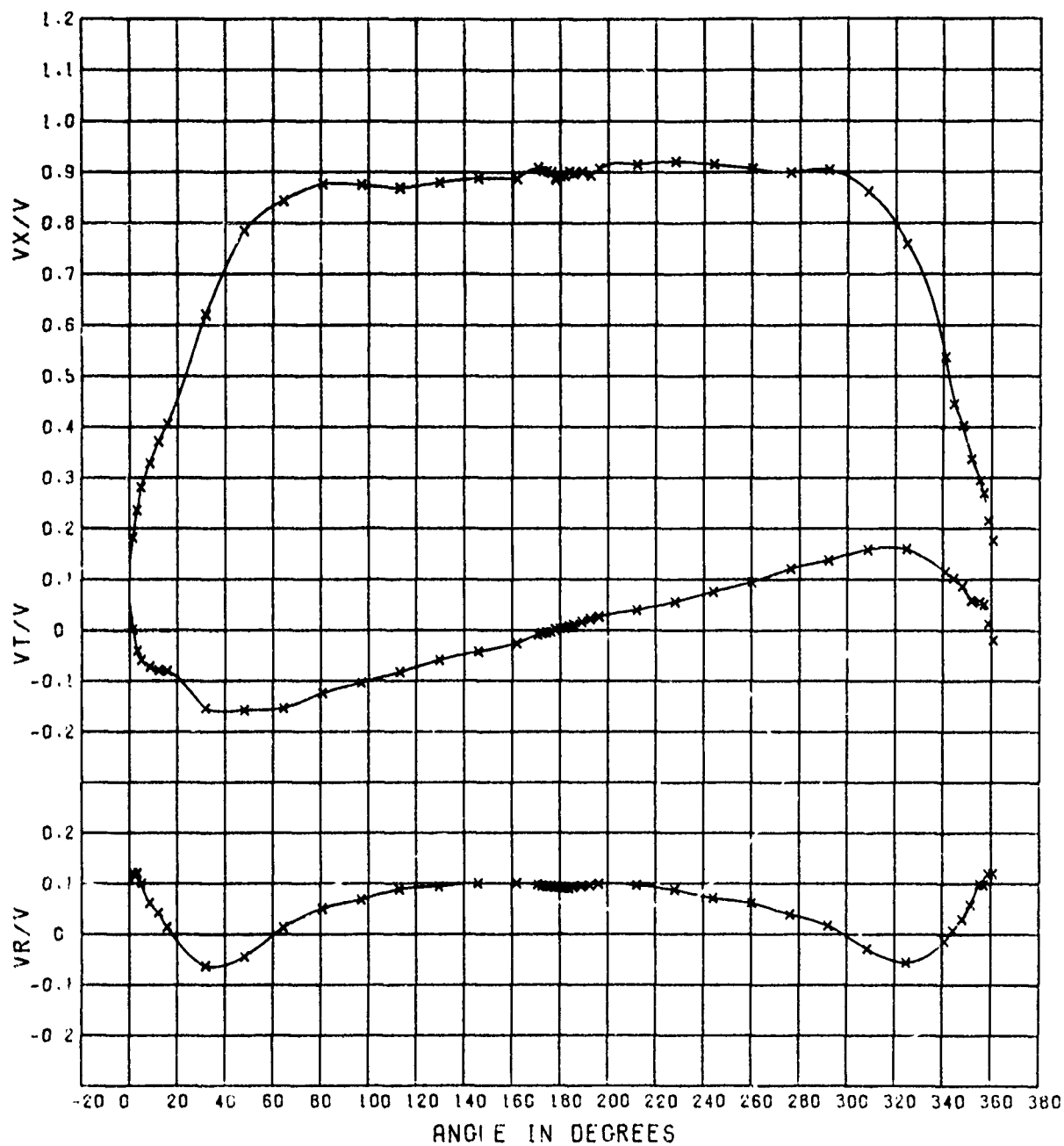


Figure A5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 1 (10/80)
Radius Ratio = 1.178

Fin Configuration None
Displacement 26,390 tons (26 810 metric tons)

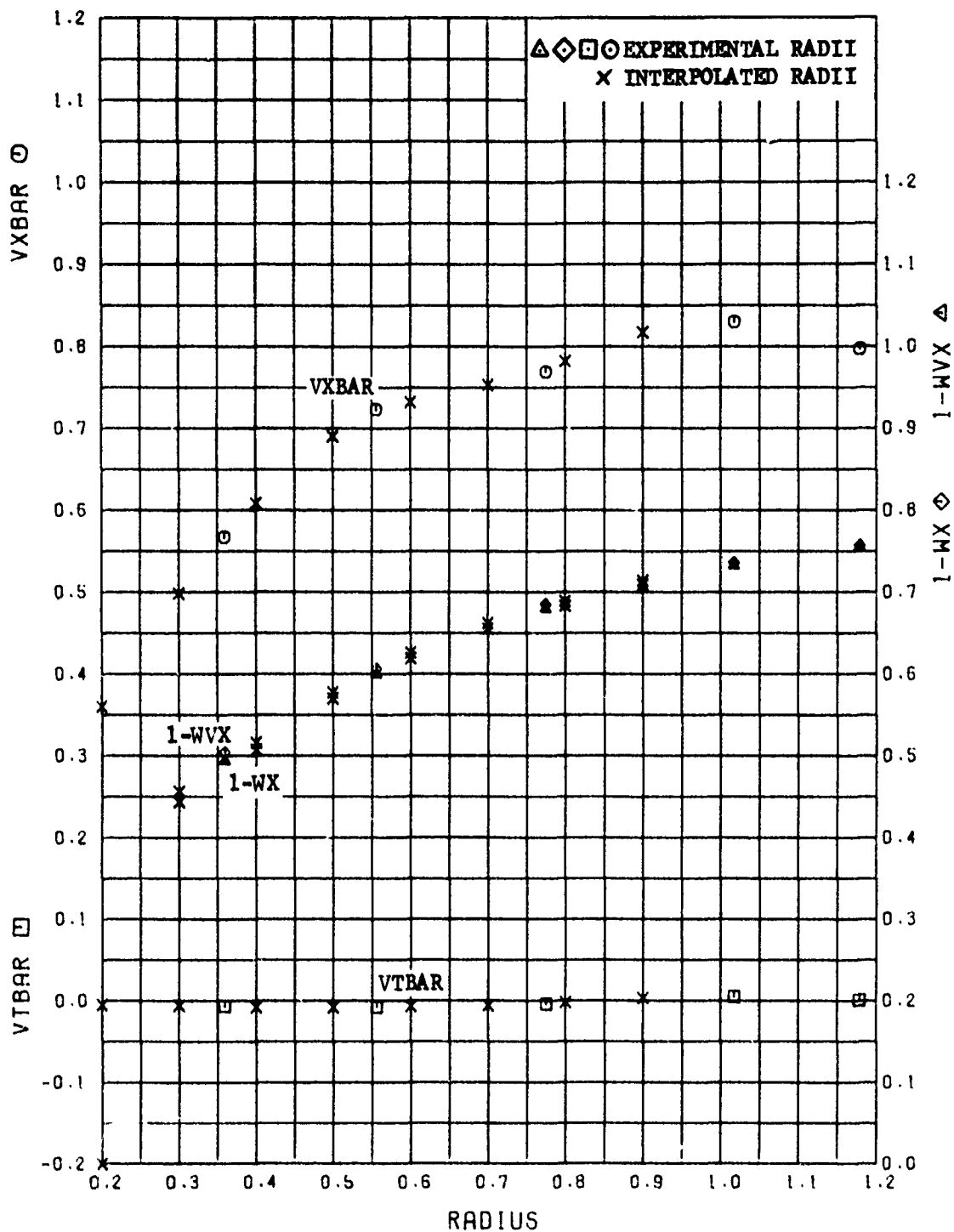


Figure A6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 1 (10/80)

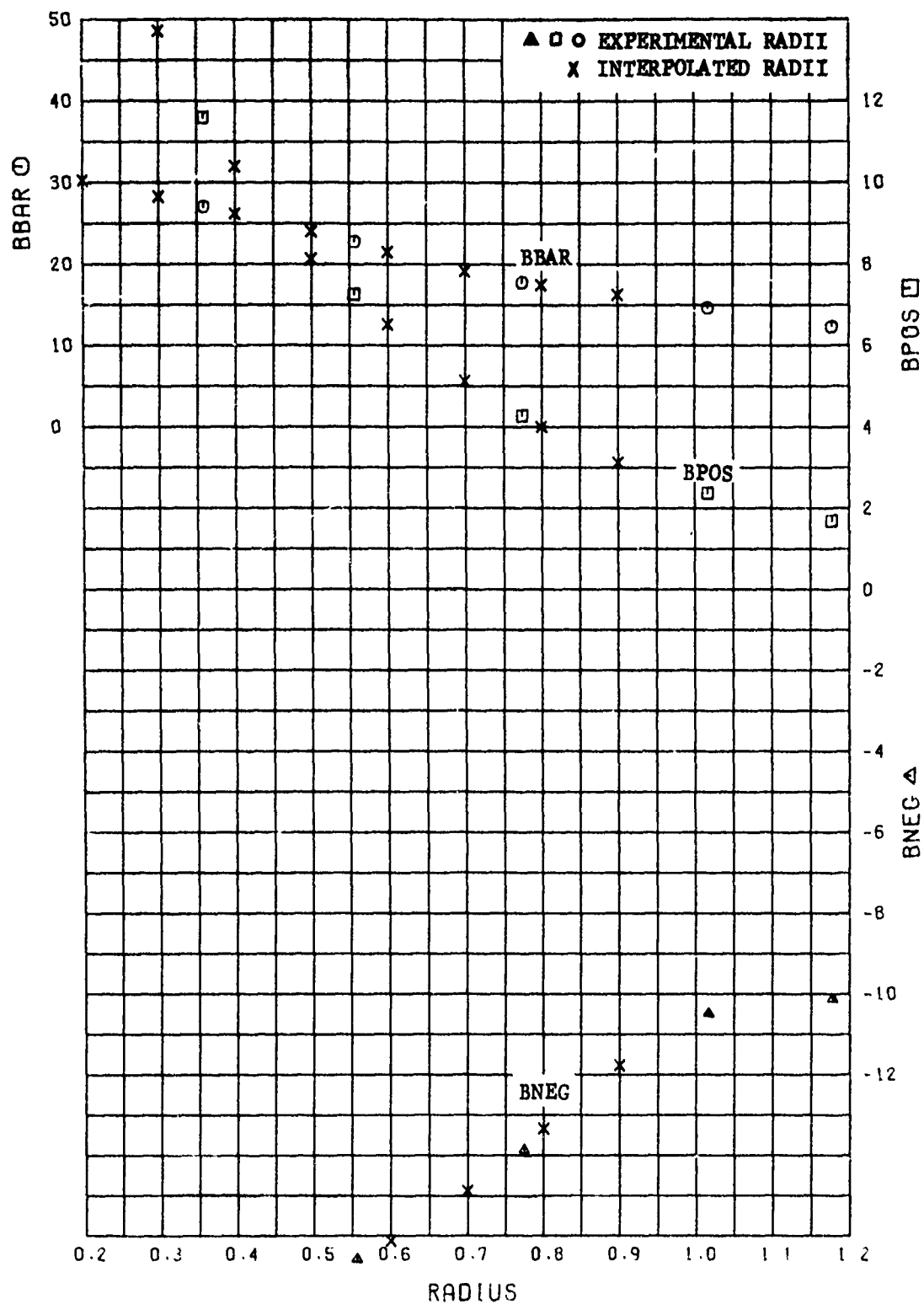


Figure A7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 1 (10/80)

Table A1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 1 Repeat (10/80) without Fins

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.567	.723	.766	.830	.797	.360	.498	.608	.690	.732	.753	.782	.817
VTBAR =	-.007	-.003	-.004	.005	.001	-.005	-.006	-.008	-.008	-.007	-.006	-.002	.003
VRBAR =	.078	.039	.053	.031	.045	.143	.098	.066	.045	.045	.052	.048	.035
1-WVX =	.493	.599	.679	.732	.754	0.000	.443	.507	.570	.619	.655	.683	.709
1-WX =	.504	.606	.685	.736	.757	0.000	.456	.516	.577	.626	.662	.689	.714
BBAR =	27.05	22.79	17.73	14.67	12.27	30.26	29.27	26.19	24.03	21.49	19.12	17.46	16.25
BPOS =	11.60	7.26	4.27	2.37	1.66	22.05	13.72	10.40	8.13	6.52	5.12	4.00	3.12
THETA =	115.00	85.00	87.50	82.50	170.00	220.00	115.00	115.00	112.50	87.50	87.50	87.50	85.00
BNEG =	-16.94	-16.58	-13.87	-10.49	-10.13	-38.71	-18.38	-17.14	-16.97	-16.12	-14.89	-13.34	-11.77
THETA =	0.00	0.00	0.00	2.50	0.00	42.50	32.50	0.00	0.00	0.00	0.00	5.00	2.50

VABAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.
 VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.
 VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.
 1-WVX IS VOLUMETRIC MEAN MAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.
 1-WX IS VOLUMETRIC MEAN MAKE VELOCITY WITH TANGENTIAL CORRECTION.
 BBAR IS MEAN ANGLE OF ADVANCE.
 BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).
 BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).
 THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim 1.0 ft by the bow (0.305 m)
 Displacement 26,390 tons (26 810 metric tons)
 Propeller Diameter 21.0 ft (6.40 m)
 Speed 20.0 knots
 Jv 1.01

**Table A2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 1 Repeat (10/80) without Fins**

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.2433	-.1424	.0576	-.0236	.0199	-.0144	.0053	-.0049
RADIUS = .556									
AMPLITUDE	=	-.1999	-.2264	-.0170	-.0587	.0316	-.0335	.0122	-.0212
RADIUS = .775									
AMPLITUDE	=	-.2191	-.1832	-.0675	-.0641	.0015	-.0257	.0076	-.0158
RADIUS = 1.017									
AMPLITUDE	=	-.1921	-.1404	-.0946	-.0514	-.0239	-.0165	-.0080	-.0074
RADIUS = 1.178									
AMPLITUDE	=	-.1830	-.1354	-.0924	-.0573	-.0303	-.0198	-.0128	-.0088

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.3203	.0104	.1380	.0256	-.0165	.0191	-.0079	.0230
RADIUS = .300									
AMPLITUDE	=	-.2675	-.0945	.0853	-.0075	.0092	-.0038	.0012	.0039
RADIUS = .400									
AMPLITUDE	=	-.2295	-.1695	.0398	-.0332	.0253	-.0204	.0076	-.0100
RADIUS = .500									
AMPLITUDE	=	-.2064	-.2144	.0014	-.0516	.0320	-.0306	.0113	-.0187
RADIUS = .600									
AMPLITUDE	=	-.2071	-.2174	-.0291	-.0611	.0250	-.0320	.0120	-.0203
RADIUS = .700									
AMPLITUDE	=	-.2172	-.1975	-.0529	-.0641	.0110	-.0285	.0102	-.0179
RADIUS = .800									
AMPLITUDE	=	-.2155	-.1768	-.0719	-.0616	-.0020	-.0240	.0056	-.0143
RADIUS = .900									
AMPLITUDE	=	-.2031	-.1558	-.0960	-.0543	-.0140	-.0188	-.0017	-.0099

Table A3 - Harmonic Analysis of the Tangential Velocity Component Ratios for Experiment 1 Repeat (10/80) without Fins

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.0561	-.0122	.0483	-.0102	.0197	-.0087	.0076	-.0024
RADIUS = .556									
AMPLITUDE	=	-.1233	-.0287	.0149	-.0021	.0199	-.0111	.0119	-.0112
RADIUS = .775									
AMPLITUDE	=	-.1364	-.0388	-.0143	-.0006	.0038	-.0011	.0032	-.0044
RADIUS = 1.017									
AMPLITUDE	=	-.1294	-.0464	-.0207	-.0045	-.0014	.0020	.0007	.0005
RADIUS = 1.178									
AMPLITUDE	=	-.1324	-.0545	-.0244	-.0079	-.0046	-.0008	-.0016	-.0011

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.0364	.0062	.0803	-.0212	.0094	.0011	-.0043	.0150
RADIUS = .300									
AMPLITUDE	=	-.0258	-.0059	.0597	-.0138	.0169	-.0059	.0041	.0030
RADIUS = .400									
AMPLITUDE	=	-.0744	-.0162	.0408	-.0090	.0209	-.0101	.0094	-.0054
RADIUS = .500									
AMPLITUDE	=	-.1096	-.0247	.0237	-.0038	.0212	-.0115	.0119	-.0102
RADIUS = .600									
AMPLITUDE	=	-.1274	-.0309	.0072	-.0014	.0158	-.0085	.0097	-.0097
RADIUS = .700									
AMPLITUDE	=	-.1340	-.0356	-.0068	-.0006	.0081	-.0037	.0055	-.0064
RADIUS = .800									
AMPLITUDE	=	-.1350	-.0393	-.0150	-.0009	.0032	-.0004	.0030	-.0035
RADIUS = .900									
AMPLITUDE	=	-.1311	-.0421	-.0177	-.0024	.0010	.0016	.0020	-.0008

Table A4 - Input Data for Wake Survey Analysis
Experiment 1 Repeat (10/80) without Fins

ANGLE	RADIUS = .359	VT/V	VR/V	64.0	.844	-.159	-.034
1.3	.208	.003	.092	80.1	.916	-.141	-.010
3.1	.227	.005	.085	96.6	.922	-.125	.014
4.9	.244	.015	.090	112.4	.935	-.105	.045
6.5	.205	.024	.098	128.7	.939	-.081	.066
12.2	.238	.015	.087	144.9	.931	-.057	.085
15.8	.259	.016	.086	160.9	.870	.008	.119
31.9	.291	.012	.085	164.5	.830	.033	.118
31.9	.286	.003	.056	168.1	.740	.066	.092
46.1	.358	-.040	.042	171.6	.627	.074	.035
64.5	.497	-.079	.046	175.3	.602	.071	.005
80.7	.646	-.107	.074	177.0	.543	.060	-.012
97.1	.757	-.103	.097	178.9	.522	.045	-.026
113.2	.823	-.098	.117	179.5	.495	.031	-.026
129.6	.928	-.044	.129	180.6	.501	.027	-.031
145.8	.316	.010	.135	181.3	.495	.014	-.036
161.9	.711	.064	.080	183.2	.511	-.010	-.030
178.1	.556	.031	-.008	184.9	.514	-.033	-.024
170.8	.612	.063	.022	188.6	.537	-.055	.011
172.6	.592	.060	.008	192.1	.658	-.060	.064
174.5	.583	.052	.009	195.8	.692	-.058	.069
175.4	.565	.049	-.006	211.9	.846	.044	.113
178.1	.565	.051	-.004	228.1	.871	.067	.086
190.0	.546	.040	-.014	244.5	.892	.088	.063
181.8	.543	.025	-.021	260.6	.896	.106	.033
183.7	.530	-.009	-.019	277.1	.895	.127	.005
185.5	.522	-.017	-.020	277.1	.809	.128	.003
169.1	.532	-.054	-.007	293.3	.819	.136	-.009
192.7	.543	-.073	.012	309.6	.623	.117	-.010
193.3	.600	-.082	.030	325.8	.506	.070	.015
212.2	.714	-.045	.125	341.9	.331	.008	.055
228.1	.802	.025	.131	345.5	.277	.021	.067
244.1	.765	.041	.115	349.2	.247	.017	.091
260.2	.747	.069	.098	352.8	.242	.020	.114
276.4	.637	.074	.064	356.5	.252	.006	.114
292.5	.536	.069	.056	358.2	.254	-.021	.110
300.8	.419	.038	.044	360.0	.154	.009	0.000
324.9	.319	.004	.044				
340.9	.242	-.025	.065				
344.4	.218	-.036	.080	ANGLE	RADIUS = .775	VT/V	VR/V
148.1	.229	-.020	.085	.8	.185	.014	.136
351.6	.246	-.014	.086	2.5	.189	.008	.145
355.3	.233	.001	.111	4.4	.155	0.000	.149
357.0	.231	-.012	.102	7.9	.159	-.029	.148
358.8	.227	-.009	.101	11.5	.221	-.020	.126
360.7	.227	.011	.102	15.1	.276	-.044	.083
362.5	.248	.014	.088	30.9	.478	-.103	.001
				47.1	.701	-.146	-.042
				63.3	.848	-.159	-.032
				79.5	.911	-.143	.017

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APPENDIX B

EXPERIMENT 2

FIN CONFIGURATION 1 (NAVY)

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jy	1.01

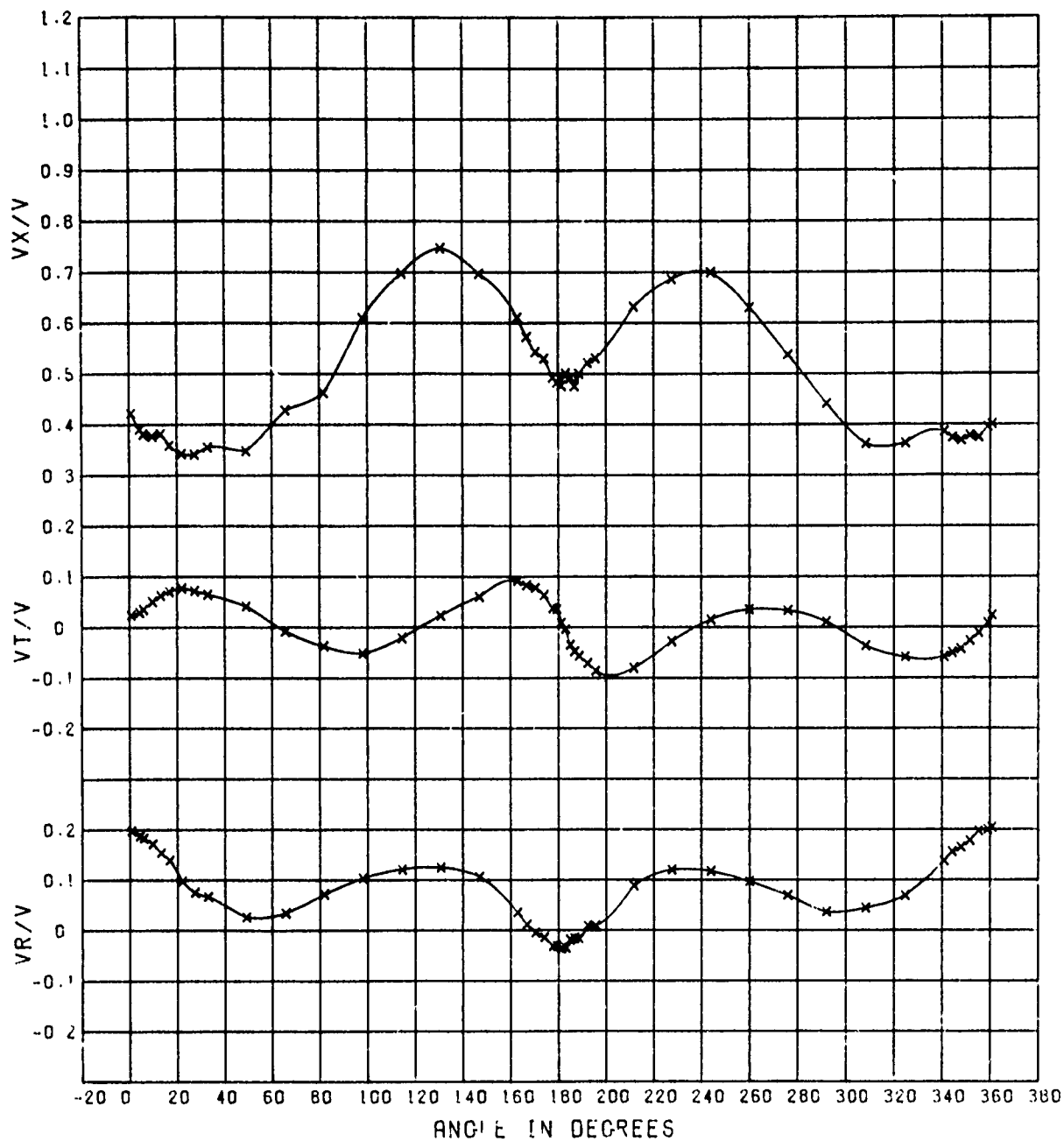


Figure B1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 2
Radius Ratio = 0.359

Fin Configuration 1 (Navy)
Displacement 26,390 tons (26 810 metric tons)

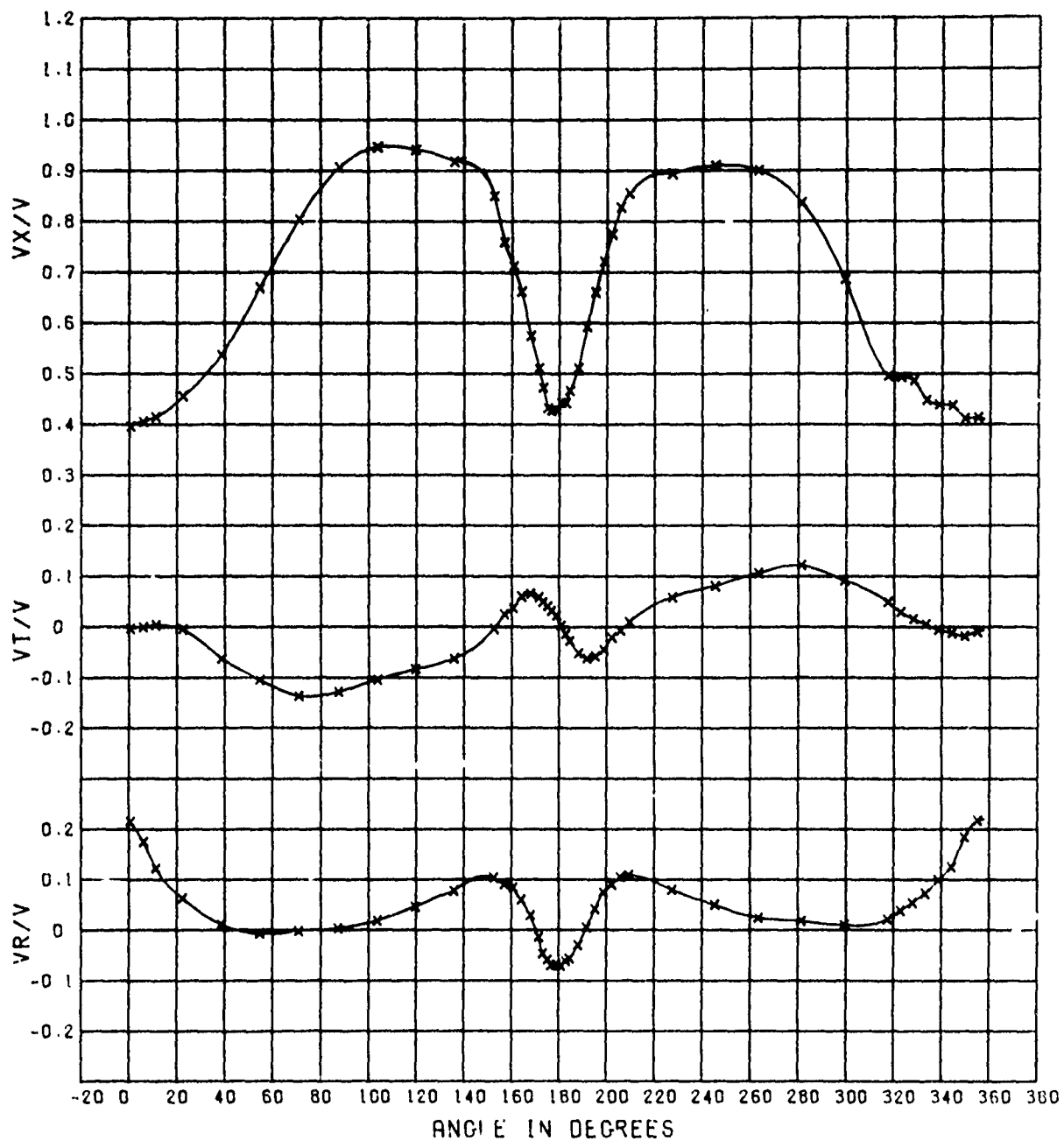


Figure B2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 2
Radius Ratio = 0.556

Fin Configuration 1 (Navy)
Displacement 26,390 tons (26 810 metric tons)

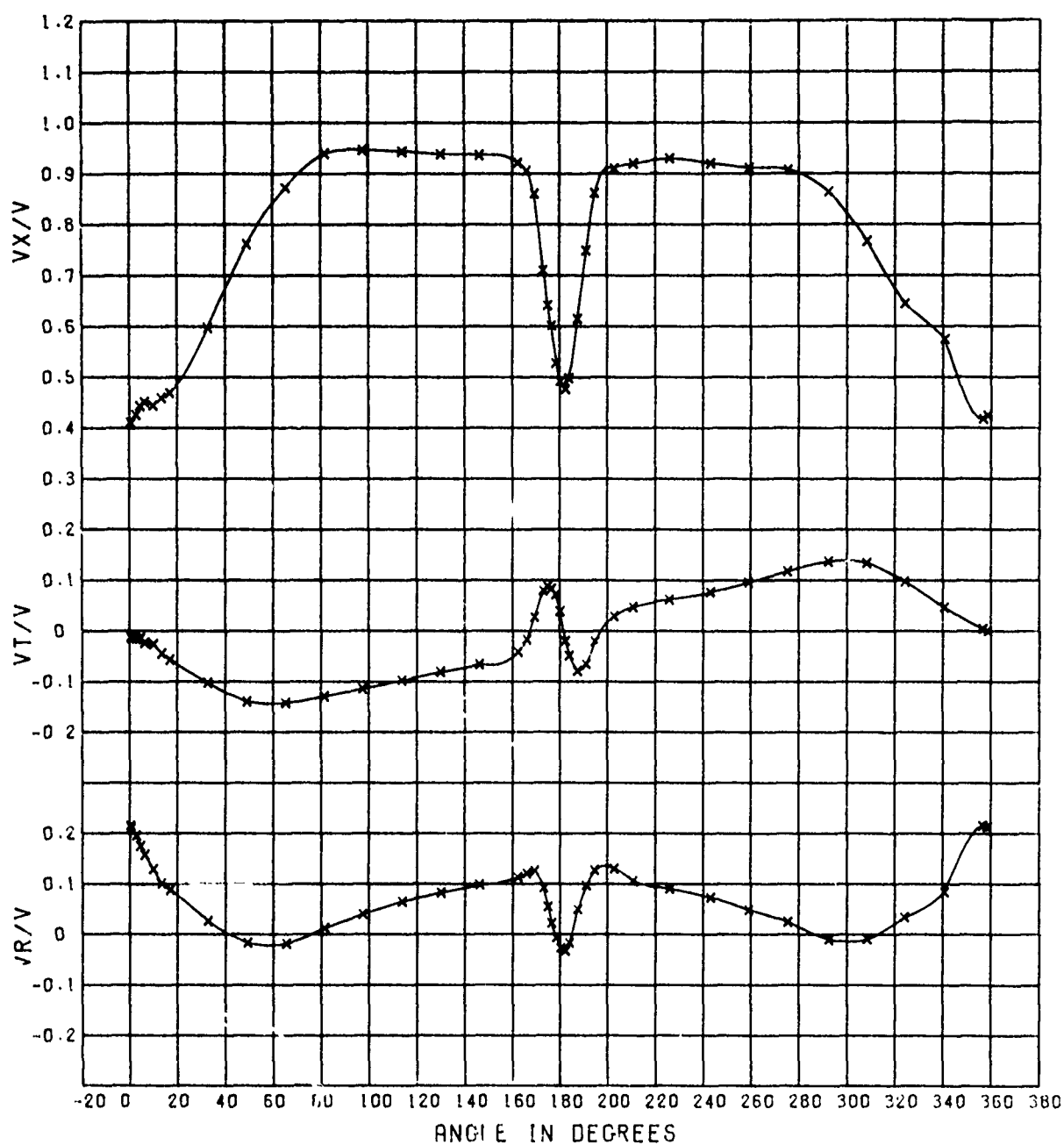


Figure B3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 2
Radius Ratio = 0.775

Fin Configuration 1 (Navy)
Displacement 26,390 tons (26 810 metric tons)

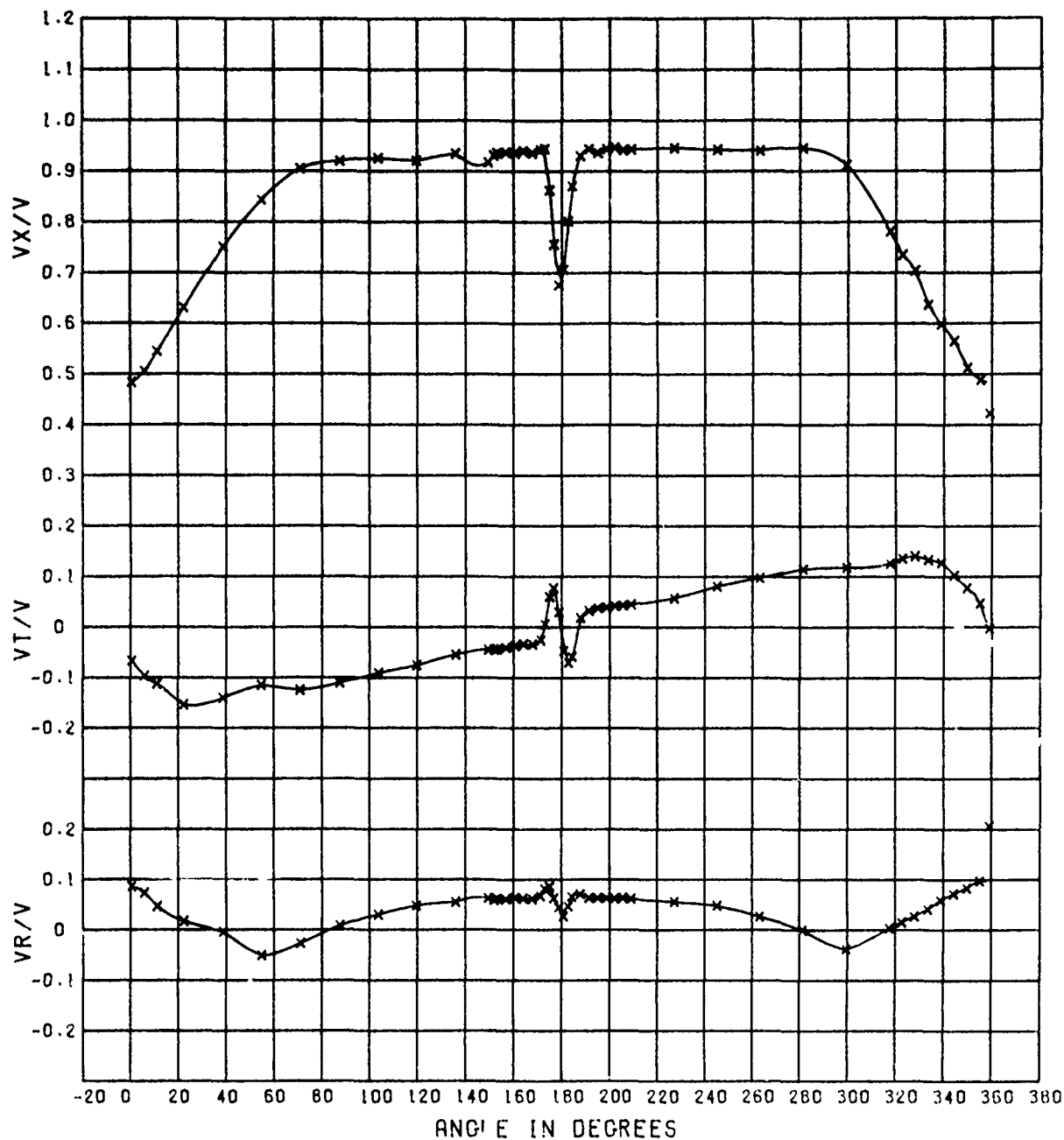


Figure B4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 2
Radius Ratio = 1.107

Fin Configuration 1 (Navy)
Displacement 26,390 tons (26 810 metric tons)

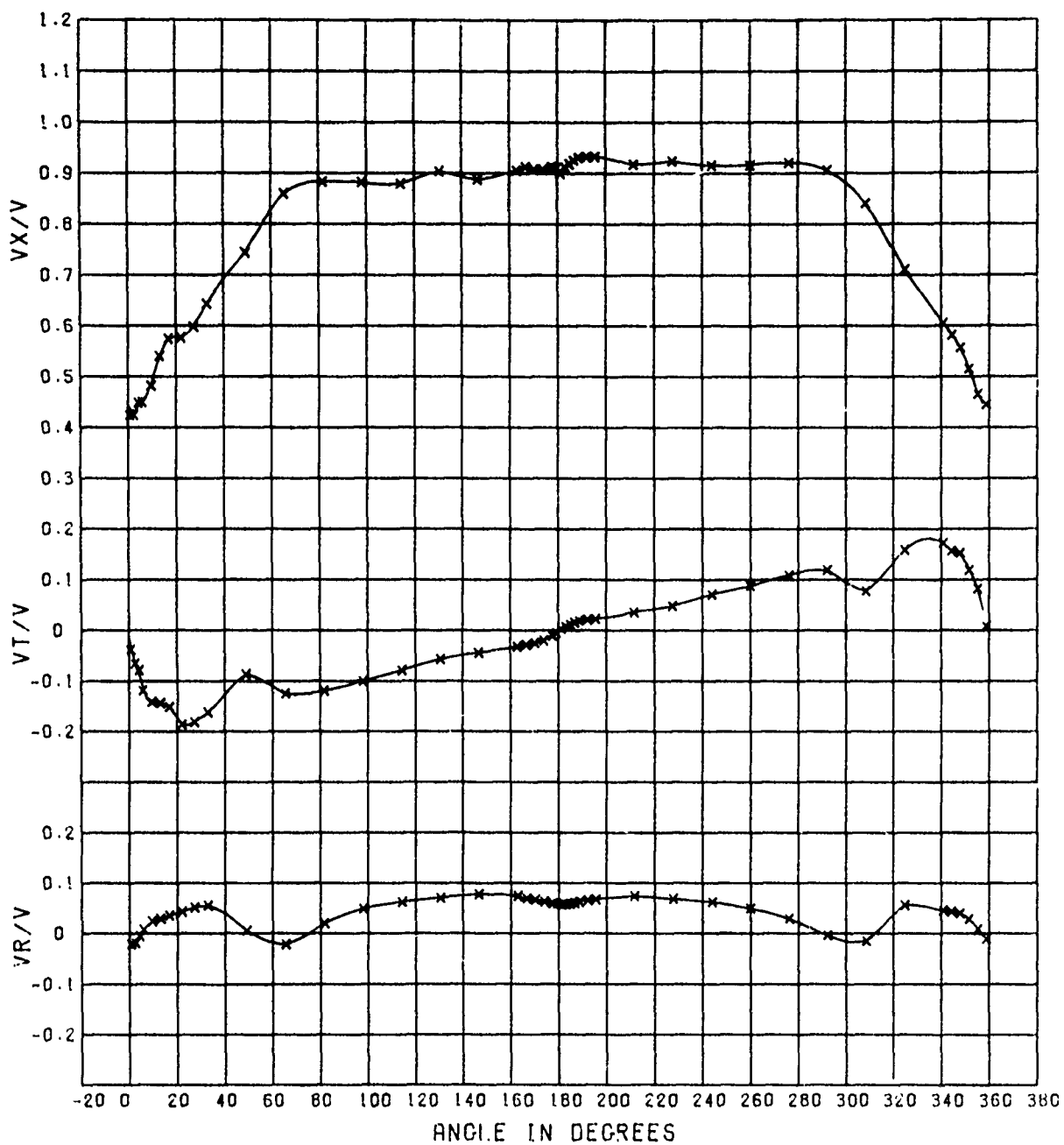


Figure B5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 2
Radius Ratio = 1.178

Fin Configuration 1 (Navy)
Displacement 26,390 tons (26 810 metric tons)

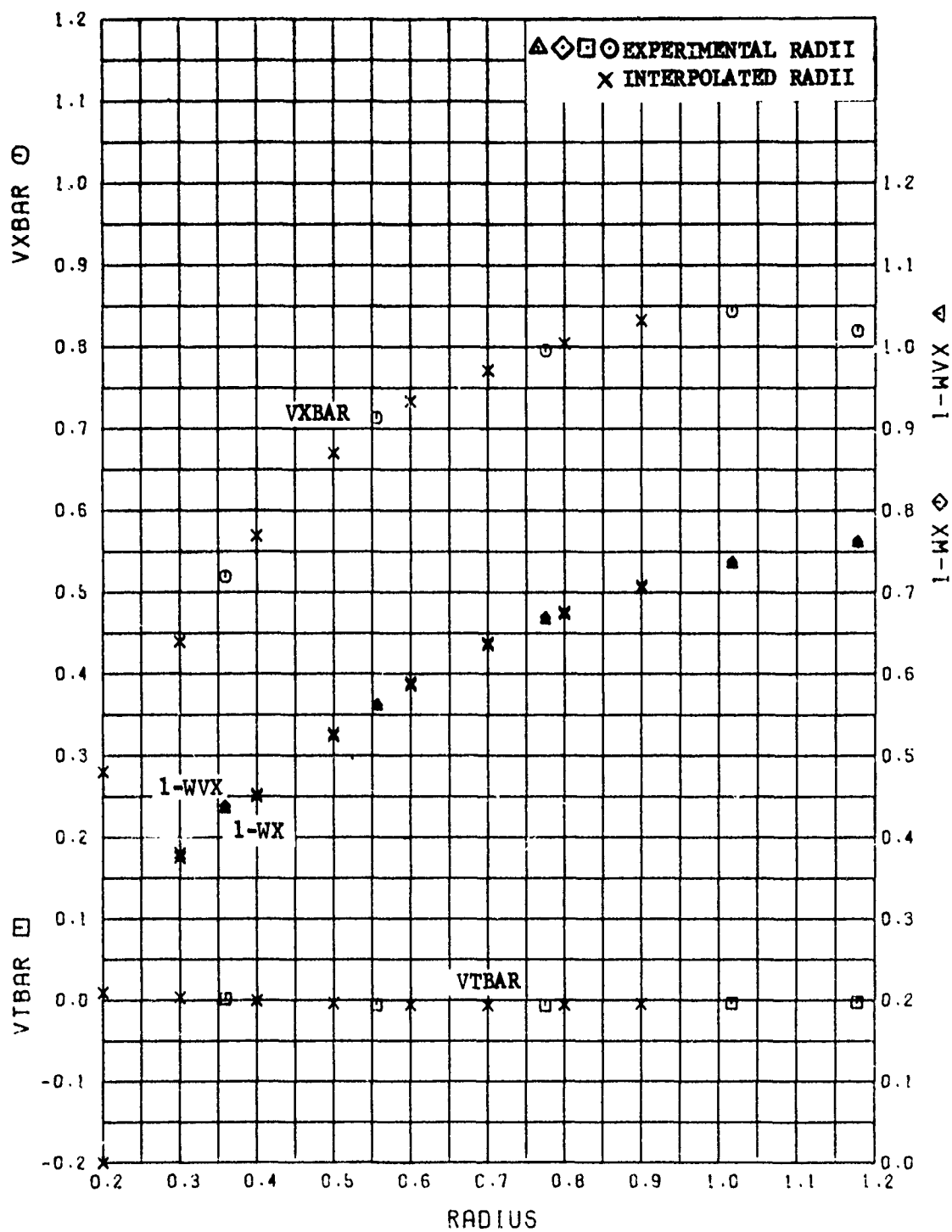


Figure B6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 2

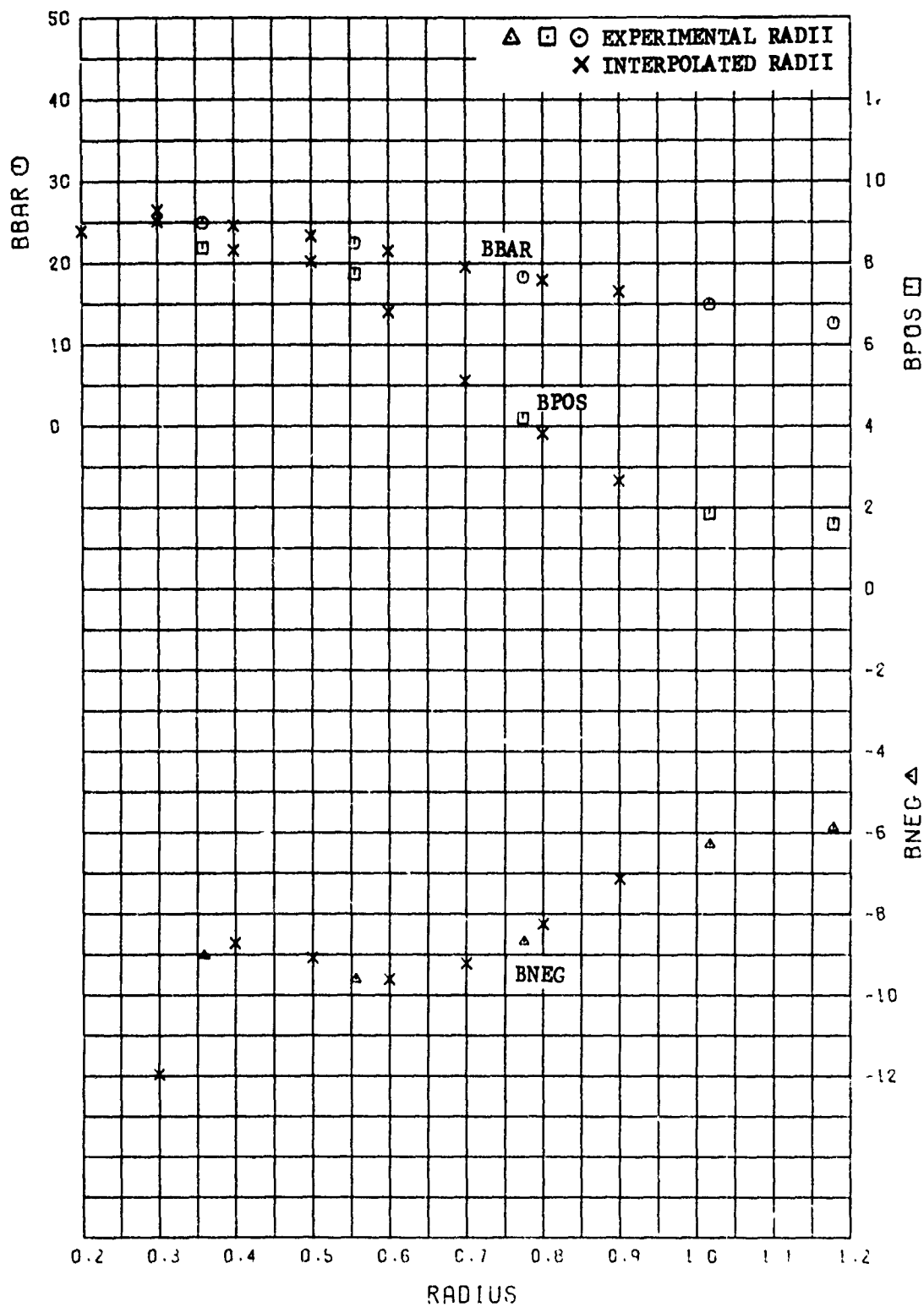


Figure B7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 2

Table B1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 2 with Fin Configuration 1

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.519	.713	.795	.343	.819	.220	.439	.569	.670	.733	.771	.804	.832
VTBAR =	.001	-.006	-.007	-.004	-.003	.003	.003	-.001	-.004	-.006	-.007	-.006	-.005
VRBAR =	.081	.048	.059	.030	.041	.127	.099	.071	.054	.054	.060	.054	.037
1-WVX =	.434	.560	.665	.734	.760	0.000	.375	.450	.524	.586	.635	.673	.705
1-WX =	.438	.562	.659	.737	.762	0.000	.380	.452	.527	.589	.638	.676	.708
BBAR =	24.93	22.48	18.29	14.93	12.61	23.88	25.12	24.60	23.36	21.49	19.55	17.95	16.58
BPOS =	8.38	7.74	4.19	1.85	1.59	23.24	5.29	8.32	8.04	6.81	5.12	3.82	2.67
THETA =	127.50	105.00	90.00	95.00	195.00	175.00	230.00	125.00	110.00	102.50	92.50	90.00	95.00
BNEG =	-9.03	-3.61	-8.68	-6.28	-5.68	-32.61	-11.97	-8.72	-9.08	-9.61	-9.22	-8.25	-7.13
THETA =	25.00	0.00	0.00	355.00	2.50	82.50	50.00	22.50	5.00	0.00	0.00	0.00	355.00

VABAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.
 VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.
 VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.
 1-WVX IS VOLUMETRIC MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.
 1-WX IS VOLUMETRIC MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.
 BBAR IS MEAN ANGLE OF ADVANCE.
 BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).
 BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).
 THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim 1.0 ft by the bow (0.305 m)
 Displacement 26,390 tons (26 810 metric tons)
 Propeller Diameter 21.0 ft (6.40 m)
 Speed 20.0 knots
 Jv 1.01

**Table B2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 2 with Fin Configuration 1**

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.1568	-.0539	.0871	-.0177	.0108	-.0027	.0044	-.0050
RADIUS = .556									
AMPLITUDE	=	-.1595	-.2017	.0659	-.0362	.0507	-.0354	.0181	-.0180
RADIUS = .775									
AMPLITUDE	=	-.1544	-.1638	-.0097	-.0488	.0349	-.0351	.0241	-.0292
RADIUS = 1.017									
AMPLITUDE	=	-.1455	-.1161	-.0475	-.0311	.0039	-.0124	.0051	-.0134
RADIUS = 1.178									
AMPLITUDE	=	-.1567	-.1004	-.0556	-.0175	-.0032	-.0037	-.0093	-.0075

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.1496	.1912	.0721	.0022	-.0587	.0463	-.0123	.0075
RADIUS = .300									
AMPLITUDE	=	-.1547	.0240	.0849	-.0108	-.0111	.0131	-.0012	-.0006
RADIUS = .400									
AMPLITUDE	=	-.1580	-.0988	.0864	-.0221	.0234	-.0121	.0079	-.0079
RADIUS = .500									
AMPLITUDE	=	-.1595	-.1772	.0764	-.0316	.0446	-.0293	.0150	-.0146
RADIUS = .600									
AMPLITUDE	=	-.1587	-.1945	.0475	-.0409	.0485	-.0369	.0210	-.0222
RADIUS = .700									
AMPLITUDE	=	-.1565	-.1774	.0116	-.0476	.0416	-.0373	.0245	-.0261
RADIUS = .800									
AMPLITUDE	=	-.1520	-.1570	-.0150	-.0471	.0305	-.0322	.0223	-.0272
RADIUS = .900									
AMPLITUDE	=	-.1459	-.1355	-.0330	-.0400	.0158	-.0219	.0147	-.0200

Table B3 - Harmonic Analysis of the Tangential Velocity Component
Ratios for Experiment 2 with Fin Configuration 1

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	.0118	.0013	.0656	-.0101	.0154	-.0054	.0067	-.0019
RADIUS = .556									
AMPLITUDE	=	-.0982	-.0124	.0339	-.0002	.0198	-.0118	.0125	-.0060
RADIUS = .775									
AMPLITUDE	=	-.1255	-.0297	-.0043	.0015	.0095	-.0057	.0087	-.0092
RADIUS = 1.017									
AMPLITUDE	=	-.1227	-.0426	-.0283	-.0175	-.0173	-.0090	-.0052	-.0021
RADIUS = 1.178									
AMPLITUDE	=	-.1197	-.0478	-.0335	-.0294	-.0327	-.0199	-.0115	.0000

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.1596	.0112	.0896	-.0238	.0025	.0080	-.0044	.0023
RADIUS = .300									
AMPLITUDE	=	.0605	.0051	.0747	-.0146	.0116	-.0013	.0033	-.0004
RADIUS = .400									
AMPLITUDE	=	-.0178	-.0014	.0592	-.0073	.0174	-.0076	.0087	-.0028
RADIUS = .500									
AMPLITUDE	=	-.0752	-.0083	.0431	-.0022	.0198	-.0111	.0118	-.0050
RADIUS = .600									
AMPLITUDE	=	-.1059	-.0163	.0249	.0016	.0183	-.0099	.0124	-.0074
RADIUS = .700									
AMPLITUDE	=	-.1193	-.0244	.0070	.0029	.0145	-.0068	.0109	-.0091
RADIUS = .800									
AMPLITUDE	=	-.1253	-.0313	-.0077	-.0005	.0065	-.0053	.0070	-.0082
RADIUS = .900									
AMPLITUDE	=	-.1243	-.0372	-.0191	-.0085	-.0049	-.0055	.0009	-.0050

Table B4 - Input Data for Wake Survey Analysis for
Experiment 2 with Fin Configuration 1

RADIUS = .359				119.7	.942	-.084	.046
ANGLE	VX/V	VT/V	VR/V	135.9	.918	-.063	.077
.7	.422	.024	.197	152.0	.858	-.010	.104
4.3	.391	.030	.167	153.3	.840	.003	.104
6.0	.380	.036	.183	156.9	.759	.025	.090
9.7	.377	.051	.172	160.6	.713	.037	.084
13.2	.382	.063	.154	164.1	.662	.061	.059
16.8	.358	.070	.139	167.9	.569	.062	.020
22.1	.342	.077	.097	168.2	.581	.069	.036
27.4	.341	.072	.075	171.4	.510	.058	-.014
32.9	.355	.065	.067	173.2	.472	.049	-.047
49.2	.343	.042	.027	175.1	.432	.041	-.059
65.5	.428	-.008	.034	176.8	.427	.032	-.070
81.8	.463	-.037	.071	178.7	.425	.019	-.073
98.0	.610	-.052	.103	179.1	.431	.026	-.065
114.3	.698	-.021	.121	180.5	.445	.031	-.073
130.6	.747	.023	.124	180.9	.440	.004	-.067
146.8	.696	.061	.106	182.7	.441	-.015	-.061
162.9	.610	.091	.035	184.4	.466	-.028	-.056
166.6	.572	.083	.011	186.0	.511	-.052	-.031
170.2	.542	.078	-.005	191.5	.593	-.063	.005
173.9	.530	.063	-.014	195.1	.660	-.059	.042
177.5	.492	.037	-.032	198.7	.721	-.045	.075
179.3	.482	.036	-.032	202.2	.774	-.021	.090
181.1	.476	.008	-.036	205.8	.827	-.007	.105
183.0	.500	-.004	-.035	209.4	.905	.010	.108
184.8	.491	-.035	-.018	227.3	.894	.059	.079
186.6	.475	-.048	-.016	245.3	.909	.081	.050
188.5	.500	-.037	-.017	263.2	.901	.106	.025
192.1	.521	-.071	.009	281.3	.806	.122	.019
195.6	.531	-.086	.009	299.4	.686	.092	.010
211.6	.632	-.080	.088	317.5	.495	.049	.022
227.5	.686	-.028	.119	322.7	.493	.029	.039
243.9	.700	.015	.117	328.0	.487	.016	.054
260.0	.630	.035	.096	333.4	.448	.005	.073
276.2	.537	.033	.059	338.8	.439	-.005	.099
292.2	.441	.011	.036	344.2	.437	-.012	.125
308.5	.361	-.037	.044	349.6	.412	-.018	.185
324.7	.363	-.059	.069	355.1	.413	-.010	.217
340.9	.386	-.058	.137	360.5	.396	-.003	.215
344.4	.374	-.050	.156				
348.0	.368	-.043	.165				
351.6	.378	-.027	.178				
353.2	.374	-.011	.197				
359.0	.395	.009	.200				
360.8	.401	.024	.205				
RADIUS = .556							
ANGLE	VX/V	VT/V	VR/V				
.5	.396	-.003	.215				
5.9	.406	-.000	.175				
11.2	.414	.004	.122				
22.5	.455	-.004	.063				
39.7	.537	-.063	.011				
54.8	.670	-.104	-.007				
71.0	.804	-.137	-.002				
87.5	.906	-.129	.003				
103.7	.947	-.104	.018				
				ANGLE	VX/V	VT/V	VR/V
				.8	.409	-.016	.210
				2.7	.426	-.016	.195
				4.4	.443	-.015	.174
				6.2	.451	-.024	.157
				9.3	.444	-.026	.129
				13.3	.459	-.045	.101
				16.9	.458	-.057	.089
				32.8	.598	-.103	.026
				49.0	.762	-.139	-.017
				65.3	.872	-.142	-.013
				81.5	.939	-.129	.012
				97.6	.946	-.114	.040
				113.9	.943	-.098	.065
				130.2	.938	-.081	.083
				145.3	.936	-.066	.097
				162.4	.921	-.041	.113
				166.1	.905	-.017	.120
				169.6	.859	.027	.125
				173.3	.710	.079	.092
				175.2	.641	.088	.054

Table B4 - Continued[illegible]

APPENDIX C

EXPERIMENT 3

FIN CONFIGURATION 1 (NAVY)

SHIP VALUES

Trim	3.75 ft by the stern (1.143 m)
Displacement	17,270 tons (17 550 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jy	1.01

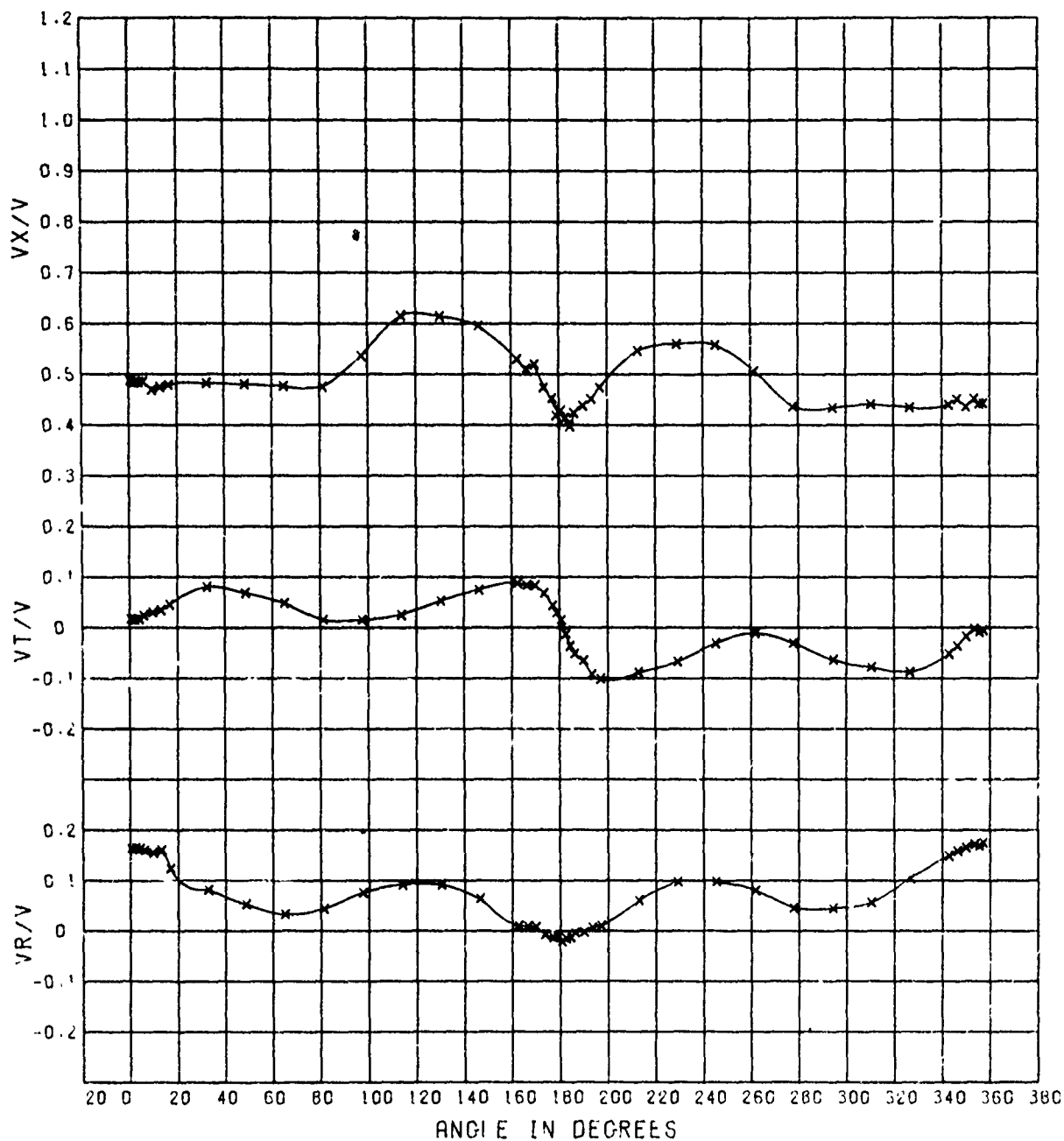


Figure C1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 3
Radius Ratio = 0.359

Fin Configuration 1 (Navy)
Displacement 17,270 tons (17 550 metric tons)

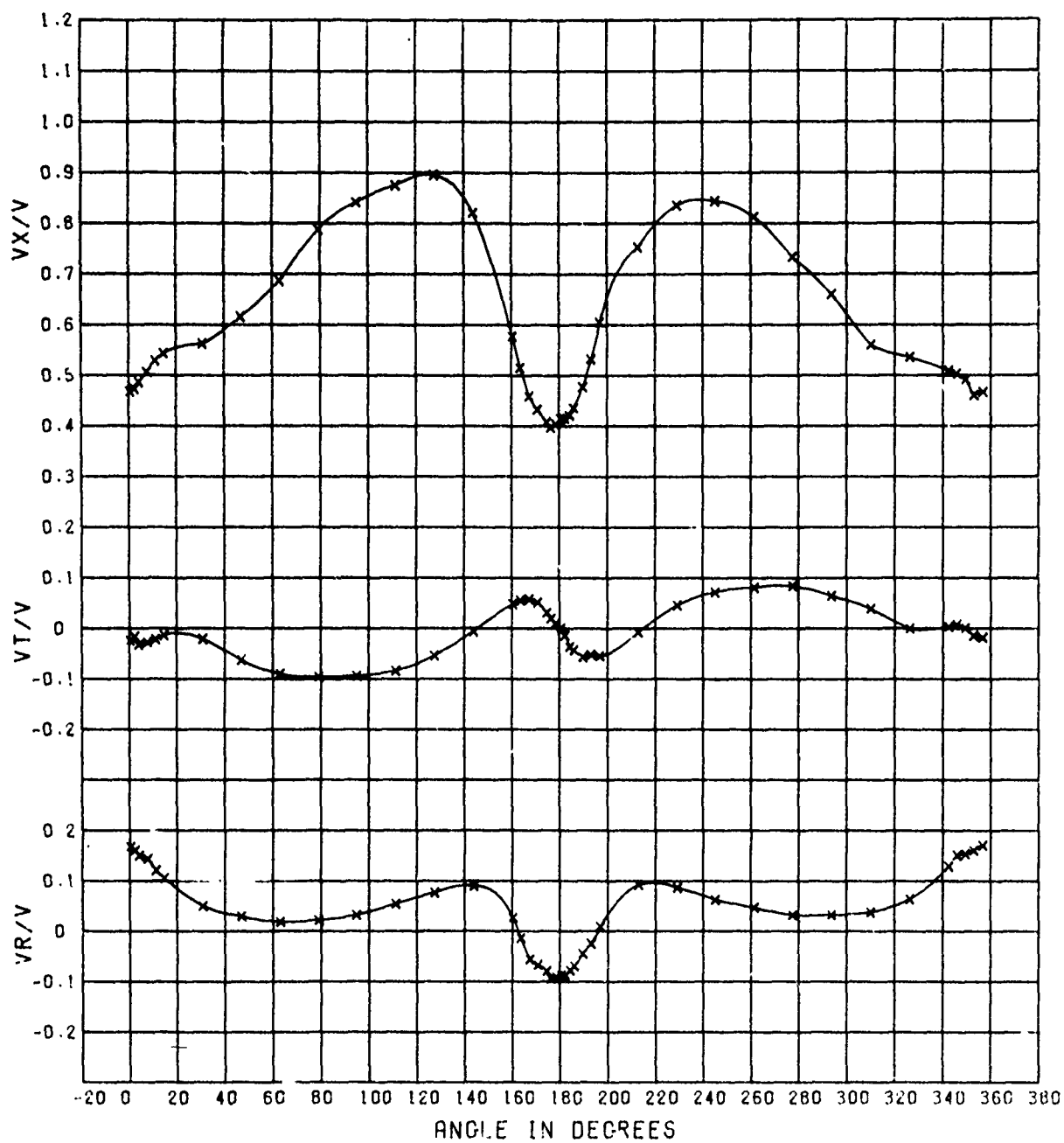


Figure C2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 3
Radius Ratio = 0.556

Fin Configuration 1 (Navy)
Displacement 17,270 tons (17 550 metric tons)

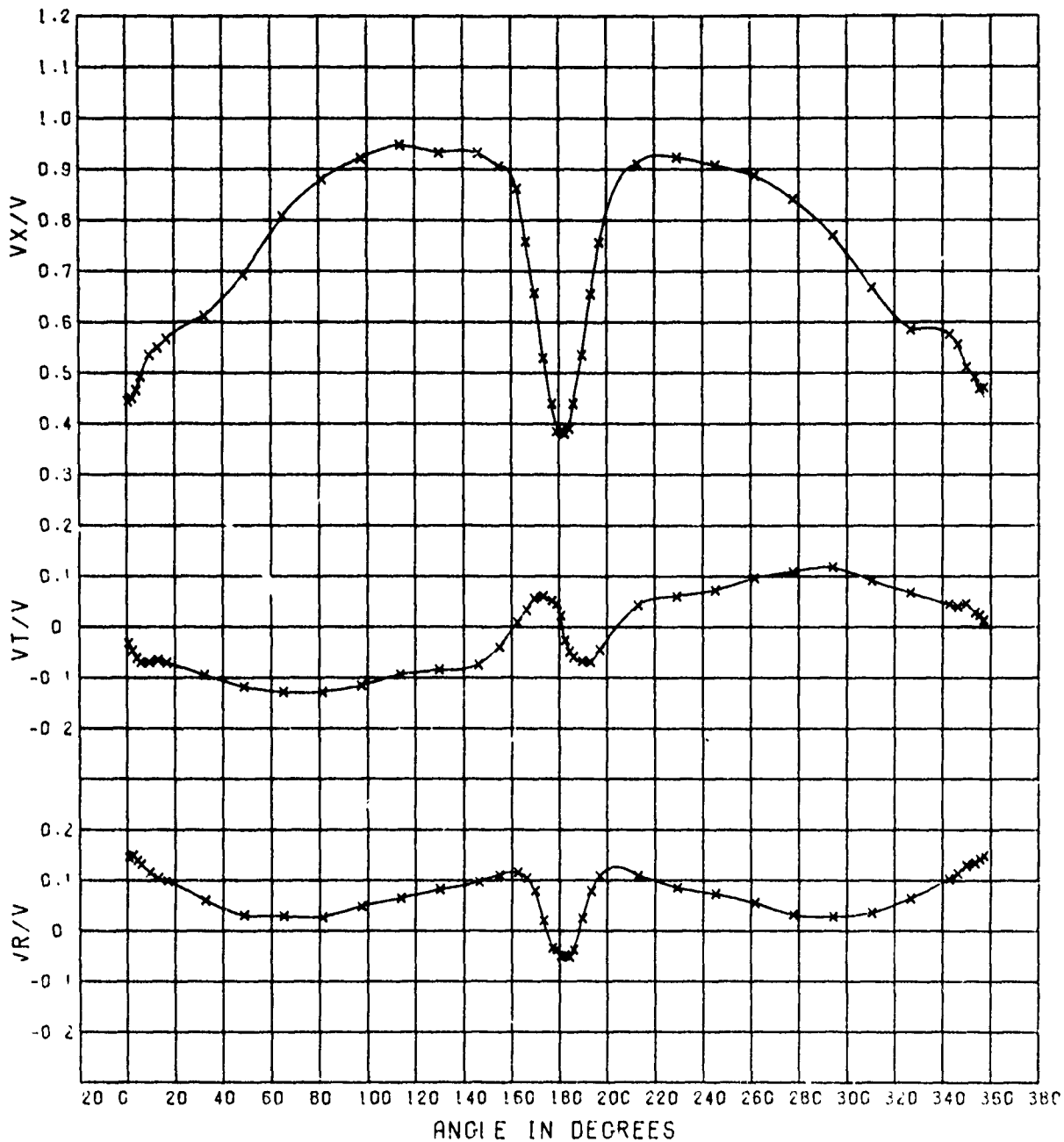


Figure C3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 3
Radius Ratio = 0.775

Fin Configuration 1 (Navy)
Displacement 17,270 tons (17 550 metric tons)

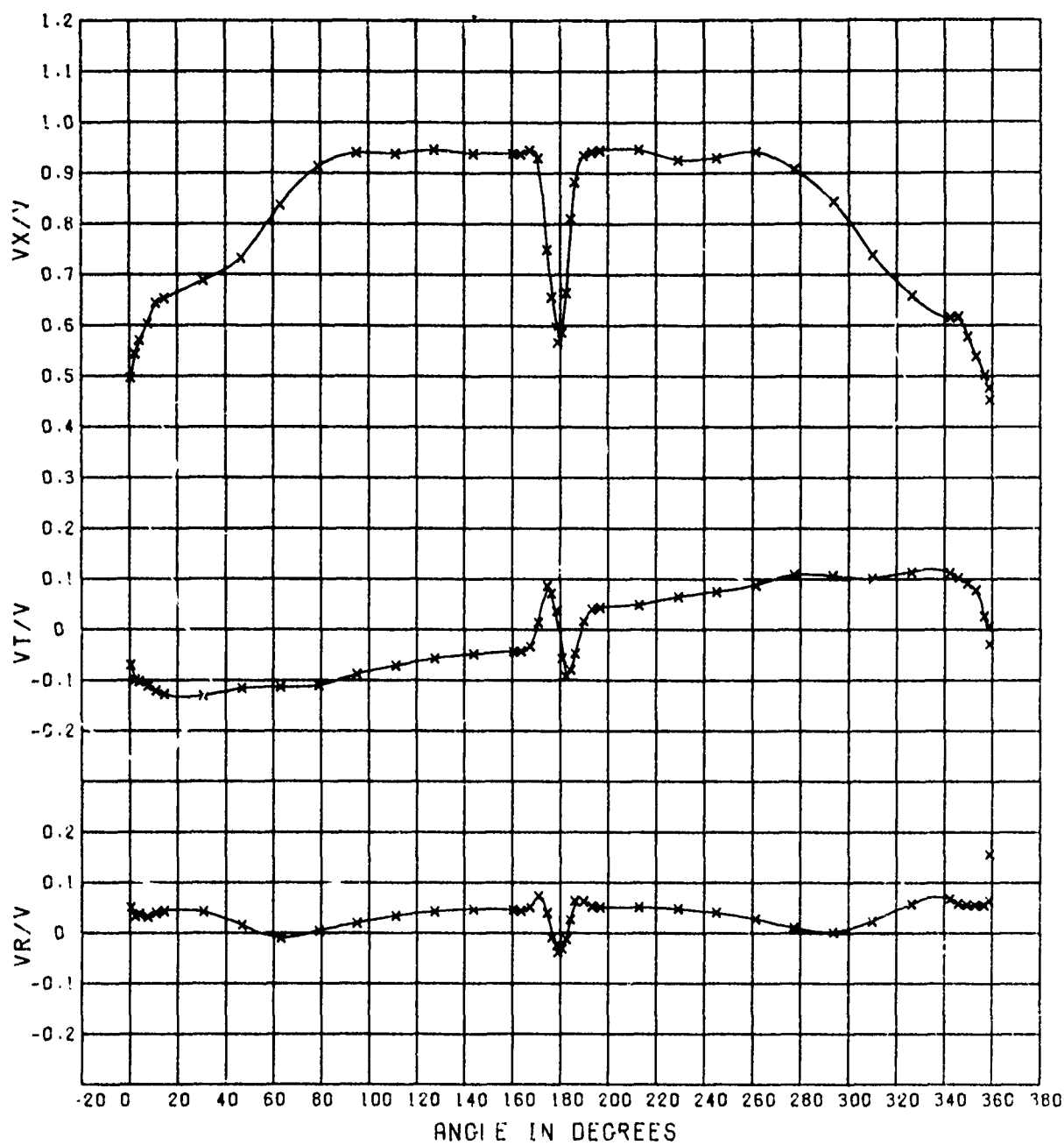


Figure C4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 3
Radius Ratio = 1.107

Fin Configuration 1 (Navy)
Displacement 17,270 tons (17 550 metric tons)

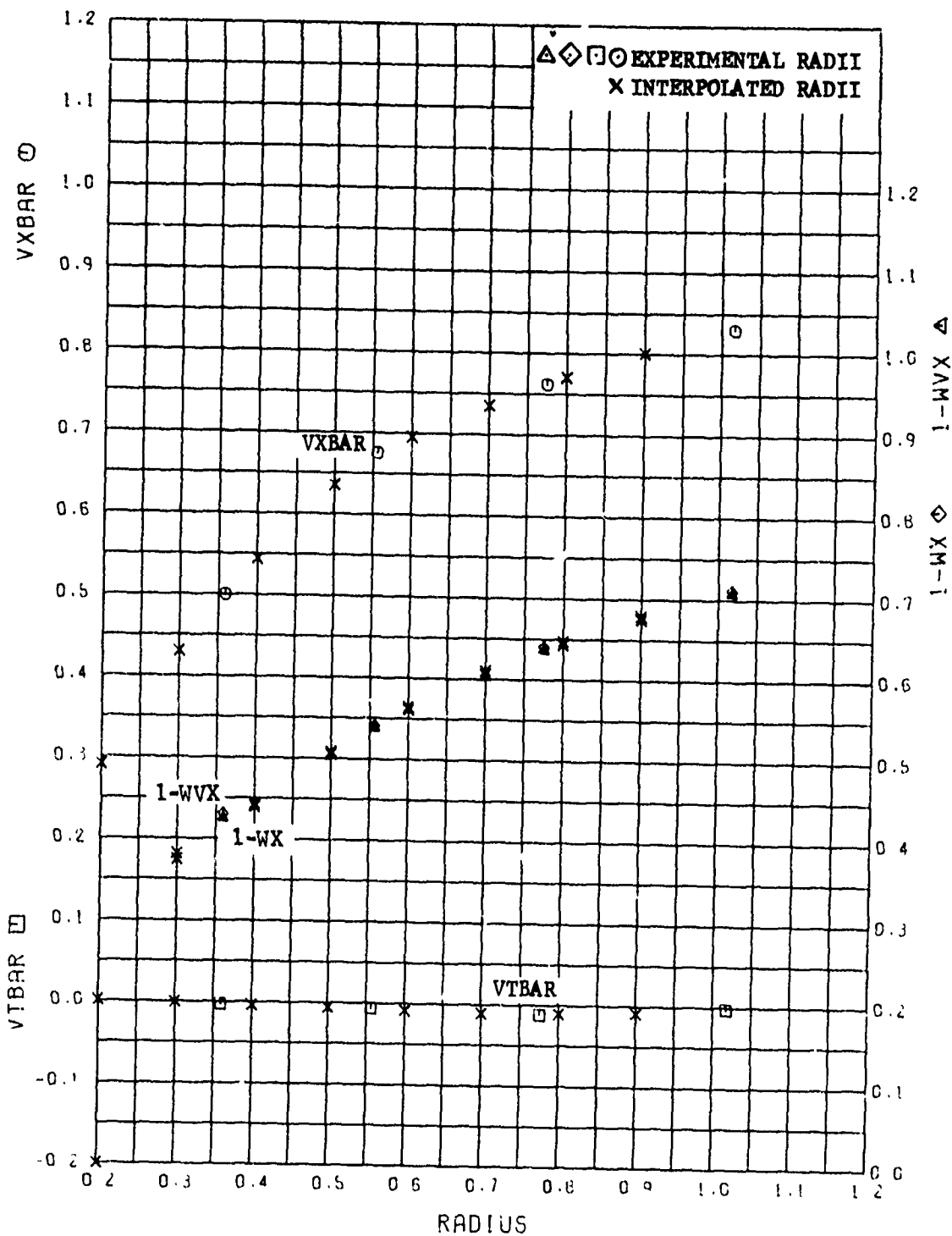


Figure C5 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 3

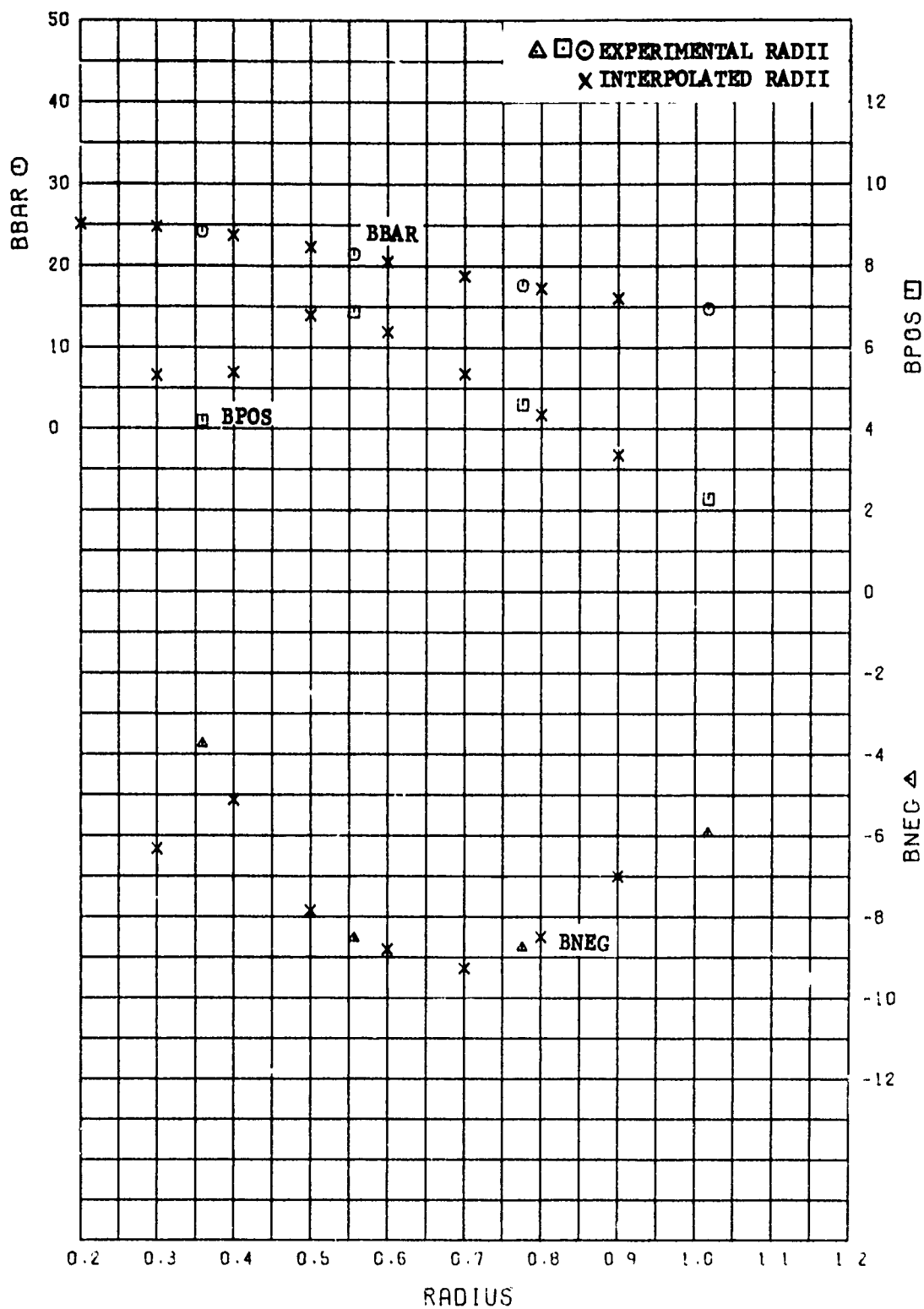


Figure C6 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 3

Table C1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 3 with Fin Configuration 1

RADIUS =	.359	.556	.775	1.017	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.500	.675	.760	.830	.291	.430	.544	.635	.695	.735	.770	.801
VTEAR =	-.003	-.007	-.012	-.003	.001	-.001	-.004	-.006	-.009	-.011	-.011	-.009
VRBAR =	.071	.052	.066	.033	.109	.083	.064	.054	.053	.065	.065	.055
1-WVX =	.425	.537	.636	.707	0.000	.37-	.440	.505	.561	.606	.643	.675
1-WX =	.431	.540	.640	.711	0.000	.381	.443	.509	.564	.610	.647	.679
BSAR =	24.18	21.41	17.62	14.71	25.05	24.73	23.69	22.29	20.51	18.75	17.28	16.01
BPOS =	4.19	6.88	4.60	2.28	21.04	5.31	5.39	6.79	6.38	5.35	4.35	3.35
THETA =	117.50	122.50	112.50	95.00	157.50	212.50	117.50	120.00	120.00	115.00	112.50	112.50
BNEG =	-3.75	-8.54	-8.76	-5.94	-21.05	-6.30	-5.12	-7.85	-9.21	-9.28	-8.50	-7.00
THE-A =	180.00	177.50	180.00	257.50	32.50	80.00	180.00	175.00	177.50	182.50	180.00	180.00

VXBAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.
 VTEAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.
 VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.
 1-WVX IS VOLUMETRIC MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.
 1-WX IS VOLUMETRIC MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.
 BSAR IS MEAN ANGLE OF ADVANCE.
 BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).
 BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).
 THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING DPOS OR DNEG OCCURS.

SHIP VALUES

Trim 3.75 ft by the stern (1.143 m)
 Displacement 17,270 tons (17 550 metric tons)
 Propeller Diameter 21.0 ft (6.40 m)
 Speed 20.0 knots
 Jv 1.01

**Table C2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 3 with Fin Configuration 1**

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.0475	-.0162	.0486	-.0276	.0027	-.0007	.0100	-.0052
RADIUS = .556									
AMPLITUDE	=	-.0803	-.1551	.0873	-.0462	.0286	-.0238	.0031	-.0099
RADIUS = .775									
AMPLITUDE	=	-.1212	-.1553	.0548	-.0574	.0485	-.0486	.0257	-.0378
RADIUS = 1.017									
AMPLITUDE	=	-.1445	-.1009	-.0006	-.0128	.0179	-.0277	.0087	-.0253

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.0239	.1917	-.0296	-.0067	-.0238	.0185	.0344	-.0157
RADIUS = .300									
AMPLITUDE	=	-.0385	.0509	.0244	-.0205	-.0065	.0064	.0171	-.0076
RADIUS = .400									
AMPLITUDE	=	-.0540	-.0559	.0619	-.0322	.0087	-.0056	.0064	-.0046
RADIUS = .500									
AMPLITUDE	=	-.0706	-.1290	.0828	-.0418	.0220	-.0173	.0024	-.0066
RADIUS = .600									
AMPLITUDE	=	-.0900	-.1589	.0821	-.0524	.0363	-.0321	.0105	-.0185
RADIUS = .700									
AMPLITUDE	=	-.1093	-.1606	.0678	-.0591	.0468	-.0448	.0220	-.0324
RADIUS = .800									
AMPLITUDE	=	-.1247	-.1524	.0501	-.0556	.0479	-.0488	.0260	-.0386
RADIUS = .900									
AMPLITUDE	=	-.1361	-.1344	.0288	-.0418	.0396	-.0442	.0224	-.0371

**Table C3 - Harmonic Analysis for the Tangential Velocity Component
Ratios for Experiment 3 with Fin Configuration 1**

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	.0624	.0018	.0522	-.0148	.0086	-.0073	.0052	-.0063
RADIUS = .556									
AMPLITUDE	=	-.0686	-.0112	.0335	-.0124	.0154	-.0103	.0035	-.0063
RADIUS = .775									
AMPLITUDE	=	-.1134	-.0254	.0021	-.0098	.0076	-.0181	.0091	-.0145
RADIUS = 1.017									
AMPLITUDE	=	-.1128	-.0367	-.0268	-.0150	-.0171	-.0139	-.0060	-.0074

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.2309	.0123	.0608	-.0168	-.0062	-.0077	.0114	-.0113
RADIUS = .300									
AMPLITUDE	=	.1164	.0057	.0561	-.0155	.0041	-.0072	.0070	-.0076
RADIUS = .400									
AMPLITUDE	=	.0281	-.0009	.0490	-.0143	.0111	-.0076	.0043	-.0057
RADIUS = .500									
AMPLITUDE	=	-.0401	-.0075	.0357	-.0131	.0143	-.0090	.0033	-.0056
RADIUS = .600									
AMPLITUDE	=	-.0811	-.0143	.0268	-.0113	.0149	-.0127	.0061	-.0091
RADIUS = .700									
AMPLITUDE	=	-.1029	-.0210	.0123	-.0099	.0118	-.0166	.0092	-.0133
RADIUS = .800									
AMPLITUDE	=	-.1158	-.0268	-.0012	-.0100	.0059	-.0183	.0086	-.0146
RADIUS = .900									
AMPLITUDE	=	-.1197	-.0319	-.0136	-.0115	-.0030	-.0176	.0041	-.0130

Table C4 - Input Data for Wake Survey Analysis for Experiment 3 with Fin Configuration 1

RADIUS = .359				79.1	.788	-.096	.021
ANGLE	VX/V	VT/V	VR/V	95.2	.842	-.094	.032
.5	.487	.017	.163	111.5	.875	-.084	.054
2.4	.484	.015	.164	127.7	.896	-.054	.077
4.2	.485	.017	.163	143.9	.820	-.006	.090
5.9	.485	.024	.160	160.3	.577	.048	.026
9.6	.469	.030	.155	163.7	.514	.055	-.015
13.0	.474	.034	.161	167.4	.458	.058	-.056
16.6	.479	.046	.124	170.9	.432	.051	-.067
32.5	.462	.080	.082	174.6	.407	.031	-.080
48.8	.480	.069	.053	176.3	.396	.019	-.095
65.0	.476	.048	.032	178.1	.399	.012	-.090
81.3	.475	.016	.044	178.9	.408	.007	-.093
97.4	.536	.015	.075	180.6	.415	.000	-.088
113.9	.615	.025	.092	182.4	.414	-.014	-.088
130.1	.614	.053	.091	184.3	.420	-.037	-.077
146.4	.595	.074	.063	186.0	.433	-.041	-.067
162.5	.529	.088	.009	186.1	.437	-.046	-.071
166.3	.509	.084	.009	189.7	.477	-.057	-.045
169.8	.519	.083	.008	193.2	.532	-.053	-.025
170.5	.473	.068	-.008	196.8	.606	-.055	.009
177.1	.453	.044	-.014	212.9	.753	-.007	.092
178.9	.418	.029	-.012	229.1	.835	.046	.086
180.7	.429	.015	-.022	245.2	.844	.071	.063
182.5	.413	-.013	-.015	261.4	.813	.081	.047
184.3	.396	-.037	-.014	277.5	.703	.064	.032
186.1	.423	-.052	-.004	293.8	.660	.065	.032
189.8	.438	-.065	-.003	310.1	.560	.039	.038
193.3	.451	-.093	.006	326.3	.536	-.000	.064
197.0	.474	-.101	.010	342.5	.509	.003	.129
212.9	.546	-.089	.059	346.0	.502	.007	.151
229.1	.559	-.067	.097	349.6	.491	.000	.153
245.3	.558	-.031	.098	353.1	.460	-.015	.160
261.7	.527	-.011	.081	358.8	.466	-.019	.171
277.7	.436	-.030	.046	358.7	.460	-.035	.161
294.3	.433	-.054	.044				
310.4	.441	.078	.056				
326.6	.435	-.037	.104				
342.7	.440	-.052	.149	ANGLE	RADIUS = .775		
346.4	.449	-.036	.159	VX/V	VT/V	VR/V	
349.9	.435	-.017	.165	.5	.444	-.032	.146
353.6	.452	-.002	.171	2.4	.430	-.047	.149
355.5	.441	-.009	.169	4.2	.466	-.061	.139
357.2	.446	-.002	.165	5.9	.453	-.070	.132
357.2	.439	-.008	.186	9.6	.535	-.070	.115
358.9	.490	.007	.166	13.0	.550	-.063	.105
				16.6	.567	-.070	.099
				32.5	.612	-.094	.050
				48.9	.692	-.118	.031
				65.0	.808	-.129	.029
				81.3	.879	-.129	.027
				97.4	.921	-.116	.049
				113.9	.917	-.094	.064
				130.1	.932	-.065	.031
				146.4	.912	-.074	.056
				155.0	.905	-.040	.110
				162.5	.862	.009	.115
				166.3	.758	.033	.104
				169.8	.656	.054	.079
				173.5	.528	.060	.020
				177.1	.439	.052	-.035
				178.9	.384	.045	-.037
				180.7	.364	.023	-.051
				182.5	.330	-.027	-.049
				184.3	.389	-.049	-.052
							</

Table C4 - Continued

186.1	.438	-.060	-.038	326.3	.659	.113	.057
189.8	.535	-.063	.024	342.5	.615	.112	.067
193.3	.655	-.069	.079	346.0	.617	.102	.058
197.0	.756	-.045	.108	349.6	.578	.091	.055
212.9	.910	.043	.109	353.1	.539	.078	.055
229.1	.923	.060	.085	356.8	.502	.026	.055
245.3	.907	.072	.073	358.7	.477	-.029	.064
261.7	.887	.096	.055	360.4	.457	-.071	.050
277.7	.841	.108	.032				
294.3	.769	.118	.027				
310.4	.668	.091	.036				
326.6	.585	.068	.064				
342.7	.576	.045	.103				
346.4	.556	.040	.114				
349.9	.510	.045	.130				
353.6	.491	.028	.134				
355.5	.468	.023	.142				
357.2	.464	.009	.148				
357.2	.478	.017	.150				
358.9	.433	-.037	.152				

Tube 5 r/R = 1.178
out of water

RADIUS = 1.017			
ANGLE	VX/V	VT/V	VR/V
359.0	.452	.007	.156
.4	.497	-.071	.050
2.2	.544	-.099	.030
4.0	.570	-.103	.037
7.5	.603	-.112	.032
11.0	.643	-.121	.039
14.6	.652	-.128	.043
30.9	.688	-.131	.042
46.9	.712	-.117	.015
63.0	.837	-.114	-.011
79.1	.913	-.111	.004
95.2	.940	-.088	.019
111.5	.938	-.072	.034
127.7	.946	-.058	.042
143.9	.938	-.049	.047
150.3	.939	-.044	.046
163.7	.937	-.043	.044
167.4	.945	-.034	.051
170.9	.929	.014	.073
174.6	.749	.087	.040
176.3	.655	.072	-.009
178.1	.585	.029	-.039
178.8	.609	.041	-.010
178.9	.567	.037	-.039
180.6	.586	-.053	-.051
182.4	.603	-.093	-.013
184.2	.835	-.072	.032
184.3	.784	-.088	.020
186.0	.895	-.041	.065
186.0	.870	-.055	.062
189.7	.934	.016	.062
193.2	.941	.039	.053
196.8	.944	.043	.051
212.9	.946	.043	.051
229.1	.926	.065	.048
245.2	.929	.074	.040
261.4	.942	.088	.028
277.5	.907	.108	.010
293.8	.844	.106	.001
310.1	.737	.100	.023

APPENDIX D
EXPERIMENT 4
FIN CONFIGURATION 3 (NAVY)

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jv	1.01

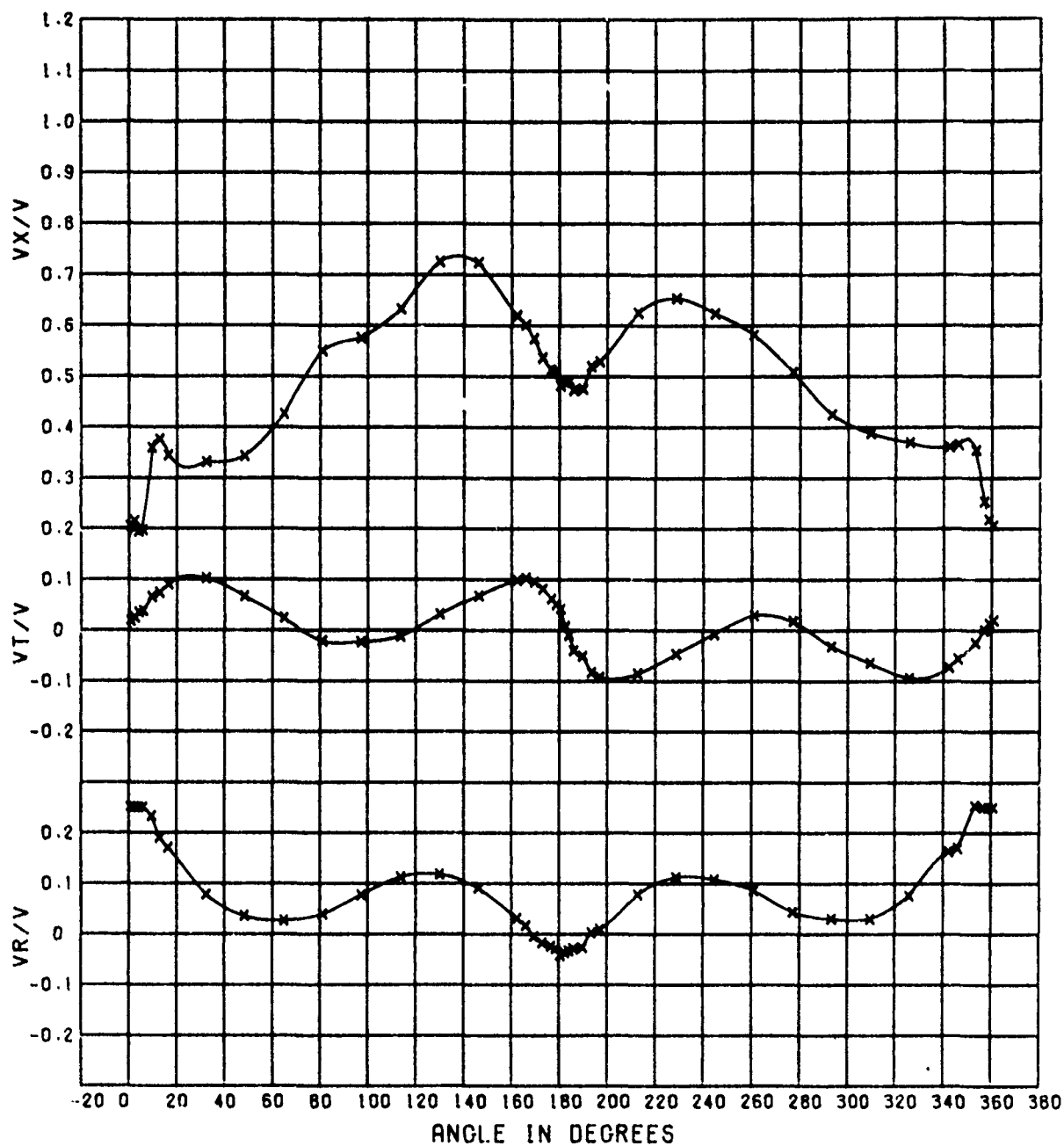


Figure D1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 4
Radius Ratio = 0.359

Fin Configuration 3 (Navy)
Displacement 26,390 tons (26 810 metric tons)

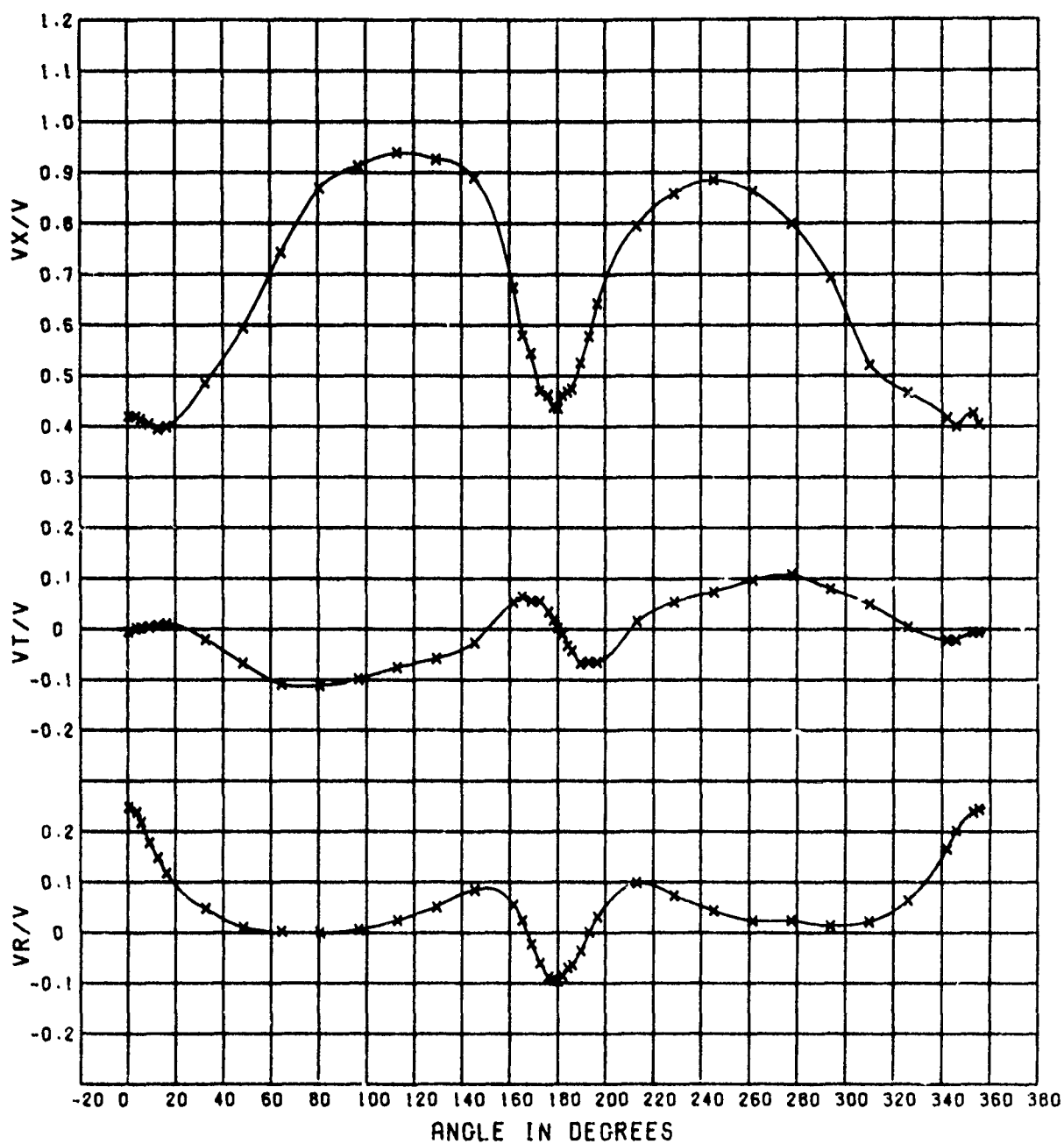


Figure D2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 4
Radius Ratio = 0.556

Fin Configuration 3 (Navy)
Displacement 26,390 tons (26 810 metric tons)

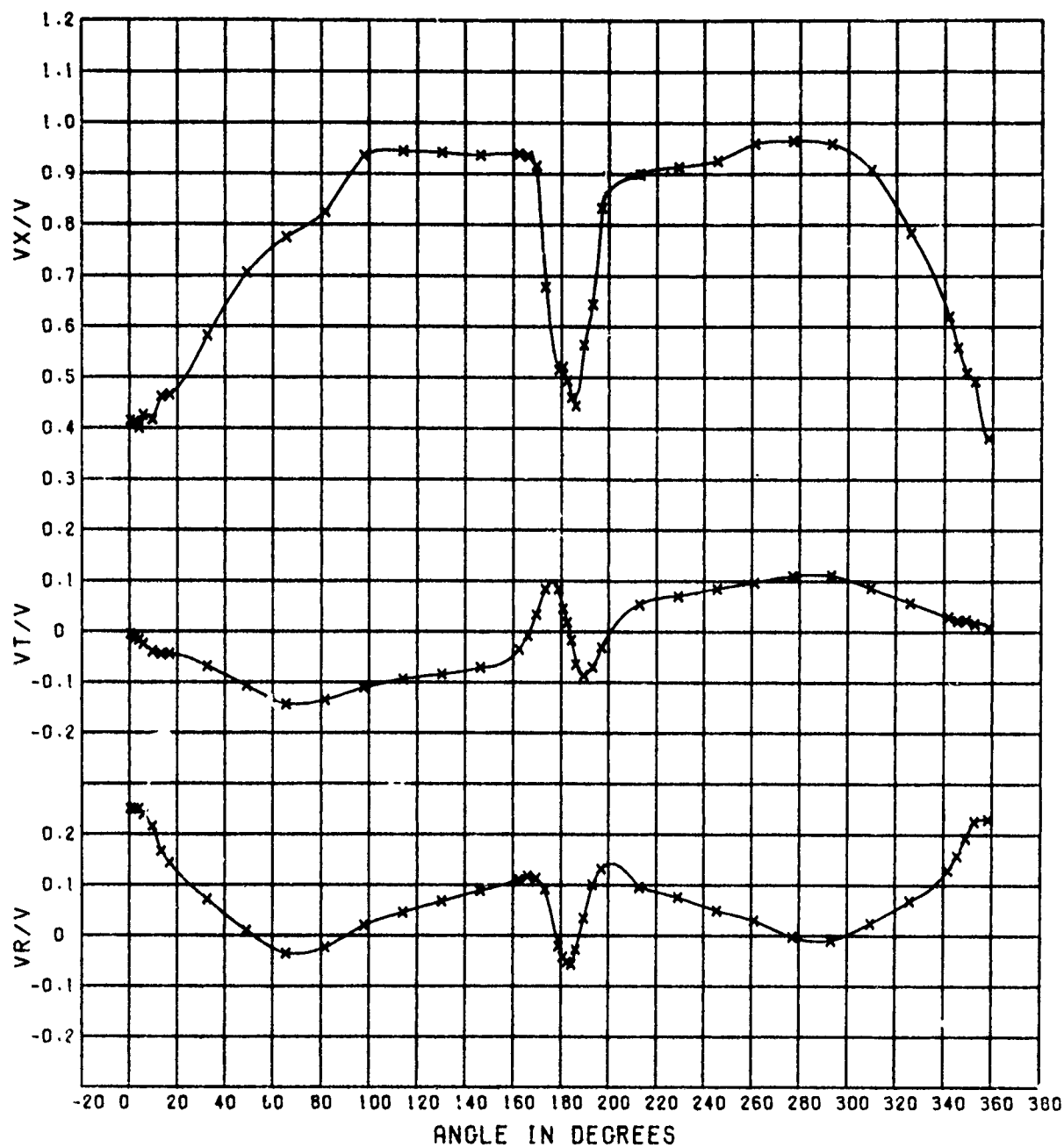


Figure D3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 4
Radius Ratio = 0.775

Fin Configuration 3 (Navy)
Displacement 26,390 tons (26 810 metric tons)

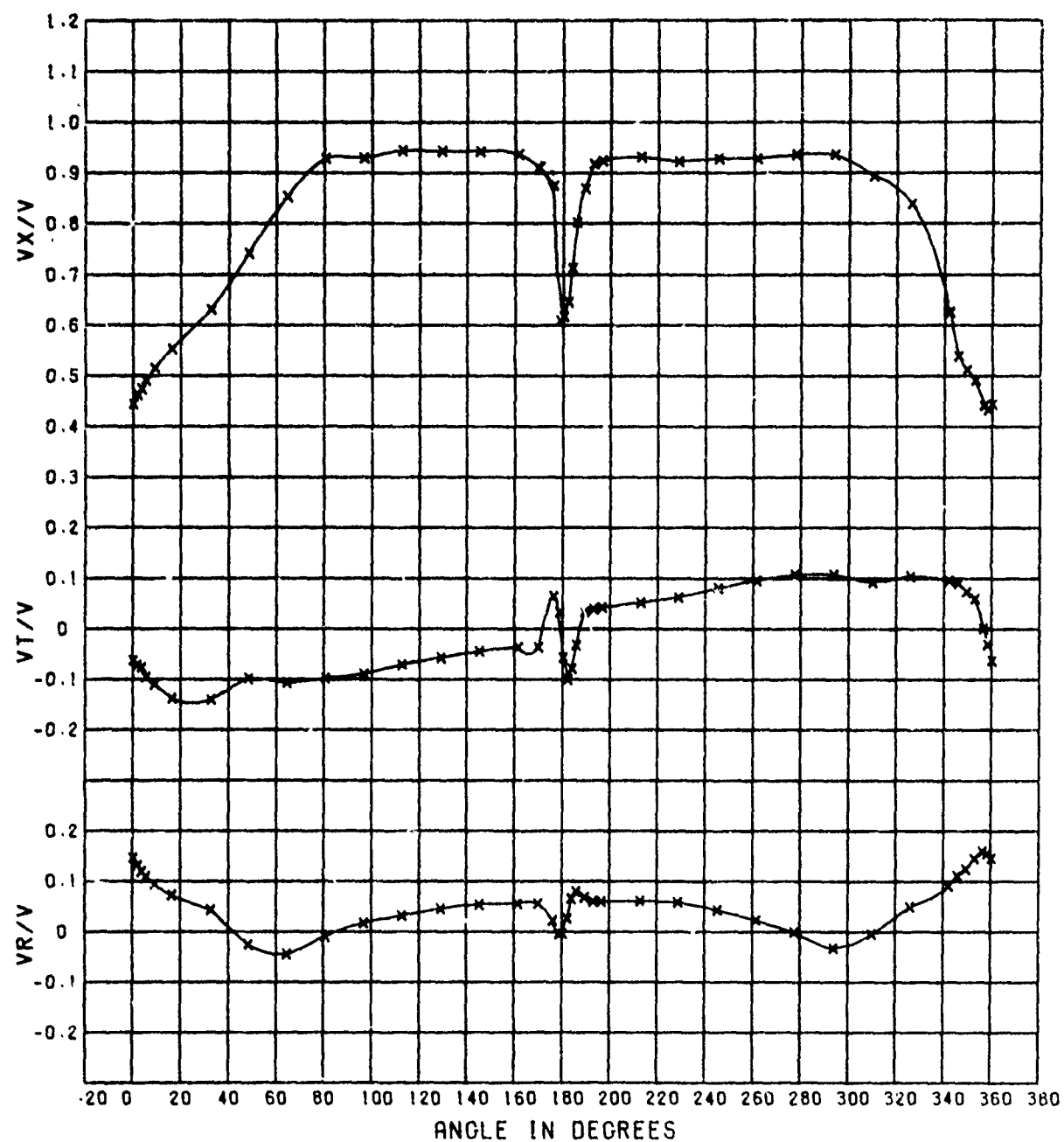


Figure D4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 4
Radius Ratio = 1.107

Fin Configuration 3 (Navy)
Displacement 26,390 tons (26 810 metric tons)

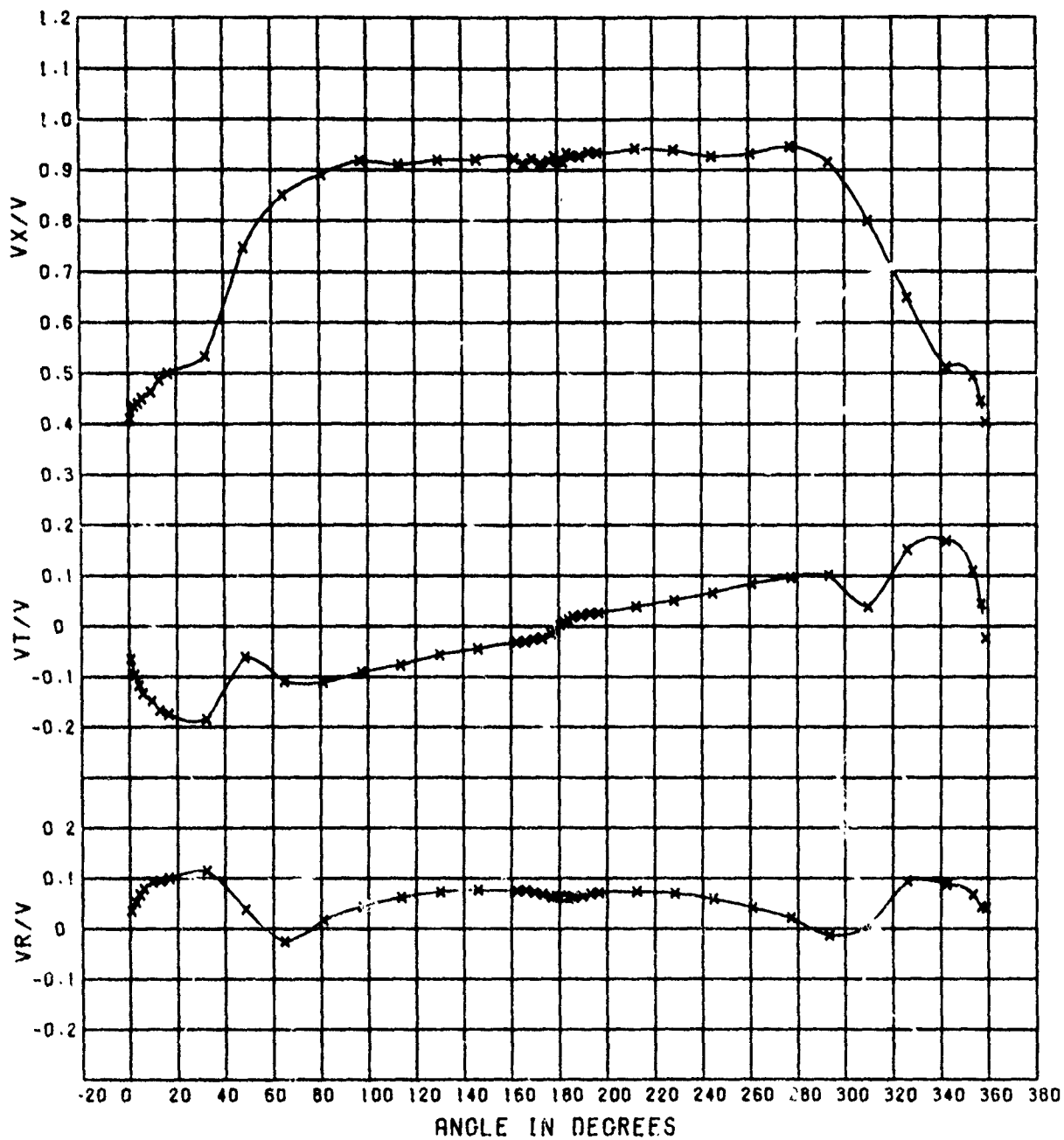


Figure D5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 4
Radius Ratio = 1.178

Fin Configuration 3 (Navy)
Displacement 26,390 tons (26 810 metric tons)

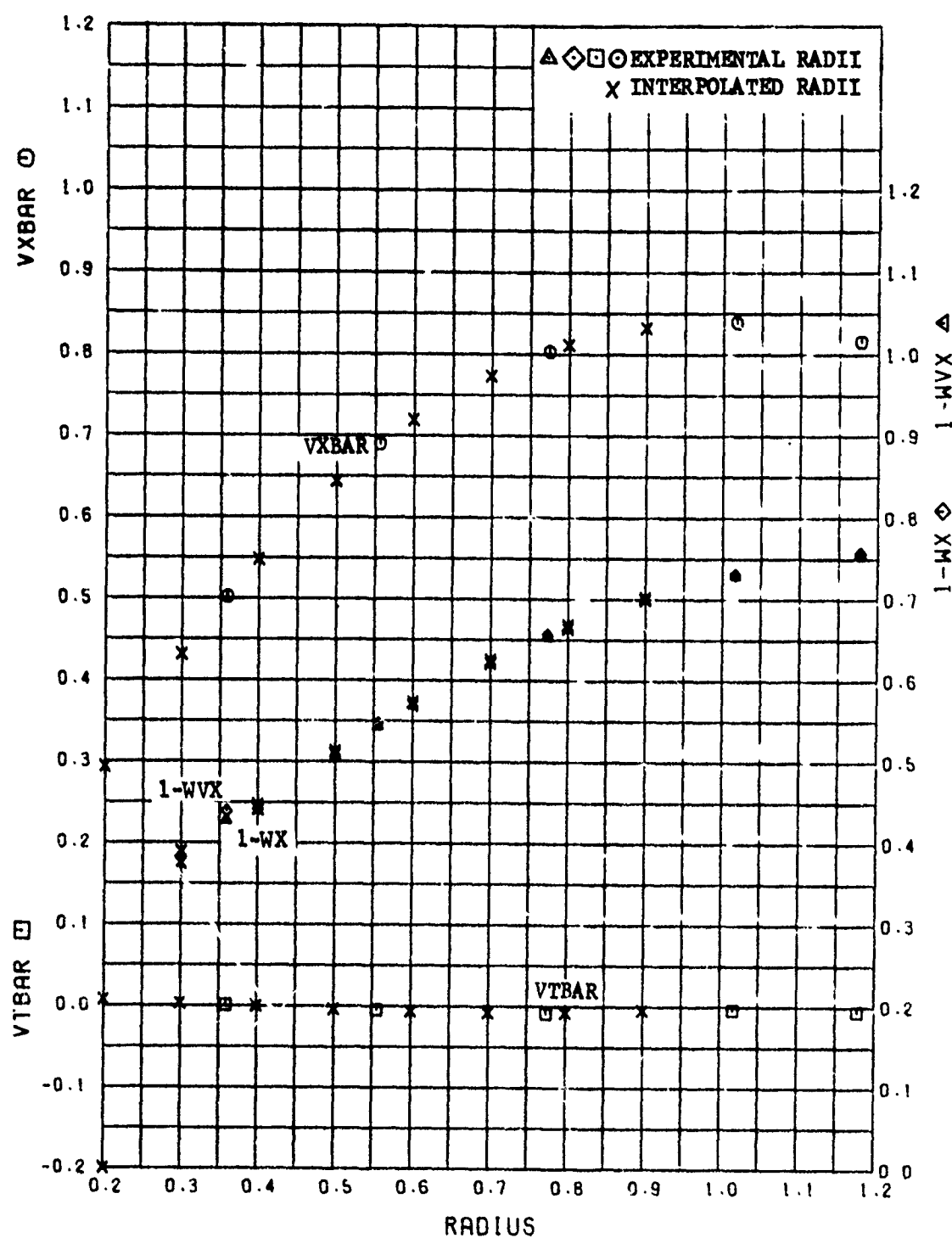


Figure D6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 4

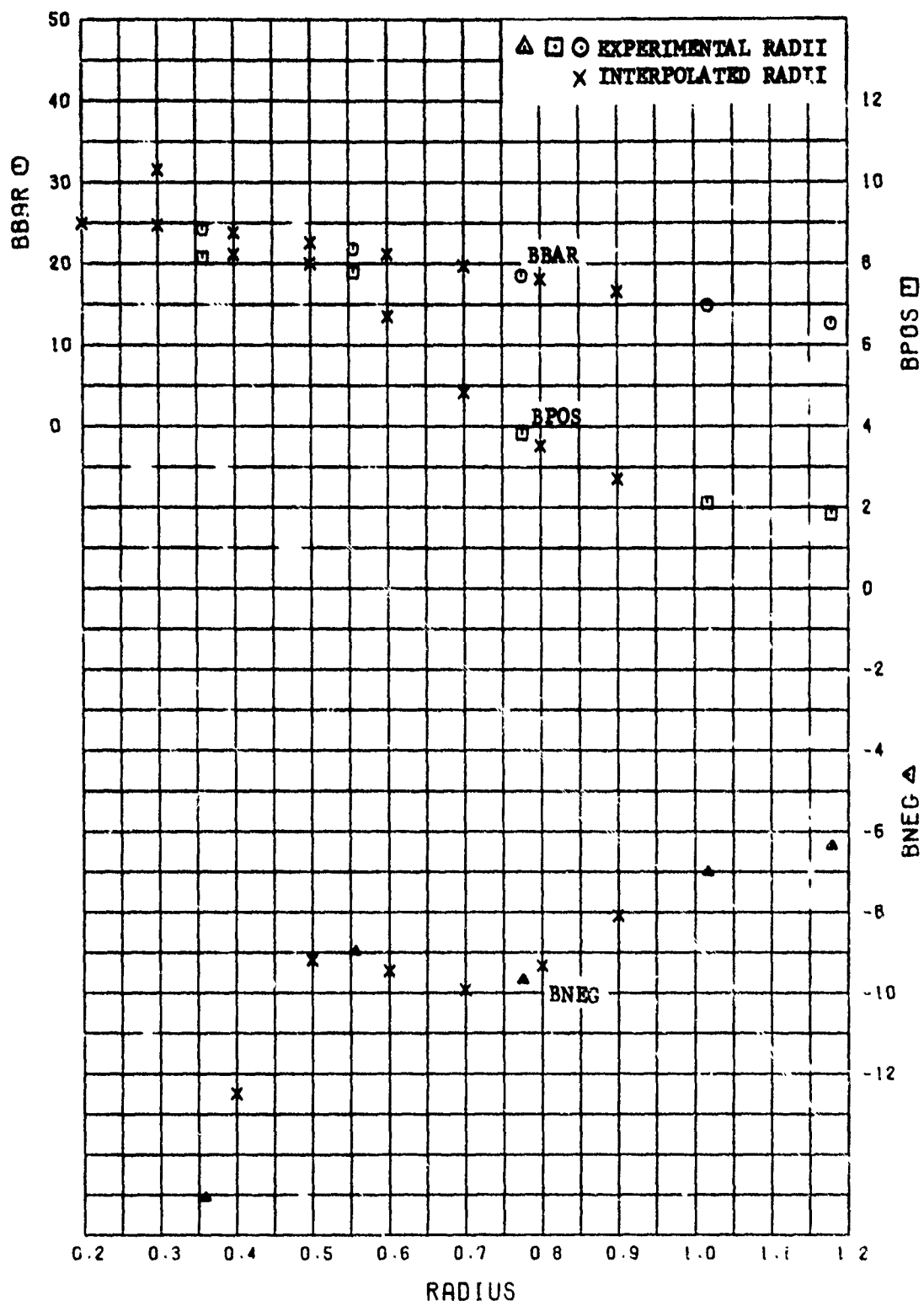


Figure D7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 4

Table D1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 4 with Fin Configuration 3

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.502	.690	.803	.839	.816	.293	.431	.548	.644	.719	.773	.811	.832
VTBAR =	.001	-.005	-.009	-.004	-.006	.007	.003	-.000	-.004	-.006	-.008	-.008	-.005
VRBAR =	.079	.050	.061	.035	.054	.129	.095	.070	.055	.055	.061	.055	.039
1-WVX =	.427	.543	.653	.729	.755	0.000	.375	.441	.509	.569	.621	.664	.699
1-WX =	.439	.547	.656	.731	.757	0.000	.389	.447	.513	.573	.625	.668	.702
BBAR =	24.20	21.79	18.49	14.87	12.58	24.92	24.70	23.78	22.50	21.12	19.61	18.10	16.58
BPOS =	8.15	7.79	3.81	2.11	1.83	24.67	10.31	8.22	8.00	0.70	4.82	3.52	2.70
THETA =	135.00	112.50	105.00	112.50	97.50	165.00	217.50	132.50	117.50	110.00	105.00	107.50	112.50
BNEG =	-15.07	-8.98	-9.69	-7.01	-6.36	-39.26	-20.69	-12.49	-9.19	-9.46	-9.92	-9.33	-8.09
THETA =	0.00	12.50	357.50	357.50	0.00	0.00	0.00	0.00	357.50	357.50	357.50	357.50	357.50

VXBAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.
VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.
VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.
1-WVX IS VOLUMETRIC MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.
1-WX IS VOLUMETRIC MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.
BBAR IS MEAN ANGLE OF ADVANCE.
BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).
BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).
THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim 1.0 ft by the bow (0.305 m)
Displacement 26,390 tons (26 810 metric tons)
Propeller Diameter 21.0 ft (6.40 m)
Speed 20.0 knots
Jv 1.01

Table D2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 4 with Fin Configuration 3

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.1637	-.0606	.0500	-.0257	.0160	-.0213	-.0096	-.0059
RADIUS = .556									
AMPLITUDE	=	-.1528	-.1964	.0695	-.0319	.0445	-.0244	.0133	-.0118
RADIUS = .775									
AMPLITUDE	=	-.1290	-.1628	-.0078	-.0699	.0199	-.0470	.0340	-.0336
RADIUS = 1.017									
AMPLITUDE	=	-.1368	-.1216	-.0404	-.0426	.0010	-.0281	.0030	-.0211
RADIUS = 1.178									
AMPLITUDE	=	-.1912	-.1218	-.0529	-.0095	.0109	.0053	.0035	-.0007

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.1653	.1637	-.0271	-.0400	-.0420	-.0306	-.0312	-.0106
RADIUS = .300									
AMPLITUDE	=	-.1651	.0106	.0278	-.0290	-.0019	-.0235	-.0173	-.0067
RADIUS = .400									
AMPLITUDE	=	-.1623	-.1018	.0610	-.0248	.0259	-.0206	-.0045	-.0061
RADIUS = .500									
AMPLITUDE	=	-.1569	-.1738	.0725	-.0275	.0413	-.0219	.0072	-.0088
RADIUS = .600									
AMPLITUDE	=	-.1457	-.1900	.0503	-.0443	.0390	-.0320	.0212	-.0187
RADIUS = .700									
AMPLITUDE	=	-.1339	-.1747	.0135	-.0636	.0275	-.0435	.0322	-.0297
RADIUS = .800									
AMPLITUDE	=	-.1257	-.1563	-.0120	-.0683	.0161	-.0468	.0291	-.0333
RADIUS = .900									
AMPLITUDE	=	-.1219	-.1353	-.0267	-.0592	.0051	-.0420	.0132	-.0299

Table D3 - Harmonic Analysis of the Tangential Velocity Component
Ratios for Experiment 4 with Fin Configuration 3

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	.0370	.0111	.0723	-.0076	.0143	-.0046	.0082	-.0039
RADIUS = .556									
AMPLITUDE	=	-.0788	-.0083	.0378	-.0029	.0200	-.0124	.0119	-.0070
RADIUS = .775									
AMPLITUDE	=	-.1139	-.0141	.0061	.0008	.0089	-.0139	.0079	-.0117
RADIUS = 1.017									
AMPLITUDE	=	-.1107	-.0319	-.0253	-.0158	-.0187	-.0106	-.0067	-.0041
RADIUS = 1.178									
AMPLITUDE	=	-.1093	-.0407	-.0364	-.0347	-.0393	-.0251	-.0136	.0007

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.1886	.0365	.1041	-.0122	-.0011	.0062	.0002	-.0023
RADIUS = .300									
AMPLITUDE	=	.0872	.0195	.0836	-.0092	.0097	-.0011	.0057	-.0032
RADIUS = .400									
AMPLITUDE	=	.0063	.0059	.0646	-.0065	.0168	-.0068	.0095	-.0044
RADIUS = .500									
AMPLITUDE	=	-.0540	-.0042	.0470	-.0041	.0199	-.0109	.0115	-.0060
RADIUS = .600									
AMPLITUDE	=	-.0888	-.0087	.0312	-.0008	.0188	-.0131	.0118	-.0088
RADIUS = .700									
AMPLITUDE	=	-.1059	-.0111	.0166	.0015	.0142	-.0139	.0102	-.0114
RADIUS = .800									
AMPLITUDE	=	-.1135	-.0162	.0020	-.0002	.0062	-.0121	.0061	-.0109
RADIUS = .900									
AMPLITUDE	=	-.1121	-.0240	-.0123	-.0060	-.0048	-.0084	-.0003	-.0077

Table D4 - Input Data for Wake Survey Analysis for
Experiment 4 with Fin Configuration 3

RADIUS = .359				112.9	.939	-.076	.024
ANGLE	VX/V	VT/V	VR/V	129.3	.926	-.058	.051
.6	.204	.018	.250	145.4	.889	-.027	.083
2.3	.215	.024	.250	161.6	.674	.053	.054
4.1	.194	.035	.250	165.3	.579	.064	.024
5.8	.196	.038	.250	168.9	.544	.056	-.023
9.5	.359	.066	.232	172.5	.470	.055	-.060
12.9	.376	.074	.190	176.1	.461	.034	-.088
16.5	.344	.090	.171	177.8	.439	.019	-.090
32.3	.331	.101	.077	178.7	.437	.015	-.098
48.4	.343	.067	.036	179.6	.433	.002	-.096
64.8	.426	.024	.026	180.4	.437	.003	-.098
81.0	.550	-.022	.039	181.5	.458	-.013	-.084
97.4	.575	-.023	.077	182.3	.465	-.007	-.089
113.7	.632	-.013	.112	184.1	.468	-.033	-.071
130.0	.725	.031	.118	185.9	.474	-.043	-.064
146.1	.723	.068	.091	189.5	.525	-.069	-.036
162.3	.619	.098	.031	193.2	.578	-.065	.001
166.1	.601	.103	.016	196.8	.643	-.066	.031
169.6	.574	.095	-.005	213.0	.795	.016	.098
173.2	.536	.081	-.018	228.7	.858	.054	.073
176.8	.513	.062	-.025	245.4	.885	.073	.043
178.7	.510	.050	-.029	261.6	.862	.096	.023
180.5	.482	.042	-.042	277.7	.798	.108	.024
182.4	.489	.007	-.036	293.9	.693	.079	.014
184.1	.491	-.009	-.033	310.1	.521	.050	.022
186.0	.473	-.040	-.029	326.1	.466	.004	.064
189.7	.475	-.051	-.027	342.2	.417	-.022	.166
193.3	.520	-.084	.003	345.9	.399	-.022	.202
196.9	.529	-.092	.009	353.0	.426	-.006	.238
212.6	.625	-.086	.078	354.9	.405	-.008	.243
228.6	.653	-.047	.112	355.6	.405	-.004	.245
244.7	.624	-.008	.108	360.2	.419	-.006	.247
260.9	.582	.029	.086	RADIUS = .775			
277.2	.508	.018	.043	ANGLE	VX/V	VT/V	VR/V
293.4	.425	-.032	.031	.3	.414	-.006	.250
309.7	.388	-.065	.030	2.2	.411	-.013	.250
326.0	.370	-.094	.076	4.0	.400	-.017	.250
342.4	.361	-.073	.164	5.8	.425	-.025	.239
346.1	.366	-.056	.170	9.5	.416	-.040	.215
353.4	.354	-.025	.253	13.1	.462	-.045	.166
357.0	.253	-.001	.250	16.7	.465	-.044	.143
358.9	.218	.013	.250	32.6	.573	-.065	.070
360.7	.207	.019	.250	32.6	.590	-.073	.072
RADIUS = .556				49.0	.706	-.108	.009
ANGLE	VX/V	VT/V	VR/V	65.5	.775	-.144	-.036
.2	.419	-.006	.247	81.5	.916	-.115	-.016
3.7	.420	.001	.238	81.7	.733	-.156	-.032
7.2	.413	.002	.218	97.9	.935	-.112	.019
12.2	.404	.004	.177	114.2	.944	-.094	.045
12.7	.394	.006	.148	130.4	.942	-.085	.068
16.3	.399	.010	.117	146.4	.937	-.071	.088
32.6	.484	-.021	.048	162.5	.939	-.035	.110
48.5	.595	-.068	.010	166.2	.935	-.008	.117
64.5	.742	-.109	.002	169.7	.916	.034	.113
80.6	.869	-.112	-.001	173.4	.678	.084	.091
96.7	.912	-.099	.005	178.9	.515	.084	-.021
				180.7	.521	.045	-.043
				182.5	.493	.018	-.053
				184.3	.461	-.017	-.057
				186.2	.444	-.065	-.028
				189.7	.564	-.087	.035

Table D4 - Continued

193.3	.644	-.070	.101	2.3	.435	-.096	.053
197.0	.833	-.031	.132	4.1	.441	-.118	.068
213.0	.900	.054	.096	5.8	.450	-.135	.079
229.1	.913	.070	.076	9.5	.463	-.149	.093
245.5	.926	.084	.049	12.9	.486	-.168	.095
261.1	.959	.097	.030	16.5	.499	-.176	.100
277.1	.964	.110	-.003	32.3	.533	-.185	.114
293.3	.959	.111	-.010	48.4	.747	-.062	.038
309.6	.908	.086	.024	64.8	.850	-.110	-.026
325.8	.784	.057	.068	81.0	.890	-.112	.017
341.8	.620	.029	.129	97.4	.918	-.091	.043
345.5	.559	.022	.158	113.7	.910	-.077	.061
349.1	.509	.023	.193	130.0	.919	-.057	.072
352.7	.492	.016	.226	146.1	.920	-.045	.076
358.2	.376	.010	.230	162.3	.923	-.032	.075
358.7	.386	.006	.230	166.1	.912	-.031	.076
				169.6	.921	-.027	.072
				173.2	.912	-.025	.068
				176.8	.918	-.015	.063
				178.7	.927	-.010	.064
				180.5	.918	.002	.064
				182.4	.916	.007	.062
				184.1	.933	.013	.060
				186.0	.928	.019	.062
				189.7	.927	.022	.065
				193.3	.935	.025	.069
				196.9	.933	.027	.071
				212.6	.942	.038	.073
				228.6	.939	.051	.070
				244.7	.927	.066	.059
				260.9	.932	.084	.041
				277.2	.946	.096	.021
				293.4	.915	.101	-.014
				309.7	.800	.038	.006
				326.0	.648	.151	.094
				342.4	.510	.169	.087
				353.4	.493	.109	.067
				357.0	.445	.044	.043
				358.9	.408	-.016	.040
				358.9	.397	-.033	.039
				360.6	.411	-.066	.035
RADIUS = 1.017							
ANGLE	VX/V	VT/V	VR/V				
.2	.414	-.063	.146				
2.0	.462	-.072	.131				
3.7	.474	-.076	.119				
5.6	.491	-.095	.109				
9.2	.515	-.111	.093				
16.3	.553	-.138	.072				
32.6	.631	-.141	.043				
48.5	.741	-.098	-.026				
64.5	.852	-.107	-.045				
80.6	.929	-.098	-.010				
96.7	.929	-.090	.016				
112.9	.944	-.071	.031				
129.3	.942	-.058	.045				
145.4	.942	-.045	.053				
161.6	.937	-.037	.055				
170.0	.910	-.037	.055				
176.1	.874	.064	.022				
178.7	.608	.033	-.005				
180.4	.617	-.057	-.004				
182.3	.646	-.101	.026				
184.1	.712	-.079	.065				
185.9	.801	-.033	.080				
189.5	.868	.034	.068				
193.2	.918	.040	.060				
196.8	.923	.042	.060				
213.0	.931	.052	.060				
228.7	.922	.063	.058				
245.4	.927	.080	.043				
261.6	.928	.095	.022				
277.7	.935	.106	-.002				
293.9	.935	.108	-.033				
310.1	.893	.092	-.005				
326.1	.838	.104	.050				
342.2	.626	.096	.091				
345.9	.539	.090	.111				
349.4	.512	.073	.124				
353.0	.491	.060	.145				
356.6	.441	.000	.160				
358.4	.432	-.032	.155				
360.2	.444	-.063	.146				
RADIUS = 1.178							
ANGLE	VX/V	VT/V	VR/V				
.6	.411	-.066	.035				

APPENDIX E

EXPERIMENT 5

FIN CONFIGURATION 3 (NAVY) (leading edge up 2.5°)

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jv	1.01

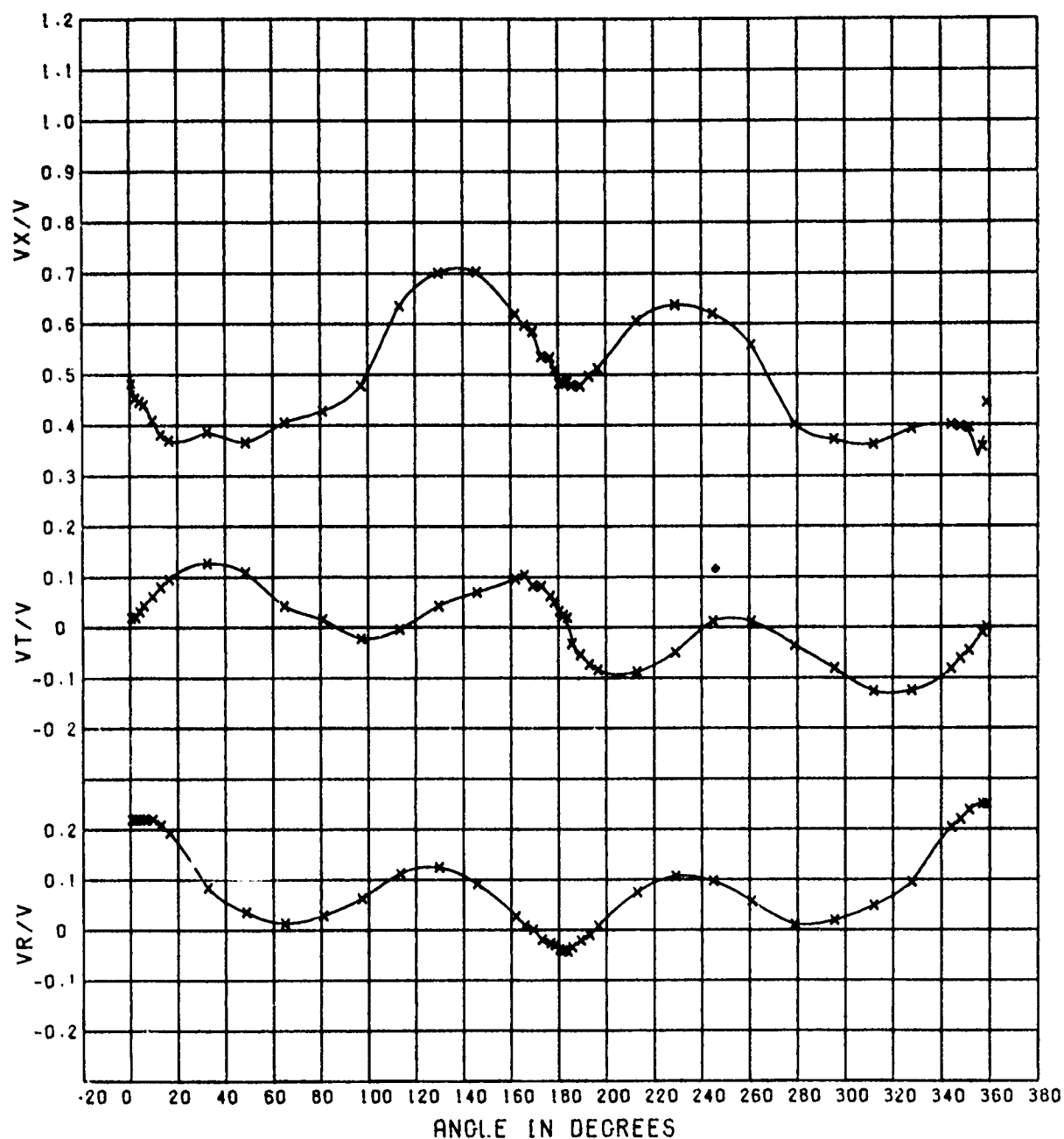


Figure E1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 5
Radius Ratio = 0.359

Fin Configuration 3 (Navy) leading edge up 2.5 degrees
Displacement 26,390 tons (26 810 metric tons)

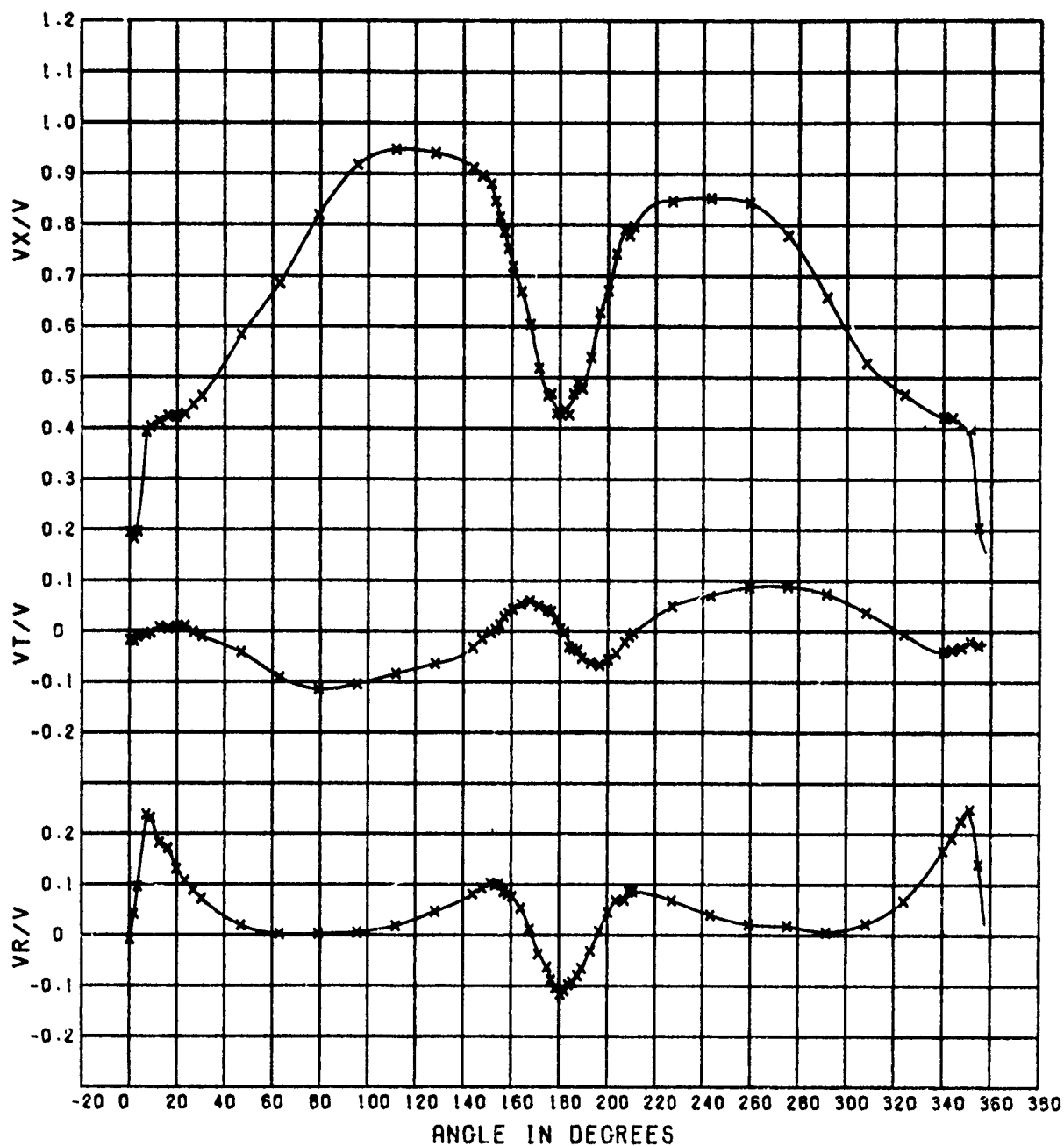


Figure E2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 5
Radius Ratio = 0.556

Fin Configuration 3 (Navy) leading edge up 2.5 degrees
Displacement 26,390 tons (26 810 metric tons)

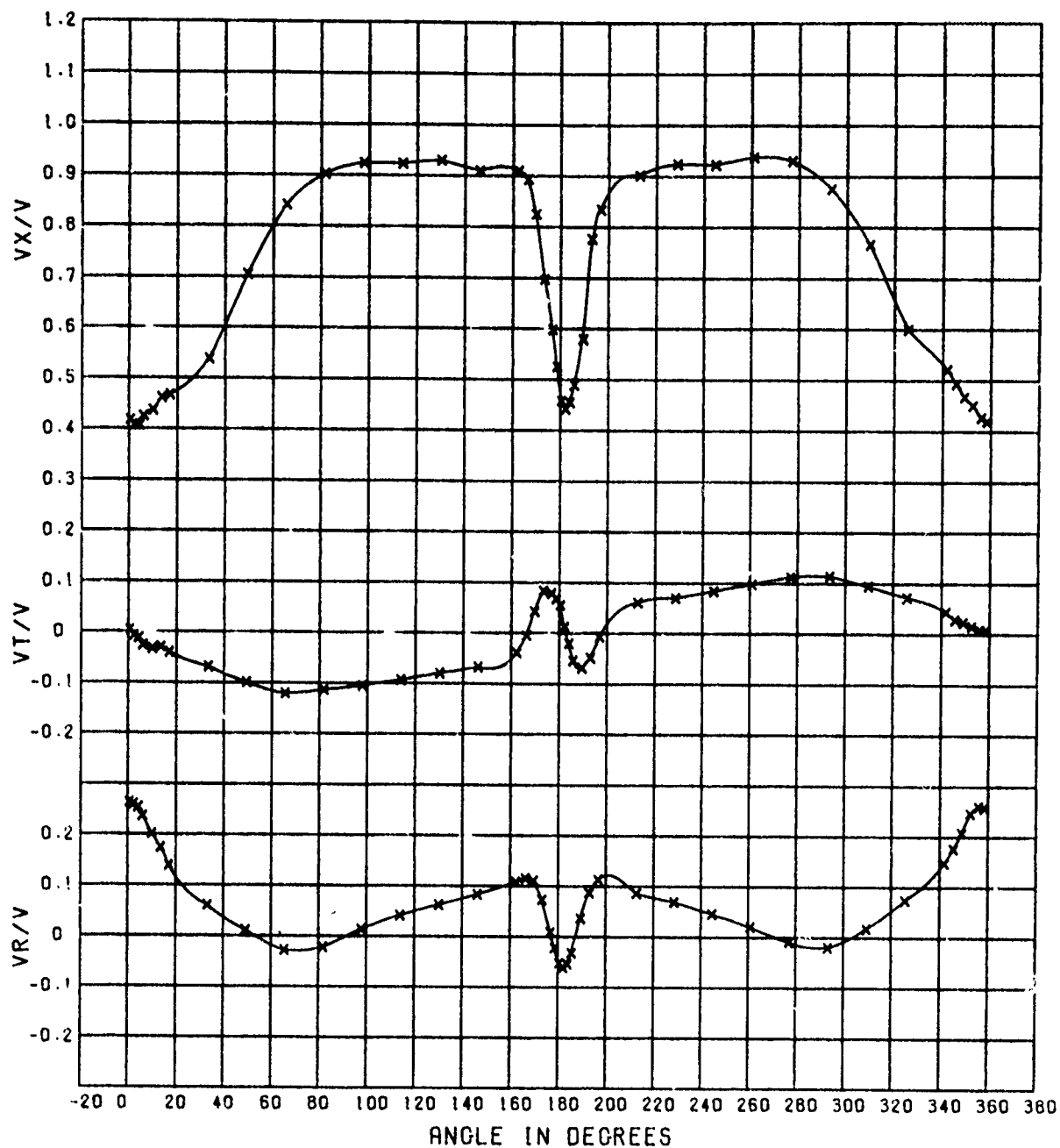


Figure E3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 5
Radius Ratio = 0.775

Fin Configuration 3 (Navy) leading edge up 2.5 degrees
Displacement 26,390 tons (26 810 metric tons)

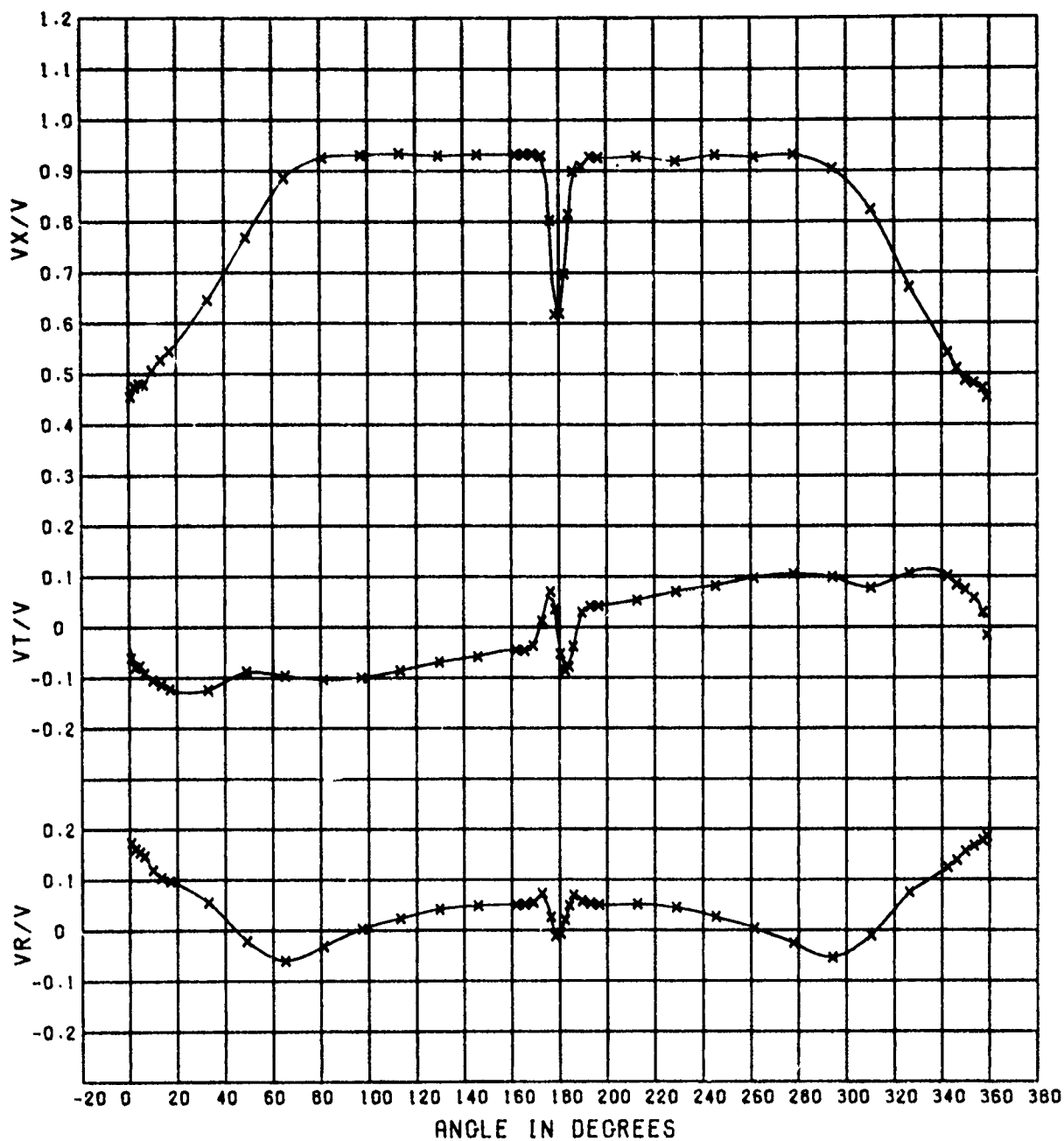


Figure E4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 5
Radius Ratio = 1.107

Fin Configuration 3 (Navy) leading edge up 2.5 degrees
Displacement 26,390 tons (26 810 metric tons)

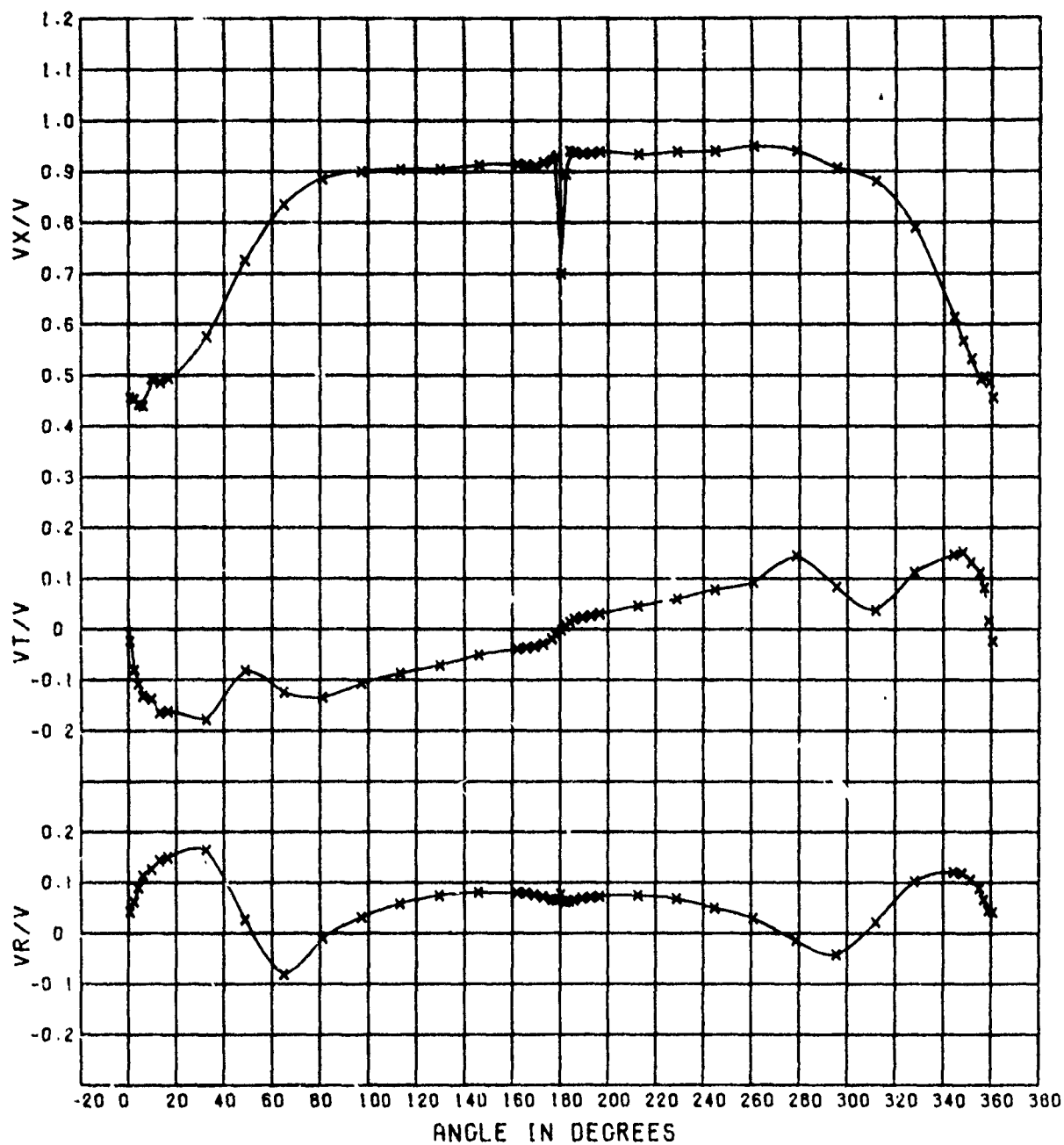


Figure E5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 5
Radius Ratio = 1.178

Fin Configuration 3 (Navy) leading edge up 2.5 degrees
Displacement 26,390 tons (26 810 metric tons)

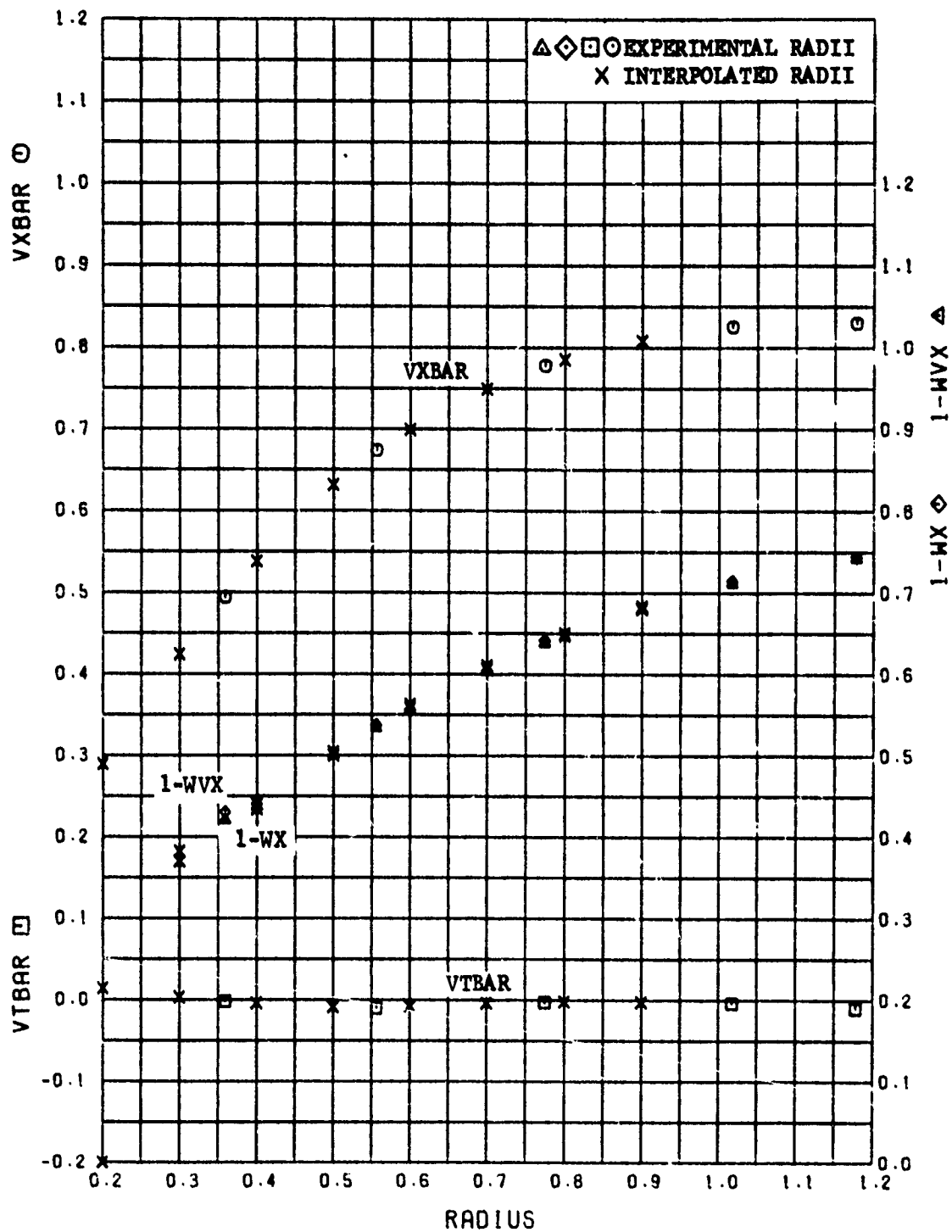


Figure E6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 5

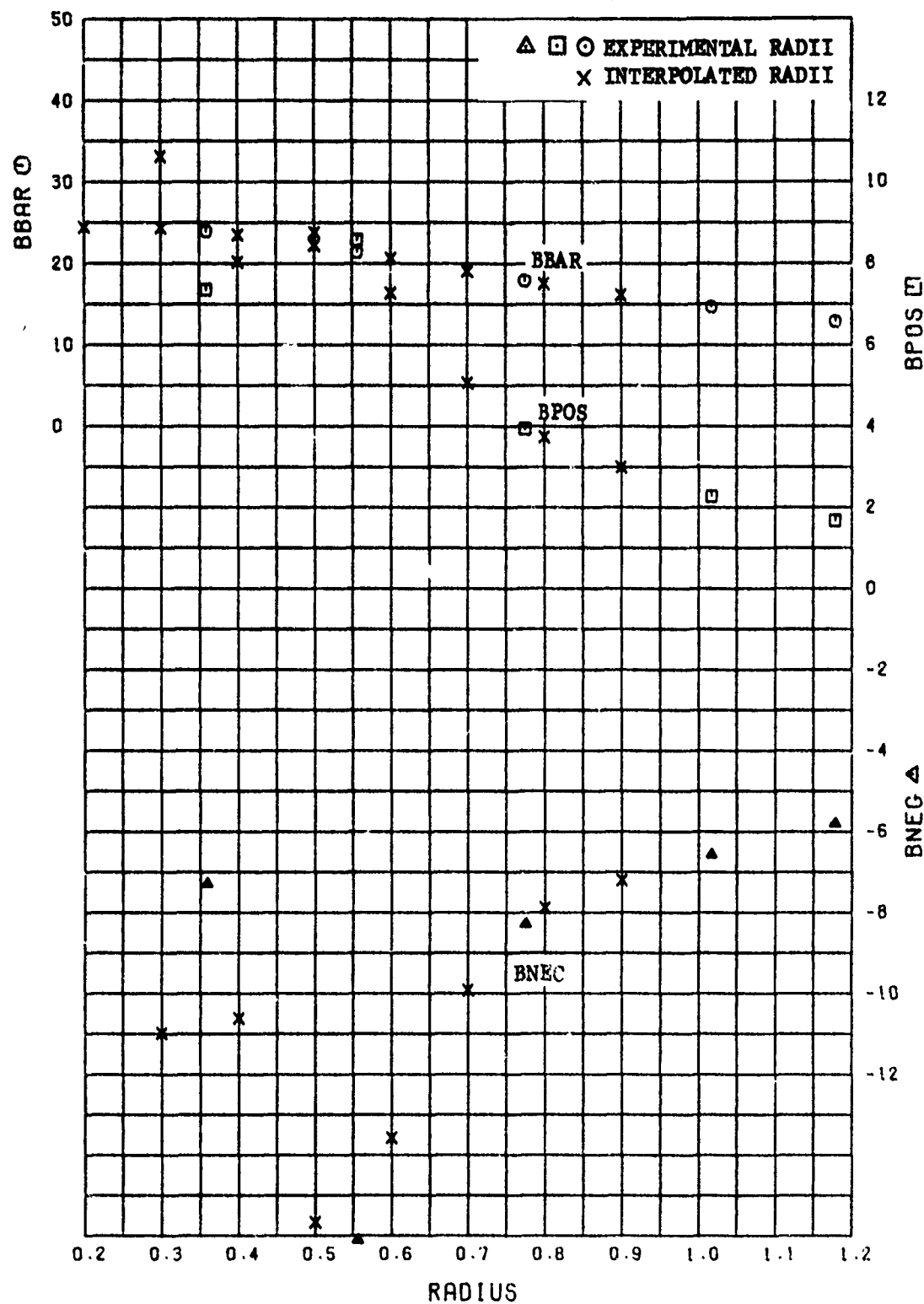


Figure E7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 5

Table E1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 5 with Fin Configuration 3 Leading Edge Up 2.5 Degrees

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.494	.674	.778	.825	.830	.289	.424	.538	.631	.699	.749	.785	.808
VTBAR =	-.002	-.010	-.003	-.004	-.010	.014	.003	-.004	-.009	-.008	-.004	-.002	-.003
VRBAR =	.076	.046	.058	.032	.054	.129	.093	.067	.050	.051	.058	.052	.036
1-WVX =	.420	.533	.637	.711	.742	0.000	.370	.434	.500	.558	.606	.647	.680
1-WX =	.430	.537	.641	.714	.744	0.000	.382	.440	.504	.562	.610	.650	.683
BPOS =	23.89	21.39	17.90	14.64	12.60	24.41	24.36	23.46	22.19	20.62	19.01	17.52	16.12
BPOS =	7.35	8.57	3.93	2.27	1.67	32.20	10.62	8.03	8.76	7.27	5.05	3.73	2.99
THETA =	135.00	110.00	100.00	90.00	177.50	0.00	0.00	125.00	117.50	107.50	102.50	100.00	102.50
BNEG =	-7.30	-16.11	-8.29	-6.58	-5.81	-39.88	-10.99	-13.62	-15.67	-13.58	-9.92	-7.89	-7.21
THETA =	47.50	357.50	2.50	0.00	0.00	95.00	35.00	355.00	357.50	357.50	2.50	2.50	0.00

VXBAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.

VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.

VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.

1-WVX IS VOLUME MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.

1-WX IS VOLUME MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.

BPOS IS MEAN ANGLE OF ADVANCE.

BNEG IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).

BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).

THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26,810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jv	1.01

**Table E2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 5 with Fin Configuration 3 Leading
Edge Up 2.5 Degrees**

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.1348	-.0049	.0754	-.0319	.0086	.0006	.0057	-.0037
RADIUS = .556									
AMPLITUDE	=	-.1771	-.1956	.0640	-.0527	.0256	-.0472	.0065	-.0229
RADIUS = .775									
AMPLITUDE	=	-.1549	-.1756	.0004	-.0414	.0439	-.0297	.0277	-.0284
RADIUS = 1.017									
AMPLITUDE	=	-.1588	-.1282	-.0424	-.0263	.0120	-.0120	.0103	-.0155
RADIUS = 1.178									
AMPLITUDE	=	-.1578	-.1074	-.0499	-.0225	-.0071	-.0093	.0001	-.0046

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.0576	.0931	.0531	.0062	-.0054	.0829	.0177	.0217
RADIUS = .300									
AMPLITUDE	=	-.1106	.0907	.0704	-.0200	.0034	.0265	.0088	.0047
RADIUS = .400									
AMPLITUDE	=	-.1485	-.0609	.0766	-.0386	.0122	-.0143	.0044	-.0088
RADIUS = .500									
AMPLITUDE	=	-.1711	-.1615	.0717	-.0497	.0208	-.0397	.0045	-.0188
RADIUS = .600									
AMPLITUDE	=	-.1707	-.1933	.0493	-.0506	.0328	-.0435	.0136	-.0253
RADIUS = .700									
AMPLITUDE	=	-.1597	-.1649	.0135	-.0455	.0426	-.0355	.0244	-.0283
RADIUS = .800									
AMPLITUDE	=	-.1556	-.1698	-.0058	-.0394	.0404	-.0271	.0258	-.0272
RADIUS = .900									
AMPLITUDE	=	-.1577	-.1487	-.0364	-.0323	.0270	-.0185	.0184	-.0223

**Table E3 - Harmonic Analysis of the Tangential Velocity Component
Ratios for Experiment 5 with Pin Configuration 3 Leading
Edge Up 2.5 Degrees**

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	.0619	.0315	.0739	-.0132	.0121	-.0024	.0025	-.0052
RADIUS = .556									
AMPLITUDE	=	-.0717	.0008	.0406	-.0034	.0189	-.0116	.0102	-.0053
RADIUS = .775									
AMPLITUDE	=	-.1117	-.0127	-.0007	-.0007	.0057	-.0096	.0078	-.0100
RADIUS = 1.017									
AMPLITUDE	=	-.1120	-.0227	-.0234	-.0180	-.0197	-.0115	-.0051	-.0037
RADIUS = 1.178									
AMPLITUDE	=	-.1200	-.0320	-.0239	-.0256	-.0384	-.0260	-.0129	.0004

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.2371	.0692	.0981	-.0262	-.0061	.0125	-.0105	-.0081
RADIUS = .300									
AMPLITUDE	=	.1199	.0442	.0832	-.0175	.0067	.0023	-.0016	-.0060
RADIUS = .400									
AMPLITUDE	=	.0265	.0237	.0673	-.0106	.0150	-.0052	.0049	-.0049
RADIUS = .500									
AMPLITUDE	=	-.0431	.0078	.0505	-.0055	.0187	-.0100	.0089	-.0049
RADIUS = .600									
AMPLITUDE	=	-.0827	-.0023	.0307	-.0015	.0169	-.0109	.0104	-.0070
RADIUS = .700									
AMPLITUDE	=	-.1023	-.0086	.0112	.0004	.0112	-.0098	.0096	-.0095
RADIUS = .800									
AMPLITUDE	=	-.1111	-.0135	-.0043	-.0028	.0032	-.0087	.0064	-.0093
RADIUS = .900									
AMPLITUDE	=	-.1101	-.0172	-.0157	-.0105	-.0070	-.0076	.0010	-.0067

**Table E4 - Input Data for Wake Survey Analysis for
Experiment 5 with Fin Configuration 3
Leading Edge Up 2.5 Degrees**

RADIUS = .359							
ANGLE	VX/V	VT/V	VR/V				
.6	.482	.019	.220	63.0	.685	-.092	.002
2.4	.453	.020	.220	79.3	.819	-.115	.002
4.2	.446	.031	.220	95.5	.917	-.105	.005
5.9	.440	.043	.220	111.7	.948	-.094	.018
9.5	.409	.061	.220	127.9	.940	-.064	.046
13.0	.381	.079	.209	144.0	.911	-.033	.081
16.6	.370	.096	.193	147.6	.896	-.016	.093
32.4	.386	.127	.084	151.2	.880	-.003	.102
48.6	.365	.109	.036	153.0	.846	.003	.099
64.8	.405	.042	.013	154.8	.815	.013	.101
81.0	.428	.016	.029	156.7	.785	.028	.065
97.2	.477	-.023	.062	158.5	.754	.036	.081
113.4	.635	-.005	.112	160.4	.710	.042	.081
129.8	.700	.042	.124	160.4	.727	.044	.070
145.9	.702	.069	.091	163.9	.668	.053	.053
162.1	.619	.096	.027	167.6	.604	.059	.012
165.9	.597	.104	.009	171.2	.518	.050	-.038
169.4	.585	.082	.001	174.8	.463	.041	-.064
173.0	.535	.082	-.020	176.5	.468	.038	-.089
176.6	.533	.061	-.027	178.4	.435	.020	-.104
178.4	.507	.050	-.030	178.5	.423	.024	-.105
180.3	.483	.032	-.039	180.3	.428	.005	-.117
182.2	.483	.023	-.041	182.1	.436	-.001	-.110
183.9	.486	.018	-.043	183.0	.426	-.002	-.000
185.8	.478	-.033	-.035	185.6	.467	-.035	-.093
189.4	.477	-.054	-.021	187.5	.430	-.038	-.080
193.0	.496	-.074	-.010	189.3	.478	-.053	-.066
196.6	.512	-.084	.008	192.8	.526	-.061	-.036
212.7	.606	-.088	.075	192.9	.554	-.065	-.027
228.9	.637	-.050	.106	196.5	.628	-.067	.007
244.8	.620	.012	.097	200.1	.670	-.056	.045
260.9	.558	.012	.057	203.6	.743	-.044	.068
278.8	.402	-.036	.011	207.3	.790	-.022	.069
295.4	.372	-.081	.019	209.1	.780	-.010	.086
311.8	.361	-.127	.048	210.9	.797	-.003	.086
327.9	.393	-.126	.095	227.0	.846	.049	.068
344.2	.400	-.082	.205	243.2	.852	.070	.039
347.9	.397	-.062	.220	259.4	.843	.086	.020
351.5	.395	-.047	.238	275.6	.780	.089	.018
357.0	.357	-.011	.250	291.7	.658	.073	.035
358.8	.444	.001	.250	307.9	.528	.037	.021
				324.0	.467	-.006	.067
				340.2	.423	-.041	.166
				343.8	.420	-.037	.191
				347.4	.408	-.032	.226
				351.0	.399	-.021	.249
				354.6	.204	-.028	.140
				358.3	.190	-.019	-.006
RADIUS = .556							
ANGLE	VX/V	VT/V	VR/V				
.1	.134	-.019	-.009				
1.9	.182	-.021	.042				
3.6	.196	-.011	.096				
7.3	.393	-.007	.238				
9.1	.403	-.004	.232				
12.7	.414	.008	.182	ANGLE	RADIUS = .775	VT/V	VR/V
16.3	.424	.005	.171	.6	.417	.004	.263
19.8	.422	.008	.130	2.4	.407	-.008	.260
23.4	.428	.010	.107	4.2	.407	-.012	.254
27.0	.446	-.002	.089	6.0	.425	-.027	.236
30.6	.463	-.010	.072	9.7	.437	-.034	.201
46.8	.583	-.042	.019	13.3	.461	-.031	.174
				16.9	.465	-.040	.141
				16.9	.468	-.042	.136
				33.1	.537	-.069	.060
				49.3	.704	-.100	.011
				65.6	.841	-.121	-.028
				81.8	.902	-.114	-.022

Table E4 - Continued

97.9	.924	-.106	.014	193.1	.928	.040	.052
114.1	.923	-.094	.041	196.7	.926	.042	.050
130.3	.929	-.080	.062	212.6	.931	.053	.051
146.4	.910	-.062	.033	213.0	.926	.054	.051
162.4	.910	-.040	.108	229.0	.919	.070	.044
166.3	.893	-.006	.115	245.5	.931	.082	.026
169.7	.824	.042	.111	261.5	.927	.098	.004
173.3	.697	.083	.072	277.9	.932	.105	-.026
176.8	.598	.078	.008	294.2	.904	.099	-.055
178.6	.525	.067	-.023	310.4	.823	.077	-.011
180.5	.458	.055	-.053	326.4	.671	.106	.074
182.3	.442	.013	-.061	342.5	.541	.101	.124
184.2	.455	-.021	-.054	346.2	.510	.083	.138
185.9	.489	-.054	-.033	349.7	.487	.074	.156
189.6	.579	-.069	.036	353.4	.481	.056	.167
193.0	.776	-.049	.087	357.1	.471	.028	.177
196.7	.834	-.009	.113	358.9	.453	-.017	.186
212.7	.901	.060	.086	360.7	.455	-.061	.173
228.8	.924	.070	.069				
244.8	.923	.084	.046				
260.9	.938	.098	.020				
277.0	.931	.112	-.010	ANGLE	VR/V	VT/V	VR/V
293.3	.875	.114	-.020	.6	.455	-.024	.041
309.6	.766	.094	.017	2.4	.453	-.081	.062
325.7	.599	.072	.074	4.2	.441	-.109	.069
341.8	.521	.043	.148	5.9	.440	-.133	.113
345.5	.433	.029	.176	9.5	.492	-.138	.126
349.0	.467	.023	.208	13.0	.485	-.166	.143
352.6	.450	.015	.246	16.6	.493	-.162	.149
356.1	.427	.008	.260	32.4	.575	-.178	.164
358.0	.431	.011	.263	48.6	.725	-.082	.026
358.8	.407	.004	.253	64.8	.835	-.126	-.081
359.8	.402	-.007	.264	81.0	.886	-.135	-.010
				97.2	.900	-.108	.031
				113.4	.904	-.088	.058
				129.8	.904	-.072	.074
				145.9	.912	-.052	.080
				162.1	.914	-.039	.079
				165.9	.912	-.037	.079
				169.4	.910	-.034	.075
				173.0	.918	-.030	.071
				176.6	.922	-.020	.066
				178.4	.928	-.012	.064
				180.3	.909	-.002	.076
				182.2	.899		.061
				183.9	.940	.014	.063
				185.8	.938	.020	.064
				189.4	.935	.023	.068
				193.0	.936	.026	.071
				196.6	.938	.030	.072
				212.7	.933	.045	.074
				228.9	.939	.059	.068
				244.9	.939	.078	.049
				260.9	.950	.092	.029
				278.8	.940	.144	-.015
				295.4	.907	.083	-.043
				311.8	.881	.037	.021
				327.9	.789	.112	.102
				344.2	.613	.146	.120
				347.9	.566	.151	.118
				351.5	.532	.131	.105
				355.3	.492	.111	.086
				357.0	.496	.081	.065

APPENDIX F

EXPERIMENT 6

FIN CONFIGURATION 2 (NAVY)

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jv	1.01

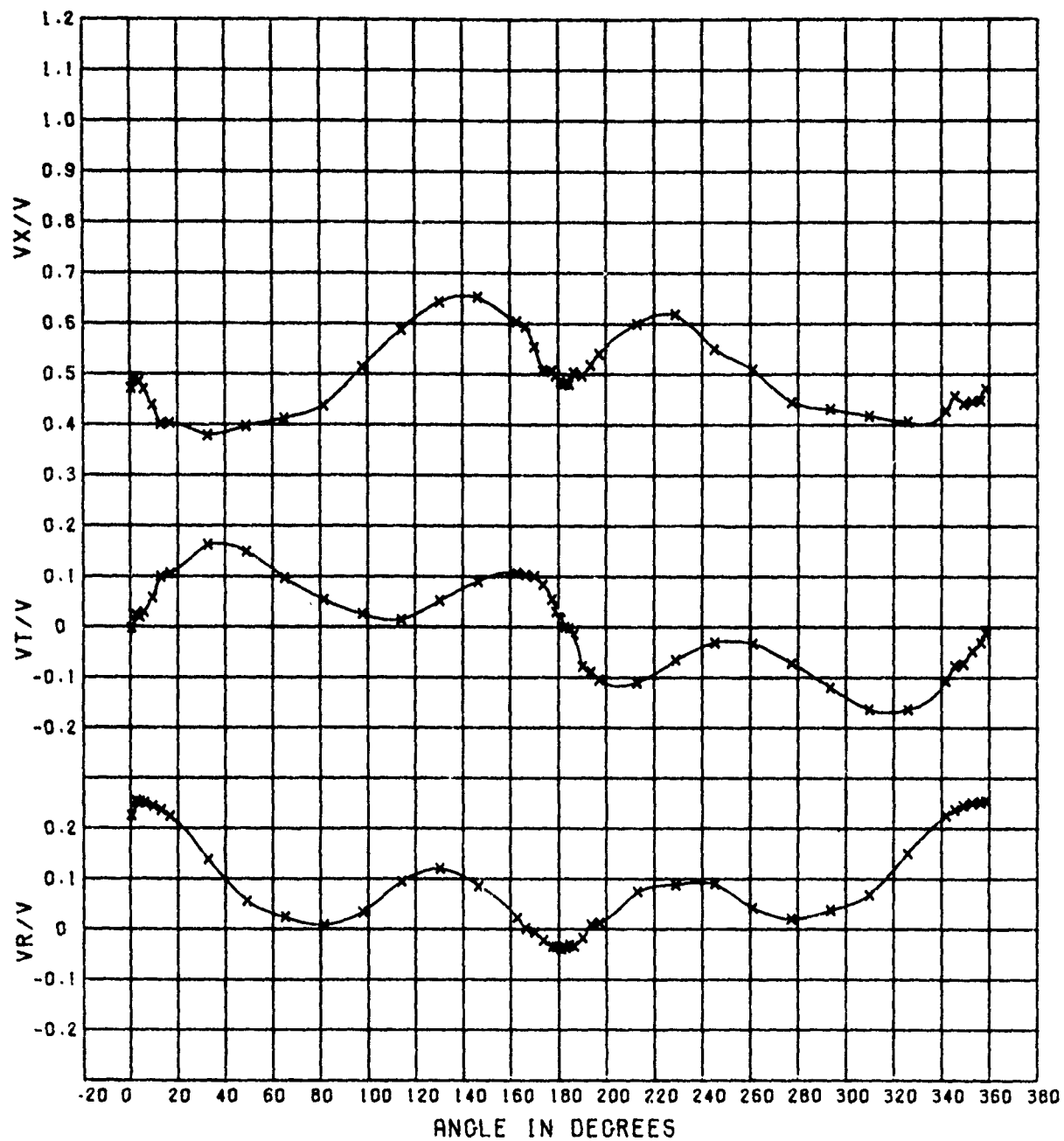


Figure F1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 6
Radius Ratio = 0.359

Fin Configuration 2 (Navy)
Displacement 26,390 tons (26 810 metric tons)

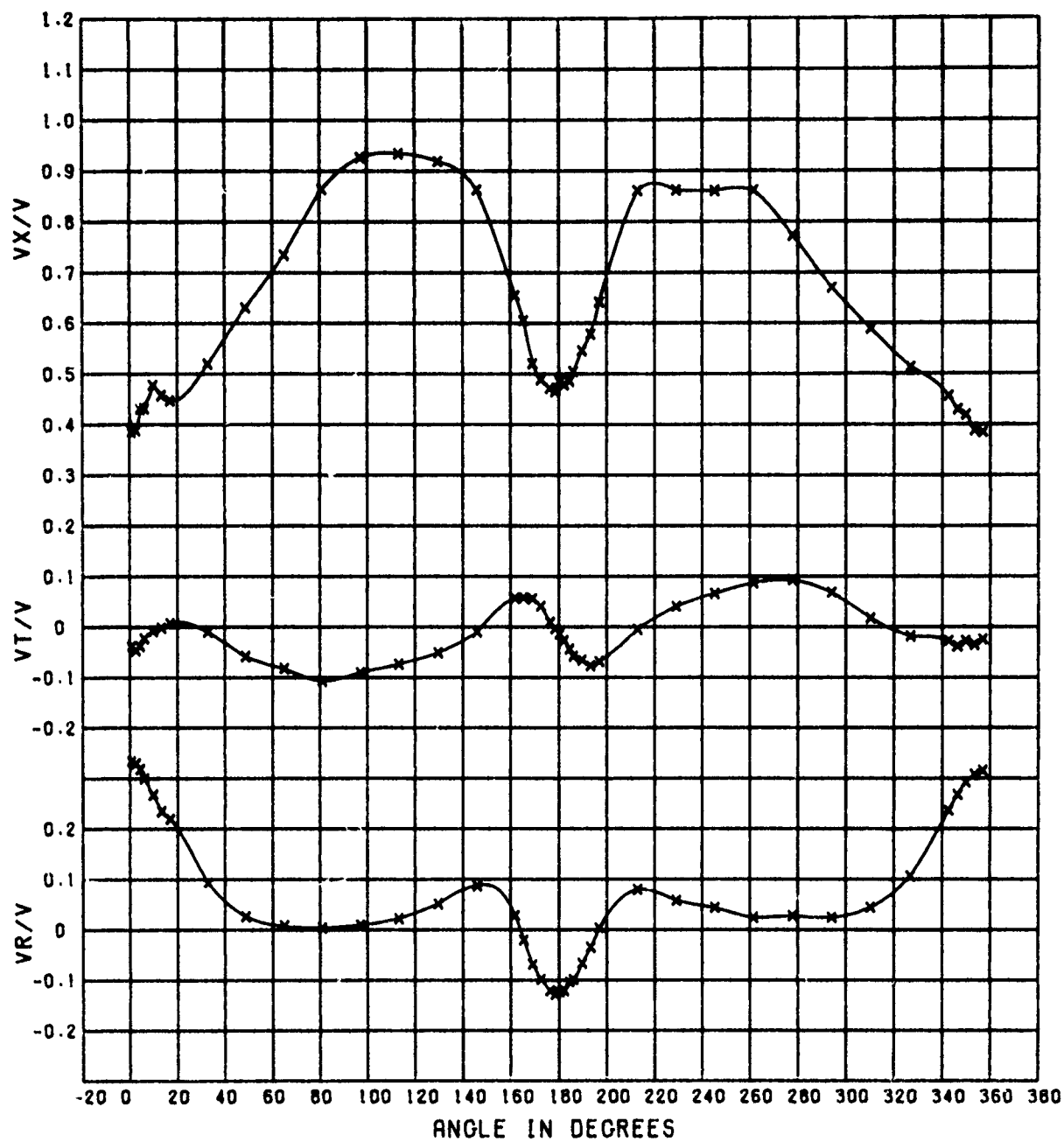


Figure F2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 6
Radius Ratio = 0.556

Fin Configuration 2 (Navy)
Displacement 26,390 tons (26 810 metric tons)

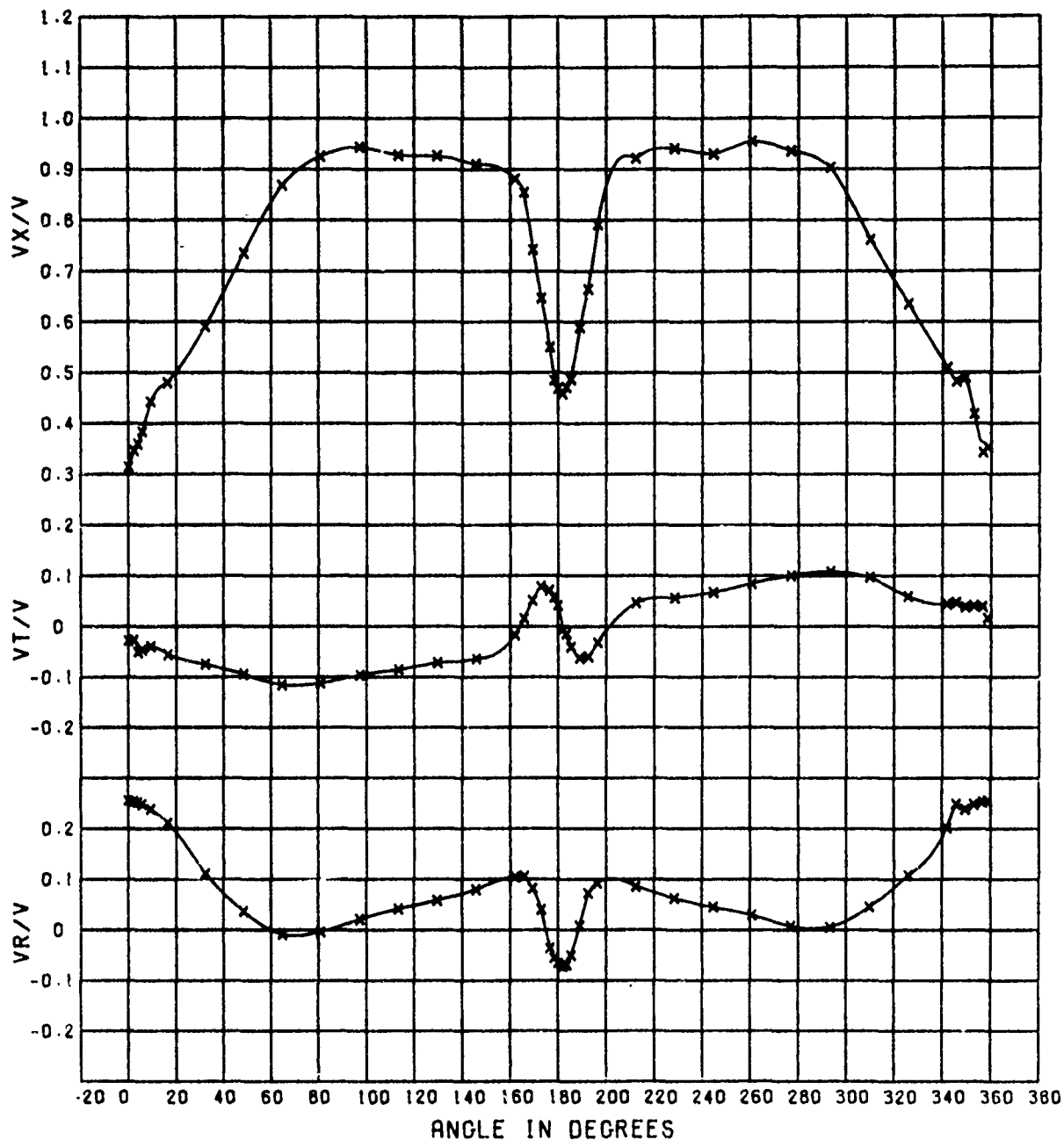


Figure F3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 6
Radius Ratio = 0.775

Fin Configuration 2 (Navy)
Displacement 26,390 tons (26 810 metric tons)

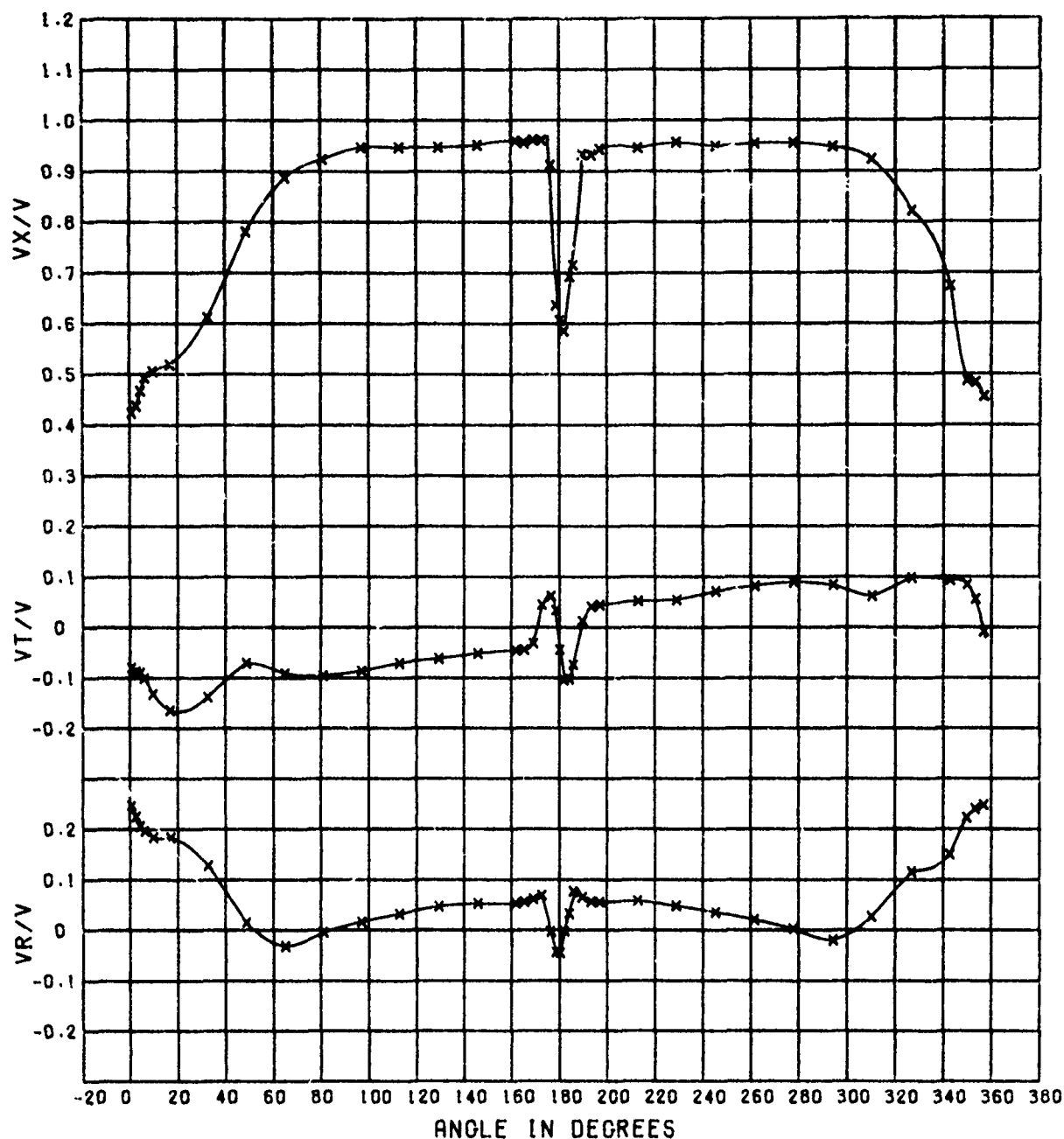


Figure F4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 6
Radius Ratio = 1.107

Fin Configuration 2 (Navy)
Displacement 26,390 tons (26 810 metric tons)

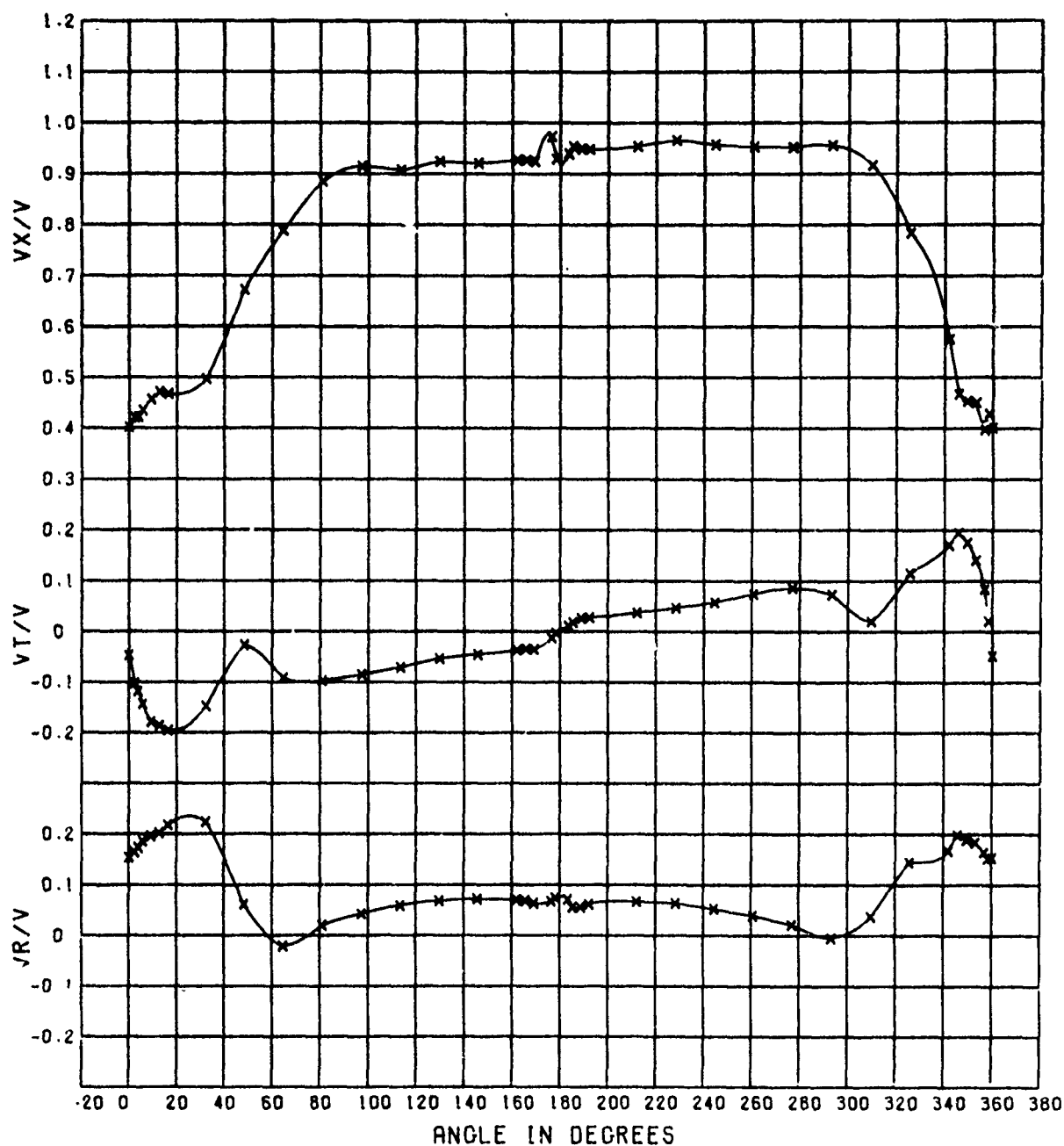


Figure F5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 6
Radius Ratio = 1.178

Fin Configuration 2 (Navy)
Displacement 26,390 tons (26 810 metric tons)

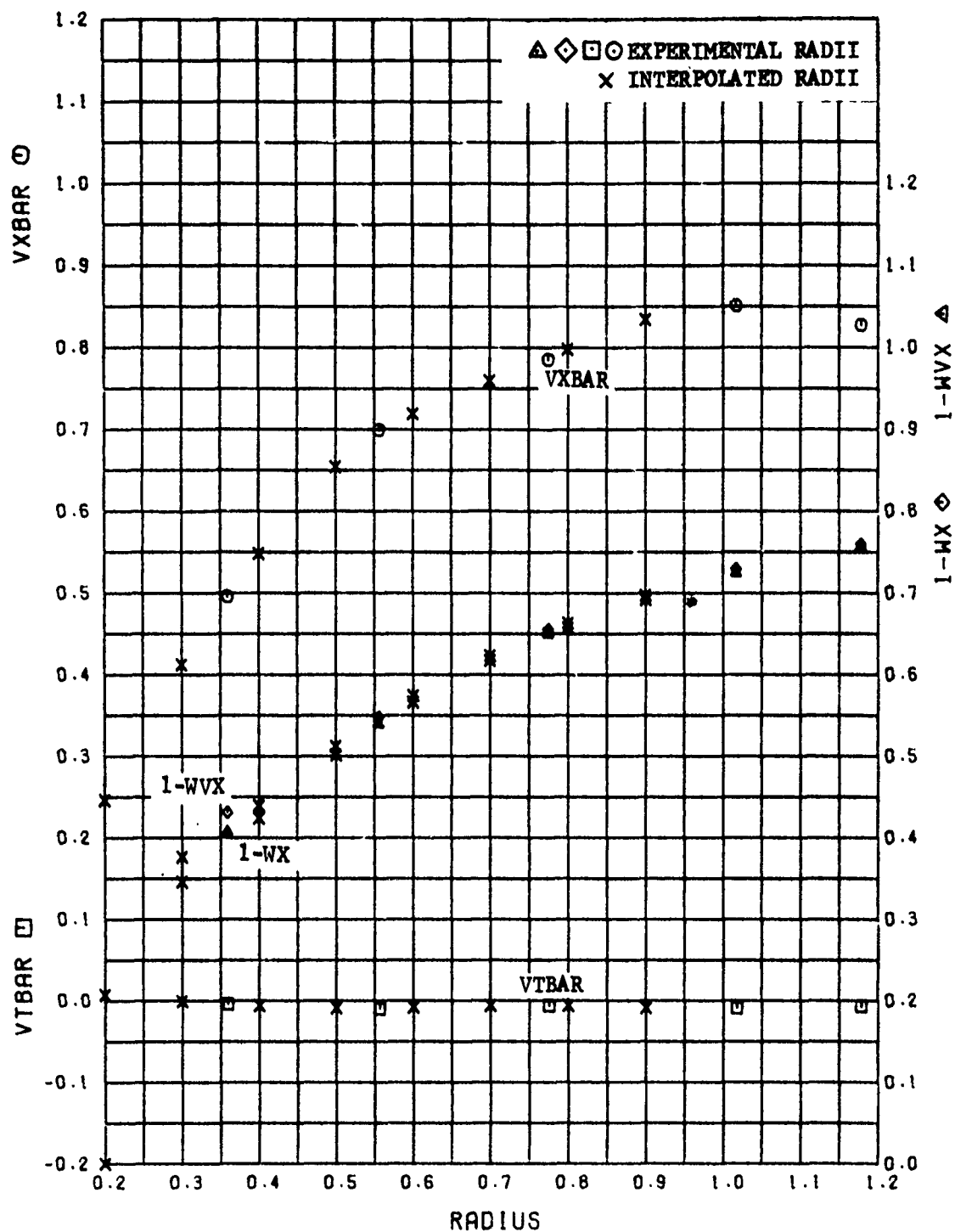


Figure F6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 6

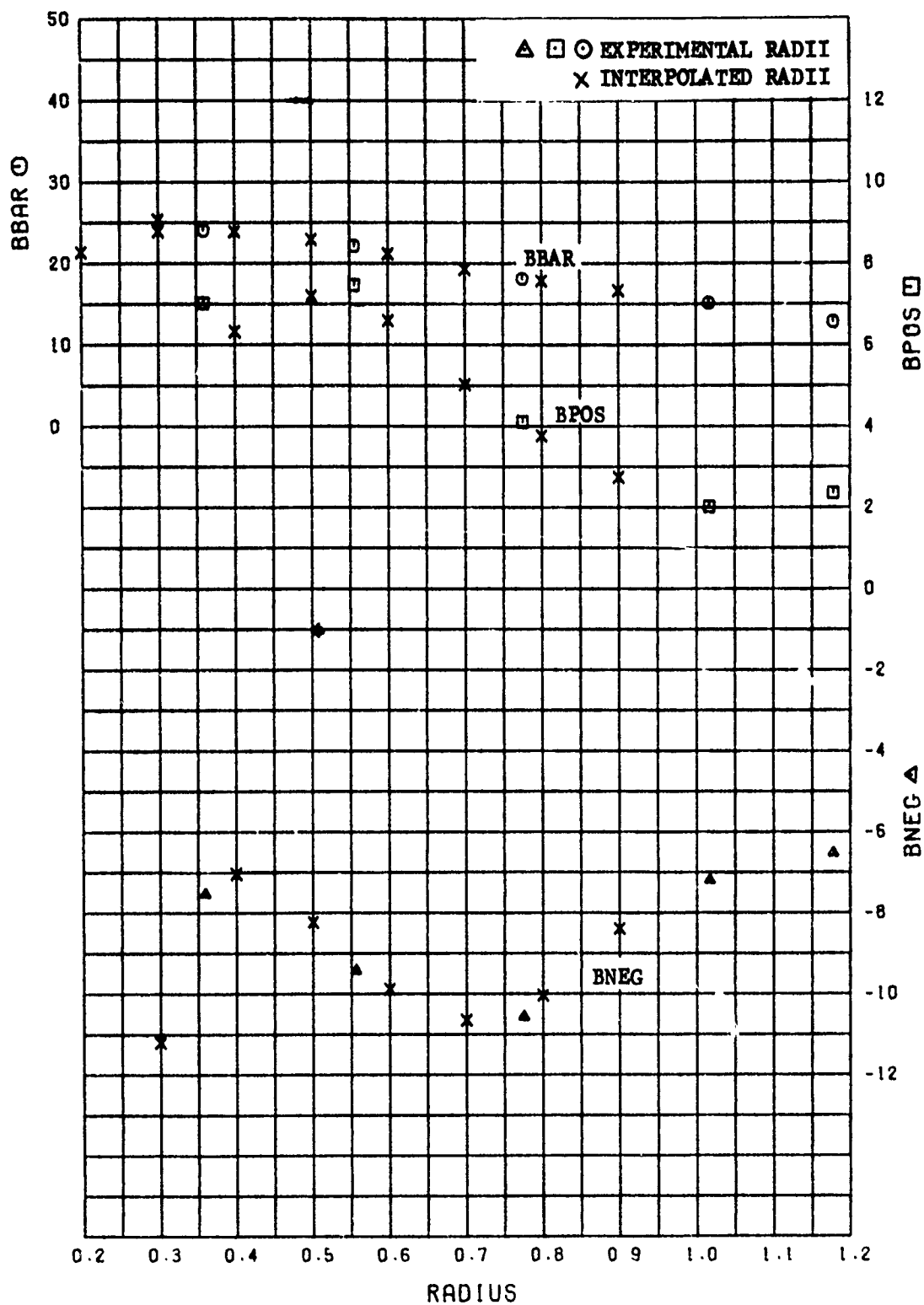


Figure F7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 6

Table F1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 6 with Fin Configuration 2

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.496	.699	.785	.851	.827	.246	.412	.548	.654	.719	.759	.758	.834
VTBAR =	-.004	-.010	-.006	-.009	-.007	.007	-.001	-.006	-.009	-.008	-.006	-.006	-.009
VRBAR =	.083	.063	.070	.057	.077	.118	.094	.077	.066	.066	.070	.067	.057
1-WVX =	.407	.539	.649	.724	.755	0.000	.346	.424	.501	.566	.617	.657	.692
1-WX =	.431	.548	.655	.729	.759	0.000	.376	.439	.512	.574	.623	.663	.697
BBAR =	24.04	22.13	18.08	15.09	12.75	21.34	23.86	23.88	22.91	21.14	19.26	17.81	16.64
BPOS =	7.02	7.47	4.10	2.01	2.35	27.61	9.06	6.32	7.20	6.58	5.02	3.76	2.73
THETA =	220.00	105.00	95.00	157.50	175.00	315.00	202.50	217.50	112.50	102.50	97.50	95.00	97.50
BNEG =	-7.53	-9.43	-10.58	-7.20	-6.54	-32.05	-11.21	-7.04	-8.24	-9.89	-10.66	-10.05	-8.40
THETA =	32.50	337.50	0.00	0.00	355.00	85.00	00.00	30.00	355.00	357.50	0.00	0.00	0.00

VXBAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.

VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.

VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.

1-WVX IS VOLUMEIC MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.

1-WX IS VOLUMEIC MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.

BBAR IS MEAN ANGLE OF ADVANCE.

BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).

BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).

THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim	1.0 ft by the bow (0.305 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
β	1.01

Table F2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 6 with Fin Configuration 2

Experimental Radii

HARMONIC		1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.1029	.0035	.0518	-.0205	.0206	.0007	.0116	.0009
RADIUS = .556									
AMPLITUDE	=	-.1380	-.1812	.0645	-.0433	.0313	-.0315	.0144	-.0047
RADIUS = .775									
AMPLITUDE	=	-.1428	-.1935	-.0042	-.0580	.0398	-.0423	.0222	-.0326
RADIUS = 1.017									
AMPLITUDE	=	-.1432	-.1294	-.0458	-.0473	.0029	-.0247	.0100	-.0217
RADIUS = 1.178									
AMPLITUDE	=	-.1925	-.1196	-.0582	-.0214	-.0074	-.0027	-.0043	-.0001

Interpolated Radii

HARMONIC		1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.0533	.2726	-.0100	.0045	.0099	.0422	.0122	-.0079
RADIUS = .300									
AMPLITUDE	=	-.0867	.0909	.0342	-.0119	.0168	.0145	.0115	-.0010
RADIUS = .400									
AMPLITUDE	=	-.1126	-.0485	.0603	-.0260	.0230	-.0078	.0118	.0013
RADIUS = .500									
AMPLITUDE	=	-.1310	-.1454	.0681	-.0377	.0285	-.0245	.0132	-.0013
RADIUS = .600									
AMPLITUDE	=	-.1393	-.1890	.0484	-.0481	.0362	-.0357	.0174	-.0132
RADIUS = .700									
AMPLITUDE	=	-.1417	-.1900	.0100	-.0556	.0414	-.0415	.0215	-.0271
RADIUS = .800									
AMPLITUDE	=	-.1388	-.1841	-.0098	-.0585	.0348	-.0413	.0214	-.0327
RADIUS = .900									
AMPLITUDE	=	-.1320	-.1530	-.0291	-.0567	.0176	-.0355	.0173	-.0302

**Table F3 - Harmonic Analysis of the Tangential Velocity Component
Ratios for Experiment 6 with Fin Configuration 2**

Experimental Rad11

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	.1049	.0406	.0746	-.0166	.0146	-.0069	.0022	-.0033
RADIUS = .556									
AMPLITUDE	=	-.0643	-.0048	.0428	-.0062	.0170	-.0123	.0091	-.0051
RADIUS = .775									
AMPLITUDE	=	-.1023	-.0201	.0003	-.0044	.0063	-.0148	.0064	-.0138
RADIUS = 1.017									
AMPLITUDE	=	-.1000	-.0254	-.0277	-.0216	-.0246	-.0170	-.0063	-.0062
RADIUS = 1.178									
AMPLITUDE	=	-.0940	-.0293	-.0343	-.0359	-.0460	-.0306	-.0203	-.0055

Interpolated Rad11

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.3349	.0990	.0958	-.0311	.0045	-.0003	-.0097	-.0059
RADIUS = .300									
AMPLITUDE	=	.1805	.0600	.0829	-.0214	.0117	-.0047	-.0015	-.0038
RADIUS = .400									
AMPLITUDE	=	.0592	.0286	.0685	-.0138	.0160	-.0083	.0043	-.0032
RADIUS = .500									
AMPLITUDE	=	-.0292	.0050	.0524	-.0083	.0175	-.0111	.0080	-.0040
RADIUS = .600									
AMPLITUDE	=	-.0750	-.0087	.0329	-.0045	.0162	-.0129	.0092	-.0080
RADIUS = .700									
AMPLITUDE	=	-.0936	-.0160	.0130	-.0032	.0118	-.0140	.0083	-.0125
RADIUS = .800									
AMPLITUDE	=	-.1024	-.0206	-.0036	-.0060	.0032	-.0140	.0056	-.0126
RADIUS = .900									
AMPLITUDE	=	-.1021	-.0228	-.0169	-.0127	-.0095	-.0132	.0011	-.0089

Table F4 - Input Data for Wake Survey Analysis for Experiment 6 with Fin Configuration 2

ANGLE	RADIUS = .359	VT/V	VR/V	64.9	.734	-.083	.008
.4	.472	-.003	.225	80.9	.864	-.108	.003
2.3	.493	.024	.254	97.1	.926	-.091	.009
4.0	.485	.020	.252	113.2	.934	-.074	.022
5.8	.470	.029	.250	129.5	.919	-.052	.051
9.5	.438	.058	.244	145.9	.863	-.010	.086
13.0	.401	.100	.236	161.8	.654	.057	.028
16.7	.403	.106	.224	165.4	.605	.058	-.021
32.7	.379	.162	.138	169.1	.520	.056	-.069
49.0	.397	.149	.055	172.6	.488	.041	-.099
65.2	.413	.097	.023	176.3	.471	.009	-.121
81.5	.438	.054	.008	178.1	.467	-.003	-.129
97.8	.514	.025	.034	178.8	.463	-.005	-.129
114.2	.588	.014	.094	179.8	.484	-.007	-.121
130.4	.643	.052	.120	180.6	.486	-.021	-.126
146.6	.652	.090	.085	181.7	.487	-.023	-.125
162.8	.603	.107	.022	182.4	.470	-.032	-.118
166.3	.595	.103	.001	184.3	.486	-.044	-.104
170.0	.554	.100	-.007	186.0	.504	-.059	-.100
173.6	.507	.084	-.023	189.7	.545	-.067	-.067
177.3	.506	.055	-.035	193.3	.578	-.078	-.035
179.0	.497	.031	-.035	196.9	.641	-.069	.003
180.9	.484	.031	-.039	212.9	.861	-.005	.079
182.7	.481	-.001	-.037	223.1	.001	.040	.057
184.5	.479	-.002	-.032	245.3	.860	.066	.043
196.3	.503	-.015	-.035	261.6	.861	.087	.023
190.0	.497	-.078	-.018	277.8	.772	.093	.027
193.5	.517	-.089	.008	294.2	.670	.068	.024
197.2	.540	-.105	.012	310.4	.589	.017	.044
212.9	.600	-.111	.074	326.7	.513	-.019	.106
228.9	.619	-.066	.087	342.6	.456	-.028	.236
245.1	.550	-.031	.090	346.3	.429	-.039	.267
261.0	.509	-.033	.041	349.8	.418	-.028	.292
277.3	.444	-.072	.020	353.4	.388	-.036	.307
293.6	.431	-.120	.037	356.9	.384	-.025	.315
309.8	.418	-.164	.068	358.9	.380	-.039	.333
325.8	.407	-.164	.150				
341.9	.427	-.108	.225				
345.6	.456	-.077	.237				
349.1	.441	-.074	.245				
352.8	.446	-.047	.250				
356.3	.447	-.031	.253				
358.2	.473	-.006	.254				
358.6	.469	-.018	.254				
359.9	.466	.001	.255				

ANGLE	RADIUS = .775	VT/V	VR/V	64.6	.868	-.116	-.009
.6	.314	-.029	.255	80.9	.924	-.113	-.004
2.6	.346	-.027	.254	97.1	.943	-.097	.021
4.3	.359	-.052	.252	113.4	.927	-.086	.041
3.1	.384	-.047	.248	129.7	.926	-.073	.058
9.7	.443	-.040	.236	145.8	.910	-.064	.079
13.2	.479	-.057	.211	161.9	.880	-.018	.105
16.9	.589	-.075	.111	165.7	.854	.015	.106
32.7	.734	-.095	.036	169.3	.743	.051	.082
48.7	.868	-.116	-.009	172.9	.646	.078	.040
	.924	-.113	-.004	176.5	.550	.071	-.037
	.943	-.097	.021	178.3	.485	.057	-.057
	.927	-.086	.041	180.0	.468	.042	-.066
	.926	-.073	.058	181.9	.458	-.007	-.072
	.910	-.064	.079	183.6	.471	-.014	-.070
	.880	-.018	.105	185.4	.487	-.041	-.051
	.854	.015	.106				
	.743	.051	.082				
	.646	.078	.040				
	.550	.071	-.037				
	.485	.057	-.057				
	.468	.042	-.066				
	.458	-.007	-.072				
	.471	-.014	-.070				
	.487	-.041	-.051				

Table F4 - Continued

ANGLE	VX/V	VT/V	VR/V
.6	.424	-.080	.247
2.6	.437	-.088	.225
4.3	.403	-.090	.200
6.1	.492	-.101	.196
9.7	.505	-.133	.184
16.9	.518	-.165	.183
32.7	.612	-.138	.128
48.7	.780	-.071	.015
64.9	.887	-.092	-.033
80.9	.923	-.096	-.005
97.1	.947	-.087	.016
113.2	.947	-.071	.032
129.5	.947	-.062	.046
145.9	.951	-.052	.052
161.8	.959	-.046	.053
165.4	.956	-.044	.056
169.1	.961	-.032	.061
172.6	.960	.044	.068
176.3	.911	.062	-.004
178.1	.726	.028	-.036
178.8	.548	.038	-.052
179.8	.617	-.040	-.041
180.6	.596	-.049	-.051
181.7	.597	-.099	-.008
182.4	.573	-.109	.003
184.3	.693	-.103	.032
186.0	.715	-.074	.076
189.7	.932	.012	.064
193.3	.932	.040	.056
196.9	.943	.044	.055
212.9	.945	.051	.058
229.1	.956	.055	.048
245.3	.948	.071	.035
261.6	.954	.082	.020
277.8	.955	.089	.002
294.2	.947	.083	-.020
310.4	.923	.062	.026
326.7	.821	.098	.115
342.6	.673	.092	.150
349.8	.486	.085	.222
353.4	.483	.056	.240
356.9	.455	-.008	.247

APPENDIX G

EXPERIMENT 7

FIN CONFIGURATION 4 (SSPA)

SHIP VALUES

Trim	1.0 ft by the bow (0.303 m)
Displacement	26,390 tons (26 810 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
J _y	1.01

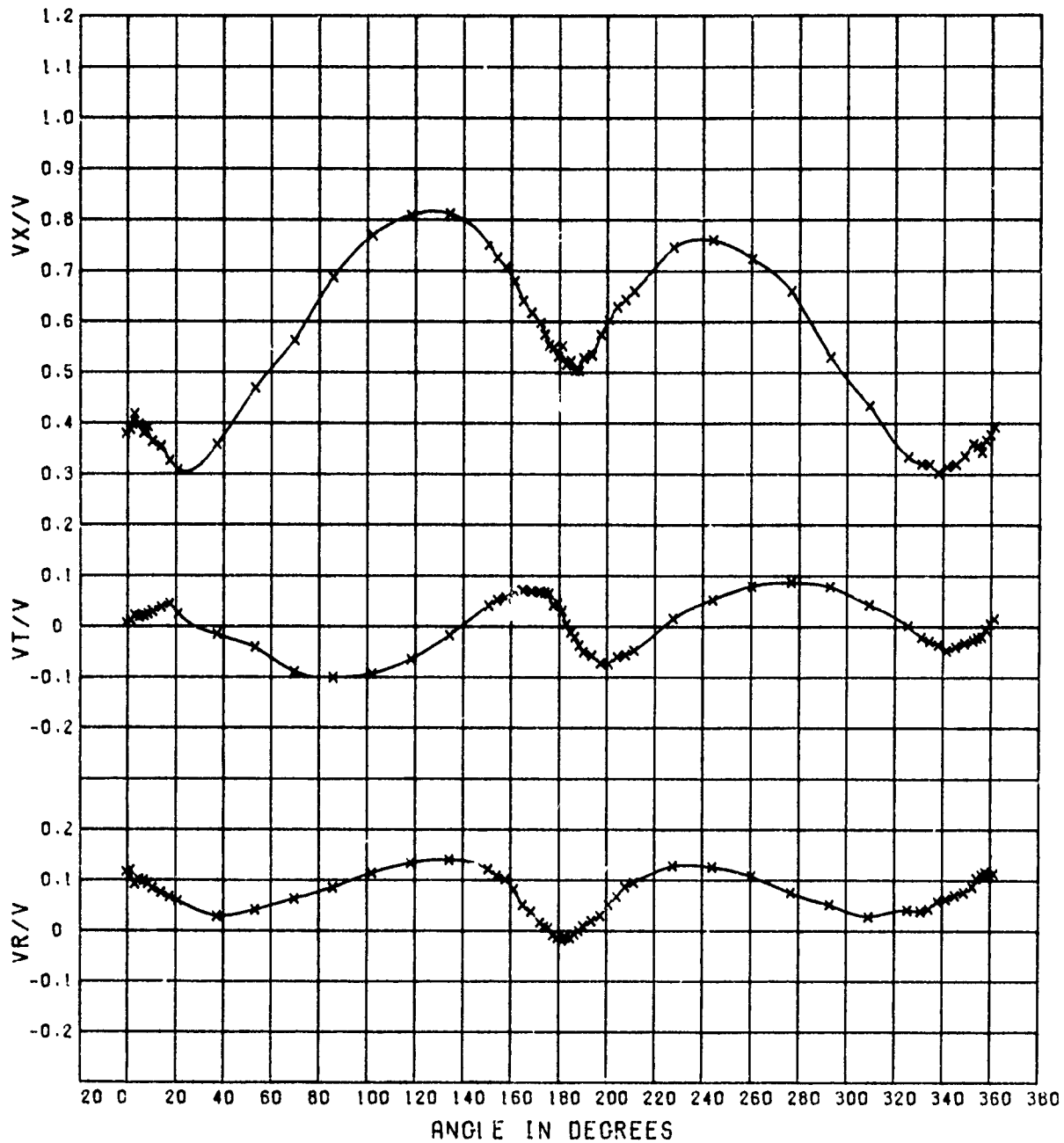


Figure G1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 7
Radius Ratio = 0.359

Fin Configuration 4 (SSPA)
Displacement 26,390 tons (26 810 metric tons)

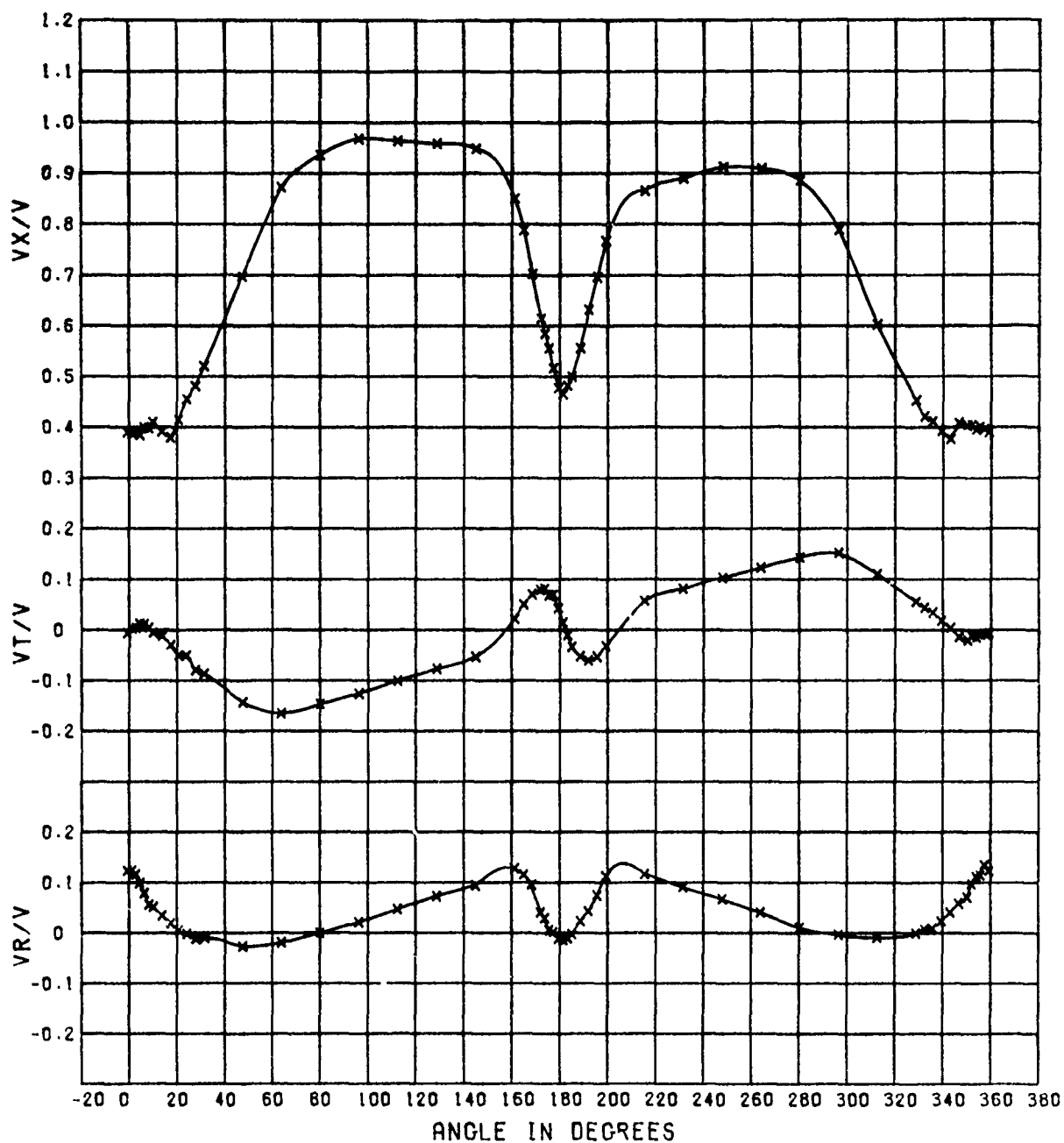


Figure G2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 7
Radius Ratio = 0.556

Fin Configuration 4 (SSPA)
Displacement 26,390 tons (26 810 metric tons)

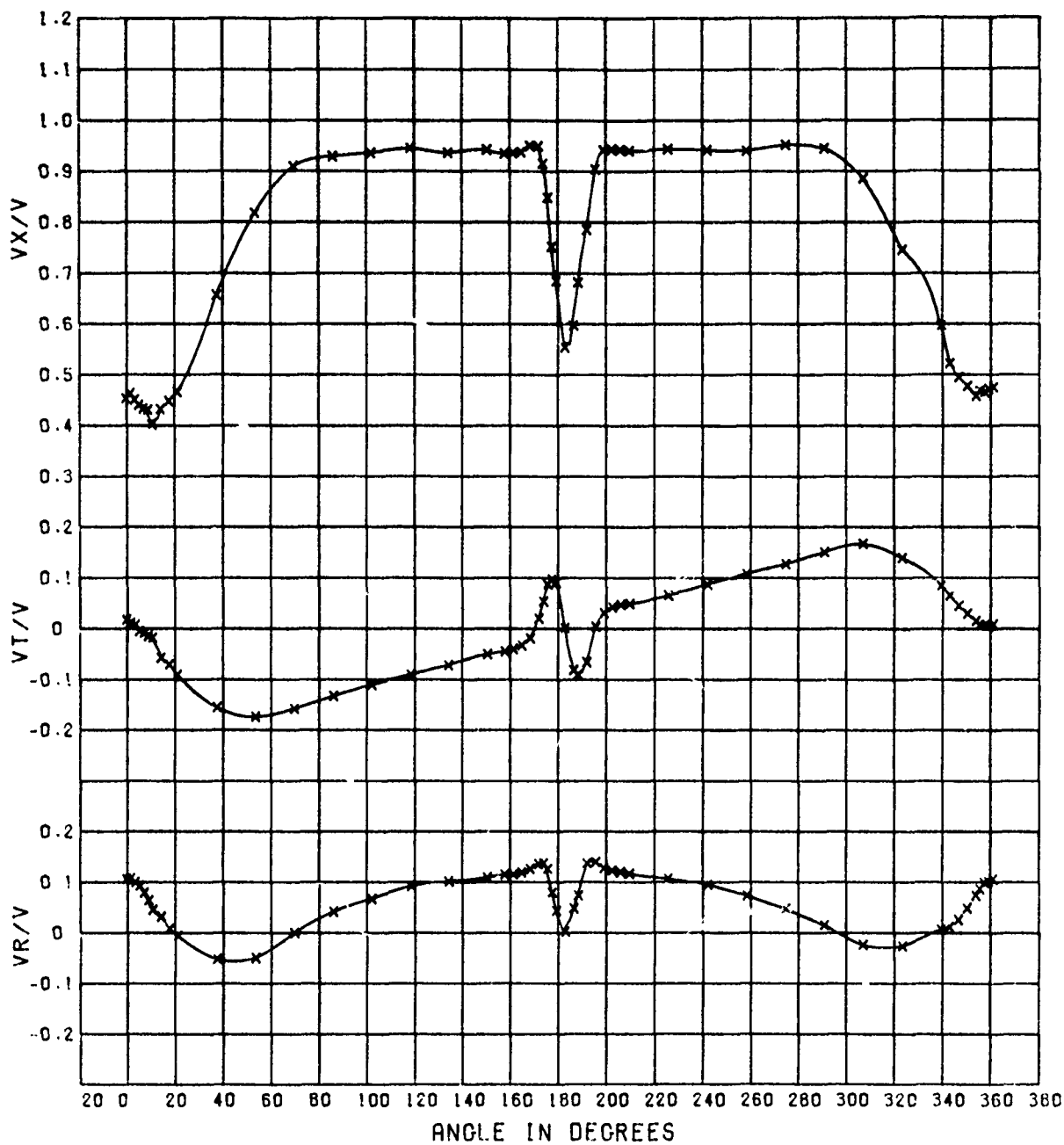


Figure G3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 7
Radius Ratio = 0.775

Fin Configuration 4 (SSPA)
Displacement 26,390 tons (26 810 metric tons)

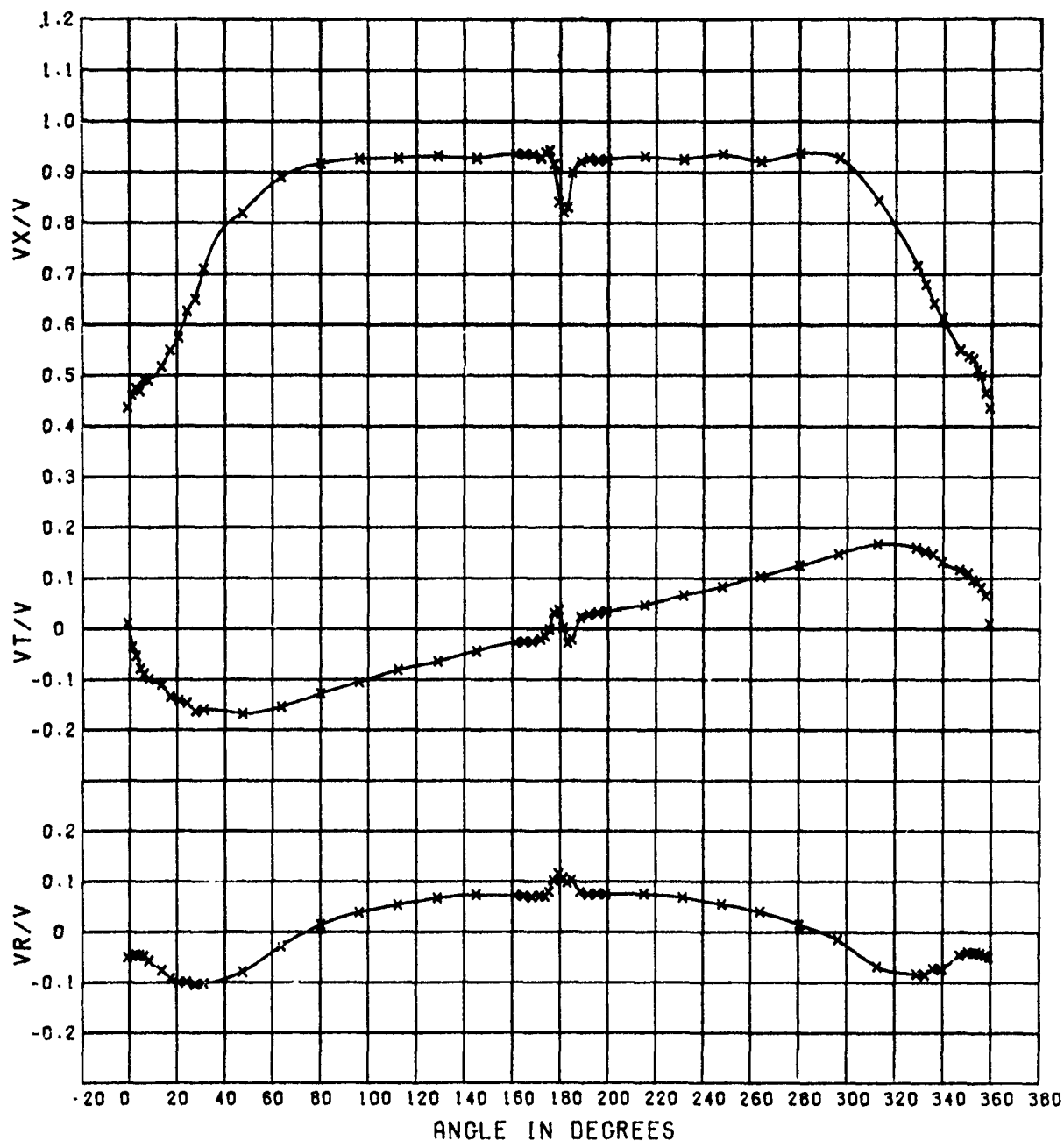


Figure G4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 7
Radius Ratio = 1.107

Fin Configuration 4 (SSPA)
Displacement 26,390 tons (26 810 metric tons)

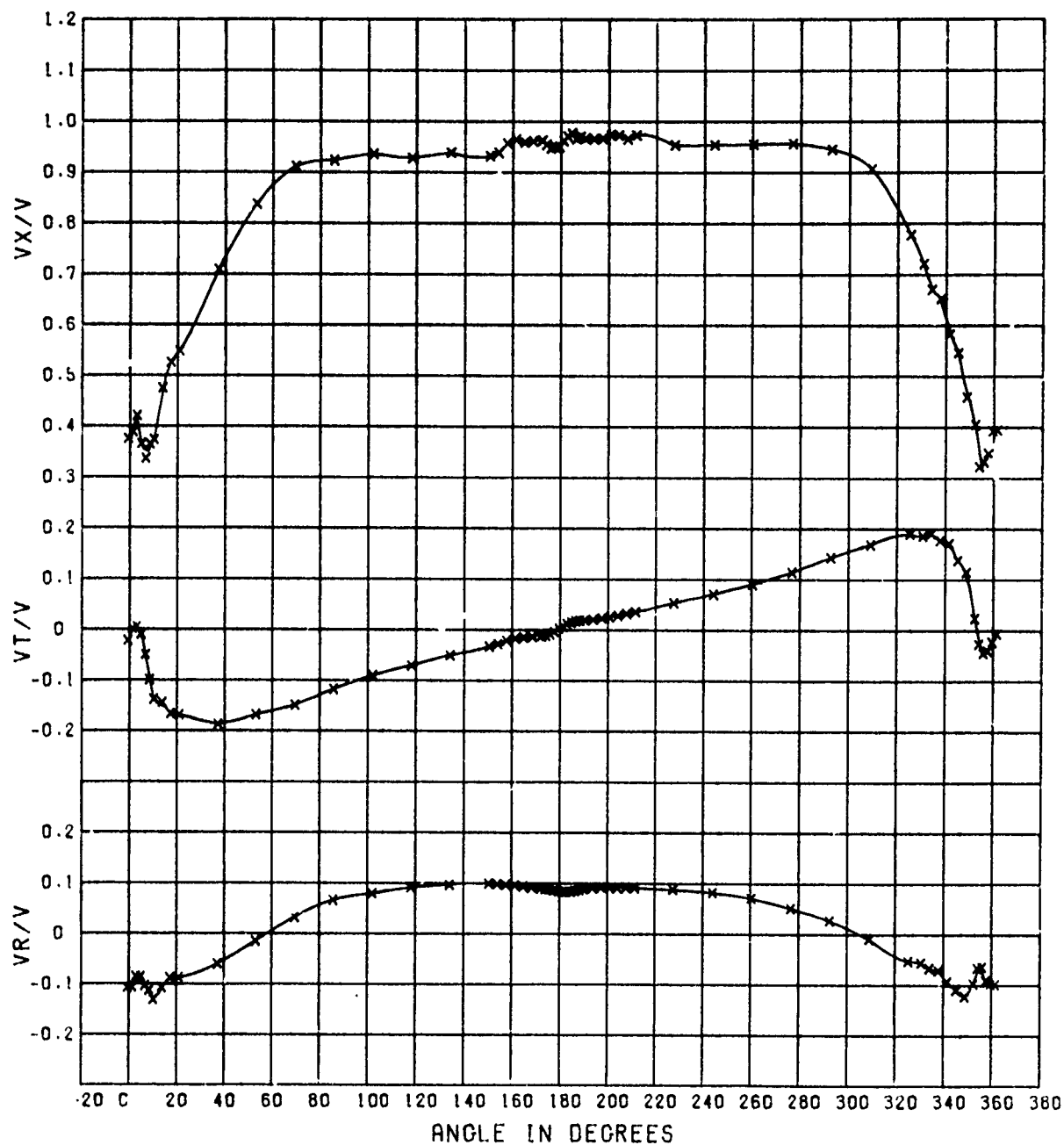


Figure G5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 7
Radius Ratio = 1.178

Fin Configuration 4 (SSPA)
Displacement 26,390 tons (26 810 metric tons)

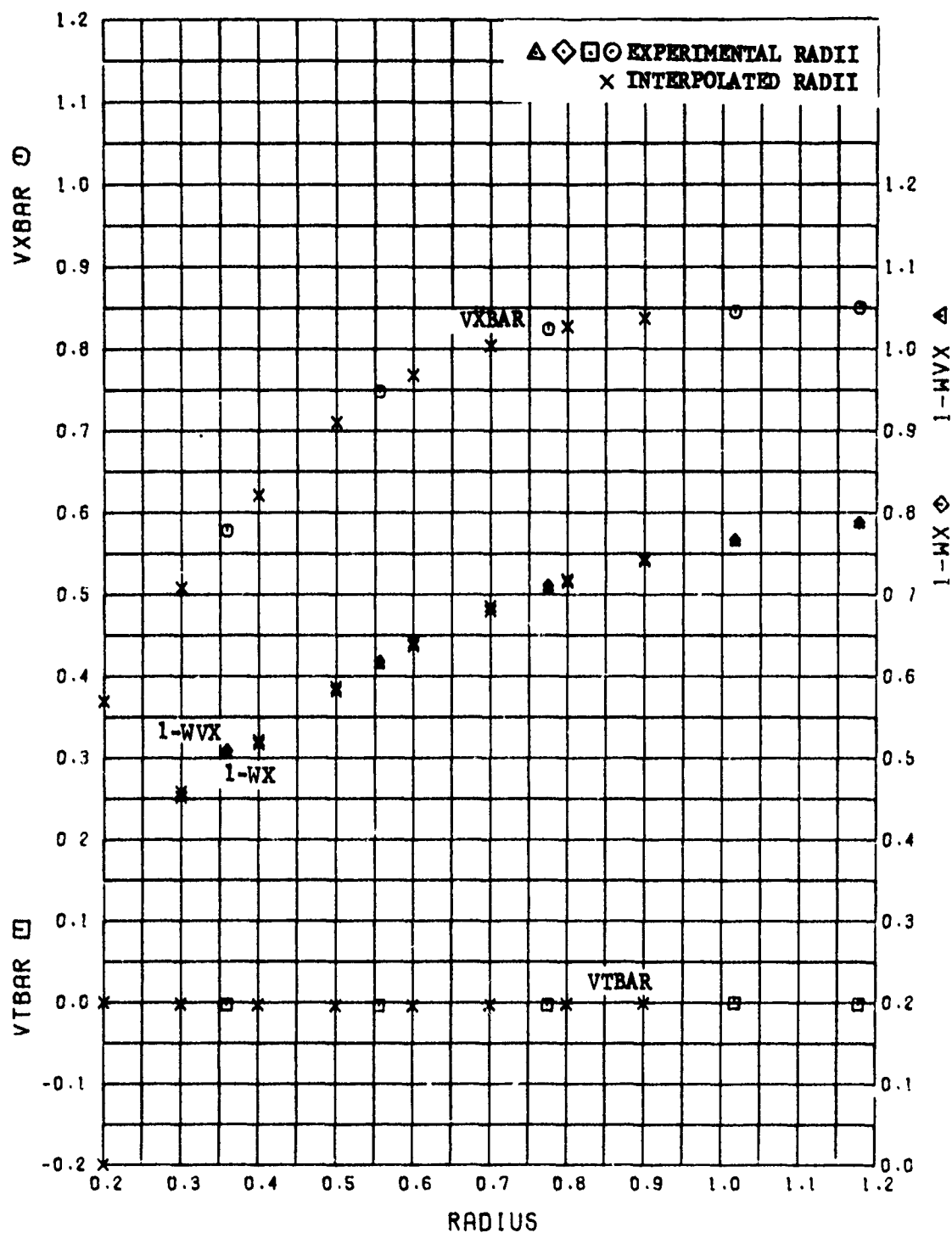


Figure G6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 7

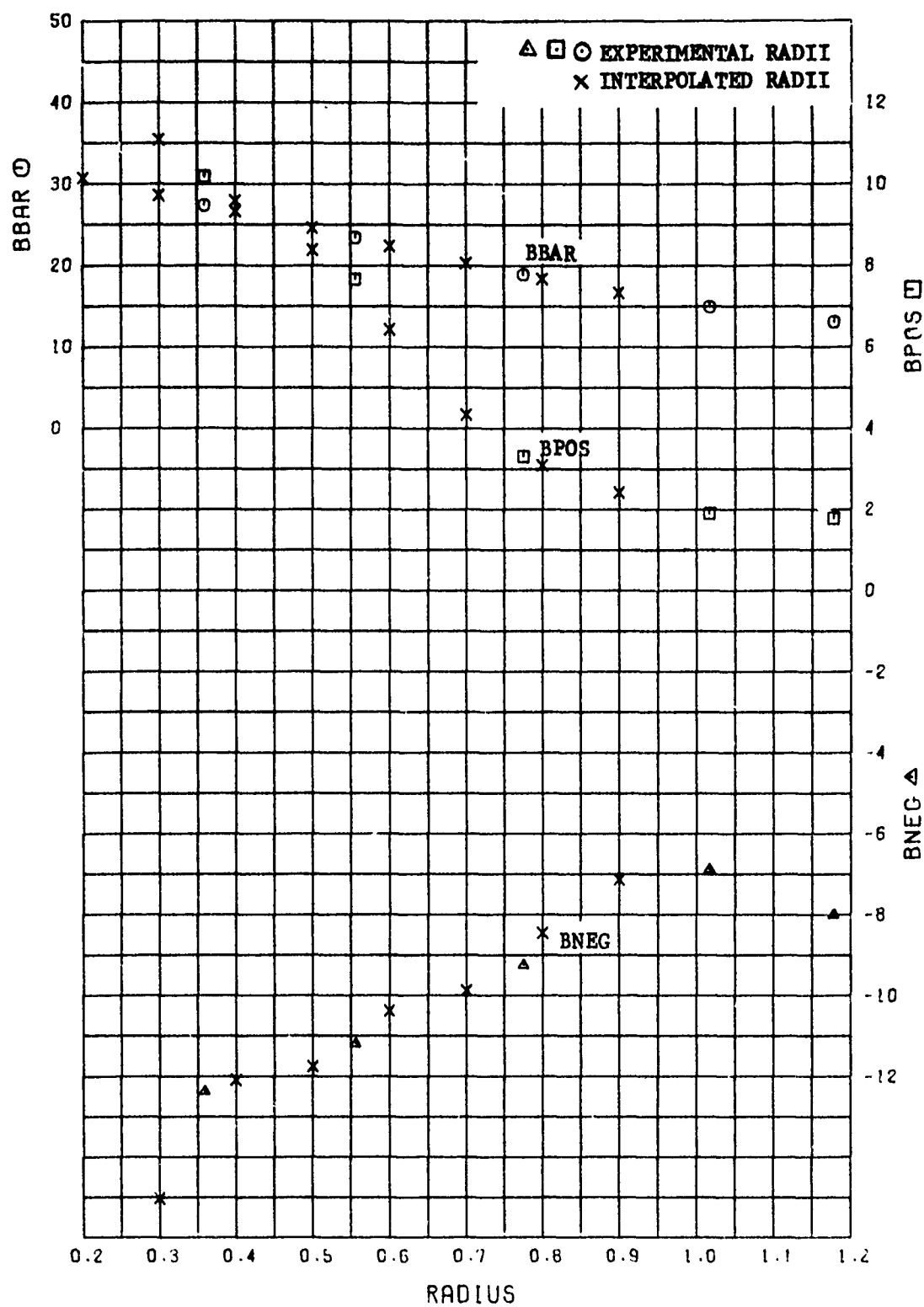


Figure G7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 7

Table G1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 7 with Fin Configuration 4

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.578	.748	.824	.845	.850	.369	.508	.621	.710	.768	.804	.827	.837
VTBAR =	-.003	-.004	-.003	-.000	-.002	-.000	-.002	-.003	-.004	-.004	-.003	-.002	-.001
VRBAR =	.077	.041	.052	.010	.030	.135	.095	.066	.047	.046	.051	.042	.019
1-WVX =	.503	.613	.707	.764	.786	0.000	.452	.517	.582	.637	.680	.715	.741
1-WX =	.509	.618	.711	.767	.788	0.000	.458	.521	.586	.641	.685	.718	.744
BBAR =	27.40	23.44	18.89	14.96	13.06	30.68	28.59	26.58	24.58	22.40	20.30	18.40	16.65
BPOS =	10.18	7.67	3.31	1.90	1.78	20.40	11.08	9.58	8.38	6.43	4.33	3.09	2.41
THETA =	115.00	95.00	80.00	90.00	185.00	172.50	117.50	112.50	100.00	95.00	92.50	82.50	87.50
BNEG =	-12.38	-11.20	-9.25	-6.89	-8.01	-28.80	-15.03	-12.09	-11.76	-10.39	-9.88	-8.46	-7.14
THETA =	22.50	342.50	10.00	0.00	355.00	62.50	27.50	337.50	342.50	5.00	10.00	10.00	0.00

VXBAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.
 VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.
 VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.
 1-WVX IS VOLUMETRIC MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.
 1-WX IS VOLUMETRIC MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.
 BBAR IS MEAN ANGLE OF ADVANCE.
 BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).
 BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).
 THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim 1.0 ft by the bow (0.305 m)
 Displacement 26,390 tons (26 810 metric tons)
 Propeller Diameter 21.0 ft (6.40 m)
 Speed 20.0 knots
 Jv 1.01

Table G2 - Harmonic Analysis of the Longitudinal Velocity Component
Ratios for Experiment 7 with Fin Configuration 4

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.1865	-.1242	.0668	-.0035	.0256	.0027	.0124	.0062
RADIUS = .556									
AMPLITUDE	=	-.1721	-.2135	.0159	-.0398	.0552	-.0227	.0299	-.0177
RADIUS = .775									
AMPLITUDE	=	-.1562	-.1555	-.0421	-.0488	.0207	-.0184	.0207	-.0167
RADIUS = 1.017									
AMPLITUDE	=	-.1454	-.1115	-.0611	-.0343	-.0084	-.0073	.0004	-.0053
RADIUS = 1.178									
AMPLITUDE	=	-.1828	-.1253	-.0842	-.0408	-.0218	-.0134	-.0085	-.0085

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.1980	.0457	.1072	.0452	-.0402	.0435	-.0171	.0424
RADIUS = .300									
AMPLITUDE	=	-.1907	-.0713	.0819	.0125	.0056	.0157	.0039	.0178
RADIUS = .400									
AMPLITUDE	=	-.1835	-.1538	.0553	-.0133	.0365	-.0049	.0187	-.0007
RADIUS = .500									
AMPLITUDE	=	-.1762	-.2017	.0305	-.0322	.0526	-.0183	.0276	-.0133
RADIUS = .600									
AMPLITUDE	=	-.1684	-.2005	.0011	-.0433	.0477	-.0223	.0287	-.0182
RADIUS = .700									
AMPLITUDE	=	-.1610	-.1734	-.0266	-.0481	.0317	-.0205	.0248	-.0180
RADIUS = .800									
AMPLITUDE	=	-.1513	-.1474	-.0432	-.0459	.0172	-.0162	.0182	-.0147
RADIUS = .900									
AMPLITUDE	=	-.1406	-.1231	-.0495	-.0377	.0044	-.0097	.0092	-.0084

Table G3 - Harmonic Analysis of the Tangential Velocity Component
Ratios for Experiment 7 with Fin Configuration 4

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.0555	-.0135	.0529	-.0068	.0202	-.0034	.0090	.0011
RADIUS = .556									
AMPLITUDE	=	-.1288	-.0298	.0192	.0012	.0237	-.0096	.0144	-.0083
RADIUS = .775									
AMPLITUDE	=	-.1423	-.0464	-.0131	-.0013	.0091	-.0005	.0063	-.0045
RADIUS = 1.017									
AMPLITUDE	=	-.1379	-.0591	-.0321	-.0137	-.0102	-.0060	-.0065	-.0047
RADIUS = 1.178									
AMPLITUDE	=	-.1379	-.0706	-.0386	-.0190	-.0112	-.0060	-.0035	.0001

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.0461	.0004	.0833	-.0206	.0058	.0115	-.0020	.0174
RADIUS = .300									
AMPLITUDE	=	-.0222	-.0084	.0600	-.0112	.0160	.0011	.0053	.0062
RADIUS = .400									
AMPLITUDE	=	-.0755	-.0170	.0455	-.0044	.0222	-.0058	.0110	-.0018
RADIUS = .500									
AMPLITUDE	=	-.1139	-.0253	.0283	-.0001	.0243	-.0092	.0139	-.0068
RADIUS = .600									
AMPLITUDE	=	-.1329	-.0335	.0115	.0014	.0210	-.0067	.0138	-.0072
RADIUS = .700									
AMPLITUDE	=	-.1396	-.0413	-.0037	.0005	.0144	-.0021	.0112	-.0054
RADIUS = .800									
AMPLITUDE	=	-.1416	-.0475	-.0156	-.0029	.0061	-.0013	.0057	-.0049
RADIUS = .900									
AMPLITUDE	=	-.1393	-.0523	-.0243	-.0084	-.0036	-.0041	-.0022	-.0057

Table G4 - Input Data for Wake Survey Analysis for Experiment 7 with Fin Configuration 4

RADIUS = .359				357.7	.367	-.006	.116
ANGLE	VX/V	VT/V	VR/V	359.5	.378	.006	.110
-.7	.379	.007	.118	361.4	.393	.015	.113
1.2	.387	.012	.120				
2.9	.418	.022	.093				
4.7	.397	.019	.101				
6.6	.380	.021	.099				
8.4	.393	.024	.093				
10.1	.364	.029	.084				
13.7	.355	.038	.075				
17.3	.326	.044	.067				
20.9	.308	.025	.059				
37.1	.358	-.015	.028				
53.2	.469	-.041	.041				
69.5	.562	-.089	.063				
85.7	.687	-.101	.084				
102.0	.769	-.094	.114				
118.2	.809	-.065	.133				
134.3	.312	-.018	.140				
150.5	.752	.041	.121				
154.1	.726	.052	.108				
157.7	.707	.057	.101				
161.3	.680	.070	.081				
164.9	.341	.071	.050				
166.5	.617	.069	.033				
172.2	.597	.068	.016				
174.0	.574	.066	.008				
175.7	.554	.065	.005				
177.5	.548	.042	-.009				
179.4	.531	.046	-.015				
181.2	.552	.030	-.019				
192.9	.516	.003	-.013				
184.7	.522	-.012	-.014				
106.6	.504	-.021	-.007				
188.4	.503	-.038	-.001				
190.2	.527	-.051	.009				
193.7	.534	-.057	.019				
197.3	.574	-.073	.029				
200.8	.603	-.074	.051				
204.1	.629	-.060	.067				
208.0	.643	-.057	.087				
211.5	.660	-.048	.095				
227.7	.746	.016	.127				
244.1	.760	.053	.126				
260.3	.724	.079	.108				
276.6	.650	.087	.075				
292.8	.530	.079	.052				
309.1	.454	.043	.028				
325.3	.333	.001	.041				
330.7	.320	-.022	.039				
334.2	.319	-.029	.043				
337.9	.302	-.037	.058				
341.5	.315	-.047	.062				
345.1	.319	-.040	.070				
348.7	.336	-.034	.076				
352.4	.360	-.027	.086				
354.1	.355	-.022	.103				
355.9	.344	-.020	.112				

RADIUS = .556			
ANGLE	VX/V	VT/V	VR/V
-.8	.390	-.006	.123
1.1	.387	.002	.124
2.7	.392	.004	.116
4.5	.384	.012	.098
6.3	.399	.011	.078
8.2	.398	.004	.055
10.0	.410	-.006	.051
13.5	.391	-.012	.034
17.1	.379	-.030	.019
20.7	.414	-.051	.005
24.2	.455	-.050	-.002
27.8	.481	-.080	-.013
31.3	.520	-.087	-.010
47.4	.697	-.143	-.028
63.8	.872	-.166	-.020
80.0	.936	-.147	-.001
96.2	.968	-.126	.021
112.4	.964	-.101	.046
128.8	.959	-.077	.073
144.9	.948	-.053	.094
161.1	.850	.022	.128
164.8	.788	.050	.115
168.3	.702	.070	.096
172.0	.614	.079	.040
173.8	.584	.081	.029
175.5	.556	.069	.006
177.3	.516	.070	.002
179.2	.468	.039	-.018
179.4	.466	.045	-.007
181.0	.470	.019	-.016
181.3	.459	.009	-.012
183.0	.481	-.011	-.011
184.8	.500	-.034	-.003
188.5	.556	-.053	.023
192.0	.631	-.061	.042
195.7	.695	-.054	.074
199.3	.767	-.032	.113
215.3	.865	.057	.116
231.6	.890	.081	.091
247.8	.912	.103	.067
264.0	.909	.122	.041
280.2	.886	.142	.010
296.4	.788	.151	-.004
312.5	.602	.110	-.010
328.7	.453	.056	-.001
332.3	.421	.044	.007
335.8	.411	.034	.009
339.5	.392	.019	.023
343.1	.376	.003	.041
346.6	.408	-.014	.059
350.2	.402	-.021	.071
352.1	.404	-.012	.097
353.9	.395	-.014	.112
355.7	.400	.009	.114
357.5	.397	-.008	.135
359.2	.390	-.006	.123
361.1	.387	.002	.124

Table G4 - Continued

RADIUS = .775							
ANGLE	VX/V	VT/V	VR/V				
-5	.454	.017	.106	8.2	.490	-.099	-.058
1.3	.463	.011	.108	13.5	.517	-.110	-.076
3.1	.451	.008	.100	17.1	.549	-.135	-.092
4.9	.440	-.006	.093	20.7	.574	-.142	-.100
6.8	.434	-.009	.079	24.2	.627	-.147	-.100
8.6	.431	-.015	.064	27.8	.650	-.164	-.104
10.3	.402	-.018	.045	31.3	.710	-.161	-.103
14.0	.432	-.058	.032	47.4	.819	-.169	-.079
17.5	.448	-.071	.008	63.8	.890	-.155	-.029
21.1	.466	-.091	-.006	80.0	.917	-.129	.014
37.3	.657	-.156	-.052	96.2	.926	-.106	.038
53.4	.818	-.175	-.050	112.4	.928	-.081	.053
69.7	.909	-.158	-.000	128.8	.932	-.065	.067
85.9	.928	-.134	.041	144.9	.927	-.044	.073
102.1	.935	-.111	.067	161.1	.936	-.028	.072
118.3	.945	-.091	.092	164.8	.934	-.027	.071
134.4	.936	-.072	.101	168.3	.935	-.026	.069
150.6	.942	-.050	.108	172.0	.928	-.021	.071
157.8	.934	-.045	.114	173.8	.939	-.015	.071
161.4	.936	-.041	.115	175.5	.943	-.002	.079
165.0	.937	-.033	.119	177.3	.917	.032	.102
168.6	.950	-.019	.126	179.2	.858	.037	.114
172.1	.950	.020	.136	179.4	.825	.038	.117
174.0	.915	.054	.137	181.0	.832	-.001	.106
175.8	.848	.087	.126	181.3	.811	.002	.107
177.5	.752	.097	.079	183.0	.831	-.029	.097
179.3	.685	.091	.043	184.8	.900	-.021	.103
182.9	.554	.001	.002	188.5	.920	.023	.078
186.5	.597	-.082	.048	192.0	.927	.028	.074
188.4	.682	-.091	.073	195.7	.924	.032	.075
192.0	.785	-.066	.137	199.3	.925	.035	.075
195.5	.905	.004	.140	215.3	.931	.046	.075
199.0	.942	.031	.127	231.6	.925	.066	.068
202.6	.943	.042	.123	247.8	.935	.082	.055
206.1	.942	.047	.120	264.0	.921	.104	.040
209.7	.940	.049	.117	280.2	.936	.124	.015
225.8	.944	.065	.107	296.4	.928	.147	-.015
242.1	.942	.087	.095	312.5	.844	.167	-.068
258.3	.940	.107	.073	328.7	.717	.159	-.084
274.6	.951	.127	.047	332.3	.680	.152	-.085
290.8	.944	.150	.015	335.8	.642	.147	-.072
307.0	.886	.167	-.024	339.5	.613	.132	-.074
323.3	.745	.139	-.027	346.6	.550	.116	-.046
339.5	.597	.084	.006	350.2	.537	.110	-.040
343.0	.521	.065	.011	352.1	.532	.096	-.042
346.7	.495	.045	.026	353.9	.511	.093	-.041
350.3	.477	.030	.048	355.7	.500	.081	-.043
353.9	.458	.015	.074	357.5	.465	.066	-.047
355.6	.468	.008	.087	359.2	.437	.011	-.051
357.5	.465	.007	.099	361.1	.460	-.036	-.048
RADIUS = 1.017				RADIUS = 1.178			
ANGLE	VX/V	VT/V	VR/V	ANGLE	VX/V	VT/V	VR/V
-8	.437	.011	-.051	-7	.375	-.022	-.108
1.1	.460	-.036	-.048	1.2	.389	.001	-.106
2.7	.474	-.053	-.045	2.9	.420	.005	-.086
4.5	.469	-.079	-.047	4.7	.365	-.010	-.086
6.3	.493	-.069	-.047	6.6	.336	-.050	-.103
				8.4	.365	-.100	-.113
				10.1	.373	-.138	-.132
				13.7	.475	-.145	-.108
				17.3	.525	-.167	-.068
				20.9	.548	-.169	-.088

Table G4 - Continued

37.1	.709	-.187	-.060
53.2	.837	-.168	-.015
69.5	.911	-.150	.032
85.7	.923	-.118	.066
102.0	.936	-.091	.079
118.2	.928	-.071	.091
134.3	.938	-.051	.096
150.5	.932	-.034	.099
154.1	.939	-.028	.098
157.7	.957	-.022	.097
161.3	.965	-.017	.096
164.9	.959	-.015	.094
168.5	.961	-.014	.092
172.2	.963	-.013	.090
174.0	.955	-.011	.088
175.7	.947	-.009	.088
177.5	.950	-.005	.086
179.4	.950	.003	.083
181.2	.962	.007	.083
182.9	.971	.012	.083
184.7	.977	.015	.083
186.6	.966	.017	.085
188.4	.970	.018	.087
190.2	.966	.019	.088
192.7	.966	.020	.091
197.3	.966	.023	.092
200.8	.974	.025	.091
204.4	.973	.028	.091
208.0	.966	.033	.092
211.5	.973	.036	.091
227.7	.954	.054	.088
244.1	.954	.071	.082
260.3	.955	.091	.071
276.6	.957	.114	.051
292.8	.945	.143	.027
309.1	.907	.168	-.009
325.3	.778	.189	-.053
330.7	.721	.185	-.056
334.2	.670	.191	-.067
337.9	.652	.177	-.071
341.5	.583	.171	-.093
345.1	.546	.138	-.110
348.7	.459	.114	-.122
352.4	.405	.021	-.097
354.1	.322	-.027	-.066
355.9	.332	-.045	-.064
357.7	.349	-.041	-.091
359.5	.392	-.023	-.098
361.4	.394	-.007	-.099

APPENDIX H

EXPERIMENT 8

FIN CONFIGURATION 4 (SSPA)

SHIP VALUES

Trim	3.75 ft by the stern (1.143 m)
Displacement	17,270 tons (17 550 metric tons)
Propeller Diameter	21.0 ft (6.40 m)
Speed	20.0 knots
Jv	1.01

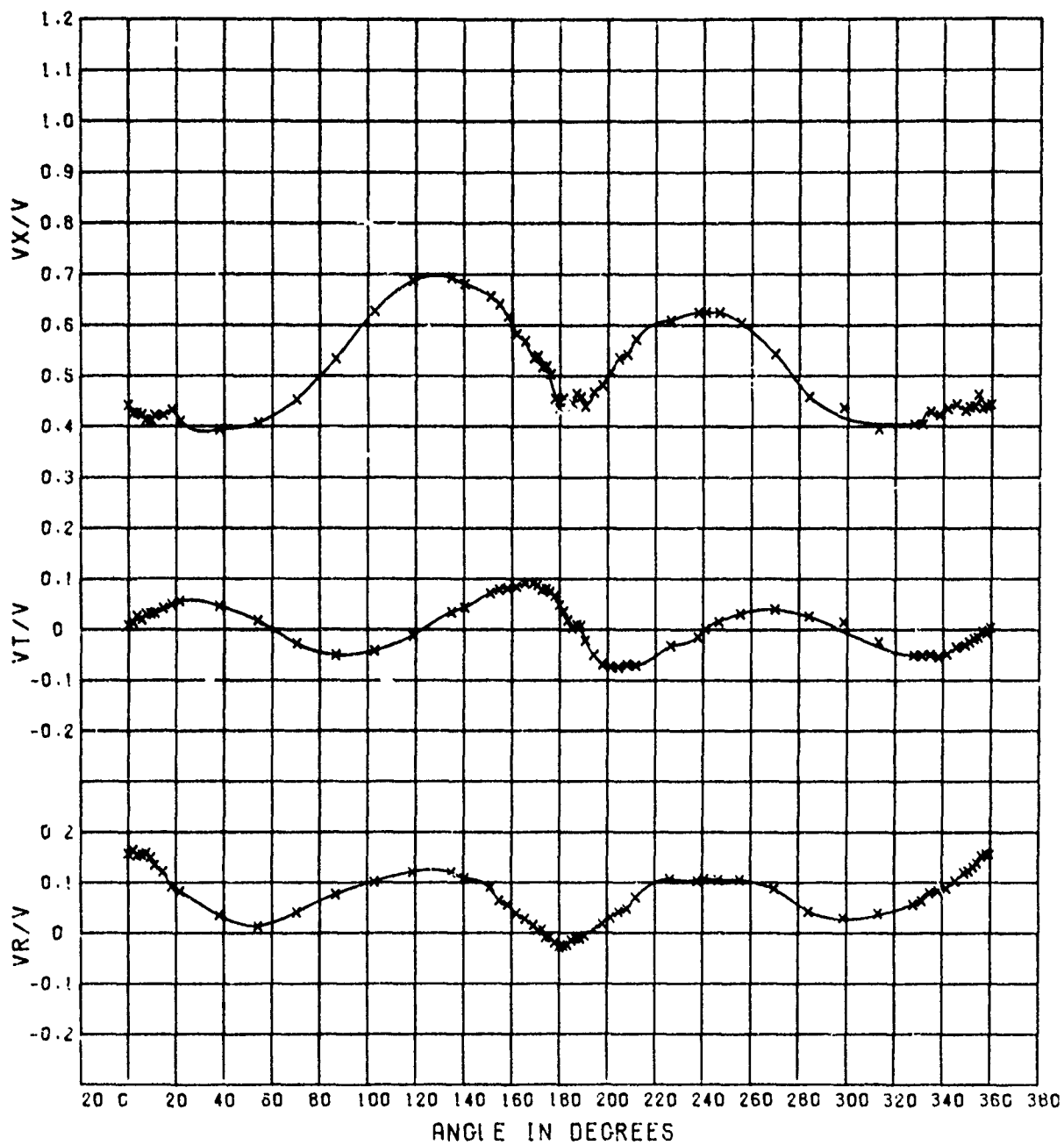


Figure H1 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 8
Radius Ratio = 0.359

Fin Configuration 4 (SSPA)
Displacement 17,270 tons (17 550 metric tons)

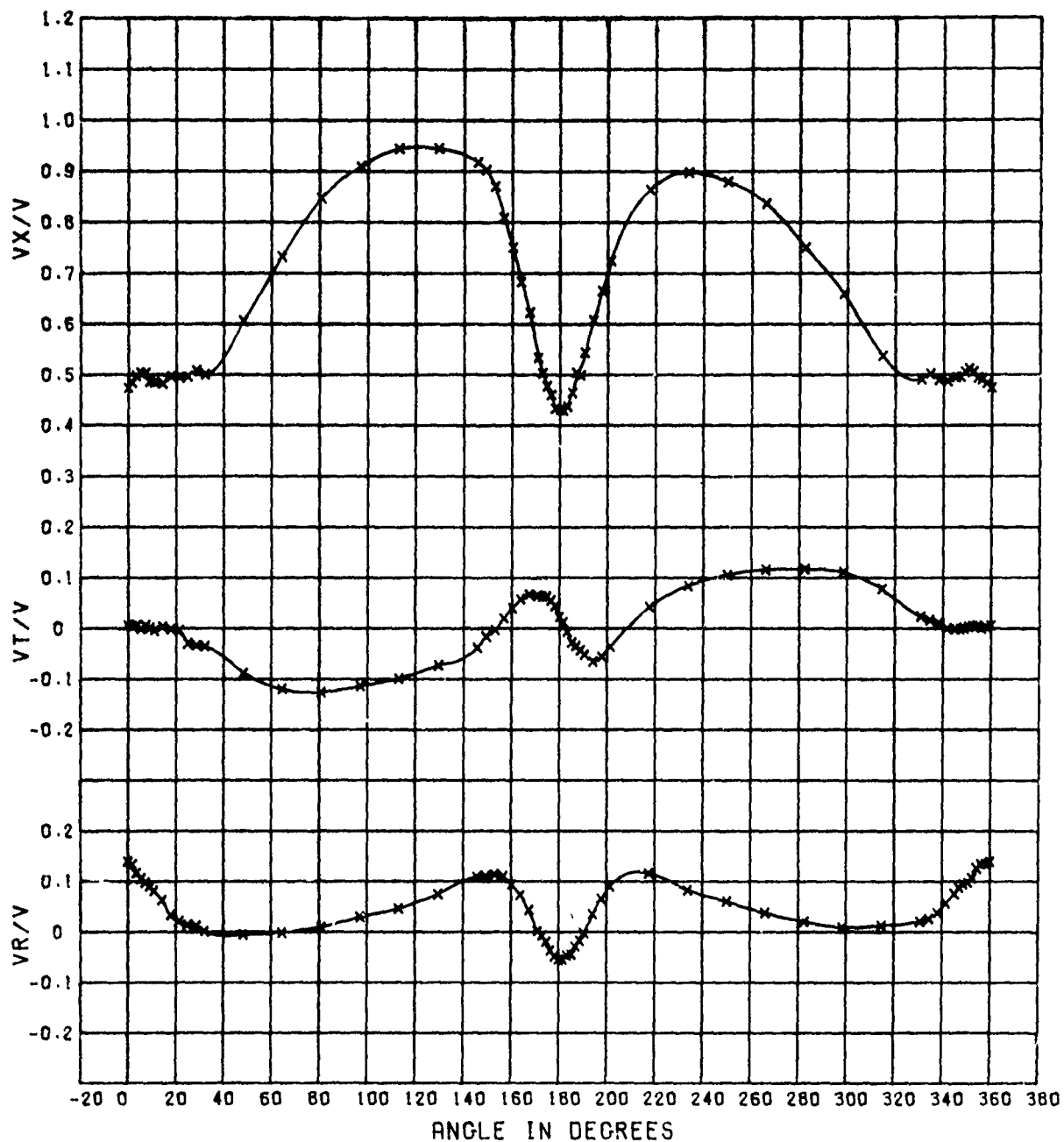


Figure H2 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 8
Radius Ratio = 0.556

Fin Configuration 4 (SSPA)
Displacement 17,270 tons (17 550 metric tons)

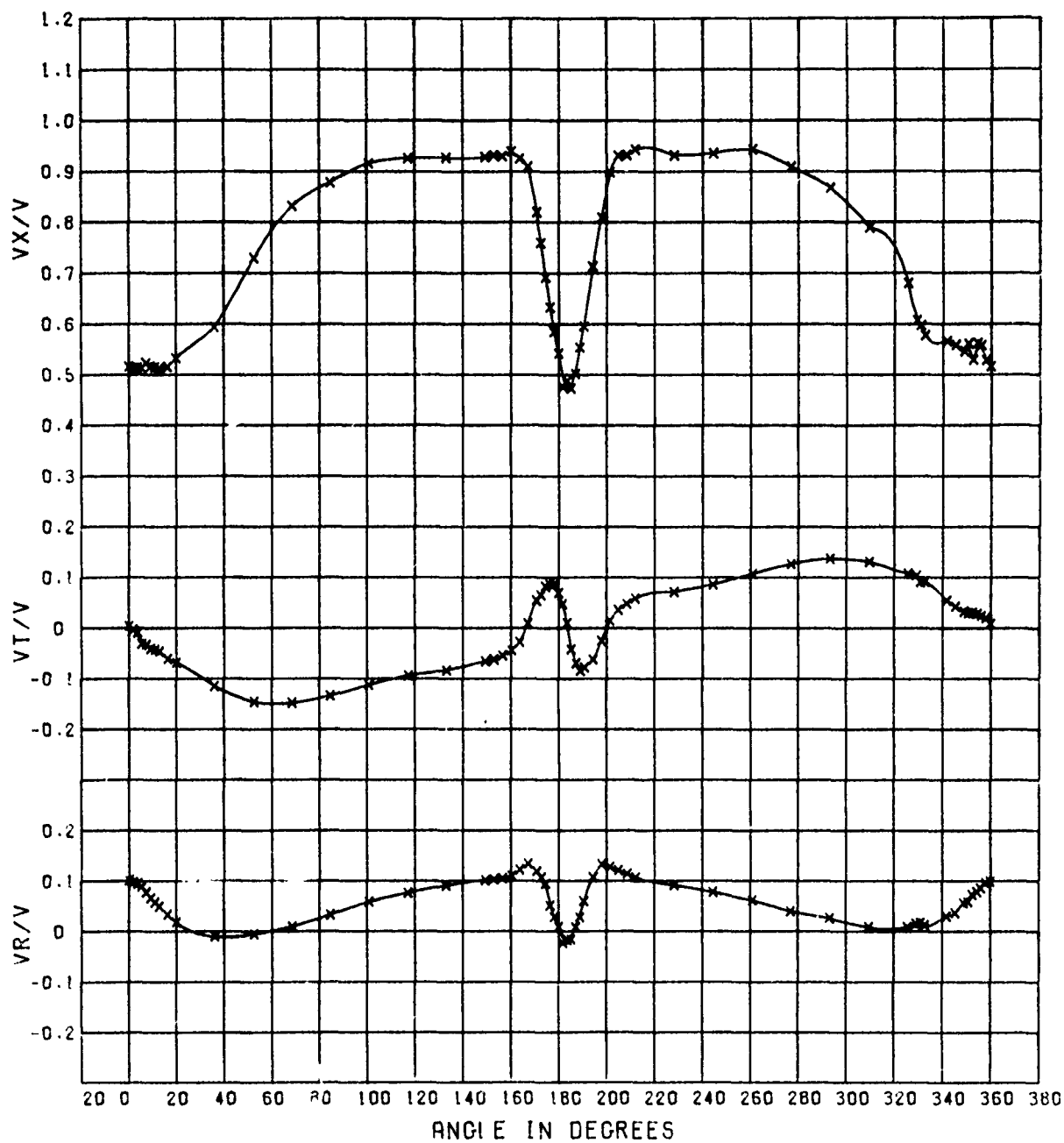


Figure H3 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 8
Radius Ratio = 0.775

Fin Configuration 4 (SSPA)
Displacement 17,270 tons (17 550 metric tons)

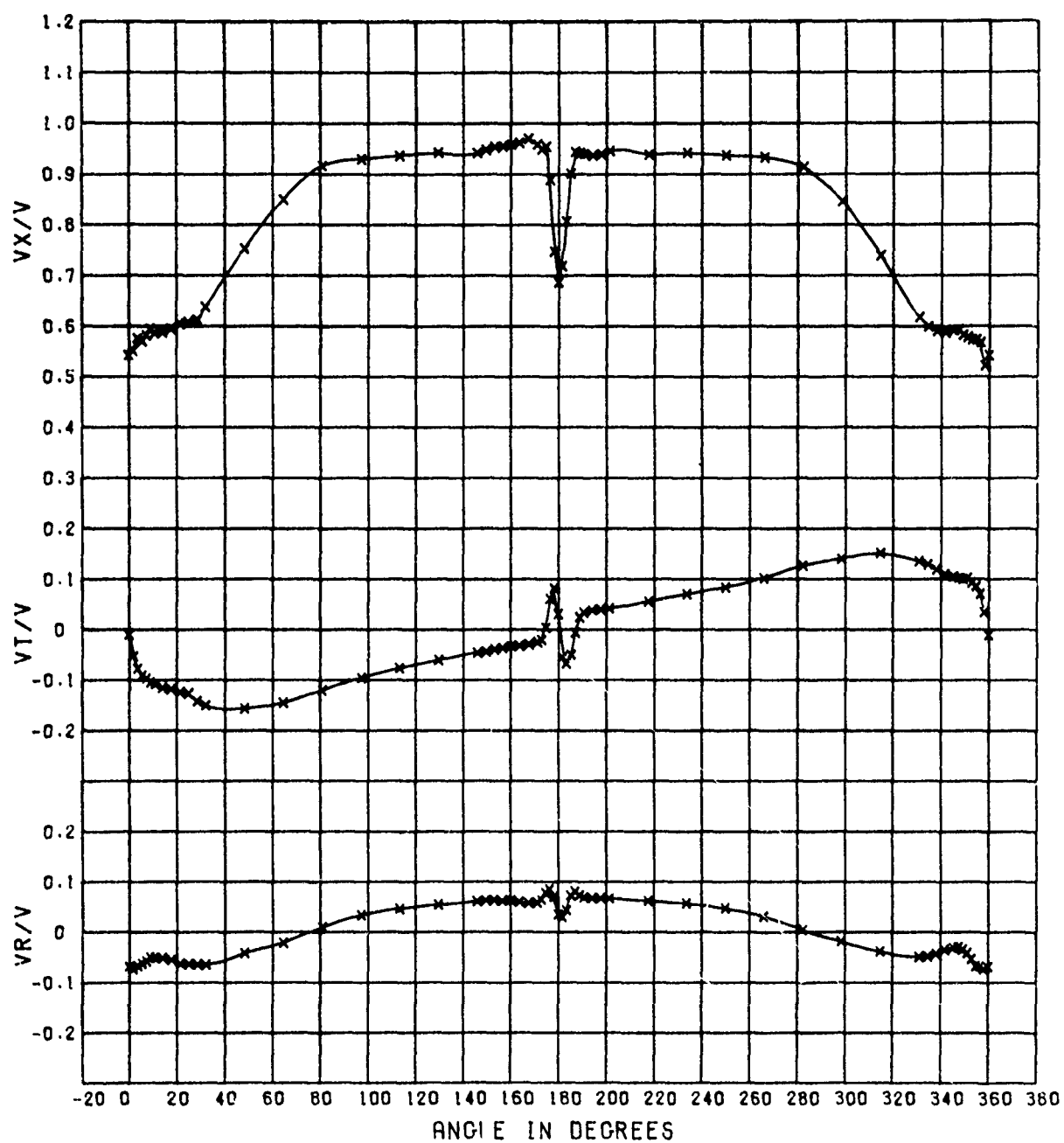


Figure H4 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 8
Radius Ratio = 1.107

Fin Configuration 4 (SSPA)
Displacement 17,270 tons (17 550 metric tons)

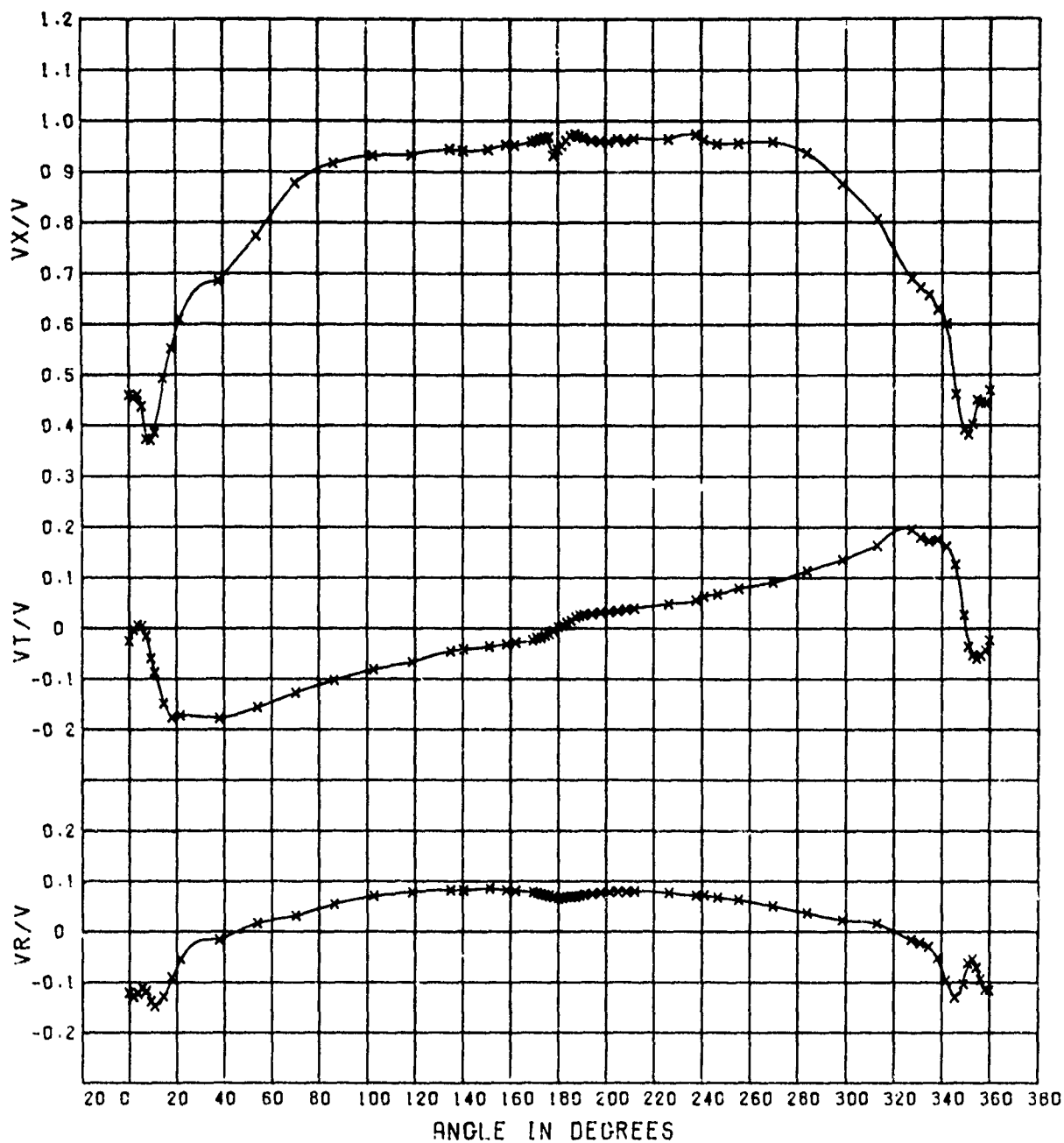


Figure H5 Circumferential Distribution of the Longitudinal, Tangential, and Radial Velocity Component Ratios. Experiment 8
Radius Ratio = 1.178

Fin Configuration 4 (SSPA)
Displacement 17,270 tons (17 550 metric tons)

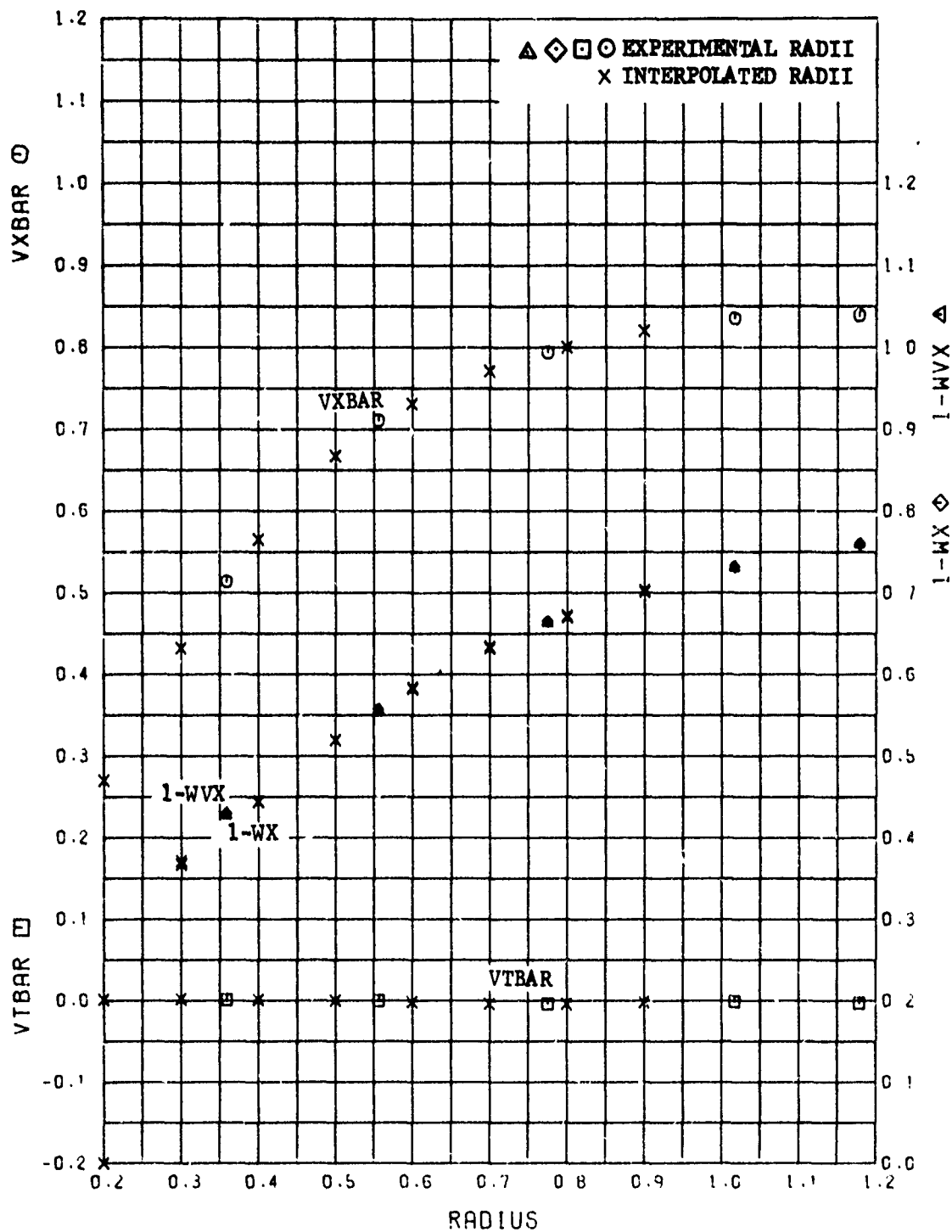


Figure H6 - Radial Distribution of the Mean Velocity Component Ratios for Experiment 8

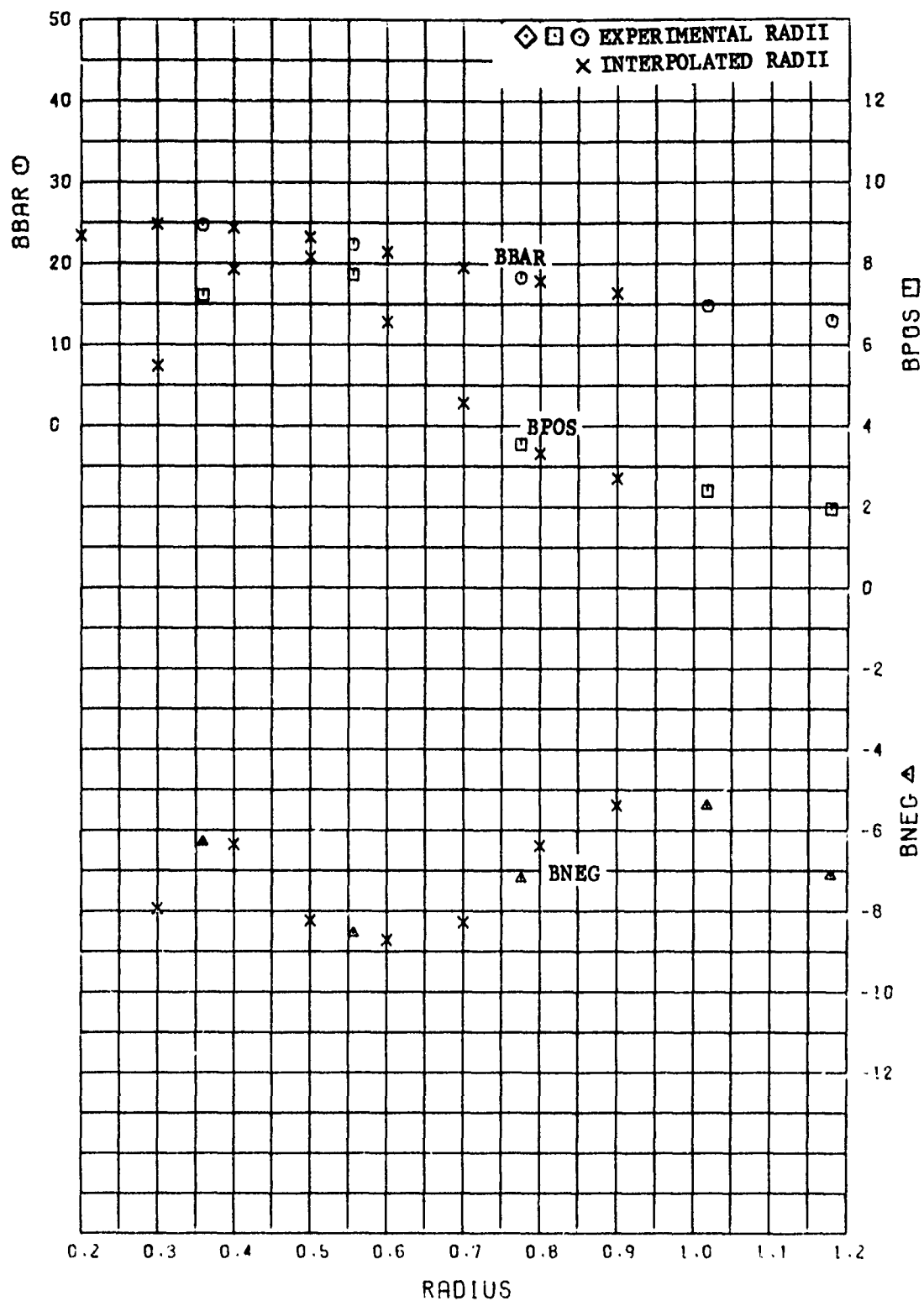


Figure H7 - Radial Distribution of the Mean Advance Angle and the Maximum Variations of the Advance Angle for Experiment 8

Table H1 - Listing of the Mean Velocity Component Ratios, the Mean Advance Angles and other Derived Quantities for Experiment 8 with Fin Configuration 4

RADIUS =	.359	.556	.775	1.017	1.178	.200	.300	.400	.500	.600	.700	.800	.900
VXBAR =	.514	.711	.794	.835	.839	.270	.432	.565	.667	.731	.771	.800	.820
VTBAR =	.001	-.000	-.004	-.001	-.003	.001	.002	.001	.000	-.002	-.004	-.004	-.002
VRBAR =	.070	.044	.053	.011	.030	.116	.085	.062	.048	.049	.055	.044	.020
1-WVX =	.427	.555	.663	.730	.759	0.000	.367	.444	.519	.582	.632	.670	.701
1-WX =	.430	.557	.665	.732	.760	0.000	.371	.445	.520	.584	.634	.672	.703
BBAR =	24.69	22.36	18.26	14.79	12.91	23.40	24.82	24.39	23.21	21.42	19.52	17.85	16.34
BPOS =	7.21	7.73	3.54	2.40	1.95	20.56	5.48	7.86	8.15	6.56	4.56	3.32	2.70
THETA =	120.00	115.00	110.00	167.50	175.00	172.50	217.50	120.00	117.50	115.00	112.50	110.00	160.00
BNEG =	-6.30	-8.56	-7.20	-5.39	-7.13	-23.74	-7.95	-6.35	-8.24	-8.72	-8.29	-6.39	-5.39
THETA =	30.00	180.00	182.50	357.50	7.50	77.50	55.00	32.50	180.00	182.50	182.50	182.50	357.50

VXBAR IS CIRCUMFERENTIAL MEAN LONGITUDINAL VELOCITY.
 VTBAR IS CIRCUMFERENTIAL MEAN TANGENTIAL VELOCITY.
 VRBAR IS CIRCUMFERENTIAL MEAN RADIAL VELOCITY.
 1-WVX IS VOLUMEIRIC MEAN WAKE VELOCITY WITHOUT TANGENTIAL CORRECTION.
 1-WX IS VOLUMEIRIC MEAN WAKE VELOCITY WITH TANGENTIAL CORRECTION.
 BBAR IS MEAN ANGLE OF ADVANCE.
 BPOS IS VARIATION BETWEEN THE MAXIMUM AND MEAN ADVANCE ANGLES (DELTA BETA PLUS).
 BNEG IS VARIATION BETWEEN THE MINIMUM AND MEAN ADVANCE ANGLES (DELTA BETA MINUS).
 THETA IS ANGLE IN DEGREES AT WHICH CORRESPONDING BPOS OR BNEG OCCURS.

SHIP VALUES

Trim 3.75 ft by the stern (1.143 m)
 Displacement 17,270 tons (17 550 metric tons)
 Propeller Diameter 21.0 ft (6.40 m)
 Speed 20.0 knots
 Jv 1.01

Table H2 - Harmonic Analysis of the Longitudinal Velocity Component Ratios for Experiment 8 with Fin Configuration 4

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	-.1032	-.0419	.0753	-.0136	.0079	-.0063	.0068	-.0029
RADIUS = .556									
AMPLITUDE	=	-.1397	-.1629	.0862	-.0367	.0517	-.0242	.0201	-.0153
RADIUS = .775									
AMPLITUDE	=	-.1344	-.1446	.0168	-.0443	.0419	-.0280	.0358	-.0199
RADIUS = 1.017									
AMPLITUDE	=	-.1629	-.0978	-.0199	-.0047	.0172	-.0047	.0105	-.0091
RADIUS = 1.178									
AMPLITUDE	=	-.1935	-.1133	-.0546	-.0231	-.0162	-.0161	-.0152	-.0077

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	-.0452	.1507	.0160	.0162	-.0637	.0180	-.0034	.0129
RADIUS = .300									
AMPLITUDE	=	-.0846	.0197	.0586	-.0037	-.0149	.0017	.0029	.0024
RADIUS = .400									
AMPLITUDE	=	-.1140	-.0778	.0833	-.0197	.0211	-.0112	.0095	-.0061
RADIUS = .500									
AMPLITUDE	=	-.1333	-.1418	.0901	-.0317	.0443	-.0205	.0162	-.0125
RADIUS = .600									
AMPLITUDE	=	-.1362	-.1611	.0695	-.0415	.0507	-.0268	.0262	-.0173
RADIUS = .700									
AMPLITUDE	=	-.1328	-.1535	.0367	-.0463	.0466	-.0293	.0346	-.0198
RADIUS = .800									
AMPLITUDE	=	-.1363	-.1359	.0139	-.0364	.0407	-.0233	.0339	-.0183
RADIUS = .900									
AMPLITUDE	=	-.1465	-.1099	.0002	-.0137	.0330	-.0099	.0247	-.0130

Table H3 - Harmonic Analysis of the Tangential Velocity Component
Ratios for Experiment 8 with Fin Configuration 4

Experimental Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .359									
AMPLITUDE	=	.0061	-.0035	.0579	-.0077	.0092	-.0040	.0042	-.0017
RADIUS = .556									
AMPLITUDE	=	-.1039	-.0131	.0303	-.0063	.0224	-.0112	.0102	-.0080
RADIUS = .775									
AMPLITUDE	=	-.1315	-.0315	-.0048	-.0031	.0091	-.0103	.0107	-.0106
RADIUS = 1.017									
AMPLITUDE	=	-.1311	-.0511	-.0297	-.0099	-.0093	-.0066	-.0059	-.0056
RADIUS = 1.178									
AMPLITUDE	=	-.1272	-.0641	-.0408	-.0163	-.0100	.0016	.0011	.0060

Interpolated Radii

HARMONIC	=	1	2	3	4	5	6	7	8
RADIUS = .200									
AMPLITUDE	=	.1537	-.0005	.0775	-.0078	-.0187	.0074	-.0046	.0061
RADIUS = .300									
AMPLITUDE	=	.0548	-.0019	.0655	-.0079	.0007	-.0003	.0013	.0009
RADIUS = .400									
AMPLITUDE	=	-.0234	-.0049	.0525	-.0076	.0139	-.0061	.0059	-.0033
RADIUS = .500									
AMPLITUDE	=	-.0808	-.0097	.0385	-.0069	.0211	-.0099	.0090	-.0065
RADIUS = .600									
AMPLITUDE	=	-.1115	-.0169	.0223	-.0050	.0200	-.0112	.0115	-.0090
RADIUS = .700									
AMPLITUDE	=	-.1250	-.0253	.0059	-.0032	.0140	-.0108	.0122	-.0105
RADIUS = .800									
AMPLITUDE	=	-.1317	-.0335	-.0070	-.0037	.0062	-.0104	.0075	-.0108
RADIUS = .900									
AMPLITUDE	=	-.1321	-.0416	-.0189	-.0062	-.0030	-.0097	-.0020	-.0099

Table H4 - Input Data for Wake Survey Analysis for
Experiment 8 with Fin Configuration 4

ANGLE	RADIUS = .359			341.8	.435	-.049	.088
	VX/V	VT/V	VR/V				
-.3	.443	.003	.156	345.4	.444	-.035	.103
0.0	.441	.015	.158	349.0	.431	-.031	.119
1.8	.427	.014	.164	350.3	.439	-.025	.123
3.5	.426	.026	.153	352.6	.439	-.019	.131
5.4	.423	.020	.155	354.4	.462	-.016	.138
7.2	.412	.031	.158	356.1	.436	-.003	.152
9.1	.413	.032	.150	358.0	.436	-.006	.153
10.8	.421	.033	.135	358.0	.442	-.009	.161
14.4	.422	.041	.122	359.7	.443	.003	.156
18.0	.432	.049	.091	361.8	.427	.014	.164
21.6	.411	.056	.082				
37.9	.394	.046	.035				
54.0	.407	.018	.013				
70.2	.453	-.028	.041				
86.4	.533	-.050	.077				
102.7	.628	-.042	.101				
118.8	.687	-.012	.121				
135.0	.693	.034	.120				
140.4	.681	.043	.108				
151.1	.657	.071	.090				
154.8	.641	.078	.064				
158.3	.617	.081	.055				
161.9	.583	.084	.038				
165.5	.569	.022	.028				
169.1	.535	.022	.015				
170.9	.539	.087	.004				
172.7	.517	.078	.006				
174.5	.519	.080	-.009				
176.2	.503	.074	-.008				
178.1	.455	.065	-.020				
179.9	.435	.048	-.028				
181.7	.457	.036	-.026				
183.4	.432	.018	-.024				
195.2	.445	.002	-.015				
187.1	.465	.009	-.011				
188.9	.458	.008	-.012				
190.6	.439	-.022	-.006				
194.2	.468	-.050	.006				
197.8	.482	-.069	.018				
201.3	.507	-.074	.030				
204.9	.534	-.074	.042				
208.4	.543	-.069	.048				
212.0	.572	-.071	.070				
226.4	.609	-.032	.107				
237.6	.625	-.015	.103				
240.9	.625	.001	.107				
246.6	.624	.015	.105				
255.4	.605	.031	.105				
269.7	.542	.040	.088				
284.1	.458	.026	.042				
331.0	.404	-.052	.063				
327.4	.404	-.051	.056				
312.9	.394	-.025	.038				
298.5	.437	.015	.030				
334.5	.428	-.050	.079				
338.2	.422	-.055	.083				
ANGLE	RADIUS = .556			341.8	.435	-.049	.088
	VX/V	VT/V	VR/V				
-.2	.474	.006	.139				
1.6	.484	.004	.134				
3.3	.494	.009	.116				
3.3	.500	.003	.117				
5.1	.500	-.002	.110				
5.1	.507	.000	.102				
7.0	.504	.005	.097				
8.7	.486	.000	.089				
10.6	.484	-.004	.081				
14.1	.482	.003	.062				
17.7	.496	-.002	.033				
21.3	.495	-.004	.021				
24.8	.496	-.030	.014				
28.4	.508	-.034	.011				
32.0	.501	-.036	.001				
48.2	.607	-.089	-.006				
64.5	.733	-.121	-.002				
80.7	.847	-.127	.009				
97.0	.909	-.114	.029				
113.1	.944	-.100	.046				
129.5	.944	-.073	.074				
145.7	.917	-.038	.109				
149.3	.902	-.017	.111				
152.9	.870	-.003	.114				
156.5	.809	.020	.110				
160.2	.750	.040	.094				
163.7	.683	.058	.073				
167.4	.623	.066	.043				
171.0	.533	.065	.001				
172.7	.503	.063	-.008				
174.6	.477	.063	-.020				
176.3	.460	.055	-.037				
178.1	.433	.044	-.049				
179.8	.426	.023	-.058				
180.0	.435	.021	-.052				
181.6	.429	.012	-.055				
183.3	.437	-.007	-.047				
185.1	.465	-.028	-.045				
186.9	.504	-.035	-.029				
188.8	.499	-.044	-.018				
190.5	.544	-.053	-.003				
194.1	.608	-.066	.035				
197.7	.666	-.056	.066				
201.3	.725	-.036	.090				
217.6	.864	.042	.116				
233.7	.897	.084	.082				
250.0	.879	.105	.060				
266.1	.837	.115	.037				
282.3	.749	.117	.021				

Table H4 - Continued

298.5	.659	.111	.009	228.2	.932	.071	.092
314.8	.536	.078	.012	244.5	.936	.086	.078
330.9	.491	.025	.021	260.7	.943	.107	.062
330.9	.490	.021	.020	276.9	.909	.126	.040
334.5	.502	.016	.025	293.1	.868	.137	.026
338.1	.489	.010	.038	309.4	.789	.131	.009
341.7	.487	-.000	.056	325.7	.680	.108	.009
345.3	.495	-.002	.075	329.2	.607	.104	.015
347.2	.495	-.002	.087	331.0	.597	.091	.017
348.9	.506	.001	.095	332.8	.577	.091	.012
350.7	.511	.003	.098	341.8	.566	.055	.030
352.5	.506	.004	.107	345.4	.558	.042	.036
354.4	.493	.005	.126	349.0	.546	.032	.057
356.1	.490	-.000	.135	350.7	.561	.030	.059
358.0	.482	.002	.135	352.6	.529	.031	.072
359.8	.474	.006	.139	354.5	.561	.029	.078
361.6	.484	.004	.134	356.1	.558	.023	.086
				358.0	.528	.020	.097
				359.8	.516	.008	.099
				361.6	.524	.007	.097
ANGLE	RADIUS = .775			ANGLE	RADIUS = 1.017		
-.2	.516	.008	.099	-.2	.542	-.011	-.069
0.0	.515	-.001	.102	1.6	.550	-.053	-.073
1.8	.512	-.003	.098	3.3	.580	-.074	-.070
3.5	.513	-.009	.095	3.3	.571	-.081	-.065
5.3	.512	-.032	.088	5.1	.568	-.094	-.060
7.2	.522	-.033	.077	5.1	.573	-.089	-.064
9.0	.516	-.041	.066	7.0	.582	-.098	-.058
10.8	.514	-.043	.057	8.7	.595	-.106	-.051
12.6	.512	-.046	.049	10.6	.596	-.108	-.051
16.2	.515	-.061	.033	14.1	.588	-.116	-.052
19.9	.532	-.068	.018	17.7	.594	-.119	-.055
36.0	.594	-.115	-.011	21.3	.605	-.124	-.063
52.3	.729	-.146	-.006	24.8	.608	-.127	-.063
68.4	.832	-.149	.009	28.4	.612	-.143	-.065
84.0	.878	-.135	.033	32.0	.638	-.151	-.065
100.9	.916	-.113	.058	48.2	.753	-.157	-.042
117.1	.926	-.095	.076	64.5	.850	-.146	-.022
133.2	.927	-.084	.090	80.7	.916	-.121	.009
149.4	.928	-.066	.101	97.0	.929	-.096	.033
153.0	.932	-.062	.103	113.1	.936	-.077	.046
156.5	.930	-.054	.105	129.5	.943	-.061	.054
160.2	.939	-.044	.110	145.7	.942	-.047	.060
163.7	.925	-.028	.122	149.3	.948	-.044	.063
167.3	.910	.009	.134	152.9	.953	-.040	.064
170.9	.819	.054	.119	156.5	.955	-.037	.061
172.7	.759	.065	.107	160.2	.958	-.033	.062
174.6	.692	.083	.094	163.7	.962	-.032	.060
176.3	.633	.087	.051	167.4	.970	-.030	.057
178.1	.585	.086	.028	171.0	.958	-.025	.058
179.9	.541	.069	.008	172.7	.949	-.021	.065
181.7	.476	.047	-.023	174.6	.954	.003	.078
183.5	.488	.010	-.017	176.3	.889	.061	.065
185.2	.469	-.038	-.018	178.1	.747	.081	.070
185.2	.476	-.047	-.015	179.8	.693	.030	.039
187.1	.501	-.070	.008	180.0	.679	.031	.030
188.9	.554	-.085	.028	181.6	.718	-.055	.029
190.6	.596	-.078	.060	183.3	.807	-.068	.043
194.2	.713	-.062	.107	185.1	.901	-.050	.072
197.8	.809	-.025	.133	186.9	.944	-.007	.080
201.4	.899	.014	.128	188.3	.940	.023	.073
204.9	.931	.036	.121				
208.5	.932	.048	.114				
212.0	.943	.059	.107				

DTNSRDC ISSUES THREE TYPES OF REPORTS

- 1. DTNSRDC REPORTS, A FORMAL SERIES, CONTAIN INFORMATION OF PERMANENT TECHNICAL VALUE. THEY CARRY A CONSECUTIVE NUMERICAL IDENTIFICATION REGARDLESS OF THEIR CLASSIFICATION OR THE ORIGINATING DEPARTMENT.**
- 2. DEPARTMENTAL REPORTS, A SEMIFORMAL SERIES, CONTAIN INFORMATION OF A PRELIMINARY, TEMPORARY, OR PROPRIETARY NATURE OR OF LIMITED INTEREST OR SIGNIFICANCE. THEY CARRY A DEPARTMENTAL ALPHANUMERICAL IDENTIFICATION.**
- 3. TECHNICAL MEMORANDA, AN INFORMAL SERIES, CONTAIN TECHNICAL DOCUMENTATION OF LIMITED USE AND INTEREST. THEY ARE PRIMARILY WORKING PAPERS INTENDED FOR INTERNAL USE. THEY CARRY AN IDENTIFYING NUMBER WHICH INDICATES THEIR TYPE AND THE NUMERICAL CODE OF THE ORIGINATING DEPARTMENT. ANY DISTRIBUTION OUTSIDE DTNSRDC MUST BE APPROVED BY THE HEAD OF THE ORIGINATING DEPARTMENT ON A CASE-BY-CASE BASIS.**