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Vibratory Loads Data From a Wind-Tunnel Test of Structurally Tailored Model Helicopter Rotors

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Abstract

An experimental study was conducted in the Langley Transonic Dynamics Tunnel to investigate the use of a Bell Helicopter Textron rotor structural tailoring concept, known as rotor nodalization, in conjunction with advanced blade aerodynamics, and to evaluate rotor-blade aerodynamic design methodologies. A 1/5-size, four-bladed bearingless hub, three sets of Mach scaled model rotor blades, and two sets of Froude scaled model rotor blades were tested in forward flight from transition up to an advance ratio of 0.35. The data presented herein pertain only to evaluation of the structural tailoring concept and consist of fixed-system and rotating-system vibratory loads. These data are useful for evaluating the effects of tailoring blade structural properties on fixed-system vibratory loads and for validating analyses used in the design of advanced rotor systems.

Introduction

Vibration has always been a problem for all helicopters. Excessive vibration levels have adverse effects on crew members, passengers, and aircraft components. Decreased vibration levels reduce crew fatigue and discomfort, increase aircraft component reliability, and reduce aircraft maintenance costs. To obtain these desired benefits, helicopter manufacturers have initiated research programs with the aim of reducing excessive vibrations.

The rotor system, which transmits the vibratory air loads to the fuselage through the rotor shaft, is one of the most significant contributors to the vibrations of the helicopter. As the loads from the individual blades combine at the rotor hub, some harmonics cancel each other, and others are additive. The additive loads are passed from the blades to the rotor shaft and then to the fuselage. These loads are felt as vibratory forces and moments whose frequencies are integer multiples of the blade passage frequency (number of blades times rotational frequency).

Various mechanical devices (e.g., absorbers, isolators) and aerodynamic techniques, such as higher harmonic control, have been proposed to either isolate or cancel these undesirable dynamic loadings and thus prevent their transmission through the shaft (ref. 1). However, these devices have the disadvantages of significant weight penalty, added parts, increased maintenance requirements, and possible degradation of rotor performance. Vibration reduction may be better achieved by structural tailoring of the rotor; this method has the advantage of addressing the vibration problem in the design stage. Generally, a structurally tailored rotor is one in which mass and stiffness may be varied to tune rotor modes that may result in lower airframe vibration. Analytical investigations (refs. 2 and 3) have predicted that significant reductions in rotor vibratory loads may be obtained with structurally tailored rotors.

To experimentally evaluate a Bell Helicopter Textron rotor structural tailoring concept, known as rotor nodalization (refs. 4 and 5), a study was conducted in the Langley Transonic Dynamics Tunnel. The objective of a nodalized rotor design is cancellation of inertial and aerodynamic loads at the rotor hub at a frequency equal to the blade passage frequency (ref. 5). This study was a part of ongoing programs of the U.S. Army and NASA to improve the aerodynamic performance of helicopters and to reduce helicopter vibrations (refs. 6 to 10). The objective of the study was to investigate the use of structural tailoring in conjunction with advanced blade aerodynamics and to evaluate rotor-blade aerodynamic design methodologies. The data presented herein pertain only to evaluation of the structural tailoring concept and consist of fixed-system and rotating-system vibratory loads measured in forward flight from transition to high speed. The purpose of this report is to present these data for use in analytical correlations.

Symbols

The positive directions of forces, angles, and velocities are shown in figure 1.

A	balance axial force, positive downstream perpendicular to rotor shaft, lb
D	rotor drag, lb, $N \sin \alpha_s + A \cos \alpha_s$
EIB	blade beamwise stiffness, lb-in^2
EIC	blade chordwise stiffness, lb-in^2
f_D	vehicle equivalent parasite area, ft^2
GJ	blade torsional stiffness, lb-in^2
IB	blade beamwise cross-section mass moment of inertia per unit length, in-lb-sec^2/in.
IC	blade chordwise cross-section mass moment of inertia per unit length, in-lb-sec^2/in.
L	rotor lift, lb, $N \cos \alpha_s - A \sin \alpha_s$
MAG	magnitude
N	balance normal force, positive upward along rotor shaft, lb

nP	nth harmonic of rotor rotational frequency
Q	rotor-shaft torque, measured from balance yawing-moment channel, in-lb
R	rotor radius, in.
r	spanwise distance along rotor radius measured from center of rotation, in.
Sta.	blade radial station measured from center of rotation, in.
V	free-stream velocity, ft/sec
XCG	chordwise location of blade center of gravity measured from inboard leading edge, positive aft, in.
XNA	chordwise location of blade tension axis measured from inboard leading edge, positive aft, in.
α_s	rotor-shaft angle of attack, positive for rotor shaft tilted aft, deg (AlphaS in computer generated data tables)
μ	rotor advance ratio, $V/\Omega R$ (Mu in computer generated data tables)
ρ	mass density of test medium, slugs/ft^3
ψ	rotor-blade azimuth angle, deg
Ω	rotor rotational velocity, rev/min

Apparatus and Procedures

Wind Tunnel

The testing was conducted in the Langley Transonic Dynamics Tunnel (TDT). A schematic of the tunnel is shown in figure 2. The TDT is a continuous-flow tunnel with a slotted test section and is capable of operation up to Mach 1.2 at stagnation pressures from near vacuum up to 1 atm. The tunnel test section is 16 ft square with cropped corners and has a cross-section area of 248 ft^2. Either air or a heavy gas, dichlorodifluoromethane (R-12), may be used as the test medium. For this investigation, both air and R-12 were used. The testing in air was conducted at atmospheric pressure at a nominal density of 0.00238 slug/ft^3, and the testing in R-12 was conducted at less than atmospheric pressure at a nominal density of 0.006 slug/ft^3. Because of its high density and low speed of sound, the use of R-12 aids the matching of model-rotor-scale Reynolds number and Mach number to full-scale values. The use of R-12 as a test medium also allows the easing of some restrictions on model structural design while maintaining dynamic similarity. For example, a heavier test medium permits a simplified structural design to obtain the required stiffness characteristics, and thus eases design and fabrication requirements of the model (ref. 11).

Model Description

Rotor hub. The model rotor hub used in this investigation was a 1/5-size, four-bladed bearingless hub (fig. 3). Rotor flap, lag, and pitch motions are accommodated by flexural arms that are constructed of fiberglass, extend outward from the centerline, and are pre-coned 2.75° upward at their inboard end. The hub is formed by the two flexural members; each continues across the shaft attachment and is connected to grips for opposite blade pairs. The members are stacked vertically and are bolted to the mast at their centers. From the center of rotation, each flexural arm structurally transitions into a flat flapping element and then into a torsionally soft feathering element with a cruciform cross section. Blade lead-lag motion occurs as a result of flexibility in the cruciform cross section. The cruciform shape ends in a built-up area that contains the bushings for attachment of the cuffs. A torsionally stiff cuff encompasses each flexure. The cuff, used to control blade feathering, is bolted to the grip at its outboard end and is shear restrained to the flexure at its inboard end. The shear restraint mechanism is pinned at $r = 2.4$ to allow motion in the pitch direction and contains elastomeric shear pads that provide inplane damping augmentation. To assure that there were no aeromechanical instabilities during testing, shear pads of three different stiffnesses were used. Small shear pads were used during the air testing of the Froude scaled blades, and medium and large shear pads were used during testing of the Mach scaled blades in R-12. The trailing-edge pitch horn is attached to the inboard end of the cuff. Pitch-link loads introduced to the horn will be reacted at the shear restraint in such a way as to generate a torsional couple, so the cuff will be rotated and the attached flexure will be twisted. The shear restraint rotates in pitch with the cuff and blade.

Rotor Blades. Five sets of 1/5-size, model blades designed to represent those of an intermediate weight civil helicopter were used during these tests. A general description of the characteristics and designation of each blade set is presented in table I. The

two sets of Froude scaled blades identified as −100 and −200 in table I were tested in air at $\rho = 0.00238$ slug/ft^3. The three sets of Mach scaled blades identified as −300, −400, and −500 in table I were tested in R-12 at $\rho = 0.006$ slug/ft^3. The blades tested in air were used to evaluate structural tailoring, while the blades tested in R-12 were used to evaluate the use of structural tailoring in conjunction with advanced blade aerodynamics.

The −100 blades (fig. 4) were used as the baseline blades for the air testing and were constructed using an aluminum spar of rectangular cross section. The structurally tailored −200 blades (fig. 4) were constructed by using an aluminum spar with an I-beam cross section. The inboard end of the spar has weight pockets that accommodate nonstructural mass from $r/R = 0.31$ to $r/R = 0.43$. Both the −100 and −200 blade sets use a cellular foam construction to achieve the NACA 0012 airfoil shape (table I). The calculated structural properties of the −100 and −200 blades are presented in tables II and III and in figures 5 to 8.

The −400 and −500 blades each have the same aerodynamic design, which is different from the aerodynamic design of the −300 blades. There were differences in the aerodynamic designs so that the aerodynamic design methodology could be evaluated. The results of the evaluation of the aerodynamic design methodology are neither presented nor discussed in this report. The −300 blades were structurally tailored, had a thrust-weighted solidity of 0.079, and, as indicated in table I and figure 9, used multiple airfoils. The SFN2322 airfoil is 22 percent thick and was used only at the root end of the blade. Versions of the SFN2322 with reduced thickness were used to transition to the 10-percent-thick SFN8010 airfoil at $r/R = 0.45$. The SFN8010 airfoil was used from $r/R = 0.45$ to $r/R = 0.80$ and is the same as the RC(4)-10 airfoil (ref. 12) except for a slight modification to the lower surface near the airfoil trailing edge. Versions of the SFN8010 with reduced thickness were used to transition to the 8-percent-thick SFN9508 airfoil at $r/R = 0.95$. The 6-percent-thick SFN10006 airfoil was used only at the blade tip. The −400 blades were structurally tailored, as indicated in table I and figure 9, the −400 and −500 blades were tapered in planform with a 3:1 taper ratio beginning at $r/R = 0.60$, and each used three advanced airfoil sections. The RC(4)-10 airfoil was used in the inboard region of each blade from $r/R = 0.275$ to $r/R = 0.80$, the RC(3)-10 airfoil was used from $r/R = 0.85$ to $r/R = 0.90$, and the RC(3)-08 airfoil (ref. 13) was used in the tip region of each blade from $r/R = 0.95$ to $r/R = 1.0$. Smooth transitions were made over the 5 percent of blade radius between the different airfoil sections. The area, thrust-weighted, and torque-weighted solidities of the −400 and −500 blades were 0.081, 0.079, and 0.073, respectively. The calculated structural properties of the −300, −400, and −500 blades are given in tables IV to VI and figures 10 to 13.

Aeroelastic rotor experimental system. Each blade set was tested using the aeroelastic rotor experimental system (ARES) model shown in figures 14 and 15. The ARES model has a streamlined fuselage shape which encloses the rotor controls and drive system. The ARES model is powered by a variable-frequency synchronous motor rated at 47-hp output at 12 000 rpm. The motor is connected to the rotor shaft through a belt-driven two-stage speed reduction system. The ARES model rotor control system and rotor-shaft angle of attack α_s are remotely controlled from the wind-tunnel control room. The model rotor-shaft angle of attack is varied by an electrically controlled hydraulic actuator. Blade collective pitch and lateral and longitudinal cyclic pitch are input to the rotor through the swash plate. The swash plate is moved by three electrically controlled hydraulic actuators.

Instrumentation mounted on the ARES model allows continuous displays of model control settings, rotor forces and moments, blade loads, and pitch-link loads. For these tests, one pitch link was instrumented with a strain gage to measure pitch-link tension and compression loads. The pitch-link loads were monitored during testing for safety of flight information and are not presented in this report. Rotor-blade flap and lag motions were determined from strain gages mounted on one flexure of the rotor hub. Rotor-shaft speed was determined by a magnetic sensor. Strain-gage data from the rotating system were transferred to the fixed system through a 30-channel slip-ring assembly. Rotor forces and moments were measured by a six-component strain-gage balance mounted below the drive system. Rotor lift and drag were determined from the measured balance normal and axial forces. Rotor torque was measured by the balance yawing-moment channel. The balance was fixed with respect to the rotor-shaft axis and pitched with the fuselage. Fuselage aerodynamic forces and moments were not sensed by the balance.

Test Procedure

Because the purpose of this test was to obtain data to evaluate the effects of structural tailoring on fixed-system vibratory loads, each blade set was evaluated at the same nominal test conditions defined

by μ, Ω, L, and D. The value of Ω used for all test points was 780 rpm. The values of L and D for all five sets of blades tested were chosen to represent an aircraft of 7850 lb gross weight and an equivalent parasite area of 20.65 ft^2 operating at a density altitude of 4000 ft and 95°F. Simulated values of rotor drag were determined at each value of μ as follows: $D = f_D(1/2\rho V^2)$. The values of L and D were then used to determine α_s. The range of μ covered in these tests was from transition to high speed (μ = 0.060 to 0.35). However, for the −300 and −400 blades tested in R-12, the maximum value of μ for which data were obtained was 0.30 as a result of excessive rotor loads. At each test point, the rotor rotational speed and tunnel conditions were adjusted to give the desired values of Ω and μ. Model α_s and model L were then adjusted to the desired values. To facilitate data acquisition and reduce blade loads, rotor cyclic pitch was used to remove rotor first-harmonic flapping with respect to the rotor shaft at each test point. At most test conditions, at least two data points were taken to quantify any scatter in the measurements. The maximum obtainable values of μ and α_s were constrained by either hub and blade load limits or ARES model drive-system limits. Since the purpose of this report is to present rotating and fixed-system vibratory loads, neither model deadweight tares nor balance interactions have been applied to the data. The tares and interactions were not applied, because they affect only the mean value of each measurement, not the vibratory content.

Results

Data obtained during this investigation consist of fixed-system vibratory loads data, measured by the ARES strain-gage balance, and rotating-system data, determined from strain gages mounted on the rotor hub at r = 1.4 and 3.0. These data are presented in tables VII to XII. Data are not presented at all test conditions for the rotor-hub instrumentation because of strain-gage failures. For each blade set tested, the data from each balance and hub strain-gage channel are presented in the tables, along with the corresponding values of Mu (μ) and AlphaS (α_s). Each data point is identified by a specific test-point number. The data presented consist of the mean value and the first eight harmonic components of a Fourier analysis of the output of each data channel. The units of the mean and the magnitude of each harmonic component are pounds and inch-pounds as appropriate, and the phase angle of each harmonic component is measured in degrees referenced in the direction of rotor rotation from 0° over the tail of the model. Because the rotors tested were four-bladed rotors, the harmonics of importance for evaluating the effects of structural tailoring are the 3P and 5P rotating-system hub bending moments and the 4P fixed-system forces and moments. A review of the data presented in the tables indicates that the data scatter for the important fixed-system and rotating-system harmonics is within reasonable bounds.

The data for the −100 and −200 blades (small shear pads) are presented in tables VII and VIII; the data for the −300 and −400 blades (medium shear pads) are presented in tables IX and X; and the data for the −400 and −500 blades (large shear pads) are presented in tables XI and XII.

Concluding Remarks

Fixed-system and rotating-system vibratory loads data have been obtained for a bearingless rotor model in forward flight. These data are useful for evaluating the effects of tailoring blade structural properties on fixed-system vibratory loads and validating analyses used in the design of advanced rotor systems.

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Table I. General Description of Model Rotor Blades

Configuration	Structural tailoring	Planform	Twist	Airfoil(s)	Test medium
−100	No	Rectangular	Linear (−12°)	NACA 0012	Air
−200	Yes	Rectangular	↓	NACA 0012	Air
−300	Yes	Rectangular	↓	Multiple	Heavy gas
−400	Yes	Tapered	↓	Multiple	Heavy gas
−500	No	Tapered	↓	Multiple	Heavy gas

Table II. Hub and −100 Blade Set Properties

Segment length, in.	Segment outboard radius, in.	Weight/in., lb/in.	EIB, lb-in^2	EIC, lb-in^2	GJ, lb-in^2	IB, in-lb-sec^2/in.	IC, in-lb-sec^2/in.	XCG, in.	XNA, in.
0.800	0.800	0.0500	0.0962×10^6	1.173×10^6	0.1950×10^6	3.88×10^{-6}	33.64×10^{-6}	0.000	0.000
0.080	0.880	0.0220	0.0117	0.527	0.0010	0.78	18.12	0.000	0.000
0.320	1.200	0.0150	0.0014	0.274	0.0001	0.03	7.76	0.000	0.000
0.360	1.560	0.0115	0.0008	0.161	0.0001	0.03	5.18	0.000	0.000
0.590	2.150	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.000	0.000
0.250	2.400	0.6349	0.0008	0.091	0.0001	0.03	2.59	0.000	0.000
0.250	2.650	0.0069	0.0008	0.091	0.0001	0.03	2.59	0.000	0.000
0.300	2.950	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.000	0.000
0.550	3.500	0.0080	0.0009	0.064	0.0001	0.03	2.59	0.000	0.000
0.600	4.100	0.0065	0.0014	0.030	0.0001	0.03	0.26	0.000	0.000
0.400	4.500	0.0060	0.0018	0.019	0.0001	0.03	0.26	0.000	0.000
0.500	5.000	0.0050	0.0018	0.017	0.0001	0.03	0.26	0.000	0.000
1.800	6.800	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.000	0.000
1.800	8.600	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.000	0.000
1.000	9.600	0.0575	0.0099	0.088	0.0001	0.78	5.18	0.000	0.000
0.500	10.100	0.0740	0.0425	0.262	0.0050	2.59	12.94	0.000	0.000
1.320	11.380	0.2833	0.2003	1.070	0.0160	8.02	20.70	0.003	0.002
0.070	11.490	0.0650	0.0590	0.875	0.0410	0.80	15.50	0.000	0.000
0.710	12.200	0.0461	0.0579	0.816	0.0400	0.80	15.50	−0.003	−0.003
0.585	12.785	0.0461	0.0515	0.566	0.0340	0.80	10.40	−0.027	−0.027
0.315	13.100	0.0340	0.0206	0.336	0.0180	0.50	10.40	−0.045	−0.089
0.270	13.370	0.0296	0.0068	0.229	0.0070	0.20	12.90	−0.060	−0.156
0.480	13.850	0.0246	0.00465	0.184	0.0040	0.20	12.90	−0.093	−0.204
0.600	14.450	0.0221	0.0038	0.118	0.0030	0.20	10.40	−0.079	−0.239
0.400	14.850	0.0176	0.0033	0.097	0.0020	0.10	10.40	−0.073	−0.258
2.640	17.490	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261
5.280	22.770	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261
2.640	25.410	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261
2.660	28.070	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261
0.270	28.340	0.0161	0.0048	0.099	0.0030	0.10	10.40	−0.076	−0.252
1.360	29.700	0.0166	0.00717	0.104	0.0040	0.10	10.40	−0.074	−0.242
3.000	32.700	0.0296	0.00942	0.174	0.0040	0.10	12.90	−0.127	−0.222
3.000	35.700	0.0296	0.00942	0.174	0.0040	0.20	12.90	−0.127	−0.222
1.370	37.070	0.0166	0.00717	0.104	0.0040	0.10	10.40	−0.074	−0.242
0.270	37.340	0.0161	0.0048	0.099	0.0030	0.10	10.40	−0.076	−0.251
2.590	39.930	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261
2.590	42.520	0.0156	0.00217	0.095	0.0020	0.10	10.40	−0.078	−0.261
2.590	45.110	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261
2.590	47.700	0.0156	0.00317	0.095	0.0020	0.10	10.40	−0.078	−0.261

Table III. Hub and −200 Blade Set Properties

Segment length, in.	Segment outboard radius, in.	Weight/in., lb/in.	EIB, lb-in^2	EIC, lb-in^2	GJ, lb-in^2	IB, in-lb-sec^2/in.	IC, in-lb-sec^2/in.	XCG, in.	XNA, in.
0.800	0.800	0.0500	0.0962×10^6	1.173×10^6	0.1950×10^6	3.88×10^{-6}	33.64×10^{-6}	0.0000	0.0000
0.080	0.880	0.0320	0.0117	0.527	0.0010	0.78	18.12	0.0000	0.0000
0.320	1.200	0.0150	0.0014	0.274	0.0001	0.03	7.76	0.0000	0.0000
0.360	1.560	0.0115	0.0009	0.161	0.0001	0.03	5.18	0.0000	0.0000
0.590	2.150	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.0000	0.0000
0.250	2.400	0.6349	0.0008	0.091	0.0001	0.03	2.59	0.0000	0.0000
0.250	2.650	0.0069	0.0008	0.091	0.0001	0.03	2.59	0.0000	0.0000
0.300	2.950	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.0000	0.0000
0.550	3.500	0.0080	0.0009	0.064	0.0001	0.03	2.59	0.0000	0.0000
0.600	4.100	0.0065	0.0014	0.030	0.0001	0.03	0.26	0.0000	0.0000
0.400	4.500	0.0060	0.0018	0.019	0.0001	0.03	0.26	0.0000	0.0000
0.500	5.000	0.0050	0.0018	0.017	0.0001	0.03	0.26	0.0000	0.0000
1.800	6.800	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.0000	0.0000
1.800	8.600	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.0000	0.0000
1.000	9.600	0.5750	0.0099	0.088	0.0001	0.78	5.18	0.0000	0.0000
0.500	10.100	0.0740	0.0425	0.262	0.0050	2.59	12.94	0.0000	0.0000
1.320	11.380	0.2833	0.2003	0.070	0.0160	8.02	20.70	0.0030	0.0020
1.680	13.100	0.0282	0.0476	0.499	0.0330	0.[illegible]	10.40	0.0235	0.0255
0.750	13.850	0.0216	0.0143	0.357	0.0080	0.20	12.90	−0.0275	−0.0765
0.970	14.820	0.0178	0.0121	0.314	0.0070	0.20	12.90	−0.0385	−0.0345
1.960	16.780	0.0680	0.0121	0.322	0.0080	0.20	20.70	−0.0495	−0.0335
1.960	18.740	0.0680	0.0121	0.322	0.0080	0.20	20.70	−0.0495	−0.0335
1.960	20.700	0.0680	0.0121	0.322	0.0080	0.20	20.70	−0.0495	−0.0335
1.610	22.310	0.0178	0.0040	0.193	0.0030	0.10	10.40	−0.0135	−0.1285
2.190	24.500	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2355
2.200	26.700	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2355
2.300	29.000	0.0155	0.0060	0.132	0.0005	0.10	10.40	−0.0715	−0.2125
2.300	31.300	0.0155	0.0060	0.132	0.0005	0.10	10.40	−0.0715	−0.2125
2.300	33.600	0.0155	0.0060	0.132	0.0005	0.10	10.40	−0.0715	−0.2125
2.100	35.700	0.0155	0.0060	0.132	0.0005	0.10	10.40	−0.0715	−0.2125
2.400	38.100	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2355
2.400	40.500	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2355
2.400	42.900	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2355
2.400	45.300	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2355
2.400	47.700	0.0144	0.0030	0.116	0.0003	0.10	10.40	−0.0655	−0.2335

Table IV. Hub and −300 Blade Set Properties

Segment length, in.	Segment outboard radius, in.	Weight/in., lb/in.	EIB, lb-in^2	EIC, lb-in^2	GJ, lb-in^2	IB, in-lb-sec^2/in.	IC, in-lb-sec^2/in.	XCG, in.	XNA, in.
0.800	0.800	0.0500	0.0962×10^6	1.173×10^6	0.1950×10^6	3.88×10^{-6}	33.64×10^{-6}	0.0000	0.0000
0.080	0.880	0.0320	0.0117	0.527	0.0010	0.78	18.12	0.0000	0.0000
0.320	1.200	0.0150	0.0014	0.274	0.0001	0.03	7.76	0.0000	0.0000
0.360	1.560	0.0115	0.0009	0.161	0.0001	0.03	5.18	0.0000	0.0000
0.590	2.150	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.0000	0.0000
0.250	2.400	0.6349	0.0008	0.091	0.0001	0.03	2.59	0.0000	0.0000
0.250	2.650	0.0069	0.0008	0.091	0.0001	0.03	2.59	0.0000	0.0000
0.300	2.950	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.0000	0.0000
0.550	3.500	0.0080	0.0009	0.064	0.0001	0.03	2.59	0.0000	0.0000
0.600	4.100	0.0065	0.0014	0.030	0.0001	0.03	0.26	0.0000	0.0000
0.400	4.500	0.0060	0.0018	0.019	0.0001	0.03	0.26	0.0000	0.0000
0.500	5.000	0.0050	0.0018	0.017	0.0001	0.03	0.26	0.0000	0.0000
1.800	6.800	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.0000	0.0000
1.800	8.600	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.0000	0.0000
1.000	9.600	0.0575	0.0099	0.088	0.0001	0.78	5.18	0.0000	0.0000
0.500	10.100	0.0740	0.0425	0.262	0.0050	2.59	12.94	0.0000	0.0000
1.280	11.380	0.2833	0.2003	1.070	0.0160	8.02	20.70	0.0030	0.0020
1.720	13.100	0.0907	0.0502	2.007	0.0240	1.55	69.88	0.1910	0.1470
2.000	15.100	0.1528	0.0448	2.499	0.0790	2.07	116.46	0.2650	0.2920
2.000	17.100	0.1525	0.0477	2.498	0.0780	1.81	116.46	0.2650	0.2920
1.980	19.080	0.1522	0.0446	2.497	0.0780	1.81	116.46	0.2650	0.2920
0.500	19.580	0.0890	0.0404	1.087	0.0460	1.29	41.41	0.1290	0.08925
1.884	21.464	0.0650	0.0166	0.690	0.0240	0.78	31.06	0.0880	0.03325
0.502	21.966	0.0515	0.0121	0.363	0.0160	0.52	25.88	−0.0020	−0.0830
1.882	23.848	0.0420	0.0086	0.216	0.0110	0.26	20.70	−0.0580	−0.1610
2.388	26.236	0.0400	0.0072	0.208	0.0100	0.26	20.70	−0.0550	−0.1630
1.632	27.868	0.0400	0.0072	0.208	0.0100	0.26	20.70	−0.0550	−0.1630
1.104	28.972	0.0415	0.0105	0.222	0.0100	0.26	20.70	−0.0580	−0.1600
2.030	31.002	0.0430	0.0147	0.236	0.0090	0.26	20.70	−0.0600	−0.1570
2.040	33.042	0.0430	0.0147	0.236	0.0090	0.26	20.70	−0.0600	−0.1570
1.096	34.138	0.0415	0.0105	0.222	0.0100	0.26	20.70	−0.0580	−0.1820
1.638	35.776	0.0400	0.0072	0.208	0.0100	0.26	20.70	−0.0550	−0.2080
2.382	38.158	0.0400	0.0072	0.208	0.0100	0.26	20.70	−0.0550	−0.2080
2.388	40.546	0.0360	0.0050	0.190	0.0070	0.26	20.70	−0.0480	−0.1910
2.382	42.928	0.0295	0.0026	0.164	0.0030	0.26	20.70	−0.0350	−0.1790
2.388	45.316	0.0255	0.0016	0.146	0.0020	0.03	18.12	−0.0250	−0.1890
2.384	47.700	0.0205	0.0009	0.122	0.0010	0.03	18.12	−0.0070	−0.2110

Table V. Hub and −400 Blade Set Properties

Segment length, in.	Segment outboard radius, in.	Weight/in., lb/in.	EIB, lb-in^2	EIC, lb-in^2	GJ, lb-in^2	IB, in-lb-sec^2/in.	IC, in-lb-sec^2/in.	XCG, in.	XNA, in.
0.800	0.800	0.0500	0.0962×10^6	1.173×10^6	0.1950×10^6	3.88×10^{-6}	33.64×10^{-6}	0.00000	0.00000
0.080	0.880	0.0320	0.0117	0.527	0.0010	0.78	18.12	0.00000	0.00000
0.320	1.200	0.0150	0.0014	0.274	0.0001	0.03	7.76	0.00000	0.00000
0.360	1.560	0.0115	0.0009	0.161	0.0001	0.03	5.18	0.00000	0.00000
0.590	2.150	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.00000	0.00000
0.250	2.400	0.6349	0.0008	0.091	0.0001	0.03	2.59	0.00000	0.00000
0.250	2.650	0.0069	0.0008	0.091	0.0001	0.03	2.59	0.00000	0.00000
0.300	2.950	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.00000	0.00000
0.550	3.500	0.0080	0.0009	0.064	0.0001	0.03	2.59	0.00000	0.00000
0.600	4.100	0.0065	0.0014	0.030	0.0001	0.03	0.26	0.00000	0.00000
0.400	4.500	0.0060	0.0018	0.019	0.0001	0.03	0.26	0.00000	0.00000
0.500	5.000	0.0050	0.0018	0.017	0.0001	0.03	0.26	0.00000	0.00000
1.800	6.800	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.00000	0.00000
1.800	8.600	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.00000	0.00000
1.000	9.600	0.0575	0.0099	0.088	0.0001	0.78	5.18	0.00000	0.00000
0.500	10.100	0.0740	0.0425	0.262	0.005	2.59	12.94	0.00000	0.00000
1.280	11.380	0.2833	0.2003	1.070	0.016	8.00	12.90	0.00225	0.00125
1.720	13.100	0.0926	0.0465	2.101	0.025	1.30	20.70	0.09225	0.07725
2.000	15.100	0.1550	0.0346	2.839	0.077	1.60	75.10	0.17525	0.11925
2.000	17.100	0.1550	0.0346	2.839	0.077	1.60	157.90	0.17525	0.11925
1.980	19.080	0.1550	0.0346	2.839	0.077	1.60	157.90	0.17525	0.11925
0.500	19.580	0.0935	0.0417	1.182	0.046	1.60	157.90	0.17525	0.08625
1.884	21.464	0.0700	0.0175	0.781	0.024	1.10	75.10	0.14825	0.02825
0.502	21.966	0.0565	0.0124	0.443	0.017	0.80	67.30	0.08525	−0.08875
1.882	23.848	0.0470	0.0089	0.288	0.012	0.80	59.50	0.05125	−0.16775
2.388	26.236	0.0450	0.0075	0.280	0.010	0.50	59.50	0.05825	−0.16975
1.632	27.868	0.0450	0.0075	0.280	0.010	0.50	59.50	0.05825	−0.16975
1.104	28.972	0.0465	0.0108	0.293	0.010	0.50	59.50	0.04925	−0.16675
2.030	31.002	0.0470	0.0149	0.301	0.010	0.80	54.30	0.02725	−0.16375
2.040	33.042	0.0455	0.0149	0.291	0.010	0.50	44.00	−0.00175	−0.16475
1.096	34.138	0.0435	0.0107	0.265	0.010	0.50	36.20	−0.01775	−0.16775
1.638	35.776	0.0415	0.0073	0.232	0.010	0.30	31.10	−0.03875	−0.18075
2.382	38.158	0.0405	0.0072	0.203	0.010	0.30	23.30	−0.05775	−0.17475
2.388	40.586	0.0345	0.0048	0.148	0.006	0.30	15.50	−0.04075	−0.14375
2.382	42.928	0.0245	0.0021	0.079	0.003	0.30	10.40	−0.00575	−0.10975
2.388	45.316	0.0175	0.0010	0.039	0.001	0.02	5.20	0.00925	−0.08575
2.384	47.700	0.1100	0.0003	0.016	0.0001	0.02	2.60	−0.01075	−0.05975

Table VI. Hub and −500 Blade Set Properties

Segment length, in.	Segment outboard radius, in.	Weight/in., lb/in.	EIB, lb-in^2	EIC, lb-in^2	GJ, lb-in^2	IB, in-lb-sec^2/in.	IC, in-lb-sec^2/in.	XCG, in.	XNA, in.
0.800	0.800	0.0500	0.0962×10^6	1.173×10^6	0.1950×10^6	3.88×10^{-6}	33.64×10^{-6}	0.000	0.000
0.080	0.880	0.0320	0.0117	0.527	0.0010	0.78	18.12	0.000	0.000
0.320	1.200	0.0150	0.0014	0.274	0.0001	0.03	7.76	0.000	0.000
0.360	1.560	0.0115	0.0009	0.161	0.0001	0.03	5.18	0.000	0.000
0.590	2.150	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.000	0.000
0.250	2.400	0.6349	0.0008	0.091	0.0001	0.03	2.59	0.000	0.000
0.250	2.650	0.0069	0.0008	0.091	0.0001	0.03	2.59	0.000	0.000
0.300	2.950	0.0080	0.0008	0.089	0.0001	0.03	2.59	0.000	0.000
0.550	3.500	0.0080	0.0009	0.064	0.0001	0.03	2.59	0.000	0.000
0.600	4.100	0.0065	0.0014	0.030	0.0001	0.03	0.26	0.000	0.000
0.400	4.500	0.0060	0.0018	0.019	0.0001	0.03	0.26	0.000	0.000
0.500	5.000	0.0050	0.0018	0.017	0.0001	0.03	0.26	0.000	0.000
1.800	6.800	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.000	0.000
1.800	8.600	0.0040	0.0017	0.013	0.0001	0.03	0.26	0.000	0.000
1.000	9.600	0.0575	0.0099	0.088	0.0001	0.78	5.18	0.000	0.000
0.500	10.100	0.0740	0.0425	0.262	0.0050	2.59	12.94	0.000	0.000
1.300	11.400	0.2675	0.0832	0.964	0.0130	8.00	18.10	0.002	0.001
1.700	13.100	0.0380	0.0101	0.472	0.0060	0.50	15.50	0.000	0.000
0.300	13.400	0.0630	0.0108	0.448	0.0120	0.80	51.80	0.212	0.077
0.910	14.310	0.0600	0.0096	0.440	0.0120	0.80	51.80	0.224	0.080
2.385	16.695	0.0600	0.0096	0.440	0.0120	0.80	51.80	0.224	0.080
2.405	19.100	0.0600	0.0096	0.440	0.0120	0.80	51.80	0.224	0.080
2.365	21.465	0.0600	0.0096	0.447	0.0120	0.80	59.50	−0.008	−0.113
2.385	23.850	0.0600	0.0096	0.447	0.0120	0.80	59.50	−0.008	−0.113
2.250	26.100	0.0654	0.0110	0.478	0.0120	0.80	62.10	−0.022	−0.119
0.500	26.600	0.0670	0.0121	0.482	0.0120	0.80	62.10	−0.022	−0.118
2.020	28.620	0.0680	0.0131	0.486	0.0120	1.00	62.10	−0.022	−0.117
1.760	30.380	0.0675	0.0130	0.481	0.0120	1.00	56.90	−0.030	−0.118
1.760	32.140	0.0670	0.0129	0.473	0.0120	0.80	49.20	−0.047	−0.119
1.760	33.900	0.0660	0.0127	0.465	0.0120	0.80	41.40	−0.062	−0.119
2.000	35.900	0.0633	0.0115	0.453	0.0120	0.50	36.20	−0.078	−0.120
2.000	37.900	0.0595	0.0101	0.440	0.0120	0.50	28.50	−0.096	−0.123
0.500	38.400	0.0580	0.0097	0.432	0.0120	0.50	25.90	−0.107	−0.125
2.146	40.546	0.0350	0.0047	0.180	0.0070	0.30	12.90	0.038	−0.031
2.384	42.930	0.0260	0.0022	0.107	0.0030	0.30	7.80	0.033	−0.041
2.385	45.315	0.0185	0.0014	0.055	0.0020	0.30	5.20	0.031	−0.036
2.385	47.700	0.0115	0.0003	0.023	0.0001	0.30	2.60	0.032	−0.031

Table VII. Harmonic Components of Vibratory Loads for −100 Blades With Small Shear Pads

(a) Normal force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	65.11	5.01	0.61	0.63	3.09	0.66	0.20	0.29	1.69	MAG
				355.17	111.03	220.96	146.84	319.59	320.14	62.21	274.49	PHASE
530	0.060	−0.30	65.70	4.13	0.78	0.69	3.87	0.53	0.53	0.17	1.64	MAG
				5.18	95.35	255.58	150.90	335.46	315.63	84.96	228.70	PHASE
538	0.070	−0.75	64.31	3.35	0.71	0.67	4.89	0.87	0.25	0.15	3.74	MAG
				352.34	96.29	250.68	131.73	39.57	240.39	205.76	141.83	PHASE
541	0.070	−0.75	65.49	3.93	0.71	0.69	5.13	0.86	0.14	0.02	2.24	MAG
				354.24	96.67	242.24	126.82	26.23	241.37	205.56	156.16	PHASE
547	0.100	−0.75	65.31	5.07	1.25	0.59	4.67	0.84	0.21	0.40	4.87	MAG
				352.48	118.35	226.42	139.17	52.71	293.66	171.10	178.69	PHASE
550	0.100	−0.75	65.51	4.41	1.22	0.56	4.71	1.10	0.12	0.25	5.19	MAG
				351.00	115.41	221.45	139.52	64.64	228.15	162.08	178.55	PHASE
559	0.125	−1.21	65.95	3.93	1.05	0.32	3.01	0.58	0.35	0.70	2.72	MAG
				348.14	114.64	196.61	138.67	59.48	261.10	107.41	171.00	PHASE
562	0.125	−1.21	66.59	4.11	0.83	0.36	3.18	0.45	0.33	0.10	3.29	MAG
				345.53	119.65	210.25	141.48	87.37	274.33	268.39	164.93	PHASE
568	0.150	−1.70	66.99	4.08	0.83	0.52	2.47	0.45	0.41	0.31	1.15	MAG
				342.73	122.53	252.90	150.11	45.45	272.85	240.48	199.07	PHASE
571	0.150	−1.70	67.33	4.08	0.99	0.43	2.26	0.47	0.45	0.15	2.04	MAG
				343.52	119.63	220.71	147.31	47.16	267.55	248.18	184.05	PHASE
577	0.175	−2.33	66.98	3.63	1.25	0.41	1.26	0.46	0.24	0.18	0.14	MAG
				343.02	127.57	172.04	138.80	23.37	299.25	312.87	37.62	PHASE
580	0.175	−2.33	66.93	3.49	1.33	0.47	1.31	0.57	0.13	0.27	0.40	MAG
				340.43	119.96	179.18	136.45	12.46	326.56	298.94	322.48	PHASE
588	0.200	−2.98	67.23	4.56	1.26	0.41	1.28	0.78	0.98	0.25	3.86	MAG
				341.18	139.82	185.47	173.02	39.21	130.98	26.16	252.66	PHASE

Table VII. Continued

(a) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	68.03	4.56	1.37	0.49	1.36	0.69	1.18	0.27	1.45	MAG
				342.81	152.00	226.26	184.79	54.60	150.24	42.51	248.23	PHASE
611	0.225	−3.82	70.17	6.88	1.51	0.46	1.35	1.01	1.28	0.19	3.23	MAG
				345.62	146.62	184.45	240.31	65.42	177.23	68.01	225.07	PHASE
614	0.225	−3.82	70.47	6.72	1.72	0.46	1.45	0.99	1.19	0.37	2.02	MAG
				345.02	149.57	165.05	235.05	53.65	168.49	35.35	188.76	PHASE
625	0.250	−4.66	69.36	7.75	1.49	0.71	1.31	1.50	0.89	0.24	1.93	MAG
				343.95	164.36	200.48	236.02	54.05	136.22	353.43	175.00	PHASE
628	0.250	−4.66	69.79	7.68	1.37	0.84	1.39	1.59	0.79	0.19	0.44	MAG
				345.88	156.38	202.33	248.27	59.19	169.10	57.00	94.13	PHASE
634	0.275	−5.67	70.20	7.88	2.18	1.06	1.58	1.81	0.59	0.38	1.01	MAG
				352.61	153.36	192.12	293.05	71.42	195.66	332.58	138.60	PHASE
639	0.275	−5.67	71.20	7.99	2.30	0.63	1.21	1.73	0.68	0.35	0.32	MAG
				347.93	145.76	195.79	292.46	55.70	171.49	296.78	166.08	PHASE
645	0.300	−6.69	69.56	8.12	2.30	0.49	2.49	1.88	0.46	0.45	0.93	MAG
				349.45	144.98	150.19	292.98	57.95	175.47	324.31	305.83	PHASE
649	0.300	−6.69	69.72	7.91	1.91	0.67	2.68	1.95	0.71	0.39	2.28	MAG
				349.17	158.62	161.84	296.34	58.58	190.47	314.75	316.33	PHASE
655	0.325	−7.78	70.35	9.53	2.49	0.96	3.60	2.03	0.49	0.53	3.53	MAG
				354.71	154.36	139.28	293.32	46.55	161.66	309.16	323.46	PHASE
659	0.325	−7.78	69.65	8.77	2.57	0.63	3.68	2.03	0.40	0.38	2.83	MAG
				353.77	154.48	126.63	296.38	57.64	168.98	315.48	330.10	PHASE
670	0.350	−9.08	70.59	10.75	2.87	1.59	4.62	2.50	0.82	0.43	2.28	MAG
				358.49	147.11	145.51	296.96	40.11	149.59	348.07	342.78	PHASE
672	0.350	−9.08	71.03	9.91	3.04	1.56	4.62	2.67	1.09	0.37	0.72	MAG
				2.35	149.03	157.51	315.08	55.34	162.06	356.14	12.88	PHASE

Table VII. Continued

(b) Axial force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	−1.57	4.46	0.59	0.41	2.79	0.47	0.71	0.41	2.23	MAG
				16.84	204.62	245.14	103.40	167.01	107.54	232.98	114.44	PHASE
530	0.060	−0.30	−0.61	4.37	0.66	0.45	3.26	0.32	0.85	0.40	2.17	MAG
				18.02	206.79	301.75	102.16	224.39	75.31	228.01	141.71	PHASE
538	0.070	−0.75	1.07	4.34	0.75	0.43	3.07	1.38	0.50	0.04	2.49	MAG
				15.60	200.81	259.59	96.26	248.34	359.70	182.23	138.26	PHASE
541	0.070	−0.75	0.86	4.33	0.77	0.39	3.04	1.19	0.44	0.11	2.84	MAG
				14.97	199.86	255.50	91.70	236.39	345.15	188.78	123.57	PHASE
547	0.100	−0.75	−1.72	4.32	1.04	0.45	2.50	1.32	0.62	0.56	1.62	MAG
				17.22	200.95	266.18	123.11	255.76	13.73	6.67	140.91	PHASE
550	0.100	−0.75	−2.70	4.20	1.01	0.45	2.50	1.68	1.14	0.49	2.04	MAG
				16.17	196.25	253.81	116.75	259.44	337.53	323.47	132.85	PHASE
559	0.125	−1.21	−4.79	4.32	0.94	0.32	2.24	0.75	1.40	0.53	0.91	MAG
				15.05	203.18	210.76	132.61	263.22	52.10	321.09	135.32	PHASE
562	0.125	−1.21	−5.27	4.27	0.92	0.26	2.29	0.86	1.19	0.36	1.11	MAG
				14.77	208.41	240.67	137.32	282.07	47.38	327.27	210.17	PHASE
568	0.150	−1.70	−6.92	4.24	0.93	0.19	1.82	0.70	1.20	0.43	0.66	MAG
				16.69	207.86	209.71	153.73	273.27	32.66	350.83	180.18	PHASE
571	0.150	−1.70	−6.77	4.21	0.84	0.28	1.94	0.78	1.10	0.17	0.41	MAG
				15.66	212.97	223.79	153.64	279.87	45.02	4.69	242.35	PHASE
577	0.175	−2.33	−8.90	4.20	0.93	0.42	1.63	0.63	0.73	0.47	0.84	MAG
				15.44	217.16	198.35	176.47	255.20	31.59	25.19	269.70	PHASE
580	0.175	−2.33	−9.04	4.15	0.86	0.41	1.65	0.61	0.80	0.44	0.38	MAG
				14.77	216.65	205.01	170.92	246.03	338.23	3.86	190.24	PHASE
588	0.200	−2.98	−9.12	4.62	1.00	0.50	1.36	0.85	3.91	0.11	0.47	MAG
				16.50	223.90	219.10	156.23	237.29	286.86	76.29	90.70	PHASE

Table VII. Continued

(b) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	−8.48	4.50	0.92	0.61	1.34	0.79	4.23	0.32	0.62	MAG
				18.19	226.11	237.37	159.99	266.79	304.31	59.59	224.22	PHASE
611	0.225	−3.82	−10.98	4.83	0.92	0.43	1.37	0.73	3.90	0.24	0.56	MAG
				19.17	224.45	195.30	173.20	260.41	323.36	150.93	285.92	PHASE
614	0.225	−3.82	−11.53	4.88	1.16	0.29	1.39	0.82	3.95	0.04	0.48	MAG
				19.00	233.00	215.78	166.57	240.13	315.72	127.69	282.94	PHASE
625	0.250	−4.66	−15.46	5.26	1.13	0.67	1.40	0.97	3.43	0.15	1.06	MAG
				17.63	257.68	216.50	167.14	246.09	295.86	115.53	264.62	PHASE
628	0.250	−4.66	−14.92	5.25	1.16	0.66	1.33	1.41	3.29	0.12	1.17	MAG
				20.59	263.24	218.64	182.87	247.19	316.10	171.97	258.25	PHASE
634	0.275	−5.67	−17.44	5.44	1.03	0.86	1.42	1.17	3.25	0.25	0.82	MAG
				21.63	274.40	213.98	189.45	249.75	342.50	195.43	300.60	PHASE
639	0.275	−5.67	−17.98	5.44	1.25	0.87	1.42	1.39	3.26	0.14	0.71	MAG
				18.20	260.49	239.18	182.63	233.90	326.53	254.28	255.60	PHASE
645	0.300	−6.69	−20.93	5.35	0.80	0.65	1.24	1.43	3.01	0.38	0.40	MAG
				17.12	252.77	208.88	183.92	230.81	330.87	244.02	350.19	PHASE
649	0.300	−6.69	−21.32	5.56	0.94	0.72	1.33	1.76	3.32	0.37	0.25	MAG
				18.77	259.99	198.27	178.99	226.23	338.39	238.76	337.85	PHASE
655	0.325	−7.78	−26.80	5.71	1.10	0.69	1.66	1.49	3.13	0.23	0.52	MAG
				16.27	265.27	199.14	189.21	223.24	326.34	220.30	237.47	PHASE
659	0.325	−7.78	−27.51	5.67	1.08	0.51	1.62	1.26	3.23	0.34	0.24	MAG
				15.95	268.19	220.99	187.47	233.15	333.07	205.28	337.80	PHASE
670	0.350	−9.08	−31.99	5.89	1.60	0.84	1.36	1.61	2.03	0.43	1.45	MAG
				16.22	256.40	178.60	204.49	205.53	303.27	302.29	34.11	PHASE
672	0.350	−9.08	−31.96	5.89	1.78	0.98	1.64	1.99	2.85	0.45	1.80	MAG
				21.41	265.77	190.78	213.73	227.34	325.65	324.22	48.44	PHASE

Table VII. Continued

(c) Pitching moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	13.59	337.73	12.77	20.09	27.47	5.50	2.72	0.85	11.69	MAG
				25.87	158.46	251.00	209.25	137.88	111.01	297.81	71.21	PHASE
530	0.060	−0.30	−21.87	336.29	12.59	20.71	30.52	6.04	4.06	3.70	8.62	MAG
				28.35	162.98	296.68	211.33	158.64	88.58	196.28	57.58	PHASE
538	0.070	−0.75	−59.50	335.91	16.32	18.38	33.89	4.31	0.86	0.74	4.67	MAG
				27.19	156.45	278.70	204.46	195.48	74.41	347.16	81.78	PHASE
541	0.070	−0.75	−29.00	337.06	16.41	17.34	34.91	4.48	1.57	0.83	13.65	MAG
				26.13	163.84	275.04	199.12	186.93	38.57	170.89	53.01	PHASE
547	0.100	−0.75	−4.28	337.34	27.60	19.69	28.35	3.80	2.19	3.91	16.71	MAG
				28.11	170.89	275.16	217.45	206.85	105.68	86.92	62.00	PHASE
550	0.100	−0.75	−3.50	335.92	26.67	16.08	28.42	5.74	2.06	2.87	17.67	MAG
				27.34	166.08	268.84	216.05	221.09	320.43	4.75	55.48	PHASE
559	0.125	−1.21	16.58	333.95	22.74	11.22	22.13	2.31	4.86	4.66	11.86	MAG
				25.99	168.66	219.54	226.67	208.35	84.36	37.75	55.63	PHASE
562	0.125	−1.21	5.64	332.63	21.72	12.94	24.63	2.17	3.65	0.86	5.62	MAG
				26.48	172.79	244.92	228.51	227.40	75.16	321.47	57.43	PHASE
568	0.150	−1.70	−19.46	334.48	19.74	4.90	21.21	3.18	3.09	2.08	7.67	MAG
				27.65	166.69	260.11	246.29	214.21	135.22	123.33	100.48	PHASE
571	0.150	−1.70	−17.83	332.69	19.47	8.06	18.90	1.48	3.56	2.16	3.59	MAG
				27.10	169.05	248.36	243.68	213.06	114.87	87.50	73.59	PHASE
577	0.175	−2.33	−83.61	332.56	21.58	13.01	15.70	[illegible]	2.32	2.75	4.88	MAG
				27.52	164.67	204.03	266.44	[illegible]	57.89	97.60	89.34	PHASE
580	0.175	−2.33	−100.38	331.23	19.75	15.97	17.07	1.84	2.80	2.23	10.19	MAG
				26.17	156.58	210.09	259.85	208.59	74.97	101.43	91.47	PHASE
588	0.200	−2.98	−76.51	345.74	23.47	15.19	16.35	2.60	8.04	2.06	13.13	MAG
				26.96	149.00	219.36	261.57	215.43	317.56	156.28	72.21	PHASE

Table VII. Continued

(c) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	−62.55	343.87	23.89	20.31	6.[illegible]	2.95	10.16	1.92	7.76	MAG
				28.43	154.52	243.23	[illegible]	227.05	327.06	110.45	110.55	PHASE
611	0.225	−3.82	−119.50	355.93	24.70	17.02	[illegible]	2.61	9.75	1.70	9.37	MAG
				28.99	142.48	211.17	[illegible]	220.88	342.86	154.57	21.92	PHASE
614	0.225	−3.82	−100.37	357.97	21.87	14.45	[illegible]	3.19	10.22	1.99	5.86	MAG
				28.26	149.11	207.67	286.08	215.82	335.55	343.57	49.15	PHASE
625	0.250	−4.66	−110.82	359.16	7.80	[illegible]	20.00	4.94	6.35	1.18	9.79	MAG
				27.69	81.46	223.56	291.46	217.49	317.66	267.57	343.22	PHASE
628	0.250	−4.66	−123.56	359.36	11.43	27.51	20.96	4.03	5.83	0.88	5.04	MAG
				30.51	100.40	228.21	303.59	226.76	350.88	65.06	63.82	PHASE
634	0.275	−5.67	−114.24	359.99	22.70	34.91	20.74	6.31	6.72	1.41	5.46	MAG
				31.21	89.30	219.23	313.85	240.80	6.00	229.07	359.28	PHASE
639	0.275	−5.67	−117.29	358.58	15.80	31.51	20.89	5.99	8.11	0.83	7.39	MAG
				28.59	86.37	240.23	305.29	240.70	358.63	308.15	354.04	PHASE
645	0.300	−6.69	−157.60	357.43	28.54	20.79	24.87	5.92	6.28	2.27	6.46	MAG
				27.48	94.36	217.47	321.74	215.37	0.30	300.96	351.87	PHASE
649	0.300	−6.69	−133.37	357.40	20.52	25.59	22.89	6.47	7.68	2.14	7.34	MAG
				28.27	95.88	205.82	331.12	238.60	4.45	275.08	39.87	PHASE
655	0.325	−7.78	−226.01	362.66	20.99	25.40	28.52	4.54	7.73	1.89	10.84	MAG
				27.64	76.76	193.89	313.32	227.62	357.83	269.03	106.18	PHASE
659	0.325	−7.78	−237.45	361.96	22.31	16.25	25.16	4.76	7.14	2.27	12.41	MAG
				28.43	92.11	205.69	314.24	204.32	11.74	118.25	123.55	PHASE
670	0.350	−9.08	−333.09	363.44	10.93	40.69	39.76	5.38	4.86	2.83	17.98	MAG
				28.12	103.84	183.02	304.86	215.62	351.55	359.52	70.31	PHASE
672	0.350	−9.08	−328.68	357.63	5.98	43.48	36.43	6.45	6.21	1.92	14.36	MAG
				31.03	98.93	188.35	316.60	252.20	4.14	50.83	88.59	PHASE

Table VII. Continued

(d) Rolling moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	−50.93	296.17	29.40	15.14	456.37	34.05	3.20	3.68	8.79	MAG
				297.27	96.46	114.85	170.45	50.94	99.41	169.35	359.78	PHASE
530	0.060	−0.30	−56.72	297.44	28.57	18.63	485.91	27.51	3.76	6.27	9.80	MAG
				299.61	100.06	116.94	175.68	59.05	81.46	214.25	314.15	PHASE
538	0.070	−0.75	−34.87	296.72	34.45	21.78	471.70	28.26	4.14	4.83	6.81	MAG
				298.65	100.26	112.67	171.99	61.16	98.44	213.92	120.32	PHASE
541	0.070	−0.75	−10.71	297.73	31.20	19.75	473.23	27.81	3.90	2.65	17.33	MAG
				297.26	100.24	109.07	167.74	50.28	72.30	250.00	19.84	PHASE
547	0.100	−0.75	20.01	298.68	33.66	13.35	386.84	23.06	3.04	2.20	10.65	MAG
				299.85	105.03	141.71	190.11	92.29	129.39	89.96	27.44	PHASE
550	0.100	−0.75	29.48	299.82	33.16	15.09	408.68	22.30	3.56	1.00	13.78	MAG
				299.46	102.15	132.71	185.00	97.87	124.98	286.20	9.69	PHASE
562	0.125	−1.21	−85.04	297.53	34.47	12.04	352.04	21.41	3.16	1.52	7.88	MAG
				298.46	104.91	163.50	196.67	94.86	193.00	290.74	184.6[illegible]	PHASE
568	0.150	−1.70	−88.89	299.57	32.94	14.37	300.06	21.36	2.73	1.34	3.93	MAG
				299.14	103.70	154.55	208.69	109.56	234.99	174.93	93.49	PHASE
571	0.150	−1.70	−92.54	297.41	30.59	14.46	301.60	23.53	3.30	1.88	8.00	MAG
				298.59	106.11	158.86	209.06	104.07	186.48	134.76	213.87	PHASE
577	0.175	−2.33	−149.47	298.98	27.74	11.78	262.49	25.36	2.45	1.31	1.01	MAG
				298.77	112.71	164.84	228.89	129.50	186.51	7.72	95.67	PHASE
580	0.175	−2.33	−171.41	299.74	28.84	12.31	266.04	24.09	2.78	3.86	13.44	MAG
				297.38	110.42	160.73	222.54	131.64	224.07	306.23	34.58	PHASE
588	0.200	−2.98	−83.67	309.20	31.04	10.69	217.42	22.03	7.60	0.91	13.85	MAG
				298.24	120.52	168.87	227.92	146.71	173.32	315.80	344.54	PHASE
591	0.200	−2.98	−83.54	310.46	30.93	11.56	224.22	16.88	7.90	2.95	11.04	MAG
				299.97	121.86	175.94	233.13	157.17	185.16	44.91	96.52	PHASE

Table VII. Continued

(d) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
599	0.125	−1.21	−91.68	297.97	34.38	13.99	343.44	24.05	2.44	4.09	9.01	MAG
				297.45	102.67	157.73	194.29	89.14	184.22	1.93	16.06	PHASE
611	0.225	−3.82	−88.29	321.77	34.02	10.15	256.18	22.98	10.84	2.95	10.50	MAG
				300.67	123.53	173.42	247.30	153.00	205.20	109.78	304.26	PHASE
614	0.225	−3.82	−101.75	322.54	32.28	7.21	251.11	26.34	11.78	3.23	3.88	MAG
				299.63	116.28	183.73	239.91	142.60	185.82	17.76	72.87	PHASE
625	0.250	−4.66	−115.62	317.45	29.31	10.68	245.33	24.20	8.79	2.18	7.67	MAG
				299.95	137.94	182.72	245.53	149.93	199.17	295.67	288.55	PHASE
628	0.250	−4.66	−130.00	323.98	26.52	10.47	242.46	30.26	11.18	2.72	12.12	MAG
				302.47	136.18	179.72	256.88	161.30	200.34	45.17	70.60	PHASE
634	0.275	−5.67	−77.38	325.97	24.73	11.89	234.04	25.90	11.60	2.21	6.88	MAG
				299.75	113.29	181.59	257.37	165.11	214.94	50.98	41.08	PHASE
639	0.275	−5.67	−75.55	320.51	26.42	11.48	224.17	26.72	10.06	0.73	5.48	MAG
				300.17	160.23	198.02	258.30	165.85	214.07	244.60	340.96	PHASE
645	0.300	−6.69	23.18	315.91	28.81	15.97	235.12	29.52	9.31	2.21	5.26	MAG
				300.60	172.86	183.45	266.44	166.62	225.89	26.16	336.61	PHASE
649	0.300	−6.69	52.37	316.40	27.39	13.78	227.90	32.42	10.54	1.49	8.05	MAG
				300.49	172.68	188.20	266.64	158.54	213.30	183.69	353.72	PHASE
655	0.325	−7.78	−27.12	312.70	29.89	16.16	202.62	28.48	10.93	1.36	12.36	MAG
				300.81	174.28	175.55	260.47	157.19	234.16	249.86	39.10	PHASE
659	0.325	−7.78	−63.45	317.82	29.86	17.40	202.55	30.36	9.65	1.75	9.69	MAG
				300.26	170.86	169.13	264.65	162.05	227.24	96.62	81.27	PHASE
670	0.350	−9.08	−129.58	301.21	54.98	15.77	187.94	29.89	5.83	2.74	15.16	MAG
				301.14	169.39	198.98	258.16	157.05	226.49	216.85	56.94	PHASE
672	0.350	−9.08	−125.08	309.50	60.58	15.13	177.80	32.38	6.20	3.06	8.70	MAG
				303.14	171.97	203.75	266.20	170.02	224.77	223.44	122.04	PHASE

Table VII. Continued

(e) Yawing moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	208.54	84.88	3.60	5.46	261.26	13.29	1.11	1.92	3.59	MAG
				128.43	238.65	256.55	321.17	146.42	230.10	264.49	66.92	PHASE
530	0.060	−0.30	229.60	82.62	3.24	7.99	286.34	13.96	1.08	0.80	3.75	MAG
				127.05	256.25	303.51	325.91	166.30	28.23	353.59	211.93	PHASE
538	0.070	−0.75	270.32	83.60	4.96	9.11	276.66	11.61	1.88	1.67	9.56	MAG
				129.36	283.40	283.90	322.04	176.46	251.43	39.32	154.91	PHASE
541	0.070	−0.75	281.08	84.38	4.23	7.00	279.04	11.19	1.56	1.21	9.00	MAG
				127.85	263.48	272.28	317.79	162.39	272.03	134.23	86.14	PHASE
547	0.100	−0.75	265.89	84.53	6.48	0.31	246.44	8.83	3.50	0.43	2.25	MAG
				127.30	272.65	353.71	341.31	201.48	291.71	222.79	121.93	PHASE
550	0.100	−0.75	264.09	80.90	5.55	4.77	250.40	9.72	2.35	1.15	2.76	MAG
				128.93	268.81	303.30	336.44	218.14	292.46	152.71	139.73	PHASE
559	0.125	−1.21	150.66	83.52	3.05	2.91	231.95	10.63	1.60	1.76	1.46	MAG
				128.52	300.75	328.85	344.52	206.41	140.28	2.22	4.94	PHASE
562	0.125	−1.21	144.62	81.87	4.62	2.08	236.04	7.60	0.36	1.01	6.91	MAG
				125.41	276.17	320.99	347.67	219.75	298.38	11.90	226.56	PHASE
568	0.150	−1.70	130.94	77.33	3.34	4.95	203.23	8.61	2.59	0.84	3.98	MAG
				128.00	286.42	308.11	1.43	213.46	240.06	333.15	201.50	PHASE
571	0.150	−1.70	125.16	83.01	2.21	6.78	209.51	12.27	2.65	1.08	6.15	MAG
				128.00	283.03	345.24	359.96	226.82	260.41	29.81	222.61	PHASE
577	0.175	−2.33	117.58	77.41	2.72	4.46	181.30	14.86	1.66	0.28	4.27	MAG
				128.57	319.98	347.43	18.16	245.23	347.99	257.15	231.77	PHASE
580	0.175	−2.33	114.60	77.86	2.46	3.44	184.29	14.92	0.30	0.73	1.29	MAG
				128.06	279.87	350.17	13.24	252.52	128.00	76.07	323.70	PHASE
588	0.200	−2.98	200.53	72.83	6.26	4.59	166.37	4.49	2.22	0.65	4.57	MAG
				126.10	327.39	336.08	19.79	223.13	14.13	302.99	15.40	PHASE

Table VII. Continued

(e) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	223.87	68.30	4.41	4.06	163.10	4.25	2.55	1.40	5.01	MAG
				126.26	306.23	318.25	24.83	203.53	38.04	258.80	155.87	PHASE
611	0.225	−3.82	308.08	68.99	2.97	5.10	172.85	7.47	2.73	0.77	5.09	MAG
				126.11	307.43	296.64	40.39	243.25	10.52	10.79	353.72	PHASE
614	0.225	−3.82	327.41	71.03	3.57	2.70	170.29	9.76	4.37	0.59	1.44	MAG
				129.33	349.34	301.11	35.32	236.39	350.07	128.16	80.32	PHASE
625	0.250	−4.66	216.29	76.03	2.85	6.13	159.58	13.48	2.75	1.05	5.66	MAG
				120.91	319.13	333.49	41.96	210.62	311.73	99.48	324.28	PHASE
628	0.250	−4.66	225.47	66.43	6.45	1.99	155.12	11.70	3.02	0.48	4.25	MAG
				137.58	353.73	280.72	54.83	226.12	17.17	283.24	55.15	PHASE
634	0.275	−5.67	289.85	64.67	2.46	4.88	152.76	13.85	0.95	1.05	3.06	MAG
				119.79	17.18	26.34	63.92	246.84	97.81	205.18	8.93	PHASE
639	0.275	−5.67	301.71	71.89	8.28	7.83	146.73	13.46	0.76	1.24	5.28	MAG
				135.51	1.95	351.35	57.01	249.84	82.68	180.68	350.74	PHASE
645	0.300	−6.69	326.51	66.09	5.66	5.12	159.60	14.80	1.15	1.31	5.07	MAG
				119.71	323.04	335.75	61.36	233.21	80.66	188.82	342.56	PHASE
649	0.300	−6.69	322.84	62.58	4.37	2.97	148.58	17.30	2.99	1.36	6.53	MAG
				129.66	11.07	14.88	62.92	245.62	31.07	120.69	355.41	PHASE
655	0.325	−7.78	333.67	75.09	2.93	6.24	172.96	19.37	1.68	1.81	5.75	MAG
				122.72	281.82	7.54	67.21	215.76	14.58	179.09	52.57	PHASE
659	0.325	−7.78	323.31	64.71	5.05	6.14	155.12	24.18	0.51	1.62	2.21	MAG
				130.10	52.78	36.04	70.23	224.79	38.81	221.30	76.42	PHASE
670	0.350	−9.08	368.06	85.21	14.19	2.41	151.37	16.31	1.94	1.01	1.47	MAG
				123.39	11.27	356.85	76.01	207.84	352.03	344.05	354.57	PHASE
672	0.350	−9.08	367.92	73.09	8.31	4.57	153.30	25.79	2.61	0.61	4.19	MAG
				133.64	25.47	86.20	88.15	220.06	30.57	207.28	266.30	PHASE

Table VII. Continued

(f) Side force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	−1.48	4.67	1.15	0.50	18.80	1.67	0.14	0.53	1.39	MAG
				287.71	107.47	90.46	178.93	26.04	76.47	197.72	246.33	PHASE
530	0.060	−0.30	−1.91	4.60	1.17	0.54	19.60	1.50	0.32	0.33	1.17	MAG
				297.26	110.11	93.65	184.61	40.35	53.25	179.43	236.12	PHASE
538	0.070	−0.75	−2.05	4.59	1.32	0.66	19.22	1.53	0.32	0.45	0.96	MAG
				291.23	109.21	88.69	180.44	48.63	102.54	174.90	314.14	PHASE
541	0.070	−0.75	−2.00	4.60	1.29	0.61	19.07	1.35	0.40	0.34	2.39	MAG
				292.28	107.11	81.02	176.04	39.05	62.97	167.49	270.15	PHASE
547	0.100	−0.75	−1.82	4.72	1.39	0.46	14.73	1.26	0.25	0.26	1.77	MAG
				295.08	119.32	117.98	199.16	79.00	97.85	6.37	288.53	PHASE
550	0.100	−0.75	−1.47	4.82	1.39	0.50	15.61	1.40	0.35	0.14	2.23	MAG
				295.51	111.30	105.66	194.04	92.54	138.92	245.24	282.91	PHASE
559	0.125	−1.21	−1.95	4.79	1.48	0.37	12.79	1.24	0.21	0.88	1.31	MAG
				292.18	116.57	129.61	205.55	73.20	151.01	321.88	280.77	PHASE
562	0.125	1.21	−1.80	4.73	1.47	0.25	12.89	1.06	0.16	0.06	0.56	MAG
				294.92	121.64	142.00	206.98	84.08	180.24	158.75	44.05	PHASE
568	0.150	−1.70	−1.70	4.96	1.38	0.30	10.77	1.31	0.21	0.06	0.95	MAG
				294.32	118.27	126.15	218.34	87.24	208.91	187.28	328.19	PHASE
571	0.150	−1.70	−1.59	4.70	1.31	0.34	10.82	1.43	0.35	0.60	0.38	MAG
				294.03	123.77	124.86	220.01	85.10	184.91	169.66	86.64	PHASE
577	0.175	−2.33	−1.31	5.02	1.36	0.33	9.57	1.61	0.20	0.27	0.35	MAG
				292.05	132.70	135.09	240.98	106.92	172.36	285.55	340.22	PHASE
580	0.175	−2.33	−0.93	5.11	1.28	0.34	9.48	1.79	0.19	0.47	1.65	MAG
				291.41	127.58	127.10	233.63	113.04	209.38	302.21	292.52	PHASE
588	0.200	−2.98	−1.39	5.72	1.49	0.18	7.27	1.17	0.64	0.28	1.42	MAG
				292.29	138.48	134.02	242.70	102.57	167.13	325.10	261.33	PHASE

Table VII. Continued

(f) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	−1.31	5.99	1.68	0.18	7.78	0.85	0.58	0.31	1.20	MAG
				296.43	146.13	178.70	245.95	101.60	174.44	341.71	4.03	PHASE
611	0.225	−3.82	−1.39	6.51	2.06	0.22	9.18	1.73	0.91	0.18	1.28	MAG
				297.49	144.81	177.23	257.44	107.50	195.31	46.07	196.36	PHASE
614	0.225	−3.82	−1.81	6.57	1.85	0.10	8.81	2.06	0.94	0.22	0.21	MAG
				294.21	140.74	279.31	249.14	103.76	181.22	3.57	323.25	PHASE
625	0.250	−4.66	−1.39	6.03	1.89	0.10	8.72	1.84	0.82	0.03	1.12	MAG
				297.43	158.68	192.69	254.18	91.74	166.48	228.73	170.35	PHASE
628	0.250	−4.66	−1.29	6.88	1.29	0.28	8.63	1.84	1.00	0.77	0.75	MAG
				295.30	153.00	203.48	263.36	107.75	196.28	282.57	321.91	PHASE
634	0.275	−5.67	−1.27	6.67	2.19	0.15	8.67	2.10	0.82	0.23	1.20	MAG
				308.13	173.15	187.35	277.70	121.38	210.45	132.27	154.60	PHASE
639	0.275	−5.67	−1.53	6.62	1.89	0.11	7.67	2.06	0.90	0.20	0.89	MAG
				291.69	164.37	285.36	267.46	115.79	195.48	158.62	172.70	PHASE
645	0.300	−6.69	−0.98	6.54	2.15	0.40	8.10	2.13	0.91	0.15	1.24	MAG
				302.01	178.21	184.21	279.74	112.09	199.93	220.64	145.44	PHASE
649	0.300	−6.69	−1.01	6.66	2.07	0.33	7.86	2.52	1.02	0.12	1.10	MAG
				296.10	173.50	178.43	279.01	111.46	195.29	187.62	176.68	PHASE
655	0.325	−7.78	0.85	5.84	2.52	0.23	4.47	2.08	0.78	0.08	0.99	MAG
				301.66	176.83	144.33	272.11	103.91	213.42	68.01	313.71	PHASE
659	0.325	−7.78	1.05	6.89	2.44	0.69	5.16	2.44	0.83	0.10	1.18	MAG
				294.51	162.81	133.31	276.50	99.13	221.64	22.64	5.30	PHASE
670	0.350	−9.08	2.10	5.01	2.99	0.26	4.05	2.31	0.75	0.70	1.40	MAG
				300.98	168.05	207.53	249.31	102.24	199.04	187.28	259.72	PHASE
672	0.350	−9.08	2.21	6.28	3.57	0.24	3.61	2.48	0.68	0.60	0.54	MAG
				298.84	165.09	182.79	248.59	110.66	198.41	206.31	220.44	PHASE

Table VII. Continued

(g) Hub beamwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	25.23	0.40	0.16	1.00	0.53	0.14	0.04	0.06	0.09	MAG
				265.55	307.23	111.51	70.22	166.02	300.01	42.16	331.59	PHASE
530	0.060	−0.30	25.45	0.42	0.19	1.30	0.66	0.19	0.02	0.07	0.09	MAG
				41.16	311.64	117.71	76.48	170.65	331.69	58.18	313.58	PHASE
538	0.070	−0.75	24.99	0.47	0.18	1.60	0.79	0.24	0.05	0.07	0.08	MAG
				84.19	308.32	112.45	73.60	155.02	298.97	31.09	182.55	PHASE
541	0.070	−0.75	25.08	0.23	0.20	1.59	0.82	0.24	0.05	0.08	0.02	MAG
				253.67	314.97	108.92	70.49	151.58	290.54	24.82	135.65	PHASE
547	0.100	−0.75	25.28	0.21	0.25	1.34	0.68	0.22	0.02	0.05	0.12	MAG
				327.93	113.74	112.91	96.27	150.67	159.10	51.31	193.44	PHASE
550	0.100	−0.75	25.25	0.17	0.23	1.36	0.68	0.21	0.01	0.05	0.12	MAG
				164.18	116.89	111.36	92.00	148.33	182.97	50.22	181.08	PHASE
559	0.125	−1.21	25.76	0.19	0.33	0.96	0.52	0.10	0.03	0.04	0.03	MAG
				336.25	107.14	106.42	89.60	135.48	128.75	55.87	269.28	PHASE
562	0.125	−1.21	25.77	0.51	0.34	1.00	0.53	0.12	0.04	0.04	0.08	MAG
				105.01	112.22	109.59	92.89	137.78	123.79	51.73	230.89	PHASE
568	0.150	−1.70	25.58	0.28	0.33	0.74	0.39	0.13	0.01	0.01	0.05	MAG
				46.23	113.32	127.46	105.10	169.22	287.22	52.50	61.59	PHASE
571	0.150	−1.70	25.60	0.18	0.32	0.75	0.39	0.10	0.01	0.02	0.03	MAG
				306.35	113.91	127.07	109.36	156.31	22.39	39.81	32.39	PHASE
577	0.175	−2.33	25.42	0.23	0.27	0.48	0.31	0.12	0.04	0.02	0.07	MAG
				345.36	139.41	150.54	110.26	188.66	337.55	285.62	14.86	PHASE
580	0.175	−2.33	25.40	0.38	0.26	0.50	0.33	0.14	0.03	0.03	0.09	MAG
				20.87	139.06	150.69	106.54	175.33	358.35	3.95	2.99	PHASE
588	0.200	−2.98	25.34	0.09	0.37	0.52	0.27	0.14	0.06	0.03	0.11	MAG
				113.14	204.57	178.40	110.46	179.58	110.33	340.03	264.22	PHASE

Table VII. Continued

(g) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	25.29	0.20	0.35	0.53	0.26	0.12	0.07	0.02	0.10	MAG
				54.45	203.90	184.26	119.49	191.43	109.96	339.86	244.30	PHASE
611	0.225	−3.82	25.38	0.05	0.83	0.71	0.28	0.12	0.04	0 02	0.05	MAG
				205.00	222.96	199.60	159.24	210.04	147.24	52.42	288.57	PHASE
614	0.225	−3.82	25.37	0.12	0.86	0.71	0.28	0.13	0.04	0.02	0.03	MAG
				332.96	221.11	196.70	156.92	202.36	137.94	32.27	214.71	PHASE
625	0.250	−4.66	25.43	0.37	1.65	0.66	0.34	0.03	0.03	0.04	0.04	MAG
				31.93	223.57	193.77	155.20	179.53	84.53	55.51	77.75	PHASE
628	0.250	−4.66	25.39	0.29	1.66	0.67	0.35	0.01	0.05	0.06	0.07	MAG
				322.54	228.59	203.67	166.34	298.63	100.57	79.10	100.33	PHASE
634	0.275	−5.67	24.96	0.30	2.29	0.64	0.27	0.02	0.09	0.06	0.06	MAG
				337.92	232.83	207.98	165.23	355.44	36.54	102.88	64.94	PHASE
639	0.275	−5.67	25.07	0.22	2.43	0.61	0.24	0.06	0.10	0.06	0.06	MAG
				44.52	226.35	199.87	145.35	333.76	21.59	37.59	73.39	PHASE
645	0.300	−6.69	24.54	0.18	2.89	0.72	0.16	0.03	0.09	0.07	0.07	MAG
				34.26	228.75	203.62	179.71	11.38	1.89	24.62	45.42	PHASE
649	0.300	−6.69	24.52	0.54	2.91	0.73	0.15	0.03	0.10	0.06	0.10	MAG
				30.78	230.88	206.77	195.22	294.53	3.43	30.00	33.87	PHASE
655	0.325	−7.78	24.11	0.48	3.62	0.78	0.22	0.05	0.12	0.08	0.12	MAG
				333.95	232.32	203.24	201.07	161.62	9.74	32.54	42.21	PHASE
659	0.325	−7.78	24.17	0.36	3.59	0.73	0.18	0.05	0.16	0.04	0.09	MAG
				297.29	232.26	201.56	213.61	128.36	1.17	352.35	59.03	PHASE
670	0.350	−9.08	24.00	0.61	4.46	0.67	0.08	0.08	0.19	0.03	0.04	MAG
				22.32	231.33	188.98	230.94	103.86	315.16	252.80	341.90	PHASE
672	0.350	−9.08	24.05	0.23	4.52	0.65	0.02	0.05	0.19	0.06	0.05	MAG
				225.84	236.77	198.70	251.54	96.56	326.73	266.17	234.03	PHASE

Table VII. Continued

(h) Hub chordwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	45.41	25.21	1.54	3.31	2.26	3.51	1.50	0.43	0.94	MAG
				290.08	66.25	90.89	96.16	323.08	131.00	7.62	322.44	PHASE
530	0.060	−0.30	44.98	26.24	1.62	4.22	2.94	3.84	2.56	0.73	1.01	MAG
				288.67	73.32	97.91	102.52	329.31	144.79	62.65	283.54	PHASE
538	0.070	−0.75	40.52	26.64	1.86	5.07	3.43	3.32	4.74	0.73	0.81	MAG
				287.25	77.20	99.35	99.12	326.86	145.37	72.12	139.86	PHASE
541	0.070	−0.75	40.84	26.79	1.91	5.04	3.54	3.52	4.67	0.53	1.23	MAG
				287.20	75.61	95.59	95.24	321.87	137.24	59.75	351.71	PHASE
547	0.100	−0.75	33.84	23.93	2.24	4.83	3.24	2.70	4.71	0.35	0.31	MAG
				291.64	92.26	103.22	114.98	340.20	151.49	73.86	323.27	PHASE
550	0.100	−0.75	34.13	24.63	2.19	4.88	3.29	2.89	5.16	0.32	0.57	MAG
				289.56	94.56	102.09	109.80	336.01	148.78	104.03	313.67	PHASE
559	0.125	−1.21	33.61	24.60	2.46	3.89	2.51	2.26	3.31	0.73	0.91	MAG
				291.69	87.11	99.60	112.51	346.82	139.06	118.39	315.24	PHASE
562	0.125	−1.21	33.88	25.11	2.50	3.99	2.59	2.38	3.22	0.54	1.07	MAG
				292.99	86.86	101.28	116.72	352.89	142.22	133.66	208.45	PHASE
568	0.150	−1.70	32.53	23.69	2.39	3.20	1.81	1.85	3.25	0.09	0.45	MAG
				295.01	86.75	115.69	135.51	348.85	154.88	51.95	85.74	PHASE
571	0.150	−1.70	32.21	23.66	2.38	3.26	1.93	1.85	3.09	0.09	0.73	MAG
				295.93	87.71	116.08	134.81	354.95	157.26	132.40	177.31	PHASE
577	0.175	−2.33	32.26	23.50	2.13	2.48	1.22	1.39	2.95	0.09	0.11	MAG
				300.09	90.90	131.53	148.56	16.38	160.71	70.05	307.59	PHASE
580	0.175	−2.33	32.34	23.41	2.14	2.53	1.23	1.52	3.13	0.79	1.29	MAG
				297.16	87.75	127.56	140.56	5.29	148.14	76.51	346.66	PHASE
588	0.200	−2.98	35.37	24.77	1.92	2.19	1.13	0.79	1.68	0.81	1.87	MAG
				302.85	91.54	149.74	169.26	36.19	139.07	288.60	289.27	PHASE

Table VII. Continued

(h) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	35.36	24.56	2.00	2.16	1.12	0.83	1.54	0.15	0.12	MAG
				302.74	92.94	157.30	169.80	40.00	157.60	299.80	274.56	PHASE
611	0.225	−3.82	39.23	25.90	1.86	2.53	1.51	0.93	1.87	0.27	1.28	MAG
				308.52	108.09	182.81	212.12	58.39	137.05	175.00	276.30	PHASE
614	0.225	−3.82	39.23	25.48	1.90	2.62	1.55	0.71	1.88	0.30	0.11	MAG
				306.75	109.78	181.42	207.39	52.72	135.03	189.08	346.52	PHASE
625	0.250	−4.66	45.30	28.65	1.72	2.52	1.88	1.06	1.79	0.53	0.66	MAG
				312.27	132.10	192.51	212.45	59.55	117.88	188.51	264.43	PHASE
628	0.250	−4.66	45.26	28.27	1.91	2.54	1.74	0.98	2.01	0.21	1.04	MAG
				315.93	141.02	201.82	218.98	66.35	127.12	194.65	49.00	PHASE
634	0.275	−5.67	50.64	30.31	2.12	2.36	1.53	1.36	2.04	0.47	0.53	MAG
				320.56	168.69	218.64	239.56	84.08	114.08	150.35	144.94	PHASE
639	0.275	−5.67	52.46	31.16	2.11	2.48	1.73	1.31	1.86	0.53	0.28	MAG
				318.45	172.15	209.10	228.96	46.84	114.41	188.34	28.84	PHASE
645	0.300	−6.69	57.26	32.20	2.79	2.94	1.99	1.38	1.48	0.55	0.24	MAG
				320.06	194.01	224.39	245.29	84.26	86.54	161.18	300.99	PHASE
649	0.300	−6.69	57.22	31.45	2.62	2.99	2.02	1.38	1.85	0.66	0.66	MAG
				321.15	196.56	222.31	248.63	74.38	93.55	167.29	335.37	PHASE
655	0.325	−7.78	64.70	33.83	3.82	3.60	2.62	2.24	1.74	0.27	1.28	MAG
				323.83	211.44	236.52	250.91	59.99	63.46	173.92	25.14	PHASE
659	0.325	−7.78	64.84	34.24	3.57	3.56	2.59	2.21	1.69	0.09	0.94	MAG
				325.27	210.76	235.93	247.71	64.94	71.45	280.84	64.47	PHASE
670	0.350	−9.08	78.90	42.22	4.98	3.94	3.38	2.48	1.56	0.37	1.19	MAG
				326.83	211.95	242.59	253.32	44.17	60.67	191.99	71.37	PHASE
672	0.350	−9.08	79.30	42.92	5.01	3.95	3.32	2.48	1.50	0.70	1.54	MAG
				329.88	217.56	248.22	267.41	57.62	79.05	204.65	156.98	PHASE

Table VII. Continued

(i) Hub beamwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	27.42	0.97	0.04	0.22	0.11	0.14	0.08	0.02	0.02	MAG
				276.79	262.81	114.27	83.37	347.86	115.58	190.87	334.79	PHASE
530	0.060	−0.30	27.47	0.83	0.05	0.29	0.14	0.16	0.11	0.02	0.02	MAG
				283.48	295.05	118.37	92.23	351.17	131.45	139.53	276.73	PHASE
538	0.070	−0.75	27.01	0.77	0.04	0.35	0.14	0.15	0.20	0.04	0.02	MAG
				275.88	283.65	115.87	89.79	353.29	128.51	122.88	121.58	PHASE
541	0.070	−0.75	27.06	0.97	0.04	0.35	0.14	0.16	0.20	0.03	0.04	MAG
				273.07	299.41	113.17	88.67	348.50	118.22	122.86	343.91	PHASE
547	0.100	−0.75	26.79	0.84	0.07	0.29	0.14	0.12	0.18	0.03	0.03	MAG
				278.36	128.82	116.38	111.34	9.24	134.82	109.68	316.11	PHASE
550	0.100	−0.75	26.81	0.82	0.08	0.30	0.13	0.13	0.20	0.04	0.05	MAG
				270.15	135.79	114.37	104.01	9.56	131.51	117.69	302.39	PHASE
559	0.125	−1.21	26.81	0.88	0.13	0.19	0.10	0.12	0.12	0.04	0.04	MAG
				277.28	126.74	109.77	99.17	27.11	121.02	118.18	313.18	PHASE
562	0.125	−1.21	26.82	0.72	0.12	0.20	0.11	0.12	0.12	0.05	0.03	MAG
				272.62	124.36	113.24	106.67	26.41	129.25	126.06	213.20	PHASE
568	0.150	−1.70	26.65	0.77	0.11	0.14	0.06	0.11	0.12	0.03	0.01	MAG
				280.29	125.78	136.15	119.90	20.35	144.92	136.43	106.81	PHASE
571	0.150	−1.70	26.65	0.86	0.11	0.14	0.07	0.11	0.11	0.04	0.04	MAG
				278.41	127.56	137.53	118.98	20.80	150.56	147.42	171.65	PHASE
577	0.175	−2.33	26.60	0.84	0.10	0.10	0.04	0.10	0.11	0.03	0.02	MAG
				283.79	148.57	172.58	129.51	32.53	153.59	133.67	163.50	PHASE
580	0.175	−2.33	26.60	0.82	0.11	0.08	0.07	0.12	0.14	0.06	0.02	MAG
				284.22	147.75	162.95	131.78	28.28	135.69	115.13	12.43	PHASE
588	0.200	−2.98	27.00	0.82	0.14	0.12	0.05	0.07	0.03	0.01	0.06	MAG
				281.91	202.89	180.98	172.19	36.17	161.55	165.24	299.46	PHASE

Table VII. Continued

(i) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	26.98	0.80	0.13	0.12	0.05	0.08	0.03	0.01	0.02	MAG
				284.04	203.18	190.66	177.74	42.66	206.18	160.54	25.61	PHASE
611	0.225	−3.82	27.52	0.88	0.26	0.17	0.07	0.08	0.04	0.02	0.04	MAG
				286.45	221.39	199.42	216.20	60.50	120.57	178.62	268.97	PHASE
614	0.225	−3.82	27.51	0.88	0.27	0.19	0.08	0.08	0.04	0.03	0.01	MAG
				287.46	219.68	195.84	223.40	54.03	109.54	156.25	288.95	PHASE
625	0.250	−4.66	27.66	0.99	0.52	0.16	0.08	0.06	0.03	0.05	0.04	MAG
				298.42	226.03	194.93	214.86	73.24	101.53	189.84	238.58	PHASE
628	0.250	−4.66	27.66	1.06	0.54	0.16	0.09	0.06	0.05	0.04	0.02	MAG
				296.47	232.74	199.37	224.72	67.60	130.06	227.09	15.77	PHASE
634	0.275	−5.67	27.76	1.08	0.74	0.18	0.08	0.05	0.06	0.04	0.02	MAG
				299.65	238.01	211.69	230.54	70.35	160.88	213.06	218.35	PHASE
639	0.275	−5.67	27.91	1.03	0.80	0.15	0.07	0.05	0.07	0.06	0.02	MAG
				298.44	231.42	197.00	232.64	76.16	152.65	188.06	216.78	PHASE
645	0.300	−6.69	27.97	1.07	0.97	0.20	0.10	0.08	0.09	0.05	0.04	MAG
				299.24	233.68	200.40	251.34	98.10	142.27	188.08	167.84	PHASE
649	0.300	−6.69	27.97	1.04	1.00	0.20	0.09	0.06	0.09	0.06	0.03	MAG
				305.97	234.77	204.21	247.28	95.99	138.70	185.01	206.38	PHASE
655	0.325	−7.78	28.21	1.22	1.29	0.25	0.15	0.08	0.09	0.06	0.01	MAG
				305.81	236.48	203.98	261.15	75.01	141.26	193.58	99.88	PHASE
659	0.325	−7.78	28.23	1.20	1.25	0.24	0.12	0.08	0.10	0.05	0.04	MAG
				302.64	236.73	205.05	260.86	86.99	137.13	190.28	111.29	PHASE
670	0.350	−9.08	28.81	1.37	1.60	0.28	0.18	0.09	0.15	0.05	0.08	MAG
				313.02	233.57	197.80	261.84	62.39	119.42	129.40	102.20	PHASE
672	0.350	−9.08	28.82	1.35	1.60	0.28	0.17	0.10	0.13	0.05	0.08	MAG
				306.36	239.56	204.74	275.48	79.19	134.26	170.28	159.72	PHASE

Table VII. Continued

(j) Hub chordwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
527	0.060	−0.30	39.68	20.07	1.24	2.87	1.89	2.02	0.93	0.32	0.65	MAG
				291.39	66.56	103.81	103.24	326.16	136.87	8.19	329.27	PHASE
530	0.060	−0.30	39.43	20.78	1.28	3.62	2.45	2.19	1.63	0.50	0.73	MAG
				290.18	74.27	108.86	109.21	332.15	150.23	67.87	285.30	PHASE
538	0.070	−0.75	35.78	21.13	1.51	4.40	2.78	1.75	2.97	0.52	0.54	MAG
				288.53	77.75	109.17	104.70	330.83	151.38	78.48	134.71	PHASE
541	0.070	−0.75	36.03	21.33	1.58	4.39	2.85	1.91	2.95	0.35	1.02	MAG
				288.31	75.19	105.44	101.04	325.81	143.42	62.26	352.99	PHASE
547	0.100	−0.75	30.48	19.25	1.89	4.10	2.58	1.42	2.99	0.21	0.46	MAG
				293.01	95.53	112.04	120.47	342.18	157.72	72.24	332.40	PHASE
550	0.100	−0.75	30.73	19.73	1.84	4.18	2.59	1.52	3.28	0.19	0.69	MAG
				290.69	97.35	111.15	116.12	338.87	155.22	109.74	321.86	PHASE
559	0.125	−1.21	30.26	19.74	2.06	3.30	1.96	1.23	2.11	0.08	0.79	MAG
				293.02	90.42	109.58	118.23	351.35	144.85	143.30	326.71	PHASE
562	0.125	−1.21	30.56	20.08	2.09	3.37	2.04	1.28	2.05	0.39	0.69	MAG
				294.34	90.33	111.04	121.34	357.09	147.92	142.00	215.25	PHASE
568	0.150	−1.70	29.56	19.01	1.96	2.70	1.42	1.03	2.09	0.08	0.36	MAG
				296.29	91.25	125.61	139.66	349.15	161.76	49.81	66.59	PHASE
571	0.150	−1.70	29.34	19.05	1.97	2.72	1.52	1.01	1.97	0.07	0.57	MAG
				297.14	92.00	126.32	141.15	357.15	163.32	133.21	175.08	PHASE
577	0.175	−2.33	29.40	18.93	1.81	2.02	0.99	0.74	1.89	0.07	0.01	MAG
				301.23	94.26	142.10	151.14	18.76	167.25	63.72	19.33	PHASE
580	0.175	−2.33	29.52	18.82	1.79	2.09	1.01	0.82	2.00	0.14	0.95	MAG
				298.34	92.30	137.96	142.13	7.08	155.29	73.00	354.41	PHASE
588	0.200	−2.98	32.03	19.83	1.53	1.89	0.85	0.35	1.08	0.19	1.38	MAG
				303.99	93.45	160.12	171.59	49.93	142.59	295.70	300.74	PHASE

Table VII. Concluded

(j) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
591	0.200	−2.98	32.08	19.67	1.55	1.88	0.85	0.41	0.96	0.09	0.22	MAG
				303.96	95.27	168.06	175.57	49.26	164.24	328.50	16.82	PHASE
611	0.225	−3.82	34.50	20.68	1.35	2.23	1.22	0.50	1.18	0.21	0.96	MAG
				309.51	113.71	193.20	214.48	66.81	145.08	174.13	280.88	PHASE
614	0.225	−3.82	34.47	20.32	1.39	2.28	1.25	0.35	1.18	0.21	0.14	MAG
				307.85	115.20	191.46	210.04	66.95	143.21	188.61	7.83	PHASE
625	0.250	−4.66	39.78	22.77	1.30	2.20	1.46	0.63	1.16	0.42	0.51	MAG
				313.43	149.30	196.48	223.74	77.31	121.87	189.81	258.11	PHASE
628	0.250	−4.66	39.90	22.79	1.79	2.01	1.64	0.70	1.13	0.25	0.89	MAG
				316.82	156.55	210.21	226.84	74.73	134.48	188.35	45.47	PHASE
634	0.275	−5.67	43.93	23.96	1.87	2.50	1.30	0.58	1.02	0.31	0.25	MAG
				321.16	178.46	224.65	237.63	87.40	126.57	210.00	103.10	PHASE
639	0.275	−5.67	45.30	24.91	2.07	2.29	1.07	0.61	1.05	0.57	0.17	MAG
				319.41	182.62	219.76	232.78	56.41	109.73	180.10	355.76	PHASE
645	0.300	−6.69	48.86	25.73	2.53	2.58	1.44	0.73	1.13	0.27	0.16	MAG
				320.81	201.83	229.88	245.85	74.88	96.69	183.86	162.51	PHASE
649	0.300	−6.69	48.81	25.18	2.64	2.60	1.39	0.75	1.18	0.21	0.25	MAG
				322.20	202.72	232.77	245.58	71.80	102.01	178.21	336.48	PHASE
655	0.325	−7.78	54.66	26.98	3.78	3.01	1.92	1.51	1.09	0.19	0.94	MAG
				324.62	218.18	241.02	253.85	60.53	72.46	185.41	28.51	PHASE
659	0.325	−7.78	54.64	27.26	3.67	3.07	1.79	1.51	1.03	0.13	0.75	MAG
				325.91	217.21	240.74	250.90	65.24	72.94	288.18	66.93	PHASE
670	0.350	−9.08	65.55	33.49	4.95	3.32	2.32	1.67	1.02	0.29	0.79	MAG
				327.73	217.87	247.79	258.36	50.19	63.77	186.51	65.60	PHASE
672	0.350	−9.08	65.94	33.97	5.03	3.34	2.28	1.67	0.91	0.45	0.99	MAG
				330.58	224.16	255.69	272.64	66.42	90.49	206.94	154.32	PHASE

Table VIII. Harmonic Components of Vibratory Loads for -200 Blades With Small Shear Pads

(a) Normal force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	65.09	1.28	0.63	0.09	5.57	0.80	0.62	0.39	0.79	MAG
				107.56	54.09	309.83	153.16	153.61	307.83	339.84	245.58	PHASE
257	0.070	−0.30	65.68	2.03	0.65	0.32	6.15	0.68	0.99	0.04	1.10	MAG
				103.58	44.18	326.57	149.92	166.31	297.96	163.22	158.57	PHASE
265	0.060	−0.30	65.71	2.05	0.59	0.51	6.75	0.80	0.75	0.61	1.79	MAG
				115.42	29.40	335.61	153.76	200.53	276.59	40.89	230.64	PHASE
273	0.070	−0.30	66.89	2.04	0.46	0.32	6.90	0.89	0.74	0.41	1.48	MAG
				124.71	36.69	345.41	152.46	191.59	281.69	68.37	234.49	PHASE
290	0.100	−0.75	66.09	1.40	0.55	0.53	7.19	1.22	0.94	0.35	6.52	MAG
				129.68	354.05	332.98	165.16	187.17	260.42	42.99	228.28	PHASE
293	0.100	−0.75	66.79	1.57	0.59	0.58	7.17	1.54	0.95	0.36	6.43	MAG
				135.17	351.76	335.77	161.54	187.41	243.57	31.77	218.35	PHASE
300	0.125	−1.21	66.04	2.78	1.14	0.55	4.91	1.34	0.77	0.28	3.09	MAG
				119.28	345.29	332.70	183.16	200.84	268.60	40.32	210.94	PHASE
303	0.125	−1.21	66.11	2.76	0.93	0.43	4.93	1.23	0.70	0.15	3.32	MAG
				121.70	351.09	335.56	185.82	206.46	268.23	340.88	208.83	PHASE
319	0.150	−1.70	66.64	2.53	1.10	0.51	3.68	0.97	1.66	0.09	1.44	MAG
				135.73	352.72	301.90	211.15	220.42	286.94	35.40	234.72	PHASE
322	0.150	−1.70	66.68	2.67	1.16	0.50	3.58	0.97	1.64	0.12	1.44	MAG
				138.15	351.45	292.63	213.41	219.71	286.81	258.75	234.29	PHASE
327	0.175	−2.33	66.74	3.97	1.55	0.47	3.00	1.09	1.33	0.09	1.14	MAG
				133.98	355.70	298.23	237.54	220.86	284.92	246.63	156.05	PHASE
330	0.175	−2.33	67.41	4.03	1.22	0.38	2.92	1.13	1.61	0.11	1.06	MAG
				132.34	353.34	292.95	245.02	241.17	295.52	26.44	169.92	PHASE
354	0.200	−2.98	67.65	5.70	2.35	0.50	1.43	0.82	0.51	0.38	2.73	MAG
				86.17	324.02	321.59	285.33	248.02	221.78	290.20	291.48	PHASE

Table VIII. Continued

(a) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
357	0.200	−2.98	68.34	5.82	2.83	0.74	1.48	0.71	0.62	0.08	2.20	MAG
				82.86	320.91	303.32	279.78	251.84	222.91	232.71	277.59	PHASE
364	0.225	−3.82	68.36	6.99	2.56	0.67	2.18	0.97	0.99	0.12	1.29	MAG
				95.45	325.54	327.37	310.95	254.92	187.69	250.63	247.07	PHASE
367	0.225	−3.82	67.51	6.87	2.53	0.49	2.41	0.97	1.05	0.32	1.56	MAG
				99.06	317.93	330.63	300.40	250.84	186.19	312.19	252.31	PHASE
384	0.250	−4.66	69.65	8.61	1.74	0.84	3.62	0.17	1.14	0.63	1.88	MAG
				105.82	347.70	292.75	344.09	251.16	185.10	306.06	217.39	PHASE
387	0.250	−4.66	69.62	8.52	2.11	0.47	3.62	0.21	1.23	0.50	1.81	MAG
				108.13	344.37	294.10	342.54	232.42	196.12	305.27	223.92	PHASE
396	0.275	−5.67	69.88	10.23	2.34	1.12	5.19	0.77	1.26	0.65	0.91	MAG
				99.19	1.72	265.46	348.51	68.94	145.01	324.14	207.55	PHASE
399	0.275	−5.67	69.87	10.32	2.63	1.05	5.07	0.78	1.03	0.48	0.98	MAG
				105.37	7.36	269.77	0.63	80.20	174.44	327.69	238.63	PHASE
406	0.300	−6.69	70.23	11.85	1.02	1.58	8.07	0.91	0.58	0.76	0.46	MAG
				112.57	32.50	259.08	14.28	67.36	131.54	24.70	76.61	PHASE
410	0.300	−6.69	69.75	11.87	1.00	1.32	8.22	0.86	0.51	0.89	0.08	MAG
				107.12	11.49	251.26	351.90	52.37	93.83	351.70	163.45	PHASE
424	0.325	−7.78	70.29	11.56	1.41	2.11	10.21	3.71	1.94	1.55	3.23	MAG
				118.47	66.08	273.20	358.34	90.06	82.73	323.25	295.50	PHASE
427	0.325	−7.78	70.32	12.31	0.68	2.84	10.40	4.03	2.02	1.71	2.90	MAG
				115.55	76.52	264.52	358.60	79.09	61.63	307.48	303.12	PHASE
434	0.350	−9.08	70.37	13.58	1.26	3.66	12.75	2.40	1.86	0.49	5.52	MAG
				117.24	63.74	262.45	345.97	105.64	125.01	309.40	263.03	PHASE
437	0.350	−9.08	70.08	12.90	2.15	3.70	12.91	2.46	2.09	0.82	5.89	MAG
				120.01	56.42	257.01	341.53	113.45	120.04	317.10	251.66	PHASE

Table VIII. Continued

(b) Axial force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	−1.29	3.73	1.11	0.07	1.08	0.70	2.72	0.54	0.76	MAG
				273.94	212.12	235.41	91.38	323.33	55.66	91.11	102.66	PHASE
257	0.070	−0.30	−0.30	3.67	1.06	0.06	1.27	0.50	2.81	0.08	0.73	MAG
				271.35	201.28	328.73	74.87	347.51	34.64	120.23	91.37	PHASE
265	0.060	−0.30	1.72	3.74	0.84	0.39	1.34	0.70	2.82	0.43	0.40	MAG
				272.59	210.55	15.83	82.48	19.93	46.95	144.88	128.61	PHASE
273	0.070	−0.30	2.34	3.82	0.87	0.28	1.29	0.71	2.59	0.24	0.36	MAG
				273.78	216.83	358.53	79.32	354.70	58.74	110.75	150.57	PHASE
290	0.100	−0.75	0.12	3.90	1.01	0.37	1.81	0.60	3.34	0.66	0.75	MAG
				274.00	219.41	1.38	88.59	13.83	34.39	100.54	291.10	PHASE
293	0.100	−0.75	0.14	3.97	1.00	0.42	1.79	1.01	3.07	0.70	0.64	MAG
				272.02	221.03	5.78	80.42	9.25	19.79	107.15	284.67	PHASE
300	0.125	−1.21	−1.28	3.76	0.94	0.40	1.40	0.79	2.88	0.88	0.26	MAG
				274.88	228.48	329.61	98.79	1.81	53.10	107.89	201.51	PHASE
303	0.125	−1.21	−1.54	3.83	1.14	0.38	1.59	0.75	2.52	0.64	0.57	MAG
				276.79	227.66	323.57	99.32	24.45	49.09	93.37	197.89	PHASE
319	0.150	−1.70	−5.06	3.81	1.24	0.49	1.49	0.46	4.63	0.12	0.94	MAG
				274.68	236.50	289.61	120.18	7.62	64.18	348.61	180.29	PHASE
322	0.150	−1.70	−5.22	3.78	1.24	0.52	1.52	0.35	4.72	0.02	0.85	MAG
				275.99	235.65	301.05	125.76	349.93	64.57	33.46	175.45	PHASE
327	0.175	−2.33	−7.03	3.66	1.38	0.39	1.33	0.74	3.65	0.36	1.70	MAG
				275.42	243.21	292.67	136.11	34.02	58.48	104.42	237.26	PHASE
330	0.175	−2.33	−6.77	3.66	1.41	0.46	1.42	0.71	3.81	0.24	1.47	MAG
				277.30	245.26	311.96	146.64	54.09	71.74	140.67	257.81	PHASE
354	0.200	−2.98	−8.29	2.26	1.44	0.57	1.02	0.58	2.14	0.26	0.29	MAG
				303.16	248.72	320.58	193.20	43.68	355.91	167.08	59.31	PHASE

Table VIII. Continued

(b) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
357	0.200	−2.98	−7.25	2.04	1.41	0.65	1.18	0.31	2.57	0.19	0.93	MAG
				298.53	245.47	308.59	180.98	22.30	354.81	145.51	304.23	PHASE
364	0.225	−3.82	−8.67	1.97	1.36	0.69	1.25	0.66	3.36	0.33	0.46	MAG
				296.20	249.44	319.43	202.33	52.07	344.44	58.36	256.33	PHASE
367	0.225	−3.82	−8.78	1.91	1.48	0.53	1.08	0.71	3.86	0.27	0.12	MAG
				297.35	245.54	310.52	197.30	58.26	339.11	90.96	332.18	PHASE
384	0.250	−4.66	−13.74	1.73	1.94	1.10	1.10	0.36	4.15	1.07	0.62	MAG
				298.84	256.67	290.49	187.68	59.07	344.81	19.30	247.87	PHASE
387	0.250	−4.66	−13.14	1.73	1.96	0.63	1.10	0.47	4.04	0.92	0.61	MAG
				295.74	260.06	292.71	199.19	24.72	348.62	29.53	299.88	PHASE
396	0.275	−5.67	−15.69	1.50	1.97	1.04	1.31	0.27	3.53	1.10	0.34	MAG
				297.36	249.68	281.01	218.38	249.05	329.45	338.69	199.02	PHASE
399	0.275	−5.67	−15.83	1.35	1.91	1.19	1.26	0.51	3.49	0.93	0.94	MAG
				299.41	254.52	295.32	226.85	240.01	349.70	11.66	166.93	PHASE
406	0.300	−6.69	−19.38	1.24	2.57	1.52	1.48	0.54	1.53	0.31	1.01	MAG
				296.78	262.38	280.49	239.32	247.01	347.78	294.77	238.87	PHASE
410	0.300	−6.69	−19.94	1.16	2.47	1.41	1.58	0.55	1.18	0.66	0.37	MAG
				286.95	252.75	283.51	220.47	201.40	334.27	309.66	178.47	PHASE
424	0.325	−7.78	−24.31	1.08	2.88	1.81	2.12	2.38	3.97	2.57	3.34	MAG
				278.76	259.76	305.44	216.55	285.42	293.28	358.86	257.71	PHASE
427	0.325	−7.78	−23.63	1.02	2.97	2.50	1.90	2.03	3.83	2.05	3.18	MAG
				281.31	254.58	287.52	215.65	276.72	279.50	347.43	259.30	PHASE
434	0.350	−9.08	−26.36	0.83	3.34	3.47	2.36	3.57	4.56	3.53	5.12	MAG
				267.49	257.72	288.87	205.86	296.55	282.72	15.70	256.68	PHASE
437	0.350	−9.08	−26.66	0.89	3.04	3.03	2.36	4.12	5.54	4.06	5.74	MAG
				265.72	253.99	281.10	203.09	292.17	278.72	12.92	257.86	PHASE

Table VIII. Continued

(c) Pitching moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	−29.02	264.02	19.30	3.21	36.90	1.07	6.85	2.82	5.48	MAG
				291.73	218.06	159.39	196.18	17.89	89.25	50.03	64.31	PHASE
257	0.070	−0.30	−44.39	262.20	18.20	2.89	40.32	2.96	7.56	3.46	4.21	MAG
				289.26	211.23	15.45	188.44	37.88	55.69	248.21	31.54	PHASE
265	0.060	−0.30	−75.23	263.05	15.84	13.25	44.47	2.05	7.26	2.04	7.51	MAG
				291.18	218.04	20.47	191.87	66.23	75.95	152.71	36.04	PHASE
273	0.070	−0.30	−64.40	262.10	15.68	10.30	42.85	2.21	6.86	2.25	7.71	MAG
				291.40	217.29	27.86	190.23	40.35	79.85	136.99	33.26	PHASE
290	0.100	−0.75	−46.96	268.65	25.26	15.35	45.12	3.23	8.65	2.87	21.61	MAG
				291.61	222.22	16.49	203.00	57.51	57.82	112.10	27.75	PHASE
293	0.100	−0.75	−41.86	267.36	25.27	16.53	43.65	4.32	8.04	0.48	21.15	MAG
				289.89	223.74	13.14	199.33	38.38	44.88	45.25	19.81	PHASE
300	0.125	−1.21	−20.25	263.87	27.00	14.41	34.17	2.98	7.21	4.44	11.22	MAG
				291.58	236.15	335.76	224.15	28.84	82.78	123.55	24.31	PHASE
303	0.125	−1.21	−16.42	265.69	30.70	10.63	33.63	4.29	5.96	3.99	11.78	MAG
				292.19	236.00	338.95	221.53	53.60	82.96	163.44	23.04	PHASE
319	0.150	−1.70	2.64	265.45	33.44	14.11	28.26	3.22	11.63	3.14	7.22	MAG
				292.23	235.78	292.19	245.30	68.04	90.09	104.24	38.52	PHASE
322	0.150	−1.70	−17.60	265.94	31.07	13.27	29.27	2.47	11.75	1.04	7.11	MAG
				292.37	238.89	296.36	244.80	73.46	91.56	212.55	43.61	PHASE
327	0.175	−2.33	−85.69	264.87	35.89	14.52	28.43	3.28	7.96	1.44	8.51	MAG
				291.75	245.49	294.49	267.28	68.13	82.07	176.10	20.36	PHASE
330	0.175	−2.33	−101.13	264.70	36.20	12.85	26.97	3.63	9.88	2.67	6.41	MAG
				293.67	246.52	312.66	271.77	76.79	90.24	99.98	33.55	PHASE
354	0.200	−2.98	−5.37	196.72	46.40	17.98	24.39	1.87	4.28	1.70	11.69	MAG
				316.91	248.02	333.90	293.71	67.24	34.08	12.15	97.95	PHASE

Table VIII. Continued

(c) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
357	0.200	−2.98	11.65	193.30	44.84	25.01	23.51	1.36	5.23	1.29	9.34	MAG
				314.93	249.38	314.77	284.55	134.13	21.77	201.41	87.64	PHASE
364	0.225	−3.82	21.60	187.13	41.20	25.10	28.34	1.41	6.12	3.08	4.54	MAG
				315.08	246.45	328.08	305.08	91.50	3.76	44.78	96.23	PHASE
367	0.225	−3.82	−4.35	188.05	44.72	18.08	30.25	1.70	9.44	1.57	4.44	MAG
				314.04	244.92	319.20	303.08	88.78	358.35	104.18	70.31	PHASE
384	0.250	−4.66	−17.43	178.93	48.95	36.75	34.57	1.60	8.77	6.52	4.41	MAG
				313.26	254.12	298.71	343.42	89.30	8.40	86.48	47.85	PHASE
387	0.250	−4.66	−40.49	178.17	48.27	20.65	37.87	1.55	9.90	5.86	4.19	MAG
				312.86	262.49	300.19	339.16	73.19	14.23	132.50	42.17	PHASE
396	0.275	−5.67	−18.38	167.71	50.79	36.84	44.80	1.94	6.36	4.21	5.32	MAG
				310.43	250.34	283.32	338.67	247.36	355.54	56.20	9.50	PHASE
399	0.275	−5.67	−19.36	165.88	51.85	39.82	42.29	2.24	7.87	4.98	7.19	MAG
				313.96	252.63	299.17	349.70	184.01	6.27	75.11	46.81	PHASE
406	0.300	−6.69	−8.01	154.71	63.41	53.48	61.61	3.16	3.63	1.15	8.68	MAG
				312.89	262.02	284.56	18.77	203.48	5.20	358.35	31.70	PHASE
410	0.300	−6.69	−4.09	158.55	59.57	47.50	61.56	3.73	4.01	5.45	10.87	MAG
				307.79	253.73	281.55	354.13	199.01	7.69	34.57	10.08	PHASE
424	0.325	−7.78	−38.56	143.14	60.16	69.70	83.91	5.15	7.74	11.30	17.64	MAG
				304.92	263.05	306.17	11.73	252.74	310.13	61.53	55.58	PHASE
427	0.325	−7.78	−27.46	140.49	64.99	94.95	86.98	4.18	6.23	12.02	15.63	MAG
				305.20	256.59	288.83	10.53	254.88	288.56	64.58	51.57	PHASE
434	0.350	−9.09	−25.65	133.64	72.48	127.83	110.61	7.32	7.48	21.41	43.70	MAG
				300.95	255.99	286.19	3.28	271.66	306.64	76.97	41.85	PHASE
437	0.350	−9.08	−20.24	137.63	63.04	116.93	111.39	9.31	11.28	14.55	47.45	MAG
				299.41	253.72	278.70	357.78	281.39	298.81	59.41	31.37	PHASE

Table VIII. Continued

(d) Rolling moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	−51.64	239.46	32.90	9.80	322.81	9.10	8.00	4.72	1.25	MAG
				201.24	130.51	207.53	167.66	115.18	304.13	20.11	270.11	PHASE
257	0.070	−0.30	−33.36	237.25	31.62	12.56	336.47	4.40	11.26	5.37	1.67	MAG
				199.62	125.65	185.50	159.63	37.98	293.47	317.78	187.09	PHASE
265	0.060	−0.30	13.10	238.11	28.05	9.72	345.18	8.46	10.39	2.84	2.25	MAG
				201.78	126.87	193.00	166.39	92.30	309.92	25.10	309.88	PHASE
273	0.070	−0.30	27.47	237.05	27.64	12.60	317.60	6.16	9.42	2.86	2.14	MAG
				201.74	125.81	186.02	169.91	46.22	311.40	101.11	61.28	PHASE
290	0.100	−0.75	−22.25	242.44	28.16	11.29	459.64	10.96	10.81	4.69	8.75	MAG
				202.45	139.36	202.86	173.34	8.18	301.19	46.65	285.99	PHASE
293	0.100	−0.75	−20.08	241.45	29.88	11.10	460.90	10.54	9.85	6.32	8.89	MAG
				200.37	137.13	191.22	169.87	3.14	296.79	26.72	278.75	PHASE
300	0.125	−1.21	−42.08	239.11	28.31	12.99	381.50	12.88	8.45	3.89	6.01	MAG
				202.58	136.67	234.80	180.48	348.86	277.20	54.60	285.23	PHASE
303	0.125	−1.21	−44.69	241.41	29.49	16.98	377.00	10.86	7.30	1.96	3.76	MAG
				203.03	137.87	229.59	181.73	346.67	288.03	37.18	294.88	PHASE
319	0.150	−1.70	−25.85	246.04	29.77	20.58	379.18	14.18	12.37	4.13	7.71	MAG
				202.99	143.18	214.38	197.08	19.36	298.99	22.22	292.71	PHASE
322	0.150	−1.70	−32.02	245.90	29.61	20.15	387.57	12.19	12.69	1.67	6.40	MAG
				203.11	140.61	217.51	198.49	16.63	297.58	308.50	294.76	PHASE
327	0.175	−2.33	−69.95	246.47	32.36	14.65	369.19	15.24	15.16	2.97	7.96	MAG
				202.82	147.49	217.51	213.08	44.54	300.45	21.51	331.42	PHASE
330	0.175	−2.33	−88.53	248.20	32.99	15.46	370.91	13.44	14.78	4.40	8.21	MAG
				204.40	152.53	226.43	221.38	53.84	312.01	61.41	340.51	PHASE
354	0.200	−2.98	−38.36	186.78	32.22	16.33	256.83	14.69	4.72	2.14	3.55	MAG
				225.79	166.45	254.71	246.18	91.94	273.28	36.89	36.12	PHASE

Table VIII. Continued

(d) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
357	0.200	−2.98	−20.27	183.93	32.57	16.87	250.04	11.10	5.97	0.86	1.99	MAG
				224.08	162.96	257.00	239.35	84.41	269.63	62.91	174.31	PHASE
364	0.225	−3.82	−11.94	181.92	25.40	17.99	267.81	15.90	6.85	5.86	4.69	MAG
				224.68	167.75	256.66	262.36	110.52	236.53	54.68	124.65	PHASE
367	0.225	−3.82	−22.72	182.83	28.35	16.07	267.06	14.60	7.66	1.71	2.26	MAG
				222.35	158.45	246.21	257.35	103.81	233.76	23.10	33.54	PHASE
384	0.250	−4.66	−40.75	175.55	45.15	18.75	245.73	22.26	8.34	2.91	5.64	MAG
				222.02	184.71	240.89	295.84	139.80	238.01	55.27	147.12	PHASE
387	0.250	−4.66	−16.33	170.54	40.03	19.63	241.06	21.22	8.17	1.31	6.10	MAG
				222.65	183.71	245.06	294.07	140.36	239.93	152.35	164.57	PHASE
396	0.275	−5.67	−7.91	165.16	41.12	22.82	317.60	24.08	7.93	3.84	3.44	MAG
				219.21	176.33	246.53	308.93	148.96	220.33	167.90	149.07	PHASE
399	0.275	−5.67	−7.79	173.29	37.06	26.15	305.93	26.16	6.16	2.28	4.75	MAG
				224.32	185.55	252.23	322.72	162.05	225.61	82.03	82.92	PHASE
406	0.300	−6.69	35.71	156.64	51.30	30.04	400.39	28.04	3.02	5.26	1.09	MAG
				222.79	185.64	276.87	348.47	183.75	244.62	196.90	271.66	PHASE
410	0.300	−6.69	40.68	157.64	51.13	26.51	394.13	26.77	2.67	4.23	2.06	MAG
				216.49	175.86	252.57	325.29	163.41	225.79	123.63	283.29	PHASE
424	0.325	−7.78	22.17	148.38	72.62	16.13	477.19	42.63	11.38	5.80	8.77	MAG
				215.86	180.62	277.49	359.14	218.95	147.10	305.18	273.71	PHASE
427	0.325	−7.78	58.36	150.98	68.89	21.66	478.54	43.50	9.73	0.98	9.77	MAG
				216.51	175.80	274.18	356.41	214.54	127.89	172.34	279.39	PHASE
434	0.350	−9.08	95.05	146.28	88.39	23.27	571.67	36.59	22.41	7.35	3.84	MAG
				212.36	180.64	262.93	3.75	224.65	156.33	15.99	189.23	PHASE
437	0.350	−9.08	100.38	147.03	84.69	26.10	576.60	41.16	22.41	16.02	1.22	MAG
				209.00	177.87	268.70	1.80	216.56	159.40	320.25	225.31	PHASE

Table VIII. Continued

(e) Yawing moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	251.25	50.50	4.04	2.88	233.20	3.39	1.14	1.55	1.33	MAG
				28.23	323.89	350.55	329.51	321.42	192.77	84.37	293.95	PHASE
257	0.070	−0.30	277.43	57.04	2.99	4.70	240.62	2.22	1.99	1.44	1.33	MAG
				19.84	325.66	21.10	320.11	36.55	161.68	251.57	239.28	PHASE
265	0.060	−0.30	362.40	50.37	4.34	1.06	239.37	3.03	0.62	0.97	0.74	MAG
				23.69	347.97	356.16	325.68	316.07	177.55	154.04	305.03	PHASE
273	0.070	−0.30	396.36	54.39	4.69	3.37	230.08	4.50	1.69	0.71	1.52	MAG
				24.44	359.04	48.21	328.05	314.28	142.35	23.64	358.59	PHASE
290	0.100	−0.75	286.49	55.10	5.55	1.78	305.80	4.40	1.91	1.02	3.04	MAG
				23.88	350.19	318.14	331.03	330.36	117.61	131.24	250.62	PHASE
293	0.100	−0.75	294.76	54.67	5.58	1.66	304.93	6.24	1.38	1.06	3.20	MAG
				21.18	354.21	283.15	327.36	344.40	151.25	118.40	244.75	PHASE
300	0.125	−1.21	285.14	55.87	6.43	0.57	253.12	7.10	1.27	2.55	1.44	MAG
				23.46	356.18	12.04	338.91	40.72	146.62	165.14	255.43	PHASE
303	0.125	−1.21	286.52	54.38	6.37	2.32	251.77	8.46	0.47	0.61	0.78	MAG
				22.67	359.69	78.77	340.39	30.45	205.96	167.18	236.60	PHASE
319	0.150	−1.70	180.87	54.76	8.37	6.13	245.90	3.05	1.50	1.86	1.47	MAG
				19.32	3.75	27.12	354.75	136.68	187.70	171.70	237.18	PHASE
322	0.150	−1.70	184.36	52.68	5.72	4.48	252.36	4.29	2.44	2.54	2.90	MAG
				23.06	16.67	4.87	356.07	124.12	200.93	68.13	220.11	PHASE
327	0.175	−2.33	186.72	49.62	8.56	4.31	240.71	2.22	1.45	1.55	3.10	MAG
				18.80	15.28	25.70	9.95	200.70	174.24	214.07	205.93	PHASE
330	0.175	−2.33	189.82	45.47	7.49	5.82	242.83	1.08	0.55	2.32	2.12	MAG
				22.19	20.65	34.84	17.60	192.64	193.28	180.64	284.40	PHASE
354	0.200	−2.98	215.70	33.16	12.83	4.38	162.47	8.36	3.41	1.73	0.73	MAG
				46.46	4.29	63.09	42.42	249.36	60.46	263.24	20.09	PHASE

Table VIII. Continued

(e) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
357	0.200	−2.98	242.57	33.96	10.51	4.04	160.22	4.24	1.32	1.21	0.96	MAG
				42.05	5.85	53.11	34.74	258.95	87.93	213.07	301.04	PHASE
364	0.225	−3.82	311.23	27.49	10.72	4.13	167.11	7.41	1.27	1.41	1.33	MAG
				36.09	16.28	43.77	57.17	279.39	100.82	271.29	18.77	PHASE
367	0.225	−3.82	319.02	27.73	9.98	4.69	164.07	7.55	4.35	0.96	0.67	MAG
				45.10	21.42	41.75	52.47	274.82	60.69	136.40	25.12	PHASE
384	0.250	−4.66	229.80	29.07	12.34	9.38	167.50	16.01	3.79	2.30	0.26	MAG
				37.38	20.03	51.42	84.38	288.65	134.39	240.25	355.90	PHASE
387	0.250	−4.66	230.86	35.78	14.04	8.39	169.16	15.64	3.97	0.25	0.67	MAG
				35.39	19.40	35.44	84.13	297.50	103.12	265.32	113.89	PHASE
396	0.275	−5.67	271.94	19.26	16.68	5.24	204.32	16.83	3.67	1.00	1.82	MAG
				31.91	19.62	47.01	96.46	292.03	57.91	333.19	106.29	PHASE
399	0.275	−5.67	273.87	13.60	18.03	7.81	204.30	18.37	4.10	0.38	1.12	MAG
				8.65	29.86	75.58	108.54	305.63	77.08	192.26	313.35	PHASE
406	0.300	−6.69	317.20	14.59	19.17	10.79	257.75	22.79	1.13	1.04	2.28	MAG
				28.26	40.63	127.16	132.47	339.83	40.80	238.67	244.41	PHASE
410	0.300	−6.69	316.52	13.67	13.95	7.74	263.92	20.82	1.09	2.27	1.97	MAG
				45.62	24.90	119.52	110.65	310.76	60.02	223.64	175.36	PHASE
424	0.325	−7.78	324.59	10.93	20.76	13.48	348.23	30.19	1.74	1.88	3.08	MAG
				337.50	13.02	150.73	146.23	356.54	338.43	247.99	288.52	PHASE
427	0.325	−7.78	317.44	7.63	27.44	12.37	345.58	28.99	0.68	0.63	5.31	MAG
				258.07	24.37	157.86	143.67	352.53	101.83	243.75	263.28	PHASE
434	0.350	−9.08	371.68	21.42	30.30	17.12	485.39	45.61	2.78	4.56	8.19	MAG
				226.64	17.55	138.94	148.57	356.59	291.21	228.42	198.51	PHASE
437	0.300	−9.08	373.21	18.32	30.36	19.33	484.18	55.47	0.43	1.31	7.54	MAG
				201.02	24.40	141.30	144.17	352.97	340.38	92.51	215.50	PHASE

Table VIII. Continued

(f) Side force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	−7.26	2.15	4.45	3.22	16.09	1.70	3.12	4.69	4.42	MAG
				228.78	45.98	27.36	165.48	198.92	245.74	222.92	329.72	PHASE
257	0.070	−0.30	−5.27	2.65	1.69	3.03	14.39	3.00	0.62	2.65	3.66	MAG
				156.19	121.42	113.74	186.76	1.31	359.10	77.32	215.61	PHASE
265	0.060	−0.30	−6.37	6.36	4.34	4.26	17.73	1.98	1.86	3.29	2.17	MAG
				202.70	221.01	266.82	182.77	218.20	189.37	214.05	154.34	PHASE
273	0.070	−0.30	−3.60	3.23	1.83	1.74	13.42	1.41	0.32	0.85	0.78	MAG
				157.58	163.20	81.43	183.76	327.81	298.16	302.84	121.37	PHASE
290	0.100	−0.75	−6.30	7.32	6.44	1.76	19.30	3.27	1.36	6.03	5.32	MAG
				172.41	56.73	220.99	184.50	272.18	107.18	26.66	245.28	PHASE
293	0.100	−0.75	−4.47	6.54	1.09	1.94	20.81	2.55	3.48	1.62	3.34	MAG
				175.20	140.25	72.63	182.73	72.72	301.51	24.22	159.16	PHASE
300	0.125	−1.21	−5.38	6.30	5.55	2.75	15.47	1.53	3.81	3.00	5.18	MAG
				195.84	127.80	128.79	198.09	348.88	50.44	41.83	245.43	PHASE
303	0.125	−1.21	−7.17	10.68	3.18	5.51	21.42	3.02	0.80	2.72	2.51	MAG
				204.78	171.14	225.99	179.44	88.60	247.64	97.27	359.83	PHASE
319	0.150	−1.70	−4.23	7.55	0.16	1.51	17.09	4.72	2.03	2.38	3.17	MAG
				187.89	142.93	203.28	192.76	70.07	300.85	95.00	351.31	PHASE
322	0.150	−1.70	−4.59	6.10	2.21	2.99	17.72	2.37	5.07	1.95	1.45	MAG
				181.45	255.54	262.02	209.10	337.44	252.38	197.79	282.70	PHASE
327	0.175	−2.33	−0.91	4.82	1.66	0.39	13.63	0.87	1.14	0.33	0.32	MAG
				188.57	144.93	210.82	222.59	36.36	293.80	25.64	231.48	PHASE
330	0.175	−2.33	−0.75	5.08	1.65	0.39	13.63	0.68	1.21	0.31	0.50	MAG
				190.46	151.67	214.42	231.76	45.30	304.82	33.81	241.43	PHASE
354	0.200	−2.98	−1.71	3.26	1.62	0.41	9.42	0.80	0.24	0.14	0.67	MAG
				210.88	164.40	260.02	254.19	87.54	285.46	34.87	282.55	PHASE

Table VIII. Continued

(f) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
357	0.200	−2.98	−1.85	2.99	1.53	0.46	9.18	0.66	0.41	0.13	0.06	MAG
				212.44	162.47	260.15	248.38	68.85	255.85	121.40	66.39	PHASE
364	0.225	−3.82	−2.14	3.18	1.36	0.58	10.00	0.82	0.51	0.20	0.42	MAG
				215.70	164.84	248.68	270.89	102.54	218.57	38.32	351.61	PHASE
367	0.225	−3.82	−2.08	3.44	1.57	0.33	10.06	0.83	0.59	0.15	0.35	MAG
				205.42	153.24	231.76	264.93	100.14	230.08	11.03	234.56	PHASE
384	0.250	−4.66	−1.76	2.89	2.50	0.28	9.35	1.51	0.57	0.79	0.49	MAG
				201.08	182.38	226.48	309.87	133.03	215.14	336.13	64.22	PHASE
387	0.250	−4.66	−1.26	2.41	1.96	0.34	9.00	1.56	0.60	0.14	0.55	MAG
				202.83	180.60	252.45	307.96	132.75	240.75	318.29	120.94	PHASE
396	0.275	−5.67	−1.84	2.72	1.96	0.75	12.92	1.65	0.45	0.15	0.34	MAG
				205.29	171.81	246.73	322.54	132.11	194.52	150.92	102.42	PHASE
399	0.275	−5.67	−1.90	3.82	1.59	0.71	12.53	1.67	0.48	0.20	0.60	MAG
				220.57	178.47	234.05	337.73	153.39	208.58	250.93	222.63	PHASE
406	0.300	−6.69	−1.84	2.67	2.36	0.94	16.84	1.73	0.21	0.36	0.95	MAG
				213.00	178.90	273.62	2.52	185.31	200.99	137.89	195.17	PHASE
410	0.300	−6.69	−2.05	2.97	2.51	0.87	16.13	1.85	0.27	0.43	1.25	MAG
				201.17	178.29	240.81	340.74	155.65	144.37	126.26	190.86	PHASE
424	0.325	−7.78	−1.28	3.11	3.15	0.35	18.22	2.94	1.16	0.55	1.12	MAG
				208.03	182.65	233.84	15.49	209.56	146.85	151.67	263.07	PHASE
427	0.325	−7.78	−0.70	3.49	2.78	0.71	18.33	2.77	1.17	0.61	1.22	MAG
				213.22	165.93	250.72	12.78	203.27	124.83	129.71	225.45	PHASE
434	0.350	−9.08	−0.19	4.05	3.57	0.50	20.33	3.52	2.20	0.75	2.29	MAG
				209.96	176.71	197.98	27.66	213.34	151.28	248.24	239.10	PHASE
437	0.350	−9.08	−0.12	4.29	3.55	0.62	21.40	4.07	2.37	0.75	2.59	MAG
				194.92	170.54	247.76	26.36	206.92	149.18	249.91	218.48	PHASE

Table VIII. Continued

(g) Hub beamwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	22.46	0.39	0.99	0.71	0.40	0.30	0.09	0.04	0.05	MAG
				58.93	296.60	105.78	60.29	127.94	111.38	51.06	268.55	PHASE
257	0.070	−0.30	22.47	0.27	1.01	0.74	0.42	0.34	0.11	0.06	0.06	MAG
				61.00	295.15	101.38	54.42	118.48	99.78	48.34	247.97	PHASE
265	0.060	−0.30	22.13	0.27	1.00	0.76	0.42	0.33	0.12	0.06	0.09	MAG
				118.77	299.92	106.03	67.18	129.56	106.29	44.96	248.10	PHASE
273	0.070	−0.30	22.15	0.16	1.01	0.78	0.44	0.31	0.12	0.57	0.08	MAG
				287.67	304.34	105.82	67.34	147.59	112.94	43.57	254.10	PHASE
319	0.150	−1.70	22.35	0.18	0.73	0.32	0.20	0.27	0.07	0.05	0.05	MAG
				53.94	50.98	127.65	109.39	142.57	114.75	125.64	16.40	PHASE
322	0.150	−1.70	22.35	0.40	0.73	0.32	0.20	0.30	0.08	0.05	0.05	MAG
				68.85	51.49	128.34	108.64	147.65	110.47	116.93	24.28	PHASE
327	0.175	−2.33	22.22	0.19	0.53	0.25	0.15	0.26	0.05	0.02	0.13	MAG
				66.26	70.51	147.46	120.14	168.29	104.09	231.60	92.68	PHASE
330	0.175	−2.33	22.37	0.18	0.46	0.25	0.17	0.20	0.06	0.07	0.09	MAG
				326.54	78.54	159.37	123.15	172.56	21.55	310.74	98.10	PHASE
354	0.200	−2.98	23.47	0.35	0.40	0.25	0.12	0.20	0.07	0.04	0.14	MAG
				49.23	113.87	185.88	136.50	218.48	149.33	264.77	293.95	PHASE
357	0.200	−2.98	23.45	0.30	0.42	0.25	0.14	0.18	0.06	0.04	0.16	MAG
				312.75	107.20	178.07	131.01	217.19	136.73	261.24	276.46	PHASE
364	0.225	−3.82	22.90	0.40	0.68	0.33	0.15	0.24	0.07	0.02	0.08	MAG
				315.91	153.98	195.44	163.04	234.34	153.12	200.18	248.72	PHASE

Table VIII. Continued

(g) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
367	0.225	−3.82	22.84	0.53	0.68	0.33	0.16	0.24	0.07	0.02	0.10	MAG
				2.34	153.33	193.42	162.73	227.74	142.81	200.66	253.35	PHASE
384	0.250	−4.66	23.58	0.47	1.71	0.35	0.22	0.17	0.12	0.04	0.08	MAG
				343.10	187.80	208.78	159.46	260.04	138.32	122.88	226.92	PHASE
387	0.250	−4.66	23.44	0.44	1.66	0.34	0.22	0.16	0.11	0.03	0.09	MAG
				15.02	186.30	208.58	162.67	268.47	139.80	113.37	244.79	PHASE
396	0.275	−5.67	22.90	0.20	2.37	0.39	0.20	0.36	0.10	0.09	0.02	MAG
				337.93	190.30	210.83	163.84	276.39	119.96	78.40	31.71	PHASE
399	0.275	−5.67	22.87	0.60	2.32	0.37	0.19	0.34	0.09	0.10	0.04	MAG
				42.26	195.60	219.38	175.11	290.07	135.20	99.09	23.98	PHASE
406	0.300	−6.69	22.82	0.50	3.71	0.47	0.26	0.51	0.03	0.14	0.16	MAG
				324.19	209.93	233.62	207.68	308.16	160.19	105.83	71.34	PHASE
410	0.300	−6.69	22.74	0.29	3.69	0.50	0.27	0.49	0.03	0.14	0.17	MAG
				22.61	199.02	217.34	191.36	280.58	146.54	73.68	31.91	PHASE
424	0.325	−7.78	23.15	0.52	5.87	0.46	0.37	0.60	0.08	0.15	0.23	MAG
				340.37	212.11	219.81	201.54	299.48	305.00	74.39	47.76	PHASE
427	0.325	- 7.78	23.06	0.35	5.79	0.46	0.39	0.64	0.09	0.26	0.21	MAG
				9.28	210.70	219.58	197.59	293.66	303.10	65.68	39.62	PHASE
434	0.350	−9.08	22.65	0.48	7.29	0.33	0.49	0.70	0.15	0.15	0.21	MAG
				2.89	210.70	210.35	183.80	280.96	245.18	55.72	6.93	PHASE
437	0.350	−9.08	22.67	0.40	7.27	0.32	0.49	0.68	0.17	0.54	0.19	MAG
				339.41	208.64	207.78	179.40	276.35	240.25	46.39	353.18	PHASE

Table VIII. Continued

(h) Hub chordwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	40.05	31.45	1.85	3.64	3.15	4.90	0.57	0.31	0.16	MAG
				284.46	334.20	77.61	77.38	263.42	106.70	46.47	137.20	PHASE
257	0.070	−0.30	39.60	31.38	1.80	3.92	3.06	5.51	0.56	0.28	0.07	MAG
				284.20	335.86	74.14	72.67	253.13	94.32	21.07	215.80	PHASE
265	0.060	−0.30	38.15	31.33	1.76	4.14	2.95	5.64	1.06	0.35	0.39	MAG
				286.14	345.75	79.38	85.60	264.46	111.38	78.37	239.15	PHASE
273	0.070	−0.30	38.04	31.42	2.02	4.37	3.24	5.37	1.02	0.41	0.33	MAG
				287.17	351.77	79.93	81.01	269.81	118.44	107.68	231.40	PHASE
319	0.150	−1.70	27.45	26.92	3.72	2.94	2.00	4.90	0.59	0.28	0.17	MAG
				292.99	68.79	101.06	127.00	329.33	123.73	147.65	15.25	PHASE
322	0.150	−1.70	27.51	26.62	3.62	2.97	1.89	4.74	0.52	0.31	0.20	MAG
				291.24	71.15	102.73	129.56	332.09	146.68	191.65	7.71	PHASE
327	0.175	−2.33	27.20	26.48	3.29	2.51	1.72	3.91	0.49	0.17	0.52	MAG
				294.85	80.89	113.17	147.71	347.03	95.12	215.91	35.52	PHASE
330	0.175	−2.33	27.28	27.04	3.45	2.69	1.77	4.00	0.60	0.41	0.21	MAG
				295.96	84.87	119.10	159.60	353.39	99.95	162.23	58.62	PHASE
354	0.200	−2.98	32.35	29.15	3.13	2.60	1.65	1.95	0.44	0.33	0.89	MAG
				297.24	92.86	145.62	168.01	23.73	103.08	257.85	296.09	PHASE
357	0.200	−2.98	32.11	28.68	3.13	2.58	1.75	1.95	0.43	0.33	0.55	MAG
				297.47	87.33	135.93	159.46	8.15	83.63	218.76	258.84	PHASE
364	0.225	−3.82	33.82	27.77	3.27	2.92	1.90	1.89	0.54	0.23	0.38	MAG
				299.25	109.77	163.22	183.46	57.14	74.04	219.48	312.81	PHASE

Table VIII. Continued

(h) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
367	0.225	−3.82	33.66	27.49	3.13	2.77	1.88	2.02	0.57	0.23	0.78	MAG
				298.67	108.54	160.24	183.35	47.75	71.87	206.51	268.48	PHASE
384	0.250	−4.66	40.73	32.23	4.91	3.97	1.98	2.95	98	0.25	0.12	MAG
				310.26	145.11	194.24	193.00	74.40	[illegible].90	35.07	56.61	PHASE
387	0.250	−4.66	40.39	31.27	4.94	4.08	2.04	2.99	0.99	0.25	0.13	MAG
				309.01	144.46	194.30	192.97	74.47	67.84	213.82	198.30	PHASE
396	0.275	−5.67	44.35	32.38	6.23	5.20	2.12	3.52	1.21	0.33	0.14	MAG
				310.27	156.33	200.03	205.38	84.08	25.36	107.38	92.40	PHASE
399	0.275	−5.67	44.34	32.27	6.21	5.08	2.13	3.47	1.19	0.15	0.49	MAG
				313.07	160.11	209.05	218.85	99.05	48.83	123.14	326.19	PHASE
406	0.300	−6.69	51.04	34.17	9.29	7.67	2.88	6.14	1.66	0.48	0.25	MAG
				320.24	185.55	228.25	241.96	112.47	53.04	132.81	64.62	PHASE
410	0.300	−6.69	51.14	33.93	9.27	7.81	3.01	6.11	1.47	0.56	0.29	MAG
				314.15	174.77	212.82	226.27	85.87	25.07	87.31	342.53	PHASE
424	0.325	−7.78	62.23	38.89	15.66	11.68	4.19	8.96	2.18	0.75	0.26	MAG
				324.81	194.76	237.40	251.63	97.19	26.67	138.69	150.12	PHASE
427	0.325	−7.78	61.70	38.26	15.34	11.48	4.15	9.25	2.10	0.74	0.74	MAG
				323.28	192.98	235.17	247.94	95.20	21.15	127.32	190.21	PHASE
434	0.350	−9.08	71.58	40.96	21.14	14.58	4.70	11.64	3.53	1.08	0.85	MAG
				328.05	194.94	239.93	257.08	85.68	13.34	132.56	217.99	PHASE
437	0.350	−9.08	71.51	41.15	21.18	14.66	4.63	11.32	3.60	1.04	1.04	MAG
				327.50	192.55	236.74	252.20	80.05	8.36	127.34	201.93	PHASE

Table VIII. Continued

(i) Hub beamwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	26.54	0.98	0.32	0.14	0.10	0.20	0.03	0.01	0.02	MAG
				274.76	295.84	95.88	87.10	269.75	43.71	135.83	95.98	PHASE
257	0.070	−0.30	26.52	0.99	0.32	0.16	0.10	0.23	0.03	0.01	0.02	MAG
				272.97	294.66	91.52	82.34	260.84	13.66	215.40	65.71	PHASE
265	0.060	−0.30	26.31	0.98	0.31	0.16	0.09	0.23	0.02	0.02	0.02	MAG
				270.53	300.95	96.44	89.89	272.01	38.15	166.42	67.92	PHASE
273	0.070	−0.30	26.30	1.10	0.32	0.17	0.10	0.21	0.02	0.03	0.02	MAG
				274.36	305.95	97.88	81.07	280.08	43.00	173.61	81.23	PHASE
319	0.150	−1.70	26.06	0.90	0.24	0.07	0.03	0.22	0.01	0.01	0.01	MAG
				275.22	59.66	116.86	134.35	337.55	132.98	208.98	160.79	PHASE
322	0.150	−1.70	26.06	0.83	0.23	0.06	0.03	0.22	0.01	0.01	0.01	MAG
				273.29	59.47	115.17	131.62	339.77	217.32	222.75	209.21	PHASE
327	0.175	−2.33	26.00	0.86	0.18	0.06	0.03	0.20	0.01	0.01	0.03	MAG
				275.44	84.59	136.73	174.16	356.53	43.61	118.41	293.06	PHASE
330	0.175	−2.33	26.03	1.00	0.18	0.06	0.03	0.19	0.01	0.03	0.03	MAG
				277.36	88.53	133.50	170.50	4.75	84.01	127.59	297.25	PHASE
354	0.200	−2.98	26.40	0.93	0.15	0.07	0.03	0.12	0.02	0.01	0.02	MAG
				281.99	122.68	163.88	168.57	31.58	13.77	121.56	89.52	PHASE
357	0.200	−2.98	26.37	1.04	0.15	0.07	0.03	0.12	0.02	0.01	0.04	MAG
				280.40	116.78	157.55	165.66	20.59	352.81	135.41	84.70	PHASE
364	0.225	−3.82	26.20	1.05	0.26	0.11	0.05	0.11	0.03	0.01	0.03	MAG
				282.76	155.83	180.17	203.45	50.77	9.44	63.34	24.95	PHASE

Table VIII. Continued

(i) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
367	0.225	−3.82	26.18	0.96	0.26	0.10	0.06	0.11	0.02	0.10	0.01	MAG
				287.69	155.45	177.46	207.24	44.02	4.67	85.10	7.78	PHASE
384	0.250	−4.66	26.70	1.18	0.59	0.14	0.06	0.13	0.04	0.01	0.03	MAG
				296.22	185.49	188.38	215.90	67.25	10.21	225.43	42.50	PHASE
387	0.250	−4.66	26.63	1.08	0.59	0.15	0.06	0.13	0.04	0.01	0.03	MAG
				296.78	183.51	189.12	215.38	72.04	16.28	264.05	69.12	PHASE
396	0.275	−5.67	26.62	1.13	0.83	0.21	0.07	0.17	0.04	0.02	0.01	MAG
				293.03	187.92	189.48	223.68	77.84	356.44	237.42	230.22	PHASE
399	0.275	−5.67	26.62	1.05	0.81	0.20	0.07	0.16	0.03	0.03	0.02	MAG
				303.25	192.25	196.56	237.32	92.52	13.68	271.81	291.37	PHASE
406	0.300	−6.69	26.93	1.30	1.26	0.32	0.09	0.28	0.04	0.04	0.04	MAG
				304.10	208.48	209.55	270.15	111.31	46.05	276.83	259.08	PHASE
410	0.300	−6.69	26.91	1.15	1.25	0.32	0.09	0.29	0.03	0.03	0.05	MAG
				298.89	197.41	194.74	253.21	87.02	26.71	239.14	221.90	PHASE
424	0.325	−7.78	27.61	1.44	2.04	0.46	0.17	0.43	0.07	0.06	0.08	MAG
				308.64	211.47	212.90	289.90	97.28	78.96	225.76	222.65	PHASE
427	0.325	−7.78	27.57	1.35	2.01	0.45	0.16	0.45	0.06	0.07	0.10	MAG
				307.11	209.76	210.55	286.87	93.77	80.31	218.88	209.81	PHASE
434	0.350	−9.08	27.89	1.47	2.60	0.58	0.25	0.57	0.15	0.06	0.09	MAG
				312.73	209.02	214.56	299.56	78.29	43.24	202.63	185.34	PHASE
437	0.350	−9.08	27.89	1.49	2.60	0.57	0.25	0.55	0.16	0.06	0.09	MAG
				310.47	206.84	211.47	294.69	72.84	39.38	194.34	172.70	PHASE

Table VIII. Continued

(j) Hub chordwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
254	0.060	−0.30	35.03	25.20	1.65	2.89	2.26	2.91	0.42	0.27	0.06	MAG
				286.28	333.05	91.06	88.77	267.81	102.70	53.84	73.47	PHASE
257	0.070	−0.30	34.82	25.07	1.60	3.17	2.37	3.53	0.34	0.24	0.08	MAG
				285.90	336.38	86.49	83.26	255.75	99.29	22.59	263.08	PHASE
265	0.060	−0.30	33.60	25.02	1.61	3.25	2.17	3.44	0.76	0.27	0.27	MAG
				287.61	343.57	90.30	90.76	260.73	123.90	95.48	240.63	PHASE
273	0.070	−0.30	33.44	25.15	1.78	3.35	2.22	3.08	0.76	0.32	0.19	MAG
				288.50	349.45	91.25	89.81	269.61	122.98	111.01	236.52	PHASE
319	0.150	−1.70	26.39	21.57	3.04	2.29	1.42	2.74	0.38	0.25	0.23	MAG
				294.32	70.16	113.95	134.73	330.49	131.34	148.45	38.42	PHASE
322	0.150	−1.70	26.44	21.32	2.97	2.37	1.43	2.77	0.31	0.23	0.25	MAG
				292.63	72.05	116.43	138.23	333.72	147.09	188.85	26.23	PHASE
327	0.175	−2.33	28.40	22.54	2.10	2.40	1.51	2.11	0.99	0.62	0.69	MAG
				293.83	63.07	125.38	150.30	335.92	348.68	126.96	140.61	PHASE
330	0.175	−2.33	31.82	16.86	2.68	3.19	2.42	2.83	2.03	1.24	1.06	MAG
				295.25	144.05	146.87	132.41	3.33	284.13	286.55	51.64	PHASE
354	0.200	−2.98	30.25	23.24	2.49	2.01	1.14	0.98	0.31	0.80	0.63	MAG
				298.76	95.74	156.75	175.61	20.89	112.42	271.88	304.74	PHASE
357	0.200	−2.98	30.12	22.91	2.52	2.00	1.16	1.03	0.30	0.22	0.31	MAG
				298.86	88.97	147.55	167.63	4.60	90.86	224.80	275.98	PHASE
364	0.225	−3.82	31.28	22.17	2.61	2.23	1.33	0.90	0.36	0.11	0.37	MAG
				300.43	112.73	173.86	191.42	58.03	85.43	217.09	321.04	PHASE

Table VIII. Concluded

(j) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
367	0.225	−3.82	31.15	21.94	2.52	2.15	1.31	0.96	0.37	0.14	0.62	MAG
				299.88	111.69	170.86	191.65	47.98	81.25	211.57	274.29	PHASE
384	0.250	−4.66	36.58	25.71	4.06	2.97	1.43	1.67	0.68	0.79	0.08	MAG
				311.19	150.37	202.87	202.75	76.47	84.76	196.10	34.99	PHASE
387	0.250	−4.66	36.34	24.86	4.08	3.01	1.51	1.69	0.69	0.14	0.09	MAG
				310.18	149.71	202.87	202.73	76.35	80.95	234.37	202.57	PHASE
396	0.275	−5.67	39.21	25.72	5.28	3.79	1.56	1.88	0.76	0.24	0.13	MAG
				311.12	161.57	208.80	214.62	82.82	40.50	111.50	89.08	PHASE
399	0.275	−5.67	39.19	25.59	5.24	3.71	1.56	1.84	0.75	0.70	0.34	MAG
				314.05	165.21	218.02	227.63	98.70	65.37	124.42	327.77	PHASE
406	0.300	−6.69	44.47	27.16	7.98	5.59	2.04	3.47	0.97	0.33	0.21	MAG
				320.98	191.05	236.46	249.97	111.87	62.56	144.22	92.44	PHASE
410	0.300	−6.69	44.46	26.93	7.91	5.68	2.18	3.47	0.85	0.36	0.15	MAG
				315.00	180.01	221.03	234.05	85.16	35.96	97.04	11.66	PHASE
424	0.325	−7.78	53.14	30.75	13.36	8.47	2.94	5.38	1.29	0.47	0.13	MAG
				325.82	199.53	244.18	257.61	97.01	31.19	137.92	110.59	PHASE
427	0.325	−7.78	52.77	30.22	13.12	8.34	2.92	5.54	1.25	0.48	0.41	MAG
				324.24	197.81	242.13	254.10	95.19	25.55	123.84	187.30	PHASE
434	0.350	−9.08	60.31	32.17	17.98	10.48	3.24	7.09	2.15	0.61	0.42	MAG
				329.02	199.66	247.03	262.53	86.42	17.91	135.41	237.78	PHASE
437	0.350	−9.08	60.18	32.35	18.02	10.51	3.21	6.91	2.21	0.59	0.54	MAG
				328.39	197.27	243.76	257.73	80.69	12.86	133.38	213.93	PHASE

Table IX. Harmonic Components of Vibratory Loads for −300 Blades With Medium Shear Pads

(a) Normal force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	160.75	10.88	2.67	2.19	24.62	0.65	0.92	1.92	1.32	MAG
				356.67	57.90	240.41	128.98	204.41	210.97	165.80	178.62	PHASE
943	0.100	−0.30	160.87	9.32	2.60	2.04	24.11	0.36	1.15	1.46	3.54	MAG
				2.63	69.21	244.00	142.62	242.89	240.62	185.55	208.72	PHASE
990	0.125	−1.21	160.61	9.79	1.12	1.56	20.01	1.40	0.58	1.21	4.88	MAG
				9.15	259.52	246.88	145.32	316.17	205.24	212.61	196.23	PHASE
993	0.125	−1.21	160.51	10.10	1.24	1.40	19.79	1.00	0.52	1.17	4.05	MAG
				5.89	253.96	235.93	134.29	307.17	207.24	184.18	185.31	PHASE
1004	0.150	−1.50	158.74	11.93	0.53	0.89	15.77	1.27	0.61	0.73	2.74	MAG
				2.66	276.32	266.95	154.67	318.02	286.46	228.77	168.07	PHASE
1007	0.150	−1.50	157.79	11.60	0.50	0.95	15.58	1.22	0.43	0.66	1.70	MAG
				358.45	11.73	242.87	147.05	329.54	272.12	193.32	158.73	PHASE
1054	0.175	−2.33	160.51	12.11	1.32	0.68	13.93	1.64	0.42	1.64	3.41	MAG
				4.39	267.73	288.69	161.90	342.08	291.60	218.17	225.85	PHASE
1057	0.175	−2.33	158.44	12.86	1.56	0.96	13.59	1.32	0.38	1.30	3.30	MAG
				3.40	291.04	305.72	166.10	339.16	295.41	232.27	241.54	PHASE
1078	0.200	−4.70	159.71	14.34	2.84	0.39	10.51	2.01	0.43	0.94	11.02	MAG
				350.87	293.39	273.71	177.78	17.48	337.21	259.07	198.84	PHASE

Table IX. Continued

(a) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−4.70	158.91	16.21	3.33	0.15	10.39	2.10	0.30	0.68	10.26	MAG
				350.17	301.57	4.09	188.43	43.86	319.28	254.55	214.12	PHASE
1152	0.225	−2.98	163.38	13.59	7.94	1.18	10.15	2.34	1.04	0.41	4.52	MAG
				336.93	284.98	12.99	200.65	32.28	343.80	342.01	192.71	PHASE
1155	0.225	−2.98	161.51	15.99	7.65	1.71	10.02	2.04	0.96	0.42	4.71	MAG
				336.36	283.74	48.12	207.53	33.08	340.84	0.89	194.48	PHASE
1161	0.250	−4.66	164.82	20.79	10.33	2.40	10.06	2.43	0.93	2.04	1.83	MAG
				326.37	265.25	22.70	223.37	9.20	325.76	330.64	261.47	PHASE
1164	0.250	−4.66	164.01	20.22	9.40	2.27	9.98	2.11	0.63	2.27	1.45	MAG
				322.77	262.40	54.54	230.43	25.14	315.27	14.38	329.66	PHASE
1221	0.275	−5.67	163.96	12.10	9.04	3.95	11.64	2.39	1.58	1.24	7.66	MAG
				199.01	253.49	9.37	240.94	287.15	329.40	332.27	295.83	PHASE
1224	0.275	−5.67	160.00	10.03	9.57	3.56	11.48	1.21	1.73	1.61	8.77	MAG
				217.11	256.79	28.06	257.80	315.77	346.89	357.68	328.08	PHASE
1235	0.300	−6.69	163.84	12.07	7.90	6.30	15.36	1.41	3.57	2.19	17.03	MAG
				239.85	266.33	63.96	273.54	314.55	327.42	157.21	305.59	PHASE
1238	0.300	−6.69	162.35	13.03	7.14	6.19	14.96	1.62	3.58	1.87	12.57	MAG
				237.87	259.74	54.09	270.33	332.70	313.61	140.42	306.21	PHASE

Table IX. Continued

(b) Axial force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	−1.28	5.14	0.25	1.61	5.31	0.85	1.51	0.52	3.70	MAG
				12.48	9.47	265.47	351.09	246.87	13.16	258.08	213.13	PHASE
943	0.100	−0.30	−1.92	5.04	0.20	1.53	5.40	0.78	1.89	0.46	4.79	MAG
				16.21	340.17	265.79	4.87	246.92	36.63	250.44	232.47	PHASE
990	0.125	−1.21	−3.95	4.94	1.23	1.29	4.51	1.41	0.82	0.46	2.89	MAG
				16.79	11.19	257.62	8.75	174.97	341.06	316.53	229.39	PHASE
993	0.125	−1.21	−4.03	5.01	1.12	1.12	4.37	1.06	0.54	0.39	2.99	MAG
				13.17	4.69	258.64	0.02	174.63	8.91	285.02	216.70	PHASE
1004	0.150	−1.50	−4.27	4.82	1.11	0.91	3.70	0.79	1.10	0.37	2.28	MAG
				14.47	18.40	290.90	20.46	177.70	58.64	232.86	240.90	PHASE
1007	0.150	−1.50	−4.37	4.91	1.00	0.85	3.65	1.18	0.42	0.25	2.05	MAG
				13.24	12.71	266.88	14.78	186.78	63.66	267.81	234.10	PHASE
1054	0.175	−2.33	−4.23	5.22	1.44	0.72	3.27	1.40	0.76	0.80	1.27	MAG
				12.32	15.27	320.19	29.63	163.18	81.11	38.18	234.66	PHASE
1057	0.175	−2.33	−4.94	5.09	1.38	0.88	3.17	1.07	0.64	0.60	1.74	MAG
				13.76	18.18	326.33	32.74	154.32	96.69	46.48	239.93	PHASE
1078	0.200	−2.98	−13.16	5.30	1.35	0.17	3.06	1.84	0.98	0.44	2.57	MAG
				11.90	17.78	275.73	58.41	181.91	55.41	178.13	208.60	PHASE

Table IX. Continued

(b) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	−13.47	5.49	1.26	0.27	3.20	2.11	1.03	0.41	1.61	MAG
				13.26	25.60	6.97	67.00	213.29	39.44	224.97	241.22	PHASE
1152	0.225	−3.82	−7.70	5.20	2.41	0.71	3.78	2.01	3.35	0.54	2.71	MAG
				10.99	15.94	30.58	73.36	187.36	77.35	151.01	257.02	PHASE
1155	0.225	−3.82	−7.76	5.52	2.05	1.89	3.99	1.69	3.07	0.69	2.37	MAG
				11.11	21.40	57.14	79.71	172.36	78.07	159.18	266.23	PHASE
1161	0.250	−4.66	−9.73	5.70	1.90	2.08	5.26	2.88	1.00	0.63	3.27	MAG
				5.09	27.19	47.95	83.70	148.62	357.34	136.26	245.51	PHASE
1164	0.250	−4.66	−10.17	5.62	1.58	2.40	5.10	2.97	0.95	0.59	3.29	MAG
				8.44	43.77	87.10	92.95	172.77	348.83	159.56	267.89	PHASE
1221	0.275	−5.67	−11.07	3.49	0.37	2.20	5.75	3.81	4.30	1.64	6.66	MAG
				11.51	169.05	24.42	96.14	91.61	172.33	53.54	262.42	PHASE
1224	0.275	−5.67	−11.36	3.89	0.30	2.41	5.82	2.23	3.69	1.52	6.96	MAG
				12.64	202.79	52.67	112.46	118.80	199.18	104.34	294.23	PHASE
1235	0.300	−6.69	−13.13	4.16	1.23	6.15	7.82	3.93	7.01	2.56	9.36	MAG
				9.50	129.50	94.07	115.68	133.85	175.16	110.88	297.77	PHASE
1238	0.300	−6.69	−13.71	4.14	1.70	5.36	7.78	4.28	6.02	1.94	9.38	MAG
				3.93	151.51	86.88	117.08	150.77	162.12	99.90	293.22	PHASE

Table IX. Continued

(c) Pitching moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	39.93	444.78	20.36	68.39	108.93	7.83	8.40	10.39	9.50	MAG
				24.49	18.50	252.69	160.42	68.26	27.48	353.24	290.46	PHASE
943	0.100	−0.30	13.45	429.62	17.67	67.94	104.64	6.95	8.05	4.96	9.47	MAG
				27.69	12.22	254.74	175.03	84.72	53.96	1.94	283.54	PHASE
990	0.125	−1.21	36.84	416.68	28.25	55.36	85.84	6.72	3.13	5.54	4.98	MAG
				28.55	349.60	254.50	180.73	128.61	45.10	34.76	13.30	PHASE
993	0.125	−1.21	52.84	419.36	26.92	46.45	86.19	6.72	3.66	5.47	1.66	MAG
				26.07	342.25	251.46	168.10	106.07	49.05	24.15	263.94	PHASE
1004	0.150	−1.50	72.76	423.29	26.47	33.53	70.47	5.63	4.00	2.35	10.16	MAG
				28.00	357.94	280.27	191.51	115.63	78.90	4.25	354.54	PHASE
1007	0.150	−1.50	68.03	418.58	29.99	35.72	68.53	5.48	3.56	5.45	9.55	MAG
				25.48	7.79	256.07	182.96	117.10	64.68	15.15	343.74	PHASE
1054	0.175	−2.33	118.62	429.69	32.15	21.36	67.13	8.22	3.26	8.33	19.66	MAG
				27.38	347.84	302.95	201.27	140.50	112.46	71.89	10.53	PHASE
1057	0.175	−2.33	94.76	427.21	31.88	27.01	63.78	7.76	2.96	6.16	16.10	MAG
				27.76	355.94	314.47	205.18	136.24	117.11	84.69	16.06	PHASE
1078	0.200	−2.98	−49.58	434.73	29.47	17.10	55.20	7.66	2.82	3.22	20.55	MAG
				27.11	335.11	237.42	222.50	162.63	113.05	81.62	1.07	PHASE

Table IX. Continued

(c) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	−66.59	444.46	26.04	4.60	51.09	7.82	1.10	4.16	27.97	MAG
				29.00	339.62	245.67	234.61	187.36	113.24	37.99	6.71	PHASE
1152	0.225	−3.82	101.55	408.05	50.31	19.36	62.17	9.56	6.50	4.09	20.44	MAG
				25.59	313.32	30.68	241.06	179.78	125.94	161.53	6.46	PHASE
1155	0.225	−3.82	99.53	419.56	43.57	53.46	59.41	9.34	5.40	2.63	21.89	MAG
				25.59	306.82	68.85	248.04	168.40	127.26	149.10	9.64	PHASE
1161	0.250	−4.66	103.09	440.64	28.21	54.89	69.27	16.16	4.08	9.61	18.33	MAG
				21.95	258.56	47.63	254.30	163.22	156.93	144.23	43.35	PHASE
1164	0.250	−4.66	99.43	429.63	24.80	74.02	67.59	14.15	1.86	5.76	15.35	MAG
				23.42	220.62	96.41	266.03	180.94	218.11	190.55	73.47	PHASE
1221	0.275	−5.67	137.48	261.96	54.06	82.16	90.28	8.49	9.31	16.28	23.67	MAG
				29.74	203.29	32.67	260.52	162.84	190.57	89.88	59.14	PHASE
1224	0.275	−5.67	119.17	279.46	55.78	84.17	86.81	9.32	7.95	15.75	15.90	MAG
				31.18	209.58	61.48	279.12	192.73	207.07	129.87	98.05	PHASE
1235	0.300	−6.69	186.61	290.01	62.67	211.93	118.17	18.58	15.27	13.16	52.27	MAG
				26.55	172.44	101.86	286.24	226.37	178.77	69.92	109.05	PHASE
1238	0.300	−6.69	178.84	292.21	76.87	178.00	108.03	20.10	12.12	10.00	32.63	MAG
				26.42	170.32	92.87	289.35	216.41	176.15	53.48	100.41	PHASE

Table IX. Continued

(d) Rolling moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	−92.43	383.00	12.69	28.63	311.48	60.92	2.25	1.55	8.97	MAG
				295.18	237.15	105.56	140.29	297.99	261.32	180.48	114.76	PHASE
943	0.100	−0.30	−75.91	373.66	9.51	27.97	326.26	57.56	2.62	5.76	19.73	MAG
				298.51	229.93	102.44	153.71	318.87	268.75	184.48	200.84	PHASE
990	0.125	−1.21	134.89	221.11	30.01	32.25	56.32	24.74	8.14	8.56	11.48	MAG
				254.01	207.34	171.37	75.58	314.21	233.26	224.23	126.00	PHASE
993	0.125	−1.21	154.77	228.54	31.22	32.61	58.41	27.09	9.30	8.29	11.99	MAG
				252.19	201.63	162.01	64.83	304.59	217.52	203.66	107.22	PHASE
1004	0.150	−1.50	204.44	199.33	16.67	16.08	42.70	21.56	9.10	1.51	5.70	MAG
				247.22	165.67	196.33	91.43	321.45	211.55	238.19	150.36	PHASE
1007	0.150	−1.50	203.04	205.00	15.91	16.73	43.64	22.27	10.49	1.35	5.56	MAG
				243.06	124.63	208.13	85.49	309.83	189.97	325.27	149.94	PHASE
1054	0.175	−2.33	153.32	160.17	22.88	15.91	31.79	16.81	9.72	4.42	3.41	MAG
				235.09	94.85	255.50	115.01	323.88	192.92	34.89	208.42	PHASE
1057	0.175	−2.33	140.13	163.87	23.67	16.86	32.35	15.66	10.13	4.87	2.87	MAG
				235.84	95.00	261.25	119.41	330.24	195.31	53.87	206.06	PHASE
1078	0.200	−2.98	201.21	147.12	24.21	17.32	31.13	15.23	8.84	5.27	4.07	MAG
				233.47	85.73	270.64	130.42	336.70	200.59	41.80	232.41	PHASE

Table IX. Continued

(d) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	226.54	168.72	31.34	20.76	35.19	15.91	11.12	5.98	4.59	MAG
				235.84	91.30	286.45	141.82	354.23	219.06	67.76	267.26	PHASE
1152	0.225	−3.82	296.45	141.13	20.82	14.51	33.65	16.39	8.43	3.03	3.88	MAG
				238.72	130.90	273.35	140.78	351.62	236.58	83.08	251.24	PHASE
1155	0.225	−3.82	308.16	143.10	21.43	14.06	34.66	16.75	8.89	4.45	3.88	MAG
				239.37	131.46	278.42	147.61	16.48	244.97	92.63	264.32	PHASE
1161	0.250	−4.66	337.24	169.78	32.94	22.88	41.82	18.91	10.95	6.70	4.99	MAG
				237.27	116.11	295.46	156.90	8.07	246.86	100.06	288.58	PHASE
1164	0.250	−4.66	278.39	229.85	33.64	21.89	67.81	22.31	9.02	3.74	9.75	MAG
				256.61	208.82	250.02	151.46	37.74	320.19	11.83	279.65	PHASE
1221	0.275	−5.67	96.75	262.01	28.09	92.01	473.50	22.96	10.98	9.16	12.34	MAG
				294.44	295.47	112.36	249.94	108.30	108.41	346.05	330.11	PHASE
1224	0.275	−5.67	98.71	286.88	10.22	82.91	473.40	14.41	11.47	8.97	24.94	MAG
				301.57	293.55	123.90	266.35	111.39	133.42	351.37	336.51	PHASE
1235	0.300	−6.69	87.56	292.07	14.48	73.62	570.48	6.87	31.73	7.10	32.61	MAG
				300.25	214.17	124.60	277.70	323.18	128.58	3.03	319.17	PHASE
1238	0.300	−6.69	73.36	291.26	13.62	82.52	563.40	4.15	23.67	15.54	24.19	MAG
				297.82	194.20	124.10	273.40	8.15	93.19	344.08	321.43	PHASE

Table IX. Continued

(e) Yawing moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	345.47	110.76	1.50	13.46	356.93	48.83	3.29	1.46	16.07	MAG
				110.86	153.15	219.86	305.41	355.37	163.34	122.39	354.67	PHASE
943	0.100	−0.30	341.53	105.70	1.93	16.31	346.28	41.44	3.34	0.99	15.48	MAG
				116.10	229.27	235.61	318.33	14.74	209.99	86.21	357.44	PHASE
990	0.125	−1.21	331.12	104.18	5.68	14.96	296.44	35.72	1.96	1.81	9.18	MAG
				116.86	120.00	213.10	324.41	5.98	182.73	60.73	34.99	PHASE
993	0.125	−1.21	319.83	110.23	3.23	16.39	288.92	34.79	1.97	0.99	9.37	MAG
				117.13	105.09	212.21	313.59	354.46	201.33	359.35	4.85	PHASE
1004	0.150	−1.50	277.90	112.47	3.24	12.43	248.41	33.55	2.54	1.62	9.61	MAG
				115.35	131.22	237.47	332.05	22.87	195.09	62.00	20.47	PHASE
1007	0.150	−1.50	273.88	109.62	3.07	13.09	243.33	32.17	1.68	0.39	8.43	MAG
				114.51	110.82	230.02	325.36	16.01	187.28	143.76	11.89	PHASE
1054	0.175	−2.33	320.02	117.81	6.84	10.14	269.97	23.34	3.60	0.47	5.54	MAG
				118.79	109.81	257.40	339.45	24.20	201.63	86.02	86.62	PHASE
1057	0.175	−2.33	312.22	112.83	6.75	12.60	257.38	23.98	3.21	0.54	3.48	MAG
				119.23	104.93	242.51	344.61	36.49	231.51	0.55	52.86	PHASE
1078	0.200	−2.98	369.23	109.93	3.85	13.15	252.62	13.28	2.79	1.09	1.88	MAG
				117.77	112.57	286.46	358.41	2.72	227.96	122.64	99.88	PHASE

Table IX. Continued

(e) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	367.98	97.13	5.79	17.77	255.16	11.71	2.42	2.08	6.27	MAG
				117.32	129.87	291.54	6.28	32.81	189.78	155.98	82.54	PHASE
1152	0.225	−3.82	364.98	104.23	11.49	22.13	298.30	11.16	4.39	1.08	3.64	MAG
				118.70	115.82	310.42	13.12	87.68	227.61	335.01	0.57	PHASE
1155	0.225	−3.82	367.04	103.74	3.55	22.60	277.82	10.60	5.20	1.09	5.24	MAG
				115.22	136.22	314.54	16.50	124.24	235.19	264.17	24.80	PHASE
1161	0.250	−4.66	410.86	114.30	3.17	29.57	335.21	14.71	2.14	2.56	4.46	MAG
				111.21	116.33	303.31	18.06	81.48	230.33	292.54	297.37	PHASE
1164	0.250	−4.66	411.49	96.81	5.92	23.11	336.24	10.80	3.26	2.28	5.86	MAG
				115.65	95.92	310.63	28.35	63.05	293.57	302.16	318.90	PHASE
1221	0.275	−5.67	482.46	84.14	16.12	56.38	481.28	14.32	3.74	2.52	8.10	MAG
				152.56	3.25	300.85	23.87	159.38	256.29	306.45	314.32	PHASE
1224	0.275	−5.67	476.69	49.59	13.74	56.95	472.71	10.59	1.66	2.09	13.03	MAG
				150.53	36.37	313.16	41.88	187.78	326.24	335.54	345.17	PHASE
1235	0.300	−6.69	566.83	43.60	11.38	62.30	664.95	19.74	3.35	2.76	13.82	MAG
				128.32	19.11	327.13	40.67	314.90	232.52	315.89	310.04	PHASE
1238	0.300	−6.69	566.09	66.87	18.10	76.01	645.34	10.00	2.38	2.68	13.07	MAG
				124.55	354.81	326.35	38.46	266.79	258.95	314.51	323.55	PHASE

Table IX. Continued

(f) Side force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	−5.19	4.04	0.68	0.54	6.08	1.63	3.42	1.98	1.60	MAG
				289.77	341.60	100.58	207.90	148.04	321.65	211.28	32.82	PHASE
943	0.100	−0.30	−6.58	9.01	1.76	1.24	4.82	3.70	5.29	2.07	3.81	MAG
				279.99	300.67	338.54	192.20	41.56	25.82	12.10	68.60	PHASE
990	0.125	−1.21	−4.94	4.78	0.61	0.99	6.67	0.75	2.37	2.73	3.01	MAG
				279.53	333.72	11.94	210.30	0.28	313.55	237.36	105.39	PHASE
993	0.125	−1.21	−4.52	4.14	1.95	1.25	6.46	1.27	1.70	1.75	3.56	MAG
				285.53	330.24	261.48	185.22	337.22	272.37	139.01	11.84	PHASE
1004	0.150	−1.50	−3.36	5.58	2.06	0.63	7.40	1.60	0.37	0.18	0.56	MAG
				300.37	280.18	142.92	224.29	252.64	21.30	319.15	5.51	PHASE
1007	0.150	−1.50	−3.35	5.73	1.27	0.50	6.99	1.58	0.48	0.34	0.46	MAG
				299.71	277.92	121.79	216.32	248.35	38.98	273.12	325.44	PHASE
1054	0.175	−2.33	−2.92	7.15	4.00	1.52	10.58	3.05	1.82	1.79	1.13	MAG
				289.33	283.37	253.11	244.57	270.61	306.04	312.41	303.53	PHASE
1057	0.175	−2.33	−2.69	6.04	2.20	0.85	8.29	1.03	0.77	0.72	0.23	MAG
				293.98	275.42	142.14	234.00	275.03	22.35	348.12	127.03	PHASE
1078	0.200	−2.98	−2.67	5.91	6.02	0.76	13.51	2.25	2.63	2.51	2.23	MAG
				301.62	267.23	312.08	237.94	307.73	220.46	309.81	190.42	PHASE

Table IX. Continued

(f) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	−0.95	7.29	0.85	1.72	11.14	0.71	1.00	1.12	1.11	MAG
				312.21	256.66	203.42	251.43	61.95	161.08	288.31	347.71	PHASE
1152	0.225	−3.82	−3.17	6.43	4.97	1.43	12.52	0.82	0.48	0.50	0.90	MAG
				290.88	272.83	200.72	241.74	217.25	57.36	109.92	95.33	PHASE
1155	0.225	−3.82	−3.05	6.47	5.61	1.31	13.65	0.71	0.67	0.38	0.62	MAG
				298.35	282.18	215.63	247.74	267.66	326.07	268.76	290.51	PHASE
1161	0.250	−4.66	−5.69	5.10	7.91	1.49	17.43	1.88	1.97	1.48	2.36	MAG
				320.17	283.12	141.94	267.62	22.74	55.74	54.58	74.50	PHASE
1164	0.250	−4.66	−6.64	7.53	7.87	1.51	16.63	0.58	1.38	3.70	3.70	MAG
				281.18	268.01	134.94	270.38	140.68	254.38	107.88	69.74	PHASE
1221	0.275	−5.67	−5.58	7.68	0.51	1.88	22.85	4.56	3.55	2.98	3.51	MAG
				248.19	295.05	124.91	278.61	152.86	96.06	30.36	81.91	PHASE
1224	0.275	−5.67	−3.93	7.49	0.60	2.16	21.10	1.66	0.83	1.02	3.28	MAG
				291.58	60.74	125.45	298.78	155.88	64.72	22.87	139.76	PHASE
1235	0.300	−6.69	−8.46	11.41	1.43	2.21	35.08	0.42	3.25	2.08	7.79	MAG
				292.53	208.15	4.76	331.17	198.70	336.65	28.81	147.55	PHASE
1238	0.300	−6.69	−4.29	6.05	0.34	1.35	30.06	2.14	2.36	1.82	4.82	MAG
				293.54	14.58	96.71	316.63	175.75	53.59	27.47	119.35	PHASE

Table IX. Continued

(g) Hub beamwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	34.17	0.67	2.09	0.89	0.64	0.07	0.19	0.19	0.05	MAG
				251.70	20.68	109.88	64.43	66.16	114.96	105.13	259.64	PHASE
943	0.100	−0.30	34.16	0.30	2.03	0.90	0.64	0.09	0.19	0.19	0.08	MAG
				113.15	28.00	119.87	76.78	96.84	135.45	130.64	272.46	PHASE
990	0.125	−1.21	32.64	0.23	2.18	0.63	0.53	0.06	0.15	0.18	0.10	MAG
				105.92	29.02	131.63	73.45	137.39	124.84	141.60	229.33	PHASE
993	0.125	−1.21	32.63	0.34	2.16	0.62	0.54	0.07	0.15	0.17	0.07	MAG
				30.84	23.72	124.46	64.10	120.95	107.60	127.66	223.77	PHASE
1004	0.150	−1.50	32.23	0.26	2.28	0.43	0.43	0.01	0.15	0.14	0.06	MAG
				99.60	32.06	160.59	75.70	39.48	140.08	147.68	63.03	PHASE
1007	0.150	−1.50	32.37	0.16	2.20	0.43	0.43	0.01	0.15	0.13	0.06	MAG
				50.59	29.49	154.90	70.65	44.59	130.26	140.77	61.80	PHASE
1054	0.175	−2.33	31.78	0.19	1.87	0.49	0.36	0.03	0.15	0.12	0.06	MAG
				202.07	34.96	180.44	88.12	1.39	150.73	160.69	331.16	PHASE
1057	0.175	−2.33	31.81	0.57	1.88	0.47	0.36	0.02	0.14	0.11	0.07	MAG
				23.23	37.00	183.70	91.39	347.71	160.45	172.18	338.84	PHASE
1078	0.200	−2.98	31.97	0.47	0.66	0.50	0.33	0.07	0.14	0.10	0.17	MAG
				325.96	37.97	185.34	100.57	132.36	151.82	143.60	186.83	PHASE

Table IX. Continued

(g) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	32.00	0.19	0.60	0.50	0.32	0.09	0.14	0.08	0.16	MAG
				124.76	44.69	190.75	107.22	150.11	167.05	142.21	195.15	PHASE
1152	0.225	−3.82	31.86	0.21	0.68	0.55	0.31	0.05	0.15	0.04	0.15	MAG
				12.33	90.87	201.98	103.58	113.25	154.55	118.59	123.30	PHASE
1155	0.225	−3.82	31.90	0.35	0.63	0.55	0.32	0.04	0.15	0.04	0.16	MAG
				50.43	94.64	205.12	108.96	121.96	163.42	110.75	126.87	PHASE
1161	0.250	−4.66	32.02	0.33	1.07	0.65	0.30	0.02	0.16	0.08	0.08	MAG
				7.50	169.12	203.25	104.93	212.23	152.67	52.24	70.57	PHASE
1164	0.250	−4.66	32.09	0.22	1.09	0.66	0.30	0.04	0.17	0.09	0.06	MAG
				65.96	173.99	211.55	115.55	221.12	164.25	78.56	88.75	PHASE
1221	0.275	−5.67	32.16	0.66	2.18	0.87	0.33	0.19	0.25	0.13	0.09	MAG
				332.69	169.46	215.69	119.95	232.92	161.05	44.05	296.76	PHASE
1224	0.275	−5.67	31.98	0.44	2.18	0.88	0.32	0.18	0.26	0.11	0.11	MAG
				52.58	177.51	229.66	135.72	250.03	187.70	60.57	346.07	PHASE
1235	0.300	−6.69	32.00	0.54	3.82	1.02	0.40	0.22	0.38	0.12	0.20	MAG
				313.35	186.43	229.05	138.17	235.53	190.17	75.78	294.57	PHASE
1238	0.300	−6.69	32.18	0.44	3.74	1.01	0.39	0.22	0.35	0.14	0.14	MAG
				326.51	185.96	227.09	135.89	227.51	185.67	61.18	292.17	PHASE

Table IX. Continued

(h) Hub chordwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	77.17	41.91	7.70	8.61	7.25	9.23	1.03	1.46	0.41	MAG
				282.00	25.54	73.09	83.10	230.13	20.35	136.44	249.37	PHASE
943	0.100	−0.30	76.89	42.41	7.85	8.60	7.01	8.93	1.02	1.37	1.38	MAG
				283.28	32.06	83.51	97.42	246.01	45.76	165.07	218.06	PHASE
990	0.125	−1.21	72.21	34.10	7.03	6.66	5.59	7.44	0.77	0.68	0.70	MAG
				280.18	36.75	87.65	101.96	250.18	41.12	176.56	149.27	PHASE
993	0.125	−1.21	72.17	33.93	6.95	6.63	5.53	7.17	0.77	0.84	0.65	MAG
				276.76	31.87	79.95	92.01	236.71	23.59	154.90	160.94	PHASE
1004	0.150	−1.50	67.52	31.48	7.03	5.28	4.17	6.91	0.54	0.47	0.30	MAG
				277.22	38.41	94.69	113.19	262.91	38.74	191.13	17.58	PHASE
1007	0.150	−1.50	67.47	31.47	6.91	5.33	4.16	6.78	0.57	0.57	0.16	MAG
				275.98	35.33	90.54	105.17	255.14	24.12	165.04	320.57	PHASE
1054	0.175	−2.33	75.60	29.14	6.03	4.65	3.94	6.48	0.94	0.3[illegible]	0.61	MAG
				276.24	40.48	108.64	121.11	267.95	27.54	225.37	55.52	PHASE
1057	0.175	−2.33	75.12	28.41	5.98	4.56	3.89	6.20	0.97	0.42	0.16	MAG
				274.76	43.32	109.97	127.32	274.36	42.32	213.61	74.63	PHASE
1078	0.200	−2.98	87.23	31.68	4.59	4.58	3.94	5.19	0.55	0.21	1.15	MAG
				280.96	55.86	127.01	133.31	281.23	15.71	144.09	205.38	PHASE

Table IX. Continued

(h) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	87.70	32.51	4.58	4.56	3.66	5.19	0.54	0.25	0.76	MAG
				282.30	59.80	133.60	142.60	295.76	21.88	202.70	286.11	PHASE
1152	0.225	−3.82	79.88	29.66	5.12	6.81	6.07	7.84	1.28	0.72	0.23	MAG
				107.82	66.28	334.47	113.55	73.26	88.99	308.92	200.33	PHASE
1155	0.225	−3.82	79.14	29.14	5.30	6.96	5.87	7.62	1.07	0.43	0.36	MAG
				109.08	68.61	338.27	121.02	80.95	100.16	323.39	340.04	PHASE
1161	0.250	−4.66	86.60	31.48	5.93	9.20	6.22	8.08	0.60	0.73	0.39	MAG
				111.91	95.10	348.14	115.98	77.30	79.76	276.03	118.67	PHASE
1164	0.250	−4.66	86.78	31.98	6.04	8.90	6.07	7.97	0.63	0.76	0.35	MAG
				114.49	99.73	354.87	128.68	91.73	104.09	301.81	197.99	PHASE
1221	0.275	−5.67	101.09	35.58	9.32	11.18	7.15	9.90	0.21	0.92	0.74	MAG
				112.74	130.97	1.85	119.10	74.10	354.91	302.04	323.47	PHASE
1224	0.275	−5.67	99.79	34.80	9.40	11.14	7.02	9.47	0.30	0.95	1.67	MAG
				117.95	139.20	16.59	139.11	97.28	32.89	328.33	310.86	PHASE
1235	0.300	−6.69	114.11	38.70	16.25	16.75	6.81	9.83	0.91	1.34	1.57	MAG
				124.16	149.42	24.49	145.13	85.72	320.49	292.55	261.14	PHASE
1238	0.300	−6.69	113.35	36.88	15.96	16.06	7.24	10.17	0.63	1.17	1.23	MAG
				122.76	146.81	21.99	140.39	86.83	320.97	295.16	284.50	PHASE

Table IX. Continued

(i) Hub beamwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	33.56	1.52	0.42	0.25	0.18	0.13	0.02	0.01	0.00	MAG
				245.45	333.67	33.45	5.95	133.57	270.27	210.81	214.30	PHASE
943	0.100	−0.30	33.56	1.40	0.42	0.26	0.17	0.13	0.02	0.01	0.00	MAG
				247.56	341.15	44.36	18.06	150.15	293.43	238.00	97.64	PHASE
990	0.125	−1.21	33.90	1.23	0.47	0.20	0.17	0.11	0.00	0.02	0.01	MAG
				249.34	348.00	57.97	37.57	162.54	281.66	252.34	315.42	PHASE
993	0.125	−1.21	33.91	1.23	0.46	0.20	0.17	0.11	0.00	0.02	0.00	MAG
				248.92	343.93	51.65	27.43	147.33	283.69	245.61	325.51	PHASE
1004	0.150	−1.50	33.64	1.17	0.46	0.15	0.13	0.11	0.01	0.01	0.00	MAG
				247.05	354.55	71.14	58.40	174.40	248.05	248.60	64.74	PHASE
1007	0.150	−1.50	33.72	1.18	0.45	0.15	0.13	0.11	0.02	0.01	0.00	MAG
				245.94	351.59	66.27	50.14	167.28	246.29	256.06	117.63	PHASE
1054	0.175	−2.33	33.45	1.01	0.26	0.08	0.06	0.04	0.01	0.01	0.01	MAG
				266.63	330.22	56.62	44.09	155.87	254.14	258.08	355.43	PHASE
1057	0.175	−2.33	33.49	0.89	0.23	0.07	0.05	0.04	0.01	0.00	0.01	MAG
				227.00	328.75	53.37	47.70	157.87	274.70	264.11	24.18	PHASE
1078	0.200	−2.98	34.98	0.99	0.08	0.07	0.05	0.03	0.01	0.00	0.00	MAG
				227.72	337.86	62.73	50.98	172.83	253.91	227.13	161.54	PHASE

Table IX. Continued

(i) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	34.12	1.01	0.09	0.09	0.05	0.03	0.01	0.01	0.01	MAG
				229.93	349.63	69.35	54.20	187.28	264.07	181.60	186.99	PHASE
1152	0.225	−3.82	34.09	1.16	0.18	0.22	0.20	0.23	0.06	0.02	0.07	MAG
				269.34	85.58	160.38	155.22	283.53	359.77	164.07	232.25	PHASE
1155	0.225	−3.82	34.18	1.15	0.18	0.22	0.19	0.23	0.06	0.02	0.07	MAG
				270.57	88.97	163.65	160.48	293.90	13.49	183.02	261.27	PHASE
1161	0.250	−4.66	34.51	1.26	0.24	0.28	0.22	0.22	0.09	0.04	0.05	MAG
				271.30	155.67	164.46	156.91	296.36	4.15	144.27	132.72	PHASE
1164	0.250	−4.66	34.55	1.24	0.24	0.27	0.22	0.22	0.07	0.04	0.05	MAG
				272.04	158.90	172.31	165.20	304.74	12.94	167.84	151.90	PHASE
1221	0.275	−5.67	34.82	1.37	0.52	0.38	0.23	0.25	0.12	0.04	0.07	MAG
				286.20	161.77	179.08	171.54	296.72	359.18	179.63	76.27	PHASE
1224	0.275	−5.67	34.79	1.22	0.52	0.37	0.23	0.25	0.14	0.05	0.04	MAG
				287.95	170.08	192.62	191.16	316.12	23.35	194.98	157.01	PHASE
1235	0.300	−6.69	35.32	1.46	0.92	0.47	0.26	0.39	0.21	0.03	0.10	MAG
				291.99	179.96	194.06	200.46	316.96	9.95	236.60	114.41	PHASE
1238	0.300	−6.69	35.41	1.47	0.91	0.47	0.25	0.37	0.19	0.05	0.07	MAG
				290.61	178.95	192.10	199.07	314.52	4.03	223.35	101.93	PHASE

Table IX. Continued

(j) Hub chordwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
940	0.100	−0.30	71.08	30.79	5.59	5.97	4.48	5.51	0.64	1.09	0.30	MAG
				248.87	37.18	90.32	99.94	242.28	42.78	156.81	291.99	PHASE
943	0.100	−0.30	70.98	31.00	5.72	5.97	4.36	5.[illegible]8	0.64	0.99	1.11	MAG
				286.12	43.67	100.93	114.18	257.[illegible]1	66.74	186.00	242.33	PHASE
990	0.125	−1.21	66.78	25.41	5.40	4.68	3.51	4.52	0.47	0.50	0.61	MAG
				283.24	46.95	104.64	118.29	261.41	63.55	195.66	162.11	PHASE
993	0.125	−1.21	66.93	25.27	5.35	4.65	3.48	4.34	0.48	0.63	0.51	MAG
				279.94	42.28	96.76	108.40	247.70	46.48	174.91	175.36	PHASE
1004	0.150	−1.50	63.46	23.43	5.52	3.65	2.63	4.17	0.34	0.37	0.31	MAG
				280.07	49.06	111.34	129.05	275.22	65.60	205.63	41.60	PHASE
1007	0.150	−1.50	63.56	23.47	5.40	3.71	2.64	4.08	0.35	0.45	0.19	MAG
				278.88	46.03	107.31	122.24	267.78	51.01	178.32	355.96	PHASE
1054	0.175	−2.33	62.95	21.71	4.72	3.20	2.48	3.88	0.54	0.25	0.61	MAG
				278.97	50.13	127.22	138.01	280.43	51.43	243.45	84.15	PHASE
1057	0.175	−2.33	62.66	21.13	4.72	3.11	2.46	3.75	0.58	0.33	0.22	MAG
				277.80	52.94	127.84	144.81	286.45	68.65	232.18	104.02	PHASE
1078	0.200	−2.98	71.39	23.69	3.48	3.12	2.46	3.08	0.30	0.20	0.96	MAG
				283.85	64.25	146.28	150.80	290.97	46.10	154.88	227.97	PHASE

Table IX. Concluded

(j) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1081	0.200	−2.98	71.77	24.24	3.47	3.14	2.30	3.06	0.29	0.17	0.66	MAG
				285.10	67.74	152.71	160.34	305.00	48.38	209.78	316.95	PHASE
1152	0.225	−3.82	68.08	22.64	3.55	3.20	2.21	4.16	0.43	0.24	0.22	MAG
				282.21	75.02	159.80	162.67	304.32	77.32	236.04	158.31	PHASE
1155	0.225	−3.82	68.66	23.01	3.53	3.15	2.14	4.19	0.44	0.27	0.30	MAG
				283.27	76.57	162.88	166.21	310.82	98.82	224.20	36.15	PHASE
1161	0.250	−4.66	74.22	24.88	3.03	3.78	2.45	4.34	0.44	0.47	0.93	MAG
				281.91	96.10	175.23	168.49	307.09	87.10	134.69	117.60	PHASE
1164	0.250	−4.66	74.32	24.97	3.18	3.80	2.53	4.35	0.36	0.48	0.81	MAG
				284.53	101.16	182.95	176.08	318.43	107.53	148.15	153.40	PHASE
1221	0.275	−5.67	81.25	25.75	4.77	5.47	2.58	5.03	0.38	0.30	0.58	MAG
				295.00	128.98	194.94	193.81	312.03	56.87	155.86	85.39	PHASE
1224	0.275	−5.67	80.57	24.96	4.85	5.48	2.53	5.04	0.54	0.31	0.44	MAG
				297.32	136.91	209.07	212.16	332.45	66.04	212.30	316.86	PHASE
1235	0.300	−6.69	89.71	26.88	7.33	7.51	2.95	7.68	0.91	0.10	0.41	MAG
				302.25	157.31	219.76	214.11	336.27	6.96	192.15	210.70	PHASE
1238	0.300	−6.69	90.23	27.58	7.43	7.54	2.95	7.47	0.87	0.17	0.19	MAG
				300.92	155.75	216.98	212.21	332.85	350.04	217.33	126.82	PHASE

Table X. Harmonic Components of Vibratory Loads for −400 Blades With Medium Shear Pads

(a) Normal force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	168.39	8.85	0.25	0.29	2.00	0.07	0.07	0.16	0.32	MAG
				311.71	84.32	153.43	61.38	2.06	76.87	93.71	354.13	PHASE
1422	0.100	−0.30	171.50	8.12	0.34	0.28	1.95	0.08	0.07	0.20	0.30	MAG
				305.58	91.69	121.48	49.51	11.35	73.78	74.26	322.23	PHASE
1458	0.125	−1.21	164.69	9.52	0.33	0.26	1.62	0.07	0.04	0.05	0.19	MAG
				303.23	97.33	120.89	61.41	316.84	46.13	90.66	347.58	PHASE
1461	0.125	−1.21	165.63	8.13	0.33	0.13	1.39	0.02	0.04	0.03	0.22	MAG
				302.08	85.95	136.22	76.21	196.35	55.87	129.87	354.94	PHASE
1471	0.150	−1.50	167.53	11.10	0.31	0.14	1.08	0.07	0.04	0.05	0.26	MAG
				298.90	147.89	168.45	98.87	341.99	61.49	108.63	27.44	PHASE
1474	0.150	−1.50	167.40	10.56	0.31	0.01	0.98	0.06	0.08	0.07	0.25	MAG
				294.30	135.39	163.33	82.66	207.20	49.08	106.68	359.09	PHASE
1534	0.175	−2.33	165.23	12.53	0.53	0.04	0.88	0.11	0.08	0.85	0.11	MAG
				290.61	120.26	259.75	109.34	112.39	61.23	125.42	7.72	PHASE
1537	0.175	−2.33	163.89	11.91	0.53	0.01	0.92	0.06	0.05	0.08	0.13	MAG
				290.74	103.12	121.36	107.83	94.08	23.23	182.59	30.98	PHASE
1549	0.200	−2.98	166.97	16.71	0.57	0.12	0.90	0.10	0.03	0.13	0.15	MAG
				293.23	141.39	232.15	130.60	55.83	198.60	133.88	48.56	PHASE
1552	0.200	−2.98	165.98	14.98	0.48	0.07	0.82	0.06	0.04	0.13	0.15	MAG
				290.68	128.65	210.07	141.35	59.30	341.00	147.52	60.69	PHASE
1633	0.225	−3.82	169.73	13.95	0.62	0.17	0.87	0.03	0.13	0.08	0.10	MAG
				281.86	125.80	341.42	165.89	14.34	197.68	108.96	26.74	PHASE
1640	0.225	−3.82	168.14	13.25	0.49	0.11	0.76	0.12	0.11	0.08	0.13	MAG
				285.69	124.64	343.18	184.96	157.44	232.72	161.80	95.08	PHASE
1644	0.250	−4.66	174.73	15.43	0.81	0.34	0.97	0.08	0.08	0.12	0.10	MAG
				280.84	131.85	1.64	200.84	129.83	279.67	14.52	303.22	PHASE
1647	0.250	−4.66	175.47	16.28	0.81	0.39	0.96	0.09	0.08	0.17	0.08	MAG
				279.65	138.58	344.36	186.78	99.07	268.79	3.30	270.58	PHASE

Table X. Continued

(b) Axial force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	−2.77	8.26	2.15	1.28	6.34	3.12	5.32	1.83	1.88	MAG
				34.79	166.41	315.27	14.14	302.69	252.52	165.61	184.27	PHASE
1422	0.100	−0.30	−2.81	8.25	1.78	0.61	6.18	3.11	5.10	2.26	1.67	MAG
				30.38	165.58	280.74	0.93	288.09	237.95	131.29	131.01	PHASE
1458	0.125	−1.21	−4.07	7.69	2.17	0.59	4.92	1.75	4.05	1.88	1.65	MAG
				30.46	170.43	20.92	16.40	312.60	224.21	150.65	148.13	PHASE
1461	0.125	−1.21	−3.74	7.63	2.08	0.44	4.98	1.73	4.50	0.95	1.34	MAG
				31.98	175.02	32.78	23.90	335.42	243.30	169.03	177.02	PHASE
1471	0.150	−1.50	−3.11	7.38	2.01	0.94	4.15	0.63	4.41	1.44	1.79	MAG
				31.58	181.74	30.76	53.51	341.94	257.63	187.01	195.03	PHASE
1474	0.150	−1.50	−3.32	7.64	1.71	1.53	3.98	0.73	4.63	1.39	1.23	MAG
				27.71	164.33	23.10	38.94	9.47	239.17	157.72	163.52	PHASE
1534	0.175	−2.33	−5.32	7.55	1.59	1.64	3.85	1.27	4.80	1.81	2.22	MAG
				24.34	170.29	40.08	62.14	349.32	256.67	146.51	166.15	PHASE
1537	0.175	−2.33	−5.75	7.52	1.61	1.54	3.71	1.38	4.49	1.07	2.79	MAG
				25.89	167.41	52.85	61.37	359.68	262.57	151.87	172.79	PHASE
1549	0.200	−2.98	−7.41	8.05	1.38	2.18	4.09	0.77	3.09	1.80	3.60	MAG
				21.54	170.34	38.99	82.69	0.05	291.16	174.02	182.58	PHASE
1552	0.200	−2.98	−7.25	8.19	1.20	1.93	4.14	0.93	3.45	1.61	3.90	MAG
				24.74	173.73	45.34	88.34	33.67	289.29	173.84	182.76	PHASE
1633	0.225	−3.82	−9.88	9.31	1.35	2.47	5.62	2.14	4.41	2.25	4.27	MAG
				18.79	170.47	47.20	90.39	64.25	301.20	145.74	181.26	PHASE
1640	0.225	−3.82	−10.11	9.44	1.25	2.21	5.36	2.16	3.41	1.98	3.96	MAG
				24.56	176.94	64.92	111.81	71.26	321.04	180.94	209.69	PHASE
1644	0.250	−4.66	−12.95	10 62	1.09	2.79	6.72	2.60	4.88	1.39	4.67	MAG
				20.07	165.74	73.63	109.46	86.53	329.40	112.08	217.55	PHASE
1647	0.250	−4.66	−13.11	10.72	1.23	2.89	6.92	2.75	5.43	1.70	4.98	MAG
				15.38	157.37	41.33	98.98	96.81	318.49	97.96	196.22	PHASE

Table X. Continued

(c) Pitching moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	−20.31	707.92	72.62	32.51	85.30	2.38	7.31	14.94	9.96	MAG
				46.47	149.98	311.41	172.76	163.43	311.60	329.67	207.16	PHASE
1422	0.100	−0.30	−25.32	698.78	61.80	14.27	88.00	4.08	8.16	14.84	8.59	MAG
				42.14	151.60	242.60	159.06	133.66	304.20	298.85	175.85	PHASE
1458	0.125	−1.21	15.05	663.70	77.09	17.31	64.42	6.51	4.68	1.52	2.25	MAG
				40.59	149.40	115.18	167.74	18.86	263.98	0.86	39.15	PHASE
1461	0.125	−1.21	23.60	657.74	71.13	17.76	61.27	8.71	6.62	4.44	2.98	MAG
				42.39	150.39	144.48	177.86	23.67	296.88	335.21	284.91	PHASE
1471	0.150	−1.50	53.19	648.03	76.55	16.26	47.52	5.60	5.11	0.89	0.86	MAG
				41.84	160.22	86.47	201.30	76.72	306.60	85.61	239.95	PHASE
1474	0.150	−1.50	54.63	669.82	73.85	33.04	50.77	6.41	6.08	5.03	3.38	MAG
				37.50	150.68	59.19	187.84	74.55	296.86	335.35	272.56	PHASE
1534	0.175	−2.33	61.34	644.80	73.86	43.62	39.42	5.80	4.83	3.52	5.24	MAG
				35.32	147.10	77.12	213.90	68.74	318.84	73.55	4.39	PHASE
1537	0.175	−2.33	52.87	642.40	70.42	43.47	41.52	5.34	4.94	1.53	1.91	MAG
				36.25	142.36	91.07	217.19	54.57	312.72	56.04	0.87	PHASE
1549	0.200	−2.98	38.96	679.38	62.19	54.73	42.62	6.49	2.21	1.44	4.57	MAG
				33.32	148.48	58.23	247.69	170.90	28.38	11.60	281.83	PHASE
1552	0.200	−2.98	42.74	687.60	57.73	45.14	45.72	7.06	1.35	3.87	5.03	MAG
				35.08	149.18	63.63	253.78	170.78	28.56	85.67	318.47	PHASE
1633	0.225	−3.82	16.67	741.41	64.67	56.69	58.11	10.02	5.10	5.93	3.55	MAG
				28.26	137.43	61.05	271.18	178.30	33.75	296.46	141.59	PHASE
1640	0.225	−3.82	10.62	719.62	57.02	47.45	52.99	7.18	4.34	1.54	1.95	MAG
				34.16	142.11	77.41	283.78	165.15	74.97	24.28	302.28	PHASE
1644	0.250	−4.66	−6.39	770.80	62.96	66.99	72.90	11.66	9.20	18.08	2.33	MAG
				29.81	128.16	94.77	300.54	222.44	6.69	257.07	216.46	PHASE
1647	0.250	−4.66	1.76	799.02	59.95	72.97	71.99	15.31	9.21	21.65	4.09	MAG
				27.19	125.24	48.88	294.25	215.32	335.40	239.44	116.15	PHASE

Table X. Continued

(d) Rolling moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	−116.18	572.57	49.22	64.89	169.88	52.73	34.84	12.89	15.15	MAG
				319.79	98.16	138.98	143.84	269.84	110.17	9.29	123.53	PHASE
1422	0.100	−0.30	−120.07	567.37	42.20	66.98	174.72	47.65	35.00	9.75	17.39	MAG
				315.18	89.17	131.51	129.04	246.52	89.93	342.98	80.40	PHASE
1458	0.125	−1.21	−138.14	554.96	72.77	28.60	157.93	37.97	22.73	1.41	14.20	MAG
				314.19	89.61	137.66	141.50	274.40	129.92	59.66	77.82	PHASE
1461	0.125	−1.21	−131.03	550.32	74.16	29.66	153.75	42.67	22.88	3.85	12.29	MAG
				315.97	91.21	137.65	152.27	280.80	143.83	0.31	73.54	PHASE
1471	0.150	−1.50	−88.04	535.99	70.36	43.03	134.26	33.83	22.22	6.51	12.34	MAG
				316.41	99.26	142.45	190.57	306.89	158.79	119.81	143.42	PHASE
1474	0.150	−1.50	−77.10	557.81	58.00	44.98	128.17	36.60	22.07	5.56	9.86	MAG
				312.66	89.88	142.62	177.52	280.83	134.74	26.54	89.63	PHASE
1534	0.175	−2.33	−62.18	501.09	65.89	21.67	78.34	5.38	11.85	9.93	1.56	MAG
				280.49	4.98	96.46	134.43	202.87	353.41	21.80	274.68	PHASE
1537	0.175	−2.33	−42.54	504.67	70.27	24.29	81.08	7.84	13.83	10.04	1.16	MAG
				282.96	5.31	105.78	133.91	213.80	1.48	20.99	196.63	PHASE
1549	0.200	−2.98	5.67	537.08	74.45	21.21	118.10	6.42	15.33	10.83	1.74	MAG
				286.62	29.36	63.90	148.66	225.63	6.48	50.98	336.98	PHASE
1552	0.200	−2.98	13.61	557.82	75.82	18.72	134.88	10.99	15.85	13.31	4.22	MAG
				292.28	30.83	71.17	154.80	237.72	33.61	56.22	350.63	PHASE
1633	0.225	−3.82	−35.61	572.81	71.86	19.08	204.34	36.92	17.36	6.85	7.21	MAG
				296.86	68.62	64.67	156.49	253.78	39.07	33.74	41.55	PHASE
1640	0.225	−3.82	−47.46	568.75	75.44	24.69	227.66	33.47	14.88	8.75	4.55	MAG
				302.86	77.08	78.04	180.89	298.24	104.63	83.24	74.33	PHASE
1644	0.250	−4.66	−87.49	595.91	76.87	67.86	215.22	55.86	26.15	6.01	3.54	MAG
				304.14	85.19	277.97	199.52	288.21	80.11	189.14	75.90	PHASE
1647	0.250	−4.66	−92.37	609.65	73.73	61.76	195.13	59.54	25.06	2.70	7.81	MAG
				302.08	87.93	274.99	187.27	275.81	59.49	158.51	33.56	PHASE

Table X. Continued

(e) Yawing moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	458.96	171.64	18.59	1.77	268.45	71.60	4.84	1.39	7.14	MAG
				117.60	238.17	333.91	293.84	313.48	60.60	193.77	284.34	PHASE
1422	0.100	−0.30	475.79	174.02	18.17	3.16	272.74	72.77	5.90	0.31	6.82	MAG
				114.41	231.59	53.15	279.89	293.38	31.34	219.94	261.76	PHASE
1458	0.125	−1.21	346.87	160.64	17.33	5.42	216.18	47.48	0.93	0.90	5.88	MAG
				114.20	234.07	181.53	297.68	347.94	175.37	77.89	316.31	PHASE
1461	0.125	−1.21	351.16	160.84	17.85	3.98	210.19	48.24	0.33	1.91	7.81	MAG
				115.37	235.73	192.24	307.19	354.42	192.60	114.67	340.16	PHASE
1471	0.150	−1.50	378.60	163.22	20.51	11.56	169.31	37.39	0.42	0.66	5.36	MAG
				116.16	236.58	299.10	333.09	8.44	137.28	173.20	351.91	PHASE
1474	0.150	−1.50	380.36	166.49	21.11	8.90	167.82	43.96	1.78	1.14	7.38	MAG
				110.87	220.87	292.32	320.17	344.67	102.09	109.10	325.29	PHASE
1534	0.175	−2.33	360.79	142.23	19.47	19.55	152.84	40.78	1.12	1.08	4.82	MAG
				106.60	216.95	293.95	345.51	1.71	294.80	171.22	345.01	PHASE
1537	0.175	−2.33	353.79	146.57	19.05	16.58	160.96	40.82	1.28	1.63	5.26	MAG
				108.31	221.49	291.08	345.50	5.89	2.30	122.57	328.11	PHASE
1549	0.200	−2.98	373.90	153.38	22.67	27.70	190.83	38.27	1.08	1.63	7.35	MAG
				100.55	216.45	277.72	8.00	357.47	140.46	118.04	314.60	PHASE
1552	0.200	−2.98	374.72	142.28	17.90	23.24	195.58	36.44	1.05	0.77	6.17	MAG
				103.50	231.82	278.17	14.13	5.36	309.26	90.52	351.37	PHASE
1633	0.225	−3.82	397.70	162.39	16.01	23.57	259.07	59.43	5.20	1.69	7.73	MAG
				90.82	189.99	259.91	18.05	338.86	32.55	314.02	300.41	PHASE
1640	0.225	−3.82	399.24	143.49	15.62	24.46	256.02	44.02	2.39	1.22	7.48	MAG
				101.16	194.95	278.61	40.00	10.87	272.41	276.16	342.54	PHASE
1644	0.250	−4.66	451.92	157.34	12.92	19.62	333.21	70.98	3.62	2.87	10.34	MAG
				94.97	211.05	237.09	43.00	354.96	35.97	255.36	325.60	PHASE
1647	0.250	−4.66	450.83	170.63	20.66	23.29	339.11	74.40	7.79	2.61	8.58	MAG
				88.18	192.85	245.84	33.02	343.71	46.67	278.08	313.65	PHASE

Table X. Continued

(f) Side force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	−7.94	11.52	1.80	3.97	3.86	5.36	4.58	0.87	2.76	MAG
				318.77	183.14	129.44	209.05	110.11	102.79	28.00	298.88	PHASE
1422	0.100	−0.30	−5.71	9.39	1.39	2.51	5.81	1.66	1.13	0.91	1.66	MAG
				329.53	128.42	121.06	232.85	101.65	105.13	289.47	271.45	PHASE
1458	0.125	−1.21	−4.47	9.34	3.02	1.13	3.20	1.42	1.25	0.81	1.34	MAG
				326.37	110.51	139.37	237.70	173.32	92.58	302.65	304.43	PHASE
1461	0.125	−1.21	−4.46	9.25	3.02	1.10	3.38	1.63	1.37	1.01	1.39	MAG
				328.30	113.01	134.26	246.04	187.72	107.72	315.53	303.28	PHASE
1471	0.150	−1.50	−4.15	8.71	3.07	1.26	5.08	1.33	1.59	0.54	0.62	MAG
				330.84	126.64	142.78	260.79	199.94	127.99	49.53	347.37	PHASE
1474	0.150	−1.50	−4.32	9.71	2.70	1.34	4.88	1.58	1.25	0.76	0.83	MAG
				327.64	126.91	149.86	250.36	181.24	110.53	356.72	287.18	PHASE
1534	0.175	−2.33	−3.63	10.33	3.11	1.10	6.78	1.85	1.68	0.69	1.15	MAG
				324.71	117.66	143.51	239.02	201.19	134.77	28.35	322.25	PHASE
1537	0.175	−2.33	−4.31	9.37	2.01	1.97	7.37	1.54	1.75	1.82	1.39	MAG
				331.32	136.65	112.29	242.65	161.85	173.22	55.61	274.34	PHASE
1549	0.200	−2.98	−4.80	12.23	4.90	2.79	9.53	1.16	2.12	2.19	1.77	MAG
				332.12	114.25	165.22	244.61	251.06	96.51	129.93	258.41	PHASE
1552	0.200	−2.98	−5.22	11.60	2.82	1.09	8.32	3.59	1.45	0.64	3.49	MAG
				323.93	144.42	346.83	250.02	244.30	148.37	67.90	352.89	PHASE
1633	0.225	−3.82	−5.87	13.82	5.51	4.25	5.82	4.80	3.98	1.09	3.18	MAG
				331.07	146.60	240.92	240.56	164.39	204.79	52.05	99.95	PHASE
1640	0.225	−3.82	−5.01	13.64	5.58	2.29	8.22	1.09	2.05	2.80	0.56	MAG
				333.68	111.80	176.84	243.18	280.33	104.19	139.08	288.72	PHASE
1644	0.250	−4.66	−5.25	14.57	5.21	2.75	2.53	1.90	0.80	2.39	1.77	MAG
				332.24	107.04	253.25	280.40	236.29	82.59	131.46	144.82	PHASE
1647	0.250	−4.66	−5.04	14.56	6.34	5.68	3.46	3.93	0.71	2.79	0.46	MAG
				338.46	143.79	287.42	30.14	187.22	291.79	117.61	1.81	PHASE

Table X. Continued

(g) Hub beamwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	--0.30	38.21	0.14	2.20	1.03	0.81	0.33	0.25	0.16	0.17	MAG
				43.76	40.99	114.14	61.82	277.73	153.49	102.53	20.44	PHASE
1422	0.100	--0.30	38.58	0.20	2.28	1.07	0.89	0.35	0.21	0.16	0.14	MAG
				98.49	33.15	107.43	48.43	270.20	137.35	94.01	1.11	PHASE
1458	0.125	−1.21	36.66	0.35	2.43	0.70	0.76	0.29	0.11	0.11	0.06	MAG
				28.20	41.23	124.59	58.83	302.99	116.25	125.75	40.82	PHASE
1461	0.125	−1.21	36.63	0.31	2.38	0.65	0.72	0.26	0.13	0.11	0.08	MAG
				53.63	45.26	130.20	63.93	307.26	143.96	132.59	60.00	PHASE
1471	0.150	−1.50	36.23	0.15	2.35	0.47	0.63	0.22	0.13	0.06	0.06	MAG
				175.44	52.13	170.81	77.65	327.23	161.93	145.15	90.28	PHASE
1474	0.150	−1.50	36.13	0.37	2.29	0.47	0.65	0.24	0.14	0.07	0.06	MAG
				65.74	44.31	155.59	60.64	308.21	135.77	119.13	52.50	PHASE
1534	0.175	−2.33	35.90	0.18	1.67	0.54	0.47	0.08	0.10	0.02	0.01	MAG
				191.64	52.29	193.69	77.92	349.72	208.52	75.11	89.22	PHASE
1537	0.175	−2.33	35.87	0.31	1.78	0.56	0.47	0.10	0.10	0.02	0.01	MAG
				217.67	52.38	196.53	81.03	355.48	202.86	70.95	47.69	PHASE
1549	0.200	−2.98	36.21	0.23	1.02	0.83	0.50	0.12	0.15	0.03	0.04	MAG
				62.39	84.32	210.33	105.50	48.90	205.63	66.04	69.33	PHASE
1552	0.200	−2.98	36.27	0.09	1.03	0.81	0.50	0.11	0.13	0.05	0.04	MAG
				153.58	83.62	214.46	111.61	48.53	217.48	72.37	101.32	PHASE
1633	0.225	−3.82	36.40	0.67	1.41	0.96	0.46	0.10	0.11	0.08	0.07	MAG
				272.60	153.55	216.11	107.94	82.78	204.73	45.39	68.62	PHASE
1640	0.225	−3.82	36.38	0.50	1.39	0.93	0.42	0.08	0.12	0.07	0.08	MAG
				306.04	162.97	231.91	126.82	131.83	240.16	68.00	110.20	PHASE
1644	0.250	−4.66	36.88	0.29	2.80	1.23	0.43	0.11	0.11	0.12	0.09	MAG
				83.51	182.91	231.78	124.25	111.43	212.46	45.84	62.85	PHASE
1647	0.250	−4.66	36.71	0.24	2.50	1.23	0.44	0.09	0.12	0.12	0.08	MAG
				166.19	176.09	223.03	114.07	104.04	196.74	33.50	45.69	PHASE

Table X. Continued

(h) Hub chordwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	102.79	43.82	7.51	8.90	6.47	4.79	2.28	2.62	0.45	MAG
				277.29	41.65	92.22	82.35	257.58	88.42	120.32	99.73	PHASE
1422	0.100	−0.30	103.99	44.66	7.62	9.10	6.80	5.22	2.64	2.58	0.82	MAG
				274.74	32.52	82.57	68.70	238.18	70.01	97.45	44.06	PHASE
1458	0.125	−1.21	98.93	38.15	7.60	6.94	5.32	4.81	1.71	1.35	0.56	MAG
				275.40	37.26	90.29	83.58	265.92	120.19	111.55	36.77	PHASE
1461	0.125	−1.21	97.81	38.55	7.67	6.76	5.02	4.52	1.61	1.38	0.69	MAG
				277.20	40.78	95.35	92 31	275.29	125.63	118.61	357.19	PHASE
1471	0.150	−1.50	94.46	37.60	7.12	5.52	3.57	4.01	0.97	1.53	0.58	MAG
				278.83	48.21	111.74	117.13	302.18	132.63	146.71	105.73	PHASE
1474	0.150	−1.50	94.59	37.07	6.92	5.60	3.61	4.01	0.78	1.36	0.39	MAG
				272.27	41.75	99.53	101.44	282.33	101.62	115.58	9.47	PHASE
1534	0.175	−2.33	67.75	37.10	7.07	4.15	3.10	4.03	1.56	1.89	0.03	MAG
				104.32	37.74	300.96	93.33	74.58	70.75	230.57	54.83	PHASE
1633	0.225	−3.82	68.08	35.86	5.62	7.52	3.45	4.15	0.91	1.83	0.10	MAG
				111.45	89.98	2.41	124.91	96.54	53.40	259.55	137.69	PHASE
1640	0.225	−3.82	69.11	35.88	6.31	7.47	3.08	3.57	0.87	1.76	0.48	MAG
				116.78	100.73	20.12	142.33	121.86	52.72	280.70	337.09	PHASE
1644	0.250	−4.66	80.35	38.24	7.79	10.21	2.83	3.87	1.20	2.21	0.92	MAG
				114.81	133.00	24.52	160.12	116.25	347.69	281.35	305.25	PHASE
1647	0.250	−4.66	80.13	36.91	8.13	10.25	2.67	4.68	1.02	2.02	0.50	MAG
				113.91	121.26	15.68	148.02	99.50	357.58	261.63	323.46	PHASE

Table X. Continued

(i) Hub beamwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	36.02	1.60	0.40	0.21	0.29	0.10	0.13	0.06	0.09	MAG
				270.43	7.42	126.28	98.89	10.45	29.03	129.97	147.05	PHASE
1422	0.100	−0.30	36.17	1.63	0.41	0.19	0.28	0.06	0.15	0.05	0.06	MAG
				266.50	1.37	115.82	90.19	358.62	21.09	68.00	104.65	PHASE
1458	0.125	−1.21	35.18	1.41	0.44	0.08	0.20	0.06	0.02	0.05	0.04	MAG
				270.20	16.97	138.08	124.76	333.86	109.58	59.96	57.41	PHASE
1461	0.125	−1.21	35.12	1.41	0.43	0.08	0.21	0.07	0.02	0.05	0.01	MAG
				271.13	20.23	143.28	132.19	357.58	55.15	76.01	16.07	PHASE
1471	0.150	−1.50	34.86	1.40	0.33	0.06	0.18	0.07	0.05	0.05	0.03	MAG
				271.91	23.47	213.00	175.78	15.97	2.12	131.58	129.29	PHASE
1474	0.150	−1.50	34.89	1.33	0.32	0.05	0.18	0.06	0.06	0.04	0.02	MAG
				267.34	16.15	203.35	159.26	9.38	331.92	91.72	73.15	PHASE
1534	0.175	−2.33	35.02	1.39	0.21	0.09	0.14	0.09	0.07	0.07	0.03	MAG
				269.39	12.00	211.82	184.97	318.65	52.24	138.75	357.63	PHASE
1537	0.175	−2.33	35.03	1.40	0.20	0.09	0.16	0.09	0.06	0.06	0.01	MAG
				269.12	15.18	221.71	186.75	308.57	45.97	138.72	70.22	PHASE
1549	0.200	−2.98	35.17	1.39	0.08	0.12	0.17	0.10	0.13	0.07	0.02	MAG
				273.63	218.30	195.44	201.43	319.51	38.52	157.20	140.52	PHASE
1552	0.200	−2.98	35.23	1.40	0.07	0.12	0.17	0.09	0.11	0.08	0.03	MAG
				273.62	211.86	198.24	204.77	339.63	50.52	177.26	88.81	PHASE
1633	0.225	−3.82	34.89	1.62	0.44	0.21	0.21	0.13	0.13	0.70	0.07	MAG
				274.79	200.18	172.10	186.93	339.02	28.41	170.99	119.61	PHASE
1640	0.225	−3.82	34.95	1.55	0.44	0.20	0.21	0.14	0.13	0.10	0.05	MAG
				280.75	210.52	187.96	205.47	10.48	64.41	203.33	155.65	PHASE
1644	0.250	−4.66	35.55	1.60	0.87	0.30	0.24	0.15	0.14	0.13	0.06	MAG
				278.75	203.50	182.01	196.90	345.47	19.15	178.32	108.87	PHASE
1647	0.250	−4.66	35.53	1.64	0.86	0.30	0.26	0.15	0.14	0.12	0.08	MAG
				274.12	196.99	175.16	186.04	336.76	5.86	161.81	82.76	PHASE

Table X. Concluded

(j) Hub chordwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1418	0.100	−0.30	84.04	32.38	5.88	6.23	3.96	2.60	1.33	1.57	0.28	MAG
				277.79	44.94	94.95	84.92	254.87	89.96	116.87	89.91	PHASE
1422	0.100	−0.30	85.06	32.96	5.94	6.37	4.19	2.84	1.52	1.61	0.56	MAG
				275.26	36.04	85.39	70.99	235.31	71.51	93.86	39.25	PHASE
1458	0.125	−1.21	77.85	28.17	5.95	4.80	3.31	2.66	1.02	0.87	0.42	MAG
				275.93	40.56	93.09	85.00	265.36	115.35	106.88	37.77	PHASE
1461	0.125	−1.21	77.09	28.47	5.98	4.67	3.08	2.47	0.98	0.87	0.47	MAG
				277.66	44.13	98.20	93.51	274.35	123.25	115.57	2.28	PHASE
1471	0.150	−1.50	74.30	27.89	5.60	3.73	2.20	2.28	0.67	0.92	0.40	MAG
				279.16	51.86	114.42	118.50	300.56	133.90	143.79	111.28	PHASE
1474	0.150	−1.50	74.49	27.48	5.45	3.80	2.25	2.26	0.55	0.83	0.24	MAG
				272.72	45.13	101.63	102.21	280.34	107.93	110.71	17.06	PHASE
1534	0.175	−2.33	76.28	28.56	4.81	3.20	1.69	1.92	0.52	0.76	0.20	MAG
				276.31	50.63	131.04	129.96	298.04	111.41	139.89	39.59	PHASE
1537	0.175	−2.33	75.78	27.93	4.91	3.16	1.85	2.04	0.46	0.72	0.24	MAG
				277.02	51.35	131.65	134.17	295.37	115.50	132.15	160.84	PHASE
1549	0.200	−2.98	78.89	29.99	3.58	3.39	2.34	1.85	0.98	0.59	0.38	MAG
				276.22	62.69	160.82	154.88	313.59	72.45	131.51	155.98	PHASE
1552	0.200	−2.98	78.82	29.42	3.69	3.39	2.35	1.76	0.93	0.61	0.57	MAG
				277.93	64.02	164.35	158.50	324.45	84.74	148.81	97.31	PHASE
1633	0.225	−3.82	84.67	32.20	3.20	4.38	2.63	1.93	1.07	0.71	0.64	MAG
				276.56	91.91	185.10	155.82	309.93	37.69	130.60	99.60	PHASE
1640	0.225	−3.82	84.97	31.46	3.20	4.25	2.52	1.86	0.99	0.58	0.43	MAG
				281.01	101.88	198.42	178.43	335.87	75.81	176.32	102.27	PHASE
1644	0.250	−4.66	93.93	34.63	4.03	6.80	3.18	2.12	1.03	0.87	0.23	MAG
				278.75	140.11	211.47	168.18	313.87	3.48	141.67	53.12	PHASE
1647	0.250	−4.66	93.91	34.73	4.06	6.81	3.25	2.24	1.03	0.87	0.63	MAG
				275.67	134.93	202.89	158.13	299.09	353.63	117.91	61.74	PHASE

Table XI. Harmonic Components of Vibratory Loads for -400 Blades With Large Shear Pads

(a) Normal force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	164.69	16.80	7.15	2.43	15.96	2.82	0.60	1.00	3.19	MAG
				214.72	137.15	263.54	123.97	168.39	86.79	241.59	348.82	PHASE
1695	0.100	−0.75	160.49	19.13	7.17	2.26	14.79	2.24	0.63	1.00	4.88	MAG
				219.29	128.53	265.39	126.52	179.37	61.63	251.35	359.65	PHASE
1696	0.150	−1.50	164.53	27.80	7.07	2.32	8.93	1.18	0.37	0.17	2.51	MAG
				225.75	128.91	257.28	155.09	23.80	128.01	224.62	58.77	PHASE
1706	0.175	−2.33	161.79	35.85	7.13	2.28	7.20	0.76	0.26	0.11	1.32	MAG
				233.03	114.04	258.65	180.83	303.27	126.16	254.01	234.98	PHASE
1710	0.200	−2.98	162.48	44.69	10.81	2.49	5.71	2.60	0.73	0.46	2.78	MAG
				233.48	113.35	287.36	211.14	301.37	134.03	216.55	162.03	PHASE
1786	0.250	−4.66	162.23	49.45	6.24	1.39	9.60	1.60	0.79	1.70	2.75	MAG
				220.89	117.26	319.31	261.11	245.56	199.55	193.92	217.55	PHASE
1789	0.250	−4.66	161.92	49.42	6.23	1.40	9.39	2.03	0.97	1.76	3.63	MAG
				225.62	123.62	2.59	275.65	269.96	225.76	222.34	250.54	PHASE
1793	0.275	−5.67	164.31	50.57	7.75	4.36	14.31	1.08	0.57	4.72	6.59	MAG
				218.26	116.21	11.14	269.50	192.68	270.61	150.33	260.82	PHASE
1797	0.275	−5.67	164.74	51.54	6.85	4.08	14.11	1.20	0.60	5.56	6.64	MAG
				222.78	125.12	15.25	289.97	270.27	326.43	172.79	295.49	PHASE
1813	0.300	−6.69	167.06	53.07	7.15	8.84	18.61	1.35	3.45	12.22	6.32	MAG
				221.67	134.60	37.45	286.47	243.92	288.16	142.96	234.67	PHASE
1816	0.3[illegible]	−6.69	167.36	55.59	6.97	9.22	18.47	1.53	4.93	13.54	5.76	MAG
				220.93	139.95	21.79	284.10	201.14	287.39	134.38	232.39	PHASE

Table XI. Continued

(b) Axial force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	−2.82	2.09	2.47	1.02	5.04	2.84	0.67	2.23	0.61	MAG
				356.93	172.59	263.06	28.49	342.17	245.45	290.11	340.17	PHASE
1695	0.100	−0.75	−3.03	1.99	2.80	0.79	4.90	2.04	1.07	2.47	0.44	MAG
				357.01	175.95	244.09	29.24	1.24	234.88	286.98	246.23	PHASE
1696	0.150	−1.50	−4.85	1.96	2.80	1.37	3.93	0.81	2.49	0.95	1.62	MAG
				4.51	176.91	249.03	58.39	201.38	286.10	224.83	133.01	PHASE
1706	0.175	−2.33	−9.46	1.86	2.44	1.49	4.18	1.53	1.65	0.51	2.61	MAG
				347.54	179.09	234.80	76.10	70.51	259.27	271.24	180.14	PHASE
1710	0.200	−2.98	−10.37	1.73	2.29	1.17	4.31	3.83	3.11	0.24	4.54	MAG
				331.89	172.62	266.76	97.21	86.11	255.25	269.71	184.17	PHASE
1786	0.250	−4.66	−14.79	2.23	1.30	0.88	6.14	4.47	2.15	1.76	4.51	MAG
				296.98	174.89	114.23	110.27	51.13	266.33	70.50	207.87	PHASE
1789	0.250	−4.66	−14.70	2.18	1.31	1.58	6.09	4.93	2.26	2.01	6.64	MAG
				295.30	182.12	105.02	127.31	69.47	296.60	123.72	246.81	PHASE
1793	0.275	−5.67	−17.37	2.60	1.32	2.76	7.85	4.11	0.81	3.25	6.89	MAG
				281.22	171.98	52.36	115.26	43.64	209.06	105.09	231.73	PHASE
1797	0.275	−5.67	−17.01	2.51	1.24	2.06	7.83	4.29	0.75	3.57	7.17	MAG
				285.59	169.27	78.47	135.43	85.08	65.68	138.08	272.61	PHASE
1813	0.300	−6.69	−19.64	2.83	0.16	6.03	10.59	6.15	3.02	6.38	8.03	MAG
				270.72	178.17	67.90	130.05	49.79	92.59	149.21	283.53	PHASE
1816	0.300	−6.69	−19.65	2.65	0.52	5.08	10.39	5.33	3.91	7.09	7.62	MAG
				264.10	210.38	52.33	130.66	37.04	84.63	143.39	275.89	PHASE

Table XI. Continued

(c) Pitching moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	−30.03	162.06	90.61	47.37	71.52	11.80	2.20	11.90	7.53	MAG
				341.62	141.03	278.66	165.57	350.85	297.71	359.02	74.79	PHASE
1695	0.100	−0.75	−28.42	167.64	94.52	41.07	65.05	9.95	3.02	13.85	10.26	MAG
				336.76	141.18	269.69	171.21	2.07	297.62	346.70	110.41	PHASE
1696	0.150	−1.50	−59.27	147.07	97.36	58.90	44.37	0.65	5.40	5.73	6.94	MAG
				341.38	138.61	264.94	202.22	116.73	337.67	324.06	60.05	PHASE
1706	0.175	−2.33	−66.93	168.15	75.56	63.37	40.13	7.43	3.17	4.59	4.39	MAG
				327.74	119.37	249.86	228.81	58.26	325.49	0.72	12.61	PHASE
1710	0.200	−2.98	−51.97	185.46	97.66	49.07	41.47	12.60	5.88	1.17	4.46	MAG
				316.23	98.57	286.93	257.43	73.71	312.94	115.74	21.31	PHASE
1786	0.250	−4.66	−114.45	211.64	64.37	26.25	64.62	13.80	4.17	8.74	4.80	MAG
				301.25	85.69	73.32	284.35	38.71	7.23	67.46	34.14	PHASE
1789	0.250	−4.66	−107.75	211.75	73.90	52.52	63.2[illegible]	14.85	3.06	4.72	6.03	MAG
				306.65	94.16	86.53	301.39	69.02	44.49	125.95	332.33	PHASE
1793	0.275	−5.67	−110.77	237.76	77.10	133.23	86.02	15.96	9.03	10.54	11.27	MAG
				299.49	83.30	44.71	285.34	45.55	114.09	10.42	28.66	PHASE
1797	0.275	−5.67	-93.20	228.93	84.68	98.38	84.53	13.69	10.10	14.05	10.86	MAG
				302.93	87.54	62.35	308.12	79.98	126.99	25.48	61.04	PHASE
1813	0.300	−6.69	−58.75	260.32	87.40	254.86	96.69	6.60	18.24	47.84	29.68	MAG
				297.88	59.47	62.41	309.06	124.19	120.21	354.45	3.48	PHASE
1816	0.300	−6.69	−58.29	261.11	67.49	223.12	101.34	3.45	22.64	53.41	27.45	MAG
				294.70	58.91	45.77	307.00	144.27	119.11	338.83	356.44	PHASE

Table XI. Continued

(d) Rolling moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	−133.28	155.95	91.57	4.05	433.22	16.74	10.18	10.07	12.40	MAG
				259.95	87.51	200.55	113.49	267.84	128.94	233.70	86.37	PHASE
1695	0.100	−0.75	−124.32	156.74	113.66	5.88	412.09	15.80	13.09	13.43	15.48	MAG
				255.19	86.70	181.28	116.55	270.77	113.93	254.28	118.80	PHASE
1696	0.150	−1.50	−83.77	151.40	116.86	5.37	315.84	4.50	8.90	2.27	10.27	MAG
				264.95	86.18	112.92	151.08	32.06	135.67	176.62	69.21	PHASE
1706	0.175	−2.33	−125.11	163.30	121.63	2.19	334.95	6.48	13.55	7.58	3.17	MAG
				254.64	86.75	338.64	175.19	323.70	158.73	303.18	19.27	PHASE
1710	0.200	−2.98	−77.33	173.79	141.63	23.50	328.43	8.27	12.83	5.55	9.32	MAG
				250.86	84.04	66.38	198.08	281.24	164.44	285.73	121.94	PHASE
1786	0.250	−4.66	−79.11	190.50	92.93	93.67	409.92	32.84	1.67	3.95	6.21	MAG
				238.09	80.53	37.96	226.26	231.87	309.36	344.45	84.13	PHASE
1789	0.250	−4.66	−80.62	180.54	94.14	92.12	401.30	30.73	5.53	3.42	5.42	MAG
				245.65	94.63	53.87	240.59	258.13	278.34	122.74	209.07	PHASE
1793	0.275	−5.67	−82.04	192.34	63.24	156.61	474.49	47.10	5.81	6.59	4.42	MAG
				241.81	81.41	28.33	233.94	230.53	229.52	76.86	306.26	PHASE
1797	0.275	−5.67	−59.95	212.60	66.01	163.44	467.36	53.24	1.31	12.10	5.47	MAG
				243.25	89.38	41.28	255.10	245.53	218.84	104.98	259.78	PHASE
1813	0.300	−6.69	−20.52	218.93	43.49	269.24	391.09	59.99	2.02	7.93	9.13	MAG
				239.71	87.04	36.36	261.18	239.15	270.13	74.00	213.79	PHASE
1816	0.300	−6.69	−10.37	219.67	51.22	296.37	381.03	61.44	8.61	7.47	7.51	MAG
				241.55	77.56	35.27	261.47	231.88	230.84	61.69	242.56	PHASE

Table XI. Continued

(e) Yawing moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	477.49	19.46	12.86	5.64	251.80	8.67	3.38	2.51	13.64	MAG
				340.94	247.18	239.40	287.73	341.75	310.37	270.10	319.41	PHASE
1695	0.100	−0.75	466.90	16.95	15.46	6.30	231.50	7.66	4.32	1.39	10.09	MAG
				332.68	251.79	265.76	290.17	344.07	298.56	249.74	316.35	PHASE
1696	0.150	−1.50	448.56	23.85	16.21	6.40	195.11	8.91	2.45	0.97	9.55	MAG
				326.13	248.15	275.72	317.77	157.74	284.54	211.13	335.68	PHASE
1706	0.175	−2.33	371.23	24.03	17.53	8.73	203.77	1.48	4.79	1.33	11.91	MAG
				355.06	236.33	285.64	339.26	244.85	313.83	224.95	336.29	PHASE
1710	0.200	−2.98	407.18	46.61	19.84	23.41	233.29	12.64	5.50	1.93	7.05	MAG
				334.23	241.31	296.84	359.29	286.70	321.70	304.78	325.04	PHASE
1786	0.250	−4.66	498.21	54.72	20.26	40.15	343.38	36.13	4.35	0.71	11.32	MAG
				300.44	229.17	271.49	25.22	260.89	259.36	253.18	290.31	PHASE
1789	0.250	−4.66	495.71	62.50	23.15	33.82	358.37	32.04	6.11	1.22	15.69	MAG
				340.30	218.65	288.52	43.22	279.85	278.07	256.55	324.21	PHASE
1793	0.275	−5.67	568.63	82.64	21.51	63.23	498.56	46.67	5.61	1.29	14.47	MAG
				323.19	231.02	257.45	34.45	278.42	233.44	228.74	277.04	PHASE
1797	0.275	−5.67	560.39	60.90	17.69	55.26	499.45	53.89	2.97	1.22	13.53	MAG
				297.51	237.70	269.02	54.14	274.07	224.54	165.31	316.06	PHASE
1813	0.300	−6.69	622.08	71.19	19.51	84.35	683.34	71.74	9.99	2.84	8.98	MAG
				308.35	209.32	260.90	55.43	285.29	235.35	28.31	347.50	PHASE
1816	0.300	−6.69	616.42	74.26	11.89	85.59	689.60	65.99	14.95	3.35	10.87	MAG
				306.26	168.71	261.22	53.53	272.79	216.46	48.76	339.66	PHASE

Table XI. Continued

(f) Side force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	−7.44	4.20	5.19	0.40	15.98	2.95	2.02	0.22	0.95	MAG
				237.60	81.81	271.33	98.18	284.45	158.62	293.26	271.82	PHASE
1695	0.100	−0.75	−9.19	4.09	7.91	2.80	21.61	5.08	7.41	3.24	5.93	MAG
				325.20	150.13	352.69	107.88	262.60	26.16	194.58	305.50	PHASE
1696	0.150	−1.50	−5.42	4.57	6.07	0.54	10.88	2.39	1.05	1.65	0.93	MAG
				275.11	90.89	294.45	156.58	43.06	76.46	217.29	282.86	PHASE
1706	0.175	−2.33	−6.61	4.72	4.08	2.80	12.55	2.73	0.39	2.19	4.47	MAG
				292.18	137.12	302.99	178.98	259.93	286.36	212.46	286.50	PHASE
1710	0.200	−2.98	−7.51	6.56	6.27	4.48	13.95	3.00	3.88	2.71	3.55	MAG
				267.71	88.15	30.06	193.75	118.58	144.26	297.28	4.48	PHASE
1786	0.250	−4.66	−6.60	8.55	4.73	5.07	14.11	2.37	0.79	1.92	7.14	MAG
				276.57	70.28	47.87	245.84	144.32	255.07	23.82	24.1[illegible]	PHASE
1789	0.250	−4.66	−3.71	7.71	2.72	3.09	12.75	1.59	1.63	0.76	1.60	MAG
				278.11	123.63	28.22	248.55	212.48	239.09	281.19	90.68	PHASE
1793	0.275	−5.67	−4.23	8.14	1.51	5.79	11.99	3.19	0.45	0.55	3.57	MAG
				284.21	62.82	25.93	252.62	162.23	246.98	352.55	58.73	PHASE
1797	0.275	−5.67	−5.54	11.38	2.87	8.18	14.20	1.63	3.54	2.88	5.30	MAG
				257.19	53.82	3.39	277.04	89.05	6.69	337.84	108.80	PHASE
1813	0.300	−6.69	−5.47	8.67	3.28	11.90	10.39	4.90	4.19	1.44	3.53	MAG
				258.34	112.39	14.71	350.84	175.49	32.01	350.39	172.81	PHASE
1816	0.300	−6.69	−4.21	10.68	2.76	11.81	12.33	2.84	1.34	0.67	4.68	MAG
				269.77	59.63	25.98	355.87	150.82	36.22	39.69	142.29	PHASE

Table XI. Continued

(g) Hub beamwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	40.88	0.11	2.17	1.07	0.69	0.15	0.12	0.20	0.23	MAG
				43.59	29.26	116.16	54.85	261.30	37.37	46.05	285.22	PHASE
1695	0.100	−0.75	41.19	0.13	2.30	1.02	0.68	0.18	0.16	0.20	0.24	MAG
				30.46	32.07	118.03	56.11	246.65	48.88	47.27	290.41	PHASE
1696	0.150	−1.50	41.29	0.12	2.62	0.51	0.44	0.18	0.09	0.03	0.09	MAG
				41.39	42.75	170.96	75.31	257.18	138.83	51.74	339.72	PHASE
1706	0.175	−2.33	39.66	0.37	2.13	0.74	0.44	0.19	0.10	0.02	0.08	MAG
				64.16	61.29	210.03	100.58	255.19	126.98	139.68	311.92	PHASE
1710	0.200	−2.98	40.20	0.89	1.42	0.96	0.40	0.12	0.17	0.06	0.14	MAG
				240.39	95.88	227.39	119.93	269.48	146.58	163.35	327.65	PHASE
1786	0.250	−4.66	39.39	0.27	2.97	1.30	0.43	0.22	0.27	0.05	0.07	MAG
				17.53	171.38	225.76	144.49	134.82	149.39	188.87	5.47	PHASE
1789	0.250	−4.66	39.25	0.37	2.93	1.32	0.46	0.22	0.23	0.03	0.09	MAG
				216.70	179.11	238.15	153.70	156.25	180.83	298.36	30.58	PHASE
1793	0.275	−5.67	38.84	0.25	5.20	1.48	0.55	0.31	0.29	0.05	0.13	MAG
				354.17	178.45	225.03	127.43	130.52	140.96	193.90	15.02	PHASE
1797	0.275	−5.67	38.81	0.43	5.22	1.50	0.57	0.30	0.28	0.06	0.14	MAG
				232.11	188.73	241.66	146.52	146.98	171.56	208.01	52.53	PHASE
1813	0.300	−6.69	38.63	0.57	7.40	1.56	0.72	0.37	0.21	0.13	0.08	MAG
				302.79	188.85	235.90	133.11	128.13	162.31	135.76	45.59	PHASE
1816	0.300	−6.69	38.58	0.34	7.47	1.59	0.69	0.37	0.23	0.13	0.09	MAG
				277.97	187.38	234.65	129.71	125.55	157.94	121.20	54.65	PHASE

Table XI. Continued

(h) Hub beamwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	36.59	2.22	0.46	0.24	0.20	0.05	0.13	0.06	0.11	MAG
				278.02	10.50	89.93	69.25	249.57	149.26	155.33	44.37	PHASE
1695	0.100	−0.75	36.64	2.15	0.47	0.23	0.18	0.04	0.14	0.09	0.14	MAG
				277.20	17.57	92.60	67.82	285.94	163.88	154.23	58.80	PHASE
1696	0.150	−1.50	36.27	2.12	0.51	0.21	0.07	0.07	0.02	0.06	0.07	MAG
				280.32	21.40	154.45	120.07	322.42	79.74	101.73	69.25	PHASE
1706	0.175	−2.33	35.34	2.29	0.35	0.20	0.10	0.06	0.04	0.04	0.02	MAG
				281.75	41.89	186.49	174.46	336.24	252.64	97.00	27.28	PHASE
1710	0.200	−2.98	35.60	2.54	0.15	0.26	0.15	0.09	0.09	0.05	0.05	MAG
				281.90	95.08	199.99	207.03	334.89	324.50	57.43	85.02	PHASE
1786	0.250	−4.66	36.24	2.38	0.73	0.41	0.23	0.20	0.22	0.07	0.03	MAG
				289.86	187.74	195.21	206.74	327.00	335.24	41.01	119.49	PHASE
1789	0.250	−4.66	36.22	2.43	0.70	0.40	0.24	0.20	0.16	0.04	0.03	MAG
				292.90	197.14	206.43	226.42	350.44	9.86	115.60	158.66	PHASE
1793	0.275	−5.67	36.92	2.50	1.35	0.52	0.37	0.26	0.25	0.05	0.07	MAG
				292.60	186.44	193.35	217.36	336.92	335.00	57.75	146.39	PHASE
1797	0.275	−5.67	36.88	2.54	1.36	0.53	0.37	0.25	0.23	0.06	0.07	MAG
				296.86	197.18	210.94	235.81	358.14	7.78	100.03	182.82	PHASE
1813	0.300	−6.69	36.98	2.66	2.07	0.74	0.46	0.32	0.21	0.05	0.08	MAG
				301.97	191.63	203.46	233.73	344.53	5.13	348.07	145.10	PHASE
1816	0.300	−6.69	37.02	2.63	2.08	0.73	0.49	0.34	0.24	0.05	0.06	MAG
				300.39	191.34	201.35	231.98	340.38	0.94	332.50	163.03	PHASE

Table XI. Concluded

(i) Hub chordwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
1693	0.100	−0.75	85.06	45.63	7.79	6.18	3.71	1.82	1.29	0.78	0.62	MAG
				281.94	29.79	86.56	78.67	231.94	154.59	102.02	337.71	PHASE
1695	0.100	−0.75	84.00	45.21	8.50	6.23	3.47	1.68	1.47	0.84	0.23	MAG
				281.49	33.34	88.85	80.78	235.81	163.07	97.85	50.35	PHASE
1696	0.150	−1.50	76.40	44.67	8.10	4.70	2.09	1.79	0.88	0.75	0.75	MAG
				282.58	35.19	113.75	90.25	254.48	118.86	92.72	353.91	PHASE
1706	0.175	−2.33	76.17	48.22	7.10	3.70	1.93	1.13	0.50	0.64	0.77	MAG
				283.62	53.12	149.11	135.87	270.85	194.14	118.55	321.35	PHASE
1710	0.200	−2.98	79.10	51.13	5.57	4.35	2.00	1.11	0.04	0.54	0.51	MAG
				286.56	73.94	179.38	172.59	287.52	348.90	109.11	16.02	PHASE
1786	0.250	−4.66	96.85	49.45	7.47	8.56	3.32	1.31	1.04	0.84	0.43	MAG
				290.12	142.19	204.69	184.95	314.64	353.35	69.32	25.37	PHASE
1789	0.250	−4.66	95.22	49.91	6.82	8.46	3.21	1.50	0.75	0.57	0.38	MAG
				295.49	150.07	215.52	200.69	338.00	42.80	109.76	359.90	PHASE
1793	0.275	−5.67	108.58	50.79	12.68	12.34	3.96	2.06	1.36	0.78	0.60	MAG
				292.13	158.24	210.35	188.37	327.49	357.93	78.50	52.21	PHASE
1797	0.275	−5.67	107.53	51.22	12.67	12.26	4.00	2.15	1.33	1.13	0.49	MAG
				298.47	169.55	226.80	207.12	353.72	35.43	123.37	101.13	PHASE
1813	0.300	−6.69	121.27	51.45	19.53	16.60	4.96	3.06	1.55	0.64	0.64	MAG
				301.15	170.48	223.99	199.76	350.27	21.98	101.23	120.79	PHASE
1816	0.300	−6.69	121.50	51.38	19.64	16.73	5.03	3.04	1.63	0.70	0.23	MAG
				300.07	170.22	222.70	198.00	344.29	17.52	93.62	129.54	PHASE

Table XII. Harmonic Components of Vibratory Loads for −500 Blades With Large Shear Pads

(a) Normal force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	162.79	10.49	2.20	0.89	13.33	2.52	1.34	0.57	4.70	MAG
				225.08	264.76	166.16	142.64	307.05	45.93	185.24	172.88	PHASE
2014	0.100	−0.75	161.74	9.85	3.57	0.75	13.01	3.24	0.84	0.60	3.53	MAG
				239.92	300.92	185.76	132.65	291.22	20.14	106.94	168.00	PHASE
2057	0.125	−1.21	162.52	17.73	3.91	1.12	9.25	2.66	0.64	1.00	1.62	MAG
				254.37	318.99	189.90	127.70	298.15	26.59	141.04	218.47	PHASE
2060	0.125	−1.21	164.80	17.12	3.92	1.39	9.09	2.80	0.62	1.67	2.07	MAG
				256.79	319.12	194.80	124.92	304.79	116.57	133.49	227.86	PHASE
2066	0.150	−1.50	163.41	20.60	5.75	1.15	6.64	1.68	0.51	1.23	2.82	MAG
				265.80	320.86	180.01	141.86	334.24	4.73	133.69	276.79	PHASE
2069	0.150	−1.50	166.44	19.39	5.28	1.30	7.16	2.46	0.62	1.15	2.28	MAG
				263.55	316.19	183.38	126.99	336.48	335.66	94.69	249.62	PHASE
2125	0.175	−2.33	161.46	16.51	5.23	0.76	4.68	1.67	1.29	0.41	3.17	MAG
				272.30	227.34	65.98	142.47	359.18	70.50	140.59	217.09	PHASE
2129	0.175	−2.33	163.02	16.83	5.58	1.01	4.69	2.02	1.23	0.93	2.95	MAG
				271.78	230.88	98.55	143.27	347.09	74.25	141.68	210.74	PHASE
2143	0.200	−2.98	164.04	24.01	2.63	1.31	2.52	2.32	0.09	0.57	1.28	MAG
				291.27	257.91	130.50	166.98	47.51	61.02	180.13	211.66	PHASE
2146	0.200	−2.98	162.78	22.29	4.32	1.06	3.11	2.84	0.34	1.36	1.78	MAG
				295.70	261.97	118.82	173.70	55.77	100.50	184.74	187.19	PHASE

Table XII. Continued

(a) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	162.88	26.48	2.26	1.14	2.83	3.34	0.69	1.38	1.73	MAG
				318.29	149.65	127.85	219.85	40.52	227.74	168.35	169.16	PHASE
2225	0.225	−3.82	163.36	24.37	2.04	0.94	3.30	3.52	0.49	0.03	1.74	MAG
				322.07	145.03	113.42	205.78	38.04	231.31	142.97	143.06	PHASE
2232	0.250	−4.66	163.04	26.70	3.14	1.16	3.50	3.45	1.11	0.88	2.36	MAG
				324.01	151.55	99.91	241.14	68.52	213.39	119.57	183.64	PHASE
2239	0.250	−4.66	162.42	26.51	4.15	1.25	3.61	3.45	1.10	1.25	2.20	MAG
				323.37	148.26	95.06	232.12	48.84	184.49	116.45	165.39	PHASE
2292	0.275	−5.67	162.78	26.94	2.79	2.65	6.05	2.33	1.54	1.39	1.62	MAG
				332.37	154.70	81.06	278.94	50.11	252.29	85.00	278.36	PHASE
2295	0.275	−5.67	162.23	26.77	1.76	2.38	5.68	3.41	1.25	1.66	1.16	MAG
				331.26	151.88	60.33	280.11	48.67	241.54	104.83	311.63	PHASE
2301	0.300	−6.69	166.62	26.10	3.64	3.84	7.40	3.23	1.49	2.05	2.97	MAG
				332.42	155.93	22.36	294.18	37.70	269.33	66.48	6.90	PHASE
2304	0.300	−6.69	164.29	27.07	2.97	2.70	7.16	3.39	1.17	1.75	2.42	MAG
				331.45	154.81	38.69	292.70	39.56	282.03	49.16	356.82	PHASE
2311	0.325	−7.78	163.05	26.92	4.59	2.07	9.65	4.02	1.50	4.47	8.00	MAG
				327.06	152.33	29.56	301.60	43.24	289.20	93.06	29.45	PHASE
2312	0.350	−9.08	163.30	22.48	5.29	2.99	11.73	4.99	1.98	7.75	9.14	MAG
				333.45	162.73	355.22	324.94	60.75	308.52	88.61	31.30	PHASE

Table XII. Continued

(b) Axial force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	−4.55	1.42	1.15	0.75	5.28	2.94	4.56	0.33	1.06	MAG
				47.58	225.34	191.34	61.59	89.69	214.89	66.13	114.26	PHASE
2014	0.100	−0.75	−4.90	1.47	1.45	0.37	5.12	3.58	3.26	0.59	1.22	MAG
				47.87	233.09	205.29	61.45	91.08	184.42	185.26	94.19	PHASE
2057	0.125	−1.21	−4.48	1.31	1.60	0.41	4.28	4.23	1.11	1.25	0.83	MAG
				54.48	222.05	239.96	77.42	88.31	168.88	188.20	94.67	PHASE
2060	0.125	−1.21	−4.32	1.41	1.83	0.70	4.08	4.12	0.59	1.30	0.75	MAG
				53.15	222.47	231.26	72.47	86.48	210.98	155.13	68.26	PHASE
2066	0.150	−1.50	−5.13	1.25	1.75	1.05	3.80	3.60	0.32	1.57	0.53	MAG
				62.90	233.70	189.19	101.51	106.29	294.76	179.11	188.51	PHASE
2069	0.150	−1.50	−5.20	1.21	1.92	1.03	3.82	3.53	1.10	1.60	1.32	MAG
				55.67	227.26	209.89	87.41	104.64	182.69	165.98	202.78	PHASE
2125	0.175	−2.33	−7.35	1.01	1.89	0.76	3.49	2.21	3.97	0.71	0.81	MAG
				34.88	211.16	119.62	95.50	103.54	227.79	22.35	216.97	PHASE
2129	0.175	−2.33	−6.99	1.01	1.84	1.08	3.58	2.79	3.92	0.65	1.40	MAG
				36.59	213.50	112.05	95.64	98.57	227.61	22.94	208.66	PHASE
2143	0.200	−2.98	−8.40	0.98	1.87	1.86	4.03	2.45	2.51	0.83	1.46	MAG
				29.69	224.90	146.73	127.40	141.22	328.34	156.78	265.44	PHASE
2146	0.200	−2.98	−8.17	1.25	1.87	1.54	3.83	1.82	2.75	0.73	2.18	MAG
				31.16	229.68	139.18	128.60	166.42	316.35	172.12	262.68	PHASE

Table XII. Continued

(b) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	−10.31	2.02	2.19	1.66	4.36	2.39	3.46	0.36	2.49	MAG
				24.84	207.53	134.68	132.35	168.75	334.01	313.08	245.24	PHASE
2225	0.225	−3.82	−10.03	2.05	1.79	1.65	4.38	2.36	2.94	0.20	2.97	MAG
				20.35	206.71	127.72	124.72	169.30	314.10	245.07	215.57	PHASE
2232	0.250	−4.66	−12.11	2.49	1.95	1.10	4.65	0.78	4.83	0.42	2.55	MAG
				17.98	206.12	111.93	130.09	250.42	315.51	316.72	245.69	PHASE
2239	0.250	−4.66	−11.89	2.51	2.34	1.05	5.17	1.62	3.68	0.94	2.93	MAG
				15.19	201.99	110.66	120.45	196.35	293.55	283.93	221.86	PHASE
2292	0.275	−5.67	−12.37	3.47	1.48	2.23	6.06	1.61	4.82	1.23	2.65	MAG
				24.96	214.20	87.33	148.75	165.22	342.46	0.44	279.25	PHASE
2295	0.275	−5.67	−12.25	3.17	0.95	2.10	6.14	3.04	5.02	1.16	2.79	MAG
				31.17	207.77	83.01	153.89	194.68	344.34	357.59	271.23	PHASE
2301	0.300	−6.69	−15.19	3.72	0.46	2.87	6.74	4.19	4.02	1.48	3.34	MAG
				21.87	191.04	36.73	155.60	176.61	22.80	14.22	293.58	PHASE
2304	0.300	−6.69	−15.55	3.72	0.12	1.96	6.55	4.26	4.76	1.21	3.74	MAG
				25.17	302.02	58.01	157.32	181.43	5.83	9.35	279.58	PHASE
2311	0.325	−7.78	−18.67	4.67	1.03	1.88	8.17	5.03	3.68	1.93	3.15	MAG
				25.61	34.76	55.78	156.71	184.74	42.56	54.38	353.24	PHASE
2312	0.350	−9.08	−21.81	5.44	2.53	2.09	9.49	7.77	5.57	4.31	4.16	MAG
				32.63	41.72	358.94	175.71	207.30	103.77	80.43	51.78	PHASE

Table XII. Continued

(c) Pitching moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	−22.69	126.63	42.10	34.74	65.10	14.38	8.48	2.00	12.60	MAG
				57.46	222.23	204.38	193.91	104.28	222.92	89.44	350.76	PHASE
2014	0.100	−0.75	−31.68	141.60	57.17	19.38	60.77	15.34	5.56	2.04	11.84	MAG
				52.20	244.38	224.90	186.72	95.38	183.83	278.83	345.08	PHASE
2057	0.125	−1.21	−3.05	139.98	48.92	14.46	33.07	15.05	3.63	5.25	10.66	MAG
				56.52	240.91	279.92	196.28	89.76	141.88	248.11	29.76	PHASE
2060	0.125	−1.21	−16.77	146.51	59.26	23.85	33.49	15.43	1.13	3.48	13.43	MAG
				52.55	237.77	253.31	194.41	88.54	142.09	232.03	15.88	PHASE
2066	0.150	−1.50	−4.18	133.32	61.70	34.87	25.77	12.03	2.15	6.95	13.77	MAG
				55.49	254.44	209.00	224.94	110.08	144.74	229.84	51.63	PHASE
2069	0.150	−1.50	−15.09	139.00	64.72	39.08	27.37	11.85	3.32	7.82	10.79	MAG
				52.50	242.78	218.29	204.96	107.16	180.25	230.32	19.02	PHASE
2125	0.175	−2.33	2.04	141.49	72.36	30.49	26.74	8.82	6.46	4.52	13.45	MAG
				43.65	198.08	134.91	234.31	99.30	252.41	37.80	0.22	PHASE
2129	0.175	−2.33	17.46	139.53	76.32	41.54	26.71	10.72	5.78	3.98	11.23	MAG
				43.12	202.01	127.85	234.22	99.06	243.47	60.07	359.54	PHASE
2143	0.200	−2.98	−5.89	154.99	53.33	68.78	25.97	9.65	2.50	3.75	11.92	MAG
				43.86	211.35	154.52	281.67	147.69	6.69	220.80	37.55	PHASE
2146	0.200	−2.98	−15.29	160.24	60.57	59.19	28.23	6.67	4.05	2.79	9.12	MAG
				44.82	223.62	145.97	281.16	171.69	344.66	222.55	34.21	PHASE

Table XII. Continued

(c) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	−30.53	223.81	64.02	56.01	37.13	8.62	5.27	4.80	7.67	MAG
				39.89	178.68	132.90	290.02	163.43	19.53	19.92	4.84	PHASE
2225	0.225	−3.82	−16.59	232.91	50.86	54.96	35.80	10.56	4.30	2.27	5.71	MAG
				40.07	175.04	134.85	273.13	163.98	358.38	6.76	1.18	PHASE
2232	0.250	−4.66	−12.44	244.36	55.39	43.45	44.15	3.63	8.82	5.39	10.65	MAG
				39.22	161.21	106.98	297.35	184.98	2.35	345.41	2.32	PHASE
2239	0.250	−4.66	−1.14	258.63	74.49	36.97	36.97	9.59	5.52	5.64	5.98	MAG
				36.91	171.40	99.47	286.05	164.47	336.05	335.47	325.67	PHASE
2292	0.275	−5.67	65.82	294.05	42.89	72.72	48.83	13.55	8.23	2.46	6.00	MAG
				42.88	145.30	84.20	308.20	180.03	47.64	16.34	14.77	PHASE
2295	0.275	−5.67	75.98	277.45	39.91	69.28	48.95	12.76	8.70	6.00	5.75	MAG
				43.22	110.08	69.69	311.66	182.35	28.06	2.24	325.53	PHASE
2301	0.300	−6.69	95.71	307.09	60.03	108.76	67.97	16.48	11.90	3.79	10.75	MAG
				45.29	85.24	25.49	308.83	192.21	59.90	329.00	168.28	PHASE
2304	0.300	−6.69	89.61	302.78	62.10	66.52	70.44	16.40	4.90	3.15	8.01	MAG
				42.53	73.25	46.84	302.09	192.94	59.93	349.30	176.97	PHASE
2311	0.325	−7.78	115.32	323.09	89.11	59.30	86.11	10.92	8.54	27.81	20.54	MAG
				46.46	62.77	36.61	310.91	218.96	45.60	298.00	151.38	PHASE
2312	0.350	−9.08	140.44	365.62	134.73	70.30	117.46	13.48	13.98	38.34	42.66	MAG
				55.29	60.61	350.26	327.52	293.40	77.17	294.90	149.98	PHASE

Table XII. Continued

(d) Rolling moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	−98.62	127.07	20.27	23.75	516.44	23.23	8.75	5.62	17.53	MAG
				325.95	147.67	72.99	154.15	29.47	194.89	132.41	184.12	PHASE
2014	0.100	−0.75	−172.24	139.80	32.48	19.87	472.67	18.74	12.94	4.94	12.39	MAG
				324.33	143.26	74.84	150.23	8.78	180.13	131.28	168.25	PHASE
2057	0.125	−1.21	−162.57	150.19	48.20	20.16	331.60	14.32	5.09	6.42	1.60	MAG
				330.17	130.94	79.36	164.55	4.76	231.25	155.48	233.70	PHASE
2060	0.125	−1.21	−125.83	152.28	48.47	20.34	343.56	13.95	6.29	3.67	3.91	MAG
				327.86	124.41	81.24	160.68	357.94	240.81	93.63	351.73	PHASE
2066	0.150	−1.50	−95.37	146.68	53.10	16.30	283.13	11.53	9.18	5.65	8.02	MAG
				331.87	129.27	58.98	190.56	18.08	254.12	138.27	91.62	PHASE
2069	0.150	−1.50	−120.73	152.53	52.30	16.17	291.36	6.98	7.92	2.80	9.20	MAG
				329.35	131.50	45.70	173.59	357.98	238.88	142.56	105.96	PHASE
2125	0.175	−2.33	−135.97	149.49	51.07	15.10	306.35	5.53	9.69	0.83	5.45	MAG
				322.39	111.27	75.76	195.75	335.06	184.72	240.98	354.98	PHASE
2129	0.175	−2.33	−128.32	145.52	45.75	10.84	311.97	7.38	7.32	3.47	1.61	MAG
				321.76	115.52	62.39	194.21	347.83	167.53	160.43	192.15	PHASE
2143	0.200	−2.98	−108.27	164.83	54.55	3.24	312.62	5.43	12.54	1.61	4.91	MAG
				329.05	116.10	96.65	231.25	355.62	261.71	167.53	94.93	PHASE
2146	0.200	−2.98	−111.44	166.07	63.60	8.81	318.64	4.59	14.95	2.22	5.35	MAG
				328.17	116.90	84.95	232.57	298.10	250.15	190.67	169.48	PHASE

Table XII. Continued

(d) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	−109.31	207.36	72.04	5.56	353.62	10.05	16.79	3.18	4.21	MAG
				323.09	105.57	191.45	232.11	338.23	248.39	270.13	110.04	PHASE
2225	0.225	−3.82	−99.06	203.26	69.87	0.94	347.88	9.51	15.30	2.16	11.33	MAG
				323.57	102.73	59.88	222.41	343.20	247.77	200.20	131.10	PHASE
2232	0.250	−4.66	−86.51	207.58	72.10	3.15	373.58	15.97	14.75	4.74	8.56	MAG
				322.37	97.04	170.58	232.28	347.92	251.54	257.31	69.42	PHASE
2239	0.250	−4.66	−83.61	218.36	72.17	6.16	345.42	19.96	15.44	4.47	5.58	MAG
				321.84	99.29	234.25	223.35	341.27	233.53	168.62	106.38	PHASE
2292	0.275	−5.67	−39.44	233.51	67.29	19.69	362.13	31.67	18.30	4.66	12.67	MAG
				328.41	98.39	235.78	249.66	44.28	272.80	37.95	59.77	PHASE
2295	0.275	−5.67	−44.15	243.70	69.98	10.77	359.69	22.59	15.62	1.55	8.50	MAG
				331.63	101.29	278.14	251.86	36.90	256.15	353.47	87.59	PHASE
2301	0.300	−6.69	−10.98	238.91	70.88	29.25	312.25	34.88	12.25	8.03	4.47	MAG
				328.83	82.08	264.49	256.19	59.48	268.88	351.15	6.88	PHASE
2304	0.300	−6.69	11.70	252.67	58.16	23.82	335.71	26.17	7.73	12.27	3.59	MAG
				327.92	91.93	263.68	252.43	46.44	253.21	352.18	122.58	PHASE
2311	0.325	−7.78	−28.72	280.73	43.02	75.51	251.27	33.39	3.79	8.22	12.29	MAG
				331.17	77.43	286.17	260.81	44.26	155.11	14.28	78.84	PHASE
2312	0.350	−9.08	−65.26	291.53	64.56	152.29	145.37	23.76	16.77	17.20	2.20	MAG
				334.73	53.85	291.49	319.97	50.01	347.14	342.40	25.82	PHASE

Table XII. Continued

(e) Yawing moment

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	351.28	20.88	4.90	6.60	342.88	13.65	1.45	1.30	16.02	MAG
				132.84	247.22	284.58	321.55	90.73	349.11	215.03	39.17	PHASE
2014	0.100	−0.75	337.11	19.12	5.13	2.87	315.54	11.85	5.38	1.38	14.58	MAG
				106.00	276.76	295.44	317.89	70.88	313.44	176.74	29.74	PHASE
2057	0.125	−1.21	351.46	18.00	4.13	9.64	230.88	10.63	1.92	1.33	0.84	MAG
				86.32	284.60	310.16	331.38	115.91	82.67	221.45	19.27	PHASE
2060	0.125	−1.21	351.69	20.26	4.75	9.21	229.62	9.91	1.67	2.00	6.66	MAG
				76.42	289.18	304.62	326.75	109.99	109.97	200.81	10.30	PHASE
2066	0.150	−1.50	337.70	19.13	5.53	6.33	200.75	2.24	2.74	1.27	4.86	MAG
				77.61	270.77	312.29	351.78	134.84	65.06	223.33	64.29	PHASE
2069	0.150	−1.50	336.74	26.01	4.12	2.64	205.58	4.28	1.93	0.65	1.70	MAG
				73.39	277.49	303.78	336.44	236.77	341.48	196.29	72.88	PHASE
2125	0.175	−2.33	325.73	26.53	8.79	11.64	205.37	10.84	2.30	1.84	8.47	MAG
				81.19	243.98	323.81	348.25	18.02	345.76	184.37	6.15	PHASE
2129	0.175	−2.33	325.59	32.07	5.18	8.31	205.22	10.43	3.19	2.11	3.27	MAG
				85.59	238.88	327.87	248.28	19.30	315.33	208.41	3.97	PHASE
2143	0.200	−2.98	360.18	42.83	11.88	6.03	219.64	2.30	3.32	1.09	7.41	MAG
				61.02	270.99	341.19	21.93	327.41	350.35	284.69	4.91	PHASE
2146	0.200	−2.98	356.36	31.88	11.51	7.11	216.29	2.63	3.08	0.94	3.47	MAG
				74.69	252.51	336 91	22.93	301.82	347.90	286.25	350.15	PHASE

Table XII. Continued

(e) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	415.35	35.04	7.66	6.85	243.29	2.82	4.37	1.51	5.46	MAG
				87.32	262.46	303.49	31.25	7.01	29.26	325.74	328.99	PHASE
2225	0.225	−3.82	416.45	56.97	8.39	1.94	237.81	6.65	4.74	1.31	2.64	MAG
				85.89	235.20	311.48	20.21	59.81	356.71	282.95	280.66	PHASE
2232	0.250	−4.66	455.11	58.22	16.21	6.15	272.37	11.76	7.10	1.38	6.19	MAG
				105.05	272.23	336.14	34.13	55.39	8.12	6.20	312.49	PHASE
2239	0.250	−4.66	456.65	54.74	10.66	2.63	274.31	12.53	2.68	1.23	7.67	MAG
				68.88	209.39	320.13	24.80	43.97	354.31	217.55	253.91	PHASE
2292	0.275	−5.67	537.90	74.65	11.95	11.02	348.72	27.33	3.38	1.24	8.47	MAG
				90.00	280.24	58.00	64.59	66.02	55.62	310.04	353.84	PHASE
2295	0.275	−5.67	528.28	63.86	7.79	11.37	345.37	28.20	7.15	1.89	9.28	MAG
				65.34	243.98	36.17	66.31	45.57	43.11	51.36	337.21	PHASE
2301	0.300	−6.69	625.80	90.23	15.84	3.19	464.92	24.51	8.57	2.38	15.85	MAG
				99.02	327.42	80.35	68.54	74.40	58.12	354.23	342.67	PHASE
2304	0.300	−6.69	623.04	62.75	18.98	14.52	439.73	25.73	5.39	2.21	14.57	MAG
				85.91	264.28	105.00	66.77	50.17	41.74	300.55	337.13	PHASE
2311	0.325	−7.78	711.13	68.28	9.59	24.22	585.03	26.93	7.60	4.39	16.39	MAG
				96.08	245.96	105.61	68.15	41.43	27.23	33.06	335.70	PHASE
2312	0.350	−9.08	813.50	90.24	6.17	11.32	827.28	26.58	3.43	5.63	19.95	MAG
				133.11	187.45	169.14	82.16	38.46	24.17	0.08	346.64	PHASE

Table XII. Continued

(f) Side force

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	−3.55	2.01	1.15	0.90	15.37	0.98	0.48	0.12	0.55	MAG
				329.24	151.57	41.71	154.93	344.71	176.31	55.86	343.98	PHASE
2014	0.100	−0.75	−3.27	2.71	1.60	0.63	13.74	0.78	0.88	0.24	0.74	MAG
				336.22	143.17	39.03	149.54	346.54	156.37	123.21	287.55	PHASE
2057	0.125	−1.21	−2.77	2.60	2.19	0.64	8.95	0.95	0.58	0.30	0.98	MAG
				341.50	131.87	41.31	165.48	4.92	174.50	150.71	287.04	PHASE
2060	0.125	−1.21	−2.94	2.70	2.16	0.58	9.80	0.98	0.67	0.12	0.92	MAG
				341.80	127.38	47.99	163.02	359.56	175.11	114.20	286.50	PHASE
2066	0.150	−1.50	−3.04	2.85	2.21	0.75	8.12	0.52	0.62	0.20	0.98	MAG
				340.85	139.28	9.96	200.10	32.77	237.48	98.64	349.58	PHASE
2069	0.150	−1.50	−2.00	3.06	2.31	0.75	8.30	0.54	0.66	0.15	0.63	MAG
				343.08	132.07	20.75	181.86	77.06	217.36	128.83	345.28	PHASE
2125	0.175	−2.33	−8.22	1.98	7.88	1.02	14.15	1.80	5.60	2.31	6.18	MAG
				250.92	106.08	11.34	219.36	132.53	85.19	13.22	292.47	PHASE
2129	0.175	−2.33	−6.33	3.48	2.86	1.46	11.51	2.69	2.05	1.19	1.37	MAG
				334.65	83.82	5.18	192.31	149.31	227.11	253.49	336.35	PHASE
2143	0.200	−2.98	−4.56	4.08	2.85	0.37	11.36	0.72	1.57	0.26	0.53	MAG
				353.09	125.45	326.00	245.10	171.05	261.18	346.09	70.64	PHASE
2146	0.200	−2.98	−7.84	4.98	0.82	6.18	17.61	2.67	4.83	5.18	2.46	MAG
				282.41	164.42	297.77	249.88	234.77	291.79	283.76	250.36	PHASE

Table XII. Continued

(f) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	−4.86	4.56	3.94	1.28	11.89	1.32	2.15	0.75	0.20	MAG
				341.71	133.44	296.86	236.19	221.75	277.65	193.78	132.39	PHASE
2225	0.225	−3.82	−4.58	4.29	4.55	1.01	13.12	1.10	2.16	1.15	1.84	MAG
				357.79	116.15	272.39	234.39	153.87	212.55	289.83	39.52	PHASE
2232	0.250	−4.66	−4.06	2.93	2.34	1.02	12.99	1.09	1.79	0.48	1.13	MAG
				345.73	109.42	301.84	237.12	254.88	268.07	319.57	39.01	PHASE
2239	0.250	−4.66	−5.19	6.37	5.48	1.49	12.48	3.24	2.07	1.90	2.66	MAG
				346.22	99.74	135.22	227.40	256.67	289.09	90.02	105.41	PHASE
2292	0.275	−5.67	−4.54	4.22	3.84	0.74	9.72	2.07	1.52	0.61	1.65	MAG
				5.58	110.21	326.49	243 17	245.60	234.55	19.77	60.15	PHASE
2295	0.275	−5.67	−6.43	11.25	4.80	1.38	10.47	2.95	5.25	2.88	3.18	MAG
				13.68	128.57	247.96	255.68	119.88	248.26	5.86	111.76	PHASE
2301	0.300	−6.69	−6.54	2.40	3.46	4.23	2.79	1.86	1.07	1.13	4.78	MAG
				28.07	57.99	259.11	200.90	206.50	212.86	270.18	147.80	PHASE
2304	0.300	−6.69	−5.77	5.52	3.25	3.28	4.16	1.98	2.67	1.18	3.11	MAG
				5.63	105.09	294.82	216.44	176.19	320.18	223.37	128.56	PHASE
2311	0.325	−7.78	−3.96	6.47	1.85	3.33	9.07	0.72	0.21	0.91	1.86	MAG
				353.50	79.65	286.04	69.03	228.66	153.80	288.37	162.33	PHASE
2312	0.350	−9.08	−6.14	3.76	4.45	5.74	32.12	3.55	2.97	2.94	3.11	MAG
				9.17	18.44	276.78	68.11	217.18	354.22	277.31	117.89	PHASE

Table XII. Continued

(g) Hub beamwise bending moment with $r = 1.4$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	35.84	1.03	1.51	1.87	1.05	0.09	0.28	0.40	0.07	MAG
				4.27	49.40	136.77	97.97	222.45	119.84	79.70	324.48	PHASE
2014	0.100	−0.75	35.59	0.97	1.56	1.75	1.05	0.11	0.26	0.40	0.09	MAG
				6.21	50.89	135.10	94.46	214.17	114.02	78.00	314.95	PHASE
2057	0.125	−1.21	34.59	0.53	1.78	1.28	0.79	0.12	0.22	0.37	0.09	MAG
				140.30	50.62	157.75	101.61	277.11	124.22	100.90	350.57	PHASE
2060	0.125	−1.21	34.81	0.13	1.83	1.25	0.75	0.10	0.22	0.37	0.08	MAG
				1.38	47.87	154.35	98.13	272.90	120.37	90.96	336.78	PHASE
2066	0.150	−1.50	34.94	0.27	1.78	0.97	0.68	0.17	0.16	0.33	0.08	MAG
				96.36	57.88	184.36	116.60	328.90	145.85	127.05	352.01	PHASE
2069	0.150	−1.50	34.98	0.28	1.80	0.96	0.70	0.15	0.17	0.34	0.08	MAG
				208.69	50.58	174.63	101.62	313.57	135.71	103.26	323.96	PHASE
2125	0.175	−2.33	35.44	0.36	1.31	0.80	0.60	0.22	0.16	0.20	0.07	MAG
				9.78	47.04	194.89	107.87	251.35	143.82	103.67	2.08	PHASE
2129	0.175	−2.33	35.32	0.41	1.32	0.80	0.60	0.20	0.16	0.20	0.06	MAG
				33.47	47.86	194.13	107.98	260.98	144.25	101.78	3.20	PHASE
2143	0.200	−2.98	34.90	0.41	0.86	1.20	0.65	0.20	0.13	0.14	0.07	MAG
				247.68	65.25	221.52	137.07	279.89	188.11	150.46	85.21	PHASE
2146	0.200	−2.98	34.65	0.20	0.89	1.15	0.62	0.20	0.10	0.18	0.05	MAG
				110.40	65.79	221.03	135.52	282.13	182.68	147.04	49.64	PHASE

Table XII. Continued

(g) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	34.00	0.42	0.39	1.23	0.62	0.18	0.11	0.13	0.03	MAG
				29.12	106.82	222.87	149.02	283.49	164.86	98.34	54.92	PHASE
2225	0.225	−3.82	33.80	0.27	0.43	1.22	0.62	0.18	0.11	0.15	0.03	MAG
				23.22	101.05	217.27	142.85	279.92	140.22	91.40	41.36	PHASE
2232	0.250	−4.66	33.84	0.25	0.73	1.46	0.66	0.20	0.10	0.24	0.02	MAG
				18.73	184.94	221.45	153.12	296.92	169.20	71.12	304.41	PHASE
2239	0.250	−4.66	33.67	0.21	0.65	1.46	0.66	0.24	0.11	0.22	0.04	MAG
				235.46	178.15	214.05	140.03	277.22	146.36	58.97	312.62	PHASE
2292	0.275	−5.67	33.28	0.49	1.85	1.68	0.70	0.24	0.11	0.23	0.05	MAG
				354.04	208.79	236.01	171.56	312.99	207.20	87.76	320.61	PHASE
2295	0.275	−5.67	33.40	0.23	1.88	1.66	0.70	0.25	0.12	0.23	0.05	MAG
				292.18	209.51	238.36	175.20	314.66	223.02	85.98	310.63	PHASE
2301	0.300	−6.69	33.60	0.69	3.34	1.86	0.75	0.28	0.15	0.17	0.01	MAG
				327.03	210.84	242.94	171.47	307.62	209.27	76.04	287.35	PHASE
2304	0.300	−6.69	33.38	0.52	3.25	1.85	0.74	0.25	0.15	0.17	0.02	MAG
				21.89	209.95	240.56	167.23	301.90	200.89	70.85	254.72	PHASE
2311	0.325	−7.78	32.52	0.42	4.35	2.17	0.93	0.36	0.20	0.13	0.01	MAG
				21.96	207.18	245.73	164.20	289.48	185.65	62.36	326.69	PHASE
2312	0.350	−9.08	32.16	0.34	5.86	2.41	1.00	0.28	0.24	0.12	0.08	MAG
				23.44	212.33	260.76	173.98	321.76	197.76	96.74	151.91	PHASE

Table XII. Continued

(h) Hub beamwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.160	−0.75	34.85	1.31	0.32	0.55	0.32	0.07	0.02	0.15	0.04	MAG
				274.29	34.15	141.68	90.78	15.86	60.19	242.26	151.86	PHASE
2014	0.100	−0.75	34.73	1.32	0.30	0.50	0.31	0.10	0.04	0.13	0.02	MAG
				276.97	42.27	137.77	93.07	11.35	59.28	233.02	162.51	PHASE
2057	0.125	−1.21	34.74	1.24	0.23	0.27	0.27	0.05	0.04	0.12	0.06	MAG
				272.72	70.55	170.36	112.08	32.09	326.39	274.45	193.49	PHASE
2060	0.125	−1.21	34.83	1.31	0.26	0.28	0.28	0.03	0.04	0.11	0.02	MAG
				273.40	64.06	169.10	107.54	17.66	315.08	257.92	219.02	PHASE
2066	0.150	−1.50	34.68	1.22	0.23	0.23	0.25	0.04	0.04	0.10	0.01	MAG
				277.76	75.98	202.00	133.65	52.81	2.48	298.55	203.53	PHASE
2069	0.150	−1.50	34.70	1.29	0.25	0.20	0.23	0.08	0.03	0.10	0.04	MAG
				276.73	58.69	185.35	124.58	16.97	359.55	288.96	157.40	PHASE
2125	0.175	-2.33	34.46	1.21	0.14	0.27	0.12	0.11	0.02	0.07	0.04	MAG
				274.90	20.66	180.11	148.39	73.64	292.14	279.52	221.82	PHASE
2129	0.175	−2.33	34.47	1.16	0.15	0.27	0.14	0.09	0.01	0.08	0.06	MAG
				274.86	25.07	177.93	148.80	60.72	242.03	260.02	185.32	PHASE
2143	0.200	−2.98	34.54	1.29	0.04	0.24	0.22	0.05	0.04	0.03	0.05	MAG
				283.56	157.56	219.35	181.19	64.58	69.49	313.71	269.99	PHASE
2146	0.200	−2.98	34.55	1.19	0.03	0.28	0.22	0.08	0.02	0.06	0.06	MAG
				282.72	110.58	221.51	185.14	65.29	113.96	309.71	211.30	PHASE

Table XII. Continued

(h) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	34.52	1.25	0.19	0.33	0.16	0.03	0.01	0.06	0.02	MAG
				287.56	210.75	203.16	184.55	117.21	233.51	211.33	157.89	PHASE
2225	0.225	−3.82	34.47	1.29	0.19	0.32	0.16	0.03	0.03	0.04	0.05	MAG
				283.73	203.22	195.53	174.76	126.51	257.74	226.22	120.20	PHASE
2232	0.250	−4.66	34.92	1.39	0.37	0.39	0.15	0.03	0.05	0.06	0.03	MAG
				289.69	213.61	200.12	185.98	152.28	344.34	232.27	63.94	PHASE
2239	0.250	−4.66	34.85	1.41	0.38	0.41	0.19	0.05	0.03	0.05	0.04	MAG
				286.88	207.49	196.31	179.84	116.27	301.87	223.15	135.88	PHASE
2292	0.275	−5.67	35.75	1.61	0.70	0.51	0.16	0.07	0.06	0.02	0.05	MAG
				295.32	216.55	219.99	209.36	251.56	57.38	236.59	55.08	PHASE
2295	0.275	−5.67	35.68	1.57	0.68	0.49	0.17	0.05	0.09	0.03	0.03	MAG
				294.43	215.32	219.94	207.80	240.56	66.85	211.62	91.14	PHASE
2301	0.300	−6.69	36.57	1.83	1.07	0.59	0.20	0.09	0.09	0.03	0.02	MAG
				299.74	213.15	226.71	214.98	252.79	53.98	153.46	307.78	PHASE
2304	0.300	−6.69	36.51	1.71	1.04	0.58	0.20	0.13	0.09	0.04	0.02	MAG
				299.78	211.64	219.81	211.22	251.64	47.34	167.13	18.93	PHASE
2311	0.325	−7.78	37.03	1.88	1.45	0.61	0.26	0.12	0.19	0.05	0.01	MAG
				306.04	208.62	222.58	228.17	236.19	19.67	108.98	201.76	PHASE
2312	0.350	−9.08	37.89	2.05	1.88	0.68	0.32	0.24	0.19	0.04	0.05	MAG
				312.05	210.35	241.29	233.63	283.50	39.22	63.96	350.37	PHASE

Table XII. Continued

(i) Hub chordwise bending moment with $r = 3.0$ in.

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2007	0.100	−0.75	77.38	26.81	4.56	7.82	4.70	0.54	0.72	0.72	0.22	MAG
				278.72	55.52	124.52	114.57	266.92	152.96	248.10	178.55	PHASE
2014	0.100	−0.75	76.30	26.56	4.51	6.84	4.64	0.60	0.75	0.88	0.10	MAG
				280.33	60.18	120.31	116.04	275.83	120.32	202.09	16.65	PHASE
2057	0.125	−1.21	69.77	26.56	3.92	3.70	3.94	0.98	0.15	0.45	0.52	MAG
				283.12	87.01	128.05	121.33	259.53	315.48	235.47	216.20	PHASE
2060	0.125	−1.21	70.03	27.93	4.47	3.80	3.74	1.04	0.13	0.39	0.55	MAG
				281.90	77.24	124.67	117.46	253.40	328.62	231.91	295.75	PHASE
2066	0.150	−1.50	68.35	26.06	4.21	2.59	3.41	1.01	0.23	0.31	0.52	MAG
				284.56	89.95	142.12	139.00	299.79	17.70	253.58	31.25	PHASE
2069	0.150	−1.50	68.40	26.29	3.94	2.80	3.37	1.04	0.24	0.24	0.35	MAG
				284.25	79.89	123.04	126.71	304.98	112.99	261.39	95.63	PHASE
2125	0.175	−2.33	70.86	26.50	2.89	3.28	1.59	0.36	0.79	0.24	0.50	MAG
				277.75	65.32	132.43	150.96	273.04	197.04	282.28	317.38	PHASE
2129	0.175	−2.33	70.82	26.16	2.91	3.25	1.89	0.54	0.89	0.43	0.21	MAG
				277.93	69.48	129.37	150.77	298.70	176.67	252.29	171.02	PHASE
2143	0.200	−2.98	72.95	26.60	2.57	2.30	3.15	0.92	0.63	0.37	0.43	MAG
				286.85	91.80	182.54	178.07	319.65	169.03	256.24	9.39	PHASE
2146	0.200	−2.98	72.62	26.71	2.86	2.52	2.86	0.93	0.75	0.44	0.27	MAG
				284.76	94.52	185.24	175.11	320.75	188.08	238.80	174.52	PHASE

Table XII. Concluded

(i) Concluded

Point	Mu	AlphaS	Mean	1P	2P	3P	4P	5P	6P	7P	8P	
2222	0.225	−3.82	76.10	26.51	2.73	3.38	2.69	0.68	1.00	0.31	0.26	MAG
				281.65	105.27	189.12	191.49	298.08	185.04	244.64	59.47	PHASE
2225	0.225	−3.82	75.56	27.09	2.71	3.14	2.64	0.51	0.95	0.34	0.82	MAG
				279.16	99.56	180.98	183.74	288.53	177.69	266.93	101.69	PHASE
2232	0.250	−4.66	82.53	28.91	2.08	4.49	2.74	0.38	0.45	0.14	0.40	MAG
				281.56	129.89	197.06	199.11	279.38	212.59	7.82	47.64	PHASE
2239	0.250	−4.66	82.65	28.71	2.22	4.46	2.89	0.46	0.79	0.22	0.59	MAG
				281.58	130.83	188.81	185.73	290.53	181.61	299.41	125.82	PHASE
2292	0.275	−5.67	93.49	31.60	3.17	6.50	2.82	1.12	0.33	0.40	0.87	MAG
				284.58	177.01	223.55	220.05	280.41	143.38	101.62	51.73	PHASE
2295	0.275	−5.67	92.38	30.65	2.92	6.21	2.89	0.93	0.40	0.41	0.50	MAG
				285.65	171.62	224.03	221.68	281.78	133.23	121.18	85.97	PHASE
2301	0.300	−6.69	106.71	34.31	5.29	8.88	2.91	1.45	0.76	0.63	0.31	MAG
				288.14	189.99	236.52	222.25	276.53	112.97	135.51	92.56	PHASE
2304	0.300	−6.69	105.97	33.94	5.32	8.78	2.65	1.62	0.82	0.87	0.49	MAG
				286.95	192.02	231.70	220.12	270.14	101.29	131.50	91.07	PHASE
2311	0.325	−7.78	117.40	34.91	8.86	11.06	3.26	1.40	1.29	1.18	0.18	MAG
				293.41	201.61	237.23	220.04	271.22	38.90	101.24	141.21	PHASE
2312	0.350	−9.08	132.52	36.39	12.30	15.02	3.49	2.94	2.06	1.14	0.73	MAG
				296.05	201.85	256.01	225.77	306.85	65.69	101.62	134.27	PHASE

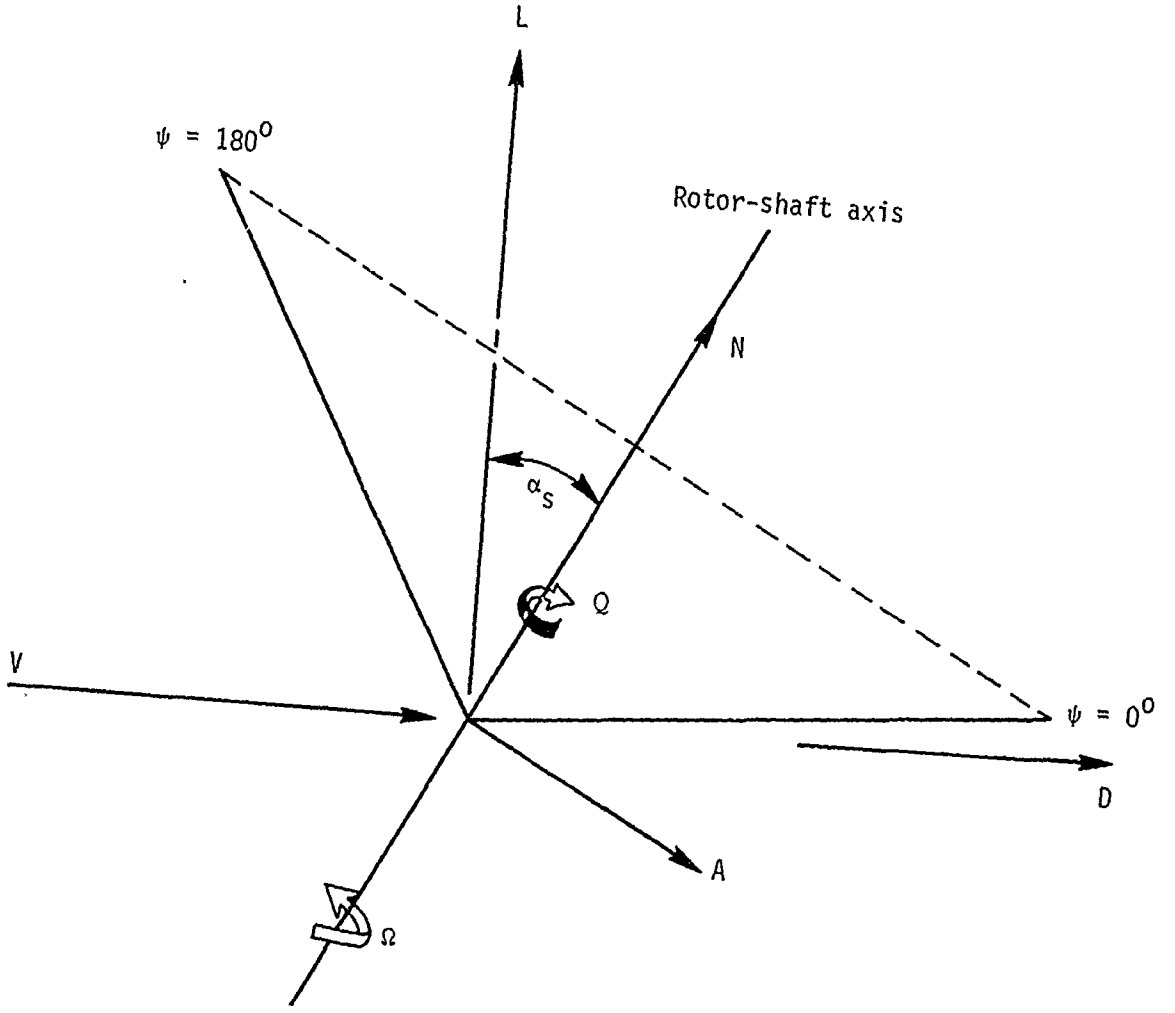

Figure 1. Notation showing positive directions of forces, angles, and velocities.

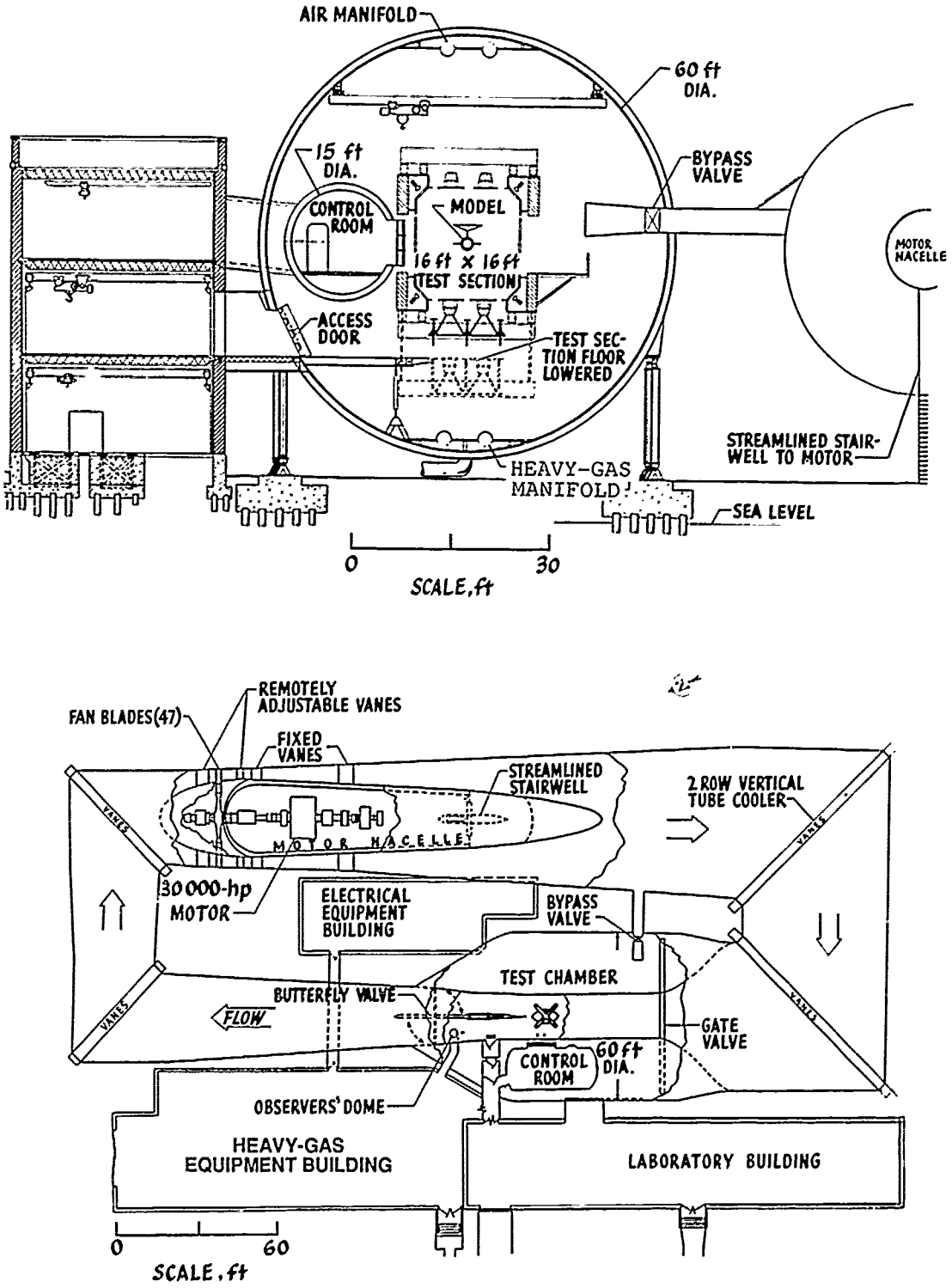

Figure 2. Langley Transonic Dynamics Tunnel.

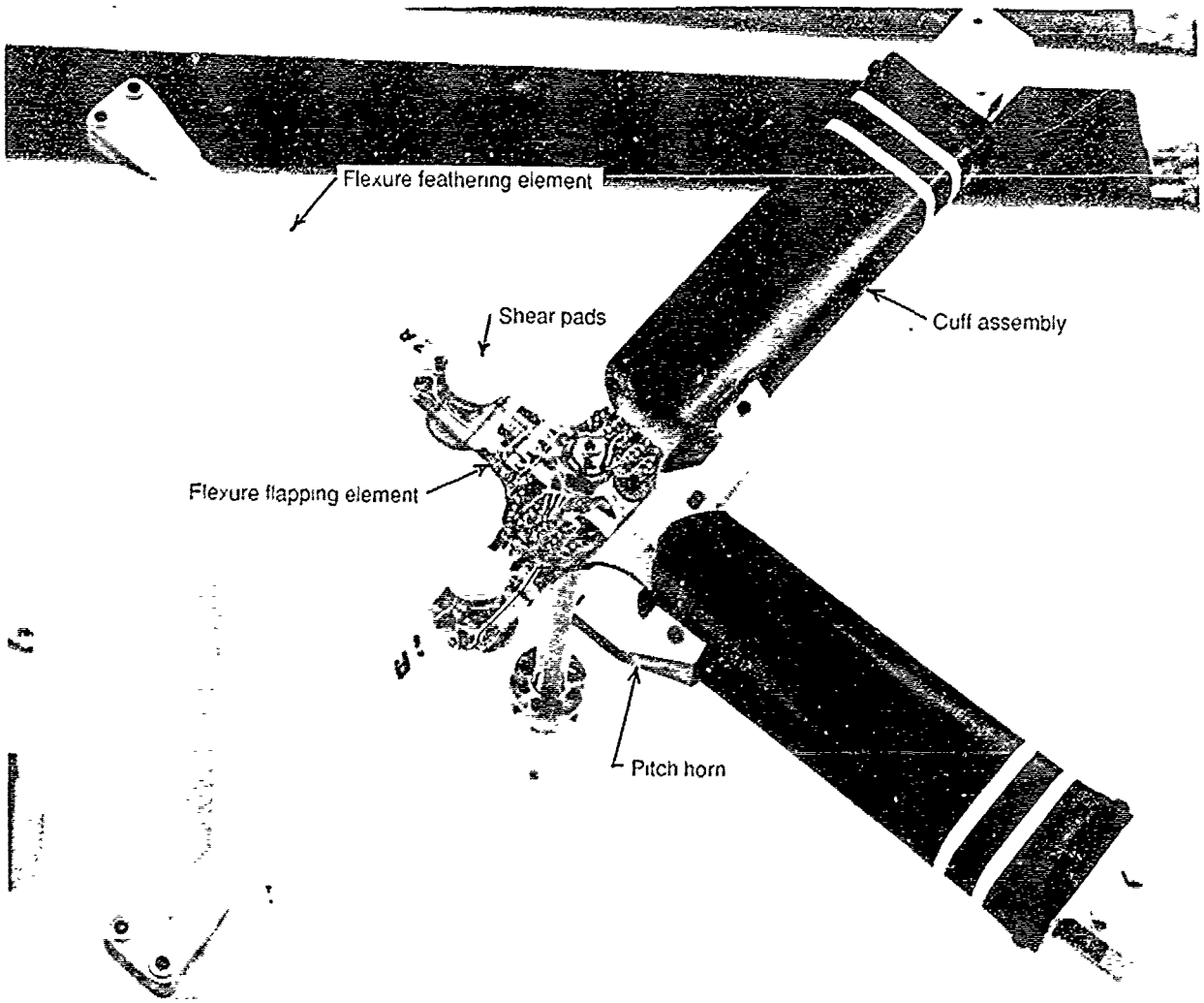

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Figure 3. Model rotor hub.

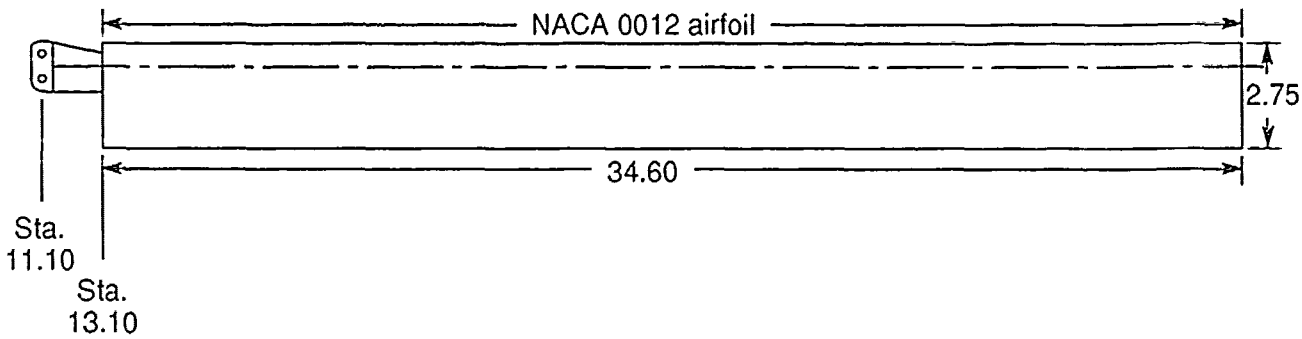


Figure 4. Geometry of −100 and −200 model rotor blades. All dimensions are in inches.

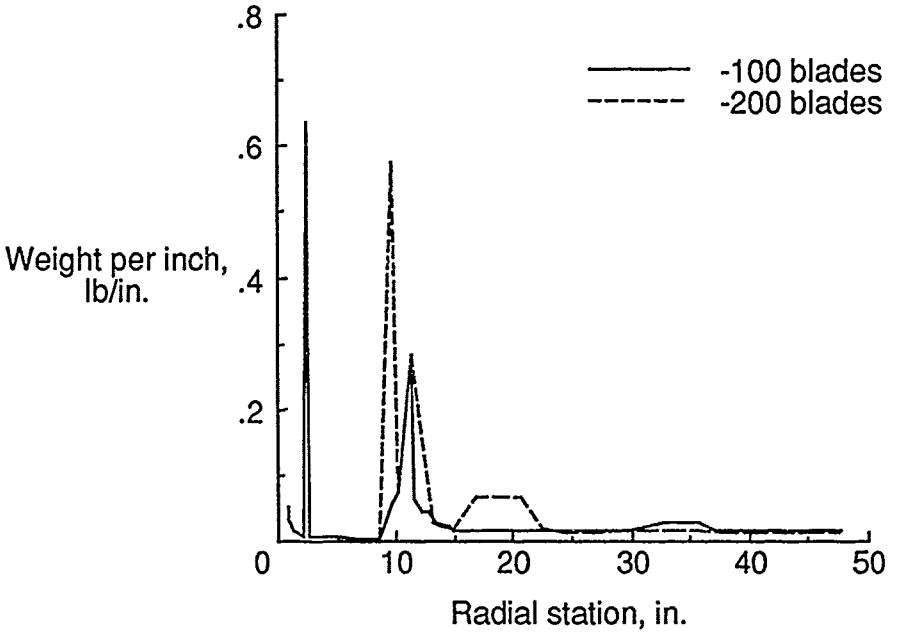


Figure 5. Weight distribution of rotor hub and −100 and −200 blade sets.

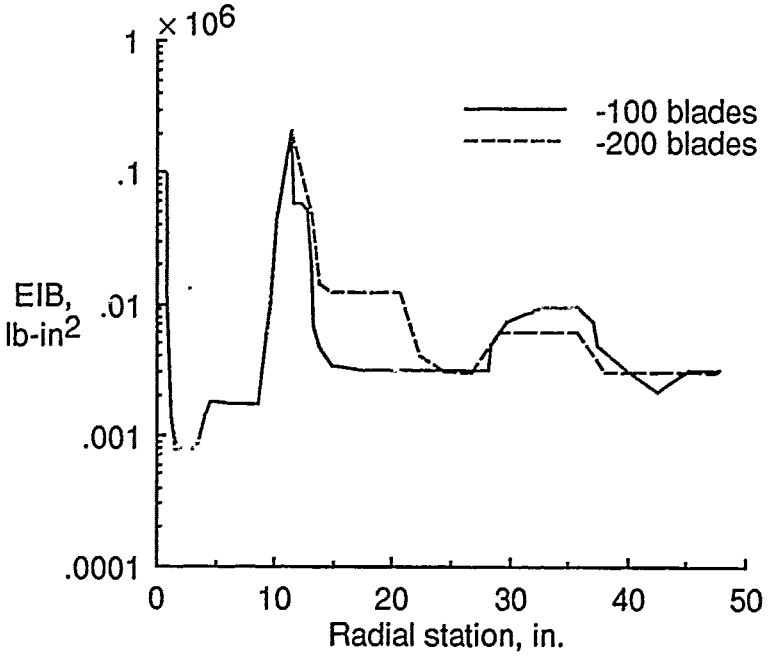


Figure 6. Beamwise stiffness distribution of rotor hub and −100 and −200 blades.

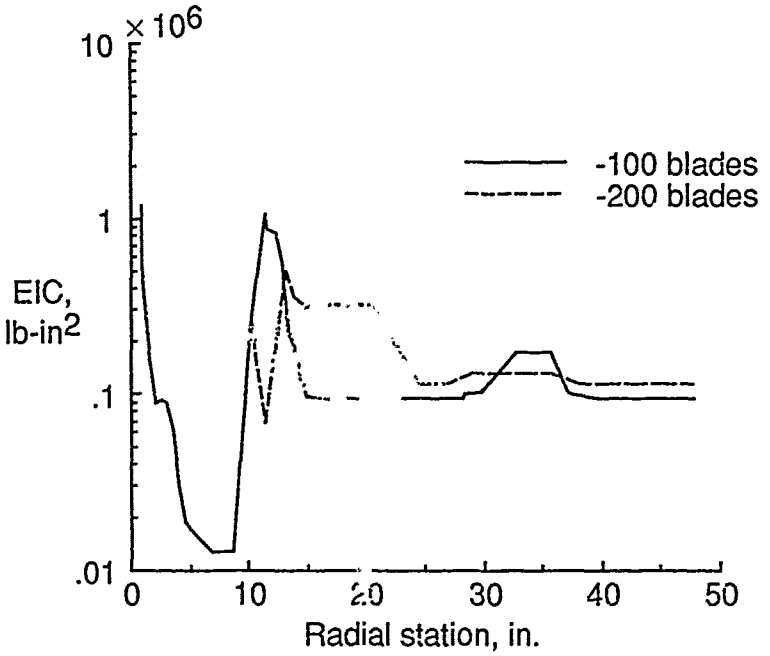


Figure 7. Chordwise stiffness distribution of rotor hub and −100 and −200 blades.

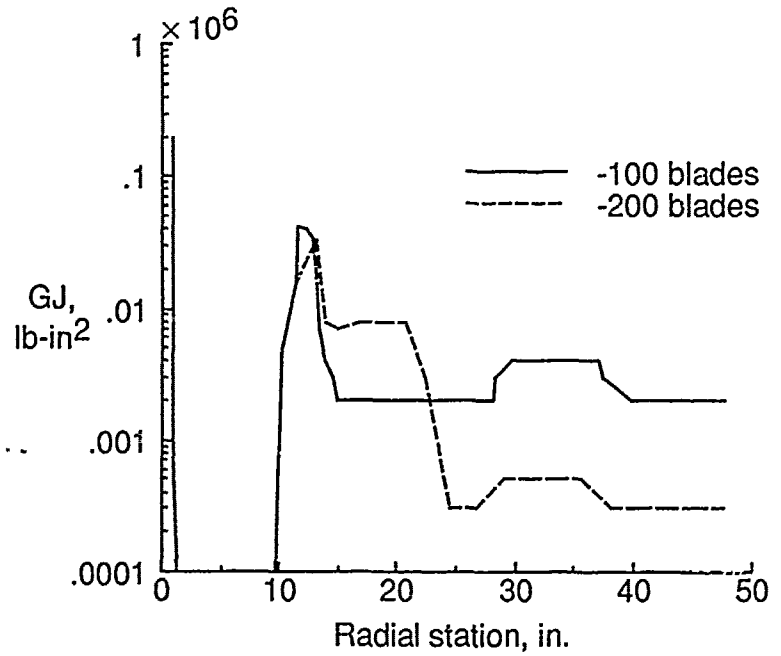
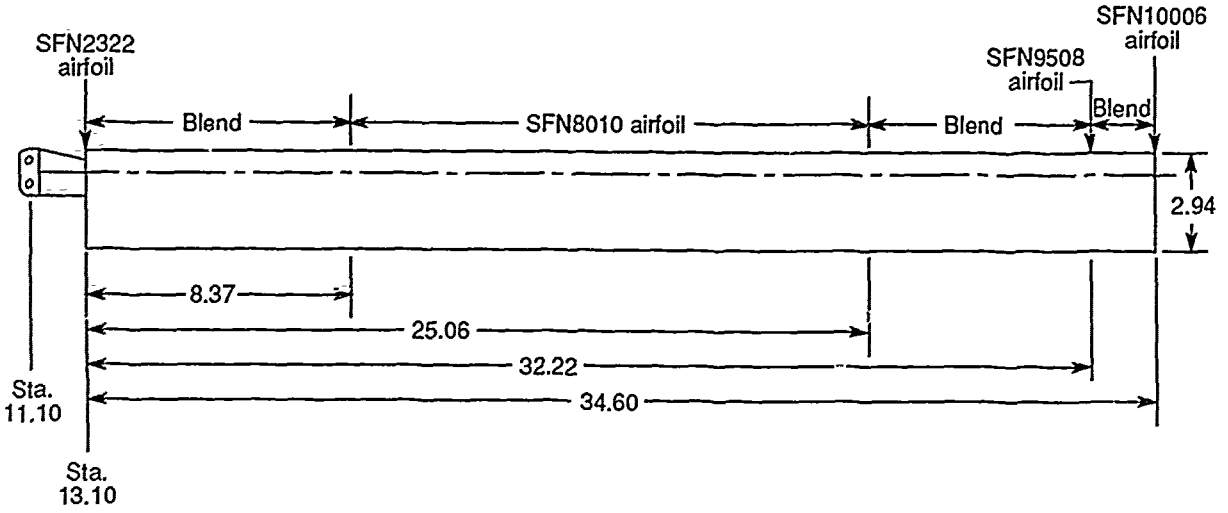
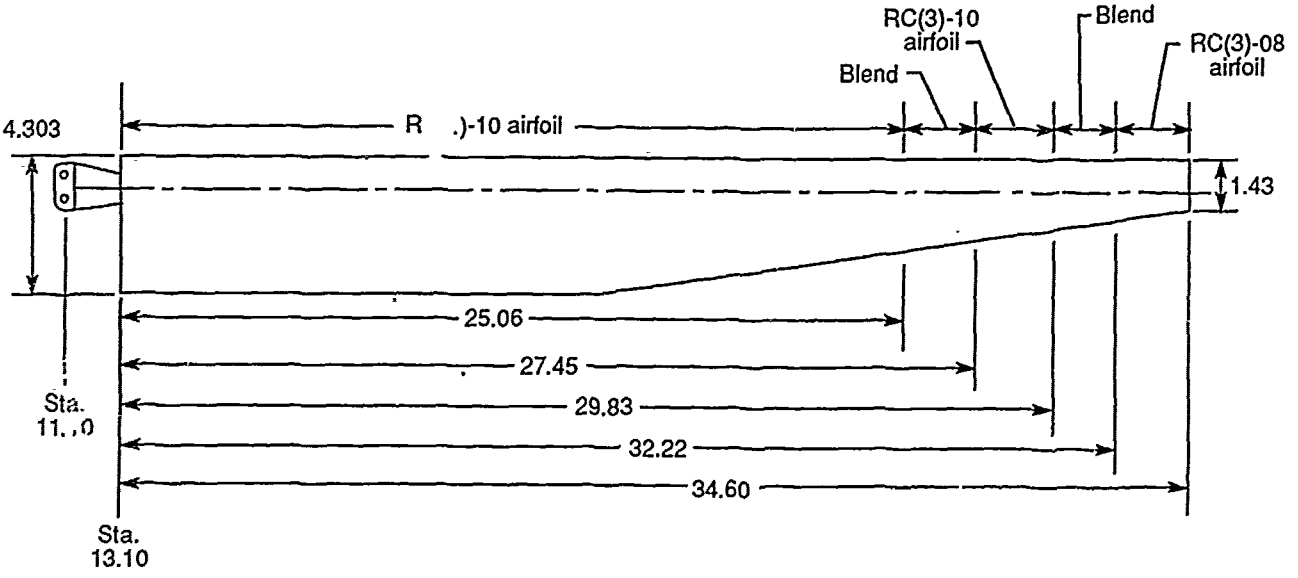


Figure 8. Torsional stiffness distribution of rotor hub and −100 and −200 blades.



(a) −300 blades.



(b) −400 and −500 blades.

Figure 9. Geometry of −300, −400, and −500 model rotor blades. All dimensions are in inches.

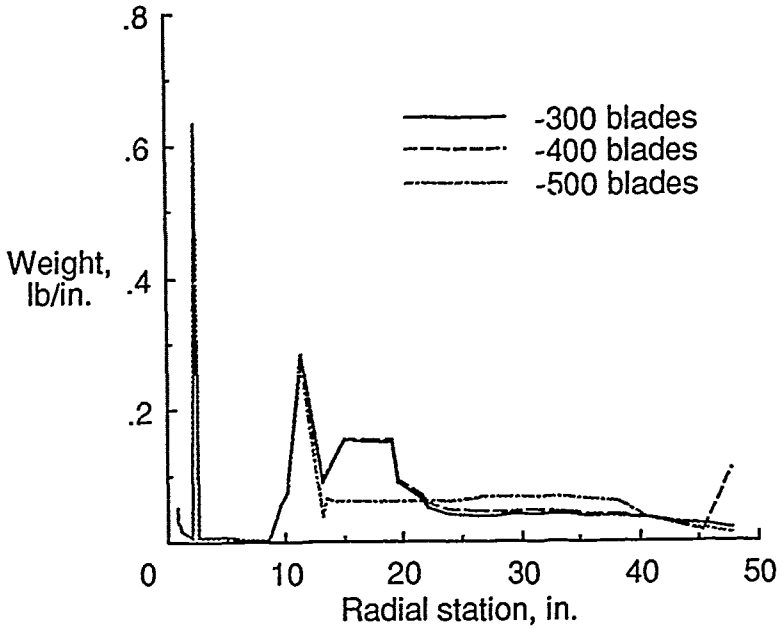


Figure 10. Weight distribution of rotor hub and −300, −400, and −500 blades.

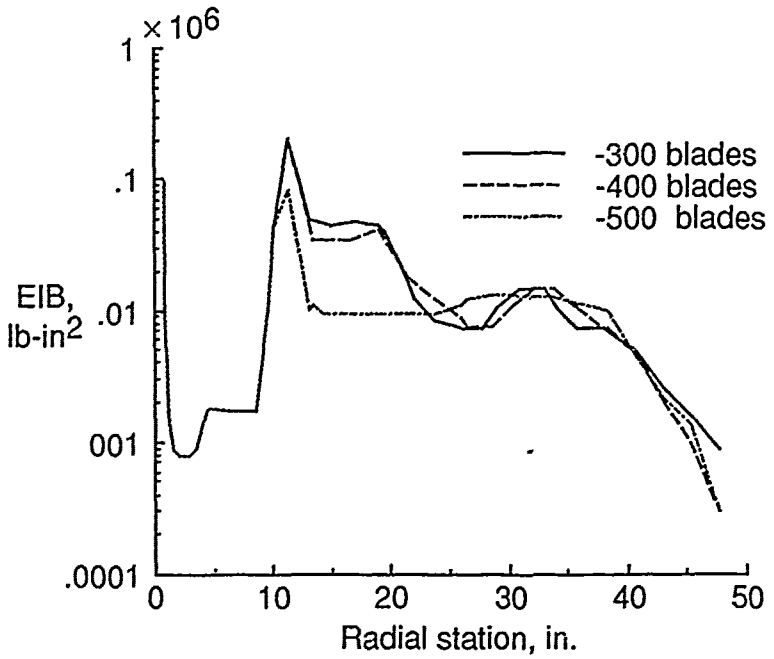


Figure 11. Beamwise stiffness distribution of rotor hub and −300, −400, and −500 blades.

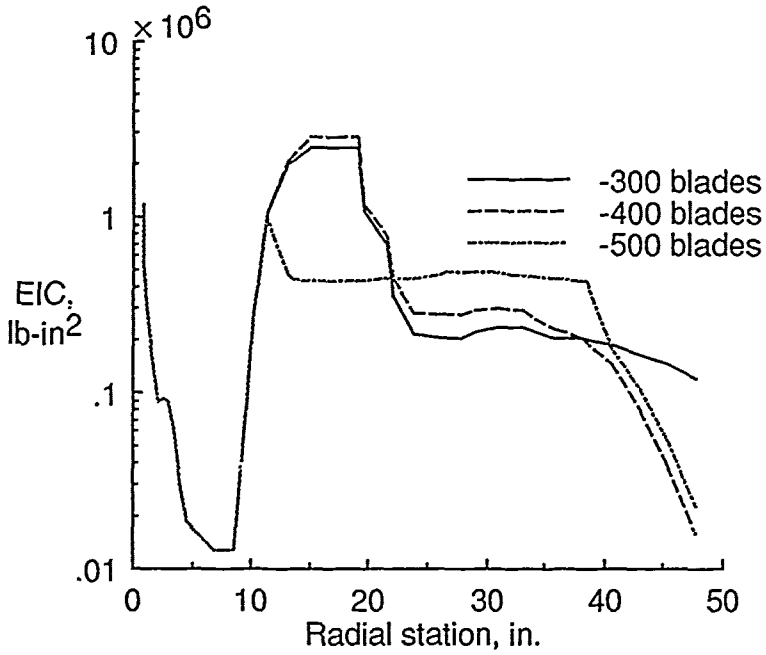


Figure 12. Chordwise stiffness distribution of rotor hub and −300, −400, and −500 blades.

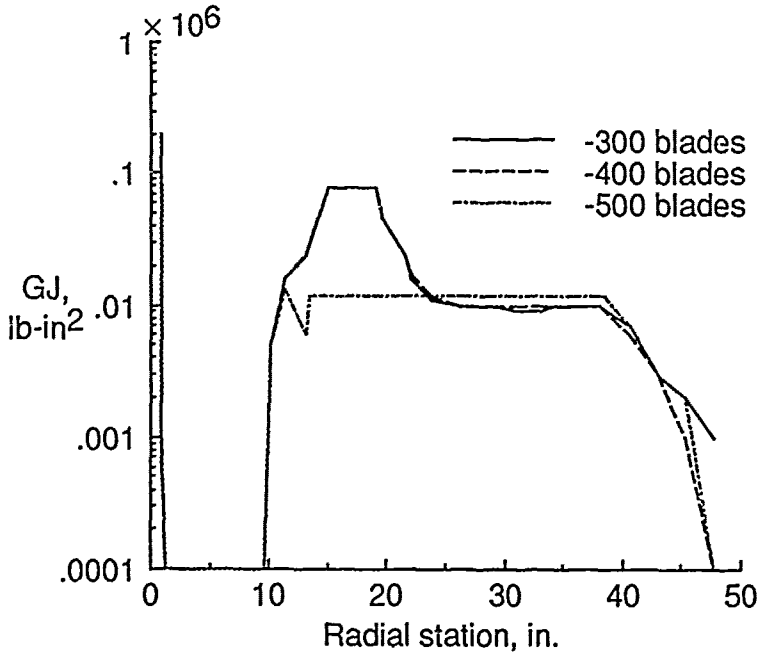


Figure 13. Torsional stiffness distribution of rotor hub and −300, −400, and −500 blades.

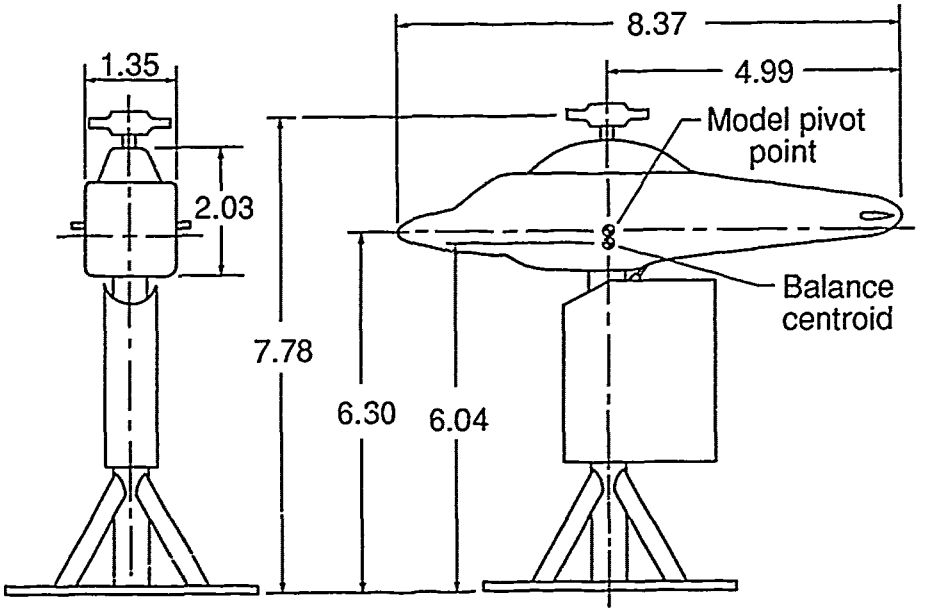


Figure 14. Schematic of aeroelastic rotor experimental system model. All dimensions are in feet.

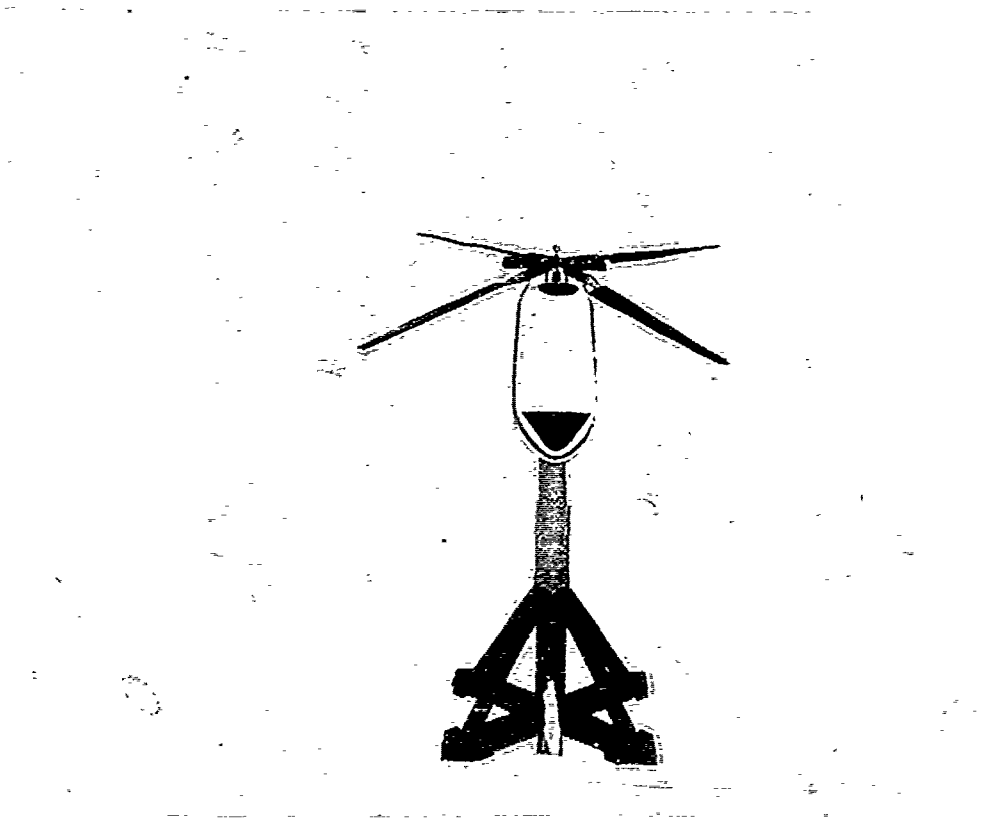


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Figure 15. Aeroelastic rotor experimental system model in Langley Transonic Dynamics Tunnel.

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15. Supplementary Notes

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16. Abstract

An experimental study was conducted in the Langley Transonic Dynamics Tunnel to investigate the use of a Bell Helicopter Textron rotor structural tailoring concept, known as rotor nodalization, in conjunction with advanced blade aerodynamics, and to evaluate rotor-blade aerodynamic design methodologies. A 1/5-size, four-bladed bearingless hub, three sets of Mach scaled model rotor blades, and two sets of Froude scaled model rotor blades were tested in forward flight from transition up to an advance ratio of 0.35. The data presented herein pertain only to evaluation of the structural tailoring concept and consist of fixed-system and rotating-system vibratory loads. These data are useful for evaluating the effects of tailoring blade structural properties on fixed-system vibratory loads and for validating analyses used in the design of advanced rotor systems.

17. Key Words (Suggested by Author(s)) Helicopters Model rotor testing Helicopter vibration Structural dynamics Rotor-blade design		18. Distribution Statement Unclassified—Unlimited Subject Category 01	
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