

NASA Contractor Report 178160

SUMMARY OF AH-1G FLIGHT VIBRATION DATA FOR VALIDATION OF COUPLED ROTOR-FUSELAGE ANALYSES

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A Subsidiary of Textron Inc.

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FOREWORD

Bell Helicopter Textron Inc. (BHTI) has been conducting a study of finite element modeling of helicopter airframes to predict vibration. This work is being performed under U.S. Government Contract NAS1-17496. The contract is monitored by the NASA Langley Research Center, Structures Directorate.

This report summarizes the AH-1G flight vibrations data which was prepared to provide a basis for evaluating extant analysis methods for predicting coupled rotor-fuselage vibrations. Key NASA and BHTI personnel are listed below:

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SECTION 1. INTRODUCTION

The NASA Langley Research Center is sponsoring a rotorcraft structural dynamics program with the overall objective to establish in the United States a superior capability to utilize finite element analysis models for calculations to support industrial design of helicopter airframe structures. Viewed as a whole, the program is planned to include efforts by NASA, universities, and the U.S. helicopter industry. In the initial phase of the program, teams from the major U.S. manufacturers of helicopter airframes will apply extant finite element analysis methods to calculate static internal loads and vibrations of helicopter airframes of both metal and composite construction, conduct laboratory measurements of the structural behavior of these airframes, and perform correlations between analysis and measurements to build up a basis upon which to evaluate the results of the applications. To maintain the necessary scientific observation and control, emphasis throughout these activities will be on advance planning, documentation of methods and procedures, and thorough discussion of results and experiences, all with industry-wide critique to allow maximum technology transfer between companies. The finite element models formed in this phase will then serve as the basis for the development, application, and evaluation of both improved modeling techniques and advanced analytical and computational techniques, all aimed at strengthening and enhancing the technology base which supports industrial design of helicopter airframe structures. Here again, procedures for mutual critique have been established, and these procedures call for a thorough discussion among the program participants of each method prior to the applications and of the results and experiences after the applications. The aforementioned rotorcraft structural dynamics program has been given the acronym DAMVIBS (Design Analysis Methods for Vibration^S). Under the DAMVIBS program, the four industry participants (BHTI, Boeing-Vertol, McDonnell-Douglas Helicopter, and Sikorsky Aircraft) are to apply existing company methods for coupled rotor-fuselage analysis to calculate vibrations of the AH-1G helicopter and to correlate with data available from an Operational Load Survey (OLS) flight test program (References 1 and 2). In support of this common activity, BHTI, the manufacturer of the subject aircraft, was tasked to prepare and provide to the other participants the data needed to independently make these analyses and correlations. Specifically, BHTI was tasked to:

1. Present a detailed description of the modeling rationale and techniques used to develop the AH-1G NASTRAN fuselage vibration model under previous contract (Reference 3). A NASTRAN data deck of this model was provided to all participating manufacturers.
2. Present a detailed description of all previous correlation work used to verify the fuselage vibration model (two versions - stick and built-up tailboom), including the following:
 - a. Ground vibration tests (GVT), static deflection tests and in-flight excitation simulation (References 4 and 5).

- b. Application of the built-up tailboom model predictions to the previous static and vibration ground tests of Reference 4.
 - c. Correlation of both models with other prior AH-1G GVT results contained in References 6 and 7.
3. Describe the OLS flight-test program on the AH-1G and assemble the vibration data to be used in the correlations.
 4. Present the AH-1G rotor system mechanical and aerodynamic coefficient data to all participants.
- This report addresses items 3 and 4, i.e., describes the OLS flight test program conducted with the AH-1G, summarizes the mechanical and aerodynamic characteristics of the rotor system, and identifies the vibration data to be used in the correlations.

SECTION 2. DESCRIPTION OF THE
AH-1G OPERATIONAL LOAD SURVEY (OLS) HELICOPTER

AH-1G OPERATIONAL LOAD SURVEY (OLS) HELICOPTER

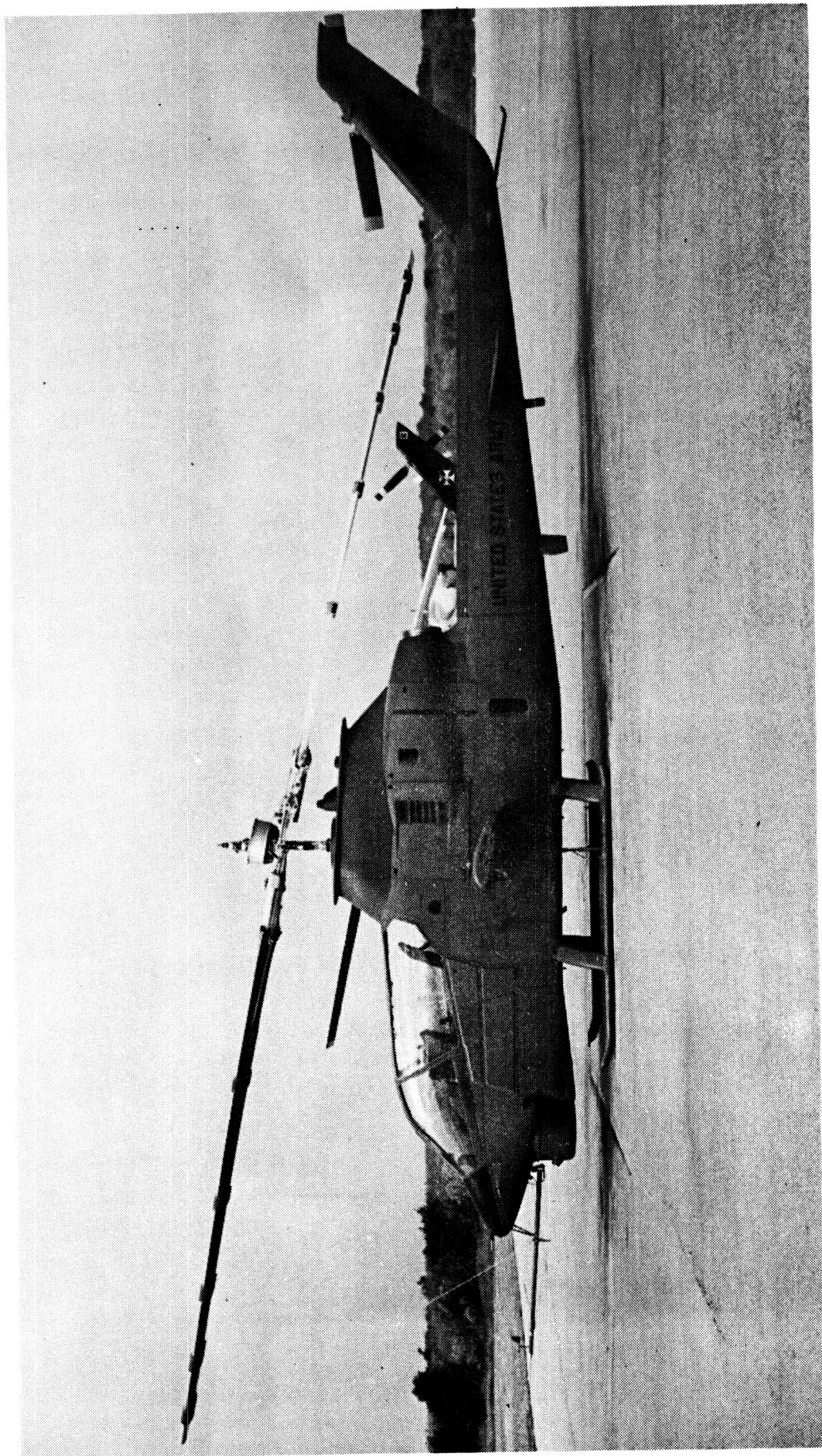
The subject helicopter of this contract is a U.S. Army AH-1G helicopter, Serial No. 20391. This model was picked because both a well-documented fuselage model and flight-test data exist from previous contract work. A large-scale Operational Load Survey (OLS) flight-test program was conducted in 1975 by BHTI under contract to the Army using an extensively instrumented AH-1G. The OLS program produced an enormous library of consistent, well-documented test data suited for investigations with rotorcraft simulation programs. The OLS data base is presented in this report for use by all participating analysts to correlate the proposed rotor-fuselage vibration predictions.

In addition to the standard equipment on the helicopter, the following items were installed on the fuselage:

1. A 28-track, AR-728 tape recorder, stationary multiplex, telemetry transmitter (TM) and power supplies, all mounted on an equipment rack in the ammo bay.
2. 23 accelerometers mounted on the fuselage.
3. A rotating multiplex (R-MUX), mounted on the trunnion.
4. A nose boom, mounted forward of the ship for airspeed measurements.
5. A hot-wire fault indicator, mounted in the cockpit.

Minor fuselage modifications were necessary to facilitate instrumentation routing. These modifications were made in low-load or nonstructural areas to ensure that fuselage structural integrity was not compromised.

AH-1G OPERATIONAL LOAD SURVEY (OLS) HELICOPTER



AH-1G OLS ROTOR ENVIRONMENT TEST INSTRUMENTATION

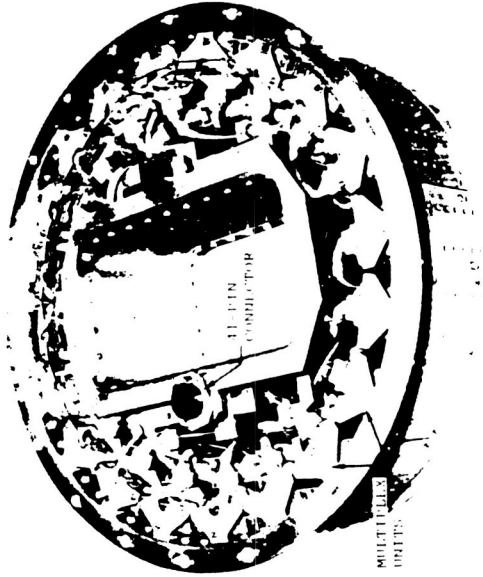
The production version of the AH-1G helicopter uses a BHT-developed 540 main rotor. This rotor was modified using a "gloved blade" approach during instrumentation to maintain structural integrity and a smooth aerodynamic surface for the OLS main rotor (see figure). Due to the large quantity of wiring needed for the 314 rotating sensors used on the OLS rotor system, a rotating electronics/multiplex (R-MUX) was used to provide a reliable means of interfacing between rotating and stationary system instrumentation.

New main rotor blades were manufactured for the OLS program to accommodate the extensive instrumentation installed in the fiberglass sleeve attached to the exterior of the production 540 blades. The midspan and tip tuning weights were reduced from the 540 to return the main rotor blades with the additional mass and stiffness of the sleeve. A detailed description of the OLS rotor changes appears in Reference 2, pages 66-78. However, for the AH-1G FEM, the analyst must only consider the total weight of the OLS system shown in Appendix B, page 1, to be 504.298 lb_f/blade. This weight is placed at the main rotor cg (grid 200153) and R-MUX instrumentation locations (grids 200155 and 200162) to simulate main rotor weights which includes the multiplexor equipment rotating and flapping with the blade.

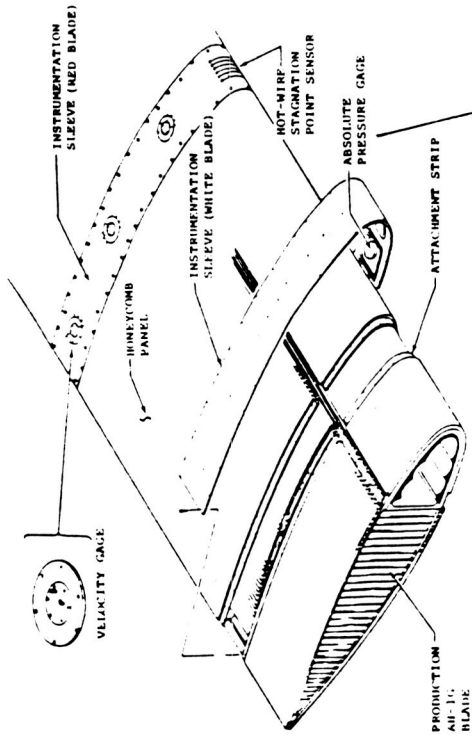
The OLS instrumentation weight additions are described below:

Instrumented package in ammo bay	Weight (lb)
Main rotor slip ring	246.5
Tail rotor slip ring	15.0
Main rotor stand pipe	3.5
Main rotor mast nut	5.0
Telemetry transmitter	8.5
Hub accelerometer and azimuth blipper	2.5
Yaw boom	5.5
Yaw boom yaps head	12.0
R-MUX box	4.5
Wiring	56.0
Main rotor blade instrumentation	41.0
Useful loads for Flight 35A tailboom ballast	29.0
	100.0 (to achieve desired location of cg)
OLS instrumentation weights (for all configurations)	Total
	529.0

AH-1G OLS ROTOR ENVIRONMENT TEST INSTRUMENTATION



ROTATING MULTIPLEX UNIT (R-MUX)



INSTRUMENTATION SLEEVE



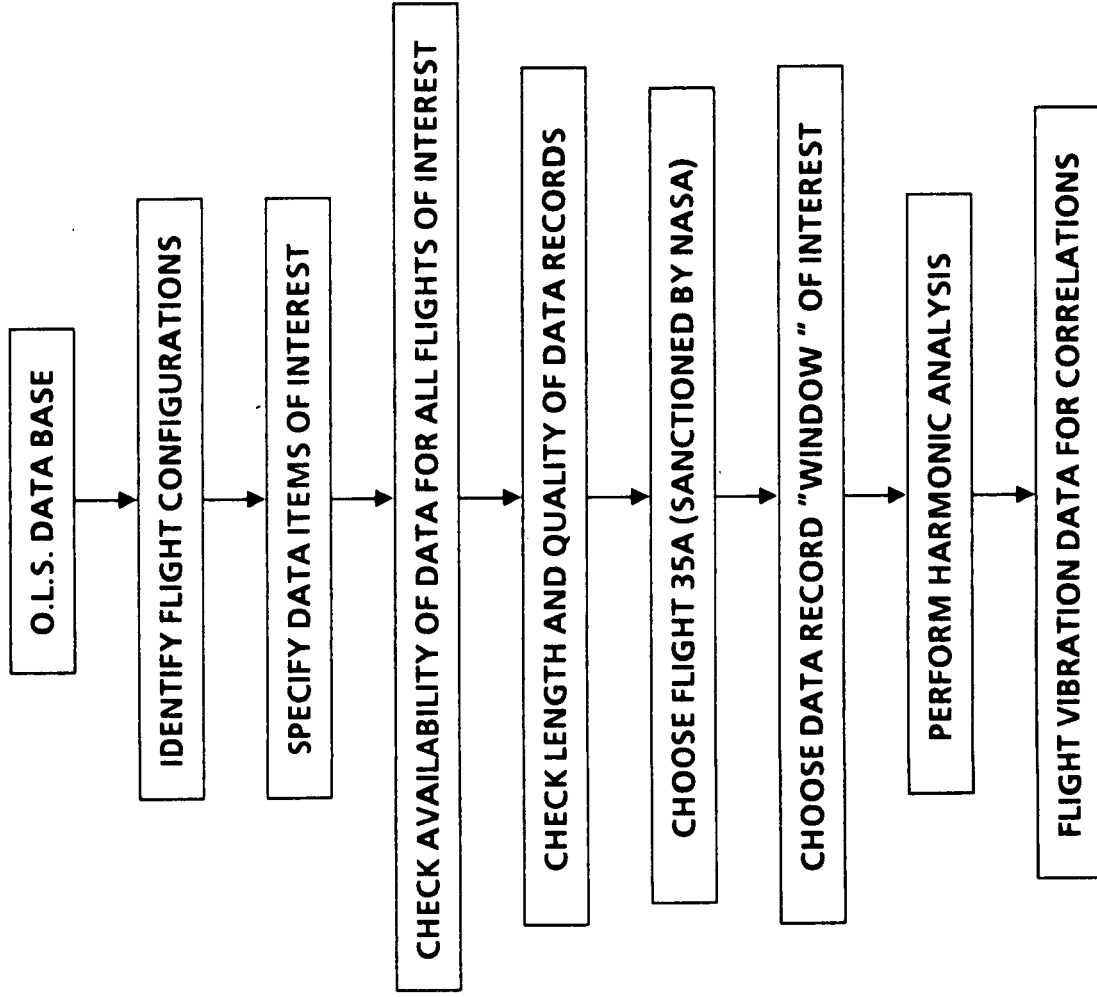
AH-1G OLS HELICOPTER

OLS DATA REDUCTION PROCEDURE

This section of the report describes the effort to select and retrieve portions of an existing body of data applicable to the coupled rotor/fuselage vibration analysis. The OLS data base is very extensive and represents flight vibration levels of the AH-1G helicopter under several flight conditions. An outline is presented below of the steps used to obtain the proper OLS flight-test data.

1. Identify flights of interest
 - a. Straight-and-level flights with available data identified from Reference 1
 - (1) 45C, 43, 35A, 35B, 36A, 37A
2. Data item availability was verified
 - a. 45C, 43 - no fuselage vibrations exist (written over by acoustical data)
 - b. 35B - no hub accelerations exist
 - c. 35A, 36A, 37A - all data items of interest available
 - *Flight 35A sanctioned by NASA as target flight configuration
3. Time-history stripouts
 - a. Entire data records (~10 sec) produced for each item of interest in Flight 35A
 - b. "Gross" data characteristics evaluated (i.e., glitches, blossoms, spikes, etc.)
 - c. Data "window" (0.5 to 2.5 sec range) selected based on "gross" characteristics
 - d. Airspeed values and rotor pulses checked to verify test identification
4. Perform harmonic analysis
 - a. Automated data processing using BHT-developed program "FFAE04"
5. Provide correlation data for all participants

OLS DATA REDUCTION PROCEDURE



SECTION 3. FLIGHT CONDITION OF INTEREST

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FLIGHT CONDITIONS FROM THE BASIC OLS PROGRAM

Proper identification of data items within the OLS data base begins with specification of the flight number and hence the flight configuration of interest. Flight 35A represents the OLS straight-and-level, clean-wing, aft cg flight configuration chosen for this study. There are 6 counter numbers, 610 through 615, associated with Flight 35A and its six target airspeeds. V_h is defined as the maximum speed attainable (powerplant limited) at maximum continuous power and corresponds to a true airspeed of 142 knots for Flight 35A.

FLIGHT CONDITIONS FROM THE BASIC OLS PROGRAM

Flight Condition	8100 lb (clean wing)			9000 lb (wing stores)		
	Fwd Flt/Ctr	Mid Flt/Ctr	Aft Flt/Ctr	Fwd Flt/Ctr	Mid Flt/Ctr	Aft Flt/Ctr
Normal start	-	45C 1084	-	-	-	-
Normal shutdown	-	45A 1053	-	-	-	-
Normal takeoff	-	45C 1085	-	-	-	-
Normal acceleration	-	45C 1087	-	-	-	-
Normal deceleration	-	45A 1048	-	-	-	-
Normal landing	-	45C 1099	-	-	-	-
Hover, ICE (4 ft)	-	45C 1098	-	-	-	-
Hover, OGE (100 ft)	-	45B 1078	-	-	31A 535	-
Forward flight, 0.5 V _h	45C 1088	43 860	35A 611	35B 618	37B 685	37A 676
Forward flight, 0.6 V _h	1089	863	612	619	637	677
Forward flight, 0.7 V _h	1090	864	613	620	638	678
Forward flight, 0.8 V _h	1091	865	614	621	639	679
Forward flight, 0.9 V _h	1092	868	615	622	640	680
Forward flight, 1.0 V _h	45C 1093	43 869	35A 610	35B 617	36A 635	37A 675
Climb at 1100 shp	-	22A 367	-	-	-	-
Maximum level flight acceleration	-	22A 377	-	-	-	-
Pullups	-	32A 562	-	-	-	-
Pushovers	-	563	-	-	-	-
Gunnery dive	-	568	-	-	-	-
Gunnery dive, left pullout	-	569	-	-	35C 626	-
Gunnery drive, right pullout	-	571	-	-	625	-
Gunnery drive, symmetrical pullout	-	32A 567	-	-	35C 627	-
Power to autorotation	-	45C 1094	-	-	31 538	-
Autorotation to power	-	45C 1095	-	-	-	-
Partial power descent	-	45A 1047	-	-	-	-

OLS AIRSPEED CALIBRATION CHART

Most transducer calibration values have linear relationships to the engineering units in question. Therefore, the structural analyst never deals with instrumentation calibration because the electronic signals are directly converted to engineering units during digitization. Airspeed calibration, however, often has a nonlinear calibration curve and requires the analyst to convert the measured value to a desired format. The boom airspeed measured by instrument #B1698 during the OLS program was recorded in knots squared. The square root of the mean value of the measured boom airspeed is indicated airspeed (IAS) and was compared with velocities recorded on the pilot card from Flight 35A to verify test conditions. All velocities checked well with pilot card information. IAS is converted to calibrated airspeed (CAS) via the graph below. The diagonal curve represents instrument calibration due to installation error. The nonlinear curve was obtained from calibration tests done during flights 24 and 25 of the OLS flight-test program. IAS is converted to CAS by projecting a straight line from the IAS diagonal curve to the CAS curve as shown by the dotted line. Assuming no compressibility effects exist at these low airspeeds, the desired value of true airspeed (TAS) in knots is determined by dividing CAS by the square root of the density ratio (σ) to account for altitude and outside air temperature (OAT) conditions. The following information was obtained from the pilot card of Flight 35A and the equations used to determine σ are shown below.

$$\text{Pressure altitude} = H_D = 5000 \text{ ft}$$

$$\text{Density altitude} = H_p = 2900 \text{ ft}$$

$$\text{Pressure ratio} \equiv \delta = 0.9005 \text{ (from aerodynamic tables)}$$

$$\text{Temperature ratio (absolute)} \equiv \theta = 1.045$$

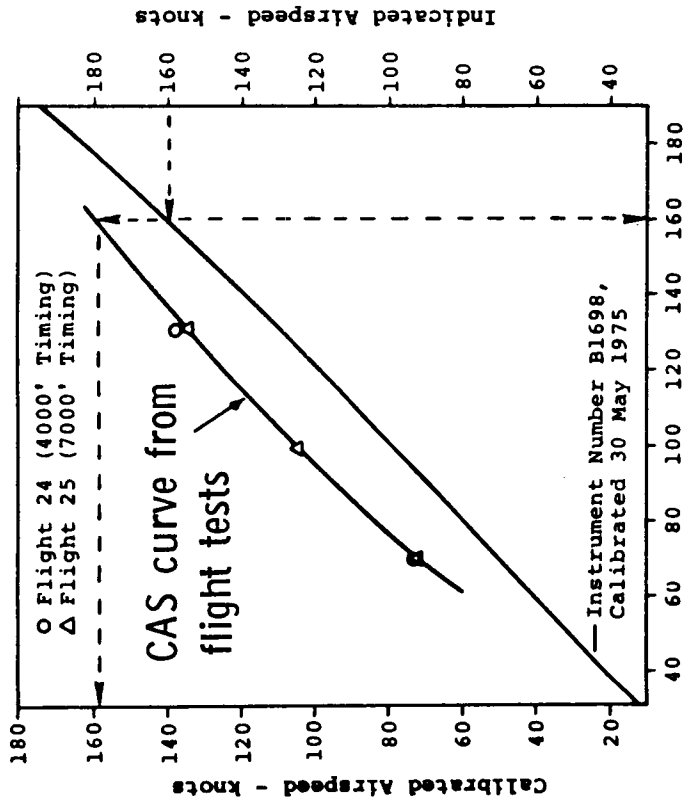
$$\text{Density ratio} \equiv \sigma = \frac{\delta}{\theta} = 0.8617$$

$$\text{TAS} = \frac{\text{CAS}}{\sqrt{\sigma}} \quad \text{values for all counter numbers (target airspeeds) shown on figure below.}$$

$$T = 28^\circ\text{C} = 82.4^\circ\text{F} \text{ (from pilot card)}$$

$$\theta = \frac{^\circ\text{F} + ^\circ\text{R}}{^\circ\text{F}_0 + ^\circ\text{R}_0} = \frac{82.4 + 460}{59 + 460} = 1.045$$

OLS AIRSPEED CALIBRATION CHART



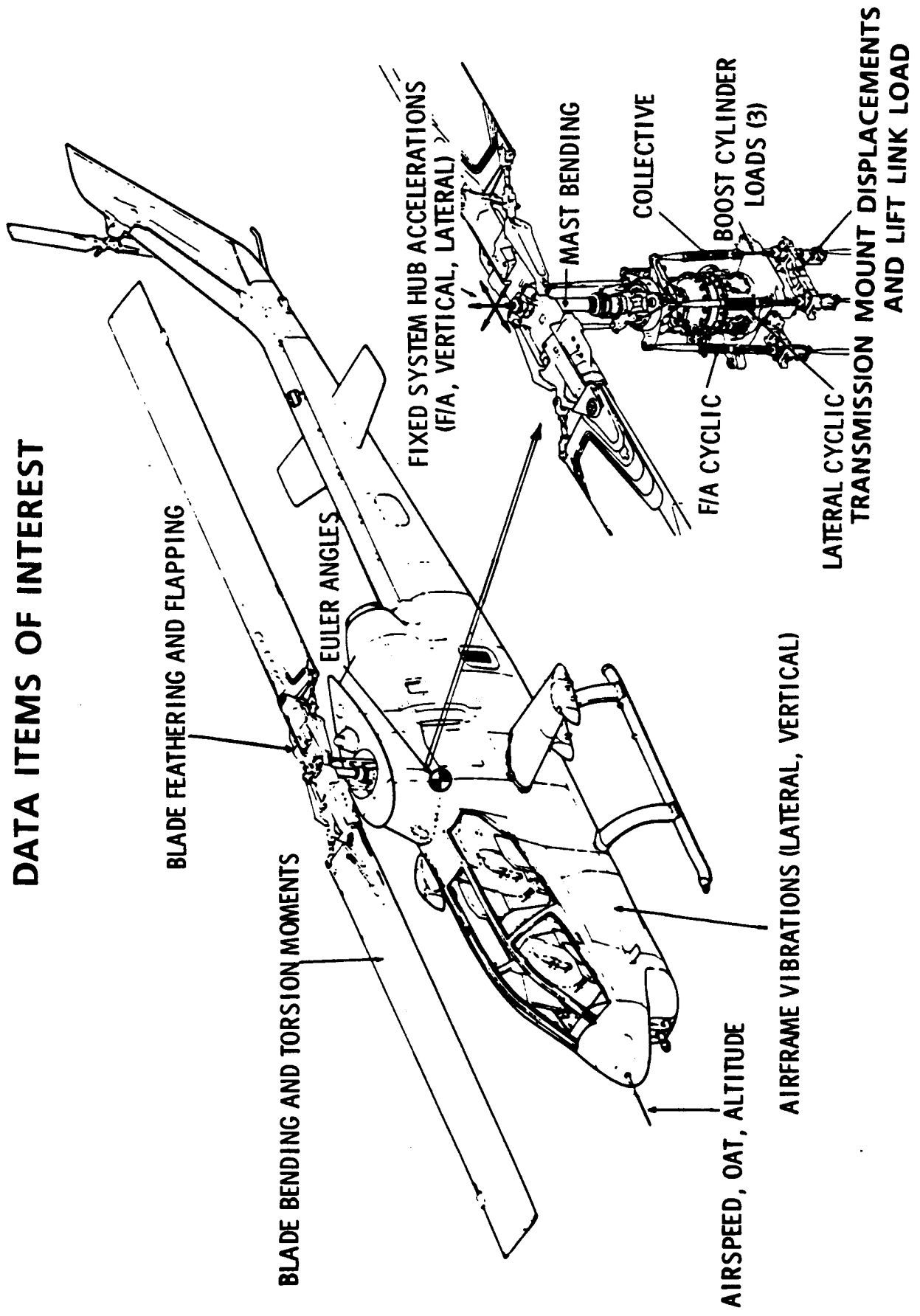
True Indicated Airspeed - knots

FLIGHT	COUNTER	IAS	CAS	DENSITY RATIO	TAS
35A	611	62.7	62.2	.8617	67
35A	612	76.8	78.8	.8617	85
35A	613	91.3	93.8	.8617	101
35A	614	103.2	105.5	.8617	114
35A	615	115.3	119.1	.8617	128
35A	610	128.8	131.6	.8617	142

DATA ITEMS OF INTEREST

Approximately 60 data items were selected from the OLS data base to provide correlation points for the coupled rotor/fuselage vibration analysis. Fuselage vibrations, control system loads, blade moments, transmission mount displacements, and vehicle performance information are all represented. The availability and accessibility of each of these data items for Flight 35A was determined by producing time-history stripouts for each item. From these stripout charts a "window" was picked which provided consistent quality data records for each data item of interest. A two-second range of interest (0.5 to 2.5 sec) was specified which encompasses approximately 10 cycles of data at the 324 nominal rpm used during the test. None of the data items exhibited faulty data patterns or excessive glitches, spikes, or blossoms during this specified range of interest. The following two figures show the physical locations of fuselage accelerometers and blade strain gages used during the OLS test program.

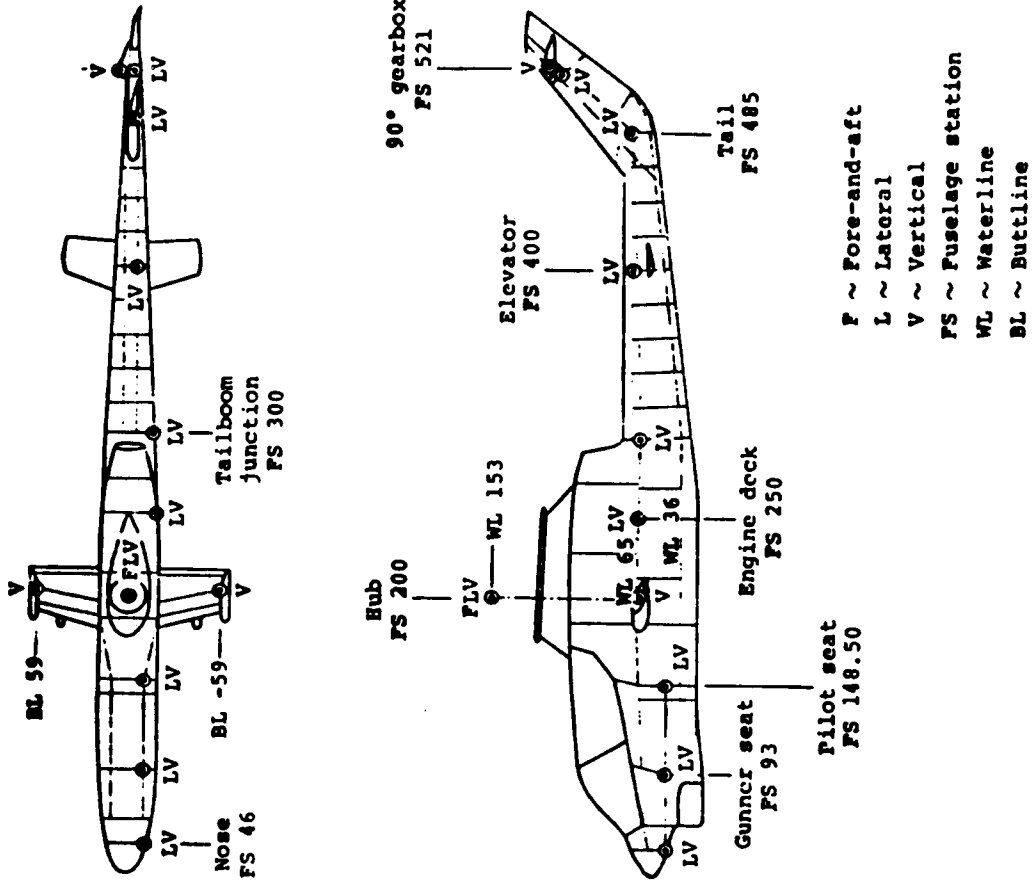
DATA ITEMS OF INTEREST



FUSELAGE ACCELEROMETER LOCATIONS

Fuselage accelerometer locations for the OLS flight-test program are shown in this figure. Fixed system primary harmonics are 2 (10.8 Hz), 4 (21.6 Hz), and 6 (32.4 Hz) per rev for the two-bladed teetering rotor used in the OLS program. These harmonics represent the predominant excitation frequencies through at least a 30 Hz frequency range of interest as prescribed under this contract.

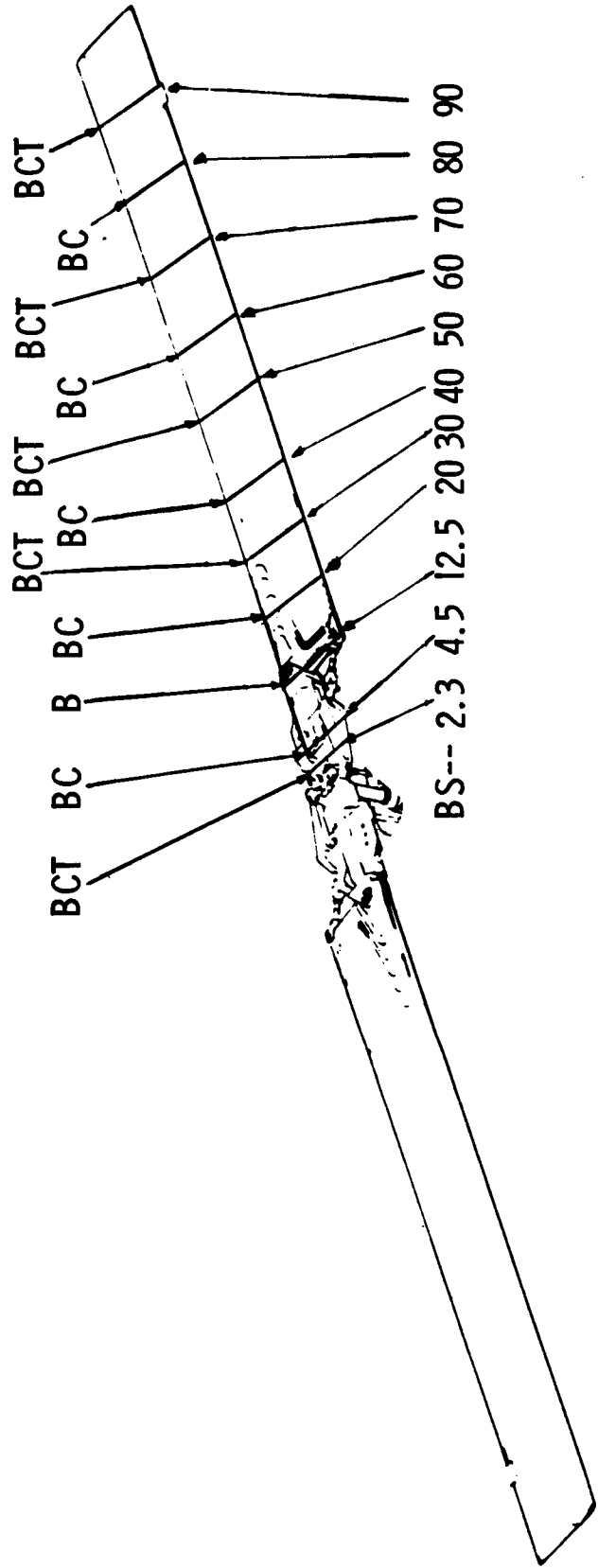
FUSELAGE ACCELEROMETER LOCATIONS



BLADE AND YOKE STRAIN GAGE LOCATIONS

The radial locations of the blade strain gages used to monitor blade beam, chord, and torsion moments are specified in this figure. 1 (5.4 Hz), 3 (16.2 Hz), and 5 (27 Hz) per rev harmonics are the predominant excitation frequencies for the chord (inplane) and torsion moments and 2, 4, and 6 per rev harmonics for the beam (out-of-plane) moments. Again, these harmonics represent the low frequency range through at least 30 Hz.

BLADE AND YOKE STRAIN GAGE LOCATIONS



- B- BEAM BENDING MOMENT
- C- CHORD BENDING MOMENT
- T- TORSIONAL MOMENT
- BS- BLADE STATION (% RADIUS)

DATA ITEM DESCRIPTION

The attached table contains a listing of all the data items presented with this report for Flight 35A. Each data item listed in the table has a specific description to enable all participating manufacturers to identify a particular item for use during correlation. The harmonic data reduction values are presented in Appendix A.

DATA ITEM DESCRIPTION

PERTINENT INFORMATION FOR EXTRACTING DATA FROM THE
DIGITIZED GDC TAPES AT BELL HELICOPTER TEXTRON

DATA GROUP	GDC TAPE #	SAMPLING RATE(SAMPLES/SEC)/BREAK FREQUENCY(Hz)
A	F2270202	512 / 50
B	F1800131	2048 / 200
C	F2230205	4096 / 400
D	F1930601	2048 / 200
E	F2040202	512 / 50

GROUP #	DATA ITEM #	UNITS	ITEM DESCRIPTION	HARMONICS OF INTEREST
A	A005	G	C. G. LOAD FACTOR	2, 4, 6
A	F050	LB	LIFT LINK AXIAL FORCE	2, 4, 6
A	F100	LB	F/A CYCLIC BOOST TUBE AXIAL FORCE	2, 4, 6
A	F101	LB	LATERAL CYCLIC BOOST TUBE AXIAL FORCE	2, 4, 6
A	F102	LB	COLLECTIVE BOOST TUBE AXIAL FORCE	2, 4, 6
A	F103	LB	MR RED PITCH LINK AXIAL FORCE	1, 3, 5
A	F104	LB	MR WHITE PITCH LINK AXIAL FORCE	1, 3, 5
A	D009	DEG	ROLL ATTITUDE	1, 2, 3, 4, 5, 6
A	D010	DEG	PITCH ATTITUDE	1, 2, 3, 4, 5, 6
A	D011	DEG	YAW ATTITUDE	1, 2, 3, 4, 5, 6
A	D051	IN	LEFT FORWARD PYLON VERTICAL DISP.	2, 4, 6
A	D052	IN	RIGHT FORWARD PYLON VERTICAL DISP.	2, 4, 6
A	D053	IN	LEFT AFT PYLON VERTICAL DISP.	2, 4, 6
A	D054	IN	RIGHT AFT PYLON VERTICAL DISP.	2, 4, 6
A	D110	DEG.	MR HUB FLAPPING ANGLE	1, 3, 5
A	D111	DEG	MR HUB FEATHERING ANGLE	1, 3, 5
A	M107	IN-LB	MR MAST TORQUE	1, 2, 3, 4, 5, 6

DATA ITEM DESCRIPTION (CONTINUED)

GROUP #	DATA ITEM #	UNITS	ITEM DESCRIPTION	HARMONICS OF INTEREST
B	A019	G	PILOT VERTICAL VIBRATION STA 148.5	2, 4, 6
B	A02B	G	GUNNER VERTICAL VIBRATION STA 93.0	2, 4, 6
B	A60B	G	LEFT WING VERTICAL VIBRATION STA 204.0	2, 4, 6
B	A601	G	RIGHT WING VERTICAL VIBRATION STA 204.0	2, 4, 6
B	A302	G	PILOT LATERAL VIBRATION STA 148.5	2, 4, 6
B	A304	G	GUNNER LATERAL VIBRATION STA 93.0	2, 4, 6
B	A306	G	NOSE LATERAL VIBRATION STA 46.0	2, 4, 6
B	A307	G	ENGINE DECK LATERAL VIBRATION STA 250.0	2, 4, 6
B	A308	G	TB JUNCTION LATERAL VIBRATION STA 298.7	2, 4, 6
B	A309	G	ELEVATOR LATERAL VIBRATION STA 401.33	2, 4, 6
B	A311	G	VERTICAL FIN LATERAL VIBRATION STA 515.43	2, 4, 6
B	A315	G	NOSE VERTICAL VIBRATION STA 46.0	2, 4, 6
B	A316	G	ENGINE DECK VERTICAL VIBRATION STA 250.0	2, 4, 6
B	A317	G	TB JUNCTION VERTICAL VIBRATION STA 298.7	2, 4, 6
B	A318	G	ELEVATOR VERTICAL VIBRATION STA 401.32	2, 4, 6
B	A319	G	TAIL FIN JUNCTION VERT. VIBRATION STA 488.93	2, 4, 6
B	A320	G	VERTICAL FIN VERTICAL VIBRATION STA 515.43	2, 4, 6
B	A321	G	TB 90° GEAR BOX VERTICAL VIBRATION STA 520.67	2, 4, 6
B	F105	LB	MR RED DRAG BRACE AXIAL FORCE	1, 3, 5
B	B122	IN-LB	50%R MR RED BLADE BEAM BENDING	2, 4, 6
B	B123	IN-LB	50%R MR RED BLADE CHORD BENDING	1, 3, 5
B	B126	IN-LB	30%R MR RED BLADE BEAM BENDING	2, 4, 6
C	A886	G	MAST TOP(HUB) F/A VIBRATION STA 200	2, 4, 6
C	A887	G	MAST TOP(HUB) LATERAL VIBRATION STA 200	2, 4, 6
C	A888	G	MAST TOP(HUB) VERTICAL VIBRATION STA 200	2, 4, 6
C	A150	IN-LB	30% MR RED BLADE TORSION MOMENT	1, 3, 5
C	T004	DEG C	OUTSIDE AIR TEMPERATURE	
C	P002	KT**2	AIRSPEED-BOOM SYSTEM	
D	B108	IN-LB	MR MAST PARALLEL BENDING STA 18.5	1, 3, 5
D	B109	IN-LB	MR MAST PERPENDICULAR BENDING STA 18.5	1, 3, 5
D	B127	IN-LB	30%R MR RED BLADE CHORD BENDING	1, 3, 5
D	B132	IN-LB	70%R MR RED BLADE BEAM BENDING	2, 4, 6
D	B133	IN-LB	70%R MR RED BLADE CHORD BENDING	1, 3, 5

DATA ITEM DESCRIPTION (CONCLUDED)

GROUP #	DATA ITEM #	UNITS	ITEM DESCRIPTION	HARMONICS OF INTEREST
D	B134	IN-LB	90%R MR RED BLADE BEAM BENDING	2, 4, 6
D	M935	IN-LB	50%R MR RED BLADE TORSIGN MOMENT	1, 3, 5
D	M936	IN-LB	70%R MR RED BLADE TORSIGN MOEMNT	1, 3, 5
D	M937	IN-LB	90%R MR RED BLADE TORSION MOMENT	1, 3, 5
E	R992	PULSES	M/R AZIMUTH	1
E	B882	IN-LB	MR MAST PARALLEL BENDING STA 6.5	1, 3, 5
E	B883	IN-LB	MR MAST PERPENDICULAR BENDING STA 5.0	1, 3, 5

SAMPLE HARMONIC OUTPUT

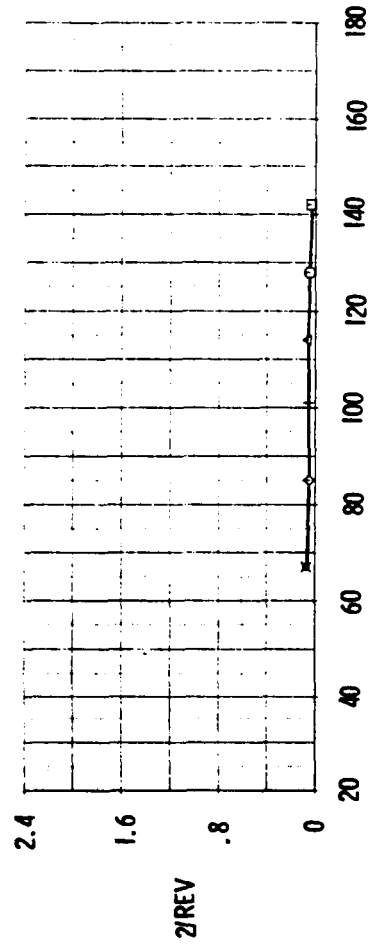
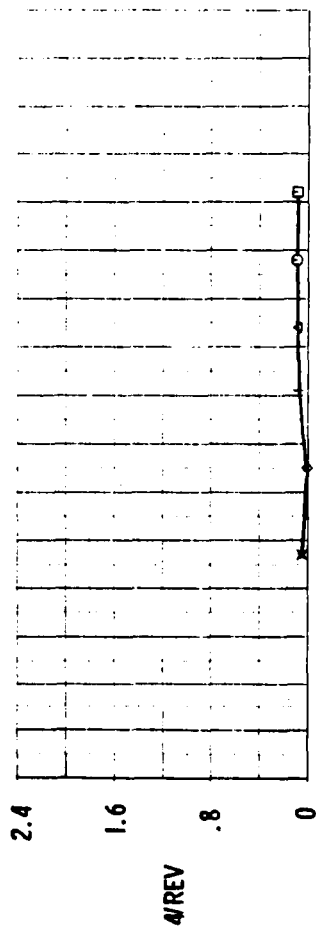
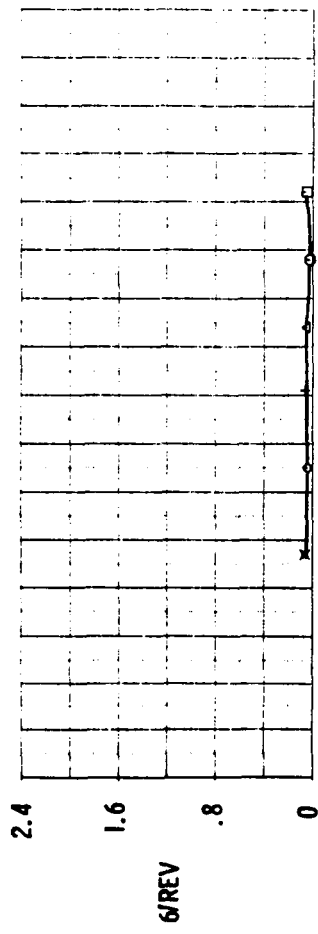
Sample plots of selected data items are presented on the following nine pages as an example of the final result of the OLS data reduction procedure. These plots show sample 2, 4, and 6p hub and fuselage accelerations in G's as a function of airspeed. Tabular listings for all data items appear in Appendix A. This data presentation marks the end of the descriptive section on the OLS data base.

Example plots of harmonically reduced data versus airspeed for Flight 35A include:

1. Hub vertical accelerations
2. Gunner vertical accelerations
3. Pilot vertical accelerations
4. 90° gearbox vertical accelerations
5. Hub lateral accelerations
6. Gunner lateral accelerations
7. Pilot lateral accelerations
8. Tailboom lateral accelerations
9. Hub longitudinal accelerations

SAMPLE HARMONIC OUTPUT

FLIGHT 35A HUB VERTICAL ACCELERATION

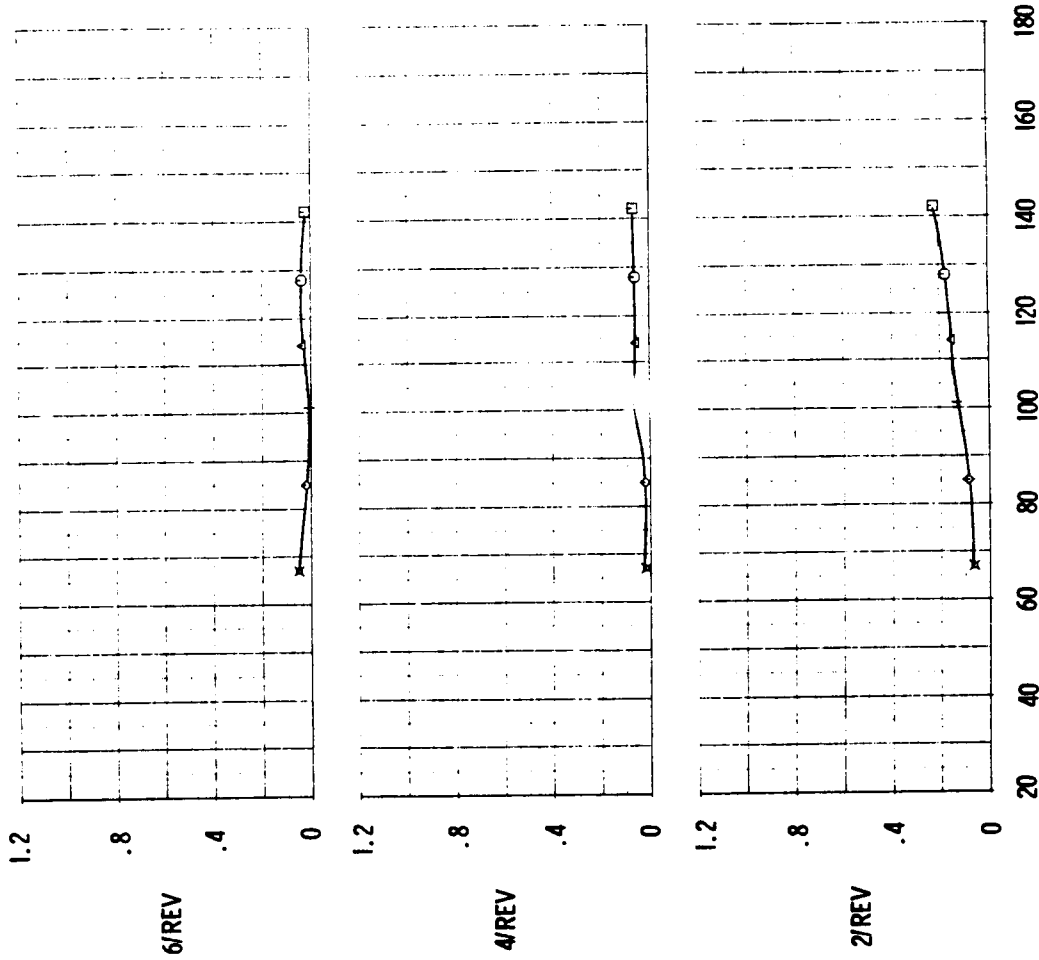


TRUE AIRSPEED (KNOTS)

SAMPLE HARMONIC OUTPUT (CONTINUED)

FLIGHT 35A FUSELAGE VERTICAL ACCELERATION

GUNNER

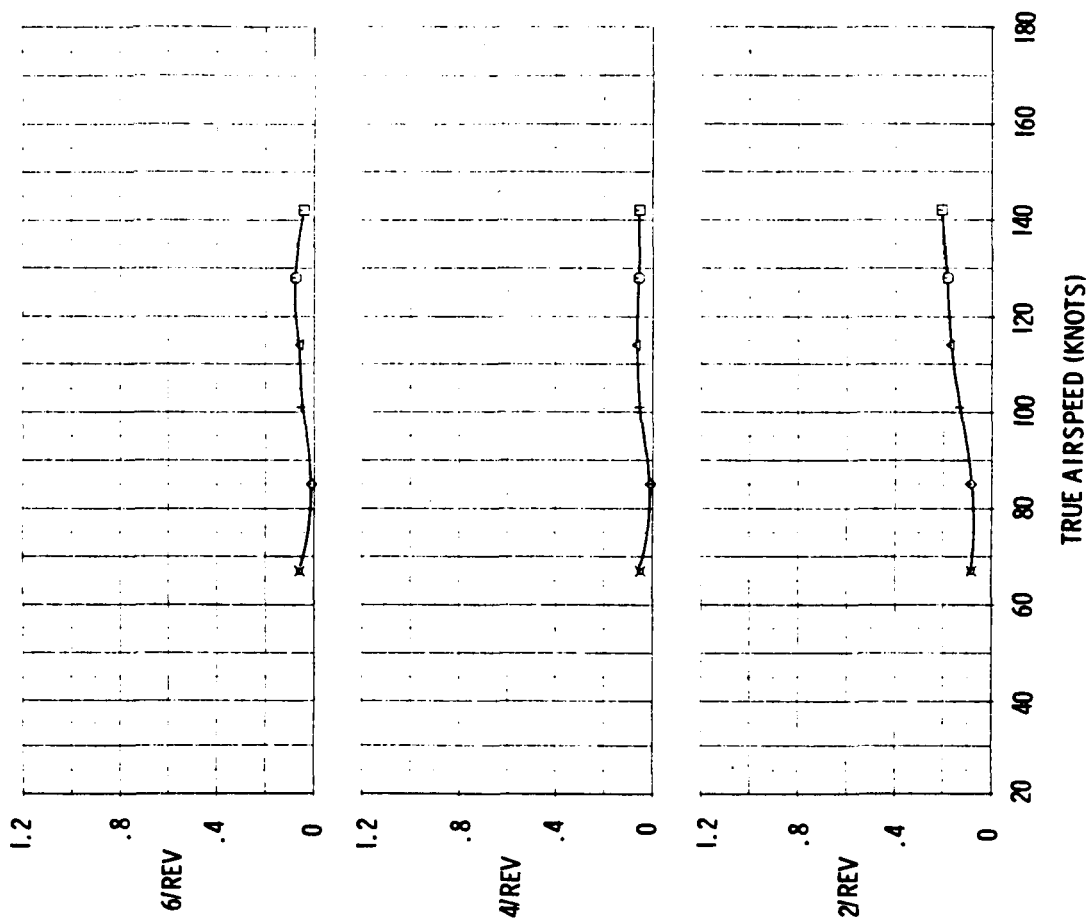


TRUE AIRSPEED (KNOTS)

SAMPLE HARMONIC OUTPUT (CONTINUED)

FLIGHT 35A FUSELAGE VERTICAL ACCELERATION

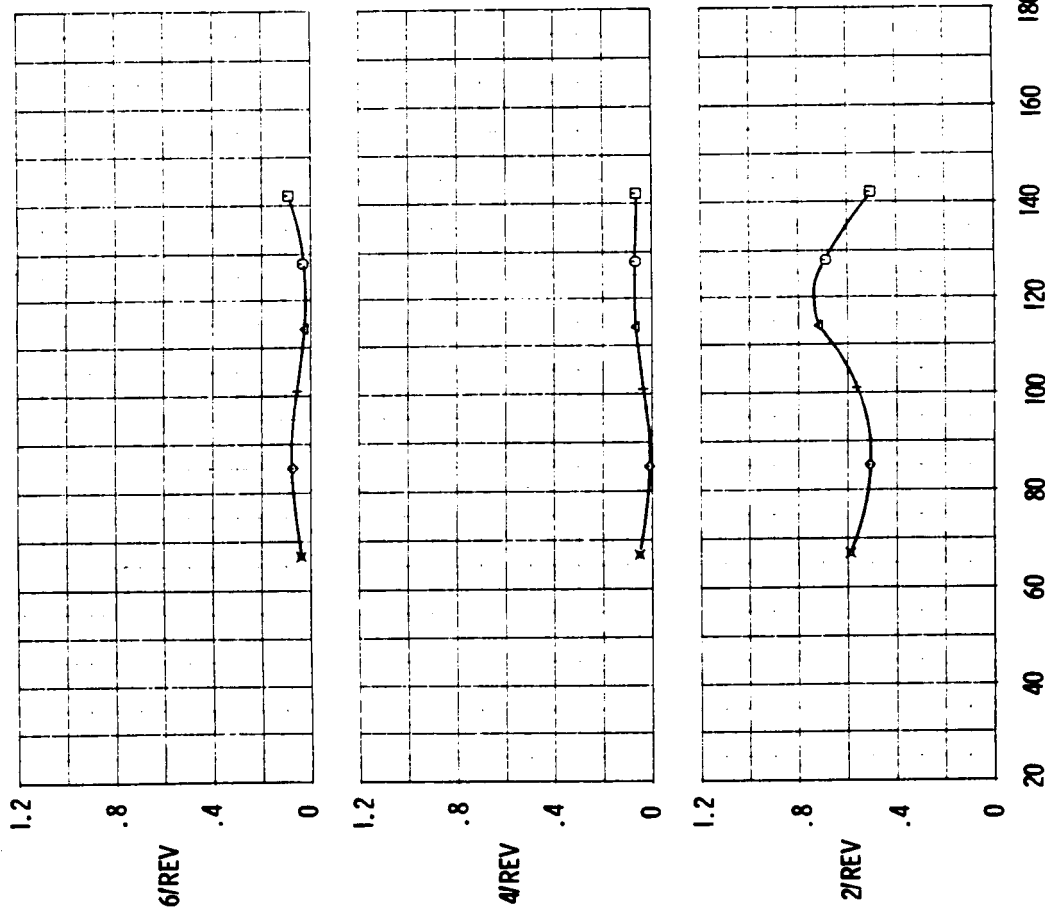
PILOT



SAMPLE HARMONIC OUTPUT (CONTINUED)

FLIGHT 35A FUSELAGE VERTICAL ACCELERATION

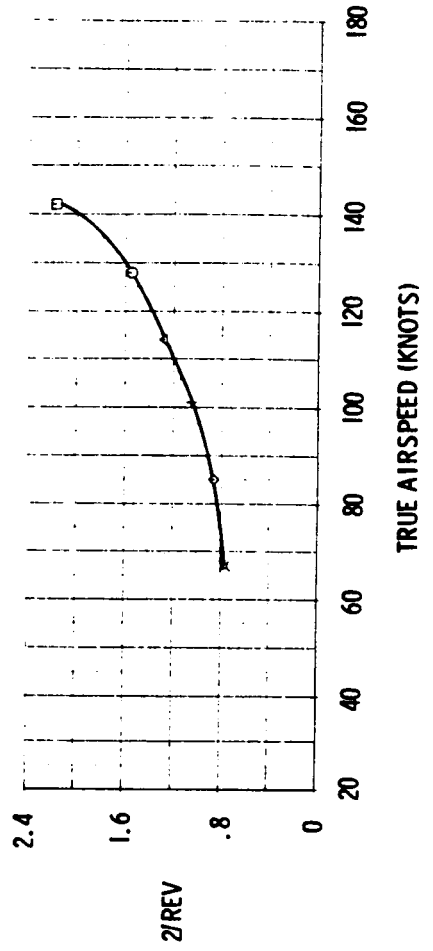
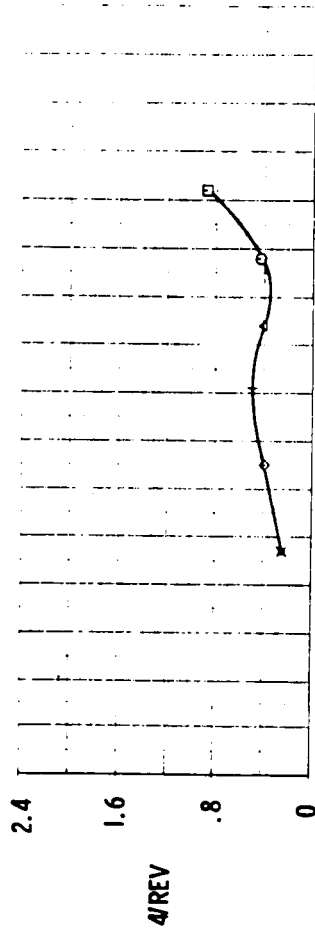
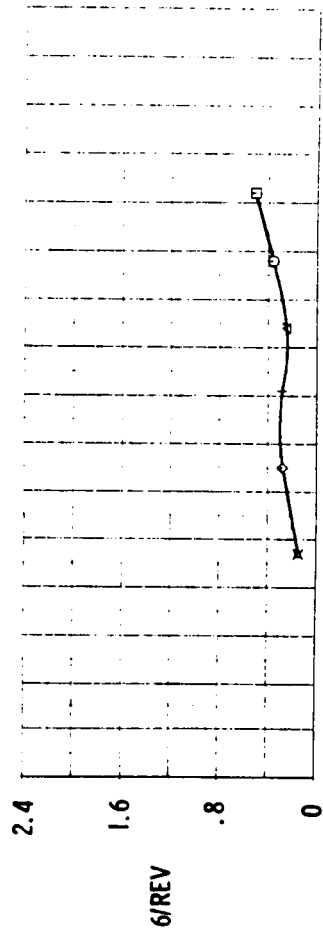
90° GEAR BOX



TRUE AIRSPEED (KNOTS)

SAMPLE HARMONIC OUTPUT (CONTINUED)

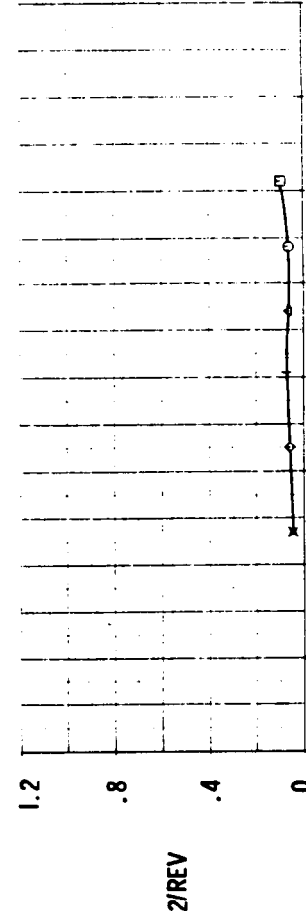
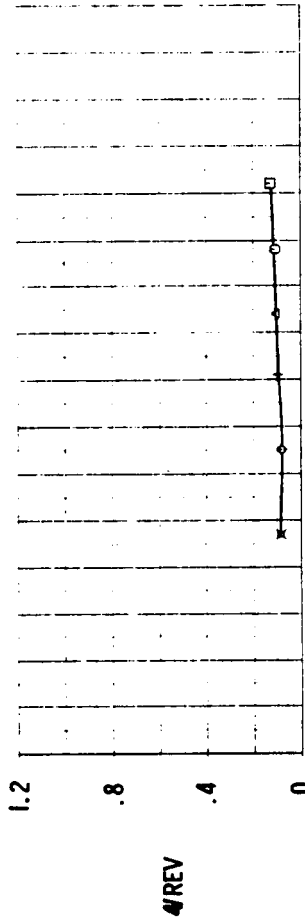
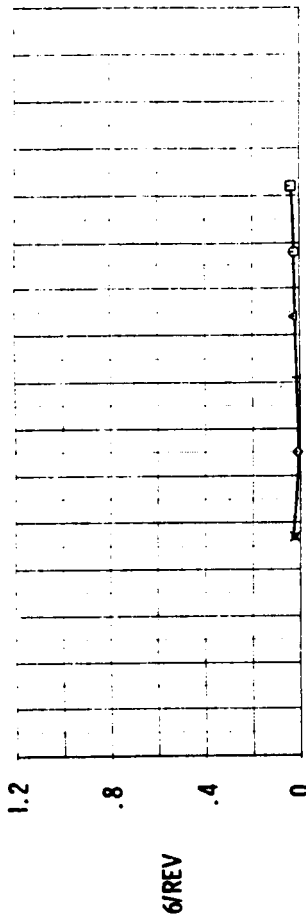
FLIGHT 35A HUB LATERAL ACCELERATION



SAMPLE HARMONIC OUTPUT (CONTINUED)

FLIGHT 35A FUSELAGE LATERAL ACCELERATION

GUNNER

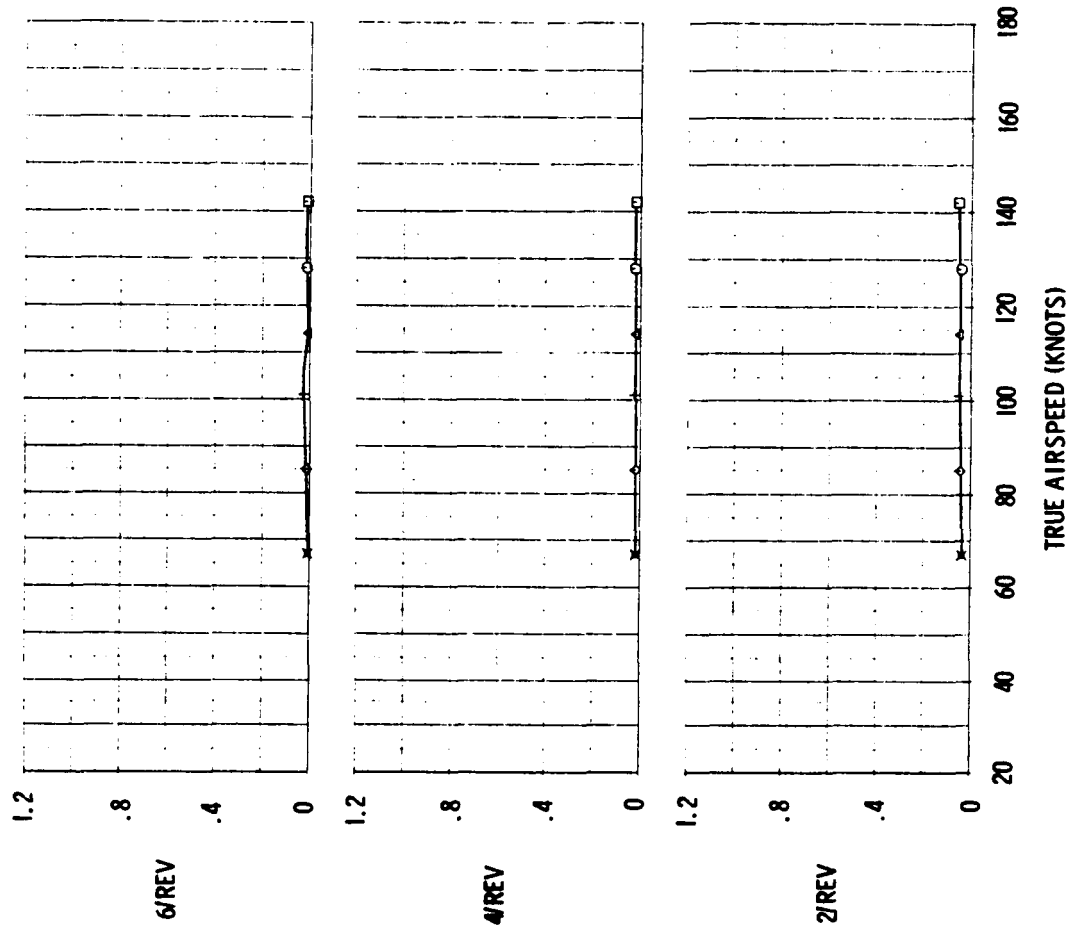


TRUE AIRSPEED (KNOTS)

SAMPLE HARMONIC OUTPUT (CONTINUED)

FLIGHT 35A FUSELAGE LATERAL ACCELERATION

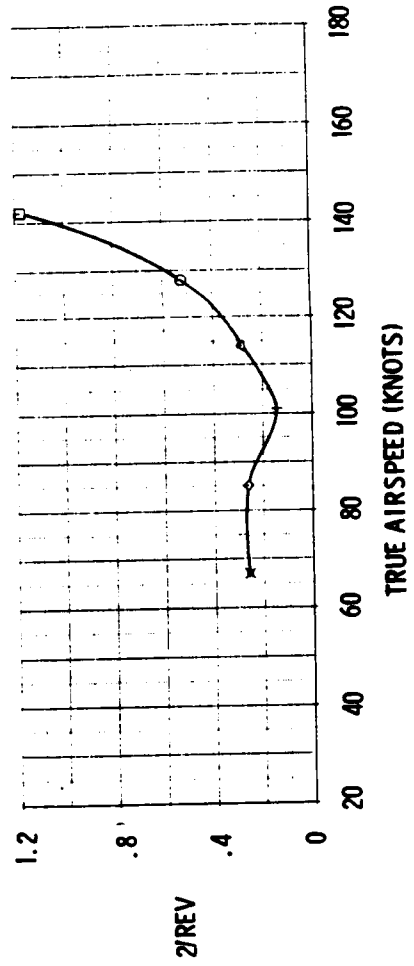
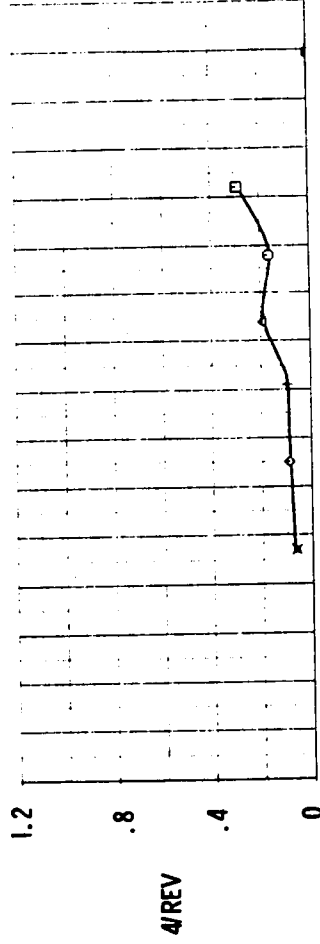
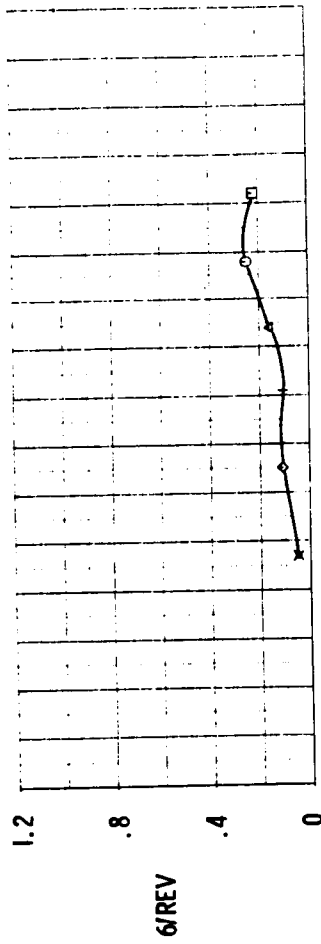
PILOT



SAMPLE HARMONIC OUTPUT (CONTINUED)

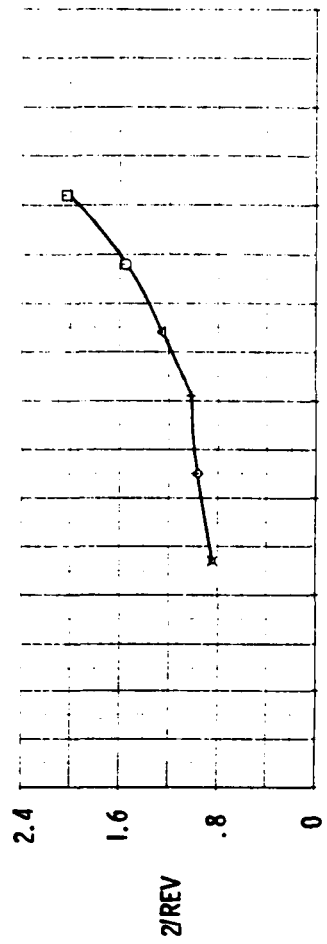
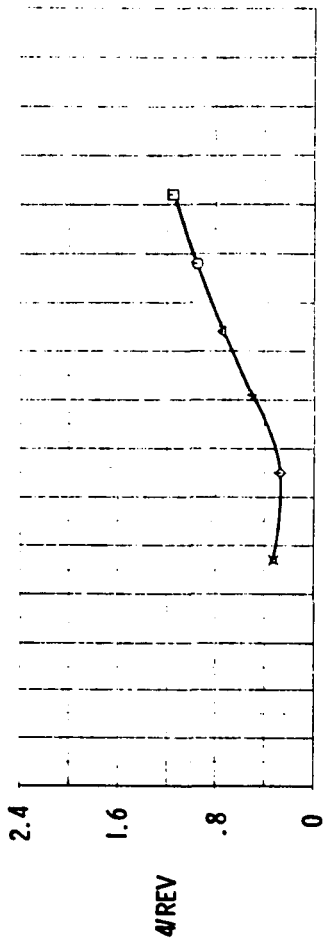
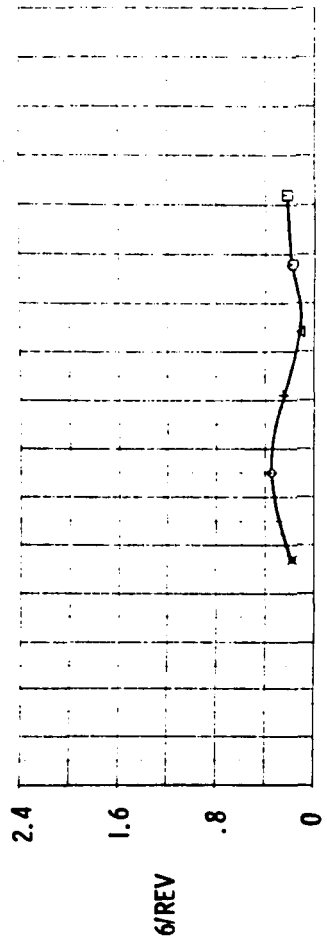
FLIGHT 35A FUSELAGE LATERAL ACCELERATION

TAILBOOM UPPER FIN



SAMPLE HARMONIC OUTPUT (CONCLUDED)

FLIGHT 35A HUB LONGITUDINAL ACCELERATION



TRUE AIRSPEED (KNOTS)

SECTION 4. FINITE ELEMENT ANALYSIS MODEL
OF THE AH-1G AIRFRAME

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AH-1G NASTRAN FUSELAGE MODEL MODIFICATIONS

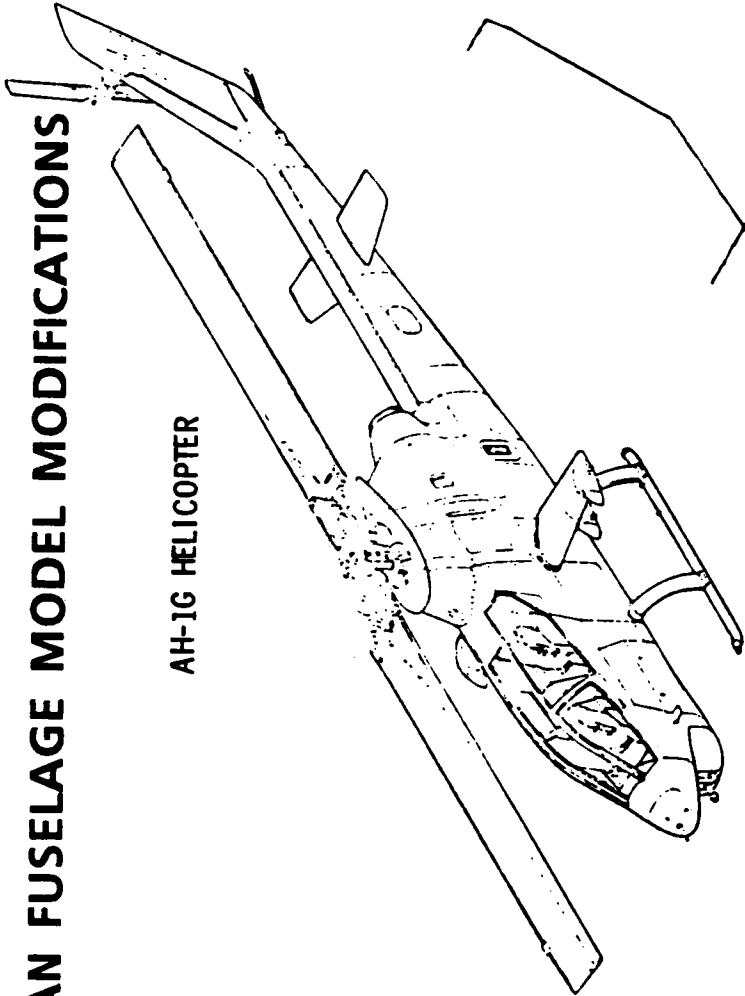
The NASTRAN finite element model of the AH-1G (OLS) fuselage with a stick, elastic-line tailboom representation is shown below. Details of model formulation and verification are presented in References 3 through 5. The original model (reference 3) for the production AH-1G helicopter did not contain a control system representation or OLS modifications. The NASTRAN airframe model provided to all participants was modified to reflect these changes and are compiled in this section for reference. The OLS instrumentation weight additions are listed below. The control system model required 14 additional grid points.

	<u>Weight (lb)</u>	<u>NASTRAN Grid Points</u>
Instrumented package in ammo bay	246.5	11700
Main rotor slip ring	15.0	200153
Tail rotor slip ring	3.5	520057
Main rotor stand pipe	5.0	200112
Main rotor mast nut	8.5	200162
Telemetry transmitter	2.5	26825
Hub accelerometer and azimuth blipper	5.5	200162
Yaw boom	12.0	3339
Yaw boom yaps head	4.5	3331
R-MUX box	56.0	200155
Wiring	41.0	21361
Main rotor blade instrumentation	29.0	200153
Useful loads for Flight 35A tailboom ballast	<u>100.0</u>	(to achieve desired location of cg)

OLS instrumentation weights (for all configurations) Total 529.0

AH-1G NASTRAN FUSELAGE MODEL MODIFICATIONS

AH-1G HELICOPTER

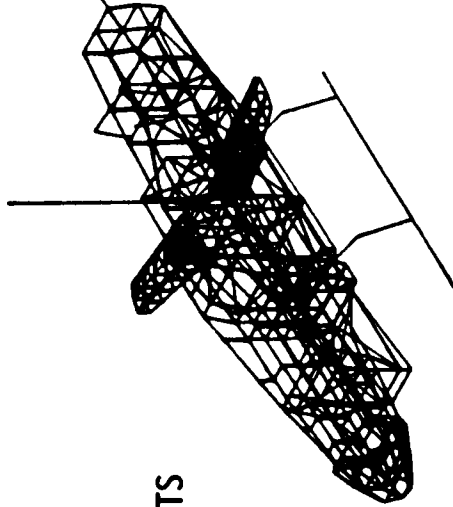


MODIFICATIONS

CONTROL SYSTEM MODELING
OLS INSTRUMENTATION WEIGHTS

DEGREES OF FREEDOM		ELEMENTS	
K _{gg}	3024	BAR	197
K _{nn}	2748	ROD	2012
K _{ff}	1766	SHEAR	340
K _{aa}	236	QDMEM	160
K _{ll}	230	TRMEM	243
		ELAS2	13

NASTRAN AIRFRAME MODEL



NASTRAN GRID POINTS FOR OLS CORRELATION

In order to facilitate the use of the NASTRAN fuselage vibration model with a minimal need to delve into model documentation, the next figure is presented which shows the grid points corresponding to the OLS accelerometer locations. The actual coordinates for these grid points are given here.

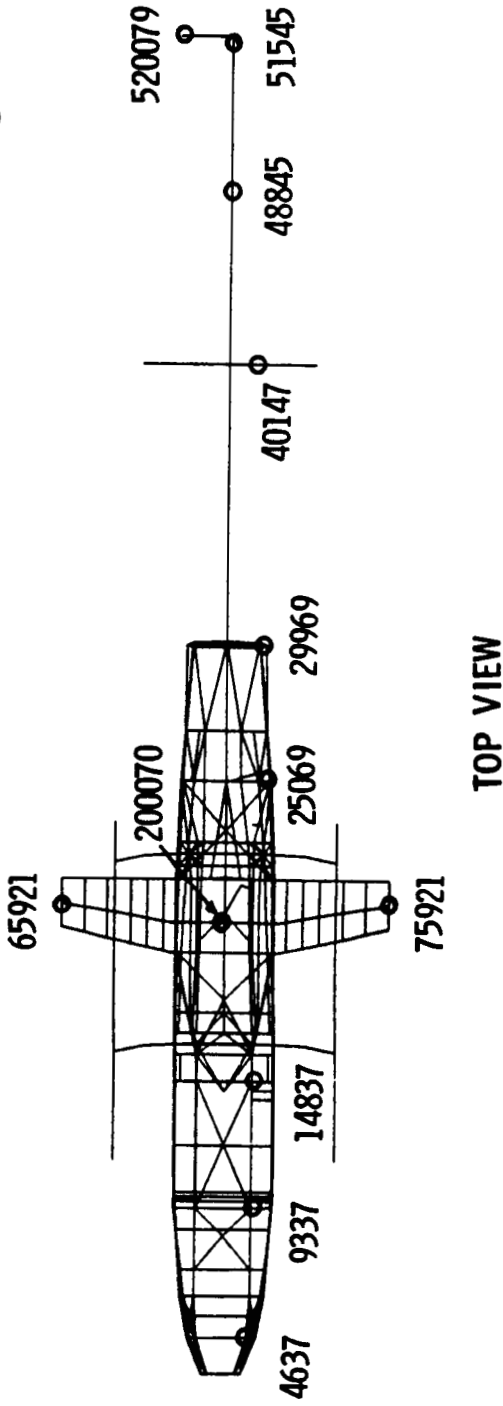
ACCELEROMETER COORDINATE LOCATIONS
OLS (AH-1G - Flight 35A)

Accelerometer	FS	BL	WL	Corresponding NASTRAN Grid Point ID
Nose (LV)	46.00	-9.07	46.00	4637
Gunner (LV)	93.00	-10.00	46.00	9337
Pilot (LV)	148.50	-10.00	46.00	14837
CG (V)	200.00	0.0	70.00	200070
Hub (FLV)	200.00	0.0	152.76	200153
Engine (LV)	250.00	-16.20	64.07	25069
T/B junc (LV)	298.70	-12.29	62.80	29969
Elevator (LV)	401.33	-9.68	55.91	40147
Tail (LV)	488.93	0.00	83.82	48845
Fin (LV)	515.43	0.00	109.46	51545
Gearbox (V)	520.67	7.90	118.27	520079
Left wing (V)	204.04	-59.00	63.95	75921
Right wing (V)	204.04	59.00	63.95	65921

23 fuselage accelerometers used in flight tests

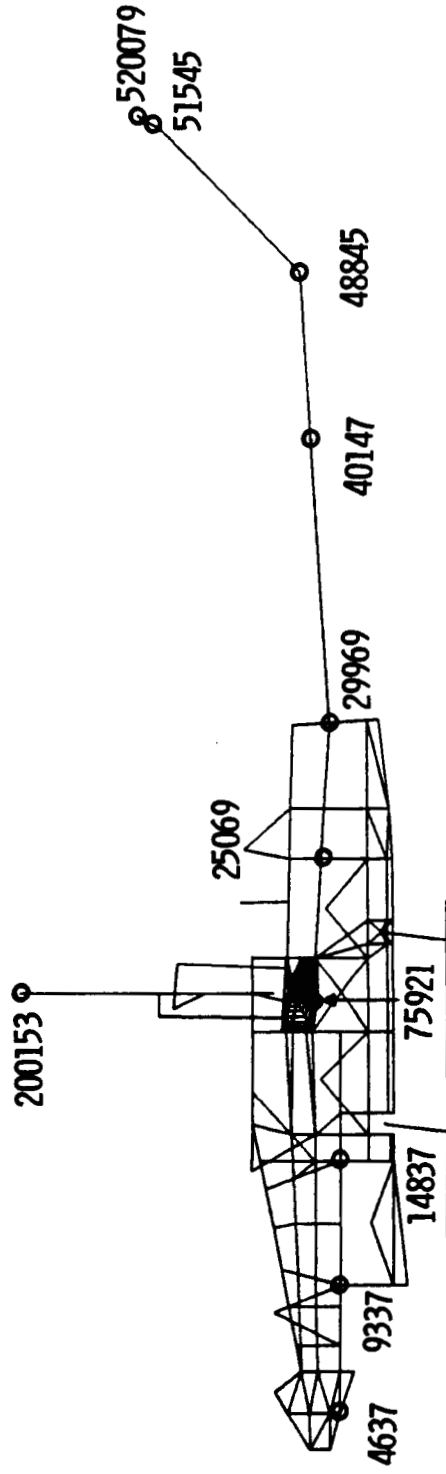
- L - lateral
- V - vertical
- F - fore and aft

NASTRAN GRID POINTS FOR OLS CORRELATION



TOP VIEW

O- GRID POINT LOCATIONS

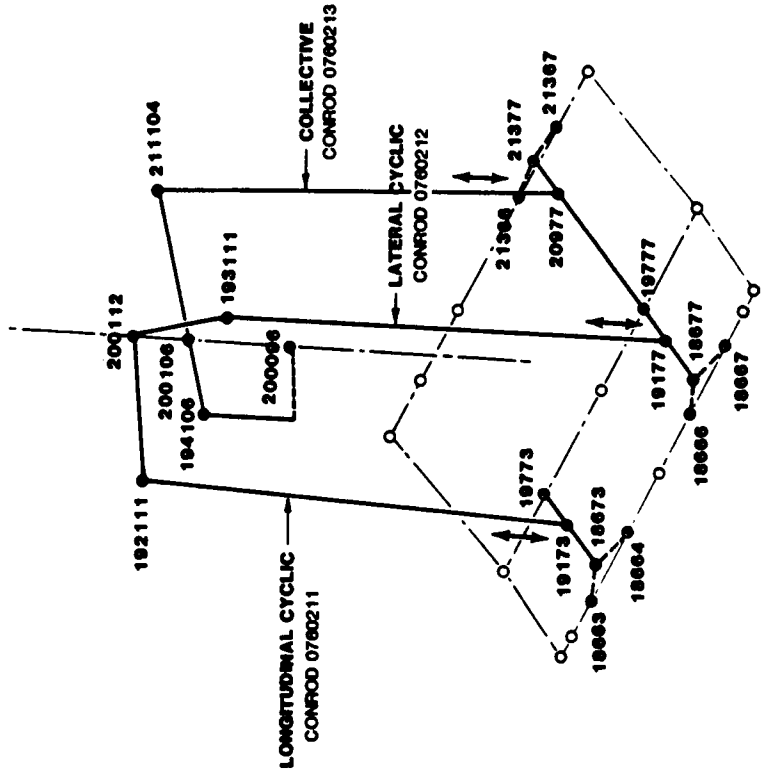
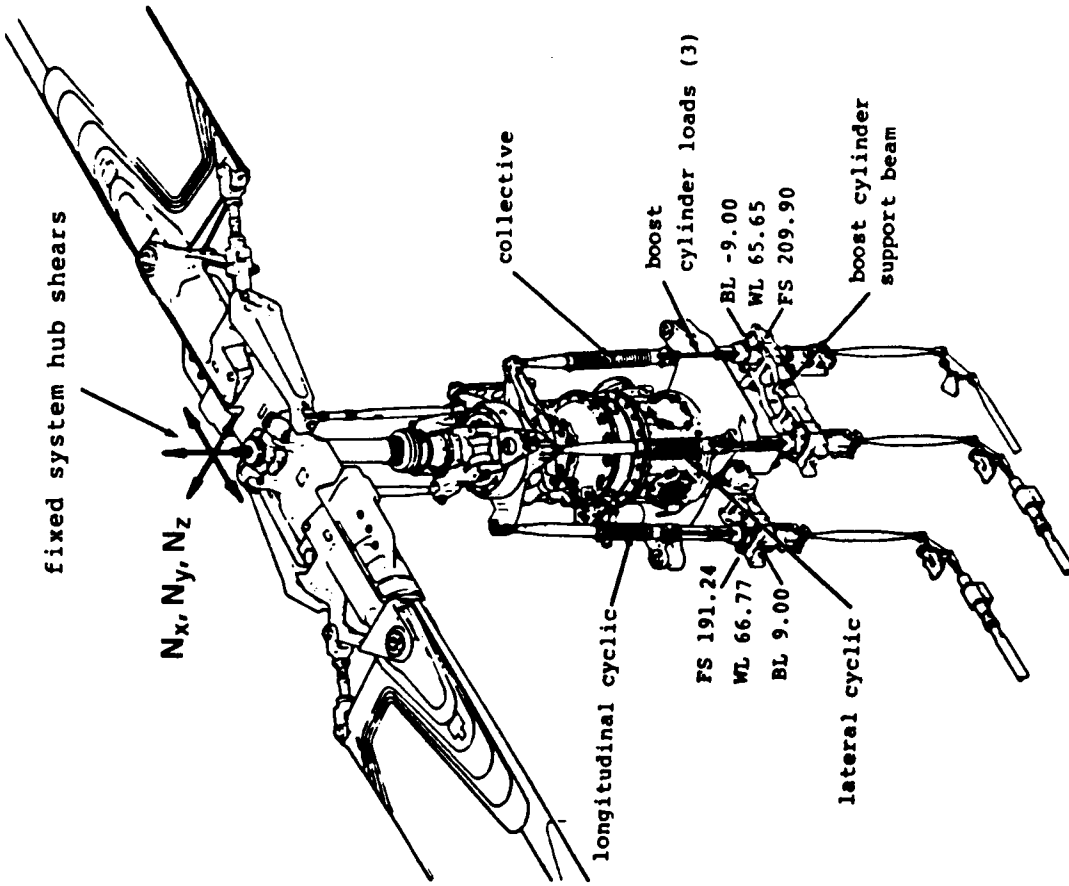


SIDE VIEW

APPLIED MAIN ROTOR AND CONTROL SYSTEM LOADS

The applied loads from the main rotor to the fuselage are represented by hub shears (N_x, N_y, N_z) and vertically applied control loads through the boost cylinder fuselage reaction locations shown in the figure. The hub shears are derived from the coupled rotor/fuselage analysis. The applied control loads are obtained from the 2, 4, and 6 per rev control load harmonic OLS test data listed in Appendix A.

APPLIED MAIN ROTOR AND CONTROL SYSTEM LOADS



MAIN ROTOR AND CONTROL SYSTEM

NASTRAN MODEL

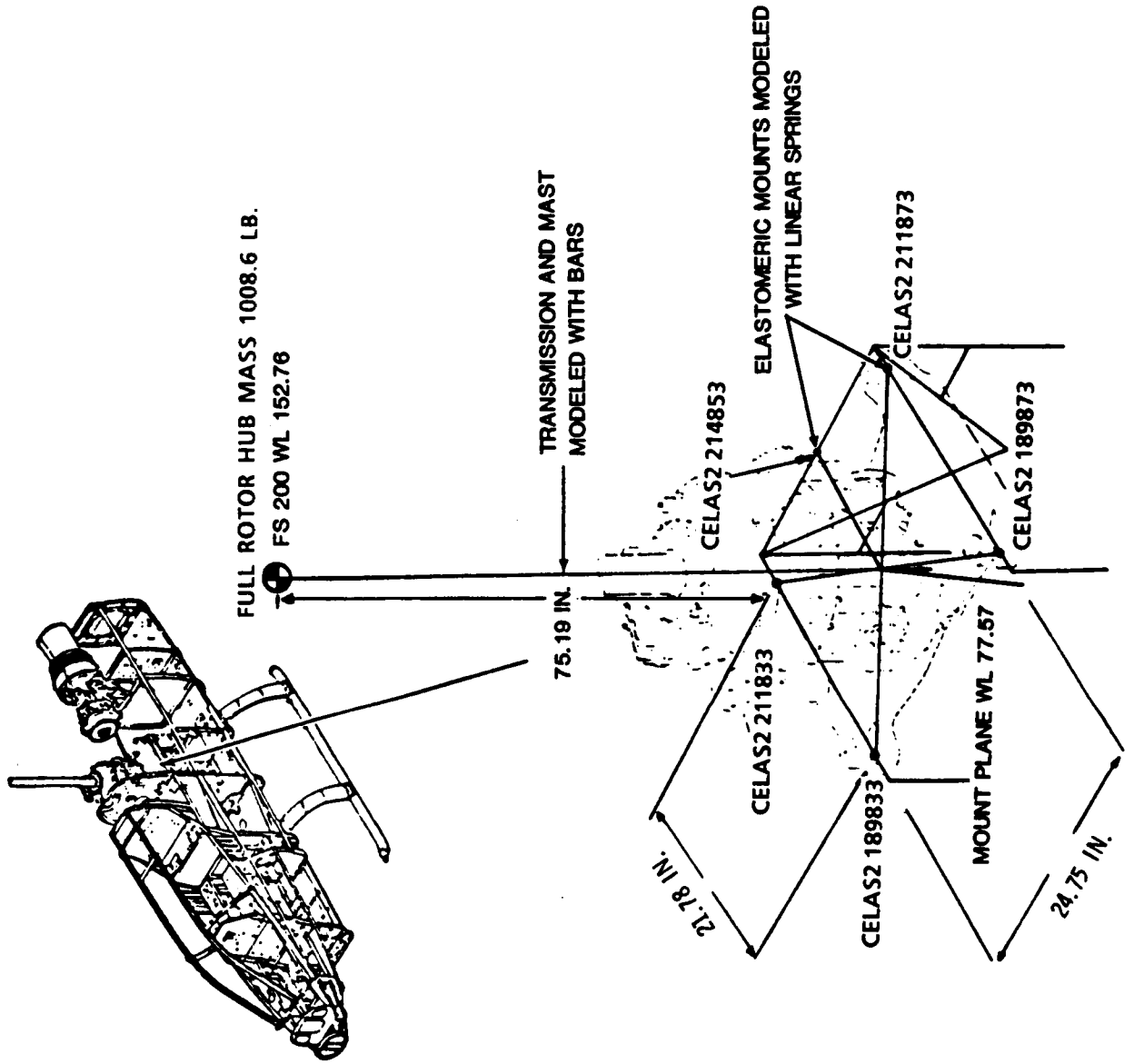
MAIN ROTOR PYLON MODELING

The AH-1G main rotor transmission and mast (pylon) are idealized as simple bar elements in the NASTRAN fuselage model. These elements are mounted on the fuselage model with five vertical springs located at the base of the transmission. Transmission mount deflections are available in the OLS reduced data contained in Appendix A. These displacements can be used for correlation with the model spring elements indicated in the figure. The OLS pylon displacements can also be used to determine pylon rocking motions, both longitudinal and lateral, by using the relative difference between F/A and lateral mount displacements.

Note that the full rotor mass is included in the AH-1G NASTRAN fuselage model given to all participants. If other than full rotor mass is required for the rotor/fuselage coupling analysis, some of this mass would need to be removed and the NASTRAN model reanalyzed prior to coupling with the rotor analysis. The main rotor weight is lumped at grid point 200153 located at the rotor cg (FS 200, WL 153, BL 0). The breakdown of total rotor weight contributions are shown below. Rotor flapping interias (mr^2 terms) are not included with the rotor weights because the Bell teetering hinge rotor system does not transfer flapping moments to the airframe.

Blade Inertia Weights	= 110.0 lb _f
Blade Assembly Weight	= 348.0 lb _f
Hub Assembly Weight	= 489.5 lb _f
OLS Instrumentation Weight	= <u>61.1</u> lb _f
	1008.6 lb _f

MAIN ROTOR PYLON MODELING



IMPORTANT NORMAL MODES

For the rotor-fuselage analysis, a modal analysis of the fuselage is often used which requires the analyst to provide a rotor simulation program with calculated fuselage natural frequency and mode shape information. The normal modes that are listed represent the important modes needed to describe AH-1G fuselage response. These elastic modes must be augmented by the six rigid body modes. The entire low frequency range of interest (0 to 30 Hz) is represented. Note that these modes consider the full rotor mass of 1008.6 lb lumped at the rotor hub. An input data tape listing of input data, and samples of normal mode and forced response analyses were provided to NASA and all the helicopter fuselage manufacturers participating in the rotor-fuselage coupling analysis program.

IMPORTANT NORMAL MODES

	Mode	Natural Frequency, Hz
(1) *	Main rotor pylon fore-and-aft rocking (pylon pitch)	3768 kg-clean wing-aft cg
(2) *	Main rotor pylon lateral rocking (pylon roll)	2.987
(3) *	First fuselage lateral bending	3.866
(4) *	First fuselage vertical bending	7.121
(5) *	Skid	7.969
(6) *	First fuselage torsion	14.572
(7) *	Second fuselage vertical bending	16.032
(8) *	Second fuselage lateral bending	17.221
	Fuselage roll/engine lateral	17.783
	Skid	19.273
	Fuselage torsion/wing yaw	19.834
	Wing asymmetric torsion	21.879
	Skid	-
	Third fuselage vertical bending	23.431
(9) *	Main rotor mast lateral bending	25.153
	Third fuselage lateral bending	25.591
(10) *	Main rotor mast fore-and-aft bending	26.529
	Wing symmetric torsion	27.099
	Skid	-
	Fourth fuselage vertical bending	29.104
	Fuselage torsion	32.264
		34.013

SECTION 5. AH-1G OLS ROTOR SYSTEM

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AH-1G OLS ROTOR SYSTEM GEOMETRY

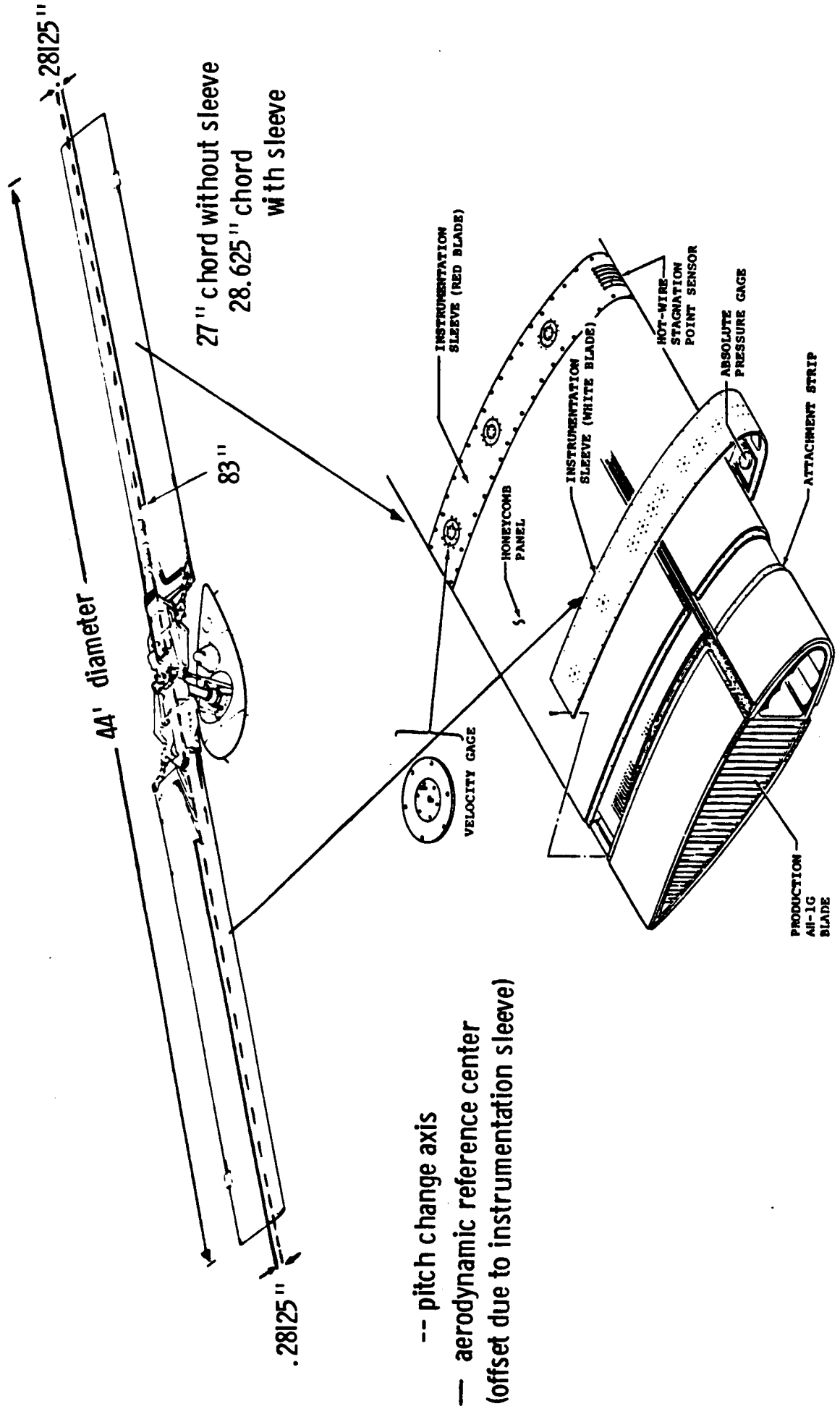
The production version of the AH-1G helicopter uses a BHT-developed 540 main rotor. This rotor was modified using a "gloved blade" approach during instrumentation to maintain structural integrity and a smooth aerodynamic surface for the OLS main rotor (see figure). The rotor parameters are summarized in Appendix B.

This section of the report marks the beginning of information provided to each of the participating manufacturers to enable them to develop a representative model of the AH-1G rotor used during the OLS flight-test program. Tabular listings of rotor modeling parameters are contained in Appendix B and include the following:

1. EI_b , EI_c , GJ distributions
2. Weight, cg, and inertia distributions
3. C_L , C_D , C_M airfoil data
4. Rotor geometry and miscellaneous parameters

This figure depicts the location of the blade feathering, or pitch-change, axis and aerodynamic reference center for the modified OLS main rotor blade. Note the shift in the aerodynamic reference center beyond blade station 83 (in) due to the fiberglass sleeve used to attach instrumentation. The application of the sleeve extended the leading edge of the airfoil 0.125 inch and the trailing edge 1.5 inches. Therefore, the aerodynamic reference center (1/4 chord) was shifted aft (-0.28125 inch).

AH-1G OLS ROTOR SYSTEM GEOMETRY



AH-LG OLS ROTOR HUB PARAMETERS

A list of pertinent structural and aerodynamic information for the AH-LG OLS rotor is given below to facilitate rotor model development. The teetering rotor has an inherent undersling distance and built-in precone angle to eliminate or reduce the first harmonic variation of Coriolis induced forces. The control system spring rate of the AH-LG is also shown to facilitate model development. Note should be taken of the (R-MUX) rotating multiplexor instrumentation housing aerodynamic effects which affect the overall drag component of the hub. The R-MUX unit can be seen on the picture of the instrumented rotor configuration shown in Section 2. The pitch horn offset was taken to be 14.1 inches, as it was assumed that the shears and moments in the pitch link are reacted at the inner feather bearing.

Rotor pitch-lag coupling = 0°

Rotor pitch-flap coupling (δ_3) = 0°

Rotor lead-lag damper (stiff inplane) = none

C_D hub = 0.13

Hub length = 3.4 ft = 40.8 inches

Main rotor nacelle flat plate drag area = 2.0 ft²
consisting of R-MUX and control components between transmission cowling and hub

located at -0.759 ft (below) mast pivot point
location of M/R nacelle aerodynamic reference center

Pitch-cone coupling ratio = -0.682 (for inelastic modeling of rotor)

Control phasing or mast tilt = none

Pre-lag = none

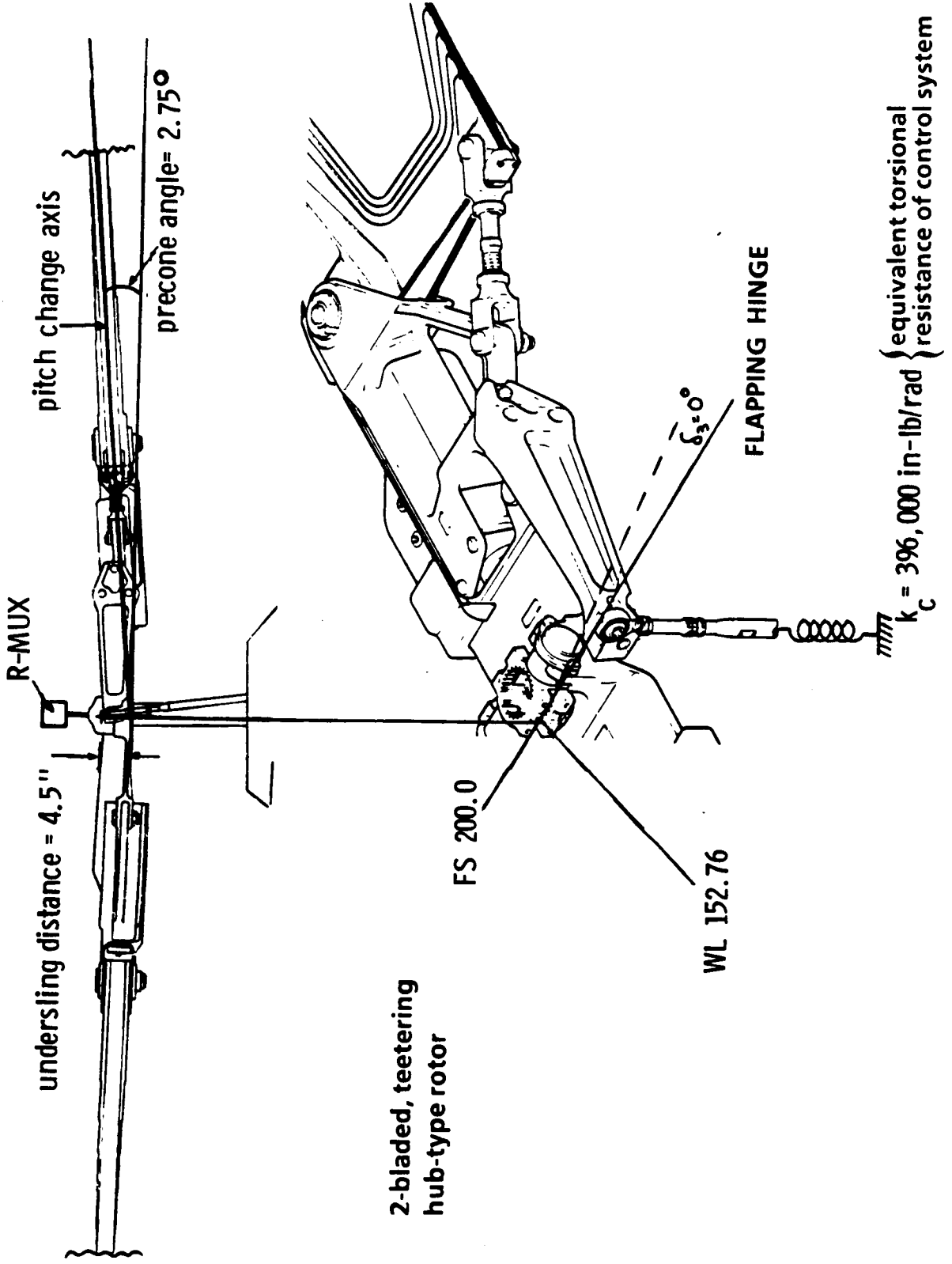
Precone = 2.75°

Underslinging = 4.5 inches (PCA intersection below mast pivot axis)

Control system torsional spring rate, $K_C = 396,000$ (in-lb/rad)

PHOFF = 14.1 inches

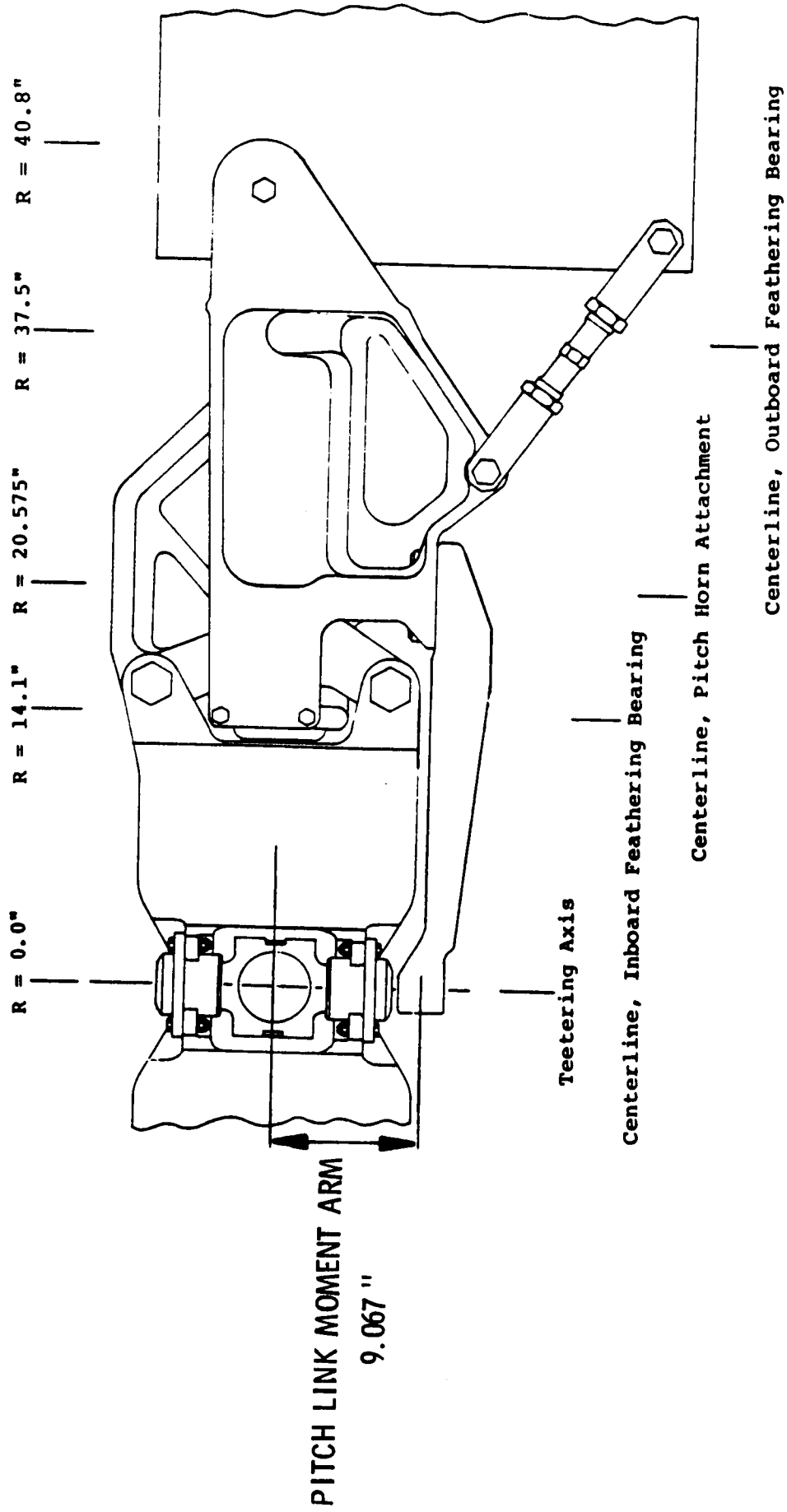
AH-1G OLS ROTOR HUB PARAMETERS



AH-1G OLS MAIN ROTOR HUB GEOMETRY

The geometry of the two-bladed, teetering rotor hub of the AH-1G helicopter is shown in the figure below. This hub contains teflon bearings with a tension/torsion strap between the inboard and outboard feathering bearings. This arrangement is considered to be infinitely stiff in the radial direction. The tension/torsion strap has a torsional stiffness of $K_{\theta} = 170 \frac{\text{in-lb}}{\text{deg}}$ at 100% rpm. This torsional spring rate is much smaller than the control system spring rate for this rotor $K_c = 6911.5 \frac{\text{in-lb}}{\text{deg}}$ but can be significant when calculating steady or 1 p pitch link loads. Note that the tension/torsion strap has zero twist (null point) at 50.4° nose up attitude.

AH-1G OLS MAIN ROTOR HUB GEOMETRY



AH-1G OLS ROTOR BLADE STIFFNESS DISTRIBUTION

Tabular listings of rotor blade and hub stiffness and weight distributions appear in Appendix B. The stiffness distributions (EI_b , EI_c , GJ) are plotted versus blade station on the following three figures. Overall blade mass properties are listed below:

MASS/BLADE = 504.298 lb_F (includes OLS instrumentation and hub weights)

First blade moment of inertia = 110.787 slug-ft/blade

I_β = flapping inertia = 1499.704 slug-ft²/blade

γ = Lock number = 5.078 (SLSTD)

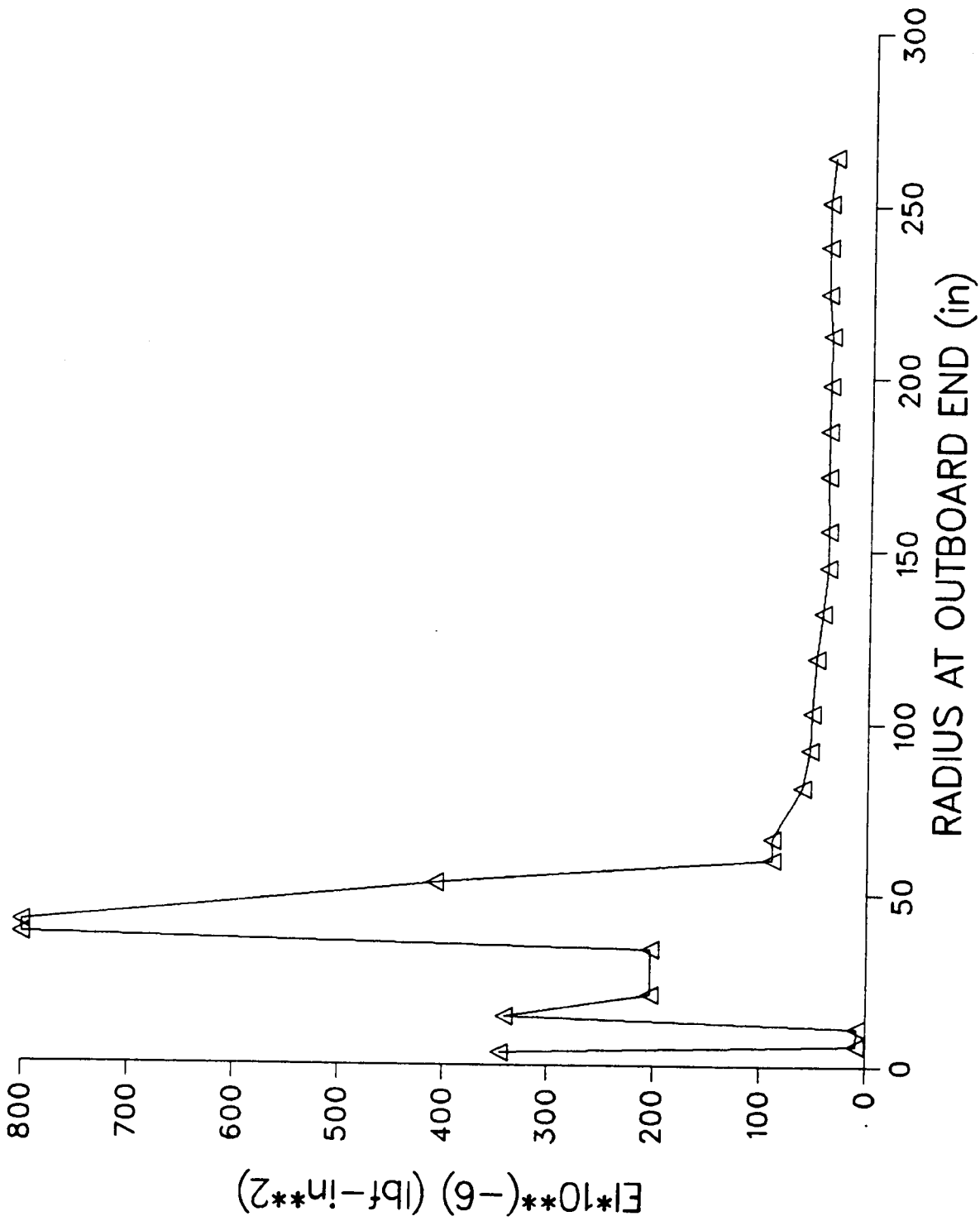
Effective blade cg = -0.156 inch (forward from pitch-change axis)

Effective blade and hub cg = -0.155 inch (forward from pitch-change axis)

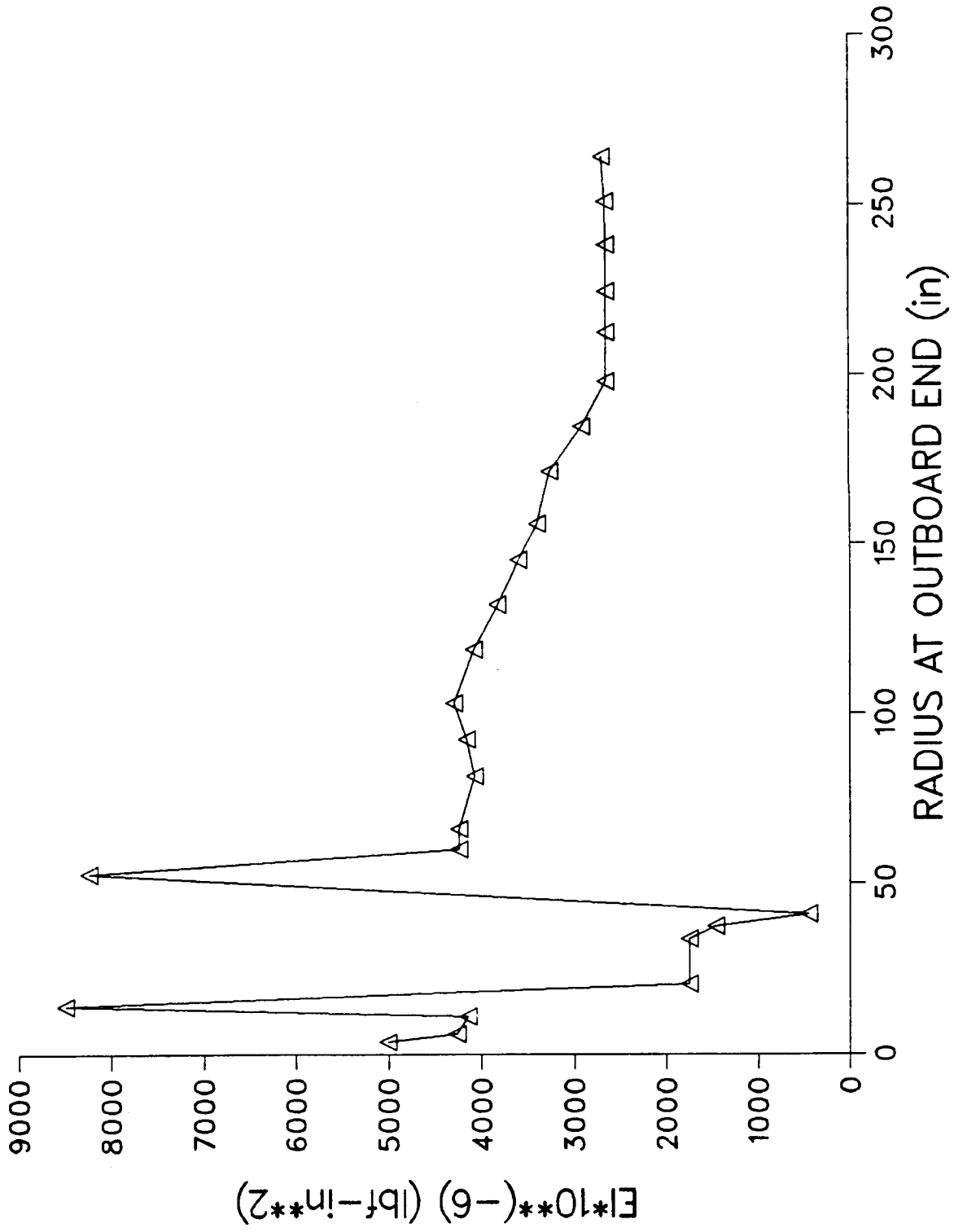
Clamped torsional frequency = 15.341 Hz

J_{BLADE} = torsional inertia about PCA = 42.62 in-lb/sec²

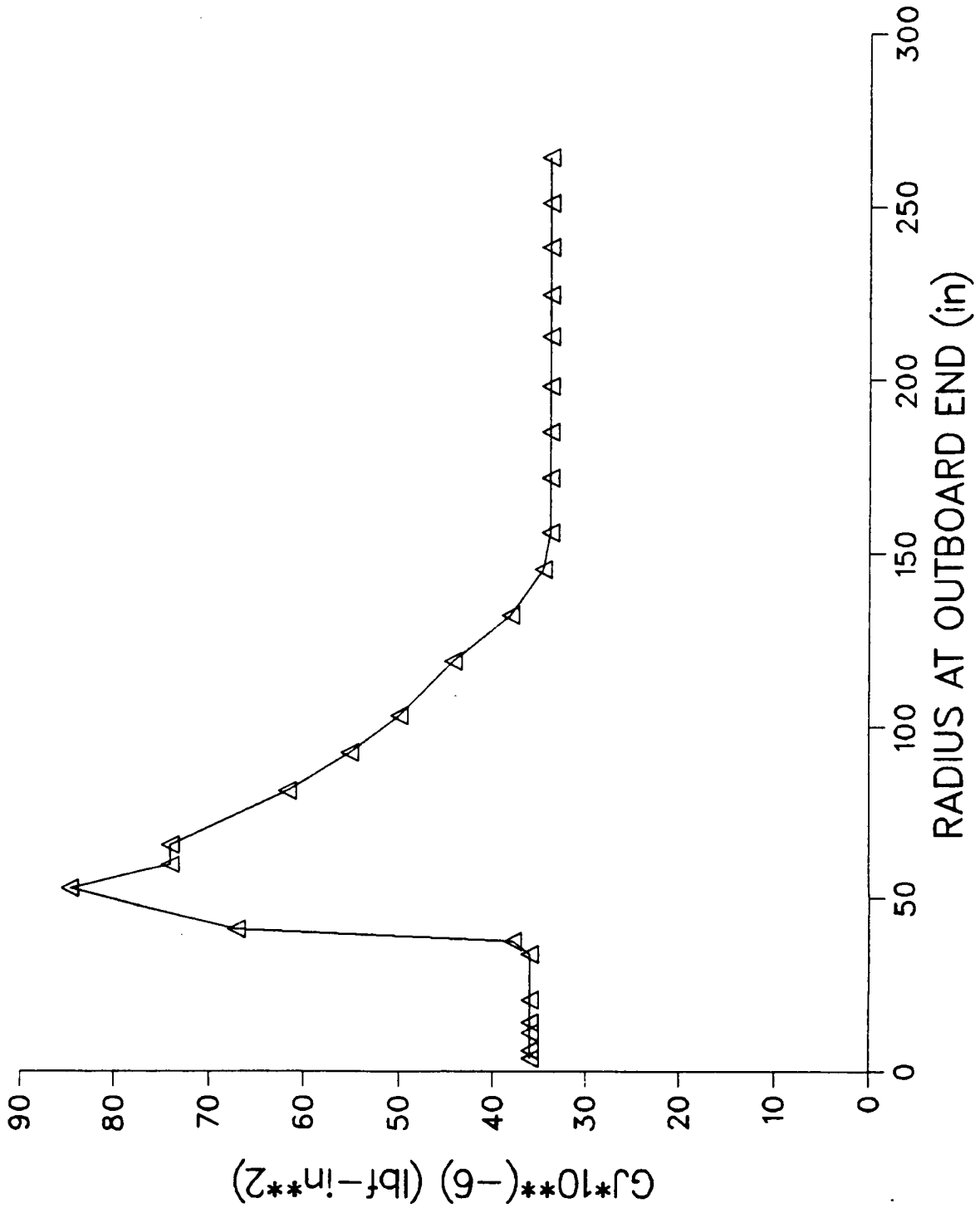
BEAMWISE STIFFNESS DISTRIBUTION



CHORDWISE STIFFNESS DISTRIBUTION



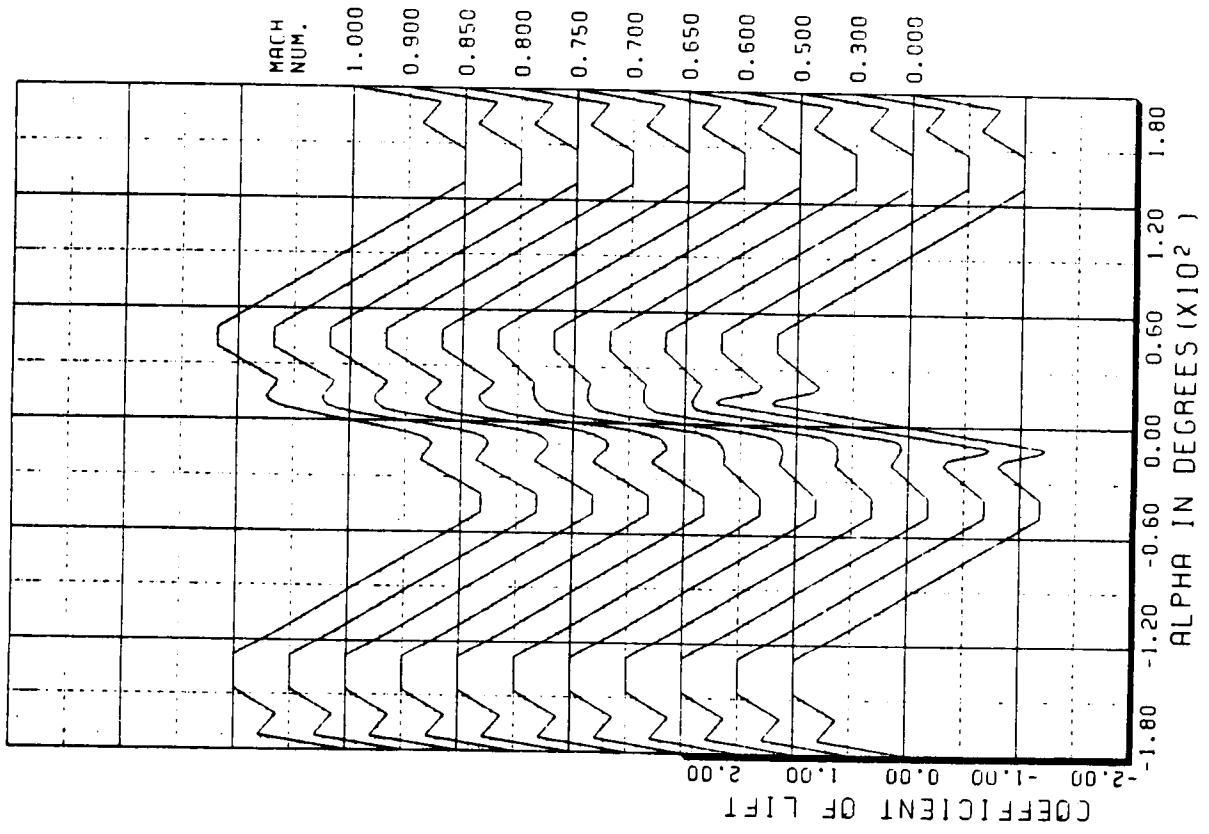
TORSIONAL STIFFNESS DISTRIBUTION



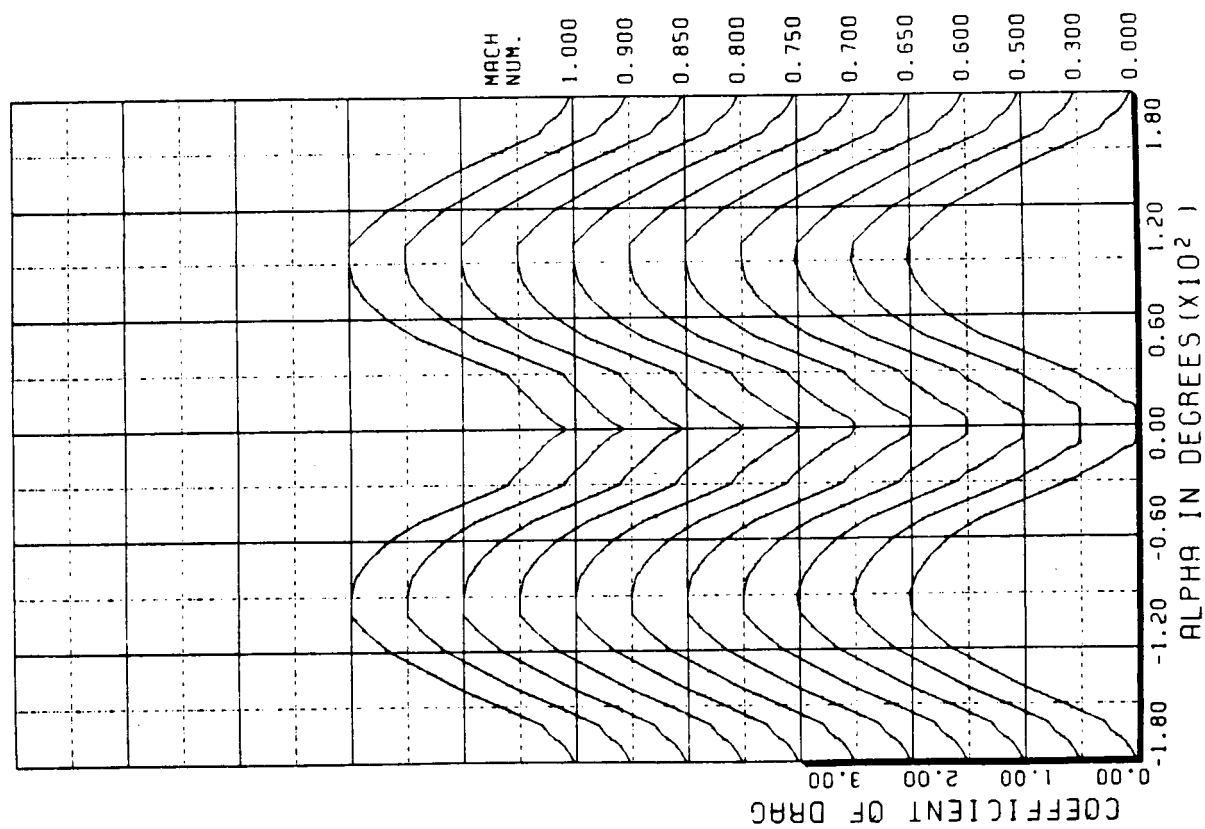
ROTOR AERODYNAMIC COEFFICIENT DATA

The rotor aerodynamic coefficient data is presented in tabular form in Appendix B. C_L , C_D , C_M versus angle of attack (α) and Mach number are plotted in the following three figures from C81 data storage file CLCD5474.

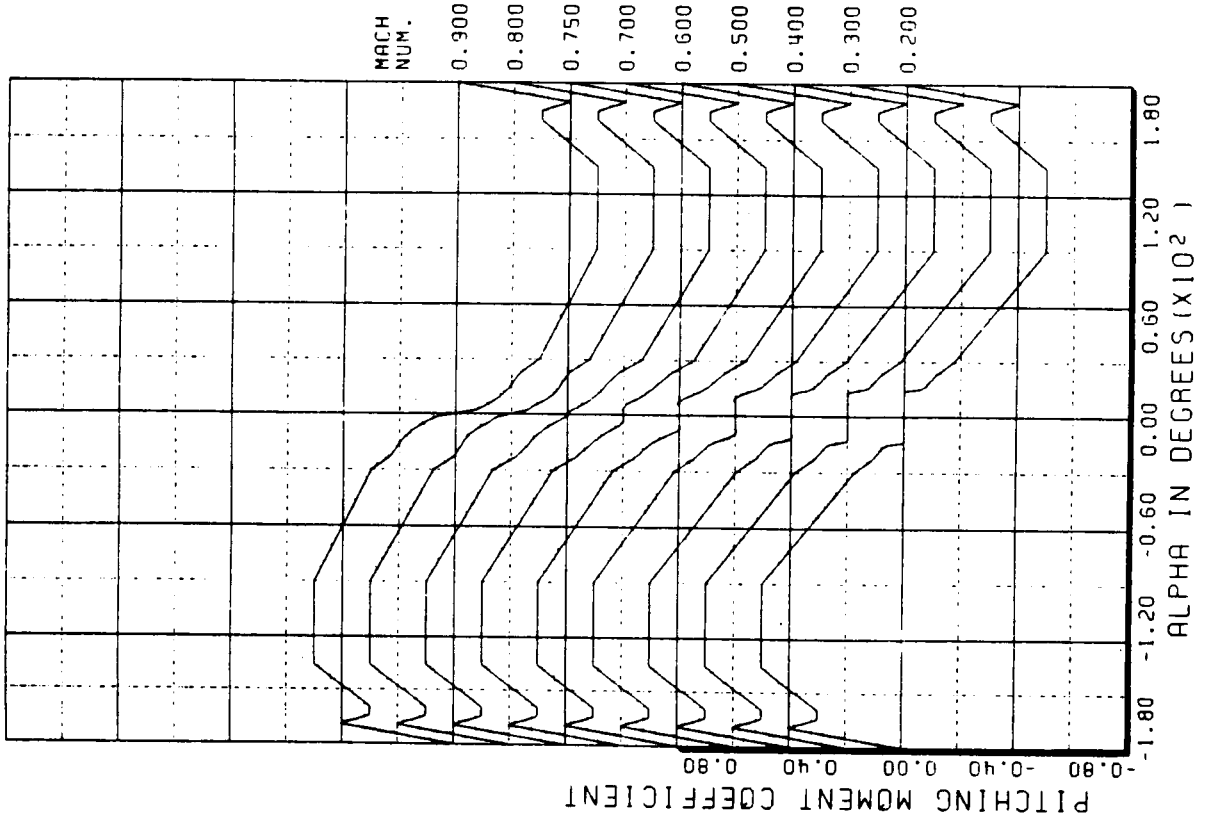
ROTOR AERODYNAMIC COEFFICIENT DATA



ROTOR AERODYNAMIC COEFFICIENT DATA (CONT'D)



ROTOR AERODYNAMIC COEFFICIENT DATA (CONCLUDED)



SECTION 6. REFERENCES

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REFERENCES

1. Shockey, G. A., Williamson, J. W., Cox, C. R., "AH-1G Helicopter Aerodynamics and Structural Loads Survey," USAAMRDL-TR-76-39, April 1976.
2. Van Gaasbeek, J. R., "Validation of the Rotorcraft Flight Simulation Program (C81) Using Operational Loads Survey Flight Test Data," USAAVRADCOM-TR-80-D-4, November 1979.
3. Cronkhite, J. D., Berry, V. L., Brunken, J. E., "A NASTRAN Vibration Model of the AH-1G Helicopter Airframe," U.S. Army Armament Command Report No. R-TR-74-045, June 1974.
4. Cronkhite, J. D., Berry, V. L., "Correlation of AH-1G Airframe Test Data with a NASTRAN Mathematical Model," NASA CR-145119, February 1976.
5. Cronkhite, J. D., Wilson, H. E., Berry, V. L., "Correlation of AH-1G Helicopter Flight Vibration Data and Tailboom Static Test Data with NASTRAN Results," NASA CR-145120, 1978.
6. Giansante, N., Berman, A., Flannelly, W. G., and Nagy, E. J., "Structural System Identification Technology Verification," USAAVRADCOM-TR-81-D-28, November 1981.
7. Jones, R., Flannelly, W. G., Nagy, E. J., Fabunmi, J. A., "Experimental Verification of Force Determination and Ground Flying of a Full-Scale Helicopter, USAAVRADCOM-TR-81-D-11, May 1981.

APPENDIX A - OLS HARMONIC DATA
FOR CORRELATION

APPENDIX A - TABLE OF CONTENTS

The reduced operational load survey (OLS) flight test data for the data items described on pages A-6 through A-77 for main rotor harmonics 1p-6p are shown in this appendix. The data is separated into functional groups for ease of retrieval.

<u>Group</u>	<u>Airspeed (Kts)</u>	<u>Page</u>
Hub Accelerations	142	A-6
	128	A-7
	114	A-8
	101	A-9
	85	A-10
	67	A-11
Fuselage Vertical Accelerations	142	A-12
	128	A-14
	114	A-16
	101	A-18
	85	A-20
	67	A-22
Fuselage Lateral Accelerations	142	A-24
	128	A-26
	114	A-28
	101	A-30
	85	A-32
	67	A-34
Main Rotor (Red Blade) - Chord Bending Moments	142	A-36
	128	A-37
	114	A-38
	101	A-39
	85	A-40
	67	A-41

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APPENDIX A - TABLE OF CONTENTS (Continued)

<u>Group</u>	<u>Airspeed (Kts)</u>	<u>Page</u>
Main Rotor (Red Blade) - Beam Bending Moments		
	142	A-42
	128	A-43
	114	A-44
	101	A-45
	85	A-46
	67	A-47
Main Rotor (Red Blade) - Torsion Moments		
	142	A-48
	128	A-49
	114	A-50
	101	A-51
	85	A-52
	67	A-53
Axial Forces		
	142	A-54
	128	A-56
	114	A-58
	101	A-60
	85	A-62
	67	A-64
Pylon Vertical Displacements		
	142	A-66
	128	A-67
	114	A-68
	101	A-69
	85	A-70
	67	A-71

APPENDIX A - TABLE OF CONTENTS (Concluded)

<u>Group</u>	<u>Airspeed (Kts)</u>	<u>Page</u>
Vehicle Performance Data	142	A-72
	128	A-73
	114	A-74
	101	A-75
	85	A-76
	67	A-77

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: HUB ACCELERATIONS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 610
ROT SPEED 323.3

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
MAST TOP F/A					
	MEAN	-0.022			
1	0.127	5.39	-0.102	-0.076	-126.525
2	2.031	10.78	-1.445	-1.428	-134.653
3	0.067	16.16	-0.067	-0.004	93.668
4	1.153	21.55	-0.122	-1.147	-173.903
5	0.072	26.94	0.064	-0.033	117.361
6	0.219	32.33	0.209	0.067	72.207
UNITS: 7.024 G'S					
MAST TOP LATERAL					
	MEAN	-0.005			
1	0.147	5.39	-0.073	-0.128	-150.334
2	2.174	10.78	-1.740	-1.304	-126.854
3	0.102	16.16	0.022	0.099	12.774
4	0.879	21.55	0.767	0.430	60.719
5	0.092	26.94	0.087	0.031	70.568
6	0.505	32.33	-0.233	0.448	-27.456
UNITS: 5.782 G'S					
MAST TOP VERTICAL					
	MEAN	0.848			
1	0.046	5.39	-0.011	-0.045	-166.353
2	0.031	10.78	0.024	-0.021	49.306
3	0.065	16.16	0.064	-0.014	102.258
4	0.085	21.55	0.084	0.010	82.917
5	0.028	26.94	-0.027	0.007	-75.092
6	0.043	32.33	-0.009	0.043	11.412
UNITS: 1.904 G'S					

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: HUB ACCELERATIONS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO 615
ROI SPEED 324.0

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM AMP HZ SIN COS PHASE ANGLE

MAST TOP F/A MEAN 0.006

1	2	3	4	5	6
0.146	5.40	-0.095	-0.111	-139.630	
1.555	10.80	-0.671	-1.403	-154.455	
0.051	16.20	0.047	0.020	66.734	
0.948	21.60	0.549	-0.773	144.631	
0.047	27.00	0.006	0.046	7.299	
0.177	32.40	-0.019	0.176	-6.102	

MAST TOP LATERAL MEAN 0.039

1	2	3	4	5	6
0.116	5.40	-0.011	-0.116	-174.708	
1.548	10.80	-1.468	-0.491	-108.488	
0.074	16.20	-0.027	0.069	-21.643	
0.431	21.60	0.243	0.356	34.344	
0.026	27.00	-0.024	0.011	-66.384	
0.359	32.40	-0.351	-0.077	-102.334	

MAST TOP VERTICAL MEAN 0.842

1	2	3	4	5	6
0.031	5.40	-0.000	-0.031	-179.380	
0.044	10.80	0.017	0.041	22.438	
0.050	16.20	0.040	0.030	52.704	
0.091	21.60	-0.083	-0.037	66.048	
0.027	27.00	-0.019	-0.019	-134.990	
0.019	32.40	0.016	0.010	58.374	

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: HUB ACCELERATIONS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 614
ROT SPEED 323.3

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KIS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
MAST TOP F/A					
	MEAN	0.027	ITEM CODE A886	UNITS:	G'S
			MAX OSC.	6.173	
1	0.143	5.39	-0.098	-0.104	-136.685
2	1.252	10.78	-0.773	-0.984	-141.842
3	0.021	16.16	0.018	-0.012	123.868
4	0.740	21.55	0.169	-0.721	166.825
5	0.059	26.94	0.013	0.057	13.193
6	0.095	32.33	-0.004	0.095	-2.305
MAST TOP LATERAL					
	MEAN	0.033	ITEM CODE A887	UNITS:	G'S
			MAX OSC.	5.022	
1	0.123	5.39	0.000	-0.123	179.968
2	1.273	10.78	1.076	-0.680	122.298
3	0.054	16.16	0.038	0.038	44.933
4	0.400	21.55	0.374	0.141	69.285
5	0.050	26.94	0.041	-0.029	125.647
6	0.235	32.33	-0.183	0.147	-51.243
MAST TOP VERTICAL					
	MEAN	0.857	ITEM CODE A888	UNITS:	G'S
			MAX OSC.	2.186	
1	0.018	5.39	-0.004	-0.018	-167.163
2	0.055	10.78	0.023	0.050	24.718
3	0.048	16.16	0.037	0.031	50.332
4	0.077	21.55	0.062	-0.047	127.192
5	0.035	26.94	-0.034	-0.011	-107.890
6	0.043	32.33	0.016	-0.040	158.451

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: HUB ACCELERATIONS
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP NO. 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT
REC. NO. 613 ALT. 5000. FT. TEST CONDITION: FORWARD FLIGHT
ROT. SPEED 322.6 A/S 101.0 KTS--IAS

HARM AMP HZ SIN COS PHASE ANGLE
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MAST TOP F/A ITEM CODE A886 UNITS: G'S
MEAN MAX OSC. 5.919

	MAST TOP F/A MEAN	HZ	SIN	COS	PHASE ANGLE
1	0.141	5.38	-0.102	-0.097	-133.593
2	1.016	10.75	-0.761	-0.674	-131.545
3	0.039	16.13	0.024	0.030	39.335
4	0.508	21.51	0.364	-0.354	134.220
5	0.020	26.88	-0.006	0.019	-17.631
6	0.246	32.26	0.221	0.108	64.034

MAST TOP LATERAL ITEM CODE A887 UNITS: G'S
MEAN MAX OSC. 4.880

	MAST TOP LATERAL MEAN	HZ	SIN	COS	PHASE ANGLE
1	0.138	5.38	0.018	-0.136	172.392
2	1.047	10.75	0.833	-0.634	127.256
3	0.062	16.13	0.031	0.054	29.665
4	0.497	21.51	0.420	0.264	57.813
5	0.057	26.88	0.013	-0.055	167.038
6	0.280	32.26	-0.023	0.279	-4.780

MAST TOP VERTICAL ITEM CODE A888 UNITS: G'S
MEAN MAX OSC. 1.880

	MAST TOP VERTICAL MEAN	HZ	SIN	COS	PHASE ANGLE
1	0.029	5.38	-0.016	-0.024	-146.360
2	0.056	10.75	0.026	0.049	28.209
3	0.077	16.13	0.025	0.010	67.750
4	0.077	21.51	0.059	-0.049	129.824
5	0.030	26.88	-0.014	-0.026	-152.411
6	0.062	32.26	0.032	-0.053	149.159

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: HUB ACCELERATIONS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 612
ROT SPEED 323.3

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
MAST TOP F/A					
	MEAN	0.059	ITEM CODE A886	UNITS: 5.092	G'S
1	0.138	5.39	-0.121	0.066	-118.781
2	0.959	10.78	-0.814	-0.508	-121.992
3	0.034	16.16	0.025	-0.023	133.138
4	0.272	21.55	0.223	-0.156	124.946
5	0.010	26.94	-0.009	0.004	-67.750
6	0.344	32.33	0.311	0.147	64.672
MAST TOP LATERAL					
	MEAN	0.002	ITEM CODE A887	UNITS: 4.007	G'S
1	0.090	5.39	0.010	-0.089	173.773
2	0.860	10.78	0.597	-0.619	136.003
3	0.073	16.16	0.042	0.059	35.518
4	0.388	21.55	0.325	0.211	56.987
5	0.037	26.94	-0.031	-0.019	-121.194
6	0.280	32.33	0.164	0.226	35.903
MAST TOP VERTICAL					
	MEAN	0.845	ITEM CODE A888	UNITS: 1.529	G'S
1	0.038	5.39	-0.015	-0.035	-157.094
2	0.052	10.78	0.045	0.026	60.328
3	0.041	16.16	0.041	0.003	85.161
4	0.006	21.55	0.000	-0.006	178.430
5	0.032	26.94	-0.011	-0.030	-159.586
6	0.038	32.33	-0.030	-0.024	-128.428

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: HUB ACCELERATIONS
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT
REC. NO. 611 ALT. 5000. FT. TEST CONDITION: FORWARD FLIGHT
ROT SPEED 322.6 A/S 67.0 KTS--TAS

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
MAST TOP F/A					
	MEAN	0.053	ITEM CODE A886	UNITS: 4.920	G'S
1	0.130	5.38	-0.110	-0.069	-121.913
2	0.837	10.75	-0.647	-0.532	-129.430
3	0.029	16.13	-0.026	0.013	-62.803
4	0.324	21.51	-0.036	-0.322	-173.595
5	0.048	26.88	0.034	0.033	45.619
6	0.175	32.26	0.063	0.163	21.108
MAST TOP LATERAL					
	MEAN	0.015	ITEM CODE A887	UNITS: 3.529	G'S
1	0.097	5.38	0.025	-0.094	164.856
2	0.764	10.75	-0.545	-0.535	134.442
3	0.012	16.13	-0.009	-0.008	-131.631
4	0.243	21.51	0.236	0.057	76.472
5	0.079	26.88	0.017	-0.077	167.745
6	0.146	32.26	-0.019	0.145	-7.651
MAST TOP VERTICAL					
	MEAN	0.859	ITEM CODE A888	UNITS: 1.296	G'S
1	0.040	5.38	-0.017	-0.037	-154.901
2	0.072	10.75	0.051	0.051	45.349
3	0.034	16.13	0.032	0.012	69.595
4	0.044	21.51	-0.041	-0.014	-108.541
5	0.012	26.88	-0.005	0.011	23.583
6	0.058	32.26	-0.057	0.011	-79.455

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SERIAL NO. 20391
REC. NO. 929
ROT SPEED 323.2

FLI. 35-A-75
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.977 UNITS: G'S					
	MEAN		ITEM CODE A315	MAX OSC.	
1	0.061	5.39	0.049	-0.036	126.036
2	0.225	10.77	-0.176	-0.147	-128.783
3	0.014	16.16	-0.011	-0.010	-173.064
4	0.073	21.55	-0.009	-0.073	-173.770
5	0.034	26.93	0.032	-0.009	106.072
6	0.035	32.32	0.035	-0.007	101.711
GUNNER STATION 100 0.962 UNITS: G'S					
	MEAN		ITEM CODE A020	MAX OSC.	
1	0.050	5.39	0.044	-0.023	117.463
2	0.223	10.77	-0.214	-0.064	-106.790
3	0.008	16.16	-0.001	-0.008	-169.996
4	0.066	21.55	-0.068	-0.003	-82.656
5	0.008	26.93	0.001	-0.001	84.198
6	0.021	32.32	-0.016	-0.014	-131.631
PILOT STATION 146 0.977 UNITS: G'S					
	MEAN		ITEM CODE A019	MAX OSC.	
1	0.040	5.39	0.036	-0.017	115.097
2	0.206	10.77	-0.206	-0.003	-90.841
3	0.014	16.16	-0.014	-0.012	-152.410
4	0.054	21.55	-0.054	-0.005	-94.885
5	0.007	26.93	0.002	-0.006	-20.895
6	0.039	32.32	-0.023	-0.031	-143.622
ENGINE DECK STA 249.54 UNITS: G'S					
	MEAN		ITEM CODE A316	MAX OSC.	
1	0.030	5.39	0.026	-0.013	116.674
2	0.332	10.77	-0.300	-0.142	-124.955
3	0.009	16.16	-0.004	-0.098	-124.001
4	0.130	21.55	-0.036	-0.123	-123.782
5	0.024	26.93	0.016	-0.018	40.605
6	0.024	32.32	0.024	0.001	88.104
TAIL BOOM STA 297 0.928 UNITS: G'S					
	MEAN		ITEM CODE A317	MAX OSC.	
1	0.024	5.39	0.021	-0.011	117.967
2	0.328	10.77	-0.292	-0.142	-64.340
3	0.026	16.16	-0.022	-0.003	-97.218
4	0.102	21.55	-0.024	-0.099	-166.134
5	0.013	26.93	0.001	-0.013	5.932
6	0.035	32.32	0.002	-0.034	176.713
TAIL BOOM STA 400 0.971 UNITS: G'S					
	MEAN		ITEM CODE A318	MAX OSC.	
1	0.032	5.39	0.028	-0.017	121.323
2	0.306	10.77	-0.185	-0.246	-36.823
3	0.077	16.16	-0.070	0.038	-61.611
4	0.177	21.55	-0.158	0.079	63.558
5	0.092	26.93	-0.089	0.021	-76.898
6	0.117	32.32	-0.097	-0.066	-124.170

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A-75 G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ STA ITEM CODE A319 UNITS: G'S
COS SIN COS PHASE ANGLE

TAIL BOOM STA 485 0.938

HARM	AMP	HZ	STA	ITEM CODE A319	UNITS: G'S	COS	SIN	COS	PHASE ANGLE
1	0.052	5.39	0.043	MAX OSC.	2.431	-0.030	0.043	-0.030	124.519
2	0.159	10.77	0.094			-0.128	0.094	-0.128	143.676
3	0.062	16.16	-0.061			0.009	-0.061	0.009	-82.034
4	0.287	21.55	0.229			0.172	0.229	0.172	53.041
5	0.130	26.93	-0.175			-0.037	-0.175	-0.037	-106.451
6	0.028	32.32	-0.010			-0.026	-0.010	-0.026	-156.994

90 DEG GEAR BOX 518 0.952

HARM	AMP	HZ	STA	ITEM CODE A321	UNITS: G'S	COS	SIN	COS	PHASE ANGLE
1	0.056	5.39	0.047	MAX OSC.	4.201	-0.030	0.047	-0.030	122.426
2	0.504	10.77	0.325			-0.385	0.325	-0.385	139.767
3	0.035	16.16	0.033			-0.012	0.033	-0.012	110.670
4	0.063	21.55	-0.062			0.010	-0.062	0.010	-80.765
5	0.043	26.93	0.042			-0.008	0.042	-0.008	-100.817
6	0.091	32.32	-0.014			0.090	-0.014	0.090	9.039

T/B FIN LOAD STA 521 0.507

HARM	AMP	HZ	STA	ITEM CODE A320	UNITS: G'S	COS	SIN	COS	PHASE ANGLE
1	0.061	5.39	0.053	MAX OSC.	16.048	-0.030	0.053	-0.030	119.607
2	0.471	10.77	0.316			-0.349	0.316	-0.349	137.899
3	0.009	16.16	-0.008			0.007	-0.008	0.007	-35.692
4	0.086	21.55	0.079			0.036	0.079	0.036	65.549
5	0.082	26.93	-0.033			-0.075	-0.033	-0.075	-23.563
6	0.131	32.32	0.008			0.131	0.008	0.131	3.333

LFT WING-TIP STA 195 0.934

HARM	AMP	HZ	STA	ITEM CODE A600	UNITS: G'S	COS	SIN	COS	PHASE ANGLE
1	0.051	5.39	0.051	MAX OSC.	1.865	-0.003	0.051	-0.003	93.810
2	0.447	10.77	-0.445			-0.042	-0.445	-0.042	-84.559
3	0.034	16.16	0.021			-0.027	0.021	-0.027	142.139
4	0.172	21.55	-0.172			0.008	-0.172	0.008	-92.552
5	0.031	26.93	0.001			-0.031	0.001	-0.031	2.107
6	0.138	32.32	-0.030			-0.134	-0.030	-0.134	-167.563

RT WING-TIP STA 195 0.892

HARM	AMP	HZ	STA	ITEM CODE A601	UNITS: G'S	COS	SIN	COS	PHASE ANGLE
1	0.051	5.39	-0.007	MAX OSC.	1.541	-0.050	-0.007	-0.050	-172.409
2	0.151	10.77	0.111			0.102	0.111	0.102	47.440
3	0.029	16.16	-0.025			-0.016	-0.025	-0.016	-57.045
4	0.212	21.55	0.167			-0.130	0.167	-0.130	127.891
5	0.022	26.93	0.001			-0.022	0.001	-0.022	176.604
6	0.115	32.32	0.074			0.088	0.074	0.088	39.889

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 615
ROT SPEED 323.9

FLY 35-A-75
DATE 8-20-75
ALT. 5000. FT.

C.W. 8320 LB.
200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KIS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.998					
1	0.057	5.40	0.036	-0.044	140.786
2	0.174	10.80	-0.159	-0.070	-113.805
3	0.009	16.20	0.002	-0.009	-169.945
4	0.017	21.59	-0.016	0.016	-14.789
5	0.047	26.99	0.071	-0.045	166.092
6	0.114	32.39	0.101	-0.054	118.353
GUNNER STATION 100 0.992					
1	0.047	5.40	0.033	-0.034	136.033
2	0.176	10.80	-0.175	-0.023	-82.478
3	0.011	16.19	-0.001	-0.011	-174.259
4	0.058	21.59	0.058	-0.005	-84.882
5	0.071	26.99	-0.009	0.005	-118.578
6	0.038	32.39	-0.031	0.021	-55.725
PILOT STATION 146 1.003					
1	0.037	5.40	0.027	-0.026	133.370
2	0.183	10.80	-0.162	-0.089	-22.246
3	0.010	16.19	-0.001	-0.008	-92.404
4	0.059	21.59	-0.021	-0.028	-119.705
5	0.014	26.99	-0.011	0.009	-51.550
6	0.074	32.39	-0.074	0.004	-86.550
ENGINE DECK STA 249 0.984					
1	0.028	5.40	0.022	-0.017	127.970
2	0.347	10.80	-0.223	-0.266	-39.815
3	0.009	16.19	0.001	-0.009	174.681
4	0.132	21.59	-0.056	-0.118	-153.633
5	0.015	26.99	0.012	0.005	69.061
6	0.024	32.39	-0.023	0.004	-80.801
TAIL BOOM STA 297 0.992					
1	0.022	5.40	0.019	-0.012	121.220
2	0.364	10.80	-0.236	-0.277	-40.524
3	0.002	16.19	-0.002	-0.001	-19.524
4	0.091	21.59	-0.038	-0.083	-135.128
5	0.012	26.99	0.006	0.010	31.399
6	0.010	32.39	-0.008	-0.006	-124.986
TAIL BOOM STA 400 0.995					
1	0.025	5.40	0.024	-0.004	99.112
2	0.343	10.80	-0.093	0.330	-15.765
3	0.040	16.19	-0.014	0.028	-30.017
4	0.232	21.59	0.156	0.071	42.400
5	0.076	26.99	-0.009	-0.075	-78.905
6	0.022	32.39	0.000	-0.022	178.905

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 485		ITEM CODE A319		UNITS: G'S	
MEAN		MAX OSC.			
1	0.043	5.40	0.043	-0.003	94.221
2	0.256	10.80	-0.142	-0.213	146.232
3	0.060	16.19	-0.038	0.047	-39.046
4	0.361	21.59	-0.027	0.360	-4.292
5	0.099	26.99	-0.099	-0.001	-90.470
6	0.038	32.39	0.037	-0.005	97.433

90 DEG GEAR BOX 518		ITEM CODE A321		UNITS: G'S	
MEAN		MAX OSC.			
1	0.050	5.40	0.046	-0.020	113.689
2	0.687	10.80	-0.407	-0.553	143.612
3	0.019	16.19	-0.003	0.018	-10.668
4	0.066	21.59	0.027	0.060	24.320
5	0.049	26.99	-0.047	-0.011	-103.549
6	0.032	32.39	-0.012	-0.030	-158.685

T/B FIN LOAD STA 521		ITEM CODE A320		UNITS: G'S	
MEAN		MAX OSC.			
1	0.045	5.40	0.042	0.016	68.736
2	0.733	10.80	-0.436	-0.589	143.481
3	0.054	16.19	-0.018	0.051	-19.304
4	0.091	21.59	0.042	0.080	27.680
5	0.022	26.99	-0.018	-0.013	-127.156
6	0.065	32.39	-0.004	-0.065	-176.400

LFT WING-TIP STA 195		ITEM CODE A600		UNITS: G'S	
MEAN		MAX OSC.			
1	0.040	5.40	0.038	-0.014	110.340
2	0.401	10.80	-0.384	-0.113	173.592
3	0.015	16.19	-0.007	-0.013	152.919
4	0.150	21.59	-0.107	-0.105	-134.333
5	0.011	26.99	-0.005	0.010	-29.041
6	0.141	32.39	-0.049	-0.133	-159.837

RT WING-TIP STA 195		ITEM CODE A601		UNITS: G'S	
MEAN		MAX OSC.			
1	0.021	5.40	0.007	-0.020	159.693
2	0.097	10.80	0.052	0.082	32.289
3	0.007	16.19	0.001	0.007	7.381
4	0.196	21.59	0.185	-0.066	109.756
5	0.031	26.99	-0.025	-0.018	-125.118
6	0.049	32.39	-0.012	-0.047	-14.397

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 614
ROT. SPEED 323.2

FLI. 35-A
DATE 8 20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.C. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 1.023 UNITS: G'S					
	MEAN		ITEM CODE A315		MAX OSC.
1	0.048	5.39	0.038	-0.029	127.451
2	0.138	10.77	-0.119	-0.070	-120.265
3	0.003	19.16	0.002	-0.001	-121.635
4	0.012	21.55	0.004	0.011	18.778
5	0.050	26.93	0.027	0.017	70.294
6	0.099	32.32	0.093	-0.036	111.121
GUNNER STATION 100 1.014 UNITS: G'S					
	MEAN		ITEM CODE A020		MAX OSC.
1	0.037	5.39	0.031	-0.021	123.642
2	0.151	10.77	-0.150	-0.014	-84.530
3	0.005	16.16	-0.005	-0.002	-109.357
4	0.053	21.55	-0.017	-0.017	-108.433
5	0.008	26.93	-0.007	0.003	-68.392
6	0.032	32.32	-0.009	0.031	-15.640
PILOT STATION 146 1.025 UNITS: G'S					
	MEAN		ITEM CODE A019		MAX OSC.
1	0.030	5.39	0.025	-0.016	122.411
2	0.167	10.77	-0.150	-0.073	-63.470
3	0.007	16.16	-0.007	-0.003	-113.007
4	0.063	21.55	-0.049	-0.040	-126.475
5	0.022	26.93	-0.022	-0.004	-52.222
6	0.056	32.32	-0.054	0.013	-76.527
ENGINE DECK STA 249 1.016 UNITS: G'S					
	MEAN		ITEM CODE A316		MAX OSC.
1	0.024	5.39	0.020	-0.014	124.793
2	0.373	10.77	-0.221	-0.249	-41.633
3	0.042	16.16	0.000	-0.012	179.073
4	0.069	21.55	-0.063	-0.064	-135.256
5	0.013	26.93	-0.000	0.013	-1.380
6	0.039	32.32	-0.038	-0.006	-98.676
TAIL BOOM STA 297 0.997 UNITS: G'S					
	MEAN		ITEM CODE A317		MAX OSC.
1	0.022	5.39	0.020	-0.011	118.357
2	0.357	10.77	-0.242	-0.263	-48.323
3	0.008	16.16	0.003	-0.007	155.082
4	0.069	21.55	-0.046	-0.052	-138.201
5	0.019	26.93	0.004	0.018	11.058
6	0.009	32.32	-0.007	-0.005	-125.906
TAIL BOOM STA 400 1.002 UNITS: G'S					
	MEAN		ITEM CODE A318		MAX OSC.
1	0.033	5.39	0.028	-0.018	123.715
2	0.312	10.77	-0.103	-0.264	-19.374
3	0.010	16.16	0.010	0.001	86.699
4	0.169	21.55	0.144	0.020	58.013
5	0.043	26.93	-0.022	-0.037	-30.282
6	0.050	32.32	0.047	-0.017	109.930

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL SHIP AH-1G 20391
FLY DATE 35-A 8-20-75
G.W. 8320 LB.
C.G. 200.6 IN.
PROBLEM 1 REPORT

HARM AMP HZ SIN COS PHASE ANGLE

	AMP	HZ	SIN	COS	PHASE ANGLE
TAIL BOOM STA 485					
	MEAN	1.011			
1	0.041	5.39	0.041	-0.003	93.507
2	0.280	10.77	0.081	-0.269	163.261
3	0.026	16.16	0.004	0.025	8.420
4	0.251	21.55	0.183	-0.172	46.828
5	0.111	26.93	-0.105	-0.035	-108.604
6	0.026	32.32	-0.002	0.026	-3.591
90 DEG GEAR BOX 518					
	MEAN	1.122			
1	0.045	5.39	0.045	-0.004	95.206
2	0.715	10.77	0.261	-0.865	158.580
3	0.011	16.16	-0.011	0.004	-69.953
4	0.062	21.55	0.058	-0.022	110.697
5	0.103	26.93	-0.059	-0.085	-145.382
6	0.021	32.32	-0.012	0.017	-35.169
T/B FIN LOAD STA 521					
	MEAN	0.708			
1	0.037	5.39	0.036	-0.008	102.072
2	0.784	10.77	0.299	-0.725	157.613
3	0.028	16.16	0.011	0.025	23.764
4	0.072	21.55	0.069	-0.070	106.296
5	0.108	26.93	-0.080	-0.072	-132.069
6	0.026	32.32	-0.008	0.025	-18.935
LFT WING-TIP STA 195					
	MEAN	1.040			
1	0.020	5.39	0.018	-0.008	113.415
2	0.374	10.77	-0.299	0.183	-58.505
3	0.017	16.16	-0.017	-0.003	-106.506
4	0.142	21.55	-0.136	0.040	-106.579
5	0.027	26.93	-0.025	-0.010	-111.133
6	0.113	32.32	-0.112	-0.013	-96.714
RT WING-TIP STA 195					
	MEAN	1.007			
1	0.029	5.39	0.015	-0.024	148.760
2	0.117	10.77	0.072	0.093	37.739
3	0.019	16.16	0.018	0.006	70.560
4	0.124	21.55	-0.085	-0.090	-136.896
5	0.016	26.93	-0.015	-0.003	-102.794
6	0.060	32.32	-0.033	0.050	33.295

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SHEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 613
ROT. SPEED 322.5

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

C.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KIS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

NOSE STATION 46		ITEM CODE A315		UNITS: G'S	
MEAN		MAX OSC.			
1	0.047	5.38	0.031	-0.036	139.392
2	0.134	10.75	-0.077	-0.081	-127.810
3	0.071	19.13	-0.071	-0.071	-129.908
4	0.072	21.50	-0.016	-0.071	-167.588
5	0.052	26.88	0.046	-0.024	118.789
6	0.128	32.25	0.127	0.021	80.750
GUNNER STATION 100		ITEM CODE A020		UNITS: G'S	
MEAN		MAX OSC.			
1	0.035	5.38	0.024	-0.025	137.204
2	0.129	10.75	-0.129	-0.012	-95.249
3	0.013	16.13	-0.012	0.003	67.587
4	0.063	21.50	-0.035	-0.052	-146.098
5	0.010	26.88	-0.002	-0.010	-165.900
6	0.007	32.25	-0.003	0.006	-24.462
PILOT STATION 146		ITEM CODE A019		UNITS: G'S	
MEAN		MAX OSC.			
1	0.027	5.38	0.019	-0.020	136.521
2	0.129	10.75	-0.123	-0.040	-71.517
3	0.008	16.13	-0.008	-0.000	90.667
4	0.052	21.50	-0.017	-0.049	-160.897
5	0.016	26.88	-0.016	-0.002	-96.918
6	0.049	32.25	-0.044	-0.023	-117.700
ENGINE DECK STA 249		ITEM CODE A316		UNITS: G'S	
MEAN		MAX OSC.			
1	0.020	5.38	0.013	-0.015	139.142
2	0.132	10.75	-0.077	-0.179	-44.652
3	0.012	16.13	-0.011	-0.004	110.844
4	0.066	21.50	-0.030	-0.094	-122.782
5	0.005	26.88	-0.004	-0.004	-137.682
6	0.033	32.25	-0.033	-0.001	-91.681
TAIL BOOM STA 297		ITEM CODE A317		UNITS: G'S	
MEAN		MAX OSC.			
1	0.017	5.38	0.014	-0.011	128.723
2	0.271	10.75	-0.186	-0.197	-43.343
3	0.013	16.13	-0.013	0.003	76.611
4	0.067	21.50	-0.015	-0.065	-167.393
5	0.017	26.88	-0.017	0.003	79.742
6	0.023	32.25	-0.015	-0.018	-40.362
TAIL BOOM STA 400		ITEM CODE A318		UNITS: G'S	
MEAN		MAX OSC.			
1	0.029	5.38	0.021	-0.020	134.270
2	0.243	10.75	-0.080	-0.229	-39.270
3	0.019	16.13	0.015	0.011	54.971
4	0.223	21.50	0.097	0.201	25.997
5	0.092	26.88	0.075	0.053	54.635
6	0.083	32.25	0.078	-0.030	111.251

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL SHIP AH-1G 20391
FLY DATE 35-A 8-20-75
G.W. 8320 LB.
C.G. 200.6 IN.
PROBLEM 1 REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 485 1.051

ITEM	MEAN	MAX	OSC.	UNITS: G'S
1	0.038	5.38	0.037	0.010
2	0.207	10.75	0.050	-0.201
3	0.040	16.13	-0.020	0.035
4	0.315	21.50	0.091	0.301
5	0.145	26.88	-0.037	0.133
6	0.091	32.25	0.050	-0.076

90 DEG GEAR BOX 518 1.099

ITEM	MEAN	MAX	OSC.	UNITS: G'S
1	0.050	5.38	0.045	-0.021
2	0.561	10.75	0.199	-0.525
3	0.021	16.13	-0.021	0.001
4	0.035	21.50	0.034	0.009
5	0.117	26.88	-0.117	-0.007
6	0.052	32.25	-0.005	-0.052

T/B FIN LOAD STA 521 0.782

ITEM	MEAN	MAX	OSC.	UNITS: G'S
1	0.080	5.38	0.061	-0.052
2	0.632	10.75	0.185	-0.604
3	0.035	16.13	-0.030	-0.017
4	0.058	21.50	0.058	-0.001
5	0.139	26.88	-0.139	0.004
6	0.103	32.25	-0.033	-0.097

LFT WING-TIP STA 195 1.087

ITEM	MEAN	MAX	OSC.	UNITS: G'S
1	0.025	5.38	0.018	-0.017
2	0.283	10.75	-0.260	0.111
3	0.016	16.13	0.014	-0.008
4	0.133	21.50	-0.089	-0.098
5	0.009	26.88	-0.006	-0.006
6	0.094	32.25	-0.093	0.004

RT WING-TIP STA 195 1.059

ITEM	MEAN	MAX	OSC.	UNITS: G'S
1	0.032	5.38	0.029	-0.012
2	0.112	10.75	0.074	0.084
3	0.018	16.13	-0.017	-0.008
4	0.117	21.50	0.113	-0.027
5	0.033	26.88	-0.032	0.005
6	0.069	32.25	-0.019	-0.066

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHP 20391
REC. NO. 612
ROI SPEED 323.2

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KIS--TAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM AMP HZ SIN COS PHASE ANGLE

NOSE STATION 46		ITEM CODE A315		UNITS: G'S	
MEAN		MAX OSC.		0.618	
1	0.020	5.39	0.015	-0.013	130.287
2	0.106	10.77	-0.083	-0.063	-126.480
3	0.011	16.16	-0.010	-0.003	-113.952
4	0.084	21.55	0.019	-0.082	167.245
5	0.056	26.93	0.006	0.052	67.265
6	0.052	32.32	0.048	-0.020	112.641
GUNNER STATION 100		ITEM CODE A020		UNITS: G'S	
MEAN		MAX OSC.		0.357	
1	0.016	5.39	0.010	-0.013	142.735
2	0.085	10.77	-0.085	-0.003	-88.182
3	0.009	16.16	-0.005	-0.007	-145.583
4	0.021	21.55	-0.014	-0.016	-139.915
5	0.015	26.93	-0.014	-0.005	-108.017
6	0.020	32.32	0.014	-0.014	133.653
PILOT STATION 146		ITEM CODE A019		UNITS: G'S	
MEAN		MAX OSC.		0.384	
1	0.014	5.39	0.008	-0.011	145.653
2	0.084	10.77	-0.067	-0.021	-55.502
3	0.007	16.16	-0.001	-0.007	172.502
4	0.076	21.55	-0.000	-0.007	-113.679
5	0.009	26.93	-0.014	-0.042	-148.222
6	0.009	32.32	-0.008	-0.004	-118.266
ENGINE DECK STA 249		ITEM CODE A316		UNITS: G'S	
MEAN		MAX OSC.		0.645	
1	0.008	5.39	0.005	-0.007	147.070
2	0.196	10.77	-0.021	-0.188	-16.760
3	0.006	16.16	0.004	-0.004	137.130
4	0.079	21.55	0.072	-0.029	111.679
5	0.013	26.93	-0.007	0.011	-33.252
6	0.020	32.32	0.004	0.020	10.827
TAIL BOOM STA 297		ITEM CODE A317		UNITS: G'S	
MEAN		MAX OSC.		1.700	
1	0.005	5.39	0.004	-0.003	131.363
2	0.227	10.77	-0.060	-0.219	-106.323
3	0.007	16.16	-0.041	-0.002	113.856
4	0.045	21.55	-0.024	-0.018	-48.170
5	0.036	26.93	0.027	0.009	67.038
6	0.022	32.32	0.020	0.009	67.038
TAIL BOOM STA 400		ITEM CODE A318		UNITS: G'S	
MEAN		MAX OSC.		2.947	
1	0.012	5.39	0.011	-0.005	115.613
2	0.203	10.77	0.034	-0.201	8.846
3	0.034	16.16	-0.034	0.003	-84.274
4	0.114	21.55	-0.108	-0.032	-71.794
5	0.133	26.93	-0.124	0.048	-69.322
6	0.099	32.32	0.062	-0.078	141.366

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ STA ITEM CODE UNITS: G'S
MEAN MEAN MEAN MEAN OSC. G'S

TAIL BOOM STA 485 0.990

HARM	AMP	HZ	STA	ITEM CODE	UNITS: G'S	COS	SIN	PHASE ANGLE
1	0.026	5.39	485	A319	1.646	-0.002	0.026	93.487
2	0.208	10.77		MAX OSC.		-0.208	-0.008	-177.913
3	0.023	16.16				0.004	-0.022	-78.933
4	0.151	21.55				-0.041	-0.145	-74.271
5	0.173	26.93				-0.121	-0.123	-134.518
6	0.036	32.32				0.015	0.033	65.664

90 DEG GEAR BOX 518 1.102

HARM	AMP	HZ	STA	ITEM CODE	UNITS: G'S	COS	SIN	PHASE ANGLE
1	0.036	5.39	518	A321	2.320	-0.004	0.035	96.360
2	0.507	10.77		MAX OSC.		-0.507	0.006	179.268
3	0.011	16.16				-0.004	0.010	111.354
4	0.010	21.55				-0.004	-0.009	-62.897
5	0.129	26.93				-0.108	-0.070	147.049
6	0.074	32.32				0.029	-0.068	-67.059

T/B FIN LOAD STA 521 0.767

HARM	AMP	HZ	STA	ITEM CODE	UNITS: G'S	COS	SIN	PHASE ANGLE
1	0.054	5.39	521	A320	7.936	-0.036	0.041	131.615
2	0.562	10.77		MAX OSC.		-0.562	-0.021	-177.900
3	0.014	16.16				-0.009	0.011	129.545
4	0.006	21.55				0.003	-0.003	-59.720
5	0.198	26.93				-0.187	-0.065	160.802
6	0.098	32.32				0.048	-0.083	-60.249

LFT WING-TIP STA 195 1.034

HARM	AMP	HZ	STA	ITEM CODE	UNITS: G'S	COS	SIN	PHASE ANGLE
1	0.020	5.39	195	A600	1.498	-0.020	0.001	-178.005
2	0.206	10.77		MAX OSC.		-0.129	-0.160	-51.183
3	0.010	16.16				-0.009	-0.005	-152.409
4	0.022	21.55				0.013	-0.018	-53.203
5	0.030	26.93				-0.028	-0.008	-163.594
6	0.023	32.32				0.017	0.015	40.087

RT WING-TIP STA 195 0.997

HARM	AMP	HZ	STA	ITEM CODE	UNITS: G'S	COS	SIN	PHASE ANGLE
1	0.024	5.39	195	A601	0.917	-0.004	0.024	100.435
2	0.142	10.77		MAX OSC.		0.074	0.121	58.323
3	0.017	16.16				0.017	0.002	7.193
4	0.119	21.55				-0.016	0.116	97.613
5	0.018	26.93				-0.015	-0.010	-146.376
6	0.041	32.32				-0.008	-0.040	-100.878

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC NO. 611
ROT SPEED 322.5

FLY: 35-A LB. PROBLEM 1
DATE 8-20-75 C.G. 200.6 IN. REPORT
ALT. 5000. FT. TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--IAS

HARM AMP HZ SIN COS PHASE ANGLE

NOSE STATION 46 0.987 ITEM CODE A315 UNITS: G'S
MEAN MAX OSC. 0.715

1	0.032	5.38	0.014	-0.028	153.384
2	0.079	10.75	-0.053	-0.058	-137.778
3	0.020	16.13	0.001	-0.020	177.296
4	0.076	21.50	0.040	-0.065	148.745
5	0.071	26.88	-0.016	-0.061	-149.292
6	0.081	32.25	-0.018	-0.079	-166.992

GUNNER STATION 100 0.982 ITEM CODE A020 UNITS: G'S
MEAN MAX OSC. 0.352

1	0.023	5.38	0.008	-0.022	159.832
2	0.063	10.75	-0.062	-0.012	178.882
3	0.018	16.13	0.001	-0.011	173.740
4	0.018	21.50	-0.016	-0.010	-38.716
5	0.018	26.88	0.007	-0.017	159.069
6	0.031	32.25	0.037	-0.035	45.903

PILOT STATION 146 0.992 ITEM CODE A019 UNITS: G'S
MEAN MAX OSC. 0.435

1	0.018	5.38	0.006	-0.017	161.877
2	0.081	10.75	-0.050	-0.064	-37.911
3	0.005	16.13	0.001	-0.005	166.906
4	0.049	21.50	-0.022	-0.042	-26.549
5	0.016	26.88	0.015	0.005	71.609
6	0.036	32.25	0.009	-0.056	9.272

ENGINE DECK STA 249 0.978 ITEM CODE A316 UNITS: G'S
MEAN MAX OSC. 0.707

1	0.013	5.38	0.003	-0.013	167.597
2	0.203	10.75	-0.041	-0.211	-10.936
3	0.003	16.13	0.000	-0.003	176.493
4	0.116	21.50	0.082	-0.082	45.170
5	0.029	26.88	-0.028	-0.007	-104.594
6	0.031	32.25	0.030	-0.007	-77.193

TAIL BOOM STA 297 0.937 ITEM CODE A317 UNITS: G'S
MEAN MAX OSC. 1.493

1	0.012	5.38	0.008	-0.010	141.695
2	0.251	10.75	-0.049	-0.249	-11.313
3	0.004	16.13	0.000	-0.004	174.784
4	0.069	21.50	0.055	-0.042	-158.516
5	0.041	26.88	-0.006	-0.041	-178.270
6	0.045	32.25	0.044	-0.009	-78.004

TAIL BOOM STA 400 0.957 ITEM CODE A318 UNITS: G'S
MEAN MAX OSC. 2.642

1	0.014	5.38	0.011	-0.008	126.026
2	0.230	10.75	-0.043	-0.224	-13.156
3	0.006	16.13	0.002	-0.006	164.623
4	0.215	21.50	-0.002	-0.214	-175.879
5	0.170	26.88	0.124	-0.117	-133.311
6	0.033	32.25	0.022	-0.024	137.530

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: FUSELAGE VERTICAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391

FLT. 35-A
DATE 8-20-75

G.W. 8320 LB.
C.G. 200.6 IN.

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 485		ITEM CODE A319		UNITS: G'S	
MEAN		MAX OSC.		1.628	
1	0.031	5.38	0.026	-0.017	122.764
2	0.253	10.75	0.012	-0.253	177.322
3	0.014	16.13	0.009	-0.010	138.789
4	0.254	21.50	0.008	-0.254	178.229
5	0.253	26.88	0.235	0.094	68.111
6	0.022	32.25	-0.017	0.014	-51.895

90 DEG GEAR BOX 518		ITEM CODE A321		UNITS: G'S	
MEAN		MAX OSC.		2.485	
1	0.029	5.38	0.028	-0.007	103.587
2	0.587	10.75	0.002	-0.587	179.850
3	0.006	16.13	-0.002	-0.002	-105.876
4	0.051	21.50	-0.051	-0.008	-98.667
5	0.160	26.88	-0.014	0.159	-5.031
6	0.037	32.25	0.037	0.002	-87.106

T/B FIN LOAD STA 521		ITEM CODE A320		UNITS: G'S	
MEAN		MAX OSC.		7.931	
1	0.032	5.38	0.032	-0.000	90.840
2	0.632	10.75	-0.000	-0.632	-179.998
3	0.013	16.13	-0.009	0.010	-44.270
4	0.063	21.50	-0.063	-0.001	-90.532
5	0.223	26.88	-0.005	0.223	-1.254
6	0.076	32.25	-0.075	0.012	-80.728

LFT WING-TIP STA 195		ITEM CODE A600		UNITS: G'S	
MEAN		MAX OSC.		1.413	
1	0.015	5.38	0.010	-0.012	-140.288
2	0.195	10.75	-0.136	0.140	-44.257
3	0.008	16.13	-0.006	-0.005	-132.464
4	0.115	21.50	-0.041	0.108	-20.761
5	0.013	26.88	0.007	0.011	30.384
6	0.064	32.25	0.003	0.064	2.976

RT WING-TIP STA 195		ITEM CODE A601		UNITS: G'S	
MEAN		MAX OSC.		1.366	
1	0.034	5.38	0.033	-0.007	101.423
2	0.153	10.75	0.119	0.095	51.450
3	0.016	16.13	0.008	0.014	31.164
4	0.093	21.50	0.089	0.077	73.947
5	0.015	26.88	0.001	0.015	3.408
6	0.067	32.25	-0.002	0.067	-1.513

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO 20391
REC. NO. 610
ROT. SPEED 323.2

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.018 UNITS: G'S					
	MEAN	ITEM CODE A306	MAX OSC. 0.836		
1	0.012	-0.002	0.011	-0.077	
2	0.144	0.069	-0.126	151.468	
3	0.072	0.066	-0.027	112.499	
4	0.223	0.222	-0.015	93.812	
5	0.005	0.004	0.003	53.009	
6	0.052	0.044	0.028	57.045	
GUNNER STATION 100 0.024 UNITS: G'S					
	MEAN	ITEM CODE A304	MAX OSC. 0.336		
1	0.005	-0.003	0.005	-33.273	
2	0.095	0.071	-0.063	131.667	
3	0.025	0.024	-0.006	104.349	
4	0.125	0.122	-0.030	103.784	
5	0.011	-0.006	0.009	-34.304	
6	0.035	0.026	-0.023	131.467	
PILOT STATION 146 0.034 UNITS: G'S					
	MEAN	ITEM CODE A302	MAX OSC. 0.325		
1	0.005	-0.004	0.002	-62.416	
2	0.053	0.052	-0.008	98.279	
3	0.004	-0.001	0.004	-12.247	
4	0.018	0.012	-0.013	136.964	
5	0.011	-0.010	0.005	-60.803	
6	0.010	-0.001	-0.010	-176.786	
ENGINE DECK STA 249 -0.029 UNITS: G'S					
	MEAN	ITEM CODE A307	MAX OSC. 0.935		
1	0.008	-0.008	-0.001	-98.037	
2	0.149	0.119	-0.089	126.865	
3	0.010	0.005	0.009	31.432	
4	0.027	0.026	0.007	74.102	
5	0.023	-0.008	0.021	-21.533	
6	0.042	0.019	0.037	27.631	

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLI. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
TAIL BOOM STA 297					
	MEAN	-0.037			
1	0.010	5.39	-0.008	0.006	-52.636
2	0.118	10.77	0.093	-0.074	128.604
3	0.028	16.16	-0.018	0.021	-40.790
4	0.031	21.55	0.027	-0.014	117.927
5	0.052	26.93	-0.051	0.011	-77.333
6	0.090	32.32	0.003	0.090	1.890
			ITEM CODE A308	UNITS: G'S	
			MAX OSC.	1.417	
TAIL BOOM STA 400					
	MEAN	0.085			
1	0.014	5.39	0.014	0.004	72.024
2	0.192	10.77	0.018	-0.191	174.591
3	0.111	16.16	0.111	0.001	89.604
4	0.057	21.55	-0.051	0.025	-63.979
5	0.145	26.93	-0.021	0.143	-8.503
6	0.166	32.32	0.161	-0.037	102.803
			ITEM CODE A309	UNITS: G'S	
			MAX OSC.	5.133	
T/B FIN LOAD STA 521					
	MEAN	0.324			
1	0.051	5.39	-0.036	0.036	-45.436
2	1.176	10.77	0.707	-0.940	143.079
3	0.212	16.16	-0.207	0.047	-77.229
4	0.291	21.55	-0.148	-0.251	-149.397
5	0.944	26.93	-0.142	-0.934	-171.325
6	0.220	32.32	-0.127	-0.180	-144.788
			ITEM CODE A311	UNITS: G'S	
			MAX OSC.	19.146	

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO 20391
REC. NO 615
ROT SPEED 323.9
FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.
G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.024					
	MEAN		ITEM CODE A306	UNITS: G'S	
1	0.027	5.40	-0.012	0.024	-27.187
2	0.061	10.80	0.055	-0.027	116.524
3	0.069	16.19	0.040	-0.056	144.763
4	0.195	21.59	0.167	0.102	58.608
5	0.007	26.99	0.007	-0.001	98.637
6	0.033	32.39	-0.010	0.032	-17.421
GUNNER STATION 100 0.039					
	MEAN		ITEM CODE A304	UNITS: G'S	
1	0.016	5.40	-0.008	0.014	-29.089
2	0.060	10.80	0.058	-0.014	104.002
3	0.026	16.19	0.017	-0.019	138.108
4	0.105	21.59	0.100	0.031	72.600
5	0.010	26.99	0.002	-0.009	10.204
6	0.021	32.39	0.015	-0.015	134.451
PILOT STATION 146 0.038					
	MEAN		ITEM CODE A302	UNITS: G'S	
1	0.008	5.40	-0.005	0.007	-37.404
2	0.043	10.80	0.043	0.002	87.967
3	0.003	16.19	0.001	0.003	14.748
4	0.022	21.59	0.016	-0.015	131.735
5	0.006	26.99	-0.004	0.005	-36.609
6	0.013	32.39	0.002	-0.012	171.761
ENGINE DECK STA 249 -0.017					
	MEAN		ITEM CODE A307	UNITS: G'S	
1	0.011	5.40	-0.008	0.008	-44.129
2	0.113	10.80	0.102	-0.047	114.766
3	0.016	16.19	0.013	-0.009	124.410
4	0.020	21.59	0.018	0.008	64.757
5	0.026	26.99	0.003	0.026	6.409
6	0.027	32.39	-0.026	0.007	-74.448

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLI. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 297 0.004 UNITS: G'S
MEAN MAX OSC. 1.406

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.016	5.40	-0.010	0.013	-37.426
2	0.094	10.80	0.084	-0.043	117.303
3	0.011	16.19	0.004	0.010	23.339
4	0.026	21.59	0.016	-0.021	142.926
5	0.048	26.99	-0.035	0.034	-45.699
6	0.028	32.39	-0.025	0.013	-63.059

TAIL BOOM STA 400 UNITS: G'S
MEAN MAX OSC. 3.734

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.017	5.40	0.014	-0.009	123.336
2	0.052	10.80	-0.010	-0.052	-169.544
3	0.114	16.19	0.086	-0.074	130.382
4	0.075	21.59	-0.045	0.060	-36.927
5	0.108	26.99	0.049	0.096	27.028
6	0.055	32.39	0.032	-0.045	144.391

T/B FIN LOAD STA 521 UNITS: G'S
MEAN MAX OSC. 20.376

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.162	5.40	0.066	-0.148	156.130
2	0.523	10.80	0.294	-0.432	145.757
3	0.105	16.19	-0.011	0.105	-5.781
4	0.164	21.59	0.082	-0.142	149.935
5	0.803	26.99	-0.311	-0.740	-157.184
6	0.251	32.39	0.099	0.230	23.385

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 614
ROT SPEED 323.2

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

NOSE STATION 46 0.018
MEAN

	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.018	5.39	-0.010	0.015	-33.174
2	0.062	10.77	-0.053	-0.031	119.916
3	0.051	16.16	-0.027	-0.043	-148.137
4	0.195	21.55	0.184	0.065	170.603
5	0.010	26.93	0.003	0.010	18.852
6	0.015	32.32	-0.004	0.015	-14.625

ITEM CODE A306
MAX OSC.
UNITS: G'S
0.631

GUNNER STATION 100 0.036
MEAN

	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.010	5.39	-0.006	0.007	-40.854
2	0.061	10.77	-0.059	-0.017	106.531
3	0.019	16.16	-0.009	-0.017	-151.016
4	0.100	21.55	0.100	0.012	83.247
5	0.003	26.93	0.002	0.003	34.064
6	0.022	32.32	0.004	-0.022	170.682

ITEM CODE A304
MAX OSC.
UNITS: G'S
0.260

PILOT STATION 146 0.041
MEAN

	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.005	5.39	-0.005	0.002	-62.912
2	0.046	10.77	0.046	-0.001	91.595
3	0.002	16.16	0.001	0.002	33.453
4	0.019	21.55	0.011	-0.015	143.855
5	0.005	26.93	0.000	-0.005	179.976
6	0.003	32.32	-0.003	-0.001	-112.650

ITEM CODE A302
MAX OSC.
UNITS: G'S
0.231

ENGINE DECK STA 249 -0.022
MEAN

	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.006	5.39	-0.004	0.005	-41.201
2	0.101	10.77	-0.082	-0.060	126.133
3	0.014	16.16	-0.009	-0.011	-140.293
4	0.015	21.55	0.014	0.004	72.930
5	0.019	26.93	-0.015	0.012	-50.161
6	0.007	32.32	-0.005	0.005	-42.857

ITEM CODE A307
MAX OSC.
UNITS: G'S
0.671

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ SIN COS PHASE ANGLE
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TAIL BOOM STA 297		ITEM CODE A308		UNITS: G'S
MEAN		MAX OSC.		1.207
1	0.009	-0.005	0.008	-31.896
2	0.091	0.072	-0.056	128.080
3	0.010	0.008	-0.006	127.245
4	0.015	0.006	-0.014	157.090
5	0.029	-0.028	-0.004	-98.704
6	0.009	-0.000	0.009	-1.710

TAIL BOOM STA 400		ITEM CODE A309		UNITS: G'S
MEAN		MAX OSC.		2.740
1	0.001	-0.000	0.001	-9.674
2	0.047	-0.038	-0.027	-124.602
3	0.099	-0.070	-0.071	-135.645
4	0.044	-0.013	0.042	-17.535
5	0.073	-0.050	0.053	-43.351
6	0.069	-0.022	-0.065	-161.479

T/B FIN LOAD STA 521		ITEM CODE A311		UNITS: G'S
MEAN		MAX OSC.		13.990
1	0.066	-0.034	0.056	-31.366
2	0.286	0.035	-0.284	173.002
3	0.119	0.113	0.037	71.888
4	0.191	-0.155	-0.112	-125.993
5	0.372	0.198	-0.315	147.816
6	0.157	-0.025	0.155	-9.004

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 613
ROT SPEED 322.5

FLT. 35-A-75
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KTS--IAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.022					
	MEAN		ITEM CODE A306	UNITS: G'S	
			MAX OSC.		
1	0.006	5.38	-0.006	0.000	-87.615
2	0.085	10.75	0.084	0.013	80.976
3	0.036	16.13	0.035	0.005	81.518
4	0.193	21.50	0.128	0.145	41.400
5	0.014	26.88	-0.009	0.010	-41.368
6	0.035	32.25	-0.027	0.023	-49.454
GUNNER STATION 100 0.036					
	MEAN		ITEM CODE A304	UNITS: G'S	
			MAX OSC.		
1	0.002	5.38	-0.001	-0.001	-127.191
2	0.072	10.75	0.071	0.010	81.643
3	0.013	16.13	0.013	0.003	74.759
4	0.097	21.50	0.083	0.049	59.504
5	0.011	26.88	-0.002	0.010	-12.798
6	0.012	32.25	-0.011	-0.005	-113.481
PILOT STATION 146 0.039					
	MEAN		ITEM CODE A302	UNITS: G'S	
			MAX OSC.		
1	0.000	5.38	0.000	0.000	3.771
2	0.048	10.75	0.047	0.009	79.475
3	0.003	16.13	-0.002	0.002	-34.162
4	0.022	21.50	0.017	-0.014	128.691
5	0.004	26.88	0.002	0.004	20.498
6	0.024	32.25	-0.022	0.010	-65.562
ENGINE DECK STA 249 -0.011					
	MEAN		ITEM CODE A307	UNITS: G'S	
			MAX OSC.		
1	0.005	5.38	0.002	-0.004	152.580
2	0.089	10.75	0.083	-0.034	112.378
3	0.004	16.13	0.003	-0.002	119.790
4	0.015	21.50	0.014	0.002	82.772
5	0.012	26.88	-0.010	-0.005	-62.615
6	0.020	32.25	0.015	-0.013	129.802

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 297 -0.008 UNITS: G'S
1.028

	MEAN	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.008	0.008	5.38	0.001	-0.008	171.581
2	0.085	0.085	10.75	0.074	-0.041	119.079
3	0.005	0.005	16.13	-0.004	-0.002	-117.532
4	0.027	0.027	21.50	0.014	-0.023	-148.071
5	0.017	0.017	26.88	-0.017	0.002	-82.019
6	0.015	0.015	32.25	0.008	-0.013	149.012

TAIL BOOM STA 400 0.035 UNITS: G'S
3.103

	MEAN	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.008	0.008	5.38	0.007	0.003	65.697
2	0.019	0.019	10.75	-0.019	-0.002	-94.980
3	0.058	0.058	16.13	0.057	0.007	83.026
4	0.062	0.062	21.50	-0.043	0.045	-43.368
5	0.049	0.049	26.88	-0.016	-0.046	-19.291
6	0.056	0.056	32.25	-0.007	-0.056	-172.721

T/B FIN LOAD STA 521 0.008 UNITS: G'S
11.132

	MEAN	AMP	HZ	SIN	COS	PHASE ANGLE
1	0.038	0.038	5.38	-0.013	0.036	-20.044
2	0.143	0.143	10.75	0.142	0.021	81.666
3	0.088	0.088	16.13	-0.088	-0.004	-92.609
4	0.093	0.093	21.50	0.091	-0.022	103.464
5	0.092	0.092	26.88	0.007	-0.092	175.745
6	0.104	0.104	32.25	0.054	0.088	31.713

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 612
ROT SPEED 323.2

FLY 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.013					
	MEAN		ITEM CODE A306	UNITS: G'S	
		MAX OSC.			
1	0.004	5.39	-0.003	0.002	-55.228
2	0.063	10.77	0.059	-0.022	110.268
3	0.027	16.16	0.003	-0.027	173.041
4	0.123	21.55	0.119	0.031	75.316
5	0.014	26.93	-0.014	-0.004	-107.779
6	0.027	32.32	0.000	0.027	0.606

GUNNER STATION 100 0.021					
	MEAN		ITEM CODE A304	UNITS: G'S	
		MAX OSC.			
1	0.001	5.39	0.000	0.001	0.474
2	0.059	10.77	0.059	-0.010	99.464
3	0.010	16.16	0.001	-0.010	174.561
4	0.080	21.55	0.080	0.004	87.011
5	0.003	26.93	0.003	-0.000	95.768
6	0.010	32.32	0.010	0.002	77.171

PILOT STATION 146 0.033					
	MEAN		ITEM CODE A302	UNITS: G'S	
		MAX OSC.			
1	0.000	5.39	0.000	0.000	56.695
2	0.043	10.77	0.043	0.001	89.244
3	0.000	16.16	-0.000	0.000	-24.207
4	0.018	21.55	0.018	-0.004	103.747
5	0.010	26.93	0.009	-0.001	96.751
6	0.012	32.32	-0.000	0.012	-0.092

ENGINE DECK STA 249 0.006					
	MEAN		ITEM CODE A307	UNITS: G'S	
		MAX OSC.			
1	0.004	5.39	0.003	-0.001	113.655
2	0.074	10.77	0.056	-0.049	131.443
3	0.005	16.16	0.000	-0.005	178.898
4	0.022	21.55	0.019	-0.012	122.739
5	0.013	26.93	0.002	-0.012	168.810
6	0.010	32.32	-0.005	-0.009	-151.853

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 297		0.013		ITEM CODE A308		UNITS: G'S	
MEAN				MAX OSC.		0.918	
1	0.004	5.39	0.001	-0.004	162.204		
2	0.074	10.77	0.053	-0.052	134.700		
3	0.004	16.16	0.002	0.003	40.123		
4	0.039	21.55	0.026	-0.029	137.808		
5	0.025	26.93	0.023	-0.008	109.771		
6	0.019	32.32	-0.016	-0.010	-121.562		

TAIL BOOM STA 400		0.040		ITEM CODE A309		UNITS: G'S	
MEAN				MAX OSC.		2.766	
1	0.011	5.39	0.002	-0.010	167.983		
2	0.054	10.77	-0.041	-0.034	-129.480		
3	0.068	16.16	0.004	-0.067	176.275		
4	0.064	21.55	-0.056	-0.031	-118.662		
5	0.081	26.93	-0.018	-0.079	167.300		
6	0.008	32.32	-0.008	-0.002	-103.956		

T/B FIN LOAD STA 521		-0.060		ITEM CODE A311		UNITS: G'S	
MEAN				MAX OSC.		8.114	
1	0.015	5.39	-0.007	0.014	-26.598		
2	0.262	10.77	-0.160	-0.208	142.321		
3	0.110	16.16	-0.055	0.095	-30.060		
4	0.089	21.55	0.036	0.081	23.858		
5	0.139	26.93	-0.002	0.139	-0.653		
6	0.109	32.32	0.062	0.090	34.255		

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BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 611
ROT. SPEED 322.5

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
NOSE STATION 46 0.014					
1	0.008	5.38	-0.008	0.000	-89.911
2	0.040	10.75	0.039	-0.009	102.555
3	0.022	16.13	-0.008	-0.021	-158.428
4	0.150	21.50	0.148	-0.020	97.672
5	0.014	26.88	0.009	0.010	43.017
6	0.041	32.25	0.030	0.028	46.628
GUNNER STATION 100 0.020					
1	0.003	5.38	-0.002	0.001	-70.268
2	0.045	10.75	0.045	-0.001	90.647
3	0.009	16.13	-0.003	-0.008	-158.708
4	0.084	21.50	0.084	0.001	89.341
5	0.013	26.88	-0.001	0.013	-4.763
6	0.022	32.25	0.021	0.002	85.673
PILOT STATION 146 0.027					
1	0.002	5.38	-0.000	0.002	-17.036
2	0.035	10.75	0.034	0.006	79.935
3	0.000	16.13	-0.000	-0.000	-127.851
4	0.018	21.50	0.005	0.017	15.389
5	0.009	26.88	-0.002	0.008	-10.600
6	0.007	32.25	-0.002	0.007	-16.978
ENGINE DECK STA 249 -0.004					
1	0.004	5.38	0.004	0.001	71.442
2	0.063	10.75	0.048	-0.041	130.709
3	0.004	16.13	-0.000	-0.004	-174.575
4	0.027	21.50	0.026	-0.007	104.104
5	0.015	26.88	-0.009	0.012	-35.039
6	0.007	32.25	0.004	-0.006	144.170

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: FUSELAGE LATERAL ACCELERATION
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT. 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT

HARM AMP HZ SIN COS PHASE ANGLE

TAIL BOOM STA 297		ITEM CODE A308		UNITS: G'S	
MEAN		MAX OSC.		0.956	
1	0.000	5.38	0.000	-0.000	120.055
2	0.062	10.75	0.051	-0.035	124.479
3	0.001	16.13	0.001	0.001	36.158
4	0.030	21.50	0.030	-0.001	92.097
5	0.035	26.88	-0.029	0.019	-56.829
6	0.018	32.25	0.001	-0.018	177.091

TAIL BOOM STA 400		ITEM CODE A309		UNITS: G'S	
MEAN		MAX OSC.		2.511	
1	0.007	5.38	0.004	0.006	35.783
2	0.092	10.75	-0.085	-0.037	-113.344
3	0.036	16.13	-0.005	-0.035	-171.433
4	0.066	21.50	0.009	-0.065	172.531
5	0.085	26.88	0.041	0.074	29.275
6	0.035	32.25	-0.021	-0.028	-143.556

T/B FIN LOAD STA 521		ITEM CODE A311		UNITS: G'S	
MEAN		MAX OSC.		9.223	
1	0.043	5.38	-0.043	-0.005	-96.516
2	0.259	10.75	-0.122	-0.229	-151.954
3	0.047	16.13	0.001	0.047	1.210
4	0.064	21.50	-0.047	0.044	-47.233
5	0.110	26.88	0.027	-0.107	165.979
6	0.048	32.25	0.005	0.048	6.278

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - CHORD BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 610
ROT SPEED 323.2

FLT: 35-A
DATE: 8-20-75
ALT: 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
---	---	---	---	---	---
30% R STATION 81.5					
MEAN 107416.062					
1	24773.523	5.39	-21730.398	11896.113	-61.302
2	3779.711	10.77	127.001	-3777.577	178.074
3	22171.613	16.16	-21996.934	-2777.729	-97.197
4	3563.491	21.55	1095.212	3391.014	17.899
5	922.943	26.93	896.102	220.964	76.148
6	4847.855	32.32	1799.781	-4501.391	158.207
ITEM CODE B127 UNITS: IN-LB MAX OSC. 44838.469					
50% R STATION 132					
MEAN 95332.750					
1	12303.184	5.39	-10741.129	5999.711	-60.813
2	2766.653	10.77	-1005.925	-2577.302	-158.679
3	14379.836	16.16	-14301.012	-1503.576	-96.002
4	3600.053	21.55	1094.933	3429.505	17.707
5	247.914	26.93	193.095	155.487	51.158
6	4140.547	32.32	1503.962	-3857.751	158.701
ITEM CODE B123 UNITS: IN-LB MAX OSC. 28629.937					
70% R STATION 184.8					
MEAN 17564.117					
1	4870.637	5.39	-4129.652	2582.458	-57.980
2	1514.228	10.77	-902.312	-1216.026	-143.424
3	6263.437	16.16	-6260.406	194.925	-88.217
4	2503.534	21.55	864.314	2349.605	20.196
5	206.008	26.93	93.292	196.045	-17.893
6	2331.551	32.32	359.320	-2303.697	171.135
ITEM CODE B133 UNITS: IN-LB MAX OSC. 14046.602					

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - CHORD BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 615
ROT. SPEED 323.9

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN 99785.625					
1	16709.609	5.40	-14047.406	9048.836	-57.212
2	1946.896	10.80	-794.596	-1777.364	-155.912
3	13837.879	16.19	-12936.824	-4911.773	-110.790
4	2306.077	21.59	269.257	2290.304	6.705
5	714.195	26.99	-133.963	701.519	-10.811
6	5165.730	32.39	1983.008	-4769.953	157.426
UNITS: IN-LB					
ITEM CODE B127 30918.031					
MAX OSC.					
50% R STATION 132					
MEAN 92019.125					
1	7925.703	5.40	-6873.449	3946.201	-60.139
2	2024.356	10.80	-1482.776	-1378.186	-132.906
3	8886.879	16.19	-7329.914	-5024.836	-124.432
4	2408.123	21.59	-625.114	2325.573	-15.045
5	641.656	26.99	-619.032	168.883	-74.740
6	4495.984	32.39	3587.474	-2709.964	127.067
UNITS: IN-LB					
ITEM CODE B123 20560.094					
MAX OSC.					
70% R STATION 184.8					
MEAN 16964.953					
1	3422.061	5.40	-2458.144	2380.762	-45.916
2	1256.922	10.80	-1216.695	-315.447	-104.535
3	3851.265	16.19	-3849.738	108.474	-88.386
4	1802.464	21.59	681.040	1668.851	22.200
5	418.596	26.99	-175.604	379.981	-24.803
6	2473.527	32.39	-392.135	-2442.247	-170.878
UNITS: IN-LB					
ITEM CODE B133 10840.074					
MAX OSC.					

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE)-CHORD BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 614
ROT. SPEED 323.2

FLY. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KIS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	30% R STATION	81.5			
	MEAN	96634.250			
			ITEM CODE B127	UNITS: IN-LB	
			MAX OSC.	26776.594	
1	13311.086	5.39	-10955.945	7559.910	-55.393
2	1048.919	10.77	-851.286	-612.815	-125.749
3	11794.641	16.16	-10379.617	-5601.523	-118.354
4	1155.485	21.55	-214.031	1135.490	-10.675
5	1308.567	26.93	-1016.143	824.501	-50.944
6	5127.859	32.32	4126.988	-3043.505	126.407

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	50% R STATION	132			
	MEAN	90522.062			
			ITEM CODE B123	UNITS: IN-LB	
			MAX OSC.	17784.500	
1	6395.203	5.39	-4660.051	4379.793	-46.776
2	7889.018	10.77	-1785.508	112.018	-86.410
3	7526.113	16.16	-7416.492	-1279.862	-99.791
4	1345.321	21.55	189.858	1331.857	8.113
5	1187.749	26.93	-789.534	887.346	-41.662
6	4444.047	32.32	1655.468	-4124.199	158.129

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	70% R STATION	184.8			
	MEAN	16724.129			
			ITEM CODE B133	UNITS: IN-LB	
			MAX OSC.	9304.508	
1	2701.255	5.39	-1999.352	1816.417	-47.745
2	1087.480	10.77	-1068.330	-203.185	-100.768
3	3131.682	16.16	-3104.953	-408.291	-97.491
4	1057.428	21.55	297.600	1014.687	16.346
5	552.900	26.93	-346.293	431.022	-38.779
6	2442.521	32.32	1020.460	-2219.138	155.305

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - CHORD BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 613
ROT SPEED 322.5

FLY 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
	MEAN	93225.687	ITEM CODE B127 UNITS: IN-LB		
			MAX	OSC.	24587.187
1	10883.559	5.38	-5889.652	9152.258	-32.762
2	101.417	10.75	20.657	99.290	11.753
3	13081.910	16.13	-11333.770	-6533.152	-119.961
4	1815.274	21.50	224.511	1801.327	7.104
5	1373.513	26.88	-1273.057	515.621	-67.951
6	4281.711	32.25	3626.465	-2276.361	122.117
50% R STATION 132					
	MEAN	88961.687	ITEM CODE B123 UNITS: IN-LB		
			MAX	OSC.	15317.281
1	4997.742	5.38	-2148.547	4512.336	-25.461
2	599.915	10.75	-534.254	272.892	-62.942
3	7968.016	16.13	-7098.824	-3618.839	-117.012
4	1918.226	21.50	225.120	1904.970	6.740
5	1289.278	26.88	-1173.492	533.998	-65.532
6	3774.947	32.25	3114.995	-2132.376	124.394
70% R STATION 184.8					
	MEAN	16252.289	ITEM CODE B133 UNITS: IN-LB		
			MAX	OSC.	7383.676
1	1924.046	5.38	-842.749	1729.662	-25.977
2	425.350	10.75	-414.663	-94.745	-102.870
3	3162.613	16.13	-3054.539	-819.703	-105.022
4	1326.839	21.50	478.455	1237.572	21.137
5	635.092	26.88	-507.449	381.886	-53.036
6	2031.177	32.25	1185.943	-1649.007	144.277

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - CHORD BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 612
ROT. SPEED 323.2

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN 90562.125					
1	10516.770	5.39	-2982.091	10085.117	-16.473
2	899.876	10.77	-891.895	-119.588	-97.637
3	8359.379	16.16	-7197.043	-4252.270	-120.576
4	941.317	21.55	-480.353	809.530	-30.684
5	1453.368	26.93	-1398.134	397.594	-74.126
6	1555.372	32.32	1424.790	-623.825	113.646
50% R STATION 132					
MEAN 87870.500					
1	5055.625	5.39	-763.244	4997.684	-8.683
2	900.455	10.77	-727.763	530.264	-53.922
3	4988.914	16.16	-4272.773	-2575.403	-121.079
4	1133.989	21.55	-796.311	807.354	-44.605
5	1108.778	26.93	-1080.700	247.948	-77.078
6	1586.163	32.32	1563.736	-265.784	99.646
70% R STATION 184.8					
MEAN 16011.672					
1	1953.080	5.39	-298.084	1930.199	-8.779
2	494.605	10.77	-413.764	270.986	-56.778
3	1816.744	16.16	-1771.027	-404.996	-102.881
4	813.806	21.55	-315.090	750.332	-22.779
5	668.465	26.93	-601.869	290.859	-64.207
6	866.354	32.32	700.194	-510.195	126.079

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - CHORD BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO 20391
REC. NO. 911
ROI SPEED 322.5
FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.
G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--TAS

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN 89392.500					
1	11736.492	5.38	-2444.083	11479.187	-12.020
2	1587.338	10.75	-865.765	1330.448	-33.053
3	3160.705	16.13	-3151.661	-238.933	-94.335
4	639.553	21.50	-66.857	-636.049	-173.999
5	524.626	26.88	-433.620	-295.307	-124.256
6	715.968	32.25	45.207	714.539	3.620
50% R STATION 132					
MEAN 87693.312					
1	6482.465	5.38	-252.381	6477.551	-2.231
2	2644.058	10.75	-812.122	2516.248	-17.888
3	2314.982	16.13	-2314.935	14.802	-89.634
4	767.022	21.50	-356.096	-679.352	-152.338
5	322.646	26.88	-314.018	-74.117	-103.280
6	745.975	32.25	-179.535	724.049	-13.926
70% R STATION 184.8					
MEAN 15724.906					
1	2310.539	5.38	-129.285	2306.920	-3.208
2	1098.396	10.75	-353.462	1039.971	-18.772
3	1123.729	16.13	-942.267	612.292	-56.984
4	739.940	21.50	-541.225	-504.565	-132.992
5	221.429	26.88	-160.643	-152.396	-133.491
6	603.763	32.25	316.347	514.251	31.598

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - BEAM BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
ROT SPEED 323.2
FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.
G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS
PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

30% R STATION 81.5
MEAN 918.017
ITEM CODE B126 UNITS: IN-LB
MAX OSC. 15616.352

1	10460.281	5.39	-9859.387	3494.280	-70.485
2	3806.534	10.77	3111.498	-2192.780	125.174
3	856.221	16.16	694.381	500.948	54.192
4	714.811	21.55	-25.082	714.371	2.011
5	502.111	26.93	-241.497	-440.221	-151.252
6	155.942	32.32	74.618	-136.931	151.412

50% R STATION 132
MEAN -2166.566
ITEM CODE B122 UNITS: IN-LB
MAX OSC. 10457.133

1	7045.309	5.39	-6384.969	2978.010	-64.995
2	2950.532	10.77	2684.506	-1224.364	114.517
3	2392.755	16.16	2315.309	603.839	75.383
4	451.676	21.55	-2.364	451.669	-0.300
5	184.798	26.93	-27.217	182.783	-8.469
6	6.868	32.32	-6.727	-1.386	-101.642

70% R STATION 184.8
MEAN -3524.502
ITEM CODE B132 UNITS: IN-LB
MAX OSC. 8752.105

1	4942.512	5.39	-4773.641	1280.934	-74.979
2	2472.430	10.77	1971.378	-1492.174	127.123
3	3690.878	16.16	3689.575	98.072	88.477
4	306.996	21.55	109.678	-286.735	159.068
5	292.706	26.93	222.554	-190.122	130.506
6	94.570	32.32	15.953	93.215	9.712

90% R STATION 238.1
MEAN 859.568
ITEM CODE B134 UNITS: IN-LB
MAX OSC. 3985.158

1	1304.302	5.39	-1164.634	587.225	-116.758
2	1023.648	10.77	821.341	-610.945	126.643
3	1483.557	16.16	1473.070	176.080	83.184
4	326.518	21.55	185.966	-268.385	145.282
5	278.385	26.93	131.620	-245.304	151.784
6	57.956	32.32	-28.640	50.386	-29.614

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - BEAM BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 615
ROT. SPEED 323.9

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
	MEAN	-856.683			
1	8340.422	5.40	-8111.160	1942.089	-76.535
2	3427.606	10.80	3026.973	-1608.078	117.979
3	936.886	16.19	-571.542	742.359	-37.593
4	801.779	21.59	-311.494	738.797	-22.861
5	238.471	26.99	238.223	-10.852	92.608
6	234.347	32.39	186.041	142.504	52.549
50% R STATION 132					
	MEAN	-2542.590			
1	6131.844	5.40	-5881.285	1734.938	-73.564
2	2875.173	10.80	2693.591	-1005.580	110.472
3	1494.428	16.19	-1158.020	944.619	-50.795
4	346.073	21.59	-177.891	296.853	-30.932
5	108.144	26.99	-71.603	81.044	-41.461
6	34.436	32.39	-31.201	14.572	-64.965
70% R STATION 184.8					
	MEAN	-3990.693			
1	4220.008	5.40	-4107.918	966.181	-76.765
2	2505.413	10.80	1729.986	-1812.248	136.330
3	524.499	16.19	-2499.244	-482.399	100.925
4	386.782	21.59	-329.558	-408.032	-141.073
5	215.705	26.99	386.009	-24.443	93.623
6		32.39	-153.032	152.019	-45.190
90% R STATION 238.1					
	MEAN	1158.425			
1	1030.751	5.40	-949.677	400.701	-112.877
2	832.907	10.80	674.880	-488.130	125.878
3	1041.571	16.19	-1041.563	44.310	89.763
4	278.912	21.59	-124.097	-249.783	-153.581
5	276.992	26.99	272.365	-50.422	-100.488
6	233.804	32.39	-154.560	175.429	-41.381

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE)-BEAM BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 614
ROT SPEED 323.2
FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.
G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--IAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

30% R STATION 81.5
MEAN -1267.515

ITEM CODE B126 UNITS: IN-LB
MAX OSC. 11266.023

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	6856.891	5.39	-6485.820	2225.110	-71.064
2	3143.190	10.77	2296.283	-2146.329	133.067
3	972.760	16.16	78.530	969.585	4.630
4	632.216	21.55	416.116	475.967	41.162
5	257.523	26.93	255.146	-34.909	97.791
6	285.643	32.32	284.903	20.549	85.875

50% R STATION 132
MEAN -2975.998

ITEM CODE B122 UNITS: IN-LB
MAX OSC. 8121.703

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	5243.723	5.39	-4912.480	1834.167	-69.526
2	2886.320	10.77	2224.794	-1838.786	129.574
3	1271.731	16.16	1255.640	201.668	80.876
4	281.800	21.55	139.606	244.788	29.697
5	78.715	26.93	75.680	-21.649	105.964
6	47.764	32.32	-27.016	39.390	-34.444

70% R STATION 184.8
MEAN -4221.258

ITEM CODE B132 UNITS: IN-LB
MAX OSC. 6937.355

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	3812.416	5.39	-3735.872	760.116	-78.499
2	2162.356	10.77	1700.074	-1336.239	128.167
3	1839.366	16.16	1826.208	-219.614	96.857
4	655.393	21.55	-590.992	-283.316	-115.613
5	535.156	26.93	-534.692	-22.292	-92.387
6	247.440	32.32	-220.827	111.632	-63.183

90% R STATION 238.1
MEAN 990.134

ITEM CODE B134 UNITS: IN-LB
MAX OSC. 3041.814

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
1	884.272	5.39	-819.359	-332.547	-112.090
2	647.925	10.77	605.115	-231.609	110.944
3	766.505	16.16	764.212	59.241	85.567
4	326.974	21.55	-231.881	-230.529	-134.832
5	331.330	26.93	-326.971	-53.566	-99.304
6	224.723	32.32	-139.016	176.564	-38.215

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - BEAM BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 613
ROT SPEED 322.5

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KTS--TAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN -1173.192					
1	5364.715	5.38	-5105.754	1646.653	-72.125
2	2264.346	10.75	1803.831	-1368.742	127.191
3	1903.077	16.13	487.663	1839.535	14.848
4	727.207	21.50	61.534	724.599	4.854
5	553.122	26.88	308.221	459.286	33.865
6	345.050	32.25	200.365	280.916	35.499
ITEM CODE B126 UNITS: IN-LB					
MAX OSC. 9356.523					
50% R STATION 132					
MEAN -3187.332					
1	4572.508	5.38	-4307.754	1533.328	-70.407
2	2016.485	10.75	1459.514	-1391.414	133.632
3	1110.422	16.13	985.629	511.444	63.575
4	165.407	21.50	113.197	120.606	43.185
5	275.475	26.88	-48.184	-271.228	-169.926
6	75.600	32.25	-47.018	-59.200	-141.542
ITEM CODE B122 UNITS: IN-LB					
MAX OSC. 6745.848					
70% R STATION 184.8					
MEAN -4370.012					
1	3341.745	5.38	-3230.084	856.632	-75.147
2	1462.723	10.75	1004.483	-1063.284	136.629
3	1471.625	16.13	1455.914	-214.465	98.380
4	381.061	21.50	-339.177	-173.685	-117.116
5	669.588	26.88	-666.894	59.999	-84.859
6	265.685	32.25	-234.368	125.141	-61.900
ITEM CODE B132 UNITS: IN-LB					
MAX OSC. 5675.055					
90% R STATION 238.1					
MEAN 793.892					
1	734.488	5.38	-675.846	287.585	-113.051
2	393.411	10.75	365.312	-146.012	111.786
3	637.500	16.13	637.376	-12.546	91.128
4	217.550	21.50	-109.003	-188.273	-149.931
5	363.205	26.88	-358.919	55.636	-81.189
6	257.506	32.25	-109.841	232.904	-25.249
ITEM CODE B134 UNITS: IN-LB					
MAX OSC. 2683.555					

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - BEAM BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 612
ROT SPEED 323.2

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KIS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN -1106.180					
1	4638.109	5.39	-4368.148	1559.275	-70.355
2	1870.317	10.77	732.404	-1720.950	156.946
3	1627.719	16.16	124.743	1622.932	4.395
4	587.428	21.55	-587.383	-7.246	-90.707
5	692.906	26.93	191.104	666.031	16.010
6	224.670	32.32	131.901	181.876	35.951
50% R STATION 132					
MEAN -3125.109					
1	3788.803	5.39	-3477.091	1504.949	-66.596
2	2028.343	10.77	514.414	-1962.028	165.309
3	707.411	16.16	612.161	354.527	59.923
4	219.238	21.55	188.693	-111.625	120.607
5	476.463	26.93	-332.391	-341.370	-135.764
6	140.464	32.32	-119.004	-74.621	-122.089
70% R STATION 184.8					
MEAN -4386.289					
1	2628.511	5.39	-2479.450	872.583	-70.612
2	1717.273	10.77	410.644	-1667.453	166.165
3	376.546	16.16	668.238	-628.307	133.236
4	458.603	21.55	175.725	-333.028	152.181
5	184.504	26.93	-380.789	-255.571	-123.868
6		32.32	61.065	174.106	-19.327
90% R STATION 238.1					
MEAN 716.174					
1	529.269	5.39	-461.583	258.973	-119.295
2	472.644	10.77	271.471	-386.905	144.945
3	314.505	16.16	367.480	-337.214	132.541
4	113.110	21.55	65.259	-307.660	168.024
5	372.239	26.93	-105.514	-40.750	-111.117
6		32.32	269.572	256.696	46.401

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - BEAM BENDING MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 611
ROT. SPEED 322.5

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS --TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

30% R STATION 81.5
MEAN -764.962

ITEM	CODE	B126	UNITS:	IN-LB
		MAX OSC.	6633.418	
1	3632.090	-3589.817	552.535	-81.250
2	2061.304	760.498	-1915.885	158.350
3	537.184	-222.867	488.771	-24.512
4	1078.182	-401.851	-1000.496	-158.117
5	376.648	-96.313	364.126	-14.816
6	189.071	145.023	-121.310	129.912

50% R STATION 132
MEAN -2969.832

ITEM	CODE	B122	UNITS:	IN-LB
		MAX OSC.	5403.992	
1	2971.727	-2885.739	709.702	-76.183
2	2390.539	570.472	-2321.474	166.194
3	607.598	595.707	-119.620	101.354
4	351.513	201.352	-288.131	145.053
5	408.493	-6.989	408.434	-179.020
6	221.737	171.049	-141.101	50.480

70% R STATION 184.8
MEAN -4537.430

ITEM	CODE	B132	UNITS:	IN-LB
		MAX OSC.	5148.973	
1	2143.048	-2040.981	653.493	-72.246
2	2156.764	483.730	-2101.818	167.039
3	1475.924	694.868	-1302.118	151.914
4	867.456	851.612	165.035	79.032
5	67.274	6.826	-66.926	174.177
6	385.246	-296.154	246.388	-50.241

90% R STATION 238.1
MEAN 602.158

ITEM	CODE	B134	UNITS:	IN-LB
		MAX OSC.	3339.234	
1	407.459	-352.066	205.117	-120.225
2	544.581	287.200	-462.693	148.171
3	818.263	376.547	-726.476	152.601
4	408.968	383.949	-140.847	110.145
5	201.293	63.140	191.134	18.281
6	356.667	-153.443	321.973	-25.481

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE)-TORSION MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 610
ROI SPEED 323.3

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN -7276.148					
1	3662.685	5.39	879.755	3555.460	13.898
2	3648.027	10.78	499.489	-3613.670	172.130
3	1389.281	16.16	946.210	1017.246	42.928
4	458.857	21.55	-196.884	-414.472	-154.591
5	571.247	26.94	-353.781	448.511	-38.266
6	386.831	32.33	-380.130	71.690	-79.320

ITEM	CODE	M935	UNITS:	IN-LB
MAX	OSC.	8188.879		
1	996.873	3341.836		16.610
2	-268.189	-2644.013		-174.208
3	-274.760	655.341		39.109
4	-274.071	-434.023		-147.729
5	-103.333	359.137		-16.052
6	-354.562	156.344		-66.205

ITEM	CODE	M936	UNITS:	IN-LB
MAX	OSC.	4464.453		
1	1395.022	2691.508		27.398
2	-622.785	-1641.371		-159.222
3	15.383	354.058		2.488
4	-223.712	-271.259		-140.487
5	-44.205	247.931		-10.109
6	-298.026	106.695		-70.302

ITEM	CODE	M937	UNITS:	IN-LB
MAX	OSC.	2441.820		
1	779.496	1746.894		24.047
2	-571.434	-345.009		-121.122
3	-246.574	-0.764		-90.178
4	-164.660	26.563		-80.836
5	-22.341	201.201		-6.336
6	-102.701	19.262		-79.377

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - TORSION MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 615
ROT SPEED 324.0

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN -6147.176					
1	3171.758	5.40	296.811	3157.840	5.370
2	3370.700	10.80	1226.852	-3139.500	158.655
3	1256.153	16.20	365.558	1201.786	16.919
4	712.558	21.60	-3.477	-712.550	-179.720
5	599.971	27.00	-577.697	-161.963	-105.661
6	280.519	32.40	-212.193	-183.480	-130.849
ITEM CODE M150 UNITS: IN-LB					
MAX OSC. 7816.914					
50% R STATION 132					
MEAN -4008.883					
1	2984.146	5.40	934.221	2834.142	18.244
2	2426.304	10.80	-462.447	-2381.826	-169.012
3	764.601	16.19	620.084	447.336	54.193
4	685.206	21.59	-483.131	-485.892	-135.163
5	427.951	26.99	-280.823	322.925	-41.011
6	263.770	32.39	-248.356	88.849	-70.315
ITEM CODE M935 UNITS: IN-LB					
MAX OSC. 5494.262					
70% R STATION 184.8					
MEAN -3447.066					
1	2632.129	5.40	1265.644	2307.867	28.741
2	1555.976	10.80	-717.848	-1380.491	-152.526
3	257.800	16.19	188.914	175.420	47.121
4	463.124	21.59	-377.265	-268.618	-125.451
5	272.575	26.99	-136.697	235.820	-30.099
6	205.261	32.39	-204.166	21.178	-84.078
ITEM CODE M936 UNITS: IN-LB					
MAX OSC. 3971.871					
90% R STATION 238.1					
MEAN 676.328					
1	1586.971	5.40	654.843	1445.565	24.371
2	653.381	10.80	-559.183	-337.966	-121.148
3	161.310	16.19	-135.120	-88.111	-123.108
4	181.208	21.59	-179.686	23.432	-82.570
5	152.396	26.99	-1.911	152.384	-0.719
6	56.194	32.39	-37.680	-41.690	-137.892
ITEM CODE M937 UNITS: IN-LB					
MAX OSC. 2060.104					

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - TORSION MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 614
ROT SPEED 323.3
FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.
G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS
PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
MEAN -5786.234					
1	2850.656	5.39	543.390	2798.387	10.989
2	2960.261	10.78	514.905	-2915.136	169.983
3	1188.045	16.16	785.389	891.413	41.382
4	635.447	21.55	-406.694	-488.255	-140.207
5	437.939	26.94	-434.483	54.915	-82.796
6	198.276	32.33	-187.951	63.148	-71.428
ITEM CODE M150 UNITS: IN-LB					
MAX OSC. 6666.695					
50% R STATION 132					
MEAN -3757.018					
1	2714.716	5.39	647.564	2636.350	13.800
2	2084.238	10.77	-120.692	-2080.741	-176.680
3	698.073	16.16	528.965	455.524	49.266
4	633.957	21.55	-464.148	-431.820	-132.934
5	310.340	26.93	-291.976	105.170	-70.191
6	139.399	32.32	-137.038	25.547	-79.440
ITEM CODE M935 UNITS: IN-LB					
MAX OSC. 4753.531					
70% R STATION 184.8					
MEAN -3283.625					
1	2391.622	5.39	968.979	2186.535	23.901
2	1300.854	10.77	-465.751	-1214.618	-159.020
3	248.331	16.16	173.634	177.538	44.363
4	435.708	21.55	-350.099	-259.369	-126.533
5	164.389	26.93	-135.930	92.448	-55.780
6	55.855	32.32	-52.912	-17.892	-108.683
ITEM CODE M936 UNITS: IN-LB					
MAX OSC. 3439.520					
90% R STATION 238.1					
MEAN 764.108					
1	1414.081	5.39	495.666	1324.365	20.519
2	576.181	10.77	-422.392	-391.880	-132.854
3	114.898	16.16	-89.888	-71.567	-128.526
4	144.751	21.55	-144.386	10.279	-85.928
5	92.890	26.93	5.041	92.753	3.111
6	64.614	32.32	31.410	-56.466	150.914
ITEM CODE M937 UNITS: IN-LB					
MAX OSC. 1785.871					

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - TORSION MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 613
ROT SPEED 322.6

FLT. 35-A-75
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
30% R STATION 81.5					
	MEAN	-5334.336			
1	2469.565	5.38	619.463	2390.610	14.527
2	2241.254	10.75	337.888	-2215.638	171.329
3	1006.977	16.13	826.153	-575.737	-55.128
4	681.954	21.50	-407.892	-546.521	-143.264
5	592.781	26.88	-587.772	76.896	-82.546
6	112.015	32.25	-102.306	45.616	-65.969
UNITS: IN-LB MAX OSC. 5905.602					
50% R STATION 132					
	MEAN	-3378.090			
1	2368.502	5.38	680.827	2268.541	16.705
2	1586.355	10.75	-189.104	-1575.043	-173.154
3	527.529	16.13	514.428	116.835	77.204
4	626.063	21.50	-443.289	-442.097	-134.923
5	394.720	26.88	-311.766	242.087	-52.171
6	84.621	32.25	-21.155	81.934	-14.478
UNITS: IN-LB MAX OSC. 4244.453					
70% R STATION 184.8					
	MEAN	-2977.525			
1	2058.987	5.38	943.195	1830.249	27.264
2	958.520	10.75	-339.826	-896.259	-159.235
3	180.026	16.13	175.641	-39.491	102.672
4	411.020	21.50	-323.941	-252.982	-127.988
5	267.981	26.88	-111.458	243.703	-24.577
6	81.639	32.25	43.175	69.288	31.928
UNITS: IN-LB MAX OSC. 3198.943					
90% R STATION 238.1					
	MEAN	860.695			
1	1229.375	5.38	463.344	1138.717	22.141
2	404.579	10.75	-283.584	-288.556	-135.498
3	124.486	16.13	-89.324	-86.706	-134.148
4	136.928	21.50	-136.725	7.457	-86.878
5	111.844	26.88	17.615	110.448	9.062
6	60.887	32.25	44.948	-41.072	132.420
UNITS: IN-LB MAX OSC. 1681.954					

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - TORSION MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 612
ROT. SPEED 323.3

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

30% R STATION 81.5 UNITS: IN-LB
MEAN -4908.402 4818.332

ITEM	CODE	M150	MAX	OSC.	UNITS:	IN-LB
1	640	523	2027	186		17.535
2	6	346	1610	526		-179.774
3	818	824	260	685		72.340
4	28	556	420	012		-176.110
5	575	816	87	003		-81.408
6	75	453	47	587		-57.761

50% R STATION 132 UNITS: IN-LB
MEAN -3113.732 3366.437

ITEM	CODE	M935	MAX	OSC.	UNITS:	IN-LB
1	736	431	1873	803		21.456
2	218	458	1051	889		-168.267
3	538	767	104	424		100.969
4	82	521	348	943		-166.695
5	278	865	230	808		-50.387
6	8	745	75	803		6.581

70% R STATION 184.8 UNITS: IN-LB
MEAN -2827.008 2765.891

ITEM	CODE	M936	MAX	OSC.	UNITS:	IN-LB
1	893	368	1501	993		30.744
2	236	664	488	654		-154.158
3	265	467	177	447		123.760
4	91	877	220	895		-157.416
5	68	121	241	878		-15.729
6	98	478	85	025		49.193

90% R STATION 238.1 UNITS: IN-LB
MEAN 1021.658 1414.540

ITEM	CODE	M937	MAX	OSC.	UNITS:	IN-LB
1	381	791	958	344		21.722
2	219	186	104	577		-115.506
3	15	245	41	198		-159.694
4	66	977	27	242		-67.867
5	2	521	105	130		1.374
6	3	314	25	438		-172.577

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: MAIN ROTOR (RED BLADE) - TORSION MOMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 611
ROT SPEED 322.6

FLI 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	30% R STATION	81.5	ITEM CODE M150	4051.518	UNITS: IN-LB
	MEAN	-4690.477	MAX OSC.		
1	1779.225	5.38	618.932	1668.103	20.357
2	1351.555	10.75	-217.260	-1333.979	-170.750
3	800.191	16.13	791.762	115.836	81.677
4	92.255	21.51	68.619	61.664	48.056
5	228.835	26.88	-188.695	-129.458	-124.453
6	281.245	32.26	276.503	51.432	79.463

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	50% R STATION	132	ITEM CODE M935	2473.553	UNITS: IN-LB
	MEAN	-3022.338	MAX OSC.		
1	1733.640	5.38	660.427	1602.917	22.392
2	878.328	10.75	-308.621	-822.322	-159.429
3	587.049	16.13	578.882	-97.384	99.569
4	201.327	21.50	171.941	104.731	58.634
5	104.088	26.88	-95.694	40.952	-66.832
6	201.681	32.25	200.578	-21.059	95.994

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	70% R STATION	184.8	ITEM CODE M936	2396.494	UNITS: IN-LB
	MEAN	-2762.869	MAX OSC.		
1	1543.507	5.38	766.864	1339.528	29.791
2	395.631	10.75	-295.962	-262.546	-131.576
3	348.033	16.13	329.137	-113.118	108.967
4	141.578	21.50	127.356	61.846	64.098
5	139.139	26.88	4.059	139.080	1.672
6	137.676	32.25	132.885	-36.005	105.160

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	90% R STATION	238.1	ITEM CODE M937	1387.679	UNITS: IN-LB
	MEAN	1031.461	MAX OSC.		
1	885.465	5.38	302.700	832.119	19.990
2	232.654	10.75	-232.410	-10.669	-92.628
3	79.169	16.13	-28.001	79.169	-0.001
4	93.202	21.50	-28.142	88.852	-17.574
5	29.202	26.88	24.723	15.729	57.535
6	121.480	32.25	81.599	-89.995	137.801

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 610
ROT SPEED 322.7

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ CYCLIC F/A BOOST CYL MEAN

	AMP	HZ	MEAN	BOOST CYL	MEAN	ITEM CODE F100 MAX OSC.	UNITS: LB	COS	SIN	PHASE ANGLE
1	61.263	5.38	-24.372			-60.314	10.742			-79.901
2	721.345	10.76				581.274	-427.491			126.332
3	46.379	16.13				35.703	-29.602			129.662
4	69.044	21.51				5.579	-68.819			175.365
5	28.750	26.89				-2.491	-28.642			-175.030
6	57.914	32.27				-51.855	25.790			-63.556

CYCLIC LAT BOOST CYL
MEAN

	MEAN	BOOST CYL	MEAN	ITEM CODE F101 MAX OSC.	UNITS: LB
1	76.014	5.38	-644.436	1.879	178.584
2	815.807	10.76		40.701	177.140
3	79.767	16.13		26.373	160.693
4	45.217	21.51		-22.341	-29.610
5	7.719	26.89		-3.385	-26.014
6	113.331	32.27		57.577	30.534

COLLECTIVE BOOST CYL
MEAN

	MEAN	BOOST CYL	MEAN	ITEM CODE F102 MAX OSC.	UNITS: LB
1	36.578	5.38	913.509	-36.501	-86.290
2	972.826	10.76		184.317	10.922
3	9.686	16.13		9.513	100.860
4	51.858	21.51		7.348	8.146
5	7.065	26.89		2.791	156.727
6	71.841	32.27		-61.905	-120.494

M/R RED PITCH LINK
MEAN

	MEAN	PITCH LINK	MEAN	ITEM CODE F103 MAX OSC.	UNITS: LB
1	716.148	5.38	759.081	-219.159	-162.180
2	689.599	10.76		408.959	36.373
3	43.869	16.13		53.247	151.350
4	62.320	21.51		-38.498	64.335
5	53.717	26.89		26.991	97.255
6	33.792	32.27		-26.784	44.222

HARMONIC ANALYSIS: AXIAL FORCES
 LEVEL FLIGHT SWEEP

MODEL AH-1G
 SHIP 20391
 REC. NO. 610
 ROT SPEED 323.2

FLT: 35-A
 DATE: 8-20-75
 ALT: 5000. FT.

G.W. 8320 LB.
 C.G. 200.6 IN.
 TEST CONDITION: FORWARD FLIGHT
 A/S 142.0 KTS--TAS

PROBLEM 1
 REPORT
 FORWARD FLIGHT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE

M/R WHITE PITCH LINK
 MEAN 635.590

ITEM CODE F104
 MAX OSC. 1262.023

1	712.550	5.38	164.534	693.294	13.351
2	818.189	10.76	383.588	722.699	27.958
3	27.715	16.13	-13.582	74.159	-29.344
4	91.124	21.51	70.470	57.772	50.655
5	64.288	26.89	-63.654	-9.011	-98.057
6	26.322	32.27	-14.031	22.271	-32.211

LIFT LINK
 MEAN 5203.117

ITEM CODE F050
 MAX OSC. 2300.443

1	239.527	5.38	190.436	-145.284	127.340
2	1982.242	10.76	-1958.098	308.441	-81.048
3	115.655	16.13	-81.186	82.371	-44.585
4	325.212	21.51	-104.287	-308.037	-161.296
5	22.374	26.89	9.563	20.228	25.304
6	35.212	32.27	-35.212	-0.021	-90.034

M/R RED DRAG BRACE
 MEAN 8754.395

ITEM CODE F105
 MAX OSC. 3436.150

1	1870.653	5.39	1542.531	-1058.273	124.453
2	328.531	10.77	-72.301	320.477	-12.713
3	1506.665	16.16	1498.461	157.018	84.018
4	138.995	21.55	-48.469	-130.271	-159.591
5	62.050	26.93	-61.617	-7.320	-96.775
6	217.902	32.32	-39.101	214.365	-10.337

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 615
ROT. SPEED 323.4

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM AMP HZ SIN COS PHASE ANGLE

CYCLIC F/A BOOST CYL 32.506

ITEM	MEAN	MAX OSC.	UNITS:	LB
1	15.809	-15.110	-4.647	-107.096
2	560.370	500.886	-251.254	116.639
3	31.863	31.847	-0.988	91.778
4	91.050	68.772	-59.671	130.947
5	16.588	15.888	-4.768	106.703
6	88.029	-58.327	-65.932	-138.502

CYCLIC LAT BOOST CYL -505.016

ITEM	MEAN	MAX OSC.	UNITS:	LB
1	76.846	24.158	-72.950	161.677
2	728.312	143.312	-714.073	168.652
3	52.455	41.751	-31.753	127.255
4	74.374	-37.656	-64.136	-149.581
5	8.665	-8.417	2.052	-76.252
6	76.711	-49.126	58.918	-39.821

COLLECTIVE BOOST CYL 690.145

ITEM	MEAN	MAX OSC.	UNITS:	LB
1	21.151	-17.622	11.698	-56.423
2	925.923	-99.653	920.545	-6.178
3	3.303	0.631	3.243	11.017
4	67.044	-20.139	63.948	-17.481
5	3.727	-3.716	-0.291	-94.473
6	45.755	-9.157	-44.829	-168.455

M/R RED PITCH LINK 587.920

ITEM	MEAN	MAX OSC.	UNITS:	LB
1	598.065	-171.174	-573.046	-163.369
2	660.340	217.688	623.427	19.248
3	53.987	-12.946	-52.411	-166.125
4	68.873	26.794	63.448	22.895
5	33.112	4.579	32.794	7.949
6	37.245	-10.099	35.850	-15.733

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 615
ROT SPEED 323.9

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

M/R WHITE PITCH LINK 479.166 UNITS: LB

ITEM	MEAN	MAX OSC.	UNITS	LB
1	611.967	176.340	586.010	16.747
2	732.185	213.398	700.397	16.945
3	55.373	19.558	51.804	20.684
4	84.894	34.198	77.701	23.755
5	45.230	-15.726	-42.408	-159.654
6	21.942	-5.353	21.278	-14.122

LIFT LINK 4988.840 UNITS: LB

ITEM	MEAN	MAX OSC.	UNITS	LB
1	179.272	136.942	-115.695	130.193
2	1611.748	-1602.529	172.134	-83.869
3	41.772	-41.509	-4.684	-96.438
4	240.302	-49.548	-235.139	-168.101
5	7.355	0.266	7.350	2.074
6	124.413	-123.350	-16.228	-97.495

M/R RED DRAG BRACE 9597.301 UNITS: LB

ITEM	MEAN	MAX OSC.	UNITS	LB
1	1302.402	1078.727	-729.794	124.080
2	200.976	-39.287	197.098	-11.273
3	921.092	742.730	544.760	53.742
4	71.397	12.151	-70.356	170.202
5	34.974	26.894	-22.358	129.738
6	224.842	-163.321	154.532	-46.584

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 614
ROT SPEED 322.7

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

CYCLIC F/A BOOST CYL		ITEM CODE F100		UNITS: LB	
MEAN 104.634		MAX OSC.		565.898	
1	3.761	0.232	-231.165	3.754	3.531
2	455.575	392.570	-8.301	-8.301	120.492
3	27.657	26.382	-85.218	-7.088	107.466
4	91.292	32.744	-10.580	-13.507	158.981
5	12.735	26.89	-90.227		123.819
6	91.232	32.27			-98.514

CYCLIC LAT BOOST CYL		ITEM CODE F101		UNITS: LB	
MEAN -403.133		MAX OSC.		732.328	
1	73.614	16.198	-71.810	-71.810	167.288
2	640.477	-35.677	-639.453	-39.079	-176.806
3	47.171	26.418	-90.475	0.240	-145.941
4	129.093	-92.082	9.429	10.058	-134.496
5	9.433	8.923			88.540
6	13.446				41.579

COLLECTIVE BOOST CYL		ITEM CODE F102		UNITS: LB	
MEAN 588.047		MAX OSC.		826.898	
1	21.112	-10.616	18.249	18.249	-30.189
2	782.923	-23.245	782.578	6.877	-1.701
3	11.246	8.898	75.428	75.428	52.299
4	77.132	-19.124	-5.603	3.773	-12.066
5	6.755	-19.448	-27.494		-56.047
6	33.677				-144.726

M/R RED PITCH LINK		ITEM CODE F103		UNITS: LB	
MEAN 514.798		MAX OSC.		984.970	
1	533.043	-219.650	-485.684	-485.684	-155.665
2	560.314	217.428	520.745	520.745	22.662
3	80.859	-69.038	-42.095	-42.095	-121.372
4	64.113	44.589	45.068	45.068	44.065
5	27.533	-0.493	27.529	27.529	-1.026
6	31.789	9.439	30.355	30.355	17.272

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 614
ROT SPEED 323.2

FLT 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS

PROBLEM 1
REPORT

HARM --- AMP --- HZ --- SIN --- COS --- PHASE ANGLE ---

M/R WHITE PITCH LINK		ITEM CODE F104		UNITS: LB	
MEAN 413.660		MAX OSC.		1035.758	
1	550.053	249.174	490.378	26.936	
2	628.651	275.129	565.249	25.954	
3	80.466	76.217	25.801	71.298	
4	83.627	61.320	56.863	47.159	
5	28.183	-15.386	-23.613	-146.911	
6	22.779	9.296	20.795	24.087	

LIFT LINK		ITEM CODE F050		UNITS: LB	
MEAN 4987.043		MAX OSC.		1550.520	
1	158.974	119.616	-104.713	131.199	
2	1330.245	-1240.769	479.631	-68.865	
3	59.525	-58.822	9.116	-81.191	
4	171.492	-148.334	-86.061	-120.122	
5	15.848	-15.443	3.561	-77.015	
6	195.123	-135.561	140.344	-44.007	

M/R RED DRAG BRACE		ITEM CODE F105		UNITS: LB	
MEAN 9848.641		MAX OSC.		1866.689	
1	1063.426	713.238	-788.776	137.879	
2	132.438	6.817	132.262	2.950	
3	770.058	750.939	170.525	77.206	
4	16.150	-8.338	-13.832	-148.917	
5	71.148	42.463	-57.088	143.358	
6	216.241	-53.840	209.431	-14.417	

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 613
ROT. SPEED 322.0

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
CYCLIC F/A BOOST CYL					
	MEAN	139.446			
1	8.731	5.37	7.276	-4.826	123.558
2	416.807	10.73	353.058	-221.537	122.108
3	16.554	16.10	15.974	-4.345	105.216
4	111.034	21.47	17.948	-109.574	170.698
5	5.710	26.83	3.948	-4.125	136.254
6	114.714	32.20	-109.960	32.684	-73.446
CYCLIC LAT BOOST CYL					
	MEAN	-334.362			
1	66.167	5.37	9.313	-65.509	171.908
2	600.078	10.73	-164.578	-577.069	-164.082
3	31.913	16.10	12.964	-29.162	-156.032
4	161.813	21.47	-139.582	-81.856	-120.389
5	4.827	26.83	4.347	-2.099	-115.779
6	22.634	32.20	-4.131	-22.253	-169.484
COLLECTIVE BOOST CYL					
	MEAN	491.648			
1	23.342	5.37	-0.828	23.327	-2.032
2	557.572	10.73	0.002	557.572	0.000
3	7.415	16.10	0.069	-7.415	179.469
4	39.458	21.47	-10.637	37.997	-15.640
5	7.708	26.83	-4.742	-6.076	-142.028
6	18.767	32.20	-12.222	-14.242	-139.363
M/R RED PITCH LINK					
	MEAN	430.820			
1	498.543	5.37	-272.130	-417.721	-146.917
2	413.330	10.73	158.528	381.720	-22.553
3	124.096	16.10	-123.665	-10.333	-94.776
4	32.562	21.47	9.728	31.075	-17.383
5	55.242	26.83	-10.225	54.287	-10.667
6	22.210	32.20	20.934	7.422	-70.479

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G FLI: 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT
REC. NO. 613 ALI. 5000. FT. TEST CONDITION: FORWARD FLIGHT
ROT SPEED 322.5 A/S 101.0 KTS--IAS

HARM AMP HZ SIN COS PHASE ANGLE

M/R WHITE PITCH LINK		ITEM CODE F104	UNITS:	LB
MEAN		MAX OSC.	875.546	
1	536.214	258.440	469.824	28.814
2	455.599	113.463	441.244	14.421
3	114.300	111.514	25.081	77.324
4	45.912	8.644	45.090	10.853
5	38.502	15.080	-35.426	156.942
6	19.017	8.907	16.802	27.929

LIFT LINK		ITEM CODE F050	UNITS:	LB
MEAN		MAX OSC.	1216.093	
1	134.306	81.060	-107.085	142.875
2	1010.330	-877.281	501.142	-60.263
3	20.397	-10.728	17.348	-31.734
4	198.011	-95.125	-173.665	-151.288
5	31.582	-19.881	24.540	-39.013
6	205.268	-106.944	175.208	-31.399

M/R RED DRAG BRACE		ITEM CODE F105	UNITS:	LB
MEAN		MAX OSC.	1938.625	
1	947.812	427.957	-845.695	153.159
2	98.677	-69.722	69.828	-44.956
3	841.673	732.461	414.626	60.487
4	66.356	-19.450	-63.441	-162.956
5	92.493	92.352	-5.107	93.165
6	192.034	-140.850	130.531	-47.178

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT 35-A G.W. 8320 LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT
REC. NO. 612 ALT. 5000. FT. TEST CONDITION: FORWARD FLIGHT
ROT SPEED 322.7 A/S 85.0 KTS--TAS

HARM AMP HZ SIN COS PHASE ANGLE

CYCLIC F/A BOOST CYL		ITEM CODE F100	UNITS:	LB
MEAN	128.617	MAX OSC.	467.136	
1	27.262	17.828	20.624	40.841
2	347.372	236.139	-254.766	137.173
3	24.732	5.666	-24.074	166.757
4	79.938	19.112	-77.620	166.168
5	4.953	-4.276	2.499	-59.697
6	65.653	-20.829	62.261	-18.497

CYCLIC LAT BOOST CYL		ITEM CODE F101	UNITS:	LB
MEAN	-298.409	MAX OSC.	744.811	
1	64.969	-19.081	-62.104	-162.921
2	570.114	-235.266	-519.307	-155.628
3	31.610	-14.946	-27.854	-151.783
4	135.318	-117.117	-67.783	-120.061
5	8.224	-7.177	-4.016	-119.229
6	102.813	-63.275	-81.037	-142.017

COLLECTIVE BOOST CYL		ITEM CODE F102	UNITS:	LB
MEAN	370.715	MAX OSC.	436.683	
1	29.863	6.926	29.049	13.410
2	371.621	119.414	351.912	18.744
3	4.400	0.790	4.328	10.345
4	16.152	14.523	-7.070	115.957
5	10.807	-10.807	-0.021	-90.111
6	14.394	-9.180	11.086	-39.627

M/R RED PITCH LINK		ITEM CODE F103	UNITS:	LB
MEAN	361.591	MAX OSC.	746.923	
1	452.079	-283.791	-351.907	-141.116
2	285.346	167.100	231.301	35.846
3	116.259	-116.049	-6.995	-93.450
4	4.263	3.400	-2.571	127.098
5	56.212	-2.402	56.161	-2.449
6	17.572	15.788	-7.715	116.043

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 612
ROT SPEED 323.2

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM AMP HZ SIN COS PHASE ANGLE

M/R WHITE PITCH LINK
MEAN 268.949

ITEM CODE F104 UNITS: LB
MAX OSC. 782.673

1	484.167	5.38	282.812	392.982	35.741
2	336.780	10.76	191.582	276.979	34.671
3	106.766	16.13	101.334	33.720	71.645
4	17.404	21.51	12.861	-11.759	132.358
5	45.191	26.89	27.761	-35.659	142.099
6	18.284	32.27	16.592	-7.680	114.838

LIFT LINK
MEAN 4687.082

ITEM CODE F050 UNITS: LB
MAX OSC. 1152.258

1	85.978	5.38	41.976	-75.034	150.776
2	806.780	10.76	-418.990	689.450	-31.288
3	12.728	16.13	-4.667	11.842	-21.509
4	174.815	21.51	160.430	-69.444	113.406
5	27.225	26.89	1.142	27.201	2.405
6	188.287	32.27	94.534	162.835	30.137

M/R RED DRAG BRACE
MEAN 10394.691

ITEM CODE F105 UNITS: LB
MAX OSC. 1565.225

1	899.653	5.39	233.986	-868.692	164.925
2	76.603	10.77	15.910	74.933	11.987
3	542.212	16.16	433.756	325.346	53.128
4	58.643	21.55	-17.199	-56.064	-162.946
5	95.020	26.93	94.824	6.099	186.320
6	91.615	32.32	-55.785	72.673	-37.510

HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 611
ROT SPEED 322.0

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

CYCLIC F/A BOOST CYL		ITEM CODE F100	UNITS:	LB
MEAN		MAX OSC.	392.777	
1	21.566	21.241	3.729	80.043
2	336.773	217.141	-257.422	139.852
3	12.935	2.547	-12.681	168.644
4	29.817	12.407	-27.113	155.411
5	7.852	-2.318	-7.502	-162.826
6	17.618	-14.451	10.079	-55.105

CYCLIC LAT BOOST CYL		ITEM CODE F101	UNITS:	LB
MEAN		MAX OSC.	597.097	
1	50.525	-3.100	-50.430	-176.482
2	502.178	-168.581	-473.037	-160.385
3	16.763	-0.823	-16.742	-177.185
4	78.754	-28.080	-73.578	-159.112
5	8.060	8.009	-0.901	96.418
6	47.140	2.807	-47.057	176.586

COLLECTIVE BOOST CYL		ITEM CODE F102	UNITS:	LB
MEAN		MAX OSC.	383.621	
1	30.160	6.900	29.360	13.226
2	294.550	80.055	283.462	12.771
3	10.325	-7.567	7.024	-47.132
4	25.969	25.026	6.933	74.516
5	7.905	-7.670	1.913	-75.996
6	9.956	8.446	5.271	58.032

M/R RED PITCH LINK		ITEM CODE F103	UNITS:	LB
MEAN		MAX OSC.	687.246	
1	408.863	-270.621	-306.486	-138.556
2	265.712	177.213	197.986	41.831
3	78.854	-72.825	-30.240	-112.550
4	46.646	23.475	-40.309	149.785
5	26.611	-24.881	9.440	-69.223
6	23.939	-11.561	-20.962	-151.123

BELL HELICOPTER COMPANY
PROGRAM FFAE04

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HARMONIC ANALYSIS: AXIAL FORCES
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 611
ROT SPEED 322.5

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
M/R WHITE PITCH LINK					
	MEAN	257.371			
1	453.318	5.37	272.192	362.504	36.902
2	301.856	10.73	179.175	242.927	36.411
3	70.145	16.10	52.523	46.493	48.485
4	48.404	21.47	38.630	-29.166	127.053
5	22.003	26.83	20.715	7.419	170.294
6	11.079	32.20	-6.558	-8.929	-143.704
LIFT LINK					
	MEAN	4711.414			
1	117.939	5.37	28.146	-114.531	166.193
2	859.841	10.73	-329.027	794.398	-22.499
3	12.228	16.10	8.090	-9.170	138.580
4	282.489	21.47	183.822	214.497	40.596
5	42.856	26.83	-42.847	0.866	-88.842
6	165.425	32.20	73.305	148.296	26.304
M/R RED DRAG BRACE					
	MEAN	10508.988			
1	935.650	5.38	215.432	-910.511	166.688
2	81.015	10.75	17.687	79.061	12.610
3	166.494	16.13	160.400	44.636	74.449
4	114.603	21.50	-11.160	9.418	-49.839
5	55.403	26.88	53.951	12.600	76.855
6	30.752	32.25	-9.372	-29.289	-162.256

HARMONIC ANALYSIS: PYLON VERTICAL DISPLACEMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 610
ROT SPEED 322.7

FLY 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	POS	VER	MEAN	LT FWD	RT FWD	LT AFT	RT AFT	ITEM CODE	MAX OSC.	UNITS:	IN	PHASE ANGLE
			0.000							D051		0.047		
1	0.003	5.38				0.003	0.003	0.003	0.003			0.002	57.286	
2	0.037	10.76				-0.035	-0.035	-0.035	-0.035			0.010	-73.809	
3	0.002	16.13				0.002	0.002	0.002	0.002			-0.000	95.794	
4	0.003	21.51				-0.001	-0.001	-0.001	-0.001			0.002	-28.979	
5	0.001	26.89				-0.000	-0.000	-0.000	-0.000			0.001	-32.356	
6	0.001	32.27				-0.001	-0.001	-0.001	-0.001			0.000	-87.865	
			0.049							D052		0.030		
1	0.007	5.38				-0.003	-0.003	-0.003	-0.003			-0.006	-151.518	
2	0.015	10.76				0.011	0.011	0.011	0.011			0.001	134.311	
3	0.001	16.13				-0.001	-0.001	-0.001	-0.001			-0.001	-48.793	
4	0.006	21.51				0.004	0.004	0.004	0.004			-0.005	138.161	
5	0.000	26.89				-0.000	-0.000	-0.000	-0.000			0.000	-156.368	
6	0.001	32.27				0.001	0.001	0.001	0.001			0.001	28.276	
			0.061							D053		0.036		
1	0.009	5.38				0.008	0.008	0.008	0.008			0.004	62.077	
2	0.024	10.76				-0.006	-0.006	-0.006	-0.006			0.023	-14.135	
3	0.001	16.13				-0.001	-0.001	-0.001	-0.001			-0.000	-122.338	
4	0.005	21.51				0.001	0.001	0.001	0.001			0.005	11.212	
5	0.001	26.89				0.000	0.000	0.000	0.000			-0.001	141.975	
6	0.001	32.27				-0.000	-0.000	-0.000	-0.000			0.001	-12.232	
			0.104							D054		0.036		
1	0.002	5.38				-0.001	-0.001	-0.001	-0.001			-0.001	-143.700	
2	0.026	10.76				0.017	0.017	0.017	0.017			0.020	139.942	
3	0.003	16.13				-0.001	-0.001	-0.001	-0.001			0.003	-23.749	
4	0.004	21.51				-0.004	-0.004	-0.004	-0.004			-0.000	-95.846	
5	0.000	26.89				-0.000	-0.000	-0.000	-0.000			0.000	-155.896	
6	0.001	32.27				-0.001	-0.001	-0.001	-0.001			-0.000	-108.675	

HARMONIC ANALYSIS: PYLON VERTICAL DISPLACEMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 615
ROT SPEED 323.4

FLT. DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 128.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

LT FWD PYLON		VER	POS	ITEM	CODE	D051	UNITS:	IN
MEAN			0.004	MAX	OSC.	OSC.	0.033	
1	0.001	5.39	0.001	-0.004	95.182			
2	0.028	10.78	-0.028	0.004	-82.121			
3	0.001	16.17	0.001	0.000	72.435			
4	0.003	21.56	-0.002	0.002	-40.260			
5	0.000	26.95	-0.000	0.000	-6.616			
6	0.001	32.34	-0.001	0.000	-83.438			
RT FWD PYLON		VER	POS	ITEM	CODE	D052	UNITS:	IN
MEAN			0.025	MAX	OSC.	OSC.	0.017	
1	0.004	5.39	-0.001	-0.004	-162.129			
2	0.010	10.78	0.009	-0.005	118.048			
3	0.000	16.17	-0.000	-0.000	-144.656			
4	0.003	21.56	0.003	0.000	85.625			
5	0.000	26.95	0.000	-0.000	96.967			
6	0.001	32.34	-0.000	0.001	-16.246			
LT AFT PYLON		VER	POS	ITEM	CODE	D053	UNITS:	IN
MEAN			0.094	MAX	OSC.	OSC.	0.026	
1	0.005	5.39	0.004	0.003	55.767			
2	0.018	10.78	-0.006	0.017	-20.043			
3	0.000	16.17	-0.000	0.000	-19.100			
4	0.005	21.56	-0.004	0.003	-54.658			
5	0.001	26.95	-0.000	0.000	55.979			
6	0.001	32.34	-0.001	0.001	-46.873			
RT AFT PYLON		VER	POS	ITEM	CODE	D054	UNITS:	IN
MEAN			0.104	MAX	OSC.	OSC.	0.025	
1	0.000	5.39	-0.000	0.000	-14.921			
2	0.021	10.78	0.018	-0.011	121.204			
3	0.001	16.17	-0.001	0.000	-55.637			
4	0.005	21.56	-0.004	-0.003	-121.484			
5	0.000	26.95	0.000	-0.000	134.486			
6	0.000	32.34	-0.000	0.000	-27.835			

HARMONIC ANALYSIS: PYLON VERTICAL DISPLACEMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO 20391
REC. NO 614
ROT SPEED 322.7

FLT. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320. LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

LT FWD PYLON VER MEAN		POS	OSC.	UNITS:	IN
		-0.005	D051	0.025	
1	0.000	5.38	-0.000	0.000	-11.133
2	0.023	10.76	-0.022	0.008	-99.354
3	0.000	16.13	0.000	0.000	51.264
4	0.002	21.51	-0.001	0.001	-31.390
5	0.000	26.89	-0.000	-0.000	-164.534
6	0.002	32.27	-0.000	0.002	-16.168

RT FWD PYLON VER MEAN		POS	OSC.	UNITS:	IN
		0.026	D052	0.015	
1	0.004	5.38	0.000	-0.004	177.271
2	0.008	10.76	0.007	-0.005	127.402
3	0.000	16.13	-0.000	0.000	-79.448
4	0.001	21.51	0.001	0.000	89.753
5	0.000	26.89	0.000	0.000	68.231
6	0.001	32.27	0.000	0.001	5.890

LT AFT PYLON VER MEAN		POS	OSC.	UNITS:	IN
		0.098	D053	0.021	
1	0.004	5.38	0.003	0.003	40.459
2	0.015	10.76	-0.001	0.015	-3.471
3	0.000	16.13	-0.000	-0.000	-141.410
4	0.003	21.51	-0.001	0.003	-24.274
5	0.000	26.89	0.000	-0.000	129.257
6	0.001	32.27	0.000	0.001	23.402

RT AFT PYLON VER MEAN		POS	OSC.	UNITS:	IN
		0.115	D054	0.021	
1	0.001	5.38	0.001	-0.001	117.602
2	0.017	10.76	0.014	-0.010	127.530
3	0.001	16.13	-0.001	0.001	-61.798
4	0.002	21.51	-0.002	-0.000	-91.000
5	0.001	26.89	0.001	0.000	72.945
6	0.000	32.27	0.000	0.000	65.456

HARMONIC ANALYSIS: PYLON VERTICAL DISPLACEMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G FLI 35-A G.W. 8320 LB. PROBLEM 1
SHIP NO 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT
REC NO 613 ALT. 5000. FT. TEST CONDITION: FORWARD FLIGHT
ROT SPEED 322.0 A/S 101.0 KTS--TAS

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
LT FWD PYLON VER POS -0.006					
	MEAN	ITEM CODE D051	UNITS:	IN	
1	0.001	5.37	-0.000	-0.000	-141.713
2	0.019	10.73	-0.017	0.009	-63.044
3	0.001	16.10	0.001	0.000	76.704
4	0.002	21.47	-0.002	-0.001	-117.538
5	0.000	26.83	0.000	-0.000	171.171
6	0.002	32.20	-0.001	0.002	-16.860
RT FWD PYLON VER POS 0.017					
	MEAN	ITEM CODE D052	UNITS:	IN	
1	0.003	5.37	0.000	-0.003	175.732
2	0.008	10.73	0.005	-0.007	146.452
3	0.001	16.10	-0.001	-0.000	-107.158
4	0.002	21.47	0.001	-0.001	138.806
5	0.000	26.83	-0.000	0.000	-65.526
6	0.000	32.20	0.000	0.000	8.891
LT AFT PYLON VER POS 0.110					
	MEAN	ITEM CODE D053	UNITS:	IN	
1	0.003	5.37	0.002	0.003	34.240
2	0.012	10.73	0.003	-0.012	15.347
3	0.001	16.10	0.001	-0.001	147.250
4	0.002	21.47	0.000	0.002	12.834
5	0.000	26.83	0.000	0.000	51.539
6	0.001	32.20	0.001	0.000	77.110
RT AFT PYLON VER POS 0.119					
	MEAN	ITEM CODE D054	UNITS:	IN	
1	0.002	5.37	0.002	0.000	86.328
2	0.016	10.73	0.012	-0.011	131.958
3	0.001	16.10	-0.001	0.000	-66.008
4	0.000	21.47	0.000	-0.000	130.842
5	0.001	26.83	0.001	0.000	58.398
6	0.000	32.20	-0.000	0.000	-81.074

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: PYLON VERTICAL DISPLACEMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 612
ROT SPEED 322.7

35-A LB. PROBLEM 1
8-20-75 IN. REPORT
5000. FT. TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
LT FWD PYLON VER POS -0.000					
1	0.002	5.38	-0.002	-0.001	-108.057
2	0.016	10.76	-0.012	0.011	-48.342
3	0.000	16.13	0.000	0.000	87.622
4	0.001	21.51	0.001	0.000	65.506
5	0.000	26.89	-0.000	-0.000	-177.978
6	0.001	32.27	0.001	0.001	50.045
RT FWD PYLON VER POS 0.004					
1	0.002	5.38	0.001	-0.002	153.678
2	0.009	10.76	0.002	-0.008	163.625
3	0.000	16.13	-0.000	0.000	-64.144
4	0.001	21.51	0.000	-0.001	178.997
5	0.001	26.89	0.001	0.001	66.664
6	0.001	32.27	-0.000	0.001	-6.338
LT AFT PYLON VER POS 0.121					
1	0.002	5.38	0.001	0.002	24.212
2	0.015	10.76	0.010	0.011	41.139
3	0.000	16.13	-0.000	-0.000	-90.409
4	0.002	21.51	0.002	-0.001	123.988
5	0.000	26.89	0.000	0.000	16.285
6	0.001	32.27	-0.000	-0.001	-136.319
RT AFT PYLON VER POS 0.113					
1	0.003	5.38	0.003	-0.000	90.860
2	0.015	10.76	0.010	-0.011	137.890
3	0.001	16.13	-0.000	0.001	-9.892
4	0.001	21.51	-0.001	-0.000	-115.737
5	0.001	26.89	0.001	0.000	75.173
6	0.000	32.27	-0.000	-0.000	-107.342

HARMONIC ANALYSIS: PYLON VERTICAL DISPLACEMENTS
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 611
ROT SPEED 322.0

FLY 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
LT FWD PYLON VER POS -0.004					
1	0.003	5.37	-0.003	-0.000	-91.764
2	0.014	10.73	-0.011	0.009	-48.874
3	0.000	16.10	-0.000	-0.000	-104.640
4	0.003	21.47	0.001	0.003	14.143
5	0.000	26.83	-0.000	-0.000	-170.160
6	0.001	32.20	0.001	0.001	39.185
RT FWD PYLON VER POS 0.005					
1	0.003	5.37	0.002	-0.002	137.520
2	0.009	10.73	0.003	-0.008	161.048
3	0.000	16.10	0.000	-0.000	147.358
4	0.000	21.47	0.000	-0.000	143.865
5	0.000	26.83	-0.000	0.000	-49.268
6	0.000	32.20	0.000	0.000	79.347
LT AFT PYLON VER POS 0.122					
1	0.003	5.37	-0.000	0.003	-7.956
2	0.016	10.73	0.010	0.012	41.066
3	0.000	16.10	0.000	-0.000	5.870
4	0.002	21.47	0.001	-0.002	143.331
5	0.000	26.83	-0.000	0.000	-57.221
6	0.001	32.20	-0.000	-0.000	-145.305
RT AFT PYLON VER POS 0.116					
1	0.004	5.37	0.003	-0.001	107.704
2	0.014	10.73	0.011	-0.009	127.225
3	0.000	16.10	0.000	-0.000	96.827
4	0.002	21.47	-0.002	-0.002	-136.500
5	0.000	26.83	0.000	-0.000	95.358
6	0.001	32.20	-0.001	0.000	-75.183

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: VEHICLE PERFORMANCE DATA
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 610
ROT SPEED 322.7

FLT. DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 142.0 KIS--IAS

PROBLEM 1
REPORT
FORWARD FLIGHT

HARM AMP HZ SIN COS PHASE ANGLE

M/R HUB FLAPPING ANG		ITEM CODE D110		UNITS: DEG	
MEAN -0.587		MAX OSC.		2.488	
1	2.544	1.590	1.986	38.668	
2	0.050	0.000	-0.050	178.588	
3	0.179	-0.177	0.029	-80.818	
4	0.044	0.032	0.031	45.552	
5	0.018	-0.008	0.016	-25.988	
6	0.031	-0.018	0.025	-34.635	
M/R HUB FEATHER ANG		ITEM CODE D111		UNITS: DEG	
MEAN 16.731		MAX OSC.		10.457	
1	10.363	8.987	5.160	-60.137	
2	0.961	-0.712	-0.645	-132.174	
3	0.190	-0.188	0.021	-83.648	
4	0.059	-0.013	-0.057	-167.565	
5	0.100	-0.088	-0.047	-118.033	
6	0.068	0.026	-0.063	-157.283	
ROLL ATTITUDE		ITEM CODE D009		UNITS: DEG	
MEAN -0.273		MAX OSC.		0.291	
1	0.007	0.003	-0.007	154.377	
2	0.034	0.032	0.013	68.071	
3	0.015	-0.013	0.008	-57.054	
4	0.028	0.020	-0.020	134.486	
5	0.009	-0.009	0.003	-69.902	
6	0.013	-0.009	-0.009	-134.379	
PITCH ATTITUDE		ITEM CODE D010		UNITS: DEG	
MEAN -5.710		MAX OSC.		0.273	
1	0.016	0.009	0.013	34.538	
2	0.018	0.017	0.005	74.462	
3	0.002	-0.001	0.002	-25.593	
4	0.007	0.004	-0.002	144.648	
5	0.017	0.006	0.015	22.371	
6	0.012	-0.011	0.004	-72.364	
YAW ATTITUDE		ITEM CODE D011		UNITS: DEG	
MEAN 0.251		MAX OSC.		0.680	
1	0.005	0.001	0.005	13.001	
2	0.005	-0.001	-0.005	-166.525	
3	0.063	0.056	-0.029	117.049	
4	0.041	-0.004	0.040	-78.044	
5	0.031	0.030	0.006	78.922	
6	0.048	-0.013	-0.046	-164.184	

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: VEHICLE PERFORMANCE DATA
LEVEL FLIGHT SWEEP

MODEL AH-1G FLT: 35-A LB. PROBLEM 1
SHIP 20391 DATE 8-20-75 C.G. 200.6 IN. REPORT
REC. NO. 615 ALT. 5000. FT. TEST CONDITION: FORWARD FLIGHT
ROT SPEED 323.4 A/S 128.0 KTS--IAS

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	M/R HUB FLAPPING	ANG	ITEM CODE D110	UNITS:	DEG
	MEAN	-0.604	MAX OSC.	2.438	
1	2.459	5.39	0.519	2.404	12.178
2	0.066	10.78	-0.048	0.045	-47.129
3	0.118	16.17	0.049	-0.107	155.358
4	0.064	21.56	-0.022	0.060	159.830
5	0.101	26.95	0.096	-0.032	-108.400
6	0.048	32.34	-0.040	0.026	-56.937

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	M/R HUB FEATHER	ANG	ITEM CODE D111	UNITS:	DEG
	MEAN	14.916	MAX OSC.	9.038	
1	8.924	5.39	-8.661	2.149	-76.062
2	1.000	10.78	-0.269	-0.663	-167.393
3	0.098	16.17	0.103	-0.096	-167.092
4	0.105	21.56	0.051	-0.016	98.775
5	0.074	26.95	0.033	-0.054	136.284
6	0.033	32.34	-0.002	-0.005	98.521

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	ROLL ATTITUDE	MEAN	ITEM CODE D009	UNITS:	DEG
	MEAN	-1.152	MAX OSC.	0.383	
1	0.021	5.39	0.018	0.011	59.732
2	0.031	10.78	0.027	0.016	59.714
3	0.021	16.17	-0.001	0.021	-2.620
4	0.012	21.56	0.011	0.004	69.264
5	0.005	26.95	0.003	0.001	83.130
6	0.004	32.34	-0.002	0.004	-26.627

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	PITCH ATTITUDE	MEAN	ITEM CODE D010	UNITS:	DEG
	MEAN	-3.628	MAX OSC.	0.183	
1	0.004	5.39	-0.004	-0.001	-100.361
2	0.011	10.78	0.006	0.010	30.025
3	0.005	16.17	0.001	-0.005	173.843
4	0.005	21.56	-0.003	-0.003	-118.413
5	0.014	26.95	0.003	0.014	170.601
6	0.004	32.34	0.001	-0.004	170.498

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
	YAW ATTITUDE	MEAN	ITEM CODE D011	UNITS:	DEG
	MEAN	0.020	MAX OSC.	0.679	
1	0.028	5.39	0.003	-0.028	173.721
2	0.032	10.78	0.010	-0.031	161.598
3	0.012	16.17	0.010	0.006	156.919
4	0.037	21.56	0.020	-0.031	146.795
5	0.032	26.95	-0.012	0.030	-22.331
6	0.096	32.34	0.038	0.088	23.507

HARMONIC ANALYSIS: VEHICLE PERFORMANCE DATA
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP NO. 20391
REC. NO. 614
ROT SPEED 322.7

FLI 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 114.0 KTS--TAS

PROBLEM 1
REPORT

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
M/R HUB FLAPPING ANG					
	MEAN	ANG	ITEM CODE D110	UNITS:	DEG
			MAX OSC.	2.265	
1	2.304	5.38	0.636	2.215	16.035
2	0.017	10.76	-0.003	0.017	-11.016
3	0.094	16.13	-0.020	-0.092	-167.892
4	0.014	21.51	-0.009	-0.011	-141.908
5	0.037	26.89	-0.056	0.007	-82.628
6	0.024	32.27	-0.011	0.022	-26.230
M/R HUB FEATHER ANG					
	MEAN	ANG	ITEM CODE D111	UNITS:	DEG
			MAX OSC.	7.896	
1	7.830	5.38	-7.395	2.572	-70.823
2	0.845	10.76	-0.323	-0.781	-157.552
3	0.047	16.13	0.007	-0.046	171.738
4	0.072	21.51	0.065	-0.044	124.159
5	0.055	26.89	0.025	-0.049	153.294
6	0.026	32.27	0.026	-0.002	94.544
ROLL ATTITUDE					
	MEAN		ITEM CODE D009	UNITS:	DEG
			MAX OSC.	0.400	
1	0.026	5.38	-0.020	-0.017	-130.158
2	0.017	10.76	-0.006	-0.016	-157.770
3	0.008	16.13	-0.005	-0.005	-133.065
4	0.021	21.51	0.012	-0.014	-132.882
5	0.016	26.89	0.015	-0.004	104.808
6	0.008	32.27	0.007	0.004	61.308
PITCH ATTITUDE					
	MEAN		ITEM CODE D010	UNITS:	DEG
			MAX OSC.	0.273	
1	0.022	5.38	-0.022	-0.003	-97.839
2	0.006	10.76	-0.009	0.010	51.039
3	0.014	16.13	0.012	0.010	-41.004
4	0.017	21.51	0.013	0.012	47.308
5	0.013	26.89	0.007	-0.011	148.264
6	0.010	32.27	-0.002	0.009	-14.791
YAW ATTITUDE					
	MEAN		ITEM CODE D011	UNITS:	DEG
			MAX OSC.	0.773	
1	0.013	5.38	-0.005	0.012	-21.739
2	0.040	10.76	-0.033	0.023	-54.615
3	0.013	16.13	-0.010	0.009	-47.654
4	0.061	21.51	-0.035	-0.050	-35.371
5	0.047	26.89	-0.010	-0.046	167.427
6	0.026	32.27	-0.011	0.024	-24.257

BELL HELICOPTER COMPANY
PROGRAM FFAE04

HARMONIC ANALYSIS: VEHICLE PERFORMANCE DATA
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 613
ROT SPEED 322.0
FLI 35-A
DATE 8-20-75
ALT. 5000. FT.
G.W. 8320 LB.
C.G. 200.6 IN.
REPORT PROBLEM 1
TEST CONDITION: FORWARD FLIGHT
A/S 101.0 KTS--TAS

HARM	AMP	HZ	SIN	COS	PHASE ANGLE
M/R HUB FLAPPING ANG					
	MEAN	-0.558	ITEM CODE D110	UNITS:	DEG
1	2.322	5.37	0.519	2.263	12.929
2	0.032	10.73	-0.001	-0.032	-1.526
3	0.087	16.10	-0.060	-0.063	-136.280
4	0.037	21.47	-0.033	-0.012	-108.597
5	0.069	26.83	-0.023	0.065	-19.211
6	0.009	32.20	0.005	-0.007	143.578
M/R HUB FEATHER ANG					
	MEAN	13.293	ITEM CODE D111	UNITS:	DEG
1	6.771	5.37	-6.219	2.678	-66.702
2	0.571	10.73	-0.222	-0.527	-157.209
3	0.037	16.10	0.033	-0.010	105.853
4	0.071	21.47	0.064	-0.031	176.168
5	0.024	26.83	0.006	-0.024	163.309
6	0.028	32.20	0.026	0.010	69.107
ROLL ATTITUDE					
	MEAN	-1.136	ITEM CODE D009	UNITS:	DEG
1	0.006	5.37	0.006	0.001	81.941
2	0.031	10.73	0.001	-0.001	92.222
3	0.009	16.10	0.008	0.001	83.433
4	0.021	21.47	0.001	-0.021	178.192
5	0.005	26.83	-0.004	0.004	-45.454
6	0.012	32.20	0.005	0.011	26.855
PITCH ATTITUDE					
	MEAN	-1.096	ITEM CODE D010	UNITS:	DEG
1	0.035	5.37	-0.034	-0.007	-101.584
2	0.002	10.73	-0.002	-0.001	-111.945
3	0.010	16.10	-0.007	-0.007	-135.359
4	0.005	21.47	-0.003	0.003	-47.100
5	0.004	26.83	0.003	0.003	38.281
6	0.002	32.20	-0.001	0.002	-33.336
YAW ATTITUDE					
	MEAN	0.412	ITEM CODE D011	UNITS:	DEG
1	0.048	5.37	-0.043	0.021	-63.799
2	0.070	10.73	-0.007	-0.069	-174.160
3	0.036	16.10	0.002	0.036	3.630
4	0.005	21.47	-0.002	-0.004	-151.560
5	0.033	26.83	0.031	-0.011	109.463
6	0.091	32.20	0.029	0.087	-18.653

HARMONIC ANALYSIS: VEHICLE PERFORMANCE DATA
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 612
ROT SPEED 322.7

FLI. DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 85.0 KTS--TAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

M/R HUB FLAPPING ANG -0.563
MEAN

ITEM CODE D110
MAX OSC.

UNITS:
2.378

DEG

1	2.318	5.38	0.660	2.222	16.541
2	0.070	10.76	0.021	0.067	17.539
3	0.137	16.13	-0.017	-0.136	-172.785
4	0.042	21.51	-0.039	-0.016	-112.098
5	0.080	26.89	0.028	0.075	20.702
6	0.036	32.27	0.020	-0.030	145.744

M/R HUB FEATHER ANG 12.674
MEAN

ITEM CODE D111
MAX OSC.

UNITS:
5.995

DEG

1	5.958	5.38	-5.186	2.933	-60.513
2	0.365	10.76	-0.275	-0.240	-131.077
3	0.030	16.13	0.019	0.023	39.821
4	0.052	21.51	0.050	-0.015	106.731
5	0.031	26.89	0.009	-0.030	163.362
6	0.010	32.27	0.009	0.005	62.842

ROLL ATTITUDE 0.793
MEAN

ITEM CODE D009
MAX OSC.

UNITS:
0.309

DEG

1	0.026	5.38	0.019	0.018	47.492
2	0.014	10.76	0.013	0.006	66.835
3	0.009	16.13	0.008	0.004	64.789
4	0.017	21.51	0.015	0.006	67.698
5	0.006	26.89	-0.004	0.004	-46.666
6	0.013	32.27	0.004	0.012	19.895

PITCH ATTITUDE -0.271
MEAN

ITEM CODE D010
MAX OSC.

UNITS:
0.433

DEG

1	0.041	5.38	0.036	0.019	62.580
2	0.041	10.76	0.026	0.032	39.022
3	0.001	16.13	0.001	0.000	84.397
4	0.013	21.51	0.003	0.013	13.505
5	0.008	26.89	-0.004	0.007	-32.253
6	0.012	32.27	-0.011	0.005	-64.352

YAW ATTITUDE 0.359
MEAN

ITEM CODE D011
MAX OSC.

UNITS:
1.223

DEG

1	0.021	5.38	-0.007	0.020	-18.982
2	0.033	10.76	0.003	0.032	4.969
3	0.046	16.13	0.043	-0.013	105.951
4	0.072	21.51	-0.064	-0.033	-117.622
5	0.022	26.89	-0.006	0.021	-16.011
6	0.016	32.27	0.010	-0.012	139.029

HARMONIC ANALYSIS: VEHICLE PERFORMANCE DATA
LEVEL FLIGHT SWEEP

MODEL AH-1G
SHIP 20391
REC. NO. 611
ROT. SPEED 322.0

FLI. 35-A
DATE 8-20-75
ALT. 5000. FT.

G.W. 8320 LB.
C.G. 200.6 IN.
TEST CONDITION: FORWARD FLIGHT
A/S 67.0 KTS--IAS

PROBLEM 1
REPORT

HARM AMP HZ SIN COS PHASE ANGLE

M/R HUB FLAPPING		ANG		ITEM CODE D110		UNITS:	
MEAN		-0.468		MAX OSC.		DEG	
1	2.025	5.37	0.428	1.979	12.193		
2	0.101	10.73	0.025	0.098	14.467		
3	0.077	16.10	0.021	-0.074	164.465		
4	0.027	21.47	-0.026	0.008	192.808		
5	0.048	26.83	-0.048	0.003	-88.669		
6	0.029	32.20	-0.004	-0.028	-172.373		
M/R HUB FEATHER		ANG		ITEM CODE D111		UNITS:	
MEAN		12.462		MAX OSC.		DEG	
1	5.071	5.37	-4.428	2.473	-60.818		
2	0.299	10.73	-0.234	-0.187	-128.718		
3	0.059	16.10	0.001	0.059	0.567		
4	0.029	21.47	-0.002	-0.029	-3.997		
5	0.074	26.83	0.009	-0.022	156.567		
6	0.015	32.20	0.009	0.012	37.808		
ROLL ATTITUDE		MEAN		ITEM CODE D009		UNITS:	
		0.055		MAX OSC.		DEG	
1	0.006	5.37	-0.001	-0.006	-175.462		
2	0.008	10.73	0.006	-0.006	133.496		
3	0.010	16.10	0.005	-0.008	148.088		
4	0.002	21.47	-0.002	0.001	-59.053		
5	0.005	26.83	0.004	-0.003	122.923		
6	0.009	32.20	0.001	-0.009	170.393		
PITCH ATTITUDE		MEAN		ITEM CODE D010		UNITS:	
		-1.045		MAX OSC.		DEG	
1	0.028	5.37	0.015	0.024	31.506		
2	0.031	10.73	0.026	0.017	56.677		
3	0.003	16.10	0.003	0.002	58.371		
4	0.014	21.47	-0.002	0.012	-25.280		
5	0.006	26.83	-0.006	0.001	-82.291		
6	0.012	32.20	-0.011	0.004	-69.488		
YAW ATTITUDE		MEAN		ITEM CODE D011		UNITS:	
		0.115		MAX OSC.		DEG	
1	0.029	5.37	0.023	0.018	51.678		
2	0.047	10.73	-0.021	-0.042	-152.868		
3	0.011	16.10	0.004	-0.010	-155.415		
4	0.015	21.47	-0.015	0.001	-85.758		
5	0.065	26.83	-0.001	-0.065	-178.714		
6	0.058	32.20	0.049	-0.032	56.493		

APPENDIX B - AH-1G ROTOR PARAMETERS

26 SEG OLS MR PRECONE AND UNDERSLING

SEG LENGTH (IN)	SEG LENGTH (IN)	RADIUS AT OUTRD END (LBF/IN)	WT/IN (LBF/IN**2)	E1*10**(-6) (LBF*IN**2) BEAM	CHORD	TWIST AT OUTRD END (DEG)	CENTER OF GRAVITY OFFSETS (IN) BEAM	CHORD	CF AT INSD END (LBF/RPM**2)
1	3.50	3.50	8.280	344.90	5003.10	0.0	0.0	0.0	1.21491
2	2.50	6.00	1.268	9.37	4262.10	0.0	0.0	0.0	1.21331
3	5.00	11.00	3.196	8.27	4144.10	0.0	0.0	0.0	1.21168
4	3.10	14.10	7.211	340.50	4492.10	-0.5341	0.0	0.0	1.20569
5	6.47	20.57	6.936	202.60	1750.00	-0.7794	0.0	0.120	1.19222
6	13.18	33.75	6.241	202.60	1750.00	-1.2784	0.0	3.610	1.15511
7	3.75	37.50	5.904	400.00	1463.60	-1.4205	0.0	3.610	1.10512
8	3.50	41.00	7.164	800.00	450.58	-1.5530	0.0	2.302	1.07998
9	11.80	52.80	4.127	407.89	8232.00	-2.0000	0.0	1.300	1.03706
10	17.20	60.00	0.952	89.50	4240.00	-2.2727	0.0	0.900	0.99544
11	6.50	66.00	0.952	89.50	4240.00	-2.5000	0.0	0.900	0.96474
12	15.50	81.50	0.775	61.75	4065.00	-3.0871	0.0	1.390	0.96814
13	10.90	92.40	0.858	55.00	4150.00	-3.5000	0.0	1.710	0.91955
14	10.60	103.00	0.836	53.30	4290.00	-3.9015	0.0	1.710	0.88653
15	10.60	118.80	0.869	49.66	4079.00	-4.5000	0.0	2.385	0.84643
16	13.20	132.00	0.762	44.50	3820.00	-5.0000	0.0	1.450	0.80564
17	13.20	145.20	0.726	40.10	3600.00	-5.5000	0.0	0.850	0.77078
18	10.60	155.80	0.875	40.00	3390.00	-5.9015	0.0	0.850	0.71192
19	15.80	171.60	1.098	40.83	3255.00	-6.5000	0.0	0.571	0.63554
20	13.20	184.80	1.062	41.00	2910.00	-7.0000	0.0	-0.550	0.63554
21	13.20	198.00	1.039	39.60	2650.00	-7.5000	0.0	0.010	0.59242
22	14.30	212.30	1.260	39.50	2650.00	-8.0417	0.0	-1.017	0.47366
23	12.10	224.40	1.186	42.00	2650.00	-8.5000	0.0	-1.870	0.37614
24	13.70	238.10	1.266	42.00	2650.00	-9.0189	0.0	-1.129	0.27522
25	12.70	250.80	1.189	42.40	2660.00	-9.5000	0.0	-1.970	0.16560
26	13.20	264.00	1.160	38.00	2690.00	-10.0000	0.0	-0.430	0.05736
BALANCE WEIGHT (9% R)		0.0	LBM				0.0	0.0	

4 HUB SEGMENTS ROTOR RPM 290.00 324.00 350.00
 GIMBALED HUB TYPE INITIAL INCREMENT FINAL
 2.00 BLADES 8.50 15.00 25.00
 28.63 INCH CHORD FREQUENCY SWEEP PARAMETERS (CPM) 29.00 87.50 3500.00

MASS/BLADE 504.298 LBF/BLADE
 (FIRST MASS MOMENT)/BLADE 110.787 SLUG-FT/BLADE
 (FLAP INERTIA)/BLADE 1499.704 SLUG-FT**2/BLADE
 LOCK NUMBER (SLSTD) 5.078

26	SEG	ULS	MR	PRECONE	AND	UNDERSLING			
CK				396000.0					IN-LBF/RAD
CDAMP				6.000					IN
PRDAMP				14.100					IN
PAHM				-9.250					IN
PLSTA				0.0					IN
FRUFF				0.0					IN
FLPSM				0.0					FT-LBF/DEG
FHANGL				0.0					DEG
CHUFF				0.0					IN
SPHGG				0.0					FT-LBF/DEG
ALPHA1				0.0					DEG
ALPHA3				0.0					DEG
RPCUNE				0.0					IN
PRECON				2.750					DEG
VUPCA				-4.600					IN
KPLAG				0.0					IN
PRELAG				0.0					DEG
MUPCA				0.0					IN
RDCS				0.0					IN
BCUNE				0.0					DEG
VUBS				0.0					IN
DUTSWP				0.0					DEG
MURS				0.0					IN

RADIUS WHERE PRECUNE STARTS
PRECUNE ANGLE
VERT OFFSET OF PCA AT R=RPCUNE
RADIUS WHERE PRELAG STARTS
PRELAG ANGLE
HORIZ OFFSET OF PCA AT R=PLAG

RADIUS WHERE BLADE COORDINATE
SYSTEM STARTS
BLADE CUNING ANGLE RELATIVE TO
PCA AT 0 DEG COLLECTIVE PITCH
VERT OFFSET OF BLADE SYSTEM
FROM PCA AT 0 DEG COLLECTIVE
BLADE SWEEP ANGLE RELATIVE TO
PCA AT 0 DEG COLLECTIVE
HORIZ OFFSET OF BLADE SYSTEM
FROM PCA AT 0 DEG COLLECTIVE

EFFECTIVE BLADE CG -0.155 IN FED FROM PCA
EFFECTIVE (BLADE PLUS MUR) CG -0.155 IN FED FROM PCA
CLAMPED TORSIONAL FREQUENCY 15.341 HERTZ
TORSIONAL INERTIA ABOUT PCA 42.62 IN-LB-SEC**2

SPECIAL OPTIONS INVOKED:
TORSION OPTION IS ON
UNEQUAL SEGMENTS ARE USED

PAGE	3	BMT PROGRAM UNAM05 - COMPILED 03/20/79	09/10/79
		NATURAL BLADE MODES	5A 0279
	20	SEG OLS MR PRECONE AND UNDERSLING	
		188	CHORD RADIUS OF
		IN-LB-SEC**2/IN	GYRATION - INCH
		BEAM RADIUS OF	
		GYRATION - INCH	
		IN-LB-SEC**2/IN	
		ICC	
		IN-LB-SEC**2/IN	
1	0.000100	0.0683	1.794
2	0.000100	0.1732	4.550
3	0.000100	0.1100	2.858
4	0.089800	2.1919	2.723
5	0.089800	2.2367	2.781
6	0.089800	2.3579	2.931
7	0.089800	2.4235	1.796
8	0.035600	1.3857	3.067
9	0.006400	0.7741	4.758
10	0.002400	0.9470	6.929
11	0.002400	0.9870	6.929
12	0.001700	0.9206	7.699
13	0.001700	0.8750	8.134
14	0.001700	0.8864	8.195
15	0.001800	0.8946	8.310
16	0.001800	0.8426	8.295
17	0.001300	0.8318	8.334
18	0.001400	0.7863	7.518
19	0.002400	0.9190	7.168
20	0.002400	0.9349	6.851
21	0.001400	0.7216	6.565
22	0.001200	0.6066	6.204
23	0.001300	0.6508	5.835
24	0.001500	0.6766	6.117
25	0.001800	0.7648	6.142
26	0.002700	0.9484	6.827

PAGE 4

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540279

26	SEG	OLS	MR	PRECDNE	AND	UNDERSLING	SHEAR CENTER* OFFSET (IN) BEAM	NEUTRAL AXIS* OFFSET (IN) BEAM
	SEG	GJLBF-IN**2)						
		(E-6)						
1		36.000				0.0	0.0	0.0
2		36.000				0.0	0.0	0.0
3		36.000				0.0	0.0	0.0
4		36.000				0.0	0.0	0.0
5		36.000				0.0	0.0	0.0
6		36.000				0.0	0.0	0.0
7		37.650				0.0	0.0	0.0
8		67.000				0.0	0.0	0.0
9		84.600				0.773	0.773	0.773
10		74.000				0.0	0.0	1.050
11		74.000				0.0	0.0	0.560
12		61.700				0.0	0.0	0.560
13		55.200				0.0	0.0	0.730
14		50.000				0.0	0.0	1.200
15		44.200				0.0	0.0	1.160
16		38.100				0.0	0.0	1.000
17		34.500				0.0	0.0	0.750
18		33.800				0.0	0.0	0.530
19		33.800				0.0	0.0	0.290
20		33.800				0.0	0.0	-0.168
21		33.800				0.0	0.0	-0.450
22		33.800				0.0	0.0	-0.690
23		33.800				0.0	0.0	-0.627
24		33.800				0.0	0.0	-0.850
25		33.800				0.0	0.0	-1.149
26		33.800				0.0	0.0	-2.510
26		33.800				0.0	0.0	-2.520

FEATHERING BEARING HAS BEEN PUT IN SEGMENT 4

* SHEAR CENTER AND NEUTRAL AXIS WERE ASSUMED TO BE AT THE SAME LOCATION

ORIGINAL PAGE IS
OF POOR QUALITY

SUPER 840 EXT'DRUMPER 840 EXT'D CLCD DATA TABLES USED

Table with 10 columns and 200 rows of numerical data, likely representing performance metrics for the Super 840 Ext'drumper. The columns contain values ranging from approximately 0.00000 to 0.99999.

Standard Bibliographic Page

1. Report No. NASA CR-178160		2. Government Accession No.		3. Recipient's Catalog No.	
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				6. Performing Organization Code	
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				15. Supplementary Notes Langley Technical Monitor: Raymond G. Kvaternik Final Report (1 of 2 final reports for Task #1 of the contract)	
16. Abstract Under a NASA research program designated DAMVIBS (Design Analysis Methods for VIBrationS), four U. S. helicopter industry participants (Bell Helicopter, Boeing Vertol, McDonnell Douglas Helicopter, and Sikorsky Aircraft) are to apply existing analytical methods for calculating coupled rotor-fuselage vibrations of the AH-1G helicopter for correlation with flight test data from an AH-1G Operational Load Survey (OLS) test program. Bell Helicopter, as the manufacturer of the AH-1G, was tasked to provide pertinent rotor data and to collect the OLS flight vibration data needed to perform the correlations. The analytical representation of the fuselage structure is based on a NASTRAN finite element model (FEM) developed by Bell which has been extensively documented and correlated with ground vibration test. The AH-1G FEM was provided to each of the participants for use in their coupled rotor-fuselage analyses. This report describes the AH-1G OLS flight test program and provides the flight conditions and measured vibration data to be used by each participant in their correlation effort. In addition, the mechanical, structural, inertial and aerodynamic data for the AH-1G two-bladed teetering main rotor system are presented. Furthermore, modifications to the NASTRAN FEM of the fuselage structure that are necessary to make it compatible with the OLS test article are described. The AH-1G OLS flight test data was found to be well documented and provides a sound basis for evaluating currently existing analysis methods used for calculation of coupled rotor-fuselage vibrations.					
17. Key Words (Suggested by Authors(s)) AH-1G flight loads Helicopter vibrations Coupled rotor-fuselage analyses			18. Distribution Statement Unclassified-Unlimited Subject Category 39		
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