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VIBRATORY HUB LOAD DATA REDUCTION AND ANALYSIS FROM
THE REVERSE VELOCITY ROTOR WIND TUNNEL TEST

R. B. TAYLOR

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PREPARED UNDER CONTRACT NO. NAS 2-8630

FOR

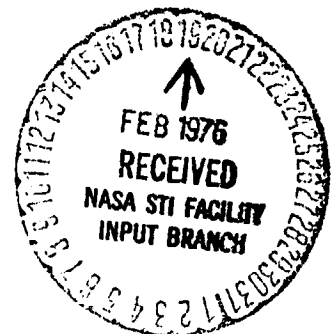NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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FROM THE REVERSE VELOCITY ROTOR WIND TUNNEL

TEST - PHASE IIB

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ABSTRACT

This document presents the results of the vibratory hub loads data analysis from the Reverse Velocity Rotor Wind Tunnel Test - Phase IIB. Vibratory loads were obtained from the rotating hub balance and also by synthesis of generalized coordinates from the blade flap bending moments. Load trends were defined as a function of speed, rotor thrust and 2 per rev cyclic from each of the data methods. These trends were compared to determine the degree of agreement between each method and provide substantiation for the generalized coordinate approach.

FOREWARD

This report was prepared by the Boeing Vertol Company
for the National Aeronautics and Space Administration,
Ames Research Center under NASA Contract NAS2-8630.
The report contains the vibratory hub load data
reduction and analysis from the Reverse Velocity Rotor
Wind Tunnel Test - Phase IIB.

Mr. Ron Smith (NASA Ames) was the technical monitor
for this work.

The Boeing Vertol Program Manager was F. J. McHugh,
and the Project Engineer was R. B. Taylor.

SUMMARY

Analysis of the vibratory hub loads obtained from the Reverse
Velocity Rotor Wind Tunnel Test - Phase IIB was performed using
hub load data obtained from a rotating balance and hub loads ob-
tained by synthesis of general coordinates from the blade bending
moments. The general results exhibited by the data indicate that
vibratory thrust and overturning moments are the two loads of
major concern. A second item of general relevance is the sensiti-
vity of the results to model/test stand resonance conditions at
different rotor speeds across the advance ratio range.

Figure 1 presents the two major loads, vibratory thrust and over-
turning moment variation with advance ratio, determined with the
hub balance and generalized coordinate methods. Two peaks are
evident in the vibratory thrust at advance ratios of 0.7 and 1.4.
These high load conditions are due to model/test stand resonant
frequencies which will be avoided on a full scale rotor system.
The hub balance data indicates two high load conditions but the
generalized coordinate data indicates one high load condition at
$\mu=0.8$ (the 3/rev - longitudinal test stand frequency) and a
suppressed load peak at $\mu=1.4$. The trend of the vibratory thrust
defined by the data at nonresonant test conditions and represented
by the solid line in Figure 1 indicates an increasing trend with
advance ratio. Agreement of the data obtained from the hub balance
and the generalized coordinate methods is good for the conditions
away from a resonance condition.

At the bottom of Figure 1 is the vibratory hub overturning moment variation with advance ratio. The large load peak at an advance ratio of 1.3 is a result of the 3/rev first flexible flapwise mode. The generalized coordinate data indicates a load level significantly higher than the hub balance data. These trends resemble load growth for a system with various amounts of damping: 4% for the generalized coordinate data and 30 percent for the hub balance data. Agreement in the data defined by both methods at advance ratios below 0.8 and above 1.6 is quite good. The implication of this is that the vibratory hub moment trend with advance ratio is constant with advance ratio as represented by the solid line.

It is concluded that the generalized coordinate method would be the most reliable and representative of the full scale (no model/ stand resonance conditions). Also the complexity of load measurement is less with the generalized coordinate method; 6 data channels required as compared to 10 channels required for the hub balance method.
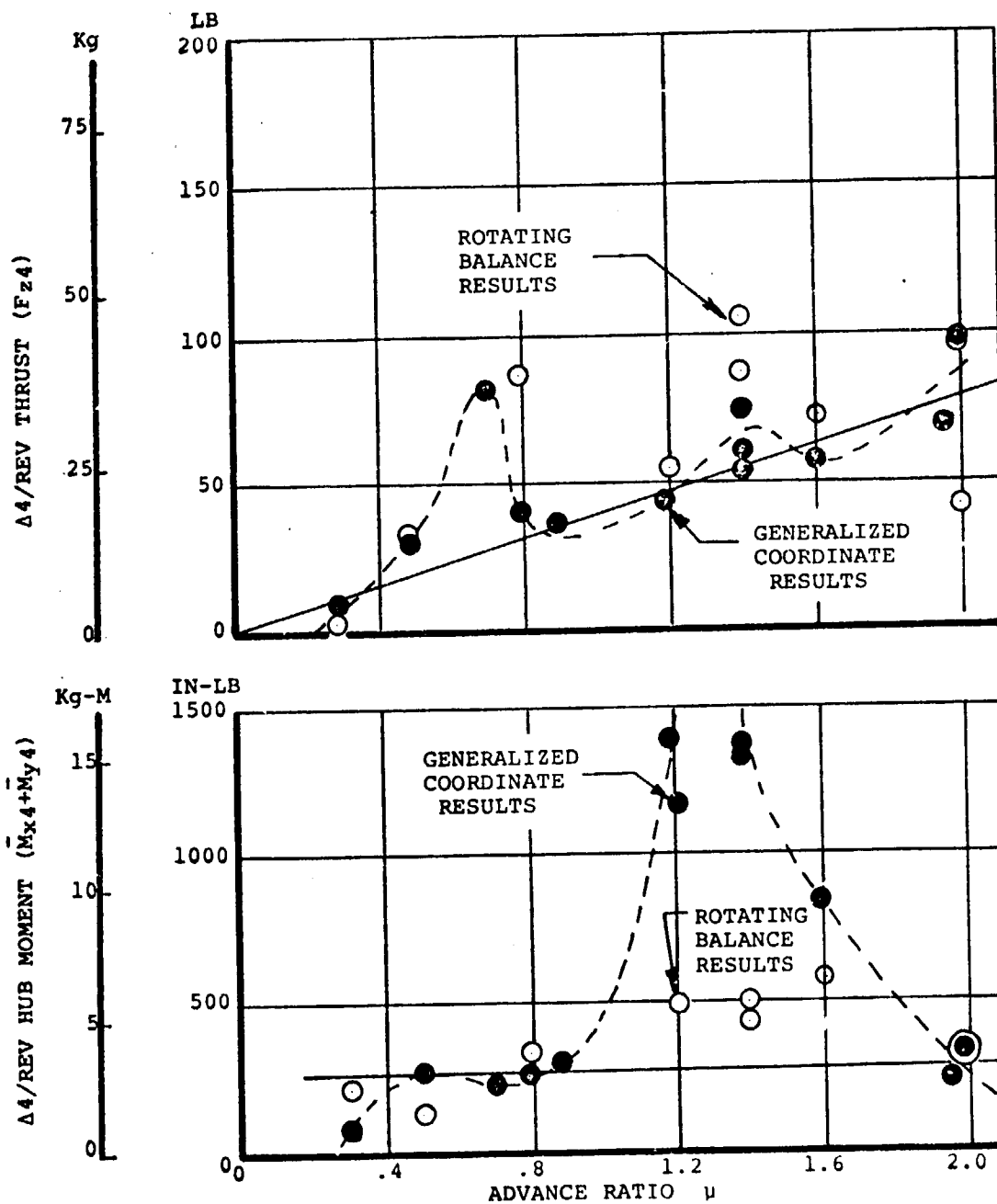
FIGURE 1   RVR WIND TUNNEL MODEL COMPARISON OF 4 PER REV FIXED
SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC OBTAINED
FROM ROTATING BALANCE AND FROM GENERALIZED COORDINATES

1.0 <u>INTRODUCTION</u>

For an articulated rotor, the blade vertical shears at the
flapping hinge are the sole contributor to hub vibratory
components of thrust, rolling moment and pitching moment. The
other three hub load components (torque, longitudinal force and
lateral force) are due to blade chordwise and radial shears at the
lag hinge. A semiempirical analysis has been developed to deter-
mine these shears and requires measured blade flap bending and
chord bending moments in addition to a dynamic description of the
rotor blade.

This analysis has been used at Boeing to determine 4/rev vibratory
hub vertical force on the Model 347, a tandem rotor helicopter
with 4 bladed rotors. The specific objective was to determine
by flight testing, the effect of blade mounted 4/rev pendulum
absorbers on the blade root 4/rev vertical shears. Figures 1.1
and 1.2 show the results of that testing effort. The effect of
the absorbers when they were optimumly tuned is shown in Figure 1.1
for both forward and aft rotors. These results, all of which
were developed by the analysis, show a 7 to 1 reduction in blade
4/rev root vertical shears on the forward rotor at 150 knots.
The upper plot in Figure 1.2 shows the effect of pendulum
absorber tuning on 4/rev blade root vertical shears on the
forward rotor at 150 knots. Note that maximum tuning is shown
by the analysis to be at 3.95 per rev pendulum tuning. The
bottom plot in Figure 1.2 shows the effect of pendulum absorber
tuning on measured vertical cockpit accelerations. The effect of

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tuning is very similar to that for the vertical shears for the plot above with minimum acceleration occurring at 3.95 per rev tuning. If the vertical shears and accelerations were normalized by their respective values for no pendulum absorbers (the baseline value), the nondimensional results would be nearly the same for vertical shear and cockpit acceleration. A more detailed discussion of this application of generalized coordinates is contained in Reference 1.

The degree of correlation obtained in the previous application indicated that the analysis had merit and would be a valuable asset to future rotor research programs. It needed additional substantiation for the loads on an isolated rotor test program that not only had adequate blade instrumentation to define the shears at the flap and lag hinges but also direct measurement of the vibratory hub loads. The capability to measure hub loads was being integrated into the Reverse Velocity Rotor Model. A recommendation was made to provide additional blade instrumentation for the purpose of providing a backup source of obtaining vibratory hub loads data as well as providing an additional degree of substantiation. NASA provided the additional instrumentation required to obtain the data that is presented in the following sections.
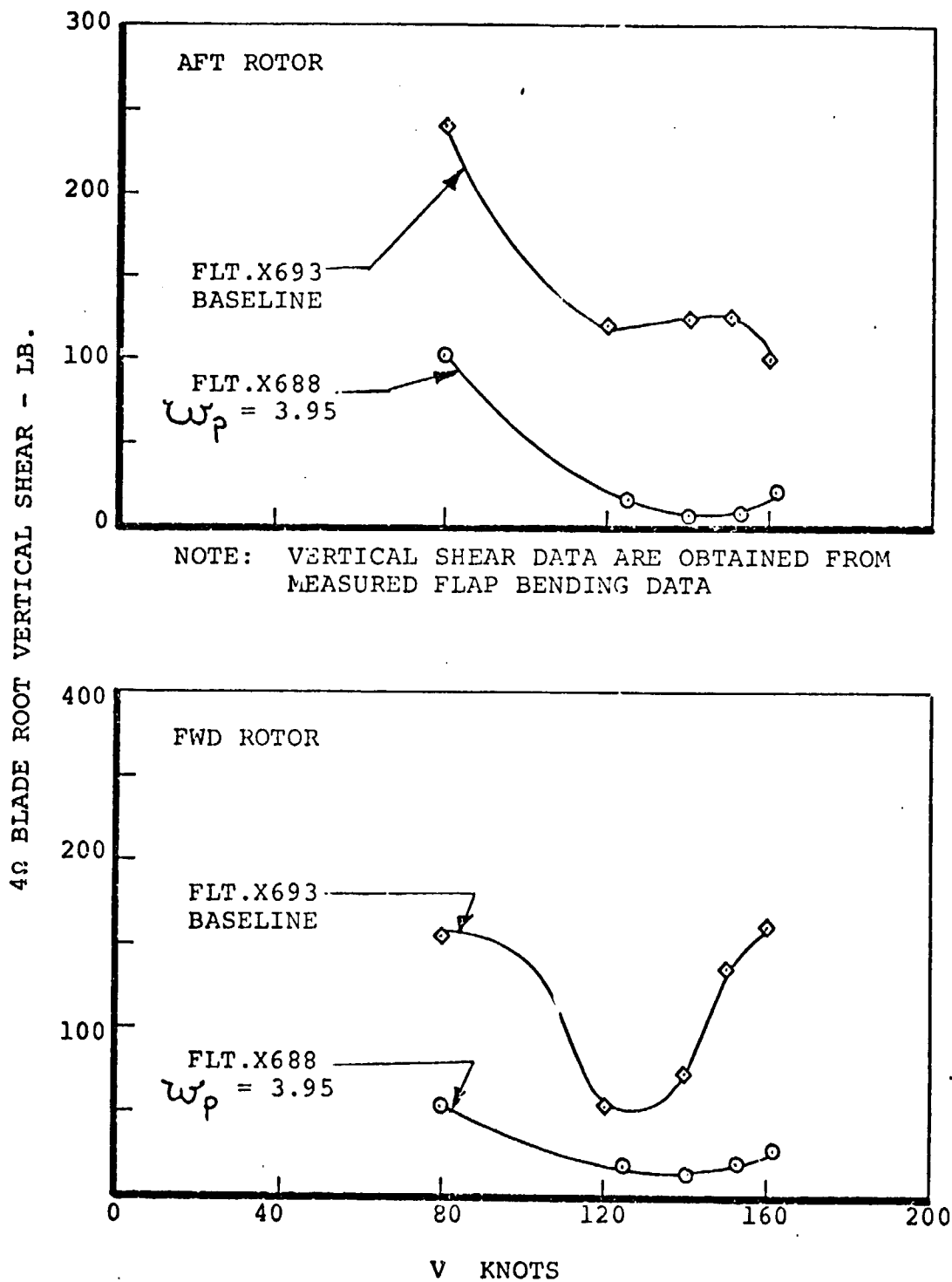
Figure 1.1   MODEL 347 PENDULUM ABSORBER – 4Ω BLADE ROOT
VERTICAL SHEAR RESULTS

4Ω BLADE ROOT VERTICAL SHEAR

FORWARD ROTOR
BASELINE (NO PENDULUMS)

LBS

4Ω COCKPIT VERTICAL ACCELERATION

BASELINE (NO PENDULUMS)

g's
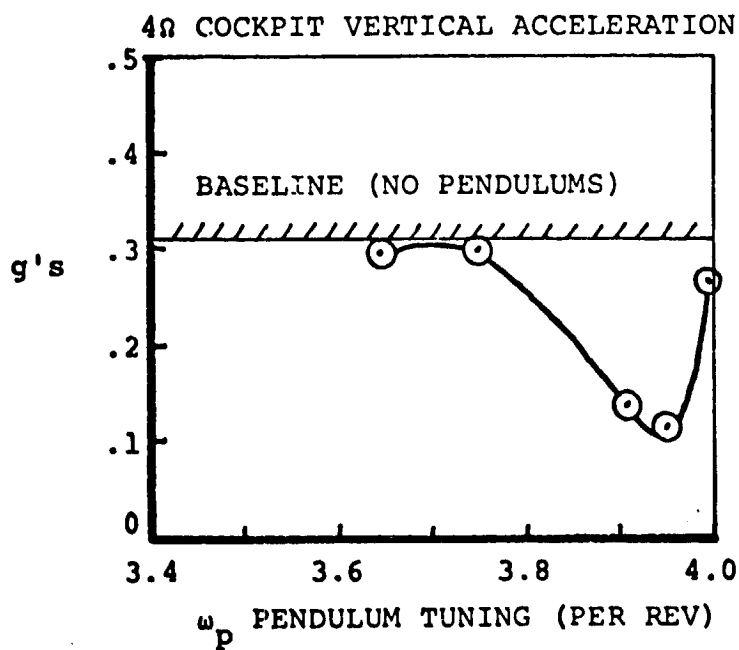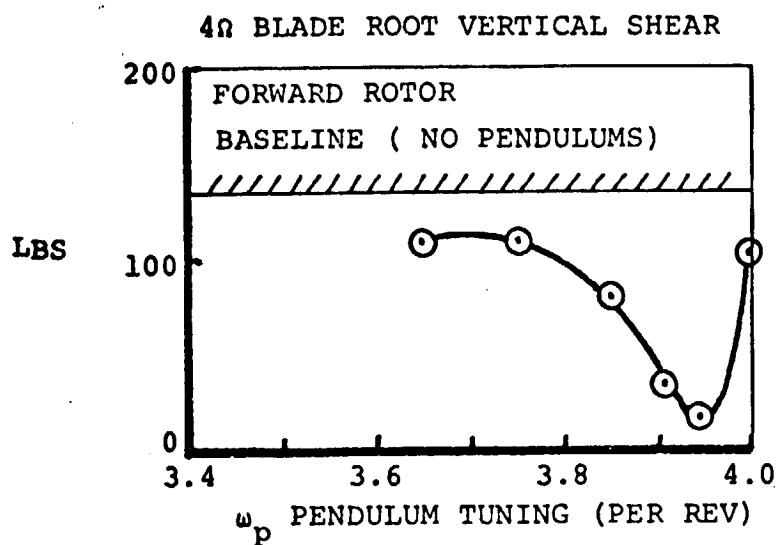
Figure 1.2 - MODEL 347   EFFECT OF PENDULUM ABSORBER TUNING
ON 4Ω BLADE ROOT VERTICAL SHEARS AND MEASURED
COCKPIT VERTICAL ACCELERATION AT 150 KTS

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2.0 DESCRIPTION OF MODEL AND TEST STAND

2.1 General

The Reverse Velocity Rotor Model was tested in NASA Ames 12 foot pressure tunnel. Figure 2.1 shows the installation in the tunnel of this 8 foot diameter, four bladed rotor mounted on the test stand. The rotor, control system and hydraulic motor are all mounted on a base plate carried on the NASA Ames 2.5 in. diameter High Endurance Main balance. This total model loads is mounted in a "Y" shaped support frame that can be pivoted on a floor mounted pedestal, as shown in Figure 2.2. The rotor shaft angle can be varied from 5° forward to 12.5° aft using the angle of attack mechanism to drive the "Y" support frame. The whole unit is enclosed in an upper fairing around the hub and a lower fairing around the control system, "Y" support frame and pedestal.

The hub fairing, hub and blades are mounted on a balance carried on the top of the rotor shaft for measuring six components of vibratory rotor loads. Figure 2.3 shows the geometric layout of the hub, hub balance as well as the base plate and main balance.

2.2 Rotor Blades

The rotor characteristics presented in Table 2-1 define the blade geometric and structural properties. The rotor blades are of constant chord with a root cutout at 23 percent radius. The Fairchild developed reversible airfoil sections are a 1.5 percent cambered, 6% thick section at the tip and a 3.5 percent cambered, 18% thick section at the root, with linear taper root to tip. The airfoil sections at root, tip and midspan are shown in Figure 2.4

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and ordinates for these sections are given in Table 1-II of Reference 2. A cross-section of one of the blades is shown in Figure 2.5. The aluminum upper and lower skins have chordwise and spanwise thickness variations formed by chemical milling. A C-spar,which is bonded to the skins over the full span at the chordwise change of skin thickness,is machiend integrally with the root end attachment. The skins are bonded to an aluminum wedge at the trailing edge and a bronze wedge at the leading edge which serves as a balance weight. An aluminum honeycomb core is machined to the internal contour and serves as a tie between the upper and lower skins as well as a forming core for the bonding operation. Strain gages were bonded internally to the spar on two of the blades at three radial stations (.37R, .51R and .70R) to measure flap bending stresses as shown in Figure 2.6.

The rotor blade was designed with maximum torsional stiffness at minimum weight as a prime concern. The bonded metal structure was found to be the minimum cost and minimum risk approach for achieving this. The resulting blade Lock number is 2.1 at sea level which is much less than that of conventional helicopter rotor blades.

The rotor shear center and pitch axis were placed at 27.5 percent chord and the section c.g. near 30 percent chord. This configuration was found to be near optimum from studies of flap-torsion dynamic stability at high advance ratio. Plots of the rotor blade physical properties including the measured and theoretical spanwise variation of bending and torsional stiffness are given in

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Reference 3. The natural frequency spectrum of the rotor blade modes in a vacuum is shown in Figure 2.7.

2.3 Rotor Hub

The rotor hub is a 4-bladed fully articulated type with provisions made for various values of delta-3 feedback; however, due to lack of time only a delta-3 angle of 26.5 degrees was used in this series of tests. The coincident flap and lag hinges are positioned at 6.5 percent of the blade radius.

Mechanical damping of the blades is provided about the lag hinge by rotary viscous dampers mounted above the rotor hub. The dampers provide approximately 130% critical damping about the lag hinge to minimize the potential of a ground resonance-type instability of the rotor mounted on the flexible balance.

In order to measure vibratory loads a NASA 6-component strain gage balance was installed in the hub so that all loads from the rotor hub to the shaft are carried through this balance. Together with the strain gaging of the pitch links and the measurement of accelerations in three axes at the hub, this enables vertical and in plane vibratory forces to be determined.

The hub is fully faired by a spun metal fairing with cut-outs to permit blade flapping, and shields mounted on the blade cuffs to close the cut-outs.

2.4 Control System

The control system shown in Figure 2.9 has a conventional
three - actuator - controlled swashplate to provide
collective pitch and one - per - rev cyclic pitch.
The actuators are set at 90°, 180° and 270° azimuthal positions
and are remotely operated with controls for collective, longi-
tudinal cyclic and lateral cyclic. Instead of operating the
incidence rods directly, the swashplate outer ring carries
four levers which allow for the addition of a two-per-rev input
to the swashplate motion.

The two-per-rev motion is generated by a lower swashplate and
a shaft driven at twice rotor rpm. In previous tests the
two-per-rev motion was transferred to the upper swashplate level
by an external sleeve. To minimize inertia forces the two-per-rev
motion is transmitted upward by a column that is now positioned
inside the main rotor shaft. A crosshead, attached to the top of
the column, projects through slots in the wall of the shaft and
is connected to the mixing levers on the upper swashplate.

To achieve a satisfactory life, all two-per-rev bearings except
the swashplate bearing are lubricated by a pressure fed oil supply
from an external system. The two-per-rev generating mechanism is
enclosed in a cylindrical housing with a sump inside the drive
pulley to collect the oil from the bearings.

The self-contained lubrication system consists of an approximately 5 gallon tank equipped with a 5 horsepower pump with pressure relief, and a pair of 1 horsepower scavenge pumps working in parallel. The oil in the tank is cooled by a fresh water supply.

2.5 Drive System

The rotor is driven through a toothed belt by a hydraulic motor mounted on the baseplate. The belt passes around the upper hydraulic motor drive pulley (21 teeth) and the rotor shaft pulley (60 teeth). A second identical drive pulley on the hydraulic motor is connected by a second toothed belt to the two-per-rev generator drive pulley (30 teeth). The ratio of hydraulic motor rpm to rotor shaft rpm is 2.857:1 and the ratio of the two-per-rev generator rpm to rotor shaft rpm is 2.0:1. When it is not required to operate the two-per-rev mechanism, the lower belt can be removed and the two-per-rev sleeve locked in its central position. The phasing of the two-per-rev input to the main rotor shaft is accomplished by the relationship of the rotor and two-per-rev pulleys; phasing can readily be changed after slackening off one or both of the drive belts.

The hydraulic motor is driven by a self-contained hydraulic power pack located outside the wind tunnel shell, consisting of an electric motor, pumps, reservoir, filters, control and relief valves, etc. The power pack can be remotely controlled from the wind tunnel control room. Provision is made for controlled braking of the rotor to prevent overspeeding in the windmilling case, and also for auto-matic control of rotor speed.

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Since the hydraulic motor is mounted on the metric part of the system, connection between it and the pedestal is through pressure-balanced swivel joints. Tare effects due to the load path across these swivels and pipes were tested for and found to be zero. The swivels also allow for the change of alignment of the hydraulic piping when the rotor shaft angle is altered.

2.6 Instrumentation

The rotor blades were fitted with bending bridges measuring flapwise bending stress at 3 blade stations: .37, .51 and .71 radius, as shown in Figure 2.6. The gages were mounted internally so as not to affect the airfoil characteristics. An additional blade was instrumented by NASA to measure bending stresses at four radial stations flapwise (.26R, .40R, .65R, and .795R) and three radial stations chordwise (.26R, .40R and .60R) as shown in Figure 2.8. This increased instrumentation provided a more detail coverage of flapwise bending and a radial distribution of the chordwise bending. The placement of these gages on the exterior of the blade was defined to provide coverage for the first two flapwise modes and the first chordwise mode for use in the semi-empirical method of obtaining vibratory hub loads.

Vibratory chordwise blade stresses were monitored by axial strain gage measurements on the lag damper rod linkage which is equivalent to monitoring the root vibratory moment. Axial strain was measured on the pitch link for purposes both of monitoring control system stresses and blade torsional loads and to enable the vibratory forces measured at the hub balance to be corrected for pitch link loads.

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All of the above quantities were displayed on oscilloscopes which were triggered from a pulse at zero azimuth position on number 1 blade to indicate the phasing of the response on the scopes. The information was also recorded on oscillographs.

The positions of the electric actuators which govern the swash-plate motion and two-per-rev pitch amplitude were measured using linear potentiometers of inifinte resolution. These voltages were read in the control room using digitally indicating millivolt potentiometers. The pots were wired and calibrated in terms of collective pitch, longitudinal cyclic pitch, lateral cyclic pitch, and two-per-rev pitch amplitude.

Rotor speed was measured by the voltage output of a D.C. generator driven by the hydraulic motor. A second indication of rotor speed was obtained by using a magnetic pickup triggered by a 60 tooth gear on the rotor shaft and connected to a counter with a digital display.

The voltage output from the NASA balance gages was filtered through the millivolt potentiometers (Imps) so that only the steady values remained; these were displayed in raw form on the "Imps" so that rolling moment at balance, rotor thrust, rotor drag and side force could be monitored during testing. The balance vibratory loads were also displayed on an oscillo-graph for monitoring of balance stresses and/or resonant conditions.

All the non-vibratory information i.e., rotor speed, steady
balance loads, control positions in terms of collective,
longitudinal, lateral, and 2/rev amplitude, and coning angle
were automatically recorded at each test run on paper tape.
The balance data was corrected for the primary interactions on
a computer with on-line capability. The rotor behavior was
made visible in the control room by means of closed circuit
television and recorded on video tape.
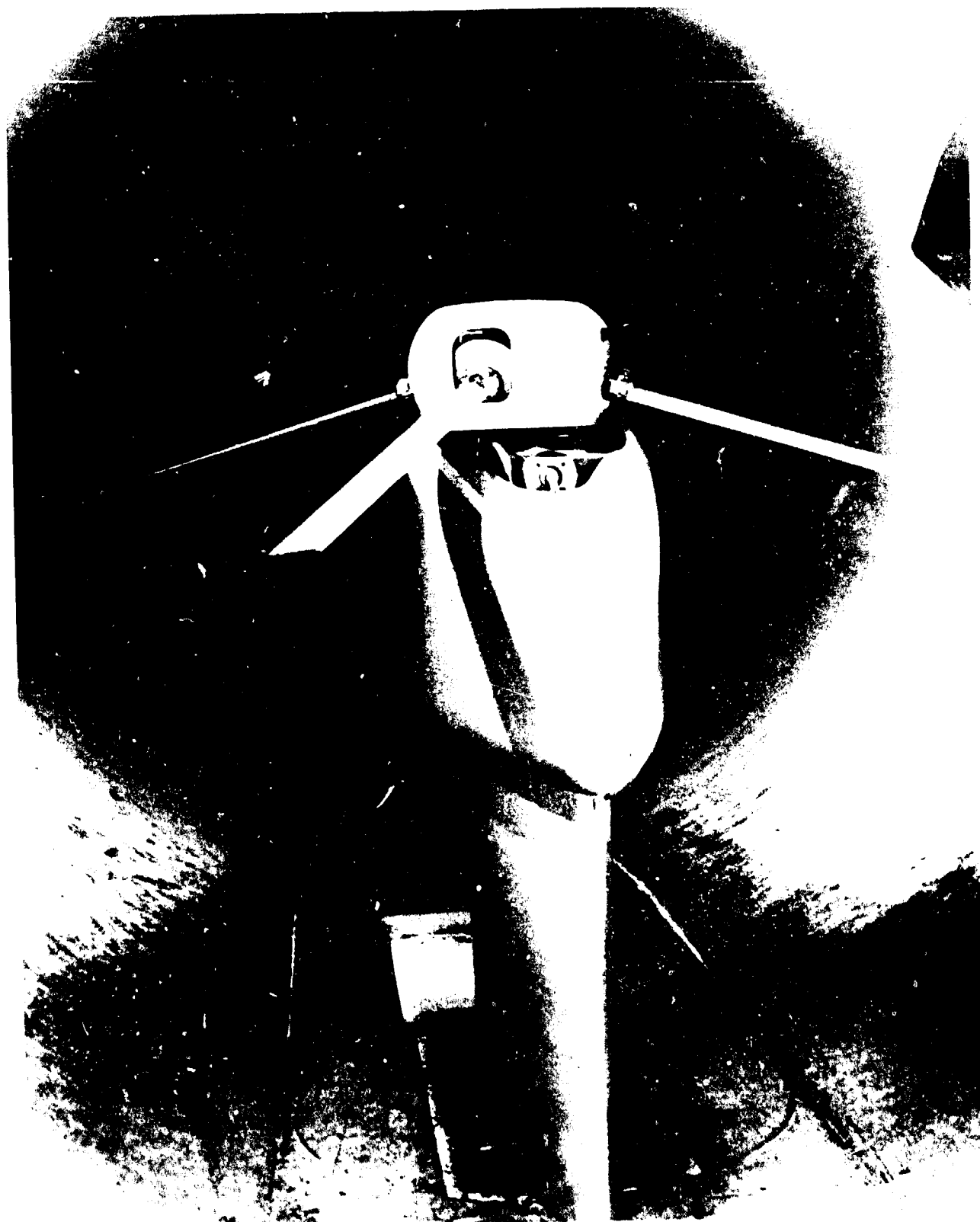
FIGURE 2.1.   REVERSE VELOCITY ROTOR TEST STAND INSTALLATION
IN NASA AMES 12 FT. PRESSURE TUNNEL
(LOOKING UP STREAM)
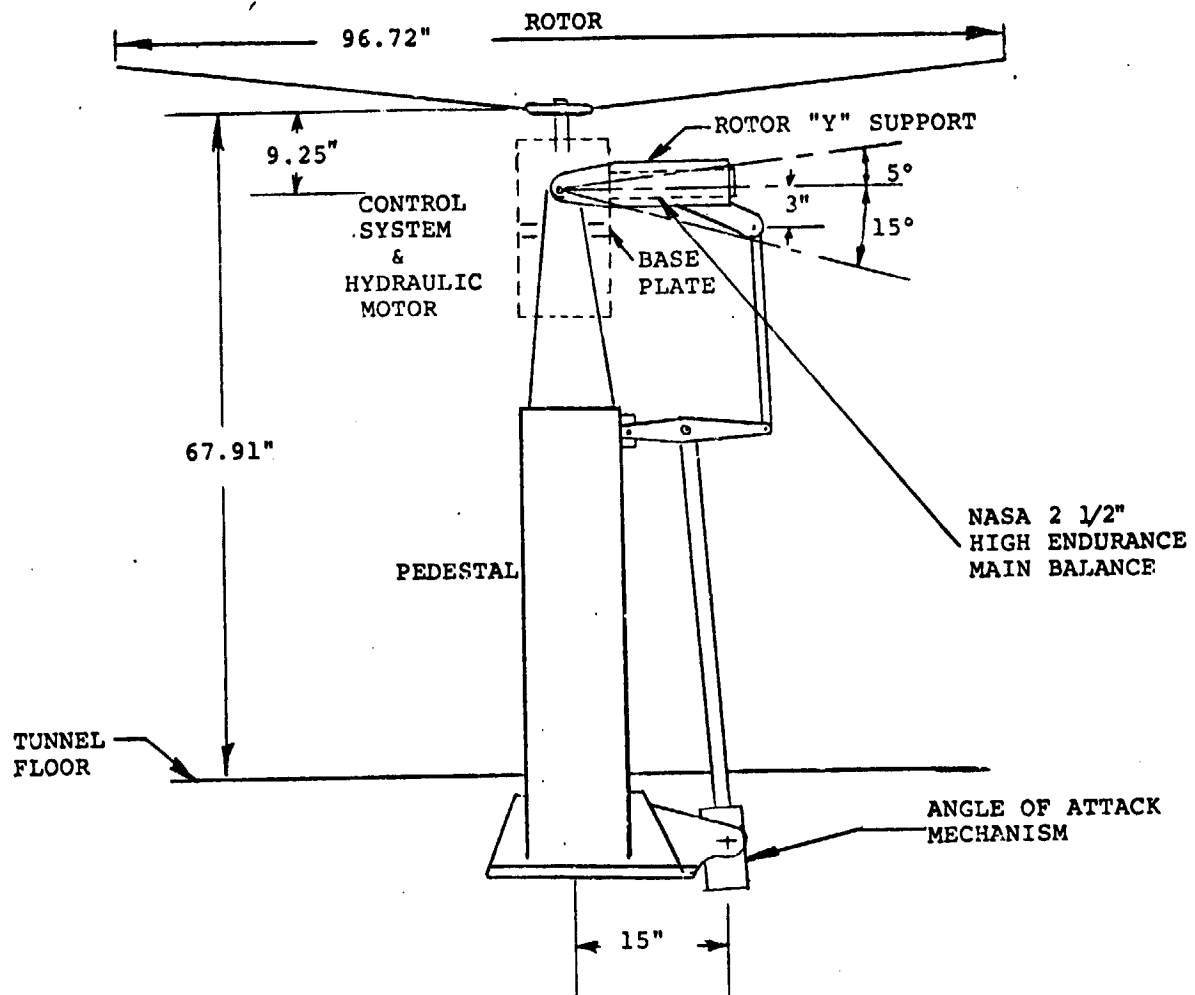
FIGURE 2.2. REVERSE VELOCITY ROTOR TEST STAND ARRANGEMENT
OF MODEL AND PEDESTAL IN THE TUNNEL

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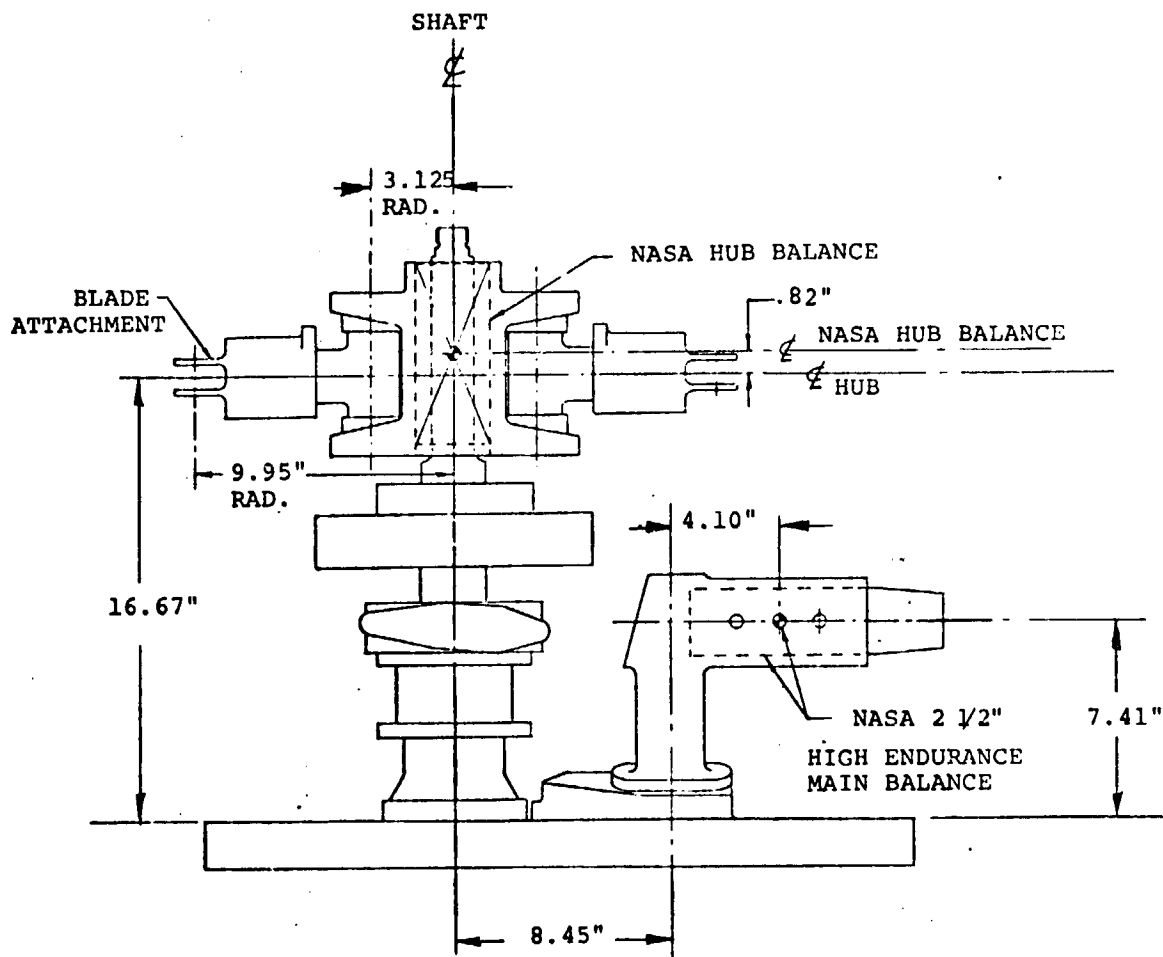
FIGURE 2.3. REVERSE VELOCITY ROTOR TEST STAND
GEOMETRIC LAYOUT

TABLE 2-1   ROTOR CHARACTERISTICS

Item	Value
Scaled Vehicle Gross Weight	400 lb
Disk Loading	8.0 lb/sq.ft.
Solidity	.133
Hover Tip Speed	700 ft/sec
Number of Blades	4
Rotor Radius	48.36 in.
Blade Chord (Constant)	5.0 in.
Blade Linear Twist	0
Root Cutoff/Blade Radius	.23
Flapping Inertia per Blade	.8504 slug ft^2
Flapping Moment per Blade	12.697 lb.ft.
Lock Number (sea level atmosphere)	2.3
Lag Hinge Offset/Rotor Radius	.065
Pitch Flap Coupling Angle - Delta-3	26.5deg*

*Other values available were not used during this test program.

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TIP

t/c 6% CAMBER 1.3%

·MID-SPAN

t/c 12% CAMBER 2.5%

ROOT

t/c 18% CAMBER 3.7%
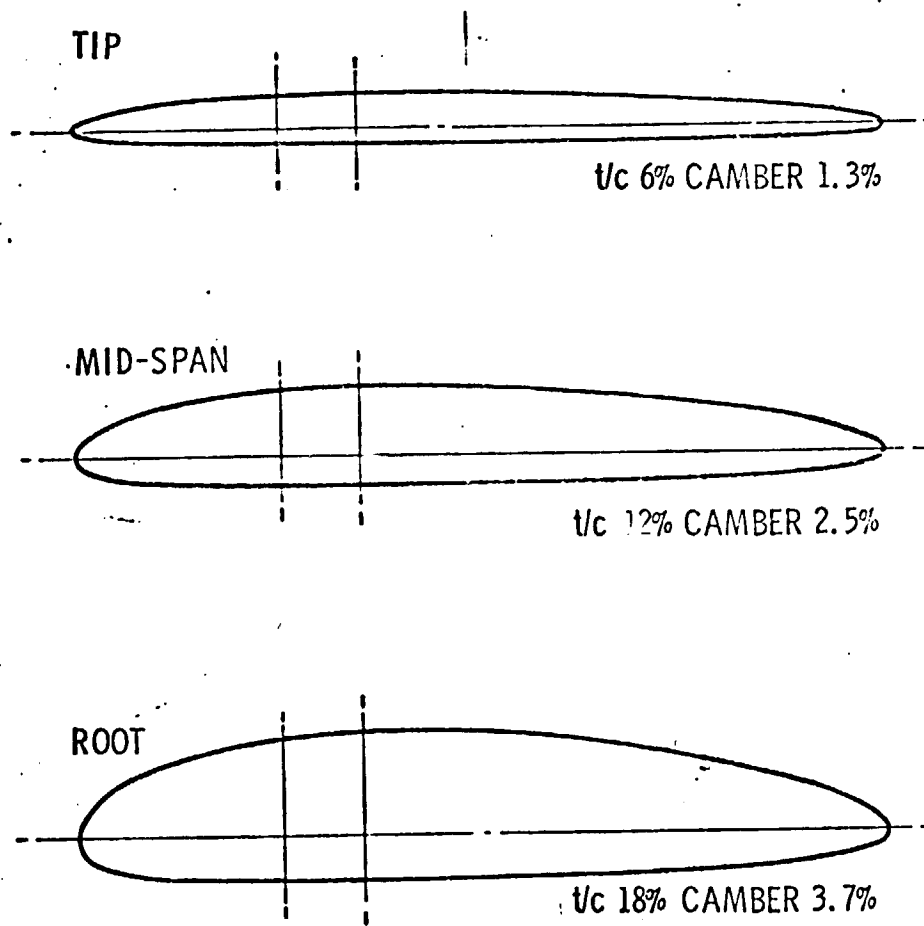
FIGURE 2.4.   MODEL ROTOR AIRFOIL SECTIONS

HONEYCOMB CORE

CHEMICALLY MILLED SKINS

ALUMINUM TRAILING EDGE

MACHINED ALUMINUM SPAR

BRONZE LEADING EDGE
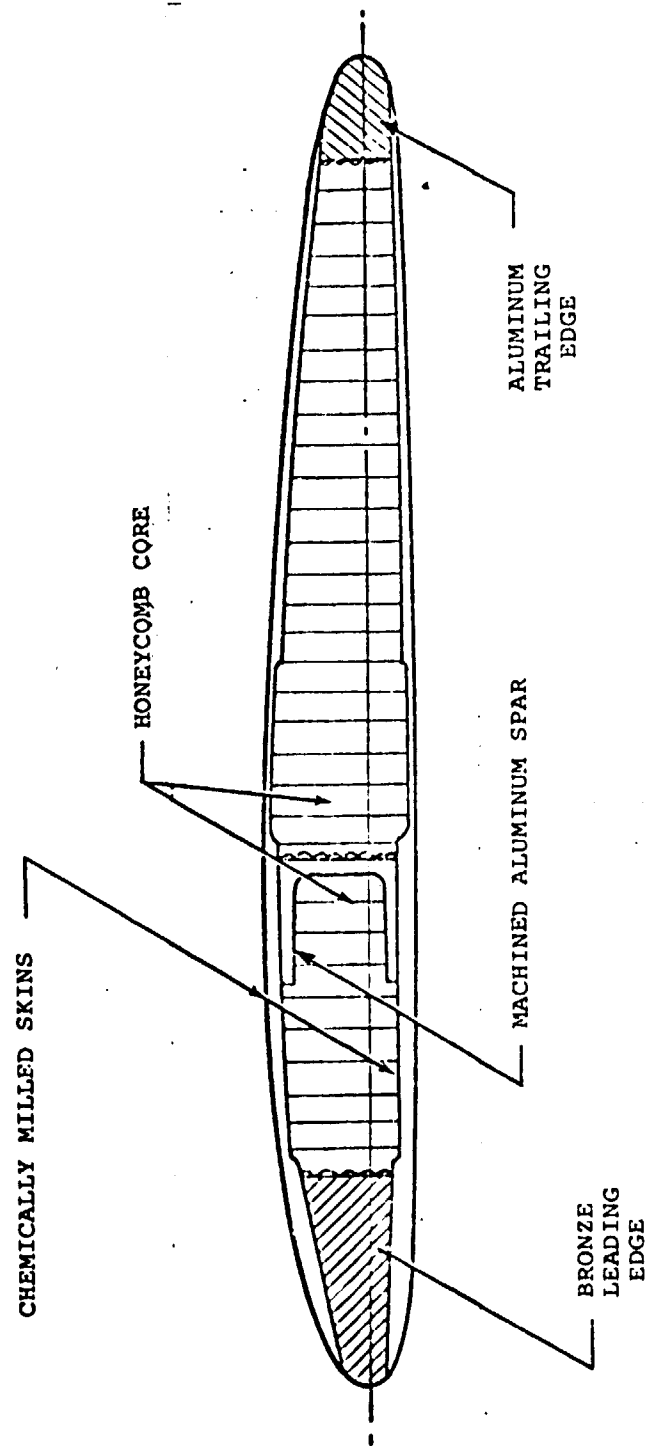
FIGURE 2.5. TYPICAL CROSS-SECTION OF MODEL ROTOR BLADE

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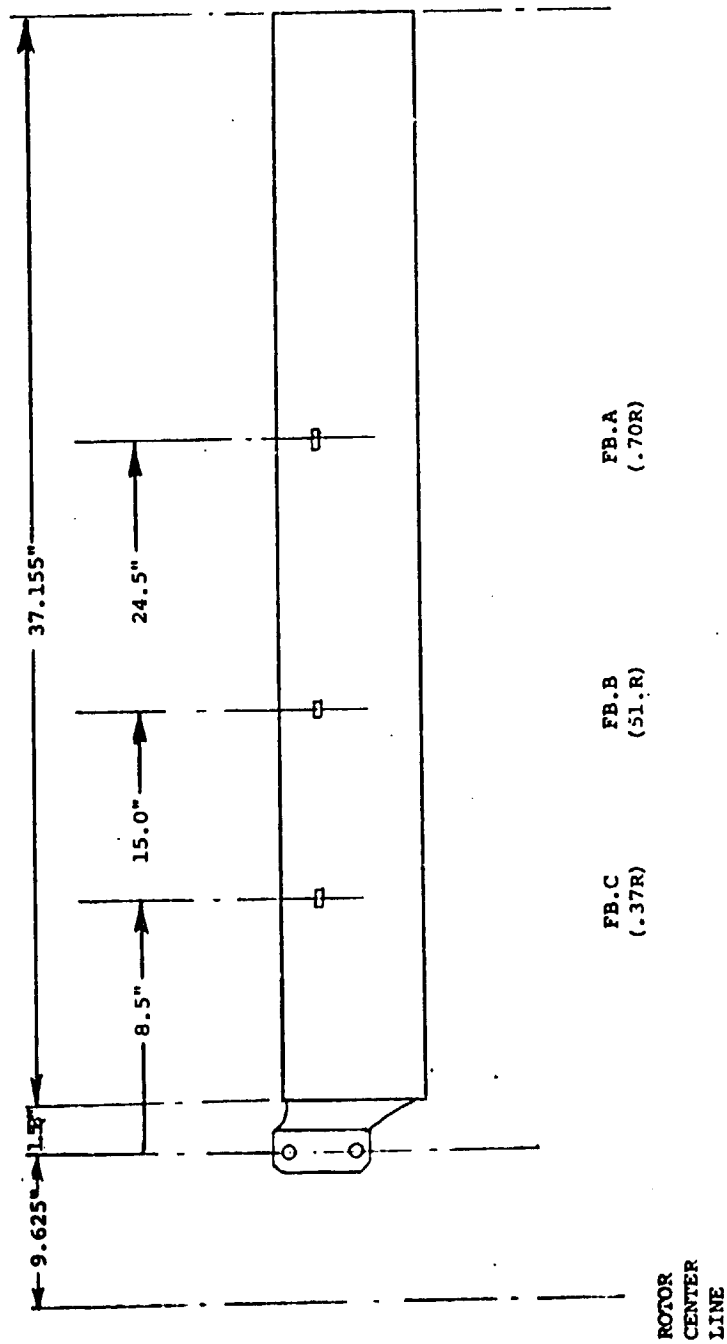
FIGURE 2.6   RVR BLADE STRAIN GAGE LOCATION
INTERNAL INSTRUMENTATION – FAIRCHILD

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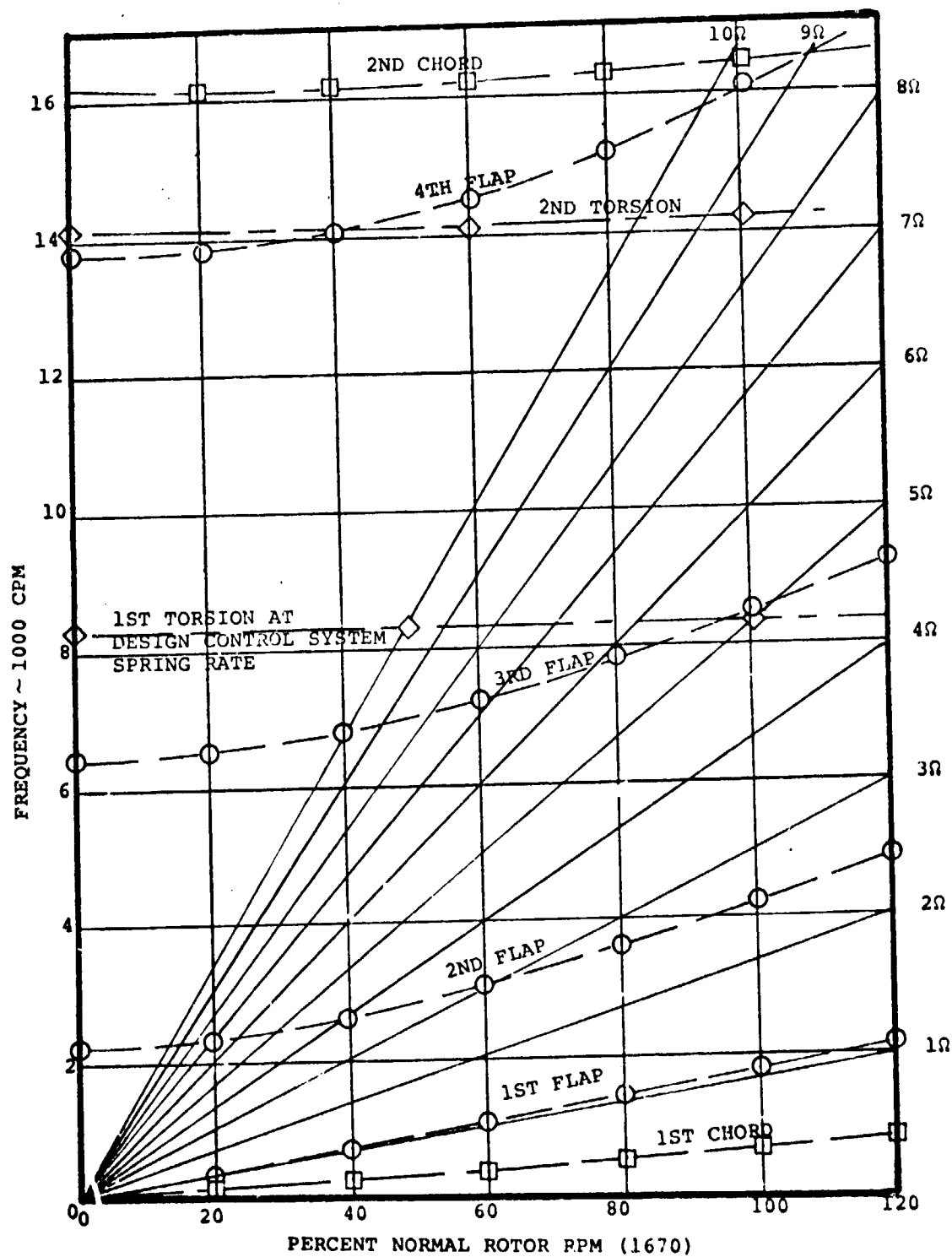
FIGURE 2.7. NATURAL FREQUENCY SPECTRUM
1/7 SCALE MODEL RVR ROTOR BLADE

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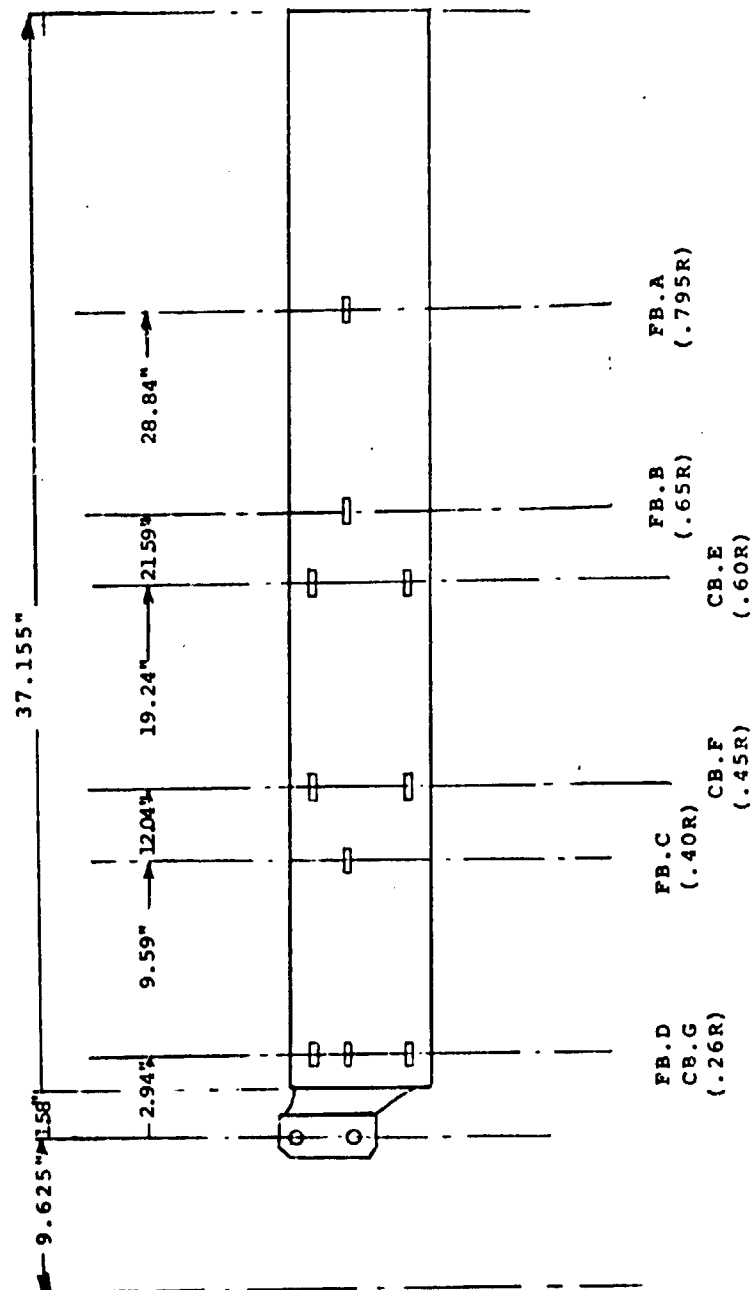
FIGURE 2.8 RVR BLADE STRAIN GAGE LOCATION
EXTERNAL INSTRUMENTATION - NASA

REVERSE VELOCITY ROTOR MODEL CONTROL SYSTEM

Labels on figure:
- 1/REV SWASHPLATE
- HYDRAULIC MOTOR
- 1/REV PULLEY
- THRUST BEARING
- 2/REV SWASHPLATE
- 2/REV ACTUATOR
- ROCKER ARM
- MIXER LEVERS
- COLLECTIVE & CYCLIC ACTUATORS (3)
- 2/REV PULLEY
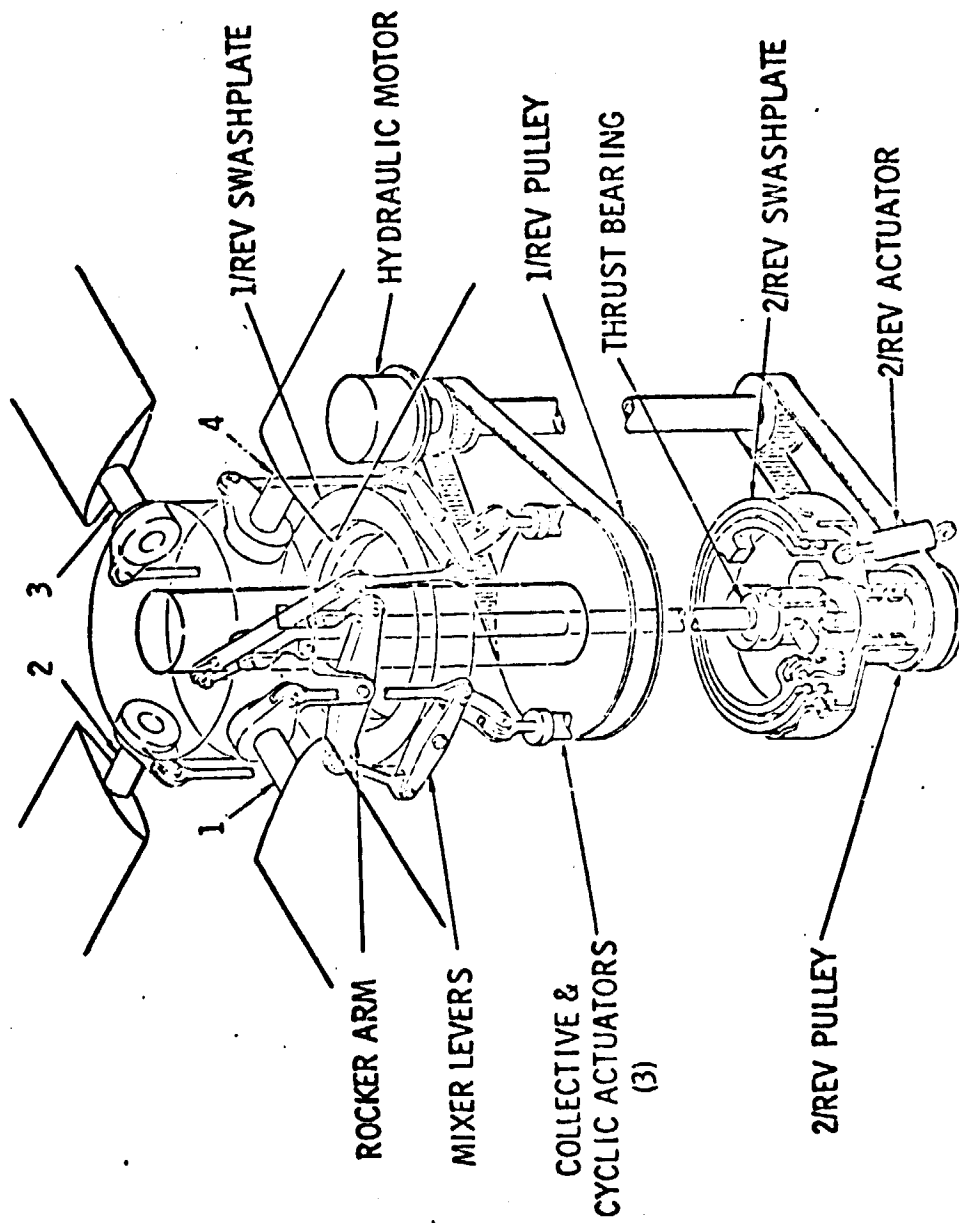
FIGURE 2.9.   REVERSE VELOCITY ROTOR MODEL CONTROL SYSTEM

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3.0 TEST RESULTS

The test results are separated into two categories: a) the six component hub loads obtained from the rotating hub balance and b) the hub loads obtained by synthesis of general coordinates from the blade bending moments. Hub balance results were obtained over an advance ratio range from $\mu = 0.3$ to 2.0 as shown in Table 3.1. Hub loads obtained from the generalized coordinate method were calculated for the same test conditions as the hub balance results, and additional test conditions where no hub balance data are available were analyzed to better identify data trends.

Analysis of both categories of hub load data addresses the three major test variables: advance ratio, thrust and two per rev cyclic. These three parameters are considered the most important for the RVR for the following reasons:

1. Rotor vibratory loads and helicopter vibration increases with advance ratio and the advance ratio range for the RVR is approximately 4 to 5 times greater than that of conventional helicopters.

2. Maneuvers require increased thrust capability which result in higher vibratory loads and increased vibration in the current helicopters. The impact of maneuvers or increased thrust at the higher speeds of the RVR could be intensified.

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3. The use of 2P cyclic is required in the transition from low speed to high speed for stall delay. This use of (2P) cyclic is one fundamental difference between the RVR and conventional helicopters and the higher harmonic excitation from 2P cyclic provides a potential source of higher vibratory loads.

The discussion of the test results are presented in this sequence for the hub balance data and then for the generalized coordinate hub loads. The results from the two methods are then compared showing the relationship of vibratory thrust and overturning moment.

3.1 Hub Balance Data

Vibratory hub loads data were obtained from the rotating hub balance for all six components (three forces and three moments). A detailed description of the data reduction equations are presented in Appendix A and the tabulated test results are presented in Appendix B. Since the model is a 4-bladed rotor, the 4/rev component of these loads is the largest contributor to vibration and the results shown in this section are exclusively 4th harmonic content in the fixed system. The 4/rev fixed system hub loads are summarized in Appendix C and are presented in the following discussion.

The basic hub loads data obtained from the hub balance for a range of collective pitch are shown in Figures 3.1 thru 3.6. These data are plotted as a function of advance ratio and form the basis of the hub balance results. All the data shown are for zero 2 per rev cyclic and for a 5 degree aft shaft tilt except the data at $\mu = 1.2$.

which is 7.5 degrees aft shaft tilt. (No hub balance data was obtained at 5.0 degrees aft shaft tilt for an advance ratio of 1.2.) The advancing tip Mach numbers for these data are between .85 and .92 except for the = 2.0 data for which the advancing tip Mach number is .77. The test results for all six hub loads components generally show a lot of data scatter. The vibratory torque is quite small for an 8 foot diameter full scale tip speed model so the amount of data scatter present in the data is typical for a model of this size. With respect to the remaining five hub loads components there are three probable sources of data scatter:

1. For a constant advance ratio, each data point is for a different collective pitch and steady thrust level. (A parametric study of thrust effects will later show this to be an important factor.)

2. The correction factors to the basic hub balance loads could vary widely because of appreciable model test stand vibration.

3. Blade flapping may not be trimmed to zero for each test data point.

In order to minimize data scatter and isolate the effect of advance ratio, the hub loads data were plotted as a function of thrust to determine the 1"g" level flight loads. Then like components (Fx and Fy) and (Mx and My) were combined vectorially to produce one in-plane force and one resultant overturning hub moment. The vector addition of these components minimizes the effect of changes in phase of 3/rev and 5/rev forces acting on the hub balance.

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For example, the hub loads data tabulation in Appendix B show that for the same test conditions the 4/rev longitudinal force is small compared to the lateral force, or vice versa, with little change in the resultant inplane component. The test data shows the same to be true for the pitch and roll moments. Treating the data in this manner reduces the hub loads components to four: vibratory thrust, torque, in-plane force and overturning moment. The 1g thrust results for these data are shown in Figures 3.7 and 3.8. The vibratory thrust and overturning moment are shown together as are the vibratory torque and in-plane force. This grouping was done purposely since each pair of hub loads components has the same primary source of vibration forcing. Vibratory thrust and over-turning moment come from blade root vertical shears produced by blade flapping or out-of-plane motion. For a 4-bladed rotor, 4/rev fixed system thrust comes solely from 4/rev blade vertical shears. Likewise, 4/rev fixed system hub moments come from 3/rev and 5/rev blade vertical shears. The 3/rev and 5/rev shears trigonometrically add to 4/rev in the transformation from the rotating to fixed systems while the 4/rev rotating moment contributions cancel in the transformation. Vibratory in-plane force and torque are primarily due to blade chordwise shears. This is produced by blade lead-lag or in-plane motion, and by trigonometric addition, the 4/rev root shears are the source of 4/rev torque and 3/rev and 5/rev root shears are the source of the 4/rev in-plane force.

All four hub loads components have definite trends with advance ratio for 1g lift and zero 2/rev cyclic. In Figure 3.7, vibratory

thrust has two local maximums at $\mu=.7$ and 1.6 for the advance ratio range up to 2 while vibratory overturning moment has a single peak at $\mu=1.2$. The double peaks for thrust cannot be clearly explained. The source of the 4/rev fixed system thrust is blade root vertical 4/rev shears and the dominant blade mode is the first flexible flapwise mode. The highest 4/rev response of this mode would be expected at its 4/rev resonant frequency, and this resonant point occurs at an advance ratio slightly greater than 2 for normal advancing tip Mach numbers. Therefore, the advance ratio of maximum vertical response is outside the range covered and no firm reason can be given for the two response peaks for 4/rev thrust.

There is a model/test stand 3/rev longitudinal frequency resonance at the rotor RPM for $\mu=1.6$ and a 2/rev longitudinal frequency resonance at the rotor RPM for $\mu=0.8$ as indicated in Appendix F, Figures F.3 and F.4. It is also possible that a model/test stand natural mode of higher frequency occur at these rotor speeds but were not detected by the shake test. These modes could possibly contribute to the amplification of the 4/rev vertical shears and result in the high loads presented in Figure 3.7. The hub balance data reduction program is designed to correct for model shaking effects, but the problem obviously becomes more difficult for near-resonant conditions. An important point to consider is that, if the peaks are caused by model/test stand natural frequencies, the amplified loads will not be present on a full scale RVR rotor, and the load level of $\mu = 0.5$, and 2.0 would be more representative of the actual load; therefore, the level of maximum

load is more than halved. Of course, it is possible that full scale fuselage (natural modes) will amplify the vibration but the identification of such modes is possible only in an advanced preliminary design stage.

The 4/rev overturning moment peak at $\mu = 1.2$ is expected and is clearly due to a first flexible flapwise mode (2nd flap) 3/rev resonant frequency condition at this advance ratio. (Refer to Appendix F, Figure F.1). Three per rev and 5/rev rotating vertical shears combine to form 4/rev moments in the fixed system so 4/rev fixed system moment peaks can be expected at the 3/rev flap crossing ($\mu=1.2$) and at the 5/rev flap crossing ($\mu>>2$).

The 4/rev inplane force results in Figure 3.8 have the same double peak characteristic as the vertical force results. There is a peak near $\mu=1.6$ and the 3/rev model/test stand natural mode resonant condition at this point is suspected to be the potential source of the amplification while the peak at $\mu=0.8$ is possibly caused by the 2/rev model/test stand natural mode resonant condition. The double peaks of 4/rev in-plane force dominate the in-plane loads forcing up to $\mu=2.0$; so if the peaks are due to model/test stand natural modes which will not be present on a full scale RVR, the realistic in-plane vibration is much lower than the peaks and about equal in magnitude to the 4/rev thrust loads at $\mu=0.3$, 1.0 and 2.0.

The 4/rev torque results in Figure 3.8 are small compared to the 4/rev nut overturning moment. The trend shows a slight peak

at μ=1.2 but the overall magnitude is so small that the 4/rev torque loading can be considered inconsequential.

The results shown in Figures 3.7 and 3.8 are for 1g lift conditions at each advance ratio. Comparing these results with the data shown previously in Figures 3.1 thru 3.6 it is clear that steady rotor thrust has an impact on 4/rev hub vibration. This effect of steady rotor thrust is shown in Figures 3.9 and 3.10 for zero 2/rev cyclic. The gradients of 4/rev hub loads with thrust are shown as a function of advance ratio. This method of data presentation shows hub loads sensitivities to lift over the advance ratio test range.

Figure 3.9 shows the vibratory thrust and hub moment sensitivity to g's thrust for thrust excursions from a 1g condition. The most important result of this figure is that the data collapse to definite trends with advance ratio for both 4/rev thrust and 4/rev moment. The highest sensitivity of vibratory thrust to g's thrust occurs at μ=1.4 which is close to the condition of highest vibratory thrust at 1g (shown in Figure 3.7). At this point the loads increase at the rate of 40 lb per .1g so that for .4g's the increase is about 160 lb. or roughly equal to the 1g loads. Therefore vibratory thrust in a 45 degree banked turn (1.4g's) at μ=1.4 would be double the level flight loads at the same advance ratio. Performing the same banked turn at higher or lower advance ratios results in a lower gradient of vibratory thrust. The vibratory hub moment has a similar thrust sensitivity trend but the peak hub

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moment gradient occurs at $\mu=1.2$ As previously discussed, the first flexible flapwise mode 3/rev resonant frequency occurs near this advance ratio so maximum amplification of thrust induced hub moments can be expected at this point. Increasing or decreasing advance ratio from this point results in lower thrust sensitivity but another peak can be expected at higher advance ratio for which the first flexible flap mode 5/rev resonant frequency occurs.

The percentage variation of vibratory hub moment sensitivity to thrust about the 1g condition at $\mu=1.2$ is about the same as that of the peak vibratory thrust gradient. The vibratory hub moment doubles for an increase of .4g's (equiv. to a 45 deg banked turn). Results for the effect of Δg's thrust on vibratory in-plane force and torque are shown in Figure 3.10. Vibratory torque sensitivity to thrust is comparable to the 1g level flight loads since both are quite small compared to the other hub load components.

The vibratory in-plane force results show a high sensitivity to g's and this sensitivity changes rapidly with advance ratio. At $\mu=1.2$, the change in 4/rev in-plane force per 0.1g thrust change is about 36 percent of the 1g load in Figure 3.8, so the vibratory in-plane force would increase by a factor of 2.5 over 1g loads for a 45 degree banked turn.

The effect of 2 per rev cyclic on 4/rev hub loads is shown in Figure 3.11 and 3.12. The results are presented as gradients per degree of 2 per rev cyclic for different advance ratios. The

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sensitivity of 4 per rev thrust to two per rev cyclic decreases nearly linearly with increasing advance ratio. At $\mu=2.0$ vibratory thrust is not affected by 2 per rev cyclic, and at the advance ratio for highest 1g level flight loads ($\mu=1.6$), 2 degrees of 2 per rev cyclic will increase 4/rev thrust 33% over 1g loads. So the effect of 2 per rev cyclic on 4/rev thrust can be termed moderate, particularly since there is no increased sensitivity to 2 per rev cyclic at the advance ratio for highest 1g vibratory thrust.

Sensitivity of 4/rev hub overturning moment to 2 per rev cyclic is nearly constant across the advance ratio range. At an advance ratio of 1.2, 2 deg of 2 per rev cyclic will increase the 4 per rev hub moments by 67% of the 1g loads.

Figure 3.12 shows the 2 per rev cyclic effects on vibratory torque and in-plane force. Vibratory torque sensitivity is shown by the cross-hatched area. Data scatter of vibratory torque with 2 per rev cyclic is large. A trend with a band width equal to the 1g vibratory torque is shown but this is quite small relative to the magnitude of vibratory hub overturning moments, and the loads shown can be considered in-consequential. The trend of 4/rev in-plane force with 2/rev

cyclic is quite smooth with increasing advance ratio. Sensitivity decreases with increasing advance ratio and at the condition of highest 1g loads (μ=1.4) 2 degrees of 2 per rev cyclic increases the in-plane force 40% over 1g loads.

3.2 Vibratory Hub Loads Obtained From Generalized Coordinates

This section summarizes the vibratory hub loads data obtained by using the generalized coordinate approach. Derivation of the approach is contained in Appendix D and a tabulation of all the hub loads calculated by this approach is included in Appendix E.

All of the hub loads data in this section were calculated by using the flapping degree of freedom generalized coordinate; that is, the coordinate obtained from the radial distribution of the blade flap bending moment. For an articulated rotor, the source of hub loads for this degree of freedom are the blade root vertical shears at the flapping pin. Four per rev blade root vertical shears result in 4/rev fixed system thrust and 3 and 5/rev blade root vertical shears combine trigonometrically to yield 4/rev fixed system hub overturning moments. The remaining three components (2 orthogonal in-plane forces and torque) require calculation of generalized coordinates for the in-plane degree of freedom, which in turn requires a measured chord bending moment radial distribution. Chord bending moments were not measured for the test runs shown in Table 3.1.

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Testing performed late in the program with a blade instrumented
for chordwise bending moment indicated that the alternating chord-
wise bending moments were very small, approximately 1/10 of the
flap bending moments, and were predominantly 1/rev, not 3, 4 or 5/rev.
The combination of very high chordwise stiffness and high chordwise
natural frequencies result in small chord bending moment amplitudes
that are difficult to accurately measure. The recorded load
amplitude was considered to be below the level that the instru-
mentation and conditioning equipment could accurately handle.
It is therefore doubtful that the generalized coordinate method
could be applied in the chordwise direction for this particular
blade and provide meaningful results. This does not have a signi-
ficant impact on the overall analysis effort and results since
the hub balance data in Section 3.1 indicate that the vibratory
thrust and hub moment are the two most important hub load components.
The generalized coordinate results for these flap dependent components
were obtained and are discussed in this section.

The vibratory thrust results obtained from generalized coordinates
are shown in Figure 3.13 for zero 2 per rev cyclic. The thrust trend
shows a steadily increasing load with increasing advance ratio.
There are two local maximum points at $\mu=.7$ and $\mu=1.4$. But the
important result is the apparent direct relationship between vibra-
tory thrust and advance ratio. Unlike the 4/rev hub moment with a
localized area of load amplification 4/rev thrust grows steadily
worse with no indication of relief over the test advance ratio range.

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Figures 3.14 and 3.15 show the vibratory 4 per rev hub moment results obtained from generalized coordinates. In order to provide a direct comparison with the hub balance data, the 4/rev hub pitch and roll moments have been combined vectorially to form one hub overturning moment. Figure 3.13 and 3.14 show the calculated hub moment as a function of advance ratio and rotor speed, respectively, for zero 2 per rev cyclic at 1g thrust. The hub moment trend peaks at $\mu=1.3$ or about 1050 RPM. The gradient is quite high above and below the maximum load. This peak is due to the 3/rev frequency crossing of the first flexible flapwise mode. These results clearly indicate that the hub moments and associated vibration can be sharply reduced by avoidance of this resonant frequency point.

Figure 3.16 shows the sensitivity of the vibratory thrust to 2 per rev cyclic. The results for 2 deg and 2 per rev cyclic are quite close to the vibratory thrust trend for no 2 per rev cyclic. The sensitivity of unsteady thrust to 2 per rev cyclic is small and even appears negative at $\mu=1.4$. It is clear that the primary forcing of 4/rev thrust is fundamental airloading with advance ratio and not 2 per rev cyclic.

The effect of 2 per rev cyclic on 4/rev hub moment as calculated by generalized coordinates is shown in Figure 3.16. The trend of hub moment with advance ratio for zero 2 per rev cyclic is compared with the results for 2 degree of 2 per rev cyclic. There is an increase in hub moment sensitivity with 2 per rev

cyclic but the increase is nearly independent of advance ratio. Compared to the hub moment amplification at $\mu=1.3$, the effect of 2 per rev cyclic is small.

3.3 Comparison of Balance and Generalized Coordinate Data

Based upon the results shown in the previous two sections, a comparison between hub loads obtained from the rotating hub balance and those obtained from generalized coordinates can be made.

The comparison is limited to those 4 per rev hub loads components obtained from generalized coordinates: vertical force and hub overturning moment. Rotating hub balance data points corresponding to the generalized coordinate data or Figures 3.13 and 3.14 will be comapred and related to the 1 "G" hub balance data fairing of Figure 3.7. This is done in Figure 3.18 which presents the 4/rev thrust and hub moment results for both methods as a function of advance ratio. The vibratory thrust comparison indicates similarities and also fundamental differences in results between the two methods. The rotating balance results are double peaked with local maximum at $\mu=.7$ and 1.6 whereas the generalized coordinates results exhibit only one distinct peak at the lower advance ratio followed by a trend of steadily increasing load with advance ratio. As previously discussed, the local maximums are most likely due to model/ test stand resonant frequencies which will not be present on a full scale rotor system.

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The rotating balance results are generally substantially larger than the generalized coordinate loads but the trend is decreasing load for high advance ratios compared to increasing load for the generalized coordinate results. It is possible that the vibratory thrust trend with high advance ratios as measured by a balance is obscured by the resonant frequency response at $\mu=1.6$ and also any factors influencing additional forcing (model hub motions, deflections, etc.). It appears that the real vibratory load levels are best represented by the results from the generalized coordinate method. This is indicated by magnitude comparisons at $\mu=0.3$, 0.5, 1.2 and 2.0 where the vibratory thrust results are believed to be unamplified due to model/test stand natural frequencies.

The vibratory hub moment comparison (Figure 3.18) shows areas of good agreement and poor agreement between results for both methods. The delineator between good and poor correlation is obviously the effect of the 3/rev flap mode frequency crossing near $\mu=1.3$. For advance ratios well removed from this point of amplification, agreement between methods is very good. For advance ratios approaching the 3/rev resonant frequency crossing, the agreement becomes poorer. The rotating balance results show less sensitivity than the generalized coordinate results to the blade 3/rev crossing. The difference in magnitude is about a factor of 3 and the reason for this difference is unknown. The rotating balance data appears to be damped appreciably more at the resonant frequency crossing, but whether this characteristic is peculiar to the rotating

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balance cannot be ascertained.

Figure 3.19 is a comparison between methods showing the effect of 2/rev cyclic for both vibratory thrust and hub moment. The results are presented as a delta change in load per degree of 2 per rev cyclic as a function of advance ratio. For vibratory thrust, the comparison shows that results obtained from generalized coordinates are nearly insensitive to 2 per rev cyclic over an advance ratio range of $\mu=.8$ to 2.0. The magnitude is approximately 10 lbs (.05 g's) per degree of 2 per rev cyclic and the direction of change is slightly positive for low advance ratios reducing to zero for the highest advance ratios. The implication is that a slight change in the 4/rev vibratory thrust results from 2 per rev cyclic at all advance ratios tested. The rotating balance results differ only in the magnitude of the vibratory thrust change with 2 per rev cyclic. It is substantially larger than that indicated by the generalized coordinate results, particularly for the lower advance ratios. The rate is about 40 lbs. (.20 g's) per degree of 2 per rev cyclic. This rate decreases with advance ratio to about 10 lbs (.05 g's) per degree at $\mu=2.0$.

The differences between 4/rev thrust results with 2 per rev cyclic for the two methods cannot be explained. Little is known about higher harmonic cyclic effects on off-harmonics, such as the case here. Intuitively it would seem that 2/rev cyclic should affect 4/rev thrust only indirectly since the major effect involved is an azimuthal redistribution of 1/rev airloads with 2 per rev cyclic rather than development of 2/rev, 3/rev or 4/rev airloading.

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This result occurs largely because of the nose down phasing of 2/rev cyclic on the advancing and retreating sides. A diametric change in 2 per rev cyclic phasing would be more likely to produce higher harmonics of airloading, although again, the major change would be a change in 1/rev airloading. The implication is that the best estimate of 2/rev cyclic effects on thrust is little or no change in 4/rev thrust. For this case the generalized coordinate results are probably closer to the actual load.

Results for hub moment sensitivity to 2 per rev cyclic are compared in the lower half of Figure 3.19. The generalized coordinate results indicate a low sensitivity of hub moment to 2 per rev cyclic. The direction of sensitivity is increasing hub moment with 2 per rev cyclic and the magnitude is about 100 in.lb/degree. This sensitivity is quite small compared to the high hub moments for zero two per rev cyclic near the 3 per rev flap frequency crossing shown in Figure 3.18. For a large range of advance ratio, these 1g loads without 2 per rev cyclic are at least 10 times larger than the max load change for 1 degree for 2 per rev cyclic. However, for advance ratios above and below 3 per rev crossing, the sensitivity to 2 per rev cyclic approaches the 1g loads and therefore becomes more important. For example, $\mu=1.0$, 1 degree of 2 per rev cyclic increases the hub moment 16 percent over 1g loads without 2 per rev cyclic and at $\mu=2.0$ the increase is 100%. The rotating balance hub moment results are more sensitive to 2 per rev cyclic between advance ratios of 0.8 and 1.4. The highest sensitivity occurs at $\mu=1.2$ where the increment due to 1 degree of 2 per rev cyclic is

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40 percent of the lg load without 2 per rev cyclic but is three times greater than that defined by the generalized coordinate method.

For increasing advance ratios from 1.2, the sensitivity slowly decreases, approaching the level defined by the generalized coordinates. The hub moment obtained from generalized coordinates shows no significant changes in sensitivity at these conditions, but rather a smooth trend with advance ratio. Just as for the vibratory thrust results, it is difficult to determine what trend is more nearly correct (hub balance or generalized coordinate). The primary difference between the vibratory thrust and hub moment results is the presence of a real dynamic resonance point with a strong effect on hub moments but no logical effect on vibratory thrust. In this sense the vibratory thrust results are more clearly forced response with 2 per rev cyclic altering the forcing. The exception to this is the probable presence of model/test stand natural modes that affect 4 per rev thrust response, as shown by the rotating balance results. The dynamic resonance point affecting hub moments is a fundamental characteristic of the rotor system and it will occur as long as the rotor speed is sufficiently reduced to approach the 3/rev 2nd flap mode frequency. Therefore, for the hub balance, it is quite possible that 2/rev cyclic has a larger effect on the 4/rev hub moments which come from 3/rev vertical shears, than on 4/rev thrust. The extent to which the sensitivity should increase for hub moment is not known but the generalized coordinate trends are considered closer to that for a full scale rotor.

RUN	μ	RPM	M_{190}	α_s	θ_{2p}
84*	.7	1440	.92	5	0, 2, 4
85*	.9	1300	.92	5	0, 2, 4
86*	1.2	1120	.92	5	0, 2, 4
87*	1.4	960	.85	5	0, 2, 4
88	.3	1670	.81	5	0
89	.5	1530	.92	5	0
90	.79	1360	.92	5	0, 2, 4
91	1.4	950	.85	5	0, 1, 2, 3
92	1.6	880	.85	5	0, 1, 2
116	1.4	950	.84	7.5	0
118	1.95	725	.78	0	0
121	2.0	700	.77	5	0, 1, 2
123	1.2	1140	.92	7.5	0, 2, 4

* Generalized Coordinate Analysis Only

Table 3-1   Test Conditions For Which Vibratory Hub
Loads Data Are Available
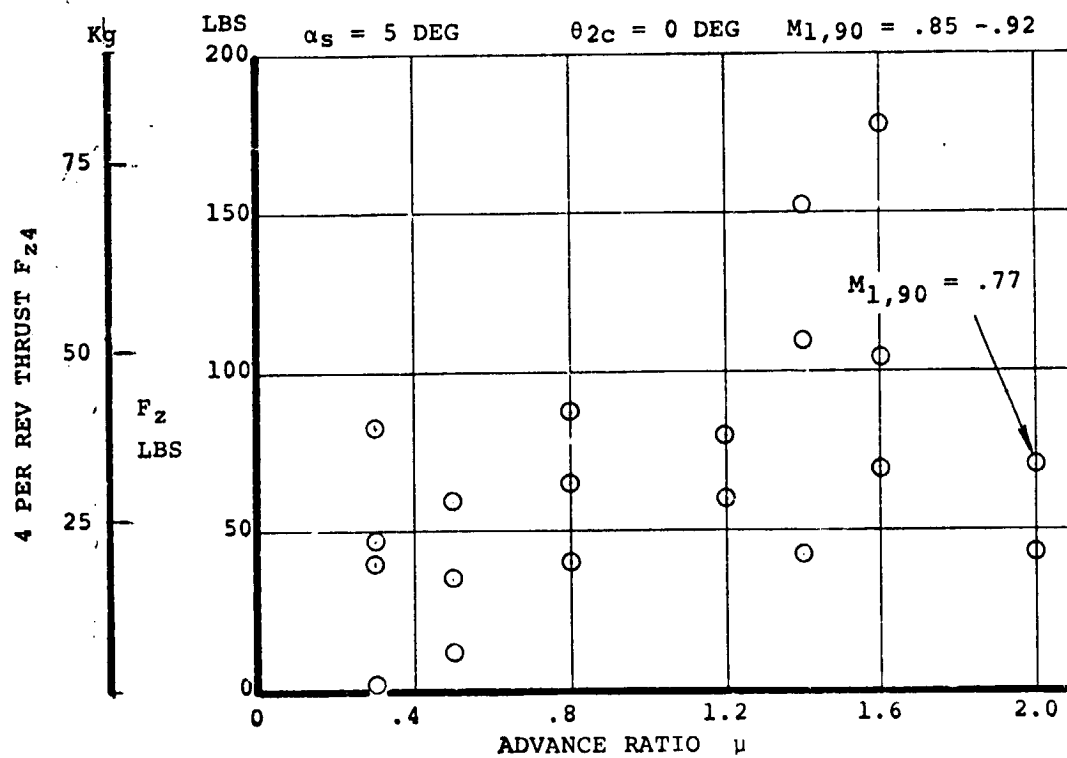
FIGURE 3.1   RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM
THRUST FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC
(ROTATING HUB BALANCE DATA)

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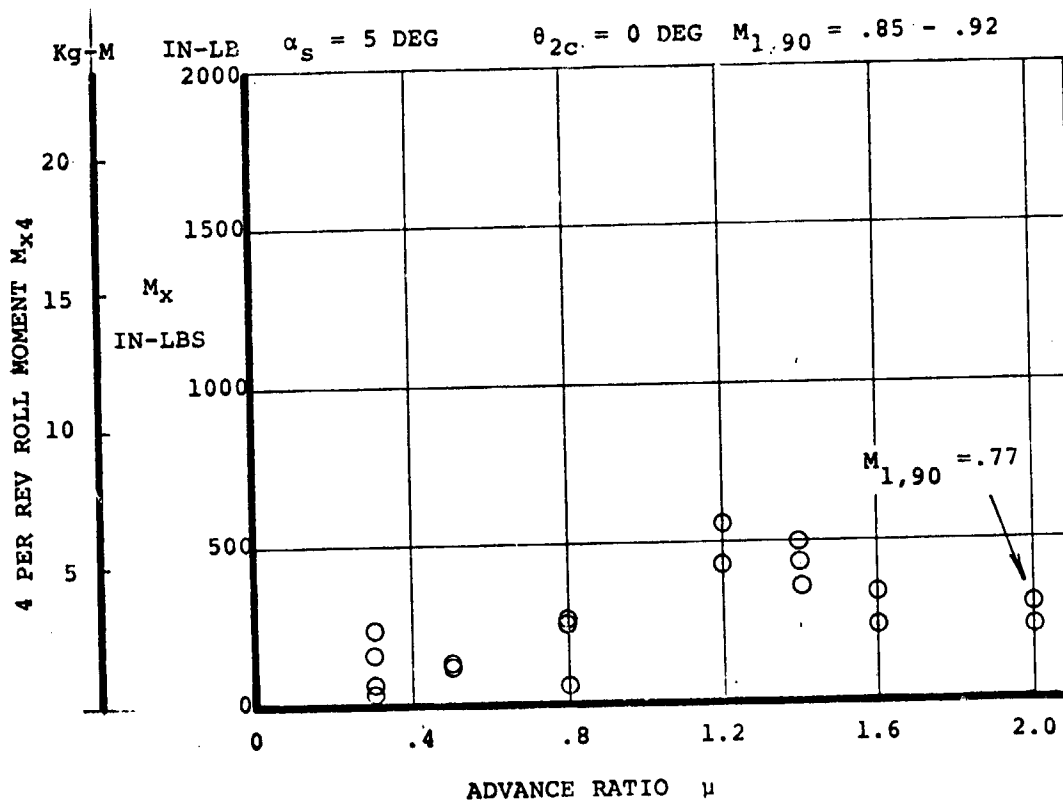
FIGURE 3.2 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM
ROLL MOMENT FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV
CYCLIC (ROTATING HUB BALANCE DATA)
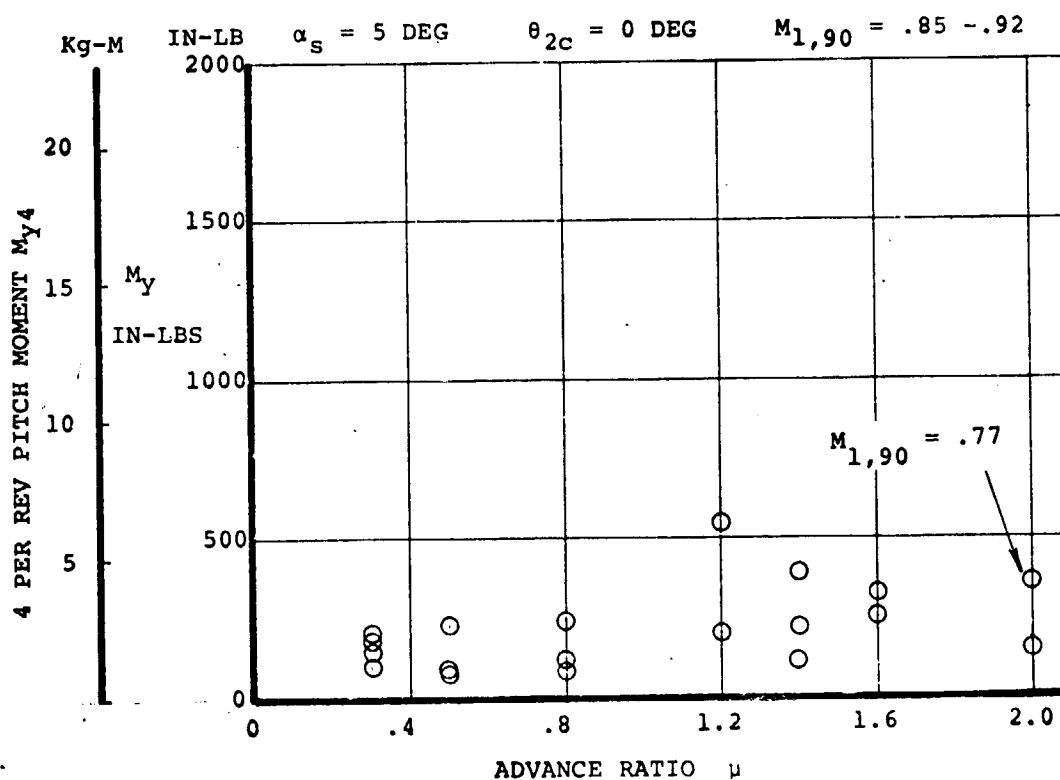
FIGURE 3.3 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM
PITCH MOMENT FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV
CYCLIC (ROTATING HUB BALANCE DATA)

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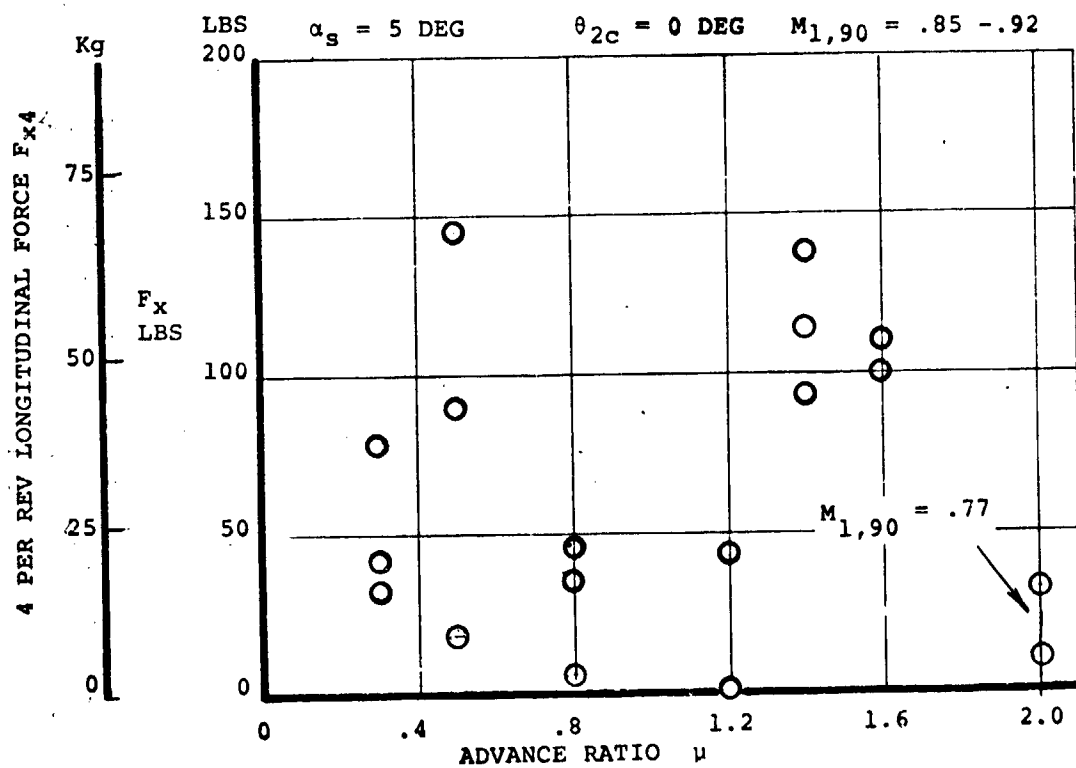
FIGURE 3.4 RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM LONGITUDINAL FORCE FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC (ROTATING HUB BALANCE DATA)
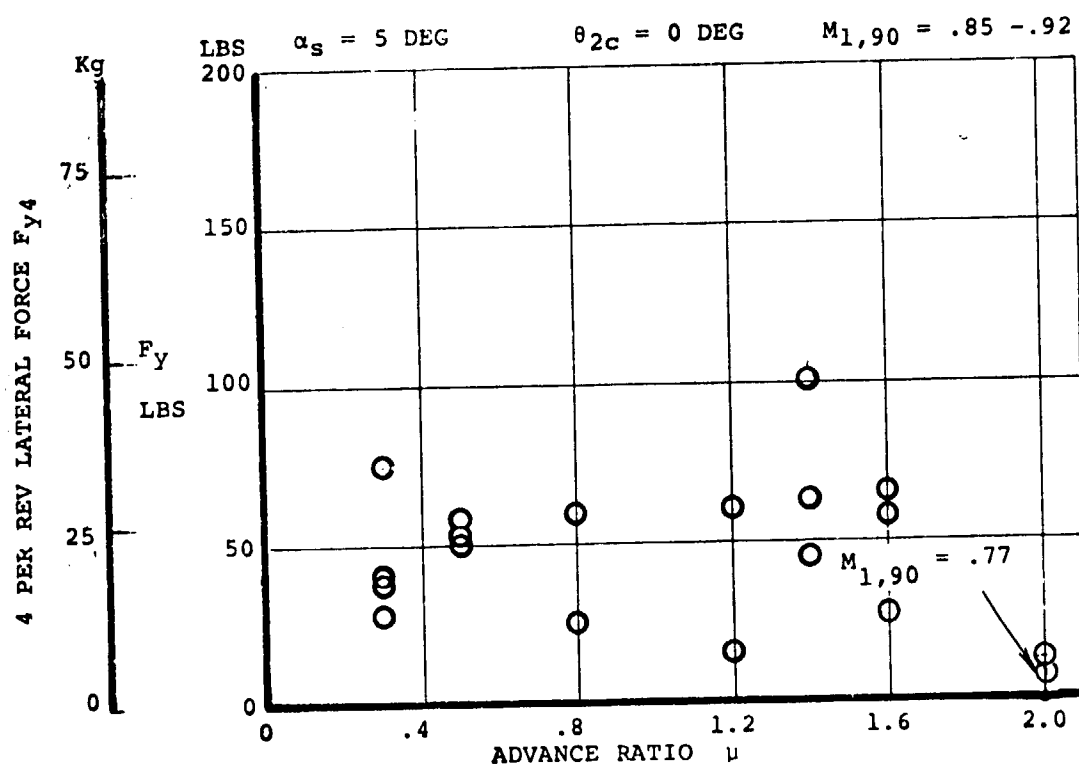
FIGURE 3.5   RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM
LATERAL FORCE FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV
CYCLIC (ROTATING HUB BALANCE DATA)
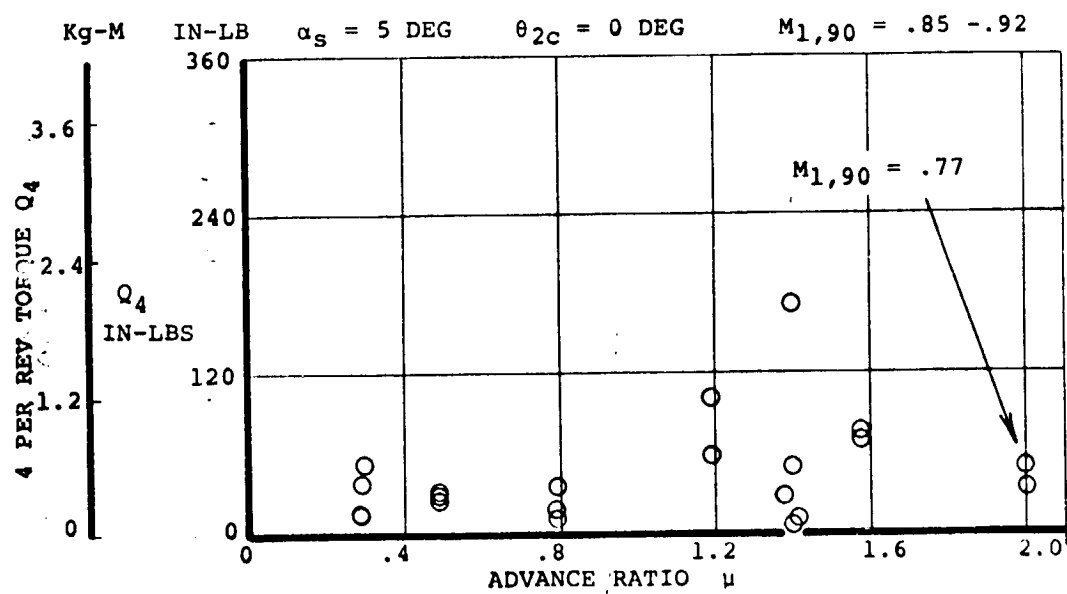
FIGURE 3.6   RVR WIND TUNNEL MODEL 4 PER REV FIXED SYSTEM
TORQUE FOR 5 DEG AFT SHAFT TILT AND ZERO 2 PER REV CYCLIC
(ROTATING HUB BALANCE DATA)
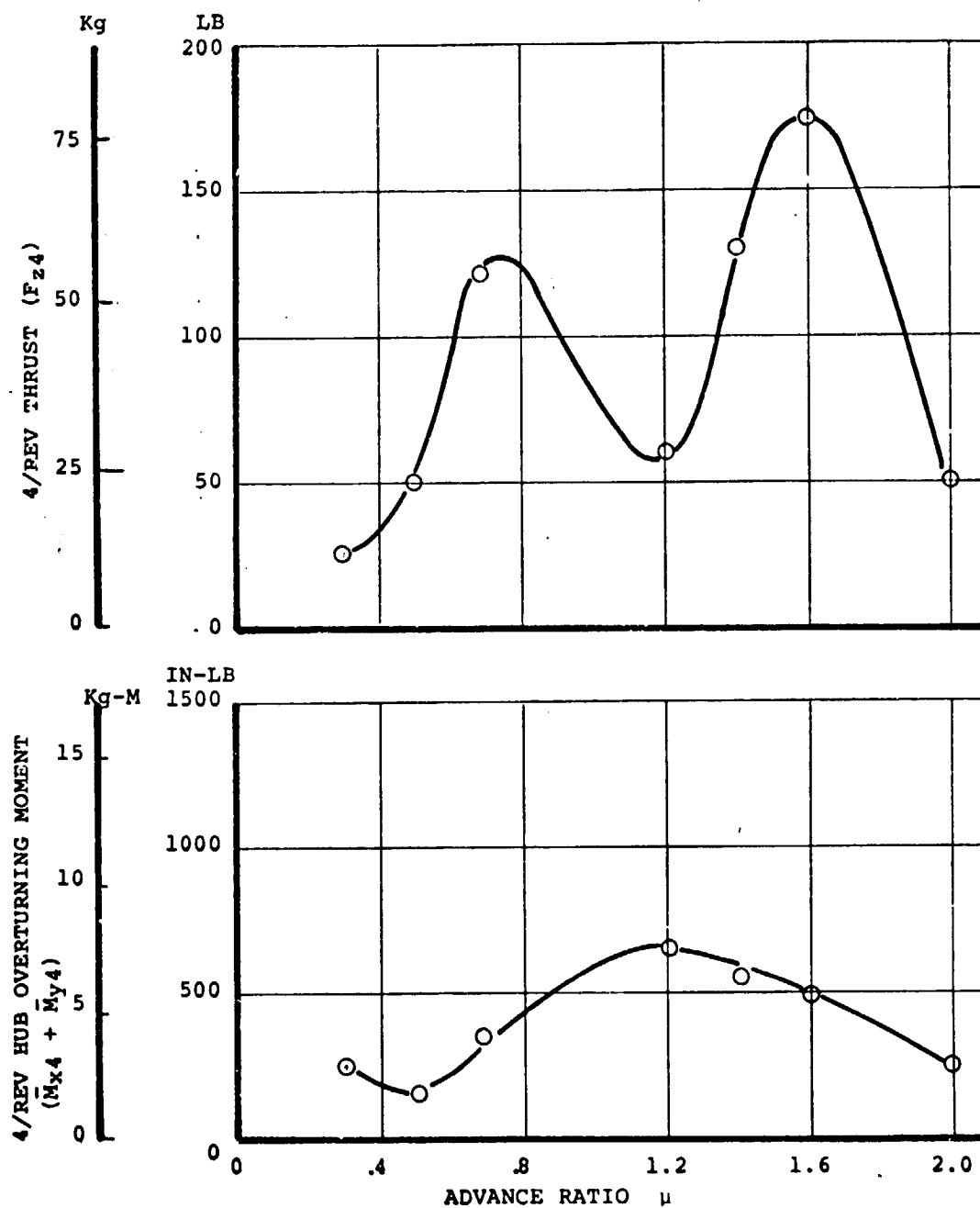
FIGURE 3.7 RVR WIND TUNNEL MODEL MEASURED 4 PER REV FIXED
SYSTEM HUB LOADS FCR ZERO 2 PER REV CYCLIC AND 1G LIFT
(ROTATING HUB BALANCE DATA)

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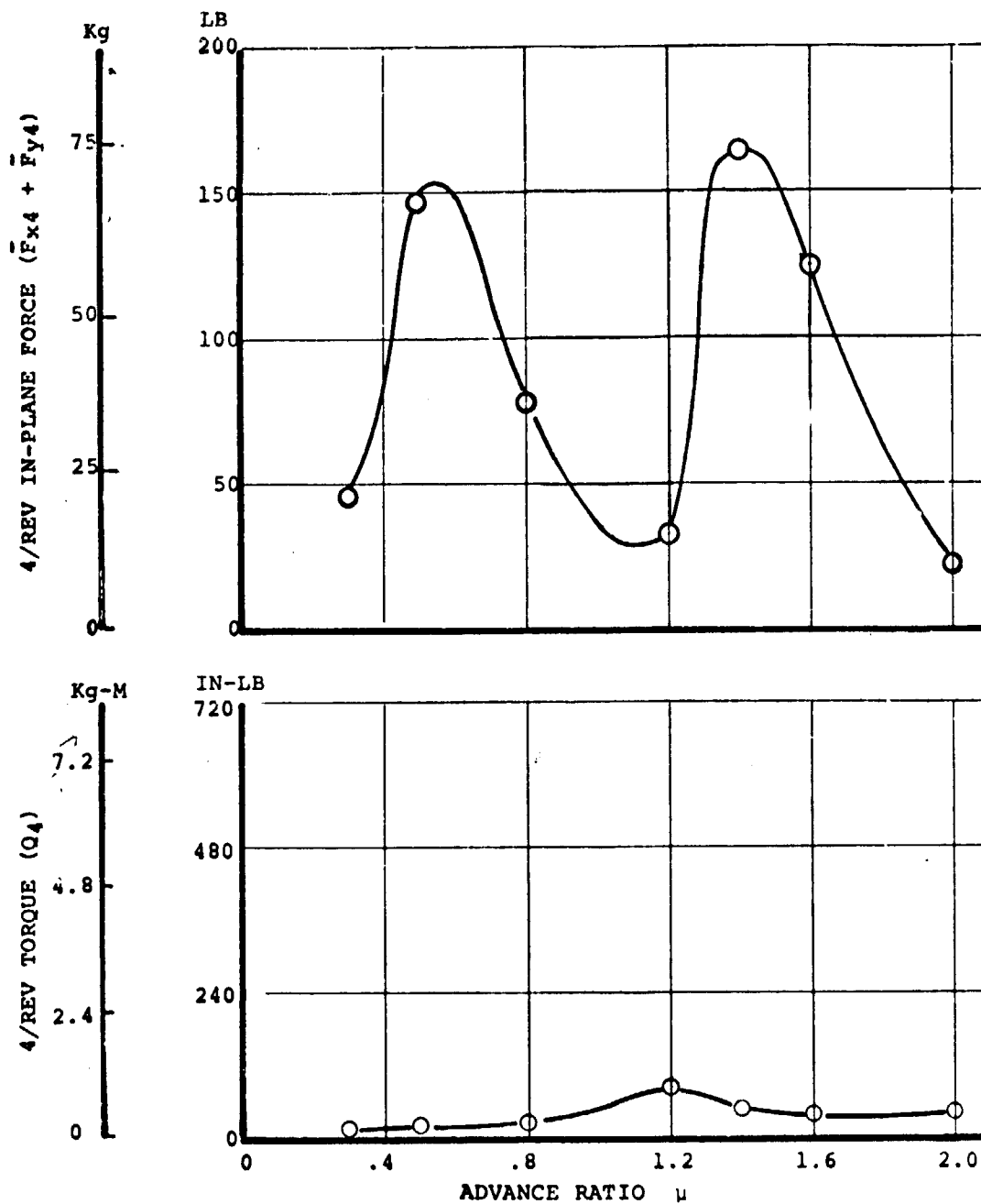
FIGURE 3.8   RVR WIND TUNNEL MODEL MEASURED 4 PER REV FIXED
SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC AND 1G LIFT
(ROTATING HUB BALANCE DATA)
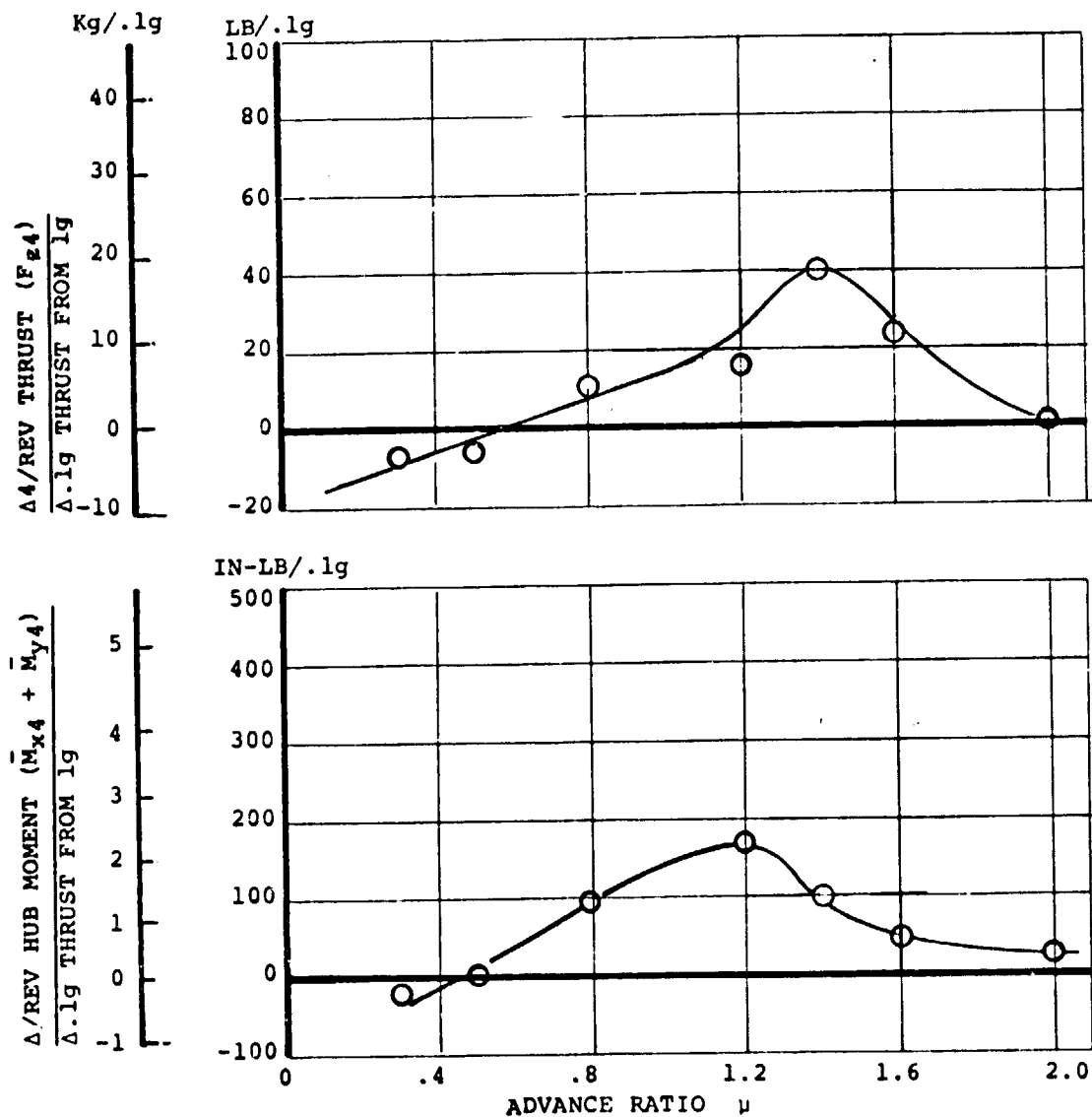
FIGURE 3.9   EFFECT OF G's THRUST ON 4/REV FIXED SYSTEM
HUB LOADS (ROTATING HUB BALANCE DATA)
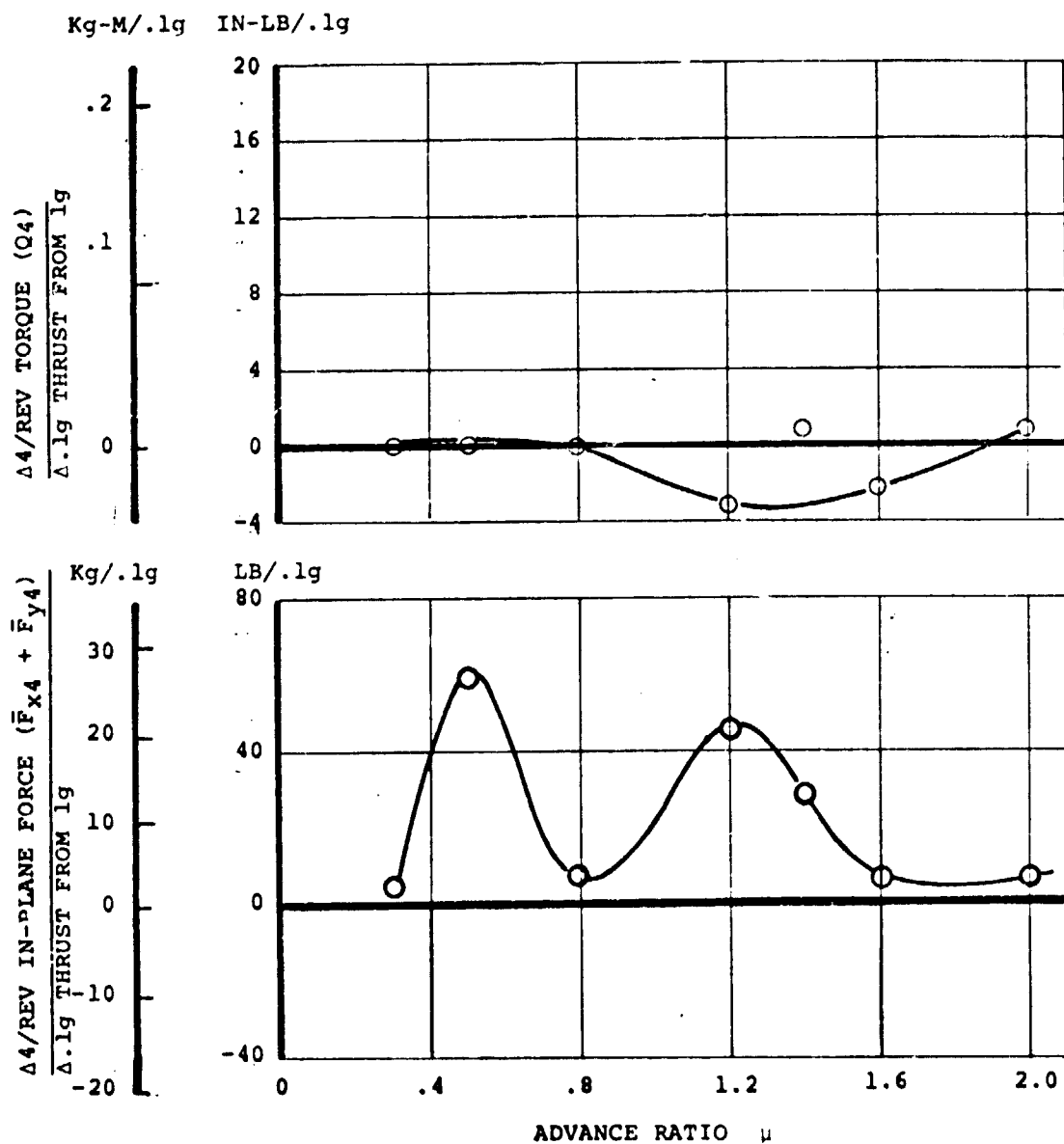
FIGURE 3.10 EFFECT OF G's THRUST ON 4/REV FIXED SYSTEM
HUB LOADS (ROTATING HUB BALANCE DATA)

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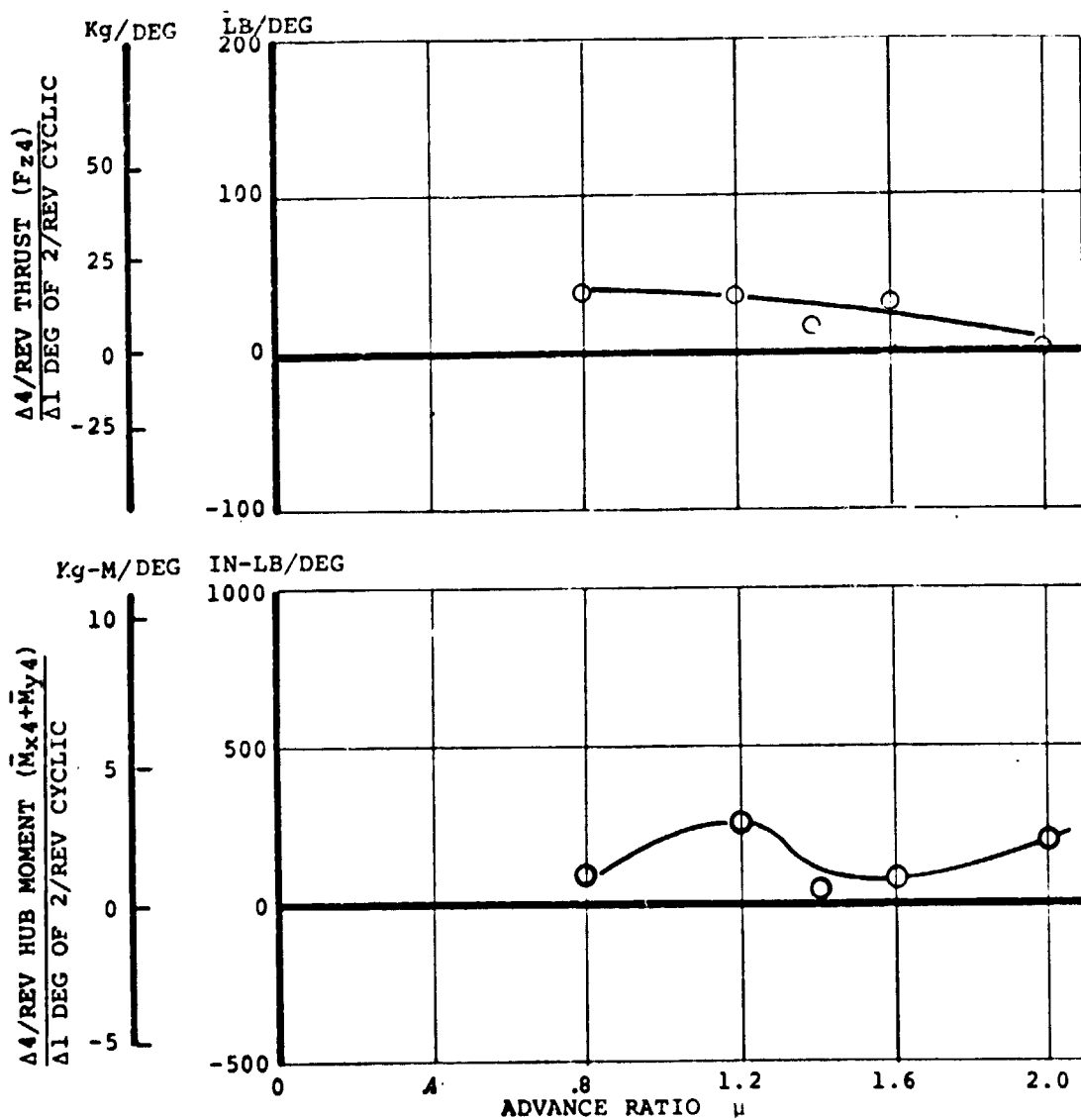
FIGURE 3.11   RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV
CYCLIC ON MEASURED 4 PER REV FIXED SYSTEM HUB LOADS
(ROTATING HUB BALANCE DATA)

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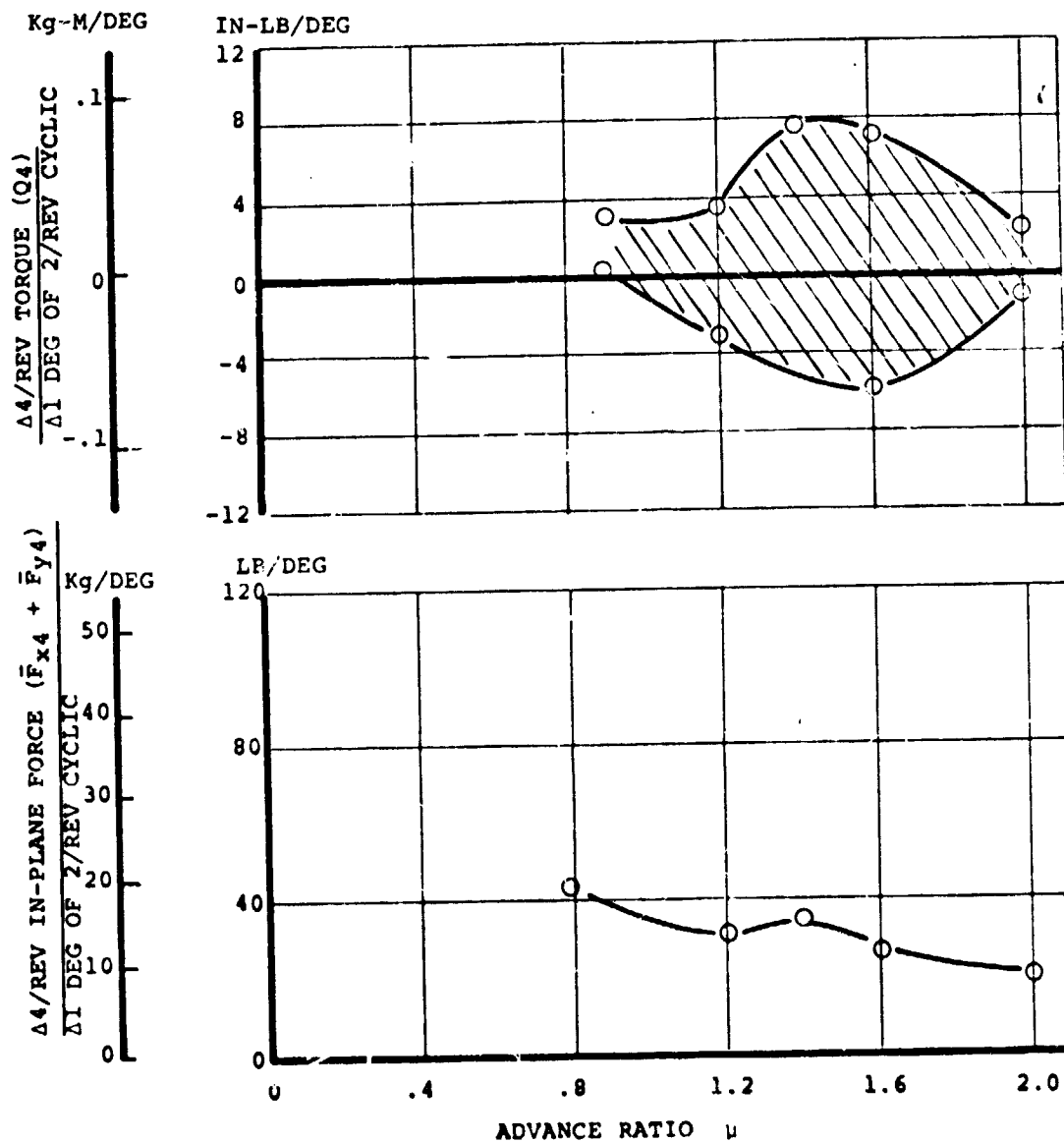
FIGURE 3.12   RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV
CYCLIC ON MEASURED 4 PER REV FIXED SYSTEM HUB LOADS
(ROTATING HUB BALANCE DATA)
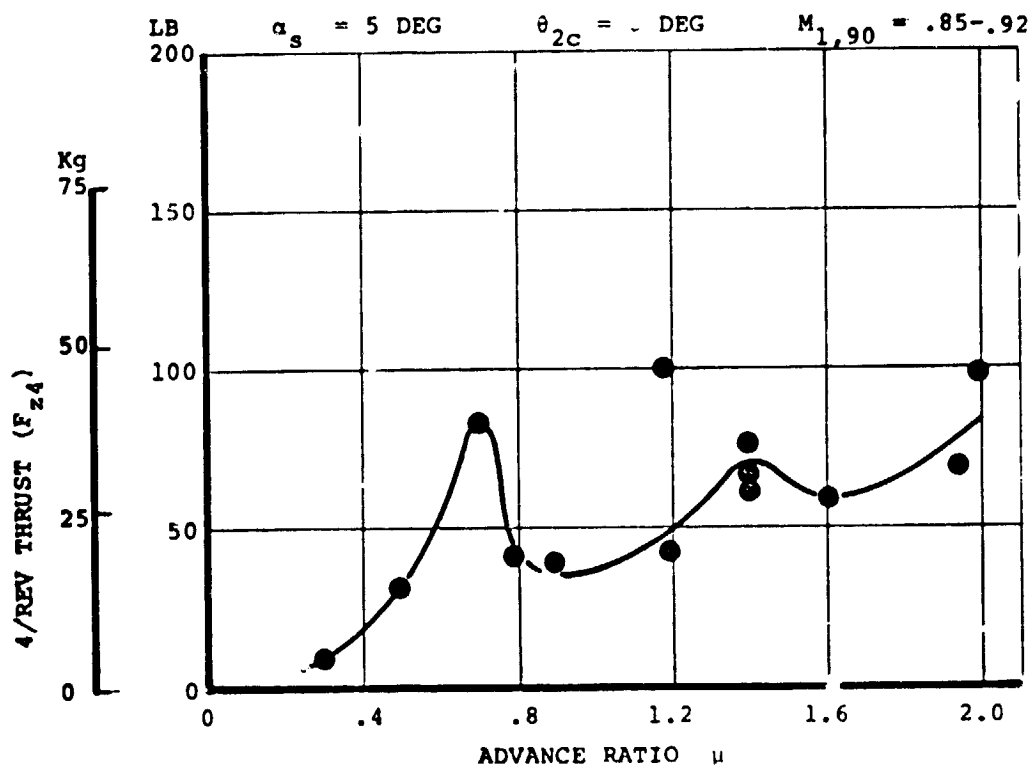
FIGURE 3.13 RVR WIND TUNNEL MODEL 4/REV FIXED SYSTEM HUB
THRUST (OBTAINED FROM GENERALIZED COORDINATES)
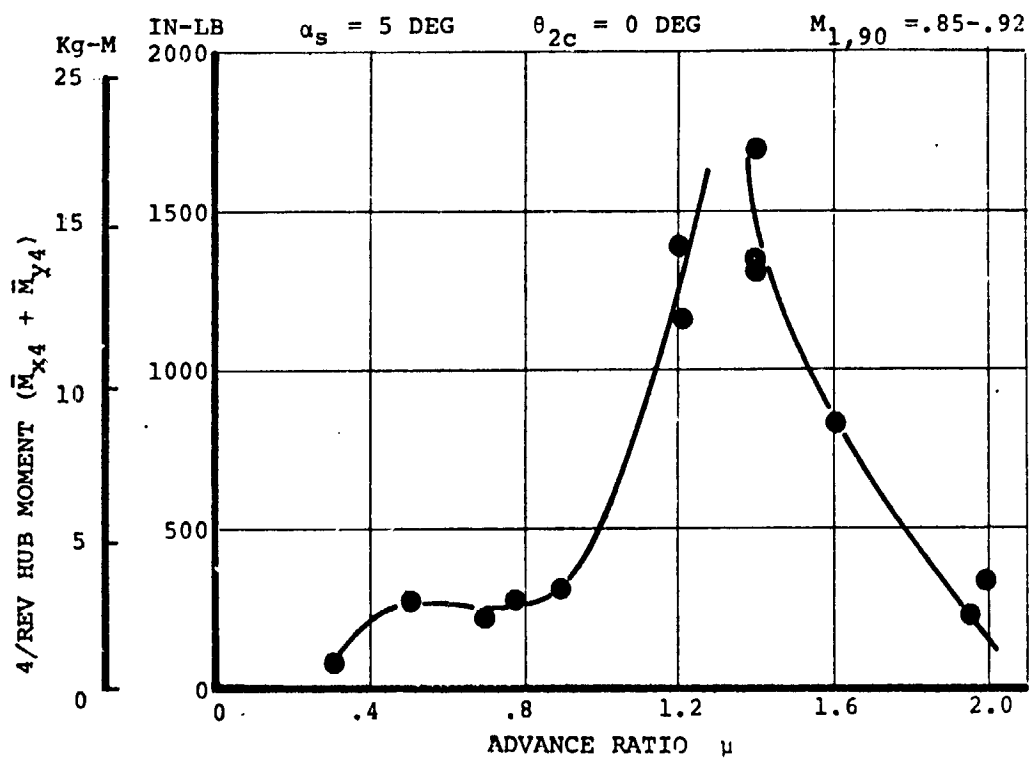
FIGURE 3.14   RVR WIND TUNNEL MODEL 4/REV FIXED SYSTEM
HUB OVERTURNING MOMENT (OBTAINED FROM GENERALIZED
COORDINATES)

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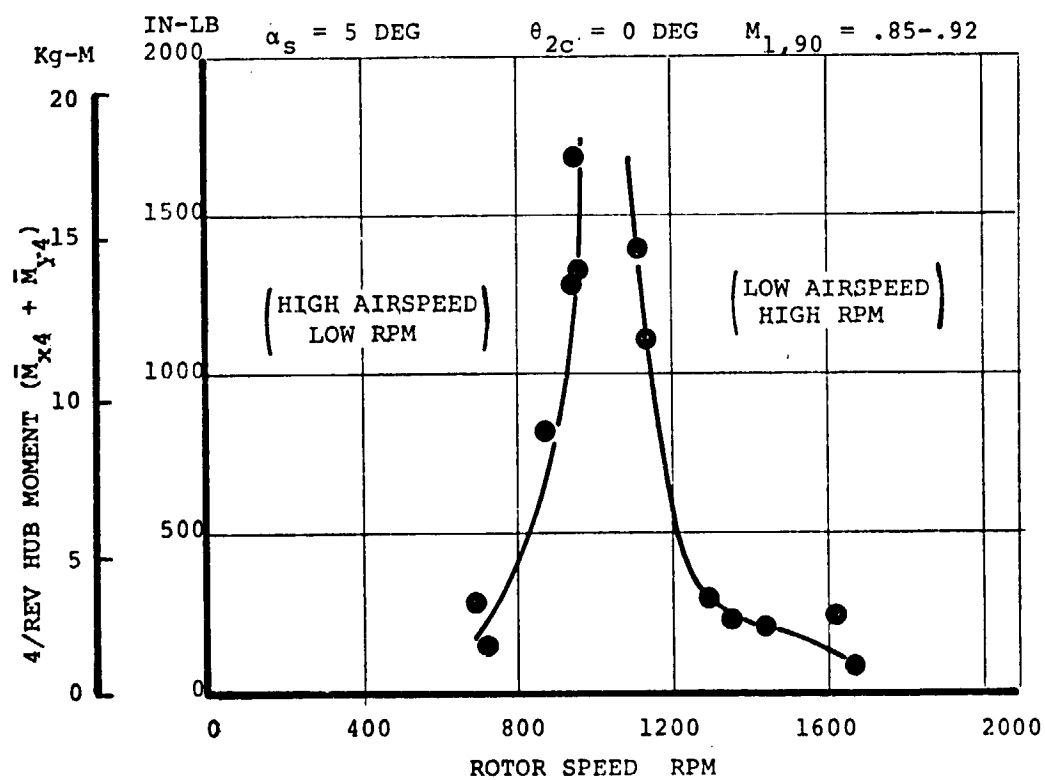
FIGURE 3.15 RVR WIND TUNNEL MODEL 4/REV FIXED SYSTEM HUB OVERTURNING MOMENT VARIATION WITH ROTOR SPEED (OBTAINED FROM GENERALIZED COORDINATES)
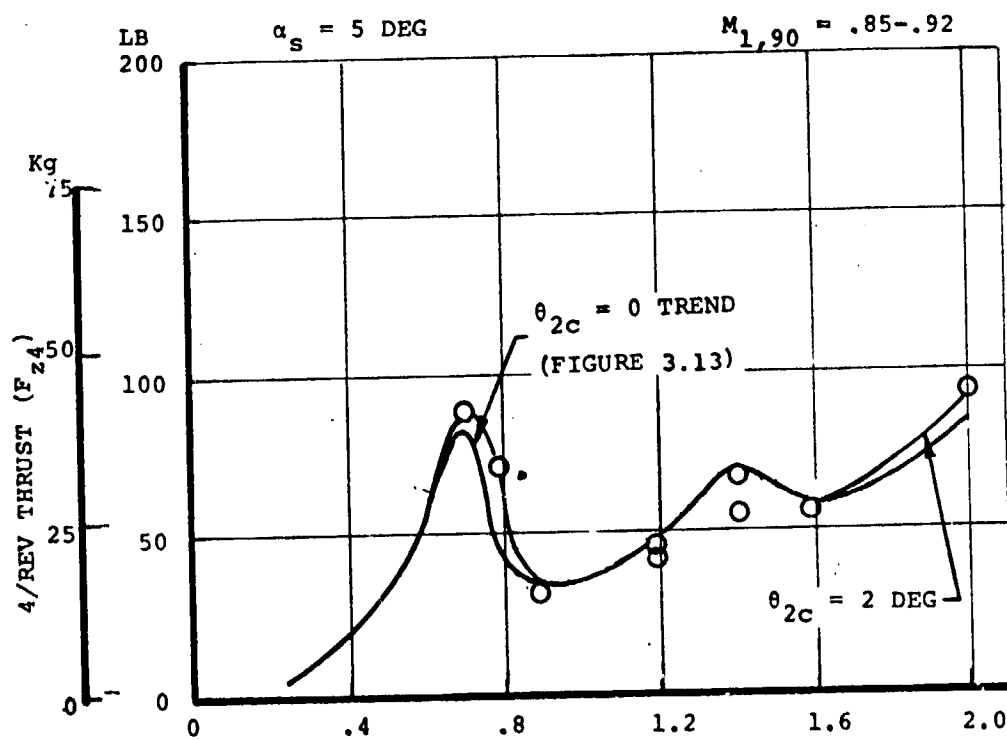
FIGURE 3.16   RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV
CYCLIC ON 4 PER REV FIXED SYSTEM HUB THRUST (OBTAINED
FROM GENERALIZED COORDINATES)

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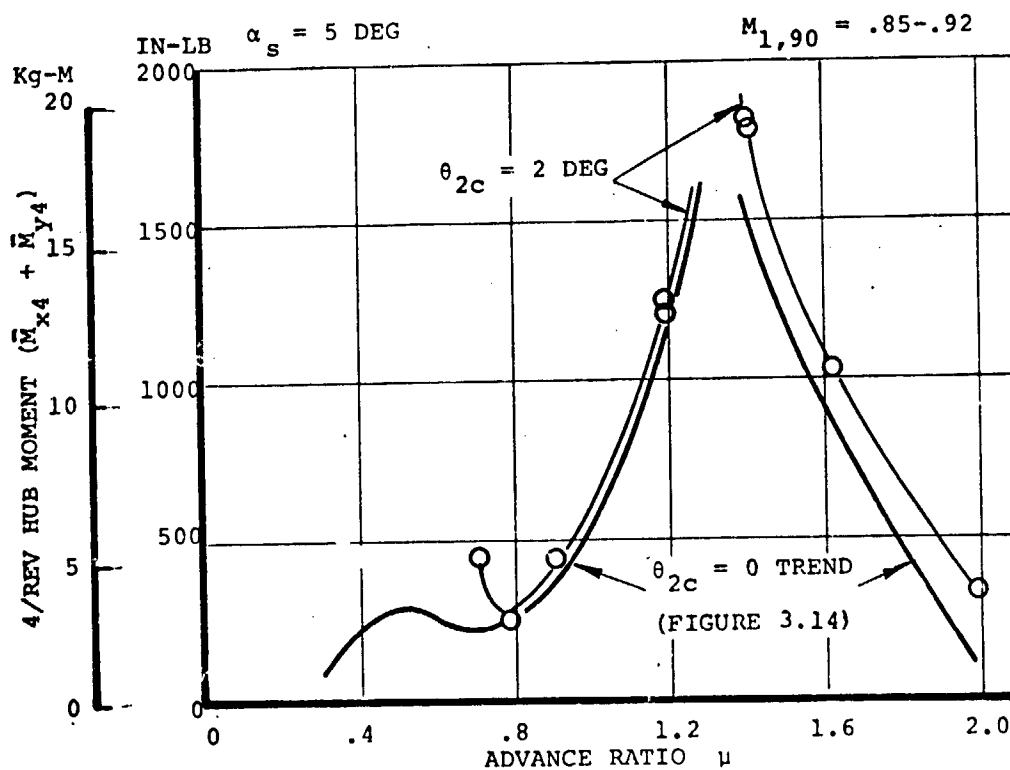
FIGURE 3.17 RVR WIND TUNNEL MODEL EFFECT OF 2 PER REV
CYCLIC ON 4 PER REV FIXED SYSTEM HUB OVERTURNING MOMENT
(OBTAINED FROM GENERALIZED COORDINATES)
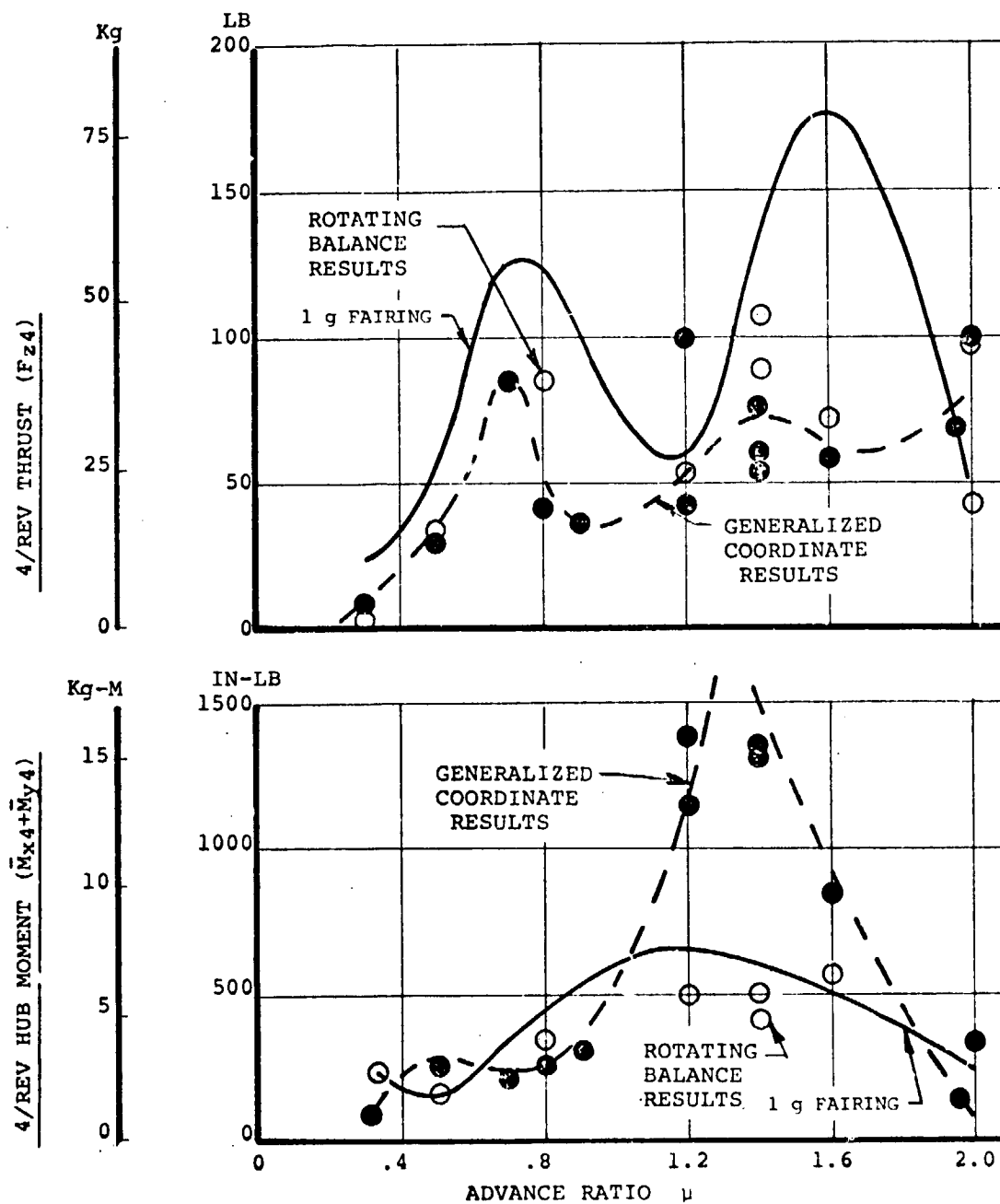
FIGURE 3.18 RVR WIND TUNNEL MODEL COMPARISON OF 4 PER REV FIXED SYSTEM HUB LOADS FOR ZERO 2 PER REV CYCLIC AND 1g LIFT OBTAINED FROM ROTATING BALANCE AND FROM GENERALIZED COORDINATES

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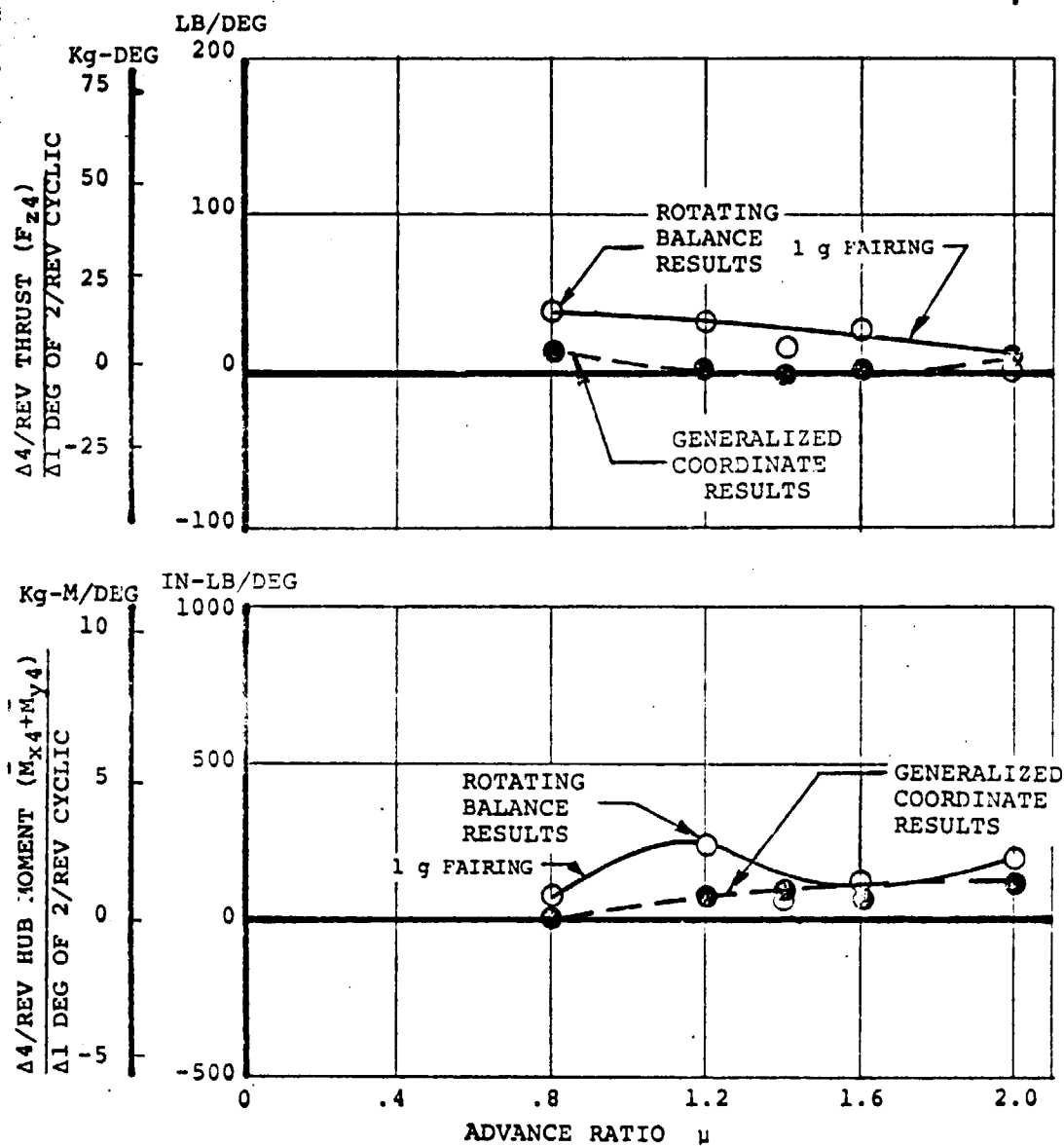
FIGURE 3.19 RVR WIND TUNNEL MODEL COMPARISON OF EFFECT OF
2 PER REV CYCLIC ON 4 PER REV FIXED SYSTEM HUB LOADS AS
OBTAINED FROM ROTATING BALANCE AND FROM GENERALIZED
COORDINATES

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4.0 CONCLUSIONS

Conclusions drawn from the results shown in Section 3 are limited to the three hub loads components (F_z, M_x and M_y) for which data from both methods (rotating balance and generalized coordinates) are available.

1. Both the rotating balance method and the generalized coordinate method can be used to compute vibratory hub loads for a model rotor. Both methods are readily applicable to model test data given some pertinent information about the model, such as geometry and blade dynamic characteristics. The most significant unknown is the dynamic characteristics of the model/test stand and how they affect the hub loads through inertial loading.

2. Comparison of results between the rotating balance method and the generalized coordinate method shows poor correlation for both vibratory thrust and hub overturning moment. There are different reasons for the disparity in results in each case. For vibratory thrust the rotating balance results seem quite sensitive to model/test stand resonance conditions at different rotor speeds across the advance ratio range. A model longitudinal mode is suspected as the source of 2 peaks in the rotating balance thrust results but the mechanism of interaction is not understood. For advance ratios removed from these resonance conditions, the agreement between rotating balance results and generalized coordinates results are good.

The generalized coordinate results for vibratory thrust show some sensitivity to one of these peaks at the lower advance ratio (μ=.7). Thereafter, a nearly linear trend, increasing with advance ratio, is exhibited with a suppressed peak at μ=1.4. The effect of these resonance points on the rotating balance results is believed to obscure the actual thrust results across the advance ratio range. The implication from this is that model/test stand resonances are important considerations when attempting to measure hub loads since both quantitative and qualitative results are directly connected to the model/test stand dynamic characteristics.

For vibratory hub overturning moment, results from both methods agree at low and high advance ratios. At advance ratios between 1.0 and 1.6, the disagreement in the results is again due to a resonance point, but the source of resonance is quite different from the thrust results. The primary source of hub moment forcing is the 3/rev resonance point for the first flexible flapwise mode (2nd flap mode). This resonance occurs as a result of reducing the rotor speed to increase advance ratio to obtain the desired test condition. This is a natural characteristic of articulated rotors and not connected to the model/test stand modes previously discussed. The generalized coordinate results show an extremely high sensitivity to this 3/rev crossing. An estimation of the damping (assuming a second order spring mass damper system) is about 4% which is close to that predicted (3%) for the first flexible flap mode. The rotating balance hub moment results exhibit

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a damping on the order of 30 percent. Substantial damping in pitch and roll is being obtained by the model balance that is not evident in the blade flap modes, and this damping is probably peculiar to this particular model.

3. Analysis of the results and the conclusions above indicate the generalized coordinate method would be the most reliable way of obtaining hub loads. The apparent advantage of minimizing model/test stand dynamic interaction is the strongest reason for recommendation since the complications of attempting to account for these inertial effects is avoided. Also, the complexity of load measurement is reduced with the generalized coordinate method from a 6 component balance in the rotating system plus pitch links and the aforementioned inertial load measurements to blade bending moment gages. For a four bladed rotor, 10 measurements are required for 6 component hub loads compared to 6 blade bending gages (3 flap and 3 chord) for the generalized coordinate method.

4. Analysis of the results indicate that 2 separate vibration trends can be expected for a 4 bladed RVR rotor system. First, 4 per rev thrust will steadily increase with increasing airspeed. Vibratory thrust at $\mu=2.0$ is roughly 4 times that at $\mu=.4$. Secondly, 4 per rev hub moment is directly associated with proximity to the first flexible flap mode frequency at 3/rev. High 4/rev hub moments result from this close proximity while hub moments at $\mu=2.0$ are equal or lower in magnitude to loads at $\mu=.4$.

5.0 REFERENCES

1. HELICOTPER VIBRATION REDUCTION WITH PENDULUM ABSORBERS, American Helicopter Society Journal, Vol 2, No 3, July 1975, R. Taylor and P. Teare.

2. FURTHER MODEL WIND TUNNEL TESTS OF A REVERSE VELOCITY ROTOR SYSTEM, Fairchild Republic Company Report HC171R1089, J. R. Ewans, F. J. McHugh, R. P. Seagrist, R. B. Taylor.

3. MODEL WIND TUNNEL TESTS OF A REVERSE VELOCITY ROTOR SYSTEM, Fairchild Republic Company Report HC144R1070, J. R. Ewans and T. A. Krauss.

APPENDIX A - ROTATING HUB BALANCE DATA REDUCTION EQUATIONS

Reduction of the dynamic data obtained from the hub balance was performed by NASA. The computer program utilized was written by Ron Smith, NASA Test Project Engineer, and is presented in this section.
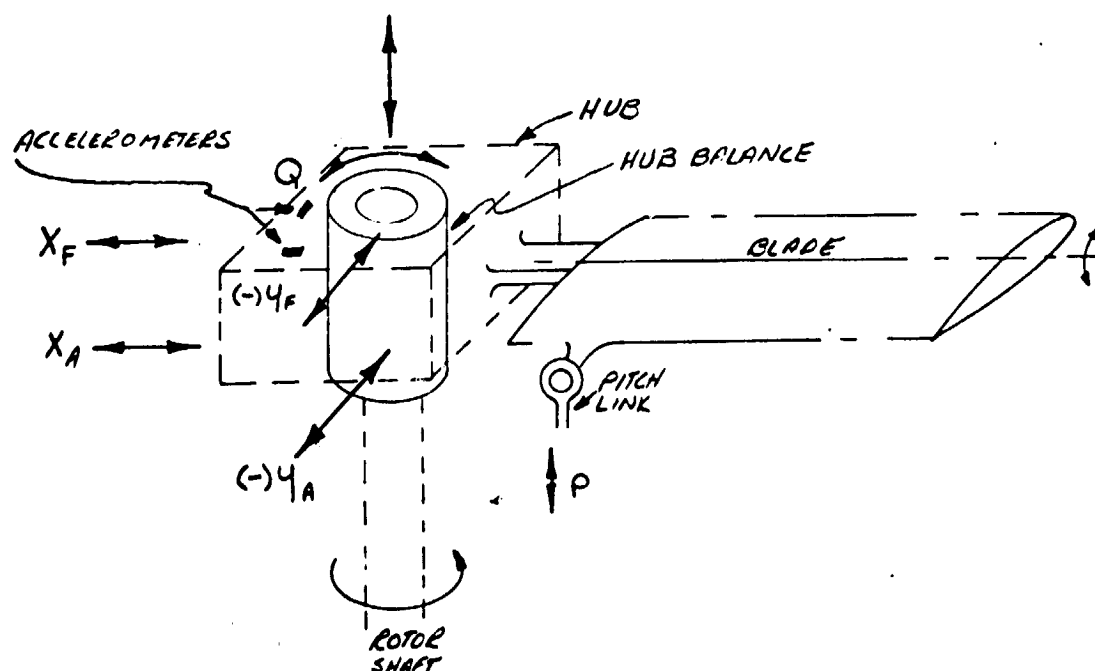
Dynamic Hub Balance	-	6 Components
Accelerometers	-	3 Components
Pitch Link Load	-	1 Component

These 10 components of data were recorded on analog magnetic tape which was then analyzed by taking the direct Fourier transform on the TD90. TD90 creates a digital tape compatible with the IBM 360 which will perform the following operations:

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TD90 Tape Variables

x_F''	$\equiv$	Upper Longitudinal Force, cts
x_A''	$\equiv$	Lower " " "
y_F''	$\equiv$	Upper Side " "
y_A''	$\equiv$	Lower " " "
T''	$\equiv$	Thrust " "
Q''	$\equiv$	Shaft Torque, "
a_x''	$\equiv$	Longitudinal Acceleration "
a_y''	$\equiv$	Side " "
a_T''	$\equiv$	Vertical " "
P''	$\equiv$	Pitch Link Force "

There are <u>28 values</u> in sequence for each of these 10 variables in <u>one record</u>. Each value is associated with a different value of the subscript i (i = 1, 28). The subscript i will be inferred in the following data reduction equations; hence, in general, each indicated operation will be done 28 times for each data record

TD90 Tape Record Format

HARMONIC →	D.C.	1P	2P	3P	------	13P	(REAL PART)
i →	1	2	3	4	------	14	
HARMONIC →	D.C.	1P	2P	3P	------	13P	(IMAG.PART)
i →	15	16	17	18	------	28	

Conversion to Physical Units

$$(x'_F)_{LB} = \frac{K_{XF}}{(CAL.RDG.)_{cts}} (X''_F)_{cts}$$

$$(x'_A)_{LB} = \frac{K_{XA}}{(CAL.RDG.)_{cts}} (X''_A)_{cts}$$

$$(y'_F)_{LB} = \frac{K_{YF}}{(CAL.RDG.)_{cts}} (Y''_F)_{cts}$$

$$(y'_A)_{LB} = \frac{K_{YA}}{(CAL.RDG.)_{cts}} (Y''_A)_{cts}$$

$$T')_{LB} = \frac{K_T}{(CAL.RDG.)_{cts}} (T'')_{cts}$$

$$(Q')_{FT-LB} = \frac{K_Q}{(CAL.RDG.)_{cts}} (Q'')_{cts}$$

$$(a_x)_{G's} = \frac{K_{ax}}{(CAL.RDG.)_{cts}} (a''_x)_{cts}$$

$$(a_y)_{G's} = \frac{K_{ay}}{(CAL.RDG)_{cts}} (a''_y)_{cts}$$

$$(a_T)_{G's} = \frac{K_{aT}}{(CAL.RDG.)_{cts}} (a''_T)_{cts}$$

$$(P)_{LB} = \frac{K_P}{(CAL.RDG.)_{cts}} (P'')_{cts}$$

NOTE: CAL.RDGS. will be found in location $i = 2$ of the "CAL." record.

Definition of Forces and Moments in Rotating System

Balance Forces:

$$(x_F)_{LB} = (x'_F)_{LB} + \text{Interaction Corr.}$$

$$(x_A)_{LB} = (x'_A)_{LB} + \quad " \quad\quad "$$

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$$(y_F)_{LB} \quad = (y'_F)_{LB} \quad + \text{ Interaction Corr.}$$

$$(y_A)_{LB} \quad - (y'_A)_{LB} \quad + \qquad " \qquad "$$

$$(T)_{LB} \quad = (T')_{LB} \quad + \qquad " \qquad "$$

$$(Q)_{FT-LB} = (Q)_{FT-LB} \quad + \qquad " \qquad "$$

Iterate for Interactions in the Usual Manner

Inertial Force Corrections

$$(I_x)_{LB} = (a_x)_{G's} \; (W_H)_{LB}$$

$$(I_y)_{LB} = (a_y)_{G's} \; (W_H)_{LB}$$

$$(I_T)_{LB} = (a_T)_{G's} \; (W_V)_{LB}$$

Corrected Balance Forces:

$$x = (x_F)_{LB} + (x_A)_{LB} + (I_x)_{LB}$$

$$y = (y_F)_{LB} + (y_A)_{LB} + (I_y)_{LB}$$

$$T = (T)_{LB} + (I_T)_{LB}$$

$$m = \overset{\cdot}{} x \; [(x_A)_{LB} - (x_F)_{LB}]$$

$$\ell = \overset{-}{} y \; [(y_F)_{LB} - (y_A)_{LB}]$$

$$Q = (Q)_{FT-LB}$$

Constants

$$\overset{\wedge}{} x \quad \equiv \quad \text{Dist. from Bal. Ctr. to "x" gage}$$

$$y \quad \equiv \quad " \qquad " \quad " \quad " \qquad " \quad " \qquad "$$

$$W_H \quad \equiv \quad \text{Weight of Rotor incl. Blades}$$

$$W_L \quad \equiv \quad \text{Effective Weight of Rotor in Vertical Direction}$$

Resolution of Pitch Link Components

$\Delta h \equiv$ VERT. DIST. FROM S TO B

$\ell \equiv$ PITCH LINK LENGTH

VERTICAL COMP: $T_P = P \dfrac{\Delta h}{\ell}$

INPLANE COMP: $P_{I.P.} = P \dfrac{c}{\ell}$

BAL. "T"
AXIS POINTS
UPWARD

$M \equiv$ POS. NOSE UP
$L \equiv$ POS. RT. ROLL

$P_{I.P.} \left(\begin{array}{l} + \text{TENSION} \\ - \text{COMPRESSION} \end{array} \right)$

THE POINT S ISON SWASHPLATE
THE POINT B IS ON BLADE ARM
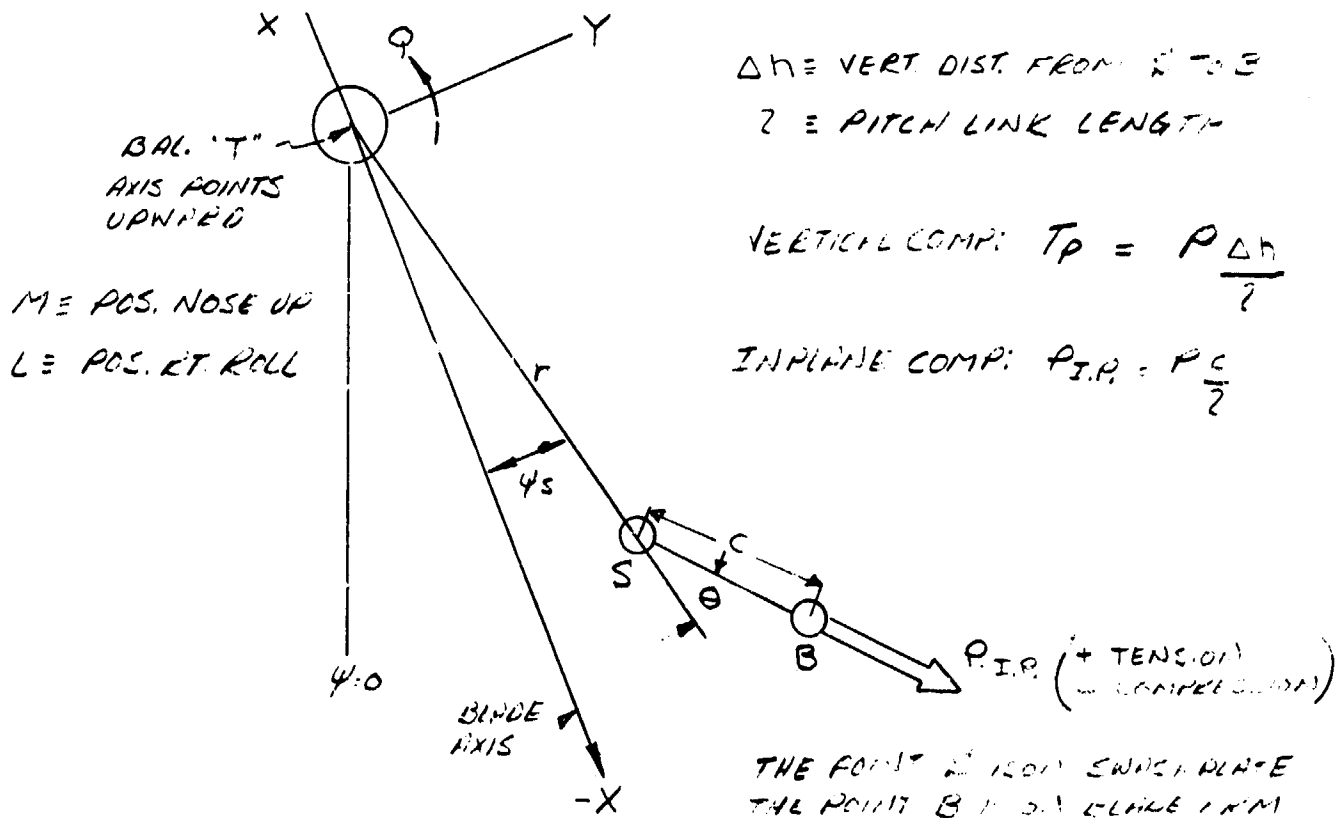
Pitch Link Force & Moment Components

$X_P = -r \dfrac{c}{\ell} \cos(\psi_s + \theta)$

$Y_P = r \dfrac{c}{\ell} \sin(\psi_s + \theta)$

$T_P = r \dfrac{\Delta h}{\ell}$

$Q_P = Y_P (r + c \cos \theta) + X_P (r \sin \psi_s + c \sin \theta)$

$M_P = -T_P (r + c \cos \theta)$

$L_P = -T_P (r \sin \psi_s + c \sin \theta)$

$\dfrac{c}{\ell}, \dfrac{\Delta h}{\ell}, \psi_s \& \theta$ ARE CONST.

NOTE: - Assumes no significant dynamic deviation

of geometric relationships. (i.e. θ, c & Δh

assumed const.)

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Transformation of Rotating Forces to Fixed Frame
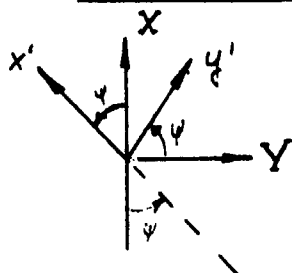
(sign convention conforms to Gessow & Mayers)

LONGITUDINAL FORCE

$$X = x \cos \psi + y' \sin \psi$$

LATERAL FORCE

$$Y = y' \cos \psi - x \sin \psi$$

4P Resultant Forces (3P & 5P in Rotat. Sys.)

We will use the trig. identities:

$$\cos n\psi \cos \psi = \tfrac{1}{2}\left[\cos(n+1)\psi + \cos(n-1)\psi\right]$$

$$\cos n\psi \sin \psi = \tfrac{1}{2}\left[\sin(n+1)\psi - \sin(n-1)\psi\right]$$

$$\sin n\psi \sin \psi = \tfrac{1}{2}\left[\cos(n-1)\psi - \cos(n+1)\psi\right]$$

$$\sin n\psi \cos \psi = \tfrac{1}{2}\left[\sin(n+1)\psi + \sin(n-1)\psi\right]$$

The components of 4P in fixed fram due to 3P & 5P in the
rotating system will be kept separated so that reference
can be made as to the origin of the force.

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4 Blade Rotor - all resultant harmonics but 4P, 8P, 12P

will be filtered out.

LONGITUDINAL FORCE, X

4P DUE TO 3P:

$$X_3 = X_{c_3} \cos 3\psi \cos \psi + X_{s_3} \sin 3\psi \cos \psi$$
$$+ Y_{c_3} \cos 3\psi \sin \psi + Y_{s_3} \sin 3\psi \sin \psi$$

$$= \frac{X_{c_3}}{2} \cos 4\psi + \frac{X_{s_3}}{2} \sin 4\psi + \frac{Y_{c_3}}{2} \sin 4\psi - \frac{Y_{s_3}}{2} \cos 4\psi$$

$$X_3 = \tfrac{1}{2}(X_{c_3} - Y_{s_3}) \cos 4\psi + \tfrac{1}{2}(X_{s_3} + Y_{c_3}) \sin 4\psi$$

4P due to 5P:

$$X_5 = X_{c_5} \cos 5\psi \cos \psi + X_{s_5} \sin 5\psi \cos \psi$$
$$- Y_{c_5} \cos 5\psi \sin \psi + Y_{s_5} \sin 5\psi \sin \psi$$

$$= \frac{X_{c_5}}{2} \cos 4\psi + \frac{X_{c_5}}{2} \sin 4\psi - \frac{Y_{c_5}}{2} \sin 4\psi + \frac{Y_{s_5}}{2} \cos 4\psi$$

$$X_5 = \tfrac{1}{2}(X_{c_5} + Y_{s_5}) \cos 4\psi + \tfrac{1}{2}(X_{s_5} - Y_{c_5}) \sin 4\psi$$

Similarly, the 8P and 12P resultant forces are found to be:

8P DUE TO 7P:

$$X_7 = \tfrac{1}{2}(X_{c_7} - Y_{s_7}) \cos 8\psi + \tfrac{1}{2}(X_{s_7} + Y_{c_7}) \sin 8\psi$$

8P DUE TO 9P:

$$X_9 = \tfrac{1}{2}(X_{c_9} + Y_{s_9}) \cos 8\psi + \tfrac{1}{2}(X_{s_9} - Y_{c_9}) \sin 8\psi$$

<u>LONG. FORCE (cont)</u>

12P DUE TO 11P:
$$X_{11} = \tfrac{1}{2}(X_{c_1} - Y_{s_1}) \cos 12\psi + \tfrac{1}{2}(X_{s_1} + Y_{c_1}) \sin 12\psi$$

12P DUE TO 13P:
$$X_{13} = \tfrac{1}{2}(X_{c_3} + Y_{s_3}) \cos 12\psi + \tfrac{1}{2}(X_{s_3} - Y_{c_3}) \sin 12\psi$$

<u>LATERAL FORCE,</u>

4P due to 3P:
$$Y_3 = -X_{c_3} \cos 3\psi \sin\psi - X_{s_3} \sin 3\psi \sin\psi$$

$$+ Y_{c_3} \cos 3\psi \cos\psi + Y_{s_3} \sin 3\psi \cos\psi$$

$$= -\frac{X_{c_3}}{2} \sin 4\psi + \tfrac{1}{2} X_{s_3} \cos 4\psi + Y_{c_3} \cos 4\psi + \frac{Y_{s_3}}{2} \sin 4\psi$$

$$\underline{Y_3 = \tfrac{1}{2}(Y_{c_3} + X_{s_3}) \cos 4\psi + \tfrac{1}{2}(-X_{c_3} + Y_{s_3}) \sin 4\psi}$$

4P due to 5P:
$$Y_5 = -X_{c_5} \cos 5\psi \sin\psi - X_{s_5} \sin 5\psi \sin\psi$$

$$+ Y_{c_5} \cos 5\psi \cos\psi + Y_{s_5} \sin 5\psi \cos\psi$$

$$= +\frac{X_{c_5}}{2} \sin 4\psi - \frac{X_{s_5}}{2} \cos 4\psi + \frac{Y_{c_5}}{?} \cos 4\psi + \frac{Y_{s_5}}{2} \sin 4\psi$$

$$Y_5 = \tfrac{1}{2}(Y_{s_5} - X_{c_5}) \cos 4\psi + \tfrac{1}{2}(Y_{s_5} + X_{c_5}) \sin 4\psi$$

8P due to 7P: $\quad Y_7 = \frac{1}{2}(Y_{c_7} + X_{s_7}) \cos 8\psi + \frac{1}{2}(-X_{c_7} + Y_{s_7}) \sin 8\psi$

8P due to 9P: $\quad Y_9 = \frac{1}{2}(-X_{s_9} + Y_{c_9}) \cos 8\psi + \frac{1}{2}(Y_{s_9} + X_{c_9}) \sin 8\psi$

12P due to 11P: $\quad Y_{11} = \frac{1}{2}(Y_{c_{11}} + X_{s_{11}}) \cos 12\psi + \frac{1}{2}(-X_{c_{11}} + Y_{s_{11}}) \sin 12\psi$

12P due to 13P: $\quad Y_{13} = \frac{1}{2}(-X_{s_{13}} + Y_{c_{13}}) \cos 12\psi + \frac{1}{2}(Y_{s_{13}} + X_{c_{13}}) \sin 12\psi$

HUB MOMENTS
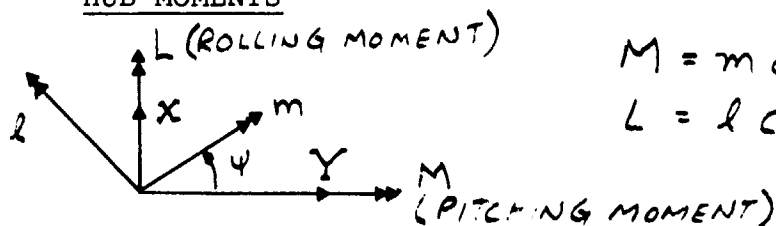
$$M = m \cos\psi - \ell \sin\psi$$
$$L = \ell \cos\psi + m \sin\psi$$

Notice that M is like Y with "m" for "y" and "ℓ" for "x".

Also L is like X. So we can use expressions for X and Y
by replacing "y" with "m" and "x" with "ℓ".

Equations and IBM Output Format

The individual components of force and moment in the fixed
system for a four bladed rotor are summarized in Table A-1
and A-2. Table A-1 defines the equations and the output format
for the inplane components and Table A-2 defines the equations
and output format for the vertical components.

TABLE A-1   FORCES AND MOMENTS IN FIXED FRAME FOR A
4 BLADED ROTOR SYSTEM

EQUATIONS AND OUTPUT FORMAT FOR IN-PLANE COMPONENTS

SUBSCRIPTS DEFINED ON PAGE 74

HARMONIC NO. / FORCE	3	5	7	9	11	13
X_C	$\tfrac{1}{2}(X_{c3}-Y_{s3})$	$\tfrac{1}{2}(X_{c5}+Y_{s5})$	$\tfrac{1}{2}(X_{c7}-Y_{s7})$	$\tfrac{1}{2}(X_{c9}+Y_{s9})$	$\tfrac{1}{2}(X_{c11}-Y_{s11})$	$\tfrac{1}{2}(Y_{c13}+Y_{s13})$
X_S	$\tfrac{1}{2}(X_{s3}+Y_{c3})$	$\tfrac{1}{2}(X_{s5}-Y_{c5})$	$\tfrac{1}{2}(X_{s7}+Y_{c7})$	$\tfrac{1}{2}(X_{s9}-Y_{c9})$	$\tfrac{1}{2}(X_{s11}+Y_{c11})$	$\tfrac{1}{2}(X_{s13}-Y_{c13})$
Y_C	$-X_{s3}$	$-X_{s5}$	X_{s7}	$-X_{s9}$	X_{s11}	$-X_{s13}$
Y_S	$-X_{c3}$	X_{c5}	$-X_{c7}$	X_{c9}	$-X_{c11}$	X_{c13}
L_C	$\tfrac{1}{2}(L_{c3}-M_{s3})$	$\tfrac{1}{2}(L_{c5}+M_{s5})$	$\tfrac{1}{2}(L_{c7}-M_{s7})$	$\tfrac{1}{2}(L_{c9}+M_{s9})$	$\tfrac{1}{2}(L_{c11}-M_{s11})$	$\tfrac{1}{2}(L_{c13}+M_{s13})$
L_S	$\tfrac{1}{2}(L_{s3}+M_{c3})$	$\tfrac{1}{2}(L_{s5}-M_{c5})$	$\tfrac{1}{2}(L_{s7}+M_{c7})$	$\tfrac{1}{2}(L_{s9}-M(\!))$	$\tfrac{1}{2}(L_{s11}+M_{c11})$	$\tfrac{1}{2}(L_{s13}-M_{c13})$
M_C	L_{s3}	$-L_{s5}$	L_{s7}	$-L_{s9}$	L_{s11}	$-L_{s13}$
M_S	$-L_{c3}$	L_{c5}	$-L_{c7}$	L_{c9}	$-L_{c11}$	L_{c13}
XP_C	$2(XP_{c3}-YP_{s3})$	$2(XP_{c5}+YP_{s5})$	$2(XP_{c7}-YP_{s7})$	$2(XP_{c9}+YP_{s9})$	$2(XP_{c11}-YP_{s11})$	$2(XP_{c13}+YP_{s13})$
XP_S	$2(XP_{s3}+YP_{c3})$	$2(XP_{s5}-YP_{c5})$	$2(XP_{s7}+YP_{c7})$	$2(XP_{s9}-YP_{c9})$	$2(XP_{s11}+YP_{c11})$	$2(XP_{s13}-YP_{c13})$
YP_C	XP_{s3}	$-XP_{s5}$	XP_{s7}	$-XP_{s9}$	XP_{s11}	$-XP_{s13}$
YP_S	$-XP_{c3}$	XP_{c5}	$-XP_{c7}$	XP_{c9}	$-XP_{c11}$	XP_{c13}
LP_C	$2(LP_{c3}-MP_{s3})$	$2(LP_{c5}+MP_{s5})$	$2(LP_{c7}-MP_{s7})$	$2(LP_{c9}+MP_{s9})$	$2(LP_{c11}-MP_{s11})$	$2(LP_{c13}+MP_{s13})$
LP_S	$2(LP_{s3}+MP_{c3})$	$2(LP_{s5}-MP_{c5})$	$2(LP_{s7}+MP_{c7})$	$2(LP_{s9}-MP_{c9})$	$2(LP_{s11}+MP_{c11})$	$2(LP_{s13}-MP_{c13})$
MP_C	$-LP_{s3}$	$-LP_{s5}$	LP_{s7}	$-LP_{s9}$	LP_{s11}	$-LP_{s13}$
MP_S	$-LP_{c3}$	LP_{c5}	$-LP_{c7}$	LP_{c9}	$-LP_{c11}$	LP_{c13}
a_{xc}	a_{xc3}	a_{xc5}	a_{xc7}	a_{xc9}	a_{xc11}	a_{xc13}
a_{xs}	a_{xs3}	a_{xs5}	a_{xs7}	a_{xs9}	a_{xs11}	a_{xs13}
a_{yc}	a_{yc3}	a_{yc5}	a_{yc7}	a_{yc9}	a_{yc11}	a_{yc13}
a_{ys}	a_{ys3}	a_{ys5}	a_{ys7}	a_{ys9}	a_{ys11}	a_{ys13}

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TABLE A-2   FORCES AND MOMENTS IN FIXED FRAME FOR A
4 BLADED ROTOR SYSTEM

EQUATIONS AND OUTPUT FORMAT FOR VERTICAL COMPONENTS

HARMONIC NO. → FORCE ↓	2	3	4	5	8	12
T_C	T_{C2}	T_{C3}	T_{C4}	T_{C5}	T_{C8}	T_{C12}
T_S	T_{S2}	T_{S3}	T_{S4}	T_{S5}	T_{S8}	T_{S12}
Q_C	Q_{C2}	Q_{C3}	Q_{C4}	Q_{C5}	Q_{C8}	Q_{C12}
Q_S	Q_{S2}	Q_{S3}	Q_{S4}	Q_{S5}	Q_{S8}	Q_{S12}
T_{P_C}	$^4T_{P_{C2}}$	$^4T_{P_{C3}}$	$^4T_{P_{C4}}$	$^4T_{P_{C5}}$	$^4T_{P_{C8}}$	$^4T_{P_{C12}}$
T_{P_S}	$^4T_{P_{S2}}$	$^4T_{P_{S3}}$	$^4T_{P_{S4}}$	$^4T_{P_{S5}}$	$^4T_{P_{S8}}$	$^4T_{P_{S12}}$
Q_{P_C}	$^4Q_{P_{C2}}$	$^4Q_{P_{C3}}$	$^4Q_{P_{C4}}$	$^4Q_{P_{C5}}$	$^4Q_{P_{C8}}$	$^4Q_{P_{C12}}$
Q_{P_S}	$^4Q_{P_{S2}}$	$^4Q_{P_{S3}}$	$^4Q_{P_{S4}}$	$^4Q_{P_{S5}}$	$^4Q_{P_{S8}}$	$^4Q_{P_{S12}}$
^aT_C	$^aT_{C2}$	$^aT_{C3}$	$^aT_{C4}$	$^aT_{C5}$	$^aT_{C8}$	$^aT_{C12}$
^aT_S	$^aT_{S2}$	$^aT_{S3}$	$^aT_{S4}$	$^aT_{S5}$	$^aT_{S8}$	$^aT_{S12}$

DEFINITION OF SUBSCRIPTS

SUBSCRIPT→	C2	C3	C4	C5	C7	C8	C9	C11	C12	C12
i →	3	4	5	6	8	9	10	12	13	14

SUBSCRIPT→	S2	S3	S4	S5	S7	S8	S9	S11	S12	S13
i →	17	18	19	20	22	23	24	26	27	28

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APPENDIX B - NASA AMES HUB LOADS TABULATED TEST RESULTS

The data reduction method and output format for the hub balance loads was described in Appendix A. Enclosed herein are the computer output tabulations for this data reduction. Listed below are equations to provide the total vibratory load, sine and cosine components, for the following:

4/REV LONGITUDINAL FORCE

$$F_{x4} = X + XP + AX$$

4/REV LATERAL FORCE

$$F_{y4} = Y + YP + AY$$

4/REV VERTICAL FORCE

$$F_{z4} = T + TP + AT$$

4/REV PITCHING MOMENT

$$M_{y4} = M + MP$$

4/REV ROLLING MOMENT

$$M_{x4} = L + LP$$

4/REV TORQUE

$$Q_4 = Q + QP$$

727 PHASE IIb DYNAMIC DATA

TST-727 PH-1 T.-12..2.01;3   IR-PRESS,JU10   13 FEB 75:05:33   PAGE 2

REVISED 1003
2.0133

		2	3	4	5	8	12
1	XC	63.531	-19.417	2.3947	-15.108	-26.216	7.1277
2	XS	49.925	59.177	-16.407	5.1224	-23.460	-4.7057
3	YC	0.9475	1.6046	-0.2044	0.2590	-1.4646	-0.0469
4	YS	-3.7891	1.4917	1.1077	1.7064	1.0372	0.1967
5	LC	-2.7913	37.642	-26.717	-6.1857	1.9733	-2.1267
6	LS	15.644	22.596	-16.615	2.4907	-3.5508	0.0000
7	NS	-0.0812	1.1027	-0.7777	-0.1799	0.0500	-0.0617
8	XPC	0.4565	0.6577	-0.4836	0.0671	-0.1045	0.0000
9	ATC	0.5408	-0.4076	0.0232	-0.1184	-0.2440	0.0635
10	DATS	0.5125	0.5491	-0.1794	0.0037	-0.2660	-0.0458

		3	5	7	9	11	13
1	XC	-2.7342	-26.637	0.1606	-2.8929	-8.5715	8.4538
2	XS	-11.640	3.2575	0.3354	-1.8466	-7.4555	-11.040
3	YC	-11.640	-8.2575	0.3544	16.949	-7.4555	11.049
4	YS	2.7302	-26.637	-0.1606	-2.8929	8.5715	8.4538
5	LC	4.8497	-0.8157	-1.6226	-1.4009	1.0087	3.0214
6	LS	-3.2149	-0.5972	1.9709	-0.4106	1.2002	1.5448
7	NS	-3.2149	-0.5972	1.9709	0.4106	1.2402	-1.5448
8	XPC	-8.3691	-0.8157	1.6226	-1.4049	-1.0087	3.0214
9	ATC	2.5648	0.3461	0.5343	-0.3779	-0.1234	0.0719
10	DATS	0.4123	-0.1774	-0.3554	-0.1623	0.0114	-0.0420
11	TPC	0.5123	-0.1776	-0.3554	0.1623	0.0117	0.0719
12	YPS	2.5648	0.3061	-0.5343	0.3779	-0.1234	0.0719
13	LPC	0.7750	0.0524	0.5650	-1.4424	-0.2644	0.0508
14	LPS	-13.223	-2.0411	3.0799	-1.3790	0.5311	-0.4909
15	NPC	-13.727	2.0011	3.0799	-1.3790	0.5311	0.4309
16	NPS	-3.7711	0.0644	-0.5650	-1.4424	0.2644	0.0508
17	AXC	-0.0222	-0.1046	0.1527	0.0072	-0.0649	0.0043
18	AXS	-0.1112	-0.0331	0.0398	-0.1615	-0.0649	0.0128
19	AVC	-0.1112	-0.0331	0.0398	0.1615	-0.0669	-0.0128
20	AVS	0.0422	-0.1645	-0.1527	0.0072	0.0067	0.0043

PRELIMINARY DATA

RUN:5EW _100's_
2.01:5

	3	5	7	9	11	13		2	3	4	5		
1 XC	-20.196	8.4998	16.425	-9.2705	-8.8737	-6.1432	TC	27.011	20.816	20.965	-28.756	-3.404	4.9277
2 XS	-.212	29.140	19.342	3.2211	0.5106	-7.0347	TS	-40.325	16.571	26.875.	35.471	-0.5765	11.201
3 YC	7.2142	-29.150	14.342	-3.2511	0.5106	6.0357	UC	2.4121	-0.6149	-0.0154	2.7732	-4.1677	0.7228
4 YS	20.146	8.4998	-14.425	-9.2705	8.8737	-6.1432	US	5.3734	-4.0958	3.1917	-2.9419	-1.7607	-4.0212
5 LC	0.1276	0.5028	1.5520	0.1213	0.1671	0.7235	TPC	6.6594	29.309	-19.539	4.2534	-0.6005	-1.3232
6 LS	-1.6697	-0.5074	0.5482	-1.2149	3.0771	0.1453	TPS	-0.3984	-7.7758	-2.5255.	-21.001	3.1234	-1.3447
7 C	-1.6697	0.6974	0.5482	1.3242	3.0771	-0.1953	UPC	0.2515	0.6531	0.5667	0.1245	-0.0019	-0.0357
8 S	-0.1276	0.5028	-1.5520	0.1213	-0.1671	0.7235	C2S	-0.0116	-0.2263	-0.0735	-0.6113	0.0509	-0.0557
9 XPC	-0.7223	-1.1701	-0.0519	-0.0600	0.1199	0.0290	ATC	0.5076	0.1660	0.1418	-0.2343	-0.0317	0.0798
10 XPS	1.7054	-0.6235	-0.4520	-0.0532	-0.0291	0.1239	ATS	-0.2514	0.2270	-0.0744	0.3465	-0.1635	0.0454
11 YPC	0.7223	-1.1701	-0.4520	-0.0532	0.0291	-0.1339							
12 YPS	1.7054	5.0043	-0.0319	-0.0646	-0.1199	0.0290							
13 LPC	0.2545	4.0403	2.0422	-0.2752	0.0441	0.7001							
14 LPS	-5.7540	-4.0403	0.7179	0.1204	0.5407	0.4792							
15 PC	-6.7540	5.0043	0.7179	-0.1304	-0.5407	0.7661							
16 PS	-0.1244	0.0024	-2.0428	-0.2262	0.0441	-0.0940							
17 ZPC	-0.1337	0.0026	0.1917	-0.0034	0.0264	-0.5171							
18 ZPS	0.0425	0.2566	0.0680	-0.0241	0.0050	0.1171							
19 ZPC	0.0425	-0.2566	0.0680	-0.0241	0.0050	0.1171							
20 ZPS	0.1337	0.0625	-0.1017	-0.0338	-0.0264	-0.0640							

REVISED 1626
2.01:0

	2	3	4	5	6	12
TC	-4.7745	39.521	-26.033	-0.7756	25.193	-4.241
TS	24.531	22.531	-23.444	-2.543	-2.264	-11.46
QC	-16.849	0.9436	-2.0068	1.7241	1.3763	0.9215
QS	1.1246	-0.4675	-0.4675	1.3217	-1.5074	0.0321
TPC	-11.647	0.7262	0.4484	1.3242	-4.5-57	0.7534
TPS	17.545	-15.751	-8.3075	-11.105	-1.7273	-0.7253
QPC	-0.3405	-0.2534	-0.2457	-0.347	-1.1235	-0.2203
QPS	0.5157	-0.4245	-0.2418	-0.3250	-0.0521	-0.0577
ATC	0.3319	0.4551	-0.0744	0.0512	0.2135	-0.1171
ATS	0.5759	0.2143	-0.2453	0.4765	-0.0066	0.1171

	3	5	7	9	11	13
XC	-46.210	15.647	-0.4245	-20.577	-3.6555	4.2376
XS	-7.7243	-32.403	-44.229	-1.2971	-5.6198	9.6643
YC	-7.7243	-32.403	-43.422	1.2071	-5.0098	-9.6603
YS	46.210	15.647	-0.4245	-20.577	3.4555	4.2290
LC	-1.1520	-0.3674	-2.4054	-2.2440	1.3045	-0.8472
LS	-1.4913	1.7511	1.4430	-1.5042	0.7595	2.0703
QS	-1.4913	1.7511	1.4448	1.5042	-0.7595	-2.0563
XQC	-1.2421	-1.3214	2.4643	-0.2700	-1.3745	-0.6472
XQS	0.6476	-0.5654	-0.1452	-0.1754	-0.0456	0.0915
XVC	1.0356	0.3740	-0.2740	0.1154	0.2440	-0.0205
YVC	1.0372	-0.3740	-0.4760	-0.1154	0.2440	-0.0715
QLC	-0.7-74	-0.5654	0.1452	0.0754	0.468	0.0824
QLS	-5.77	2.7310	2.6052	0.6553	-1.0012	-0.4476
ALC	-0.1214	1.7616	0.2577	-1.1172	-0.6720	0.4476
ALS	-0.1216	-1.7616	0.2577	1.1172	-0.6120	-0.0524
ADC	5.4027	2.7916	-2.4252	-0.6544	1.0412	-0.0257
ADS	-0.3454	-0.3134	-0.0109	-0.1705	-0.0215	0.0596
AVC	-0.1534	-0.3131	-0.3776	-0.0163	-0.0943	-0.0596
AVS	-0.3454	-0.1342	-0.0169	-0.1706	0.0215	0.0257

PRELIMINARY DATA

PHASEO 1007
2.01:7

	2	3	4	5	8	12
TC	3.3641	2?.0002	2.0347	-2?.549	2?.925	-16.217
TS	16.3?0?	-5.7156	44.347	22.2?6	-12?1??	1?.?1?
UC	-2?.?0?	1.4?66	-2?.5?2?	2?.3???	1.?4??	-?.1?1?
US	3.0442	-1.?0?4	-3.0?47	-?.1??	1.1?4?	-?.3.?1
TPC	7.775?	31.566	?.6???	2.?7?7	2.6?5?	-?.?2??
TPS	43.39?	-16.?17	-17.2??	3.?211	7.177?	-?.??2?
OPC	0.2243	-?.?1??	0.2?7?	?.3?71	?.?735	?.?174
OPS	1.2632	-?.4??2	-?.51??	?.41?1	-?.7???	-?.4?
ATC	0.1623	1.1647	?.16?5	-?.2?3?	?.3?75	-?.17??
ATS	0.4?42	-0.1206	-1.4??2	0.1745	-?.?3??	?.?5?

	3	5	7	9	11	13
XC	-2?.?3?	-4?.141	-21.72?	1.3???	16.54?	-9.3773
XS	-3?.?3??	-2?.5??	12.542	-3?.?2?	-4.7?5?	-11.??4
YC	-3?.5??	-?.5?7?	12.5??	35.?2?	-4.7?5?	11.7??
YS	2?.??7	-4?.141	21.7??	1.5?1?	-1?.53?	-4.3773
ZC	-?.5?7?	?.?1??	2.5??2	1.7???	?.0?1?	-?.5??
ZS	-2.1?7?	1.4?5?	-?.43??	?.7?3?	-?.?2??	-?.?4?
	-?.?5??	-1.4?5?	-2.4?7?	?.2?3?	?.?2??	?.?4?
	-2.5?7?	-?.?5??	-2.5?1?	-?.?4??	-?.417	?.7?1
	2.1?1?	?.?27?	-?.?4??	-?.1?2	?.?1??	?.7??
	-?.?7??	?.?27?	-?.?4??	-?.1??	?.?1??	-?.12?
	?.?5??	-1.?5??	-2.5755	?.?4??	?.?1??	?.?7?1
	-?.?5??	-?.2?4?	-?.27?5	-?.14??	-?.424?	?.?7?5
	-?.?1??	-1.4?5?	-2.27?5	?.14??	?.?4?1	-?.?7??
	-?.?4??	-?.?7?3	-1.1?57	-?.?2??	?.1?31	?.?5?1
	-?.1?7?	-?.?7?5	?.11??	?.2725	?.?2?7	?.?7??
	-?.?11?	?.?4?5	?.114?	?.2725	?.1?2	-?.?75?
	-?.?11?	-?.?4?5	?.114?	-?.?04?	-?.?1??	-?.1?7?
	0.1561	-?.2743	?.14?7	-?.?04?	-?.1182	-0.0756

PRELIMINARY DATA

ROVISED (c.c)/
2.01:9

	2	3	4	5	8	12
TC	28.941	-7.6216	27.610	-167.45	-6.212	-13.517
TS	40.510	26.579	30.010	-16.072	-5.243	24.277
UC	-0.3922	-0.1801	-0.1424	-0.0009	-0.3142	-1.3077
US	3.6816	0.4776	-1.4219	-0.4521	1.3457	0.3551
TPC	-29.504	31.636	31.136	32.010	-2.3407	0.653
TPS	62.209	18.412	-24.312	7.105	1.1223	-0.341
CPC	-0.4263	-0.9205	-0.1254	-0.1671	-0.4711	0.5252
UPS	1.8107	0.5474	-0.2231	-0.2256	-0.0320	-0.5010
TC	0.5271	-0.0940	0.3350	-1.2256	0.1594	-0.1475
ATS	0.6668	0.1550	0.2362	-0.1307	0.0354	0.2623

	3	5	7	9	11	13
TC	-12.619	-71.443	14.049	-14.213	19.940	7.7564
XS	-14.649	-26.564	14.172	-12.122	-4.9713	5.5259
UC	-14.659	-29.556	14.925	15.722	-4.9719	-5.5259
US	-12.619	-71.243	-14.241	-12.365	-12.940	7.7564
UC	-0.0722	20.919	-0.715	-0.4171	0.1540	0.3527
US	-22.574	-20.946	-0.157	-0.7744	-0.1324	-0.2263
UC	-22.514	2.0524	0.751	-0.7221	0.3524	0.5243
US	-22.124	-1.4276	-0.1416	-0.4171	-0.1057	0.3727
UPC	-20.123	-1.227	-0.1136	-0.5743	-0.1251	0.3232
UPS	0.7472	1.6471	0.5472	1.9735	-0.254	-0.2411
UPS	2.0423	-0.7271	-0.5452	-0.3135	-0.1957	-0.6592
UGC	0.4517	7.2241	-1.323	-2.7162	0.4148	1.1406
US	-11.027	-7.2741	2.3516	-1.222	-0.4262	1.0726
US	-11.017	-6.444	-1.523	-2.7762	-0.3407	1.0204
UTS	-0.4519	2.079	-1.240	-2.3221	-0.1712	1.0547
UNS	-0.1110	-0.2732	-0.1245	-0.1651	-0.0437	0.1518
UUC	-0.1110	-0.2732	0.1295	0.1261	-0.0457	0.0518
UAS	-0.0553	-0.6544	-0.1270	0.3421	-0.1712	0.0547

PRELIMINARY DATA

RUN:SEQ 1010
2.01:10

	2	3	4	5	8	12
TC	-0.3073	22.656	42.350	-22.958	-2.9987	2.8955
TS	41.317	26.917	19.881	-47.378	15.013	8.2051
UC	-6.0741	0.7605	1.7451	0.4262	0.4391	0.0562
QS	2.4594	1.7490	0.3061	1.3221	0.7413	0.2543
TPC	-24.191	29.109	12.960	-3.5286	-7.1776	0.2654
TPS	73.228	-4.3863	14.486	7.1776	2.6564	
UPC	-0.7042	0.8473	0.1994	-0.1045	-0.2089	0.0677
UPS	2.1318	-0.1277	0.3772	0.4217	0.2089	0.0774
ATC	0.1208	0.1501	0.0050	-0.4283	0.0232	0.0354
ATS	0.7919	0.3282	0.1403	-0.5198	0.1354	0.0466

	3	5	7	9	11	13
XC	-41.249	-91.361	11.399	-22.314	33.276	2.9550
XS	-40.147	-20.508	-19.636	-5.9643	-21.951	-3.0268
YC	-40.047	20.508	-19.636	5.9643	-21.951	3.0268
YS	-41.249	-91.351	-11.399	-22.314	-33.276	2.9550
LC	2.0044	-0.1349	-0.0271	-0.0775	-0.4155	0.1231
LS	-0.6741	-2.7948	0.8018	0.3355	0.0346	0.0140
...S	-0.6741	-2.7948	-0.0018	-0.3355	-0.0346	-0.0140
...C	-2.0044	0.1349	-0.0271	-0.0775	0.4155	0.1231
XPC	-0.9303	0.8330	0.7767	-0.0541	0.0165	0.0609
XPS	1.5625	-0.3933	-0.9745	-0.0766	-0.0717	-0.1305
YPC	1.5625	0.3975	-0.9745	0.0766	-0.0717	-0.0709
YPS	-0.9303	-0.8330	-0.7767	-0.0541	-0.0165	-0.4289
LPC	-5.1979	-3.3465	2.4757	-0.4449	-0.2489	-0.6094
LPS	-7.1207	-2.9617	5.3207	-0.0961	0.2098	0.6094
...PC	-7.1207	2.9617	5.3207	0.0961	0.2098	0.4249
...PS	5.1979	-3.3451	-2.4757	-0.4449	-0.2725	0.0416
AXC	-0.2367	0.0995	0.1294	-0.1049	0.2725	0.0301
AXS	-0.3523	-0.1944	-0.1879	-0.0729	-0.2073	-0.0301
AYC	-0.3523	0.1944	-0.1879	0.0729	-0.2073	0.0301
AYS	0.2367	-0.0995	-0.1294	-0.1849	-0.2725	0.0416

PRELIMINARY DATA

C . 2

RUN:SEQ 101
2.01:11

	3	5	7	9	11	13
XC	-19.592	34.264	29.225	34.509	-8.7037	-6.3755
XS	-3.9615	5.9403	-21.549	13.124	-3.0713	3.5654
YC	0.0605	-5.9403	-21.549	-13.124	-3.0713	-3.5654
YS	19.592	34.264	-23.225	34.509	8.7037	-6.3755
LC	0.5544	-3.0605	-1.3307	-0.7547	-0.1750	-0.1239
LS	3.5940	1.5917	1.5446	-0.4179	0.3132	0.2941
?S	3.5940	1.5917	1.5446	0.4179	0.3932	-0.2961
?S	-0.5544	-3.0605	2.1317	-0.7547	-0.1250	-0.1239
XEC	0.1473	-0.1440	-0.4147	-0.2442	-0.0193	-0.0365
XES	1.4519	-0.1503	-0.7075	0.5675	-0.0423	0.1671
YPC	1.4519	-0.1503	-0.7175	-0.5676	-0.0424	-0.1071
YPS	-0.1473	-0.1440	-0.4167	-0.2442	0.0173	0.0365
LPC	-7.6524	0.5576	3.9253	3.9939	-0.1543	0.6769
LES	-2.6402	-0.4619	-0.5249	0.2349	-0.1772	-0.4466
MCS	-2.4512	0.4519	-0.5249	-0.2349	-0.1672	0.4406
MCS	7.6524	0.5576	-3.9553	3.9939	0.1543	0.6769
?XC	-0.2402	0.3420	0.2162	0.3221	-0.0742	-0.0416
?XS	-0.1207	0.0965	-0.2105	0.1263	-0.0255	0.0354
AXS	-0.1207	-0.0965	-0.2105	-0.1263	-0.0255	-0.0354
AYC	-0.1217	-0.0965	0.2162	0.3221	0.0762	0.0416
AYS	0.2402	0.3426	-0.2162	0.3221	0.0762	-0.0416

	2	3	4	5	6	12
TC	64.949	1.2649	-29.721	67.272	-54.112	8.6155
TS	12.887	12.728	-33.947	82.056	32.166	23.363
QC	-2.7909	-0.7563	2.1341	1.1529	0.4582	0.2264
QS	-7.0507	-0.1043	-0.0316	-1.4946	-0.3033	0.2205
TPC	-11.293	12.074	4.7126	-2.3261	-0.0665	-3.2565
TPS	60.080	13.808	19.760	-0.9949	-5.7420	-1.2627
QPC	-0.3259	-0.5552	0.1374	-0.6677	-0.0613	-1.0445
QPS	1.7433	-0.5475	0.5115	-0.1247	-0.1603	-0.0356
ATC	6.5967	0.0720	-0.3051	0.7334	-0.2037	0.0415
ATS	0.4942	0.1769	-0.5149	0.6163	0.2538	0.2111

PRELIMINARY DATA

82

RUNISED 1014
2.01:14

	2	3	4	5	8	12
TC	-84.496	38.101	-27.994	21.663	-11.947	-17.213
TS	30.110	43.686	54.702	-24.627	-36.172	3.2310
OC	0.2961	-4.3062	-0.3948	-0.3774	0.2644	0.1616
US	0.6494	0.1382	-0.4456	1.7742	1.7676	0.4436
TPC	-3.4547	11.430	-3.8991	0.5317	5.7828	-0.1694
TPS	-68.852	-15.617	-7.1112	-12.229	-11.763	-3.9211
GPC	-0.1122	0.3443	-0.7573	0.0155	0.1543	-0.1029
GPS	-2.0042	-0.4604	-0.2070	-0.3580	-0.3424	-0.1141
ATC	-0.7504	0.5027	-0.0927	0.2036	-0.0451	-0.1637
ATS	0.4381	0.4198	0.2831	0.2245	-0.2745	-0.0293

	3	5	7	9	11	13
XC	-15.523	10.190	10.653	0.3163	40.552	-1.7259
XS	19.733	12.026	12.479	-10.046	-5.2653	2.0146
YC	19.759	-12.128	14.879	10.046	-5.2653	-2.0146
YS	-15.523	10.190	10.653	0.3163	-40.552	-1.7259
LC	-0.2529	-0.9464	-0.4581	-0.4265	-0.9185	0.4479
LS	-2.0913	-2.6319	0.8607	0.7925	0.3760	0.2376
LS	-2.0913	-2.6319	0.8607	-0.7925	0.3760	-0.2476
..S	-0.2223	-0.9404	0.4741	-0.4255	0.9185	0.8679
XPC	0.2245	-0.6068	0.3552	-0.0169	0.1234	-0.2016
XPS	1.1174	0.4553	-0.3514	0.2162	0.2102	-0.0916
YPC	-1.1674	-0.4553	0.3514	-0.2152	-0.2102	-0.0916
YPS	-0.2526	-0.6048	-0.3552	-0.0169	-0.1438	-0.2016
LPC	-5.6520	3.1154	-2.2443	0.5647	-1.2479	0.7922
LPS	-2.7635	-1.4342	0.9142	-0.1434	-0.4215	-0.7263
YPC	-0.9655	-1.4342	0.9142	0.1434	0.4215	-0.7263
YPS	5.6526	3.1154	2.2443	0.5467	1.2579	0.7922
XAC	-0.1674	-0.0940	-0.1063	0.0190	0.3794	-0.0326
XAS	-0.0927	-0.1465	0.1382	-0.0726	-0.0181	0.0584
XAYC	-0.0927	-0.1465	0.1300	0.0726	-0.0181	-0.0584
XAYS	0.1674	0.0946	0.1063	0.0190	-0.3798	-0.0326

PRELIMINARY DATA

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RUN:SEQ 1615
2.01:15

	3	5	7	9	11	13
XC	-22.379	-74.414	197.36	114.13	-74.514	16.310
XS	6.6012	-38.474	64.688	13.380	-58.628	39.771
YC	6.5072	38.474	64.688	-13.380	-58.628	39.771
YS	22.379	-74.414	-197.36	114.13	74.514	16.310
LC	0.9372	1.3390	-5.3049	0.1552	0.1552	0.2345
LS	1.3326	-3.6133	-0.5956	0.4656	-0.1544	-0.7741
MC	1.3326	-3.6133	-0.5956	-0.4656	-0.1544	0.7741
MS	-0.9372	1.3390	5.3049	-1.2933	-0.1455	0.2335
XPC	-0.3342	-0.6443	0.0632	0.5203	-1.3164	-0.6677
XPS	1.5045	0.9075	1.5041	0.5263	0.2445	-0.0175
YPC	1.5045	0.9075	1.5041	0.5263	0.2445	-0.0175
YPS	0.3342	-0.4443	-0.9632	-1.2538	1.3164	-0.6677
LPC	-6.0433	-3.2040	-6.5053	-0.1324	1.2315	1.3473
LPS	-4.3521	3.7086	1.4343	0.8404	-6.4193	2.9486
MPC	-4.3521	-3.7086	1.4343	-6.8404	-6.4193	-2.9486
MPS	6.0433	-3.2040	6.5053	-0.1324	-1.2315	1.3473
AXC	-0.1760	-0.6095	1.6114	1.0233	-0.6225	0.1245
AXS	-0.0500	-0.4566	0.4640	0.1364	-0.4419	-0.3441
AYC	-0.0500	0.4566	0.4640	-0.1364	0.4819	0.3441
AYS	-0.1760	-0.6095	-1.6114	1.0233	0.6265	0.1245

	2	3	4	5	6	12
TC	-55.632	81.144	46.624	130.80	-47.376	-18.722
TS	-35.427	54.203	0.4567	-44.069	-42.505	-11.440
OC	2.2956	-0.7094	-0.0342	1.6541	2.0912	-0.1721
OS	-0.6723	-0.5475	-2.7500	-0.6647	1.5635	0.1183
TPC	-225.43	22.198	-146.66	15.504	-0.2304	-11.943
TPS	173.99	-11.298	-75.498	3.7862	25.261	5.0509
OPC	-6.5619	-0.6461	-4.8518	0.4624	-0.0271	-0.3482
OPS	5.0646	-0.3249	-2.1976	0.1103	0.6771	0.1470
ATC	-0.5674	0.7504	0.1159	-0.9042	0.0679	0.0024
ATS	0.5918	0.4600	0.2819	-0.7944	-0.2901	0.2245

PRELIMINARY DATA

RUN:SEN 1016
2.01:16

	2	3	4	5	6	12
TC	-17.832	49.645	-33.093	47.5-1	-23.003	22.122
TS	-143.62	51.631	-31.361	69.013	-176.47	-11.3-9
UC	4.5456	0.3473	3.0185	1.9773	0.7901	0.2506
US	-2.5117	0.6159	1.8429	3.0294	-0.3266	1.6266
TPC	-259.66	-64.134	-76.694	-24.907	1.0034	-1.4509
TPS	298.74	63.070	-177.91	65.449	-55.294	-54.947
UPC	-7.5582	-1.8668	-2.2342	-2.7335	0.0310	-0.0542
UPS	8.6957	1.8359	-5.1747	1.0472	-1.6095	-1.7449
ATC	-0.1354	0.6760	-0.6162	0.4722	-0.3941	0.1600
ATS	0.0232	0.7321	-0.4551	-0.0598	-0.4269	0.4202

	3	5	7	9	11	13
XC	-25.168	17.093	60.047	-67.569	25.759	83.422
XS	40.521	206.86	211.20	110.54	46.732	7.2929
YC	60.521	206.86	211.20	-110.54	46.732	-7.2929
YS	25.168	17.593	-60.047	-67.069	-25.259	83.422
LC	-2.7497	-4.4497	-2.5168	-0.6515	1.2313	0.4316
LS	-1.5381	3.5637	-0.7115	-0.1017	0.2262	-1.4255
MC	-1.5381	-3.5637	-0.7115	0.1017	1.4255	0.4316
MS	2.7497	-4.4497	2.5168	-0.6515	-1.2313	1.4255
XPC	-0.6471	6.7264	-1.7333	2.0578	-3.0716	1.7473
XPS	-5.5446	-1.7456	-2.6492	0.1649	-1.6037	-0.4790
YPC	-5.5446	-1.9559	-2.6492	-0.1649	-1.6037	0.7790
YPS	0.6471	6.7264	1.7333	2.0578	3.0716	1.2473
LPC	25.645	-3.9175	15.125	-3.1569	14.140	-6.7959
LPS	8.3627	-33.611	-2.7048	9.5105	-13.348	3.0994
MPC	8.3627	33.611	-2.7048	9.5105	-13.348	3.0994
MPS	-25.645	-3.9175	-15.125	-3.1569	-14.140	-6.7459
AXC	-0.1249	0.2566	0.4711	-0.6749	-0.1557	0.6966
AXS	0.3572	-1.8066	1.8066	0.9139	0.4288	0.0133
AYC	0.3572	1.6628	1.6628	-0.9139	0.4288	-0.0133
AYS	0.1249	0.2566	-0.4716	-0.6749	-0.1557	0.6966

PRELIMINARY DATA

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RUN:SEQ 1020
2.01:20

	3	5	7	9	11	13
XC	-8.9577	-5.5421	-27.095	-46.595	-44.703	-16.055
XS	29.612	8.1017	-21.458	48.847	19.570	-11.796
YC	29.612	-5.1017	-27.458	-48.847	19.570	11.796
YS	8.9577	-5.5421	-27.095	-46.595	44.703	-16.055
LC	0.5924	-1.3547	0.7440	1.2097	-0.0714	0.6923
LS	-1.4908	-0.5416	0.9098	3.3047	-0.1932	-0.0455
?C	-1.4908	0.5416	0.9098	-0.3047	-0.1432	0.0456
?S	-0.5924	-1.3547	-0.7440	1.2697	0.0718	0.6923
XPC	-1.8173	-0.0152	-0.1659	-0.7456	-0.1216	-0.1550
XPS	3.4353	-1.0677	-0.2789	-0.4457	-0.0117	0.0318
YPC	3.4353	-1.0677	-0.2789	0.4457	-0.0117	-0.0318
YPS	1.8193	-0.0152	-0.1559	-0.7458	-0.1216	-0.1530
LPC	-11.553	4.7569	0.9400	-0.5729	-0.1788	0.4366
LPS	-14.654	1.9616	1.2712	4.1778	0.5651	0.6316
MPC	-14.654	1.9616	1.2712	-4.1778	0.5651	-0.6316
MPS	11.553	4.7569	-0.9300	-0.5729	0.1788	0.4366
AXC	-0.0917	-0.0707	-0.2344	-0.4146	-0.3967	-0.1391
AXS	0.1938	0.0595	-0.2147	0.4227	0.2093	-0.0599
AYC	0.1938	-0.0505	-0.2187	-0.4227	0.2093	0.0899
AYS	-0.0917	-0.0707	0.2344	-0.4148	0.3967	-0.1391

	2	3	4	5	8	12
TC	-79.573	43.916	-61.544	-3.2449	22.003	-3.6354
TS	34.780	64.019	14.642	10.814	-39.724	5.9605
UC	-4.2343	2.7801	3.5717	0.4711	0.3683	-0.0655
QS	-0.6430	-2.3906	0.5720	-0.7625	1.0627	-0.1534
TPC	-47.120	61.542	-24.391	-13.159	-9.7931	-0.5701
TPS	80.350	-12.627	1.7944	-11.165	3.4547	1.2627
OPC	-1.3716	-1.7914	-0.7100	-0.3430	-0.2424	-0.0174
OPS	2.3340	-0.3676	0.0522	-0.3259	0.1122	0.0360
ATC	-0.8298	0.5137	-0.1733	-0.0526	-0.1428	0.0195
ATS	0.4295	0.7602	0.0512	0.0390	-0.1721	0.1196

PRELIMINARY DATA

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RUN:SEJ 102
2.01:21

	2	3	4	5	8	12
TC	-97.511	129.74	12.476	-2.0?0	5.516?	24.433
TS	-7.6730	95.455	-37.551	-3.926	-94.?42	-24.417
OC	-6.0518	0.3774	0.1259	-1.13?1	4.5662	1.4796
OS	-1.0941	0.0391	-3.6003	-0.4476	-0.2745	-1.1173
TPC	-170.93	86.331	-204.96	-15.?17	26.041?	-0.3323
TPS	223.04	-25.587	-9.9569	11.?97	29.045	14.3?
OPC	-4.9756	2.5129	-5.9651	-0.6?04	0.2?61	
OPS	6.4923	-0.7440	-0.2902	0.3?05	0.4???	0.1?5?
AIC	-0.9322	1.1263	0.5657	0.4198	-0.2351	0.1?5?
ATS	0.6784	0.9359	0.4661	-0.6394	-0.7334	0.0?63

	3	5	7	9	11	13
XC	-17.756	29.744	122.30	-7.1924	17.709	52.191
XS	26.452	-26.564	-239.69	75.193	72.716	-56.783
YC	26.452	26.543	-239.49	-75.193	72.716	56.783
YS	17.726	29.744	-122.30	-7.1924	-17.709	52.191
LC	-1.4491	-0.6982	-1.6205	-1.?937	1.4304	0.547?
LS	-0.?376	-1.5275	-1.4?81	0.4022	-0.7517	0.0?06
UC	-0.?376	-1.5275	1.4?81	-0.4022	0.7517	-0.?006
US	1.?6?4	-0.6?49	1.6?03	-0.0?37	-1.4304	-0.5278
XPC	-2.1762	1.1?1?	2.0721	-0.6675	1.?020	-0.0551
XPS	5.1290	0.2948	-2.6300	-0.7279	0.6941	-0.7542
YPC	5.12?3	-0.?749	-2.6300	0.2279	0.6981	-0.7542
YPS	2.1762	1.?41?	-2.0721	-0.6475	-1.?020	-0.0551
LPC	-1?.70?	-5.?344	14.2??	-0.2?11	-5.0220	3.?72H
LPS	-19.406	5.?344	14.252	-3.413?	3.14??	-1.1875
UPC	-19.406	5.?344	14.252	-3.413?	3.14??	1.1875
UPS	1?.70?	-0.?2?1	-7.?064	0.2511	5.?220	3.4723
AXC	0.1646	-0.7632	-1.0418	-0.0?90	0.1107	0.4376
AXS	0.0?19	-0.1?1?	-2.?250	0.6360	0.6669	-0.5280
AYC	0.0?19	-0.1?1?	-2.?250	-0.6360	0.6669	0.5280
AYS	0.1646	0.7632	-1.0418	-0.0990	-0.1107	0.4376

RUN:SEJ 1022
2.01:22

	2	3	4	5	8	12
TC	-62.659	151.52	11.499	114.45	-15.193	14.529
TS	-199.78	91.964	-77.253	130.61	-244.04	-63.111
OC	2.0122	-1.4393	-0.369	4.0246	1.3956	1.1553
US	-4.6541	-7.1368	-0.1755	-4.2011	0.7699	-2.3..
TPC	-257.50	56.225	-142.63	-30.812	-29.641	0.1329
TPS	383.47	86.132	-73.039	72.640	14.435	-15.077
OPC	-6.3647	1.6366	-5.3219	-1.1296	-0.6525	0.6059
OPS	11.162	2.5071	-2.1260	2.1202	0.4217	-0.5262
ATC	-0.8639	1.6449	-0.1426	0.9445	-0.7724	0.1116
ATS	-0.4490	1.1397	-0.6138	0.9493	-1.6510	0.2356

	3	5	7	9	11	13
XC	-52.218	-34.615	305.19	17.661	22.537	59.240
XS	80.234	-25.443	343.49	11.445	-65.946	-50.640
YC	80.234	25.443	343.49	-11.445	-65.946	56.346
YS	52.218	-34.615	-305.19	17.661	-27.537	59.240
LC	-1.2556	-3.7601	-2.6361	-1.5572	1.1229	-0.1478
LS	-0.6440	-1.2465	-3.0608	0.6605	0.8526	-0.1748
YC	-0.6440	1.2469	-3.0608	-0.0605	0.4520	-0.1748
S	-1.2556	-3.7601	2.6361	-1.5572	-1.1529	-0.1578
XPC	-6.3253	5.0653	-2.6652	-1.5914	-2.1173	-0.6957
XFS	-0.7055	-1.0137	5.4065	1.5643	1.0646	-0.2849
VPC	-0.7055	-1.0137	2.0452	-1.5914	1.4060	0.2449
YFS	6.3253	5.0653	20.180	5.8017	2.1173	-0.6957
LPC	15.173	-14.040	-19.588	-5.0141	-11.486	4.5413
LPS	-26.910	20.425	-19.548	5.0141	-11.486	-4.5413
YPS	-15.173	-14.040	20.180	5.2617	0.7616	0.4302
AXC	-0.4511	-0.2564	2.6630	0.1750	0.1172	0.5543
AXS	0.5970	-0.1575	3.1452	0.1473	-0.6741	-0.5633
AYC	-0.5970	0.1575	3.1452	-0.1473	-0.6741	0.5633
AYS	0.4511	-0.2564	-2.6630	0.1750	-0.1172	0.5543

RUNSED 1627
2.01327

	3	5	7	9	11	13
XC	-21.922	18.232	-2.1178	-35.029	14.156	1.5558
XS	-19.646	19.747	-2.1977	-40.490	-40.490	4.2394
YC	-19.245	-19.747	-2.7977	40.876	-40.390	-4.2394
YS	21.922	18.232	2.1178	-35.029	-14.156	1.5558
LC	3.0118	-0.0751	0.7710	0.1495	-0.6648	-0.5368
LS	-0.4561	-1.0692	-0.4103	1.2900	2.5449	0.3046
MC	-0.4661	-1.0692	-0.4103	-1.2900	2.5449	-0.3046
MS	-3.0118	-0.0751	-0.7710	0.1495	0.6648	-0.5368
XPC	-2.5397	0.4637	0.3010	1.1977	1.2013	0.1310
XPS	-0.0417	1.5112	3.7050	-0.4450	0.0477	0.1310
YPC	-0.0417	-1.5112	3.7050	1.1977	-1.2013	-0.1110
YPS	2.5397	0.4637	-0.3010	-0.3786	-6.5153	0.0467
LPC	5.0135	5.9412	-14.047	0.3786	-6.5153	-0.4204
LPS	-11.262	-4.6750	-5.6926	-6.1562	3.5635	-0.6363
MPC	-11.262	4.6750	-5.4626	6.1562	3.5635	0.6363
MPS	-5.0135	5.9412	14.047	-0.3786	6.5153	0.4204
AXC	-0.1152	-0.2036	0.0406	-0.2729	0.1212	0.0165
AXS	-0.2647	0.2190	0.0201	-0.3945	-0.3278	0.0079
AYC	-0.2847	-0.2190	0.0201	0.3945	-0.3278	-0.0079
AYS	0.1152	0.2036	-0.0406	-0.2729	-0.1212	0.0165

	2	3	4	5	8	12
TC	-26.112	-16.574	20.977	8.6766	3.1434	-0.2738
TS	-30.122	29.807	-37.160	-4.5335	42.736	-5.5?1
QC	-3.2924	4.9751	1.6443	-0.1350	-0.5166	-0.36?1
QS	-0.8255	3.1672	0.4735	1.0570	-0.7317	-0.03?2
TPC	23.660	25.547	-11.032	-22.995	-4.4075	-19.074
TPS	-40.673	32.100	-1.4609	-10.591	24.364	-0.??45
QPC	0.6487	0.7448	-0.3211	-0.6603	-0.2418	-0.5552
GPS	-1.1239	0.9344	-0.0542	-0.3657	0.7611	-0.??1?
ATC	0.0085	-0.0439	0.5137	-0.0134	-0.0281	-0.0256
ATS	-0.1452	0.2440	-0.3390	0.0255	0.3795	-0.1?13

PRELIMINARY DATA

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NUMBER 1028
2.01:26

	3	5	7	9	11	13
XC	-0.7654	-13.124	-74.557	-122.37	-105.36	-5.1764
XS	-72.777	-5.043n	-125.71	-22.526	44.914	64.117
YC	-72.777	5.093n	-125.71	22.526	44.914	64.117
YS	0.2654	-13.124	74.557	-122.37	105.36	-5.1764
LC	-2.0303	-2.0213	1.6371	1.9405	1.9520	0.8134
LS	-0.9352	2.2445	0.3578	1.4509	-1.6005	0.0048
TC	-0.9352	-2.2445	0.3378	-1.6500	-1.6005	-0.0048
TS	2.6333	-2.0213	-1.6371	-1.9405	-1.9520	0.8134
XPC	1.7424	0.3502	-1.0464	-0.6464	0.5506	-1.8834
XPS	4.5467	3.7654	-1.0464	0.7630	0.5506	1.4534
YPC	4.5467	-3.7654	0.4491	-0.7630	-0.5506	-0.6492
YPS	-1.7424	0.3502	-0.4491	-0.7303	0.0755	-0.6492
LPC	-23.636	-17.214	5.6560	-2.1351	-2.3154	-7.1006
LPS	-0.3949	5.6450	0.0554	4.7606	-1.3836	6.6574
M LPS	-0.6560	-5.6756	0.0554	-4.7606	-1.3836	-6.6574
APS	23.636	-17.214	-5.6460	-2.1351	2.3154	-7.1006
AXC	0.0936	-0.067n	-0.6057	-1.4966	-0.9097	-0.0271
AXS	-0.6665	-0.0946	-1.1394	-0.3710	0.4204	0.5806
AVC	-0.6665	0.0906	-1.1394	0.3710	0.4204	-0.5606
AVS	-0.0936	-0.0676	0.6057	-1.0966	0.9097	-0.0271

	2	3	4	5	8	12
TC	-21.857	26.082	49.861	49.924	35.029	4.1201
TS	-63.808	18.097	-33.751	59.347	-108.67	23.106
QC	-2.0603	2.2915	1.5462	-1.0445	-0.3632	0.5160
QS	0.4513	1.8546	-0.0221	0.0148	0.1522	0.1444
TPC	-297.47	39.012	-55.22n	42.601	-37.616	12.76?
TPS	86.790	-64.653	-167.94	42.466	19.539	-25.521
QPC	-8.6569	1.1356	-1.6076	1.2400	-1.0949	0.3714
QPS	2.5845	-1.9944	-4.4865	1.2362	0.5497	-0.7425
ATC	-0.4466	0.1391	0.1037	0.4783	-0.4100	0.1342
ATS	0.0464	0.2001	-0.3136	0.1123	-0.3559	0.2343

PRELIMINARY DATA

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RUNSEQ 1029
2.01:29

	2	3	4	5	-	12
TC	156.63	-58.692	63.264	14.066	-175.64	-54.720
TS	-10.172	10.205	-6.0526	15.407	66.040	-103.10
UC	2.0124	-3.5031	-0.6743	-0.2226	0.2074	-0.6554
US	5.2737	0.9620	-1.2296	1.1471	5.4734	0.2543
TPC	272.59	251.28	64.007	-122.75	-6.9743	7.277
TPS	-221.44	174.86	160.27	-35.266	42.465	15.615
OPC	-4.2255	7.3164	1.9649	-3.5731	-0.2031	0.21-7
OPS	-6.6456	5.0897	4.3335	-2.4420	1.2476	0.4546
ATC	0.1293	0.1261	1.0347	-0.0305	-1.8426	0.1643
ATS	-0.1655	0.0354	-0.1025	0.0691	-0.1037	-0.3673

	3	5	7	9	11	13
1 XC	-9.6663	-7.6125	126.05	-317.61	6.8311	71.571
2 XS	71.194	-0.3365	-155.93	-167.28	-0.124	-47.724
3 YC	71.194	-0.3365	-155.93	167.23	-09.124	47.924
4 YS	9.6663	-7.6125	-126.35	-312.01	-6.8311	71.571
5 ZC	1.5391	-0.7541	-1.7721	-1.6333	1.5212	0.0427
6 ZS	0.9255	0.6602	0.3941	1.7210	1.6539	-0.2604
7 LC	0.9255	-0.5442	0.3441	-1.7210	1.6539	0.2604
8 LS	-1.5391	-0.7541	1.7721	-1.6333	-1.5212	0.0427
9 MC	-10.234	0.7601	-6.5619	-0.2118	0.9431	1.4940
10 XDS	5.1156	0.2104	4.3147	-2.4365	-2.5564	1.1901
11 YDC	5.1156	-9.2161	4.357	2.4365	-2.5563	-1.1901
12 YDS	10.232	30.714	41.550	-0.2118	-0.9431	1.4940
13 LDC	11.021	30.712	-7.1553	-12.464	9.5934	2.6672
14 LDS	-91.172	-20.712	-37.521	6.8371	9.1632	-8.4512
15 MDC	-0.172	-30.714	-37.551	-6.8371	9.1632	2.9512
16 MDS	-121.11	39.714	7.1553	-14.264	-9.5934	2.4072
17 AXC	-0.0132	-0.0025	0.2156	-2.5282	0.0259	0.6510
18 AXS	0.5516	0.0234	-1.3530	-1.5930	-0.3236	-0.4022
19 AYC	0.5516	-0.0236	-1.3556	1.5930	-0.8236	0.4022
20 AYS	-0.0132	-0.0025	-0.9136	-2.5282	-0.0259	0.6610

RUNSEU 1030
2.01:30

	2	3	4	5	8	12
TC	-11.330	-117.58	-93.204	-3.0542	-51.165	11.266
TS	3.7054	-5.9142	-110.47	0.2745	-25.184	-4.414
UC	-2.9054	2.4524	-11.864	-2.2140	-3.8710	1.271
US	-2.3181	3.2482	-8.6036	1.2136	0.1341	-1.2957
TPC	-71.311	92.047	-16.314	-71.909	-12.094	1.9273
TPS	13.491	21.466	11.232	-49.645	-6.1745	4.0540
OPC	-2.0757	2.5793	-0.4494	-2.1932	-0.3636	0.6541
OPS	0.3927	0.6249	0.3269	-1.4509	0.2379	0.11~
ATC	-0.3356	-1.1919	-0.6145	0.1046	-0.4400	0.136~
ATS	-0.1306	-0.0207	-0.4274	0.0549	-0.3756	-0.0136

	3	5	7	9	11	13
XC	16.213	-9.3715	-5.8344	-53.952	-8.6336	-25.946
XS	49.374	24.289	-2.0316	34.501	49.466	21.629
YC	49.376	-24.282	-20.418	-34.501	49.466	-21.629
YS	-16.213	-9.3715	5.8344	-54.952	8.6336	-23.946
LC	1.6352	1.3474	-0.0601	3.4101	2.6048	1.4295
LS	2.1420	0.3608	-3.6432	3.4101	-0.6608	2.1498
AC	2.1420	-0.3634	-3.6432	-3.4101	-0.6608	-2.1404
AS	-1.6322	1.3474	-3.4101	3.4101	-2.6148	1.4295
RFC	-4.0477	0.4504	0.3101	0.7105	-0.4751	0.3397
XFS	3.5499	5.4951	0.6012	-1.6716	0.4624	-0.1221
YFC	3.5439	5.3451	0.6412	0.7105	0.4744	0.1421
YFS	4.0477	0.4504	-0.3104	-0.2261	0.4751	0.3497
LFC	-7.0149	23.237	-3.6492	-3.0191	-1.1796	-1.1339
LFS	-27.512	-12.260	0.2156	-3.0143	-3.0160	-1.1511
AFC	-27.512	12.246	0.2150	0.0443	3.0140	1.1339
AXS	7.0149	23.237	3.6492	-3.0191	1.1764	-1.1330
AVC	-0.0008	-0.1301	-0.0705	-0.4507	-0.0707	-0.1930
AVS	0.6193	0.1405	-0.1400	0.2429	0.4956	0.2039
	0.6103	-0.1405	-0.1400	-0.2429	0.4956	-0.2039
AVS	0.0008	-0.0301	0.0705	-0.4507	0.0707	-0.1930

PRELIMINARY DATA

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TST-727 PH-1 TN-12.2.01:31   IMPRESSION

RUN SEQ 1031
2.01:31

	2	3	4	5	8	12
TC	20.342	-133.69	-123.76	54.451	-3.7513	3.7645
TS	-24.505	39.246	39.472	33.044	0.0756	-45.003
OC	-1.1332	2.8273	-11.469	-1.0264	1.5701	-0.7091
CS	1.0284	-2.1676	4.0493	0.4709	1.4416	0.1243
TPC	-135.53	74.233	-24.843	50.975	-3.3230	5.3474
TPF	65.201	-75.494	-25.122	50.177	13.425	0.2558
OFC	-3.9454	2.1763	-0.5396	-1.4435	-0.0547	1.1772
OPS	2.6401	-2.1976	-0.7512	1.4006	-0.4523	-0.0577
ATC	-0.1062	-1.3239	-0.9164	0.6479	0.1062	0.0451
AFS	-0.2062	0.6626	0.4917	-0.4747	0.1135	-0.0452

	3	5	7	9	11	13
XC	42.296	23.163	21.096	-5.3951	11.442	-5.2911
XS	61.414	39.176	24.207	2.2135	0.5476	11.637
YC	61.414	-39.076	24.207	-2.2135	8.5498	-11.637
YS	-42.296	23.163	-21.096	-5.3951	-11.442	-5.2911
LC	5.1323	0.0843	-1.0344	1.3122	-0.1034	0.1471
LS	3.0380	-0.3765	1.9640	-0.7922	-2.0050	0.3045
AC	3.0380	-0.3765	1.9235	0.7922	-2.0350	-0.3655
AS	-2.1323	0.0843	1.0344	1.3122	0.1036	0.1471
XPC	0.0576	4.4402	1.7995	-0.7350	-0.0239	0.2425
XPS	0.5496	0.4540	-2.0104	0.9751	0.3547	-0.2649
YPC	6.5446	-0.6544	-2.0148	-2.0134	0.3547	0.2626
YPS	-1.4596	4.4024	5.6142	-1.7950	0.0239	-1.7201
LPC	-9.4342	-20.530	-1.724	5.4055	-1.4464	-0.7564
LPS	-9.4042	20.530	11.724	1.6924	-0.1414	0.7564
APC	39.472	-6.3173	-5.6152	-1.494	-0.7474	0.1201
APS	0.0614	0.2226	0.0443	5.4455	1.5564	0.0263
AXC	0.6205	0.3405	0.1735	0.1137	0.0553	0.0959
AXS	0.6215	-0.3405	0.1745	-0.0047	0.0553	-0.0959
AYC	-0.0519	0.2022	-0.0203	0.0741	-0.1139	0.0263

PRELIMINARY DATA

RUN SEQ 1033
2.01:33

	2	3	4	5	6	12
TC	24.221	23.337	-70.491	-48.754	-5.1636	-33.234
TS	-8.2058	-16.360	34.612	-6x.866	13.401	-12.554
YC	1.5078	-3.0019	-1.3277	-2.0322	0.3288	-1.0265
YS	-0.5991	2.9983	-0.0503	-6.5176	1.1440	1.4141
TPC	-12.096	-32.233	59.415	-1.4021	-0.0665	10.567
TPS	-12.893	67.988	6.5130	-11.032	36.746	10.633
OPC	-0.3521	-0.9382	1.7295	-0.0420	-0.0019	0.3075
OPS	-0.3753	1.9790	-0.1496	-0.3211	1.1278	0.3153
ATC	0.4246	0.2184	-0.7553	-0.3990	-0.0574	-0.2672
ATS	-0.1049	-0.3551	0.6894	-0.3356	0.0427	-0.1257

	3	5	7	9	11	13
XC	-23.405	19.916	4.4563	-3.0073	23.548	-10.450
XS	-30.563	-4x.896	11.489	36.x24	17.922	8.6138
YC	-3x.589	4x.896	11.489	36.x24	17.922	-8.613x
YS	23.405	19.918	-4.4563	-3.0073	-23.548	-10.450
LC	-3.6001	6.5599	0.3454	0.4951	1.6907	0.9631
LS	0.8763	2.1037	1.4033	3.5471	1.0413	0.4456
MC	0.8763	-2.1037	1.4033	-3.5471	1.0413	-0.4456
MS	3.6001	6.5599	-0.3454	-0.4951	-1.6907	0.9631
XPC	-1.9775	-0.4692	-0.6025	-0.1241	-0.7108	-0.3199
XPS	-4.2149	-0.5040	-2.0102	-0.5319	-1.7108	0.3199
YPC	-4.2149	-0.5040	-2.0102	0.5319	-1.7108	0.4395
YPS	1.9775	-0.4692	0.6025	-0.1241	0.0713	-2.7644
LPC	22.561	3.1420	10.172	-2.1396	7.7754	-2.7644
LPS	-0.8197	1.1373	1.1301	1.5650	2.9335	-1.3559
MPC	-0.8197	-1.1373	1.1301	1.5650	2.9335	1.3559
MPS	-22.561	3.1420	-10.122	-2.1396	-7.7754	-2.2644
AXC	-0.0845	0.3062	0.0146	0.0294	0.1606	-0.1023
AXS	-0.3530	-0.5101	0.1760	-0.2942	0.1153	0.1214
AYC	-0.3530	0.5101	0.1760	0.2942	0.1153	-0.1214
AYS	0.0845	-0.3062	-0.0146	-0.0294	-0.1606	-0.1023

PRELIMINARY DATA

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RUNSEN 1634
2.01834

	2	3	4	5	8	12
TC	15.954	-80.812	-104.21	25.555	13.236	-3.8273
TS	-11.566	44.953	6.7934	-41.132	10.107	-12.930
OC	-1.8216	3.0034	-10.866	-3.3501	0.4747	-0.2734
QS	-0.6604	-0.5519	4.0529	3.9024	0.2437	0.2045
TPC	-114.64	68.985	-17.67ᴬ	-53.191	-2.6534	6.8453
TPS	59.083	-51.706	-13.292	40.075	10.744	-0.8640
QPC	-3.3371	2.0060	-0.5146	-1.5467	-0.0776	0.1003
QPS	1.7198	-1.5051	-0.3469	1.1655	0.4875	-0.5631
ATC	-0.1098	-0.6005	0.7049	0.3514	0.1147	0.0134
ATS	-0.2221	0.8444	0.0159	-0.3319	0.0561	-0.0241

		3	5	7	9	11	13
1	XC	46.411	16.192	1.5419	-16.072	6.2788	-22.148
2	XS	57.156	-32.531	16.268	-32.260	30.527	24.951
3	YC	57.156	-32.531	16.268	-32.260	30.527	-24.951
4	YS	-46.411	16.192	-1.5419	-16.072	-8.2788	-22.148
5	LC	5.0119	0.9754	-0.5263	1.8011	-0.4190	0.2866
6	LS	1.3457	-1.5905	-0.5410	-1.2693	-2.2452	0.1034
7	NC	-1.3457	-1.5905	-0.5410	1.2293	-2.2452	-0.1434
8	NS	-5.0119	0.9754	-0.5453	1.8511	0.4190	0.2066
9	XFC	-0.2464	4.0034	1.3027	-1.1249	0.1142	-0.1681
10	XPS	5.3264	-0.9541	-1.2311	0.4173	0.0942	-0.0746
11	YFC	5.3264	-0.9541	-1.3029	-0.4173	0.00942	0.0746
12	YPS	0.2464	4.0034	-1.3029	-1.1269	-0.1142	-0.1681
13	LPC	-23.324	-3.3505	2.1279	4.0055	-0.6576	-0.1681
14	LPS	-11.229	-19.693	7.7761	4.2351	0.3311	-0.6424
15	NPC	-11.229	-19.693	7.7761	-4.2391	0.3311	-0.6924
16	NPS	23.324	-3.3305	-2.1279	4.0055	0.6376	-0.0137
17	AXC	0.1450	0.1310	0.0137	-0.1341	0.0857	-0.1454
18	AXS	0.4603	-0.2464	0.1016	0.2259	0.3136	0.1539
19	AYC	0.4603	-0.2464	0.1618	-0.2259	0.3136	-0.1538
20	AYS	-0.1450	-0.1310	-0.0137	-0.1810	-0.0857	-0.1454

PRELIMINARY DATA

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RUNISER 1035
2.01:35

	3	5	7	9	11	13
XC	-2.2780	14.567	44.702	8.6616	29.042	50.024
XS	101.85	53.743	-45.247	-69.620	-34.894	-13.693
YC	101.85	-53.743	-45.247	69.620	-34.894	13.693
YS	2.2780	14.567	44.702	8.6616	-29.042	50.024
LC	3.0074	-0.3545	0.1683	1.1546	0.6775	0.0981
LS	2.7258	-2.1778	1.9345	3.4620	-1.1130	-1.8545
PC	2.7258	2.1778	1.9345	-3.4620	-1.1130	1.8545
PS	-3.0074	-0.3545	-0.1683	1.1546	-0.6775	0.0981
XPC	-3.5819	1.3712	-0.6352	-0.2444	-0.2345	0.2162
XPS	4.2822	3.2619	1.6346	0.6779	0.2329	-0.0610
YPC	4.2822	-3.3419	1.6346	0.6779	0.2329	0.0610
YPS	3.9419	1.6712	0.6352	-0.2444	-0.2346	0.2162
LPC	-14.234	-11.546	-5.2259	-2.5527	-0.5942	-0.6432
LPS	-27.001	-14.744	-6.2191	2.3768	-1.4905	-0.8496
MPC	-27.001	14.744	6.2191	-2.3768	-1.4905	0.8496
MPS	-14.234	11.546	5.9954	-2.5627	0.5942	-0.6832
AXC	-0.1533	-0.1534	0.3696	0.0439	0.2275	0.3799
AXS	0.5946	0.4260	-0.3362	-0.5818	-0.2587	-0.1323
AYC	0.5946	-0.4280	-0.3362	0.5818	-0.2587	0.1323
AYS	0.1593	-0.1534	-0.3696	0.0439	-0.2275	0.3799

	2	3	4	5	8	12
TC	-37.582	-147.70	-75.423	63.769	30.556	22.606
TS	-18.735	-44.507	-61.789	14.453	-67.359	-27.795
UC	-3.7484	-1.581H	-14.624	1.5209	-2.0534	1.2055
US	-3.6444	-0.4628	-3.0620	-0.0126	2.1231	-0.3540
TPC	-162.43	101.82	-47.053	-61.409	7.5764	-1.3957
TPS	-6.3801	-0.5317	-27.116	-11.431	10.364	-11.365
OPC	-4.7240	2.9637	-1.3696	-1.7475	0.2205	-0.0404
OPS	-0.1857	-0.0155	-0.7893	-0.3327	0.3018	-0.3300
ATC	-0.5735	-1.5448	-0.4393	0.7049	0.3087	0.2721
ATS	-0.1293	-0.0805	0.4637	0.3697	-0.8090	-0.4755

RUN:SEQ 109/
2.01:41

	2	3	4	5	8	12
TC	-60.526	34.471	69.842	-20.760	4.6082	-22.545
TS	-41.199	15.460	90.421	36.397	9.9111	-6.972
QC	-2.3674	-3.5232	2.3033	1.6471	-0.2119	0.0140
CS	1.1215	4.6465	1.6265	0.3152	9.6516	0.6141
TPC	-15.485	-40.407	-63.934	35.556	-2.5255	5.3.32
TPS	98.825	-39.876	11.431	-8.1745	-1.7289	-1.3957
QPC	-6.4507	-1.1762	-1.4610	1.0350	-0.0735	-0.1347
QPS	2.8766	0.1607	0.3327	-0.2379	-0.6503	0.1449
ATC	-0.9286	0.6126	0.7956	-0.1379	0.0073	-0.1762
ATS	-0.0525	0.2416	0.6492	0.1476	0.0708	-0.2221

		3	5	7	9	11	13
1	XC	-90.691	-2.8307	14.738	-19.204	40.942	14.064
2	XS	-65.657	-9.0360	-69.825	-25.251	-17.626	-24.357
3	VC	-65.657	-9.0360	-69.825	25.251	-17.628	24.357
4	VS	90.691	2.8307	-14.831	-19.204	40.942	14.064
5	LC	3.1409	3.0704	0.6239	1.2711	-1.3752	0.6474
6	LS	10.967	-2.5175	-0.6076	0.3721	-1.3985	-0.3767
7	PC	10.967	2.5175	-0.6076	-0.3721	-1.3965	0.3767
8	PS	-3.1409	-3.0704	0.6239	1.2711	1.9152	0.6474
9	XPC	3.4943	-1.7997	-0.3255	0.1541	0.5266	-0.0033
10	XPS	-0.3515	-1.3753	0.7658	0.5231	-0.0077	-0.0347
11	YPC	-0.3515	-1.7997	0.7658	0.1541	0.5266	-0.0033
12	YPS	-3.4943	-1.7997	-0.3222	2.0432	1.0353	0.1615
13	LPC	-5.0342	-2.7426	-3.2222	-1.6425	-2.3366	-0.0511
14	LPPC	16.236	10.607	-3.1012	1.6425	-2.3368	0.0511
15	PPC	16.236	-10.607	-3.1012	2.0432	-1.0353	0.1615
16	PS	5.0342	-2.7426	3.2522	-0.1365	0.4321	-0.0404
17	AXC	-0.0327	-0.0442	0.2207	-0.1365	0.4321	-0.2370
18	AXS	-0.4873	-0.1749	-0.5712	-0.2555	-0.1661	-0.2370
19	AYC	-0.4873	0.1739	-0.5712	0.2555	-0.1661	0.0404
20	AYS	0.0327	-0.0682	-0.2207	-0.1365	-0.4321	0.0404

RUN:SF? 1092
2.01:42

	2	3	4	5	8	12
TC	4.9223	-51.896	61.953	-39.420	8.1520	1.3112
TS	-57.376	-63.094	39.114	125.65	15.374	-26.294
OC	0.4915	2.8451	-1.7193	1.7491	0.0457	-1.9024
OS	-3.4807	0.9727	-0.5008	11.184	1.1039	0.5196
TPC	-57.355	45.656	-32.632	-12.024	-0.4460	5.4497
TPS	-40.075	77.957	-27.315	14.143	-9.2379	3.7217
OPC	-1.6695	2.4936	-0.9498	-0.3501	-0.1575	0.1546
OPS	-1.1665	2.2692	-0.7951	0.5261	-0.2649	-0.1043
ATC	-0.1537	-0.8603	0.7643	0.0769	0.0232	-0.0195
ATS	-0.6174	-0.2745	0.2562	0.8725	0.0081	-0.4149

		3	5	7	9	11	13
1	XC	-92.653	-41.807	-3.4830	-22.698	31.253	16.920
2	XS	49.990	-45.360	27.935	9.9148	1.3682	-8.3659
3	YC	49.990	-45.360	27.935	-9.9148	1.3682	8.3659
4	XYS	92.653	-41.807	3.4830	-22.698	-31.253	18.920
5	LC	-3.5904	5.2442	-1.2209	4.6170	-0.6414	0.6712
6	LS	1.6190	-2.0209	-2.2319	-4.1273	-0.7584	0.4782
7	MC	1.6190	2.0209	-2.2319	4.6170	-0.7584	-0.4782
8	MS	-3.5904	5.2442	1.2209	4.6170	0.6414	0.6712
9	XPC	-7.0935	-1.3397	-0.8101	0.7258	0.5314	0.2452
10	XPS	1.0219	-0.1398	0.2465	-0.4384	-0.3667	-0.3620
11	YPC	1.0219	0.1398	0.2465	0.4384	-0.3667	0.3620
12	YPS	7.0935	1.3397	0.8001	0.7258	-0.5314	0.2452
13	LPC	8.9173	-3.1705	0.4200	-3.3373	0.6274	-2.0426
14	LPS	-35.620	-5.7170	-4.0413	-2.4078	3.0700	-0.4069
15	MPC	-33.620	5.7170	-4.0413	2.4078	3.0700	0.4069
16	MPS	-8.9173	-3.1705	-0.4200	-3.3373	-0.6274	-2.0426
17	AXC	-0.4508	-0.3373	-0.0719	-0.1507	0.2731	0.2150
18	AXS	0.1355	0.2152	0.2283	0.0339	0.0531	-0.0787
19	AYC	0.1355	-0.2152	0.2283	-0.0339	0.0531	0.0787
20	AYS	0.4808	-0.3373	0.0719	-0.1507	-0.2751	0.2150

PRELIMINARY DATA

RUNSEQ 1043
2.0I:43

	2	3	4	5	8	12
TC	-59.994	56.523	105.04	-61.005	-15.504	-11.057
TS	-84.541	45.411	151.94	7.3243	127.89	4.1506
UC	-1.2350	-4.9803	4.5019	3.3019	1.1643	0.2034
QS	0.3625	-2.6558	2.2679	4.0053	-1.3666	0.9764
TPC	-90.983	-29.840	-70.181	6.3501	9.0365	-1.6415
TPS	181.37	-40.607	-21.932	30.547	5.9414	-0.7311
GPC	-2.6484	-0.8646	-2.0429	0.1457	0.2631	-0.0484
GPS	5.2793	-1.1620	-0.6384	1.1220	6.1741	-0.0213
ATC	-0.9383	0.8114	1.1116	0.0232	-6.1969	-6.2440
ATS	-0.3990	0.7431	1.3703	0.1086	1.1311	0.1562

	3	5	7	9	11	13
XC	35.699	55.756	43.782	-1.3904	10.478	10.534
XS	-30.105	-31.067	-24.870	29.722	40.435	-30.115
YC	-30.105	-31.067	-24.870	29.722	40.485	30.115
YS	-35.699	55.756	-43.982	-1.3904	-10.478	10.534
LC	3.9014	6.5059	-1.1939	2.3555	-0.1119	1.0402
LS	-6.4484	-1.7853	-2.4439	-1.1455	-3.3514	-0.6684
XC	-6.4484	-1.7853	-2.4439	1.1455	-3.3514	0.6384
XS	-3.7618	6.5069	1.1239	2.3555	0.1119	1.0402
XPC	3.1133	1.5493	-0.4950	0.5080	0.1337	-0.2509
XPS	0.1735	-1.2217	-0.1042	-0.6639	-0.0070	-0.5500
YPC	0.1735	1.4217	-0.1042	0.6039	-0.0070	-0.2509
YPS	-3.1133	1.5603	0.4950	0.5080	-0.1337	-0.5500
LPC	-6.6919	-11.150	1.4063	-3.9301	-0.2227	-1.9792
LPS	13.573	-3.6345	-2.0122	-1.0065	0.6104	2.1656
IPC	13.573	3.6345	-2.0122	1.0065	0.6104	-2.1450
APS	6.6919	-11.156	-1.4063	-3.9301	0.2227	-1.9792
AXC	0.1535	0.5007	0.3447	-0.0474	0.1680	0.1064
AXS	-0.0911	-0.1395	-0.1522	0.2327	0.3433	-0.2371
AYC	-0.0911	-0.1345	-0.1522	-0.2327	0.3483	0.2371
AYS	-0.1515	0.5007	-0.3847	-0.0414	-0.1680	0.1064

PRELIMINARY DATA

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RUNSEU *1044*
2.01:44

	3	5	7	9	11	13
1 XC	87.424	1.1727	40.196	-21.545	-5.3180	35.957
2 XS	70.804	-27.977	-33.515	35.049	-33.943	17.315
3 YC	76.824	-27.977	-33.515	-35.049	-33.943	-17.315
4 YS	-87.424	1.1727	-40.196	-21.545	5.3180	35.947
5 LC	10.001	-1.3432	-3.0178	2.2412	-0.0569	0.1520
6 LS	3.0718	-0.7710	0.0598	-2.6473	-0.4938	-0.0078
7 YC	3.0718	0.7710	0.0298	2.9673	-0.4938	0.0078
8 XS	-10.001	-1.3432	3.0178	2.2412	0.8569	0.1520
9 XPC	0.6195	5.3122	2.3933	-0.1560	-0.1279	0.0243
10 XPS	6.6760	1.2443	1.6158	0.5642	1.0990	0.4756
11 YPC	6.6760	-1.2443	1.6158	0.5642	1.0990	-0.4756
12 YPS	-0.6195	5.3102	-2.3733	-0.1560	0.1279	0.0243
13 LPC	-30.934	-4.5354	-11.764	-2.2231	-4.6648	2.0776
14 X PC	-9.9237	-26.126	7.0144	1.7690	-2.0519	-1.0125
15 X PS	-9.9237	26.120	7.6164	-1.7690	-2.0599	1.0125
16 MPS	30.934	-4.535%	11.764	-2.2231	4.6648	2.0776
17 AXC	0.2583	0.0645	0.2630	-0.2437	-0.0508	0.3368
18 AXS	0.6246	0.2453	-0.3522	0.5090	-0.3094	0.1648
19 AVC	0.6246	-0.2453	-0.3522	-0.3090	-0.3094	-0.1648
20 AYS	-0.2553	-0.0645	-0.2630	-0.2437	0.0508	0.3368

	2	3	4	5	8	12
TC	-11.026	-105.09	-124.655	99.782	-3.0483	-11.285
TS	-19.537	149.33	35.757	-63.197	-44.612	-21.476
QC	-3.3147	0.0559	-5.1149	-1.7594	-0.3594	0.2233
QS	-1.6368	0.6472	15.547	0.1360	3.4038	-0.7476
TPC	-243.30	76.094	-24.909	-70.248	24.040	3.2545
TPS	63.270	-76.362	-5.5426	53.500	-0.6646	9.5137
QPC	-6.5000	2.2342	-0.7274	-2.0443	5.8164	0.044-
QPS	1.8417	-2.2224	-0.1625	1.5513	-0.0193	0.2766
AIC	-0.4137	-1.1324	-0.5967	1.2443	-0.1062	0.1391
ATS	-0.1110	1.5669	0.0720	-0.5869	-0.4137	0.0244

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REVISED 1045
2.01:45

	2	3	4	5	8	12
TC	13.962	53.440	71.600	-102.74	-12.635	-71.020
TS	-63.329	-74.303	59.621	61.041	2.8442	-26.013
QC	1.3347	2.9401	4.4639	-4.0218	-1.1201	-0.7338
QS	-2.9599	2.3125	-1.4530	5.6176	1.4274	0.0992
TPC	-34.680	16.349	23.312	15.419	5.7620	7.0447
TPS	-10.764	83.606	-32.299	12.229	20.402	-3.0571
QPC	-1.1259	0.4759	-0.8241	0.4448	0.1683	0.2751
QPS	-0.3134	2.4336	-0.9402	0.3560	-0.6055	-0.0390
ATC	0.2282	0.0451	0.5735	-0.7785	0.9757	-0.0150
ATS	-0.5041	-0.6772	0.6540	0.3441	-0.0268	-0.2755

	3	5	7	9	11	13
XC	-69.185	-25.464	-11.379	21.573	5.2520	2.8934
XS	-32.431	9.1348	37.036	2.1144	9.6554	13.935
YC	-32.431	-9.1348	37.036	-2.1144	9.6554	-13.935
YS	69.185	-25.464	11.379	21.573	-5.2520	2.8934
LC	-2.4319	4.1500	0.5276	0.6660	-1.9360	0.0392
LS	4.8101	-0.8419	-1.1249	2.1418	1.1251	-1.2527
PC	4.8101	0.8419	-1.1249	-2.1418	1.1251	1.2527
PS	2.4353	4.2500	-0.5278	0.6660	1.9360	0.0492
XPC	-4.6353	-0.0230	0.6437	-0.6293	0.2911	0.2569
XPS	-2.5100	-1.2175	-1.3240	-0.1206	-0.1147	0.0014
YPC	-2.5100	1.2175	-1.3240	-0.1206	-0.1147	-0.0014
YPS	4.6353	-0.0230	-0.6437	-0.6293	-0.2711	0.2569
LPC	70.019	-5.3630	4.6039	1.8487	-0.0220	-0.4422
LPS	-15.929	2.4167	5.3911	2.4402	1.4732	-1.1500
PPC	-15.929	-2.4167	5.3911	-2.4492	1.4732	1.1500
PPS	-70.019	-5.3930	-4.6039	1.8487	0.0220	-0.4322
AXC	-0.4152	-0.1575	-0.1464	0.1533	0.0223	0.0046
AXS	-0.4229	-0.6681	0.2527	-0.1097	0.0895	0.0952
AYC	-0.4220	0.0681	0.2527	0.1097	0.0495	-0.0952
AYS	0.4152	-0.1575	0.1464	0.1533	-0.0223	0.0046

PRELIMINARY DATA

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RUN:SEQ 1096
2.01:46

	3	5	7	9	11	13
XC	-28.796	-30.627	-4.8722	-2.8096	-34.267	38.423
XS	92.402	31.307	-3.8262	-40.469	1.6920	-20.926
YC	92.402	-31.307	-3.8262	40.469	1.6920	20.926
YS	28.796	-30.627	4.8722	-2.8096	34.867	38.473
LC	4.0190	0.5263	0.9077	0.8440	2.6149	-1.2121
LS	1.9770	-1.3791	3.1044	1.1700	-0.0510	0.6993
UC	1.9770	-1.3791	3.1044	-1.1700	-0.0610	-0.6943
	-4.0190	-0.5263	-0.6077	-0.8440	-2.6149	-1.2121
XPC	-3.0623	-2.2260	-1.1438	-0.1366	0.3226	-0.1620
XPS	3.3641	3.0225	1.0546	-1.0064	-0.2297	-0.6232
YPC	3.3641	-3.0225	1.0546	1.0064	-0.2297	-0.1620
YPS	3.0823	-2.2260	1.1438	-0.1368	-0.3228	-0.6232
LPC	-9.1468	17.643	-2.4596	-4.2342	-0.3228	-0.1420
LPS	-20.154	-6.3343	-7.2910	2.5237	1.4772	-2.4752
UPC	-20.154	6.3343	-7.2910	-2.5237	1.4772	1.9060
UPS	9.1068	17.643	2.4570	-4.2342	-0.4127	-1.9060
	-0.3927	-0.2036	-0.0084	-0.0014	-0.2727	-2.4752
AXS	0.6347	-0.2356	-0.0423	-0.3272	0.0977	-0.3122
AYC	0.6347	-0.2356	-0.0423	0.3272	0.0977	-0.1420
AYS	0.3927	-0.2637	0.0064	-0.0014	0.2727	0.3182

	2	3	4	5	H	12
TC	-3.6062	-136.92	-132.56	44.122	17.037	51.656
TS	30.983	-29.272	-83.420	9.1693	-85.462	20.140
UC	-5.2158	1.1404	-4.3904	-2.5734	-1.6574	1.3715
US	-2.063H	0.9803	-1.6265	1.9063	0.4343	-2.1024
TPC	-123.61	73.637	-8.5060	-45.657	-23.261	-12.76
TPS	24.723	3.8547	-21.134	-42.534	-15.552	6.3601
OPC	-3.5982	2.1434	-0.2476	-1.3364	-0.6771	-0.3714
OPS	0.7196	0.1122	-0.6152	-1.2361	-0.4527	0.1657
ATC	-0.2270	-1.4216	-0.6664	0.6101	0.0427	0.4320
ATS	0.0537	-0.1403	-0.7419	0.1952	-0.4771	0.3543

PRELIMINARY DATA

102

NORISSED 1407
2.01867

	2	3	4	5	8	12
TC	-11.740	-146.06	-151.40	76.142	-51.636	92.633
TS	1.7124	16.861	-71.134	-3.5936	-94.406	1.1460
UC	-5.2230	2.0168	-7.1636	-1.3364	-2.2449	-1.1192
US	-3.7982	1.0258	1.5593	1.3195	4.0314	0.1340
TEC	-146.95	83.472	-9.06??	-46.512	-27.774	0.?6??
TPS	24.457	0.1329	-33.303	-21.732	-3.5547	-0.1329
QPC	-4.8595	2.4414	-0.2902	-1.4141	-0.7697	0.0116
QPS	0.7119	0.0039	-0.9711	-0.6326	-0.1122	-0.0039
ATC	-0.3929	-1.7107	-0.9433	0.8322	-0.5711	0.8139
ATS	-0.1342	0.2050	-0.6565	-0.0976	-0.2477	-0.0647

	3	5	7	9	11	13
XC	-31.747	-42.135	-12.291	-17.861	-120.84	-17.993
XS	63.404	67.149	8.5302	6.9099	1.3013	-14.871
YC	63.404	-67.149	8.5302	-6.9099	1.3013	-14.871
YS	31.747	-42.135	12.291	-17.461	120.44	-17.993
ZC	4.3274	0.2366	0.2361	-0.2043	6.1440	-1.7498
ZS	1.4293	0.1887	1.2745	1.1135	2.6607	0.6464
PC	-1.4273	-0.1887	1.2745	-1.1135	2.6607	-0.5464
PS	-4.3274	-0.2366	-0.2351	-0.2643	-0.1640	-1.7499
XEC	-3.3074	0.8745	-1.3475	-0.3942	-0.3201	-0.1249
YEC	3.9943	3.1749	1.6513	0.2003	-0.2565	0.1862
YES	3.3074	-3.1749	1.4513	0.2003	-0.2505	-0.1249
LPC	3.3074	-0.4745	1.3475	-0.3902	0.3201	1.0767
LPS	-11.573	12.516	-5.6500	-2.2961	1.4057	0.2218
RPC	-22.371	-9.9394	-9.7159	3.0355	-0.8773	-0.2218
RPS	-22.371	9.9395	-9.7150	-3.4355	-0.4773	1.0767
RPS	11.573	12.516	5.4301	-2.2461	-1.4057	1.0767
AXC	-0.3646	-0.3037	-0.1264	-0.1219	-1.1196	-0.1618
AXS	0.5465	0.5369	0.0795	0.0758	0.1150	-0.1160
AVC	0.5465	-0.5349	0.0795	-0.0758	0.1150	0.1160
AVS	0.3066	-0.3097	0.1264	-0.1219	1.1196	-0.1618

PRELIMINARY DATA

RUNISEU *1048*
2.01:46

	3	5	7	9	11	13
1 XC	-9.5268	13.786	6.6273	-6.3704	8.6642	17.843
2 XS	81.606	33.001	14.153	2.3262	-20.324	-40.437
3 YC	81.606	-33.601	14.153	-2.3262	-20.328	40.437
4 YS	9.5268	13.786	-6.6273	-6.3704	-8.6642	17.843
5 LC	0.9364	0.6976	-0.7049	-0.9201	-0.6927	-0.1537
6 LS	4.3167	-0.1976	-1.9297	0.3724	-0.9222	0.2016
7 NC	4.3157	0.1878	-1.9297	-0.3724	-0.9222	-0.7016
8 NS	-0.9364	0.6976	0.7009	-0.9261	0.6927	-0.1537
9 XPC	0.4093	2.9768	2.0278	-1.5970	0.3596	-0.0217
10 XPS	4.9793	1.5955	0.6110	0.2026	0.3210	0.7107
11 YPC	-4.9793	-1.5955	0.6110	-0.2026	0.3210	-0.7107
12 YPS	-0.4093	2.9768	-2.0278	-1.5970	0.3596	-0.0317
13 LPC	-23.014	1.6647	-6.5227	3.9402	-1.0626	3.2150
14 LPS	-7.6360	-16.331	7.0932	6.7465	-2.3492	-1.2539
15 NPC	-7.6360	16.331	7.0932	-6.7465	-2.3492	1.2539
16 NPS	23.014	1.6647	6.5227	3.9402	1.0626	3.2150
17 AXC	-0.2174	0.1248	0.1143	-0.0274	0.1274	0.1937
18 AXS	0.5216	0.3202	0.1353	-0.0018	-0.2357	-0.3294
19 AYC	0.5216	-0.3202	0.1353	0.0018	-0.2357	0.3294
20 AYS	0.2174	-0.1248	-0.1143	-0.0274	-0.1278	0.1937

	2	3	4	5	8	12
TC	-18.182	-144.22	-134.84	79.068	-10.751	7.1994
TS	-13.319	-0.9602	-41.307	-61.049	-41.336	8.5305
UC	-3.7714	0.1498	-3.8946	0.0962	0.8644	-0.9562
US	-0.8520	1.9648	3.9490	0.2795	2.4994	-1.4352
TPC	-104.41	57.886	-33.629	-50.509	7.0447	0.7511
TPS	57.753	-56.291	-14.222	20.735	22.995	3.7642
UPC	-3.0391	1.6850	-0.9789	-1.4702	0.2051	0.0213
UPS	1.6811	-1.6385	-0.4140	0.6036	0.6493	0.1113
ATC	-0.2807	-1.4521	-0.8822	0.9603	-0.3002	-0.0370
ATS	-0.1660	0.3783	-0.4381	-0.4747	-0.0561	0.6642

PRELIMINARY DATA

NUMBER 1049
2.01:49

	2	3	4	5	8	12
TC	-13.025	-135.11	-130.57	65.301	-27.246	64.710
TS	-43.710	-17.103	-42.641	-49.169	-65.659	-27.634
UC	-5.3039	1.6133	-10.377	-1.4696	1.3551	0.0147
OS	-2.9723	-1.6935	3.0496	-0.2738	2.0279	0.4194
TPC	-149.73	63.602	-30.970	-57.434	3.0571	-1.7269
TPS	84.337	-61.874	-40.909	13.023	14.887	-1.4421
UPC	-4.3585	1.4513	-0.9015	-1.6734	0.0996	-0.0513
GPS	2.4549	-1.6010	-1.1646	0.3511	0.4333	-0.0426
ATC	-0.4061	-1.5765	-0.8343	0.9294	-0.1672	0.4747
ATS	-0.5101	0.2831	-0.6601	-0.3145	-0.2453	0.0500

	3	5	7	9	11	13
1 XC	-14.022	-6.4746	-23.422	-54.753	-25.198	4.0466
2 XS	62.611	47.765	21.377	-29.319	34.132	-11.660
3 YC	62.611	-67.764	29.377	29.319	34.132	11.660
4 YS	14.852	-6.4736	23.422	-54.753	25.198	4.0466
5 LC	1.3136	0.4320	0.4724	1.5541	1.5545	0.2970
6 LS	2.6552	0.1241	2.4135	3.0493	-1.5190	1.7198
7 YC	2.6642	-0.1761	-2.4133	-3.0493	-1.5190	-1.7198
6 YS	-1.3136	0.4322	0.4724	1.5541	-1.0660	0.2970
9 XDC	0.4519	2.9477	1.3017	0.1027	0.3614	-0.0248
10 XDS	5.4719	7.2295	-0.4729	-0.0458	1.0227	0.2779
11 YDC	5.4719	-2.2295	-0.4729	0.1027	1.0227	-0.2779
12 YDS	-0.4519	2.9477	-1.3017	0.1861	-0.3614	-0.0244
13 LDC	-25.293	4.4474	0.5145	-0.6220	-5.2539	1.2917
14 LDS	-7.3700	-17.133	7.1137	0.6220	-0.3300	0.4040
15 YDC	-7.3700	17.133	7.1137	0.1441	0.3300	0.4040
16 YDS	25.293	4.4474	-0.5435	-0.4717	5.2539	1.2917
17 AXC	-0.2479	-0.0245	-0.1960	-0.4717	-0.1968	0.0469
18 AXS	0.4619	0.5776	0.2208	-0.3162	-0.3468	-0.0653
19 AYC	0.4619	-0.5776	0.2238	0.3162	0.3466	0.0653
19 AYS	0.2479	-0.0245	0.1960	-0.4717	0.1868	0.0469

PRELIMINARY DATA

105

RUNISEJ 1050
2.01:50

	3	5	7	9	11	13
XC	50.178	-0.5757	13.371	23.593	6.5155	7.8316
XS	7.2920	-20.695	32.534	70.370	19.075	20.904
YC	7.2920	-20.695	32.534	-70.370	19.075	-20.904
YS	-50.178	-0.5757	-13.371	23.593	-6.5155	7.8316
LC	0.0214	2.6710	-1.2207	1.7604	-1.1402	1.4914
LS	-3.6734	-0.2407	-3.4646	-3.1033	-1.2521	-0.7695
NC	-3.6734	-0.2407	-3.4646	3.1033	-1.2521	0.7695
NS	-0.0214	2.6710	1.2207	1.7604	1.1402	1.4914
XPC	3.2832	-2.0921	1.5408	0.2521	0.3439	0.1951
AFS	2.1202	-2.0221	-1.6160	-0.4157	0.4071	0.0442
YPC	2.1202	2.0221	-1.6517	-0.4157	-0.3439	0.0351
YPS	-3.2432	1.6517	0.5435	0.2221	-0.5475	0.0167
LPC	-15.708	-12.102	8.6045	1.3773	-2.5475	-0.5086
MLPS	10.632	-2.5467	0.5446	-1.9159	0.9407	0.5086
APC	10.632	2.5067	0.5495	1.9159	0.9407	0.0167
MPS	15.708	-12.102	-6.6760	1.3773	2.5475	0.0146
AXC	0.3911	0.0025	0.0186	0.1245	0.0621	0.1923
AXS	0.0651	0.1312	0.3256	0.5645	0.1616	-0.1943
AVC	0.0651	0.1312	0.3256	-0.5635	0.1616	0.0186
SAVS	-0.3911	0.0025	-0.0110	0.1245	-0.0621	

	2	3	4	5	8	12
TC	-13.882	9.8389	45.785	-22.198	6.1715	18.462
TS	-31.437	-8.6411	83.418	43.165	47.534	-5.6561
QC	-2.9380	-2.7125	-0.1653	0.1341	1.7430	0.6710
OS	0.3700	-6.7484	4.4860	1.7078	1.6774	1.2913
TPC	-21.664	-7.3106	-38.212	11.105	5.5444	-1.9434
TPS	97.563	-62.738	-20.470	35.010	-17.014	0.5317
QPC	-0.6307	-0.2128	-1.1298	0.3250	0.1702	-0.0580
CPS	2.8399	-1.8262	-0.5958	1.1530	-0.4952	0.0155
ATC	-0.5357	0.3954	0.5744	-0.1684	0.3976	-0.1977
ATS	-0.3966	0.3905	0.7004	0.2465	0.4466	-0.0865

PRELIMINARY DATA

106

RUNISED /055
2.01155

	2	3	4	5	9	12
TC	51.378	-11.685	-41.676	-39.383	-37.979	-14.623
TS	-13.739	17.741	90.592	-4.6416	15.740	51.050
OC	2.1516	-1.2623	-0.7464	-5.6411	-0.0246	0.3526
OS	-3.0540	3.9602	1.4516	0.4253	0.4307	-0.7163
TPC	-22.330	12.627	-1.2427	-40.275	22.596	-9.5707
TPS	-39.547	115.57	-37.433	-0.7783	14.421	-6.3401
CPC	-0.6500	0.3734	-0.0368	-1.1723	0.6577	-0.2766
OPS	-1.1220	3.3641	-1.0969	-3.1973	0.4256	-0.1457
ATC	0.5930	-0.1818	-0.2013	-0.2453	-0.2163	-0.0966
ATS	-0.2587	0.0525	1.3752	0.2662	0.0098	0.5650

PRELIMINARY DATA

	3	5	7	9	11	13
XC	-32.751	-32.652	31.450	-20.187	-2.6963	7.1970
XS	-11.609	-44.451	-9.1913	-1.7636	-22.375	5.4758
YC	-11.449	-44.451	-0.1913	3.7435	-22.075	-5.4758
YS	-32.751	-32.652	-41.450	-20.187	2.6963	7.1970
LC	-2.0004	1.6174	-1.6414	1.2262	-0.6532	-0.3037
LS	2.0524	-1.3197	-0.4754	-0.3460	0.4949	0.6443
VC	2.0524	-1.3197	-0.4754	0.3430	0.4459	-0.6593
VS	2.0004	1.0174	-1.0316	1.2262	0.6532	-0.3037
KPC	-6.7220	1.2415	-1.6410	-0.5742	-0.6404	-0.0624
KPS	-3.4450	2.0140	-1.9111	0.7421	-0.2178	-0.0547
VPC	-3.3453	-2.1607	-1.9111	-0.7651	0.2183	0.0547
VPS	6.7220	1.2015	1.7410	-0.5742	0.6404	-0.0624
LPC	26.020	-7.0429	7.0102	4.4180	2.1461	-0.4176
LPS	-12.415	-9.7452	-5.6002	1.1479	-2.4459	-0.4714
VPC	-9.615	9.7952	-5.6002	-1.1479	-2.6439	-0.4714
VPS	-25.020	7.3409	-7.1402	-4.4180	-2.1461	-0.0470
AXC	-0.1109	-0.1172	0.3432	-0.1009	-0.1009	0.0360
AXS	-0.2537	-0.3739	-0.0637	-0.0631	-0.1998	0.0184
AYC	-0.2537	0.3739	-0.0637	0.0231	-0.1394	-0.0144
SAYS	0.1069	-0.1672	-0.3032	-0.1094	0.0669	0.0360

REVISED 1056
2.01:56

	2	3	4	5	8	12
TC	-21.149	-90.101	-17.882	119.91	44.164	38.765
TS	-78.452	-67.022	-51.770	105.77	42.551	-14.092
OC	-4.4157	0.0399	-10.470	3.0146	-0.1771	1.1301
QS	-4.4488	-0.0071	1.2076	0.7136	1.6969	-0.4058
TPC	-178.78	68.852	-27.315	-42.135	-19.539	6.1207
TPS	12.494	-44.129	-39.145	-15.266	23.925	-3.9025
OPC	-5.2039	2.0042	-0.7951	-1.2265	-0.5587	-0.1795
OPS	0.3637	-1.2845	-1.1394	-0.4449	0.6766	-0.2662
ATC	-0.3978	-1.3532	-0.1269	0.8670	0.2501	0.4625
ATS	-0.7443	-0.3868	-0.1074	0.9647	0.0986	-0.2599

	3	5	7	9	11	13
XC	-43.438	-17.704	41.139	9.6296	-4.6379	30.177
XS	50.900	-64.030	25.112	22.576	17.531	24.405
YC	50.900	-64.030	25.112	-22.576	17.531	-24.405
YS	43.438	-17.704	-41.139	9.6296	4.6379	30.177
LC	0.7519	0.6618	1.9765	0.1307	-1.6745	-1.8666
LS	3.6057	-2.7049	-1.6533	-0.0518	0.5713	-0.2875
	3.6057	2.7049	-1.6533	0.0518	0.5713	0.2475
	-0.7519	0.6618	-1.9765	0.1307	1.6745	-1.8666
XPC	-0.6029	0.924	-2.7634	0.0492	-0.5704	0.3989
XPS	5.0242	2.6134	1.5534	-0.0612	0.7502	0.3989
YPC	5.0242	-2.6134	-2.7634	0.0292	0.5704	0.4330
YPS	0.6029	0.924	2.7634	-0.2160	-2.2659	-3.3645
LPC	-21.295	-9.9056	-1.4465	-0.2465	-3.9733	-2.9617
LPS	-12.242	-9.113	-15.382	-0.2466	-3.9733	2.9617
PC	-12.242	-9.113	-15.382	0.2180	2.2659	-3.3645
PS	21.295	9.9056	1.6465	0.0271	-0.0215	0.2527
AXC	-0.3468	-0.2324	0.3164	0.1640	0.0928	0.2070
AXS	0.2197	0.4518	0.2630	-0.1640	0.0928	-0.2070
AYC	0.2197	-0.4516	0.2630	0.0271	0.0215	0.2527
AYS	0.3468	-0.2324	-0.3164			

PRELIMINARY DATA

RUN:SEU 1057
2.01:57

	3	5	7	9	11	13
1 XC	40.423	13.022	-8.3756	-5.0020	26.501	-8.0734
2 XS	-3.9591	-18.418	29.741	14.961	-11.956	36.365
3 YC	-3.9591	-16.418	29.741	-14.961	-11.956	-36.365
4 YS	-40.423	13.022	8.4356	-5.0020	-26.501	-8.0734
5 LC	4.1415	0.3403	-0.3745	0.7993	-0.7747	0.6567
6 LS	1.1424	0.1114	-0.9184	0.2401	0.0278	-0.5972
7 MC	1.1424	-0.1114	-0.9134	-0.2401	0.0278	0.5972
8 MS	-4.1415	0.3403	0.3745	0.7993	0.7747	0.6567
9 XPC	2.0920	2.6236	0.4922	-0.0362	0.1618	0.3472
10 XPS	3.2407	-0.6705	-1.1936	0.3763	-0.2610	0.1561
11 YPC	3.2507	0.6705	-1.1936	-0.3763	-0.2610	-0.1561
12 YPS	-2.0920	2.6236	-0.4922	-0.0362	0.1618	0.3472
13 LPC	-18.627	-7.9605	4.4158	1.7492	0.8578	0.0373
14 LPS	3.1067	-10.442	4.4758	-1.5234	1.2147	-1.8472
15 MPC	3.1067	-10.442	-4.4758	1.5534	1.2147	1.8472
16 MPS	18.627	-7.9605	-4.4158	1.7492	-0.8578	0.0373
17 AXC	-0.2320	0.1604	-0.1133	-0.0412	0.1961	-0.0507
18 AXS	-0.0145	0.1099	0.2679	0.1308	-0.1320	0.2610
19 AYC	-0.0145	-0.1062	0.2699	-0.1308	-0.1320	-0.2610
20 AYS	-0.2320	0.1604	0.1133	-0.0412	-0.1961	-0.0507

	2	3	4	5	8	12
TC	-9.3105	-17.409	-69.455	0.0017	25.564	-9.8553
TS	-37.151	58.154	85.070	-26.504	15.175	-32.499
QC	-2.1973	1.0460	-2.2403	-1.0798	-0.4565	0.0935
QS	0.2368	-1.9493	4.2938	1.9073	-0.3410	-0.2218
TPC	-68.453	19.406	-27.913	-18.609	1.3957	-6.6416
TPS	62.073	-59.814	-12.229	39.610	2.8576	-5.7620
QPC	-1.9926	0.5649	-0.8125	-0.5417	0.0405	-0.2341
QPS	1.8068	-1.7411	-0.3569	1.1539	0.0632	-0.1633
ATC	-0.1623	-0.2843	-0.2038	0.2026	0.1220	0.0049
ATS	-0.4869	1.1165	0.6943	-0.2709	0.2099	-0.3807

PRELIMINARY DATA

RUN:SEW 1372
2.01:372

	2	3	4	5	8	12
TC	25.458	5.9012	-27.151	-12.453	38.840	4.8337
TS	3.9675	-3.4773	19.647	22.231	-10.465	-6.6414
UC	-0.5001	0.0447	-1.0753	-1.5118	1.5154	-0.2230
US	0.0660	0.0142	1.2611	1.3690	0.3169	4.4715
TPC	-97.496	73.234	11.495	-24.391	-12.361	-3.3230
TPS	8.4404	-55.427	1.6615	1.6615	3.8547	-9.4373
QPC	-2.8379	2.1318	0.3231	-0.7100	-0.3598	-0.0567
QPS	0.2457	-1.6134	-1.5031	0.0464	0.1122	-0.2747
ATC	0.1611	0.1367	0.0451	0.0012	0.2762	0.0317
ATS	-0.0049	0.1025	0.1525	0.2379	-0.1415	-0.0244

		3	5	7	9	11	13
1	XC	-7.2621	-11.725	10.319	14.516	12.287	-9.8755
2	XS	29.261	-3.6646	23.465	5.5906	2.3610	1.2442
3	YC	29.261	-9.6646	28.465	-6.5906	2.3610	-1.2442
4	YS	7.2621	-11.725	-10.319	14.516	-12.287	-9.8755
5	LC	1.5127	-0.4445	3.6767	2.7676	-1.3411	1.4459
6	LS	1.4014	-0.2937	-0.1513	0.5734	2.0940	0.2706
7	UC	-1.4034	-0.2937	-0.1513	-0.5734	2.0940	-0.2906
8	US	-1.5127	-0.4465	-3.6767	2.7676	1.3411	1.4459
9	XPC	-0.2351	1.0309	0.3722	-0.1162	-1.4278	0.0402
10	XPS	5.6763	-1.0491	0.1910	0.3569	-0.0470	0.0081
11	VPC	5.6763	-1.8691	0.1910	-0.3569	0.0470	-0.0081
12	VPS	0.2351	-1.0309	-0.3222	-0.1162	0.4278	0.0402
13	LPC	-24.910	-2.9330	-1.4653	1.8145	0.6031	0.2279
14	LPS	-11.847	-6.7303	1.0758	-0.1598	-1.9999	-0.3089
15	MPC	-11.847	6.7303	1.0758	0.1598	-1.9999	0.3089
16	MPS	24.910	2.9330	1.4553	1.8145	-0.6031	0.2279
17	AXC	-0.2436	-0.0310	0.0397	0.0346	0.1788	-0.1304
18	AXS	0.1691	-0.0248	0.1553	0.1233	0.0033	0.0476
19	AVC	0.1691	-0.0248	-0.1553	-0.1233	0.0033	-0.0476
20	AVS	0.2436	-0.0310	-0.0397	0.0346	-0.1788	-0.1304

PRELIMINARY DATA

110

REVISED *1373*
2.01:373

	2	3	4	5	8	12
TC	28.207	-12.980	-34.015	-21.222	22.526	2.5107
TS	29.267	-0.4812	-10.351	-10.846	32.609	-0.9319
QC	-0.4904	-0.7128	-1.3713	-0.5909	0.2667	0.3643
QS	-1.0844	0.2027	-2.8507	-0.3590	0.3300	-0.2477
TPC	-46.921	68.059	-2.0402	-20.935	-26.916	11.564
TPS	-40.275	69.543	-63.735	-28.777	22.796	17.412
QPC	-1.3658	2.5632	-0.0600	-0.6094	-0.7835	-0.3366
QPS	-1.1723	2.0254	-1.3552	-0.5376	0.6635	0.5095
ATC	0.2526	-0.0622	-0.2196	-0.1745	0.1098	-0.0448
ATS	0.1940	0.1843	0.1220	0.1257	0.1830	-0.0073

		3	5	7	9	11	13
1	XC	-24.614	-4.5448	6.8084	16.971	14.412	0.1092
2	XS	2.2301	-0.5545	17.564	-4.1377	20.250	-7.9246
3	YC	2.2301	-0.5545	17.564	4.1377	20.250	7.9246
4	YS	24.614	-4.5448	-6.8084	16.971	-14.412	0.1092
5	LC	3.0153	-1.4396	2.0052	-1.5209	-0.4062	0.4378
6	LS	4.1590	-0.1614	-1.4053	0.3603	0.4117	0.7772
7	PC	4.1590	-0.1614	-1.4053	-0.3603	0.4117	-0.7772
8	PS	-3.0153	-1.4396	-2.0052	-1.5209	0.4062	-0.4378
9	XPC	-5.7831	-0.5500	-0.4754	0.9406	-0.5065	-1.0749
10	XPS	1.4657	2.1322	1.3203	-1.8199	-0.2543	-0.2412
11	YPC	1.4657	-2.1322	1.3203	0.8123	-0.2743	-0.2412
12	YPS	6.7431	-0.5500	-0.4754	0.9406	0.5065	-1.0749
13	LPC	9.3505	10.567	-4.4955	-5.9150	2.2320	3.1291
14	LPS	-33.099	-1.5943	-4.6901	-1.7413	-1.7214	4.3416
15	PPC	-33.099	-1.5943	-4.6901	0.7413	-1.7214	-4.3416
16	PPS	-6.3505	10.567	4.4955	-9.9150	-2.2320	3.1291
17	AXC	-0.3190	-0.0831	0.0767	0.1201	0.1591	0.0172
18	AXS	-0.1599	-0.0060	0.0060	-0.0942	0.1561	-0.0728
19	AYC	-0.1599	-0.0060	0.0060	0.0942	0.1561	0.0728
20	AYS	0.3190	-0.0831	-0.0767	0.1201	-0.1591	-0.0172

PRELIMINARY DATA

RUN:SEJ 1374
2.01:374

	3	5	7	9	11	13
1 XC	-8.6933	-9.6701	-12.477	31.042	-35.843	4.5957
2 XS	8.6949	-27.142	5.4049	35.964	12.940	-6.6546
3 YC	8.6949	-27.142	5.4049	-35.964	12.940	6.6546
4 YS	8.6943	-9.6701	12.477	31.042	35.843	4.5457
5 LC	-0.7413	-1.4570	0.1542	-1.1434	-1.1097	0.7668
6 LC	2.6663	-1.0504	0.5275	-5.5538	0.7453	-0.0473
7 LS	2.6664	-1.0504	-0.5275	5.5538	0.7453	0.0473
8 LS	-0.7413	1.4570	-0.1542	-1.1434	-1.1097	0.7655
9 XPC	-2.9191	0.2211	-0.2741	-0.7406	-0.1426	0.2331
10 XPS	-1.6762	1.1022	1.5221	0.7473	-0.0456	-0.1276
11 YPC	-1.6762	-1.1022	1.5221	0.7473	-0.0456	-0.1276
12 YPS	2.9191	0.2211	0.2741	0.7606	0.1426	0.2331
13 LPC	13.033	-4.5017	-6.2761	-5.7139	0.6533	0.1268
14 LPS	-9.7497	-3.0420	-4.1170	-1.6650	-0.4742	-1.2635
15 LPC	-9.9497	3.6420	-4.1170	1.6650	-0.4742	1.2435
16 LPS	-13.033	4.5017	6.2761	-5.7139	-0.6533	0.1268
17 XXC	-0.0390	-0.0379	-0.0747	0.3302	-0.2083	0.0407
18 AXS	-0.0936	0.1599	-0.0248	0.3336	0.1573	-0.1227
19 AYC	-0.0936	-0.1599	-0.0248	-0.3336	0.1573	0.1227
20 AYS	0.0390	0.0370	0.0747	0.3302	0.2083	0.0407

	2	3	4	5	8	12
TC	0.9933	-2.5714	-6.7333	-30.264	-0.7361	6.1250
TS	16.050	-15.963	9.3812	54.041	-3.2991	-2.9157
QC	-0.0402	0.3168	0.1217	0.3392	-1.7479	0.9429
QS	-0.2452	1.0737	2.3567	2.7651	-1.0056	-0.5011
TPC	15.286	9.1050	-24.324	-16.017	-10.102	6.5100
TPS	36.021	53.633	-33.629	-8.5733	-5.5426	13.292
OPC	0.4449	0.2050	-0.7080	-0.4662	-0.2940	0.2476
QPS	1.0485	1.5612	-0.9749	-0.2446	0.1625	0.3465
ATC	-0.0464	-0.1062	0.0818	0.0537	0.0073	0.0293
ATS	0.0561	-0.0940	0.0065	0.2489	-0.0390	-0.0903

PRELIMINARY DATA

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RUNISED *137k*
2.01:376

	3	5	7	9	11	13
1 XC	-22.611	21.553	-3.4591	18.579	13.614	-44.915
2 XS	2.7157	-13.349	-4.3312	-0.2105	-24.001	11.021
3 YC	2.7157	-13.349	-4.3312	0.2105	-24.001	-11.021
4 YS	22.611	21.553	3.4691	18.579	-13.614	-44.915
5 LC	2.9322	-1.7760	0.0765	3.3217	-3.5566	5.0419
6 LS	5.1902	-5.8551	-0.7479	-2.5031	0.7024	-2.7196
7 PC	5.1902	5.8551	-0.7479	2.5031	0.7424	2.7196
8 PS	-2.9322	-1.7760	0.0765	3.3217	3.5566	5.0419
9 XPC	-4.6022	-1.6543	-10.102	12.557	-11.452	0.5664
10 XPS	17.416	-1.8151	-14.645	-12.760	-1.8975	0.8492
11 YPC	17.416	-1.8151	-14.585	12.760	-1.8975	-0.8492
12 YPS	4.6622	-1.6543	10.102	12.557	11.452	0.5668
13 LPC	-68.911	11.256	-44.780	-0.051	34.297	2.7148
14 LPS	-53.921	-3.9577	-17.200	-31.823	-47.664	-4.1449
15 PPC	-53.521	-3.9577	-17.200	31.823	-47.664	4.1449
16 MPS	68.911	11.256	-44.780	-0.051	-30.297	2.7148
17 AXC	-0.1543	0.1291	0.0617	0.1264	0.1935	-0.3579
18 AXS	-0.1599	-0.2185	0.0221	0.0675	-0.0468	0.1296
19 AYC	-0.1599	-0.2185	0.0221	-0.0675	-0.0808	-0.1296
20 AYS	0.1943	-0.1291	-0.0017	0.1269	-0.1935	-0.3579

	2	3	4	5	8	12
TC	-21.065	-47.591	-47.629	22.576	13.553	5.4295
TS	26.630	-14.914	24.429	-19.792	-13.534	2.7756
OC	-1.7100	-2.4714	-0.4599	-1.4479	0.7077	-0.1477
OS	-0.9357	1.5052	4.3769	-2.6914	0.6045	0.6237
TPC	212.60	265.11	-36.812	-5.5620	-54.624	63.604
TPS	-42.443	-120.89	-8.9056	-39.344	262.71	58.045
OPC	6.1465	7.7164	-1.1294	-0.1625	-1.5960	1.8533
OPS	-1.4103	-3.5189	-0.2592	-1.1452	7.0472	1.6906
ATC	0.0159	-0.1479	-0.1550	-0.0171	1.1269	0.0244
ATS	0.3209	0.1537	0.4210	-0.4124	-0.1952	0.0195

PRELIMINARY DATA

MIN:SEO 1377
2.01:377

	3	5	7	9	11	13
XC	25.464	7.2293	-12.135	-55.953	-56.570	2.2504
XS	-15.306	12.597	3.2266	24.279	-0.3876	-8.2642
YC	-15.306	-12.597	3.2268	-24.279	-0.3876	8.2442
YS	-25.864	7.2293	-12.185	-55.953	56.570	2.2504
LC	5.3666	1.1529	1.1818	1.9313	3.3045	-0.1550
LS	3.0821	-1.2043	-0.2227	-1.0366	0.0161	-0.1745
AC	3.0821	1.2043	-0.2227	1.0366	0.0161	0.1745
AS	-5.3660	1.1522	-1.1818	-1.9313	-3.3035	-0.1550
XPC	-4.5077	2.5761	3.0916	-0.8351	-0.4130	-0.6695
XPS	5.6105	4.6767	-0.2334	-0.7942	-0.5270	-0.4438
VPC	5.6105	-4.6767	-0.2334	0.7932	-0.5270	-0.6095
YPS	4.5077	2.5761	-3.0916	-0.8351	0.4130	0.6095
LPC	-16.487	-4.8337	-4.8337	-1.9550	3.1341	3.1401
LPS	-30.794	20.393	14.250	5.2367	-0.8426	1.8781
MPC	-30.794	20.393	14.250	-5.2367	-0.8426	-1.8781
MPS	16.487	15.563	4.8337	-1.9550	-3.1381	3.1401
AXC	0.0830	0.0505	-0.1229	-0.4445	-0.4616	0.0459
AXS	-0.1371	0.0413	0.0157	0.2122	0.0258	-0.0644
AYC	-0.1371	-0.0413	0.0157	-0.2122	0.0258	0.0644
AYS	-0.0630	-0.0505	0.1229	-0.4445	0.4616	0.0459

	2	3	4	5	8	12
TC	13.113	-9.5531	-42.737	-2.5870	31.206	-7.1633
TS	16.511	-21.334	0.1113	-13.336	11.536	-11.001
QC	-3.2090	2.3090	-10.163	0.0092	0.6608	-0.2440
QS	-3.0087	-2.6756	-0.9367	-0.5326	1.7761	-0.6924
TPC	-103.08	116.30	-34.426	-34.802	-5.5162	-11.232
TPS	55.893	-1.4621	-25.388	-15.950	11.498	17.612
QPC	-3.0004	3.3454	-1.0021	-2.4664	-0.1606	-0.3265
QPS	1.6269	-0.0426	-0.7390	-0.4643	0.3347	0.5126
ATC	0.1232	0.0647	-0.1330	-0.0586	0.3099	-0.1574
ATS	0.2062	0.1379	0.2257	-0.0635	0.1537	-0.0242

PRELIMINARY DATA

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RUN:SEQ 1378
2.01:378

	2	3	4	5	8	12
TC	22.216	-5.9175	-33.519	-23.408	13.668	8.0617
TS	20.321	-18.748	14.693	-2.5465	-7.4401	8.6697
QC	-1.3416	2.7719	-7.6406	-2.6164	1.0786	-0.7023
QS	-0.7343	0.6141	0.4401	1.1101	-0.9462	-0.4901
TPC	-115.77	114.84	12.095	-01.147	-26.185	-3.5286
TPS	39.743	-43.648	-11.032	31.302	21.400	-8.6356
QPC	-3.3699	3.3428	0.3521	-2.5229	-0.7622	-0.1045
QPS	1.1568	-1.4101	-0.3211	0.9112	-0.5229	-0.2515
ATC	0.1415	0.1147	0.0954	-0.1261	0.1037	0.1318
ATS	0.1074	0.0195	0.2379	0.0964	-0.0793	0.1611

	3	5	7	9	11	13
XC	-5.6555	-7.5073	1.5612	5.9509	8.4991	6.4613
XS	41.212	-29.410	19.310	-15.670	14.515	3.2590
YC	41.212	-29.410	19.310	15.670	18.515	-3.2590
YS	5.6555	-7.5073	-1.5612	5.9509	-8.4991	6.4613
LC	4.6545	-0.2772	1.7435	0.3784	-0.0230	0.7927
LS	2.9413	-0.3038	2.3702	1.3053	-0.8470	0.9245
	2.9413	-0.3038	2.3702	-1.3054	-0.6676	-0.9265
	-4.6545	-0.2772	-1.7635	0.9744	0.0230	0.7927
XPC	-2.1973	4.6024	-0.1189	-0.2826	0.2011	-0.6990
XPS	7.3979	2.6424	-1.4633	0.2045	-0.3091	-0.2261
	1.3979	-2.6424	-1.4633	-0.2065	-0.3991	0.2261
YPS	2.1973	4.6024	0.1189	-0.2826	-0.2011	-0.6090
LPC	-20.460	20.890	8.9936	1.4595	1.4001	0.1391
LPS	-23.873	-25.959	3.2005	0.6704	1.6567	3.1532
	-23.873	25.959	3.2005	-0.6704	1.6567	-3.1532
	-24.860	2.8890	-4.9936	1.4595	-1.4001	0.1391
AXC	-0.4235	-0.0245	0.0510	0.1060	0.0731	0.0904
AXS	-0.2255	0.1344	0.0004	-0.1019	0.1906	0.0595
AYC	-0.2255	-0.1344	0.0004	0.1019	0.1906	-0.0595
AYS	0.4235	-0.0245	-0.0510	0.1060	-0.0731	0.0904

PRELIMINARY DATA

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NUMBER *1379*

2.01:379

		3	5	7	9	11	13
1	XC	-42.057	-54.467	-8.3979	28.530	-6.7462	6.5748
2	XS	9.2395	30.145	-17.326	-63.272	0.9154	31.084
3	YC	9.2395	-30.185	-17.328	63.272	0.9154	-31.084
4	YS	-42.057	-54.467	8.3979	28.530	6.7462	6.5748
5	LC	-2.1400	3.3179	-0.4444	-1.7146	-0.9676	0.3410
6	LS	-1.4831	3.4445	-0.5175	5.4191	-1.7665	-1.2681
7	PC	1.4831	-3.4445	-0.5175	-5.4191	-1.7665	1.2681
8	PS	-2.1400	3.3179	-0.4444	-1.7145	-0.9576	0.3410
9	XPC	-6.6429	2.5842	-2.6814	-0.2658	-0.0428	0.5532
10	XPS	-5.9042	-0.9998	1.5240	-0.5752	-0.0193	-0.4667
11	YPC	-5.9042	0.9998	1.5240	0.5762	-0.0193	0.4667
12	YPS	8.6429	2.5842	2.6814	0.2658	-0.0428	0.5532
13	LPC	42.743	-9.2311	-3.0489	-3.0783	0.1672	-3.1357
14	LPS	-27.374	-0.2594	-15.441	-0.0919	-0.1543	-1.5435
15	PPC	-27.374	0.4650	15.441	0.0919	0.1543	1.5435
16	PPS	-42.793	-9.3314	3.0489	-3.0783	-0.1672	-3.1357
17	AXC	-0.2595	-0.4037	-0.0559	0.2736	-0.0969	0.0223
18	AXS	-0.0012	0.2344	-0.1782	-0.5047	-0.0143	0.2339
19	AYC	-0.0012	-0.2344	-0.1782	0.5047	-0.0143	-0.2339
20	AYS	-0.2695	-0.4037	-0.0559	-0.2736	0.0969	0.0223

	2	3	4	5	8	12
TC	1.4764	-4.2670	-25.824	-52.861	24.933	2.7931
TS	28.779	-13.951	1.5341	15.502	2.2553	6.6503
OC	0.4414	-0.5071	-2.2809	-5.0606	-1.1759	-0.9178
OS	-0.8498	2.9724	2.1308	5.0975	-0.7360	0.6776
TPC	8.5733	15.219	-2.3261	-14.222	-12.627	4.2534
TPS	-0.5981	168.48	-84.071	42.401	-12.093	4.7851
OPC	0.2495	0.4430	-0.0677	-0.4140	-0.3676	0.1235
OPS	-0.0174	4.9046	-2.4472	1.2342	-0.3753	0.1393
ATC	-0.0769	-0.0915	0.0927	0.0403	0.1586	0.0012
ATS	0.1550	-0.1110	-0.0439	0.3619	-0.1293	0.0525

LOG SUMMARY DATA

RUN:SEQ
2.01:361 /381

	2	3	4	5	8	12
TC	-9.5803	2.9521	-10.903	42.130	1.6979	0.4156
TS	12.237	-46.609	-4.3707	39.324	24.185	-9.5204
OC	-0.3089	2.1192	-2.8032	4.3631	-1.1469	-0.1130
QS	-2.7270	-0.2343	-1.0516	5.0140	-1.1965	0.3325
TPC	-60.524	66.725	-47.452	-3.3494	-11.963	26.504
TPS	1.8609	51.307	-61.143	-8.0371	26.052	-14.069
UPC	-2.5768	1.9423	-1.3812	-0.0967	-0.3482	0.7730
CPS	0.6542	-1.4935	-1.7794	-0.2573	0.7503	0.4101
ATC	-0.2987	-0.1916	-0.1611	0.4525	0.1049	-0.0645
ATS	0.1696	-0.0769	-0.0512	-0.0340	0.0480	-0.1757

PRELIMINARY DATA

	3	5	7	9	11	13
XC	-27.746	30.290	-6.9674	-8.2807	-14.142	41.813
XS	11.215	32.111	-5.0200	6.6123	-10.542	-41.747
YC	11.215	-32.111	-5.0208	-6.6123	-10.542	41.747
YS	27.746	30.290	6.9674	-8.2807	14.142	41.813
LC	-1.6385	4.5600	1.6153	1.1801	1.2022	-0.8213
LS	1.1618	-5.5591	-0.6493	1.1986	1.2063	0.4503
?C	1.1608	5.5541	0.6493	2.1486	0.6449	-0.4503
?S	-1.6385	4.6900	-1.6053	1.1601	-1.2022	-0.8213
XPC	-5.0759	-0.2446	-1.6372	1.1385	1.7705	-1.1265
XPS	1.1655	0.5097	-0.6743	-0.4162	0.9194	-1.4466
YPC	1.1655	-0.5097	0.4543	0.4162	0.9194	1.4466
YPS	5.0759	-0.2446	-1.6372	1.1385	-1.7705	-1.1265
LPC	4.6304	2.0263	0.1901	-4.0225	-7.4303	-4.3151
LPS	-24.004	0.3201	-0.3240	-4.2929	6.1752	7.7792
?PC	-24.004	-0.3201	-8.5540	4.2929	6.1752	-7.7492
?PS	4.6304	2.0264	-0.1901	-4.0225	7.4303	-4.3151
AXC	-0.0523	-0.2767	-0.0404	-0.0749	-0.1471	0.3481
AXS	-0.2660	0.1340	-0.0740	-0.0652	-0.0401	-0.3693
AYC	-0.2660	-0.1340	-0.0740	0.0652	-0.0401	0.3693
AYS	0.0528	0.2767	0.0484	-0.0749	0.1471	0.3481

RUNISFO -- 1358
2.01398

	2	3	4	5	8	12
TC	-1.8870	-3.3395	-21.351	-4.2064	-5.7937	-0.1055
TS	11.497	10.056	-1.2326	11.640	-20.646	4.3540
QC	-1.7231	-0.6810	-3.0444	-0.6939	-2.2334	-1.3691
QS	-1.5741	0.3593	-2.2182	0.3092	-0.8650	0.9609
TPC	-63.469	74.366	24.524	-5.1639	22.330	-0.8640
TPS	6.1607	18.408	-28.378	-30.439	-6.5130	8.0416
QPC	-1.8475	2.1647	0.7138	-0.1509	0.6500	-0.0251
QPS	0.1799	0.5475	-0.8260	-0.8560	-0.1246	0.2341
ATC	0.0207	-0.0574	0.3356	0.0232	-0.1550	0.0566
ATS	0.1306	0.0549	0.2233	0.0500	-0.0720	0.0781

		3	5	7	9	11	13
1	XC	-2.6327	7.1744	-2.3410	25.735	-0.3415	-36.355
2	XS	-14.542	1.3615	-10.768	-14.676	16.793	16.781
3	YC	-14.542	-1.3615	-10.764	14.676	16.793	-16.781
4	YS	-2.6327	7.1744	-2.3410	25.735	0.3415	-16.355
5	LC	0.0464	-0.0490	-0.1339	-2.7560	0.9256	1.9639
6	LS	2.6413	-0.2172	-0.4522	-0.1354	0.6154	0.0424
7	C	2.6413	-0.2172	0.8522	0.1454	0.6154	-0.0424
8	S	-0.0464	-0.4490	-0.1339	-2.7560	-0.9256	1.9690
9	XFC	-3.8220	-1.2493	0.4747	1.0447	0.2293	0.0455
10	XFS	2.8105	-1.4455	-0.5150	0.4039	-0.3342	-0.0455
11	YFC	2.8105	-1.4455	-0.5150	0.4039	-0.3342	0.2293
12	YFS	3.8220	-1.2493	-0.4747	1.0447	0.0676	0.2329
13	LPC	-5.2675	1.7676	1.7676	-3.8651	1.6380	-0.2329
14	LPS	-22.423	2.8316	5.4775	-4.0763	-1.1105	-1.1105
15	PDC	-22.423	-2.8316	5.4775	4.0763	0.3408	1.1105
16	FS	5.2675	0.8294	-1.7676	-3.8451	-1.6348	-0.2329
17	AXC	0.0277	0.0595	0.0139	0.2070	0.0119	-0.3345
18	AXS	-0.1605	-0.0518	-0.0708	-0.0718	0.1154	0.1191
19	AVC	-0.1605	0.0518	-0.0708	0.6718	-0.1154	-0.1191
20	AVS	-0.0277	0.0505	0.0139	0.2070	-0.0119	-0.3345

PRELIMINARY DATA

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RUNISEU 1399
2.01:399

	2	3	4	5	6	12
IC	-13.612	-7.7311	-32.750	13.202	1.9264	0.2217
IS	-13.495	-8.3503	-30.797	20.745	7.1344	-4.4472
OC	0.9121	-0.9102	-2.5526	0.4024	1.1767	-0.5304
OS	-3.6282	-1.5022	-0.7154	3.4469	0.4570	0.1559
TPC	-150.80	-60.545	-105.54	19.941	-55.427	14.22
TPS	25.587	75.565	75.54	-35.157	20.602	7.6423
OPC	-4.3894	-1.7623	-0.0077	0.5513	-2.6134	0.9415
OPS	0.7448	2.1996	-3.0720	-1.0234	-0.5997	0.2225
ATC	-0.0415	0.0073	-0.0244	0.0261	0.0012	0.0574
ATS	-0.0439	-0.0635	-0.0049	-0.1251	0.0250	-0.0012

	3	5	7	9	11	13
XC	-10.063	-7.2633	-6.9771	-1.3069	19.292	-0.0432
XS	-0.6453	3.5072	13.443	21.990	-5.6954	1.0634
YC	-0.6653	-3.6072	13.453	-21.990	-5.6954	-1.0634
YS	-10.063	-7.2633	6.9771	-1.3069	-19.292	-0.0432
LC	0.5229	-0.0529	-0.1459	-0.3333	-0.4432	0.4928
LS	1.4017	-0.5337	-1.1337	-0.9159	1.1494	-0.3449
ZC	1.6097	0.5317	-1.1337	0.9159	1.1494	0.4449
ZS	-1.5229	-0.0529	-0.1459	-0.3333	0.4432	0.6726
APC	-1.2249	-2.0241	-1.5315	0.7122	-1.2760	0.0848
APS	-5.0644	0.4704	0.4442	2.7970	1.534	-1.7340
VPC	-5.0644	-0.4704	0.4442	-2.7970	1.534	-0.7340
VPS	1.2249	-2.0241	1.4395	0.7122	1.2760	0.0948
LPC	2.0516	6.7481	-1.4573	11.137	5.8266	3.0600
LPS	5.6776	-9.9137	-0.0076	-4.4904	-9.2745	-1.8361
MPC	5.6776	-9.9137	8.7441	11.137	-6.2745	1.8361
MPS	-2.0516	8.7441	-1.5573	11.137	5.8266	3.0600
AXC	0.0424	-0.0376	-0.0066	-0.0940	0.1318	-0.0270
AXS	-0.1148	0.0035	0.1108	-0.0554	-0.0844	0.0329
AVC	-0.1146	-0.0035	0.1108	-0.0956	-0.0444	-0.0329
AVS	-0.0424	-0.0376	0.0506	-0.0840	-0.1318	-0.0270

PRELIMINARY DATA

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RUNISED 1400
2.0:1400

	3	5	7	9	11	13
XC	0.0643	-41.030	-8.1476	-21.014	9.1955	10.703
XS	10.633	-11.344	9.6482	12.364	-12.156	-20.?97
YC	10.633	-11.344	9.6482	12.364	-12.156	20.?97
YS	-9.0643	-41.030	8.1476	21.014	-9.1955	10.703
LC	2.0244	4.5553	1.2161	1.1770	-1.5472	-0.1951
LS	-1.1232	7.0421	0.7497	0.3148	1.1552	1.0146
PC	-1.1232	-7.0421	-0.7497	-0.3148	0.1552	-1.0146
PS	2.0244	4.5553	-1.2141	1.1770	1.5072	-1.?373
RPC	9.1642	-11.237	-1.2141	0.6125	1.5072	-1.?373
RPS	-10.904	-5.467?	-2.1443	-1.2743	-0.9630	-1.?455
XPC	-10.904	5.467?	-2.1644	-1.2743	0.9630	1.4454
YPC	-9.1642	-11.237	11.378	0.6135	0.7997	-1.9373
YPS	31.244	-11.237	11.378	4.5247	5.4202	-4.5?07
LPC	-61.676	61.366	-0.3431	-5.1015	-1.7434	12.159
LPS	61.676	-61.366	0.7431	5.1015	-1.7408	-12.159
MPC	-31.250	-44.7614	-11.378	4.5247	-5.4292	-4.5247
MPS	0.0644	-0.2015	-0.1093	-0.1711	0.1227	0.0754
ZXC	0.1810	-0.0356	-0.0620	-0.1765	-0.1030	-0.2000
AXS	0.1810	-0.0366	0.0620	-0.1666	-0.1036	-0.2000
AVC	0.0644	-0.2015	0.1093	-0.1811	-0.1227	0.0754

	2	3	4	5	8	12
TC	3.6555	-2.8993	-10.619	-9.8265	11.749	18.351
TS	26.340	1.0625	-6.4282	-24.962	2.7809	-4.444?
OC	0.2771	1.2373	-2.2013	-1.6646	1.9511	-0.4?71
CS	1.333?	-0.8363	1.3366	-0.0992	-0.7435	1.2?4?
TPC	-84.469	-230.26	81.945	18d.44	-2.1439	-36.c1?
TPS	-64.798	-2.1932	-58.950	-20.017	7.0447	-24.5??
UPC	-1.1232	-6.7031	2.3453	5.4683	-0.1509	-1.0711
UPS	-2.0243	-0.0633	-1.7159	-2.3292	0.2051	-0.7276
ATC	0.0927	0.0476	0.0378	-0.1159	-0.0122	0.11-4
ATS	0.1928	-0.0045	0.0305	0.1257	-0.0610	-0.0?11

RUN?ST? 1401
2.01?01

	3	5	7	9	11	13
XC	-5.3596	7.7965	4.1244	-3.2137	12.421	4.5293
XS	5.0192	-12.093	8.7434	-16.042	37.921	9.0411
YC	5.6032	-12.093	8.7434	16.042	37.921	-9.0411
YS	-5.3596	7.7965	-6.1244	-3.2137	-12.421	4.5293
LC	-0.3431	3.0425	1.0302	1.6677	-0.1246	0.7602
LS	0.6792	0.6090	1.6412	0.5480	-2.8062	-0.5565
?	0.6792	-0.6090	0.6412	-0.5480	-2.8442	0.5565
?	-0.5431	3.0425	-1.0302	1.0677	0.1270	0.7602
ODC	-3.9517	-8.421?	-6.5342	2.4985	4.9731	-4.4267
KDS	-4.7551	4.7213	10.706	-7.2834	2.4631	1.0021
VDC	-4.7551	-4.7213	10.706	2.2834	2.8031	-1.0021
V?S	3.9517	-8.421?	-6.5342	2.6985	-4.9731	-3.4267
ODC	21.765	37.537	-32.195	-14.965	-22.234	10.998
?PS	-?.?70?	27.?46?	-?0.612	-6.?12	19.766	13.398
?PC	-2.5?4?	-27.?46?	-40.612	6.?172	16.766	-13.398
?DS	-?2.765	37.537	32.195	-14.?46	22.234	10.948
A?C	0.022??	0.1209	0.0?3?	-0.0173	0.1150	0.0245
A?S	-0.050?	0.0632	0.0517	-0.0560	0.2470	0.1144
A?C	-0.050?	-0.0432	0.0537	0.0560	0.2470	-0.1144
A?S	-0.0227	0.1209	-0.0350	-0.0173	-0.1150	0.0245

	2	3	4	5	8	12
TC	8.4014	9.0154	-21.067	-0.4633	-11.453	1.8633
TS	-16.450	-10.477	-7.3002	24.377	14.422	5.9?13
UC	3.5535	-0.1708	-1.7765	1.7625	0.2677	0.4513
US	-1.9760	-0.5707	-0.7243	2.4536	-0.1432	0.4556
TPC	-218.32	-14.675	-14.641	26.451	184.49	-61.741
TPS	263.25	94.161	-216.53	-154.59	-35.622	-112.76
ODC	-6.3549	-0.5436	-4.2676	0.7699	5.4283	-1.7872
OPS	7.6026	2.8573	-6.3027	-4.4997	-1.6369	3.2429
ATC	-0.0574	-0.0964	-0.1440	0.2195	0.0500	0.1116
ATS	-0.1184	-0.0329	0.0659	-0.1611	0.1232	0.0712

PRELIMINARY DATA

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RUNISEQ 1405
2.01:405

	3	5	7	9	11	13
XC	9.6443	-21.703	1.8319	-12.537	17.652	-4.4597
XS	-10.638	-10.959	0.7938	4.3283	-1.2982	7.6149
YC	-10.636	10.959	0.7938	-4.3283	-1.2982	-7.6189
YS	-9.6443	-21.703	-1.8319	-12.537	17.652	-4.4597
LC	-0.5425	1.2404	-0.4059	-0.8605	-2.1534	-0.3234
LS	-0.3635	1.5306	-1.4047	1.6984	0.8329	-0.7059
MC	-0.3635	-1.5306	-1.4097	-1.6984	0.8329	-0.7059
MS	0.5425	1.2404	-0.4099	-0.8605	2.1534	-0.3234
XPC	-5.4432	-4.1977	-5.2041	-1.5363	0.4121	1.2622
XPS	-11.112	3.0020	1.4975	1.4529	0.4569	-0.5134
YPC	-11.112	-3.0020	-4.1977	-1.5363	-0.4569	0.5134
YPS	-5.4668	21.384	1.4179	9.4082	-0.4121	1.2722
LPC	-10.545	-13.040	-24.646	4.0049	0.9717	-4.7501
LPS	-16.555	-13.040	-24.646	-4.0929	0.9717	4.7501
APS	-65.672	21.384	-1.4179	9.4082	2.4237	-4.7296
AXC	0.0240	-0.0426	0.0256	-0.1207	0.1017	-0.0299
AXS	-0.1662	-0.1241	-0.0516	-0.0290	-0.0523	-0.0404
AVC	-0.1662	-0.1241	-0.0516	0.0290	-0.0523	-0.0404
AVS	-0.0280	-0.0828	-0.0258	-0.1207	-0.1017	-0.0299

	2	3	4	5	8	12
TC	5.4745	13.902	-11.923	-21.443	-4.8630	-7.3771
TS	-2.5020	-2.4175	-11.222	-25.296	4.3717	2.168
QC	2.6187	-2.3055	-1.0948	-3.2722	-0.3463	-0.3805
QS	-1.6291	0.7422	-0.9227	-1.5022	0.3471	-0.2434
TPC	-42.268	-51.772	130.73	5.7155	-9.6367	5.7155
TPS	44.661	219.52	-182.96	-83.207	3.5224	3.0571
QPC	-1.2304	-1.5070	3.8052	0.1664	-0.2405	-0.1654
QPS	1.3000	6.3897	-5.3257	-2.4220	0.1025	-0.0590
ATC	0.0110	0.1013	-0.0098	0.1879	-0.1049	-0.0781
ATS	-0.0329	-0.0354	0.0903	-0.0757	0.0659	0.1357

RUNISED *1584*
2.01:584

	3	5	7	9	11	13
XC	-3.0758	-15.173	5.1032	11.267	1.4570	-7.6401
XS	0.0429	2.2369	10.342	-0.4547	-4.8636	1.2104
YC	0.0429	-2.9369	10.592	0.4547	-4.8036	-1.2104
YS	3.0758	-15.133	-5.1032	11.267	-1.4570	-7.6401
LC	0.4757	0.5321	0.1114	-0.9324	-0.1492	-0.3778
LS	-1.3309	-0.6725	-0.1959	-1.6030	-0.9467	0.4633
-C	-1.3909	-0.6725	0.1959	1.6030	0.9467	-0.4633
-S	-0.4757	-0.5331	-0.1114	-0.9324	-1.1492	-0.3778
XPC	3.3940	-0.0101	-2.6739	-0.0121	1.1492	-0.2106
XPS	2.3606	-1.1665	-7.0439	-0.6029	-0.4715	-0.3007
YPC	-2.3606	1.1695	-2.0439	-0.0121	0.4427	0.3007
YPS	-3.3940	-0.0101	2.6799	-0.6029	0.4715	-0.2106
LPC	-16.093	-5.2033	14.221	-7.6696	-1.0307	-0.9426
LPS	10.609	2.2674	-8.0426	1.1998	-2.9470	1.5120
MPC	10.609	-2.2674	-8.0826	-1.1998	-2.9470	-1.5120
MPS	14.994	-5.2033	-14.221	-2.6696	1.0807	-0.9426
AXC	-0.0372	-0.3747	-0.0066	0.0418	0.0457	-0.0917
AXS	0.0569	0.0440	0.0950	-0.0414	-0.0369	0.0225
AVC	0.0509	-0.0440	0.0950	-0.0414	-0.0369	-0.0225
AVS	0.0372	-0.0747	0.0066	0.0418	-0.0457	-0.0917

	2	3	4	5	8	12
TC	7.8554	-1.2921	2.3465	12.695	-0.9038	-17.696
TS	6.0237	-54.360	40.294	15.457	30.677	6.613
QC	-1.5863	1.1211	-0.3967	-2.6767	-0.1568	0.2525
QS	-1.0139	-4.0288	2.6095	3.0435	-0.0437	-0.4422
TPC	-60.212	-5.4497	-35.154	14.688	14.073	-3.5224
TPS	92.246	-66.593	-15.153	11.096	-3.3294	2.657
QPC	-1.7527	-0.1586	-1.0524	0.4275	0.4082	-0.1025
QPS	2.6051	-1.9384	-0.4411	0.3453	-0.0907	0.0832
ATC	-0.0744	-0.1794	0.2318	0.2648	0.1489	-0.0952
ATS	0.0793	0.0525	-0.1147	-0.0354	0.1440	0.1196

PRELIMINARY DATA

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RUN:SEQ 1585
2.018685

	2	3	4	5	8	12
TC	29.469	26.726	1.8493	-35.638	2.8195	10.451
TS	-6.8512	-13.984	-10.584	63.601	34.667	-11.627
QC	3.9353	0.3003	0.0758	-4.1494	-0.2073	0.0...
GS	0.2556	0.9973	-0.8448	2.5723	1.0070	1.6...
TPC	-41.139	85.467	-12.694	-35.547	-10.235	-5.05.
TPS	-52.570	84.537	-25.384	4.7651	20.602	-10.102
QPC	-1.1975	2.4878	-0.3695	-1.1220	-0.2979	-0.147.
QPS	-1.5302	2.460.	-0.7600	0.1393	0.5997	-0.244.
ATC	0.0903	0.0256	-0.0073	0.1147	0.1391	-0.0927
ATS	-0.0244	-0.0964	0.0171	0.0757	0.1611	0.0000

	3	5	7	9	11	13
XC	-17.416	-12.106	-4.6043	-2.2649	12.046	-4.7575
XS	-14.707	-1.0628	-0.3242	7.3153	8.2151	2.6444
YC	-14.707	1.0628	-0.3242	-7.3153	8.2151	-2.6444
YS	-17.416	-12.106	4.6043	-2.2649	-12.046	-4.7575
LC	0.0022	-0.199.	-0.9575	1.0655	-1.9241	0.8919
LS	0.6341.	1.934.	0.8714	0.6602	-1.2417	0.0643
NC	0.6341.	-1.934.	0.8714	-0.6602	-1.2417	-0.0643
NS	-0.0022	-0.199.	-0.9676	1.0655	1.9241	0.8919
XPC	-7.400.	1.7456	-1.6703	2.2410	1.9241	-0.1680
XPS	0.7534	1.6521	-1.5101	-0.5262	0.7713	-0.6022
YPC	7.400.	1.7456	1.6703	2.242.	0.7713	0.6622
YPS	7.400.	1.7456	1.6703	2.242.	-1.0...	-0.1840
LEC	10.700.	4.0509	9.9184	-6.6102	-5.5179	-2.7272
LES	-34.474	-10.235	-4.5407	-9.0102	3.4054	2.0470
NPC	-34.478	10.935.	-4.5457	9.0102	3.4054	-2.0470
NES	-10.700.	4.059.	-9.9184	-6.6102	5.5179	-2.7272
AXC	-0.0465.	-0.0478	-0.0318	-0.0279	0.1160	-0.0065
AXS	-0.1616.	-0.0872	-0.0320	0.0732	0.1046	0.0060
AYC	-0.1616.	0.0872	-0.0320	0.0732	0.1046	0.0060
AYS	0.0865.	-0.0478	0.0318	-0.0279	-0.1160	-0.0065

PRELIMINARY DATA

RUN:SEQ 1586
2.01:586

	3	5	7	9	11	13
XC	-8.4694	0.2410	-11.567	4.1126	-4.4437	-10.349
XS	-19.530	-11.544	3.0543	-5.6955	14.332	-9.4224
YC	-19.536	11.544	3.0589	5.0926	14.332	9.4226
YS	8.4694	0.2410	11.567	4.1126	4.4437	-10.349
LC	-0.0629	2.6322	0.8008	0.2464	1.7203	-0.5324
LS	0.3440	1.7054	0.7546	-0.6790	1.6727	1.1625
?C	0.3446	-1.7054	0.7546	0.6790	1.9727	-1.1925
?S	-0.0629	2.6322	-0.8008	0.8464	1.7203	1.5329
?	-5.1803	-0.3562	1.8257	-0.6546	-1.7675	-0.0594
?C	-4.9553	-0.9194	-0.6404	0.6652	-1.4491	1.2034
XPS	-6.9543	-0.9194	-0.6363	-0.6652	1.4491	1.2034
YPC	5.1803	-0.3562	-1.1257	-0.6546	1.7676	-0.0594
YPS	40.910	4.8645	-6.3116	4.6024	10.009	-5.2412
?C	-7.9116	0.0300	6.9436	2.5701	-5.0633	2.5526
?	-9.9116	-0.0300	6.9435	-2.5701	-5.0633	-2.5526
VPS	-40.910	4.8545	5.3116	4.6024	-10.009	-5.2412
AXC	-0.0057	-0.0423	-0.1017	-0.0378	-0.0676	-0.0692
AXS	-0.1566	-0.0426	0.0598	0.0990	0.1064	0.1177
AYC	-0.1566	0.0624	0.0398	0.0675	0.1064	0.1177
AYS	-0.0057	-0.0423	0.1017	0.0378	0.0576	-0.0692

	2	3	4	5	8	12
TC	9.0770	10.027	10.742	-37.693	-8.1946	-4.0473
TS	10.505	1.0193	10.619	-37.162	-20.113	-0.9585
QC	1.3424	-0.5971	2.3834	-4.4063	-0.7140	-0.8267
QS	0.1515	1.3942	2.9000	-3.4091	1.1522	-0.4776
TPC	-3.5488	-33.496	26.052	-7.3770	-17.240	-7.1776
TPS	-105.40	135.11	18.077	-14.422	-3.9876	15.419
QPC	-0.1545	-0.9750	0.7583	-0.2147	-0.5030	-0.2030
QPS	-3.0641	3.9619	-0.5262	-0.4198	-0.1161	0.4498
ATC	-0.0661	0.0476	-0.0098	-0.1155	-0.1025	0.0512
ATS	0.0256	-0.1037	0.0146	0.0744	-0.1318	0.0654

PRELIMINARY DATA

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RUN:SEQ 1594
2.01:594

	2	3	4	5	8	12
TC	-7.8974	2.7407	-12.440	-12.672	-6.0931	3.9322
TS	-1.1612	0.3085	-39.647	-0.0852	6.1104	-3.8959
QC	-0.2423	-0.9651	-1.3440	-1.6699	0.6689	0.3295
QS	-1.3154	0.4151	-3.2625	0.3504	1.0390	0.4944
TPC	-73.207	54.105	11.105	5.0519	-7.7754	-1.4621
TPS	-59.947	28.976	-30.837	-31.635	0.4552	-2.3925
QPC	-2.4220	2.0080	0.3250	0.1470	-0.2263	-0.0426
QPS	-1.7449	0.8435	-0.0876	-0.0208	-0.0135	-0.0464
ATC	-0.0342	-0.0342	-0.0232	-0.0525	-0.0671	0.0976
ATS	0.0342	0.0342	-0.0305	-0.0647	0.0305	0.0024

	3	5	7	9	11	13
1 XC	-3.1490	-3.3129	-3.9731	11.783	7.6320	-7.0850
2 XS	16.593	10.026	-5.5152	0.6634	7.9145	14.754
3 YC	18.503	10.026	-5.5152	-0.6634	7.9145	14.754
4 YS	3.1490	-3.3129	3.9241	11.783	-7.6320	-7.0850
5 LC	-0.2976	0.3155	-0.4102	-0.5716	0.6411	-0.4198
6 LS	-0.4610	-0.4448	0.0186	-0.3458	-1.1309	-0.4312
7 PC	-0.4610	0.4448	0.0186	0.3458	1.1309	0.4312
8 PS	0.2976	0.3155	0.4102	-0.5716	-0.4611	-0.4198
9 XPC	-4.7996	-1.0037	-0.4577	1.4443	-0.6296	0.5113
10 XPS	2.1533	1.0037	-1.0401	1.3435	0.3177	-0.4986
11 YPC	2.1533	-1.0037	-1.0401	-1.3435	0.3177	0.6926
12 YPS	4.7996	-1.7092	0.4577	1.4443	0.3177	0.5113
13 LPC	-1.7255	7.7314	6.4534	3.4333	-0.2220	-4.0416
14 LPS	-22.376	5.7246	-1.7773	-9.0792	-3.4155	0.9555
15 MPC	-22.376	-5.7245	-1.7773	9.0792	-3.4155	0.9555
16 MPS	1.256	7.7314	-6.4534	3.4333	0.2220	-4.0916
17 AXC	-0.0035	-0.0234	0.0104	0.0693	0.0481	-0.0920
18 AXS	0.0745	-0.0584	-0.0444	-0.0140	0.1664	0.1336
19 AYC	0.0745	-0.0584	-0.0444	0.0140	0.1064	-0.1336
20 AYS	0.0335	-0.0234	-0.0104	0.0093	-0.0481	-0.0260

REVISED /595
2.01:595

	3	5	7	9	11	13
XC	-10.602	-14.707	5.9510	-2.2333	-4.5938	-15.030
XS	-2.498	-0.707	3.6003	-5.2394	-0.3225	6.6459
YC	2.498	0.707	3.6003	6.2494	-0.3225	-6.6459
YS	10.602	14.707	-5.9510	-2.2333	4.5938	-15.030
LC	0.1532	-0.5412	0.1970	-0.3472	-0.3472	1.6728
LS	2.1570	-1.3306	-0.6171	-0.1555	-0.2127	-0.5195
NC	2.1570	1.3306	-0.6171	-1.7850	-0.2127	0.5195
NS	-0.1532	-0.5412	-0.6706	-0.1552	0.3302	1.0728
XPC	-4.9374	-0.1410	-0.5256	-1.5958	-1.5958	-0.2156
XPS	5.4947	-0.6075	-0.5556	-0.0644	-0.0644	0.6439
YPC	4.9374	0.1410	0.6704	-0.3913	-0.3913	-0.6439
YPS	-10.064	2.3649	3.9358	0.0202	1.5758	-0.2156
LPC	-32.600	-1.9032	-1.7635	-4.8022	3.3333	4.1786
SPC	-32.600	1.1432	-1.8636	4.6022	-6.4561	0.6411
SPS	-10.064	2.3649	-3.9368	-0.0202	-3.3333	4.1746
AXC	-0.0736	0.1204	-0.0256	-0.0366	-0.0360	-0.1042
AXS	-0.0218	-0.0479	-0.0116	-0.1097	0.0510	0.0460
AYC	-0.0218	-0.0479	-0.0116	0.0197	0.0510	-0.0460
AYS	0.0736	-0.1295	-0.0256	-0.0600	0.0360	-0.1042

	2	3	4	5	8	12
TC	-6.9956	0.0373	-32.659	9.4462	-7.7860	4.4554
TS	-5.7609	-18.191	-25.533	-9.491	6.7437	-8.9141
OC	-0.7095	-0.0539	-3.5611	1.3912	-0.1150	-0.1086
OS	-2.3638	0.3333	-2.8160	0.6150	-0.0541	-0.3283
TPC	-101.75	121.82	-11.294	-9.4373	-11.365	-6.1807
TPS	-38.879	2.9907	-10.099	-3.9676	6.3137	20.602
OPC	-2.8518	3.5460	-0.3289	-0.2747	-2.3305	-0.1799
OPS	-1.1317	0.0471	-0.3173	-0.1151	0.1836	1.6055
ATC	-0.0952	-0.1116	-0.0317	-0.0476	-0.0354	-0.0305
ATS	0.0415	0.0403	0.1245	-0.1989	0.0305	-0.0727

PRELIMINARY DATA

RUN(ES) 1596
2.01:596

	2	3	4	5	8	12
TC	16.288	19.542	11.113	-44.312	-10.793	2.2234
TS	9.0417	-14.305	10.716	-11.146	-15.171	2.4465
QC	3.0961	0.2719	1.6145	-5.0477	-0.0454	0.2135
QS	0.7137	-1.4369	2.8245	-0.2474	0.7647	0.4712
TPC	2.9242	5.5162	38.214	-7.7244	-27.049	-7.377
TPS	-117.37	144.42	-1.5286	-33.562	4.0540	2.742
QPC	0.0851	0.1606	1.1123	-0.0793	-0.7474	-0.217
QPS	-3.4164	4.2037	-0.0445	-0.9769	0.1160	0.0743
ATC	-0.0061	-0.0207	-0.0317	0.0110	-0.0940	-0.0037
ATS	0.0574	-0.1550	-0.1415	0.3063	-0.0378	-0.0574

	3	5	7	9	11	13
XC	-5.4923	-13.106	-24.034	-6.9275	-0.9471	-10.973
XS	-17.002	3.7092	21.437	-17.611	-0.5646	-0.3326
YC	-17.002	-3.7092	21.437	17.611	-0.5846	0.3326
YS	5.4943	-13.106	24.034	-0.9275	0.9471	-10.973
LC	-1.6134	4.1334	0.2414	1.2492	-1.2137	-0.3948
LS	-0.3761	0.3595	0.4467	0.6506	0.6133	-0.4942
CC	-0.3761	-0.3595	0.4467	-0.6508	0.6033	0.3948
CS	1.6134	4.1336	-0.2414	1.2432	1.2037	-1.4217
XPC	-7.1124	-1.4452	-1.4552	2.1512	-0.9584	-1.0717
XPS	-5.4206	1.4511	-0.4444	1.1074	-0.9126	1.0717
YPC	-5.4206	-1.4511	-0.4444	-1.1074	-0.9126	-1.4217
YPS	7.1124	-1.4952	-1.4552	2.1602	0.3544	-2.0436
LPC	37.725	9.3217	-1.5445	0.8410	5.4971	6.3458
LPS	-21.454	3.9100	9.2735	-11.752	-2.5453	-8.3458
CPC	-21.454	-3.9100	9.2635	11.752	-2.5453	-8.3458
CPS	-37.725	9.3217	1.5445	0.8410	-5.4971	-2.0436
AXC	-0.0140	-0.0493	-0.2204	-0.0545	0.0209	-0.0790
AXS	-0.0980	0.0221	0.1249	-0.1345	-0.0158	-0.0392
AYC	-0.0980	-0.0221	0.1249	0.1345	0.0158	0.0392
AYS	0.0140	-0.0493	0.2204	-0.0545	-0.0209	-0.0790

PRELIMINARY DATA

128

RUNISED 1627
2.011627

	3	5	7	9	11	13
1 AC	-14.955	-19.540	-30.607	-29.096	32.259	-18.679
2 XS	-8.6220	6.1771	11.267	56.560	-6.3742	33.521
3 YC	-8.6220	-6.1771	11.267	-59.560	-6.3742	-33.521
4 YS	-14.955	-19.540	30.007	-29.096	-32.259	-18.679
5 LC	8.6924	-0.3331	1.6463	0.1452	-1.4509	-0.9244
6 LS	-9.0579	-0.7520	-0.3651	0.6711	-0.1435	-0.5956
7 ?C	-3.0579	-0.7520	-0.3651	-0.6711	-0.1445	0.5956
8 ?S	-9.8924	-0.3331	-1.6463	1.0455	0.2505	-0.9244
9 ?DC	-1.9157	2.5503	1.9667	1.0455	1.2524	0.3657
10 XDC	1.9429	-0.8405	-0.5691	-0.4749	-0.2524	0.9350
11 YPC	1.9429	0.8054	-0.5691	0.4749	0.3615	-0.9350
12 YPS	1.9157	3.5503	-1.9667	0.2268	0.2524	0.3657
13 LDC	-5.0621	-10.705	-7.1945	-2.5513	-1.0234	3.4401
14 LPS	-12.259	-14.375	9.5644	-0.1106	-1.7954	-3.4101
15 ?PC	-12.259	-14.375	9.5644	1.1106	-1.7954	3.4101
16 MPS	5.0621	-10.705	1.1965	-2.5513	1.0498	3.4401
17 AXC	-0.3275	-0.1259	-0.2367	-0.2035	0.2447	-0.1329
18 AAS	-0.0536	0.0916	0.1945	0.5076	-0.0651	0.2950
19 AYC	-0.0536	-0.0916	0.1945	-0.5076	-0.0651	-0.2950
20 AYS	0.3275	-0.1269	0.2367	-0.2035	-0.2347	-0.1329

	2	3	4	5	8	12
TC	-5.3906	-21.438	-36.128	-3.2167	-3.7000	-0.6797
TS	-18.596	-19.521	-15.520	-33.712	1.3399	-9.0241
QC	-2.8198	3.3003	5.8449	-3.1819	-0.1645	0.8455
QS	-0.6255	2.8027	6.8668	-2.1764	-1.6543	-0.7247
TPC	-133.92	43.966	-12.029	-20.052	12.474	1.3357
TPS	47.052	3.8547	-20.935	53.699	5.6484	-13.624
OPC	-3.8981	1.2807	-0.3501	-0.7543	0.3637	0.1405
OPS	1.3470	0.1122	-0.6694	1.5631	0.1732	-0.3550
ATC	0.0342	-0.0659	-0.0464	-0.1074	-0.0940	-0.0574
ATS	-0.0635	-0.0171	0.0537	-0.3612	-0.0418	-0.0564

PRELIMINARY DATA

RUN:SEU 1628
2.01:628

	3	5	7	9	11	13
1 XC	-17.434	41.758	-1.6240	-19.116	-78.115	15.157
2 XS	-33.068	17.882	-11.663	-31.489	-16.673	-16.673
3 YC	-33.008	-17.882	-11.663	31.489	72.347	14.673
4 YS	-17.434	41.754	1.6240	-19.116	-78.115	15.157
5 LC	-1.2563	-5.0693	0.5467	-0.4230	6.5952	-0.5414
6 LS	0.2437	-4.3006	0.7533	-0.8224	-1.5056	-0.0087
7 AC	0.2437	4.3006	0.7533	0.2224	-1.5056	0.0087
8 AS	-1.2503	-5.0693	-0.5467	-0.4230	-6.5952	-0.5414
9 XPC	2.1282	-3.5136	-2.7407	-1.0316	0.5617	0.2394
10 XPS	1.3655	0.0024	1.4645	-1.0575	-0.7201	0.6664
11 YPC	1.3600	-0.0024	1.4645	1.0575	-0.7201	0.6664
12 YPS	-2.1282	-3.5135	2.7407	-1.0316	-0.5617	-0.2394
13 LPC	-10.263	7.0457	-2.9451	2.7617	2.1434	-3.4308
14 LPS	7.1734	15.533	-16.237	6.6164	3.8769	0.1973
15 APC	7.1734	-15.233	-16.237	-5.6164	3.8769	0.1973
16 APS	10.263	7.0457	2.9451	-2.7617	-2.1483	3.4308
17 AXC	-0.1271	0.3031	0.0229	-0.1346	-0.7256	0.1263
18 AXS	-0.3312	0.2052	-0.0375	-0.2270	0.7597	-0.1113
19 AYC	-0.3312	-0.2052	-0.0475	0.2270	0.7597	0.1113
20 AYS	0.1271	0.3631	-0.0229	-0.1346	0.7250	0.1263

	2	3	4	5	8	12
TC	-94.397	35.365	-4.9255	75.270	-23.472	37.39
TS	-24.655	7.9014	-25.295	42.741	-13.554	-7.9127
QC	2.3100	-0.7489	-0.0065	6.2245	1.4130	0.6643
CS	-0.2747	-0.4116	-2.0412	9.3647	-0.2435	-1.7131
TPC	-64.865	-5.4497	28.445	35.091	-21.201	0.6605
TPS	126.54	-41.338	24.856	-44.661	-14.409	0.9782
QPC	-1.8681	-0.1586	0.8280	1.0214	-0.5171	0.9?1?
QPS	3.6433	-1.2033	0.7235	-1.3000	-0.5355	0.2031
ATC	-0.5906	0.1660	-0.1159	0.7931	-0.2026	0.1391
ATS	-0.0683	-0.0073	-0.3331	-0.1196	0.0512	-0.1045

PRELIMINARY DATA

RUN SEQ 1629
20.1:629

	3	5	7	9	11	13
1 XC	19.226	-46.310	-55.414	27.604	-7.6611	-32.460
2 XS	-12.717	-11.640	-41.763	-10.676	36.144	13.487
3 YC	-12.717	-11.640	-40.763	13.676	36.144	-13.487
4 YS	-19.226	-46.310	55.414	27.604	7.6611	-32.460
5 LC	2.4534	-1.6156	1.9663	-2.5773	-0.4358	0.0976
6 LS	3.4633	-5.2072	3.9473	3.6246	-0.6360	-0.2734
7 S	3.4633	-5.2074	3.9073	-3.4846	-0.8360	0.2734
8 XLC	-2.4534	-1.6156	-1.9663	-2.5773	0.4344	0.0976
9 XLS	2.1530	-9.5030	4.3705	1.4245	-4.5657	-5.9262
10 YLC	19.352	-16.342	4.5570	14.695	-7.3344	-4.2241
11 YLS	10.022	14.352	4.5570	-14.696	-7.3349	4.2241
12 LOC	-2.1540	9.5730	-4.3705	1.4245	4.5457	-5.9262
13 LOS	52.099	-22.151	-26.756	63.404	41.471	-7.6173
14 DXC	-11.212	-15.140	19.025	-34.691	-6.5370	34.500
15 DXS	-11.212	-15.140	19.025	34.691	-6.5370	-34.500
16 DYS	52.999	-62.151	24.054	63.404	-41.471	-7.6173
17 DXC	0.0774	-0.1913	-0.5754	0.1776	-0.1051	0.3345
18 DXS	-0.2135	0.1622	-0.3524	-0.0379	0.2625	0.0799
AYC	-0.2135	-0.1622	-0.3544	0.0379	0.2625	-0.0799
AYS	-0.0774	-0.1913	0.5754	0.1776	0.1051	-0.3365

	2	3	4	5	H	12
TC	-21.611	29.867	-20.731	-27.363	41.295	9.6490
TS	-4.1717	234.53	62.942	72.643	38.462	-131.31
QC	-2.4461	-3.4444	-4.1475	-5.5966	0.6790	-0.7221
QS	0.1554	-1.4788	0.8763	-0.7576	0.9465	-1.1640
TPC	-156.25	114.44	-72.107	71.240	71.245	73.104
TPS	-0.5969	-139.43	120.62	265.04	-143.45	66.132
QPC	-4.5481	3.3312	-2.0900	2.3659	2.0733	2.1260
QPS	-0.0290	-4.0586	3.5112	7.7437	-4.1902	2.5071
ATC	0.0439	0.4612	0.1952	0.0427	0.3453	-0.1552
ATS	-0.1904	1.3715	0.5857	0.5332	-0.1086	-0.7273

PRELIMINARY DATA

NTESTD — 1632
2.011632

	2	3	4	5	R	12
TC	1.7391	-3.3305	3.3449	-43.849	21.071	-0.4096
TS	24.337	0.9437	1.9155	27.391	9.7536	-4.324
OC	-0.7135	-0.2654	3.2304	8.1245	1.1519	0.4475
OS	1.3324	0.8923	1.9168	4.0452	-0.3051	-0.6745
TPC	-31.967	29.774	-30.173	-15.616	-2.3225	0.1323
TPS	-21.996	133.09	72.973	40.341	1.1593	12.793
QPC	-0.9305	0.8667	-0.8743	-0.4566	-0.0622	0.0435
QPS	-0.6403	3.9000	2.1241	1.1743	0.0346	0.3153
ATC	0.0610	0.0537	0.0061	0.0122	0.0459	0.0741
ATS	0.1220	-0.0679	-0.1257	0.0757	0.0073	-0.1644

PRELIMINARY DATA

	3	5	7	9	11	13
1 XC	7.9438	-43.769	-45.355	69.529	-43.373	35.854
2 AS	-11.976	12.028	29.374	-29.234	0.7374	12.173
3 VC	-17.966	-12.020	29.376	29.233	0.7374	-12.173
4 VS	-2.5634	-43.642	-45.355	69.529	43.373	35.654
5 LC	1.2431	-22.764	0.6406	-3.6974	2.6415	-1.4533
6 LS	-1.3569	-6.6342	-1.6424	-1.7355	-1.1578	0.7233
7 HC	-1.3699	-6.6342	-1.6424	1.7455	-1.1578	-0.7033
8 HS	-1.2401	-2.6666	-0.6400	-3.6973	-2.6615	-1.4533
9 RPC	-7.5664	2.5608	-1.0744	0.5051	-0.4148	-0.4556
10 RPS	-3.0510	-0.4421	-0.2175	-0.4161	-0.5601	-0.3652
11 TPC	-3.0510	0.4421	-0.2175	0.4161	-0.5601	-0.4556
12 TPS	7.5609	2.5608	1.0744	0.5051	0.6168	-0.7449
13 QPC	31.576	-8.5295	3.0910	-4.6042	3.6494	-0.7247
14 LPS	-20.612	-9.7654	-6.4025	-0.7045	-1.6910	2.7247
15 PPC	-20.619	9.7654	-6.4025	0.7045	-1.6210	-2.7287
16 PPS	-31.576	-8.5295	-3.1210	-4.6042	-3.6648	-0.7649
17 AXC	-0.1693	0.4654	-0.2402	0.6454	-0.3704	0.2446
18 PHS	-0.1724	0.1127	0.2402	-0.2238	0.1453	0.1519
19 AVC	-0.1724	-0.1127	0.2402	0.2238	0.1453	-0.1519
20 AVS	0.0606	0.4654	0.2740	0.6354	0.3704	0.2486

WINDS=J 1633
2.001:633

	3	5	7	9	11	13		2	3	4	5	6	12
XC	26.174	23.242	-34.492	-9.3442	16.352	3.9724	TC	43.070	9.4979	85.257	57.681	-33.002	-5.4935
XS	-40.074	-31.102	7.4611	13.621	-14.616	1.6125	TS	137.33	55.658	-51.959	-24.656	-20.565	13.444
YC	-40.074	31.702	7.6677	-14.520	-14.676	-1.9725	QC	1.5361	-1.3763	8.1655	3.2025	-0.2552	-0.351
YS	-25.174	23.242	-34.492	-0.3662	-17.352	3.0124	QS	-1.2415	-0.1647	1.9356	0.6713	-0.2751	-0.2741
LC	-1.7632	-6.5012	-4.5529	-0.3404	-1.3769	-0.4736	TPC	100.02	25.286	6.9703	42.091	2.3261	2.1432
LS	2.0106	-0.6451	0.0762	-1.0642	-0.3700	-0.6070	TPS	12.696	-0.4652	-67.949	86.331	11.365	-4.315
LC	2.0106	-0.6451	0.0762	-1.0662	-0.9070	0.6070	OPC	2.9243	0.7564	0.2431	1.7246	0.0677	0.1634
LS	-1.7632	-6.5012	-4.5529	-0.3404	1.3767	-0.4736	OPS	0.3637	-0.0135	-1.9704	2.5129	0.3306	-0.1257
HC	-1.8015	-2.4452	6.4037	-1.6235	0.3792	-0.9714	ATC	0.4466	0.1094	0.5235	-0.0427	-0.4100	-0.0073
HS	-1.2530	-5.4414	-0.4141	2.3029	0.4192	0.2424	ATS	0.9445	0.3002	-0.5456	-0.4465	0.1440	0.0293
VPC	1.2530	2.4452	0.4037	-2.3529	0.4192	-0.2628							
VPS	1.6015	2.4452	-0.4037	-1.4235	-0.3792	-0.9714							
UPC	-3.7210	-29.906	2.0257	-2.5924	-2.5924	3.0207							
UPS	-0.2610	0.5054	5.1631	-0.7134	0.4957	3.4402							
LPC	3.1233	-25.906	5.1631	0.0134	0.6967	-3.0402							
LPS	0.2734	-3.1473	-2.0967	12.117	2.524	3.0207							
AXC	-0.3791	-0.7366	-0.2557	-0.0015	0.1542	0.0023							
AXS	-0.3741	-0.2350	0.0670	0.1449	0.1344	0.0190							
AYC	-0.3741	-0.2350	0.0670	-0.1448	-0.1344	-0.0190							
AYS	-0.2038	0.1413	0.2597	-0.0876	0.1592	0.0023							

X Long force
Y Lat force
T Vert force
L Roll moment
M Pitch Moment
Q Torque

P Pitch Link Correction
A Hub Acceleration Correction

PRELIMINARY DATA

Long force = X + XP + AX
Lat force = Y + YP + AY
Vert force = T + TP + AT
Pitch Moment = M + HP
Roll Moment = L + LP
Torque = Q + QP

APPENDIX C - NASA AMES FIXED SYSTEM HUB LOADS DATA SUMMARY

A summary of the 4/rev content of the six vibratory hub loads are presented in Tables C-1 and C-2. Included in the summary is a definition of the test conditions as well as the sine, cosine and net vibratory load.

TABLE C-1 NASA AMES FIXED SYSTEM 4/REV HUB LOADS DATA -
THRUST, ROLLING MOMENT, PITCHING MOMENT

TABLE C-2 NASA AMES FIXED SYSTEM 4/REV HUB LOADS DATA – LONGITUDINAL FORCE, LATERAL, FORCE, TORQUE

CORR	RUN	RPM	αs	C_T	θ2p	u	FX4C	FX4S	FX4	φFX4	FY4C	FY4S	FY4	φFY4	Q4C	Q4S	Q4	φQ4
1003	88	1670	5.0°	.0048	0.0	.296	-31.82	-2.27	31.90	266.	-19.07	-21.01	28.37	222.	-.982	-.024	1.16	-57.
1005	88	1670	5.0°	.0085	0.0	.295	-13.65	39.00	41.32	-19.	-21.08	28.47	35.42	-36.	-.584	3.12	1.17	-11.
1006	88	1670	5.0°	.0110	0.0	.295	-33.53	26.25	42.58	-52.	-39.93	62.77	74.39	-33.	-.853	-.709	1.11	2.30
1007	88	1670	5.0°	.0110	0.0	.298	-70.02	-36.50	78.96	243.	-36.99	-14.69	39.79	248.	-2.28	-1.60	4.26	217.
1009	89	1630	5.0°	.0052	0.0	.497	-87.90	14.10	89.02	-81.	-41.85	-57.96	71.41	216.	-.68	-2.45	2.54	295.
1010	89	1610	5.0°	.0057	0.0	.438	-113.65	-59.94	146.48	246.	-17.74	-48.81	51.93	199.	2.12	.31	2.11	87.
1011	89	1610	5.0°	.0045	0.0	.495	14.97	7.80	16.88	-62.	-4.58	54.34	54.53	-5.	2.28	.25	2.29	83.
1014	90	1360	5.0°	.0052	0.0	.795	-5.72	33.71	34.19	-10.	8.33	25.09	26.43	18.	-4.89	-.65	.92	-83.
1015	90	1360	5.0°	.0073	1.92	.796	-98.35	-32.18	103.48	252.	48.30	54.34	71.40	137.	.78	-4.95	6.90	107.
1016	90	1360	5.0°	.0092	3.72	.800	-30.54	-151.05	154.11	-91.	262.32	-52.59	267.19	79.	2.86	-3.34	3.41	74.
1020	90	1360	5.0°	.0065	0.0	.792	-16.50	42.53	45.62	-21.	60.12	50.76	24.63	78.	-5.84	.62	2.93	6.
1021	90	1360	5.0°	.0084	1.88	.795	71.62	71.98	101.99	84.	106.78	111.81	126.95	28.	-4.49	-1.89	7.02	24.
1022	90	1360	5.0°	.0104	4.01	.793	-88.86	53.48	103.71	-60.	-41.65	29.13	60.19	74.	1.37	-2.30	5.04	26.
1027	90	1360	5.0°	.0044	0.0	.791	-5.78	1.30	79.60	-77.	-59.98	43.46	60.19	-44.	-.06	.42	1.41	73.
1028	90	1360	5.0°	.0067	1.98	.794	-11.31	-77.78	93.16	183.	67.28	-14.49	70.49	256.	1.13	-4.91	4.91	181.
1029	90	1360	5.0°	.0083	3.93	.794	-34.75	86.44	137.41	-24.	59.71	21.04	73.	110.	1.19	3.11	1.34	22.
1330	91	950	5.0°	.0114	1.90	.1396	4.60	137.16	146.13	2.	50.10	-22.50	57.17	107.	-12.35	-7.68	14.54	238.
1031	91	950	5.0°	.0179	2.01	1.410	70.77	-92.06	92.23	29.	5.74	-15.24	.40	7.	.40	.14	13.24	-59.
1013	91	950	5.0°	.0154	1.02	1.416	-5.71	96.72	117.46	184.	29.17	43.22	39.06	132.	-11.28	3.67	11.96	71.
1034	91	950	5.0°	.0173	2.04	1.407	66.64	164.38	165.20	35.	49.77	-25.99	54.83	65.	-15.59	-3.85	16.45	-72.
1035	91	950	5.0°	.0195	3.0	1.396	10.17	-77.70	116.11	-60.	-55.31	21.01	39.06	-32.	.44	2.16	11.	-44.
1041	91	950	5.0°	.0193	0.0	1.347	-86.28	96.58	173.42	228.	55.71	89.16	104.09	5.	-2.67	-1.20	2.97	56.
1042	91	920	5.0°	.0212	1.00	1.381	-141.03	-8.64	97.19	-56.	-67.41	59.42	59.69	-74.	2.46	1.63	2.95	-21.
1044	91	920	5.0°	.0121	1.97	1.389	94.88	113.64	148.04	95.	54.66	18.88	70.00	116.	-5.29	15.42	5.90	114.
1045	92	920	5.0°	.0244	2.9	1.389	-99.89	-27.53	103.61	43.	-43.19	-27.07	60.29	-42.	-4.64	-2.39	5.15	244.
1046	92	850	5.0°	.0140	1.01	1.578	-67.39	131.81	146.26	-26.	60.09	48.59	65.00	89.	-9.45	-2.24	9.78	255.
1047	92	850	5.0°	.0181	1.90	1.584	-77.05	159.21	176.87	-22.	17.49	1.15	18.52	109.	-4.88	-2.53	6.03	-52.
1048	92	850	5.0°	.0214	0.0	1.579	7.56	122.02	122.85	-4.	51.19	-6.00	57.52	63.	-11.28	3.54	6.07	260.
1049	92	850	5.0°	.0238	1.04	1.559	-21.26	139.10	14.01	-9.	-2.01	26.21	16.15	-7.	-1.29	1.88	11.44	-16.
1050	92	850	5.0°	.0260	2.01	1.587	54.73	28.21	91.52	63.	-9.26	16.03	53.77	189.	-.78	3.89	4.09	-05.
1056	92	850	5.0°	.0254	1.02	1.589	-70.54	-58.31	137.71	230.	26.06	-52.97	27.95	75.	-11.47	.15	12.47	-90.
1057	92	850	5.0°	.0294	1.92	1.597	-61.49	121.24	61.01	74.	-10.95	7.38	29.40	-22.	-3.05	.07	4.98	-13.
1372	116	950	5.0°	.0301	0.0	1.600	58.55	17.15	49.49	-22.	-18.56	27.29	29.40	214.	-.75	.24	4.22	-252.
1373	116	950	0.0°	.0052	0.0	1.412	-18.47	45.91	37.22	-87.	24.30	-26.94	24.49	97.	-1.43	-.24	.78	195.
1374	116	950	0.0°	.0209	0.0	1.414	-16.92	5.12	41.07	-31.	1.95	-7.99	26.52	-84.	-.57	-4.71	1.43	-22.
1376	115	725	0.0°	.0083	0.0	1.924	-21.37	3.14	11.22	-43.	2.63	26.52	21.81	-45.	11.16	1.38	4.39	-375.
1377	118	725	0.0°	.0116	0.0	1.943	-.84	-2.53	2.66	76.	-21.67	2.44	44.68	247.	-1.57	4.12	1.28	261.
1378	118	725	0.0°	.0152	.92	1.434	-34.17	7.48	36.73	-1.	31.72	47.09	29.52	72.	-11.53	-1.67	7.34	-66.
1379	118	725	2.5°	.0371	0.0	1.198	.92	17.76	17.78	217.	-27.15	-11.53	17.50	267.	-7.33	.52	2.37	262.
1381	116	725	5.0°	.0378	0.0	1.210	-24.75	-29.99	38.89	-74.	16.64	-5.41	32.19	-19.	-2.35	-.32	6.81	235.
1398	118	700	5.0°	.0255	0.98	2.002	-14.98	-13.67	15.54	242.	-13.84	-27.21	15.51	-50.	-4.18	-2.83	2.68	418.
1399	118	700	5.0°	.0203	1.93	2.002	-35.31	-37.15	37.86	203.	-14.68	-15.20	20.63	209.	-2.21	-3.04	1.64	214.
1400	118	700	5.0°	.0471	0.0	2.095	-13.73	31.14	39.73	-24.	-15.91	14.49	20.94	-49.	-2.56	-2.79	4.65	-33.
1401	118	725	5.0°	.0523	0.95	2.002	-1.29	31.24	34.22	-20.	9.72	11.5	9.97	77.	.18	-.32	4.28	190.
1405	118	725	5.0°	.0504	1.93	2.063	-27.67	7.86	7.99	-2.	8.49	2.73	21.50	16.	-5.99	-7.03	4.99	42.
1584	121	700	5.0°	.0607	1.93	1.952	-1.29	-17.19	32.63	227.	-27.76	30.21	27.75	266.	-1.45	6.26	5.05	154.
1585	121	700	5.0°	.0503	0.95	1.194	-1.37	-1.33	3.62	-24.	-1.40	-1.62	35.98	-61.	-.29	-1.32	1.57	211.
1586	121	700	7.5°	.0627	1.93	1.193	-21.23	-1.86	27.05	244.	-50.21	53.98	28.53	-41.	3.14	-1.12	8.28	44.
1595	121	700	5.0°	.0111	1.96	1.190	21.23	-4.37	15.18	120.	.31	-55.45	73.71	173.	1.02	.85	1.57	-147.
1596	121	700	7.5°	.0110	1.86	1.170	-14.54	-10.69	42.99	107.	-13.23	50.87	59.46	-33.	-6.25	6.22	7.63	-55.
1627	121	1140	7.5°	.0112	0.0	1.188	41.64	-82.50	97.16	142.	-7.82	.49	7.84	-80.	2.45	4.30	4.67	-55.
1628	123	1140	7.5°				61.26								8.17	4.04	4.37	90.
1612	123	1140	7.55°													.04		

APPENDIX D DERIVATION OF GENERALIZED COORDINATE
METHOD FOR OBTAINING HUB LOADS

The development of helicopter vibratory hub loads from blade bending

moments is based upon

a) generalized coordinate theory

b) trignometric transformation of rotating blade shears

and moments to the fixed system

Generalized coordinate theory assumes that the forced response of

a vibrating system (a particular degree of freedom) is the summed

response of all the natural modes of vibration. For the blade

vertical degree of freedom, the natural modes involved are the

blade flapping modes and the summed response of interest are the

root vertical shears and moments. These blade root shears and

moments are the sources of hub vibration (F_z, M_x, M_y) which are

then transmitted to the airframe below. For the inplace degree

of freedom the natural modes involved are the blade chordwise modes.

The root shears and moments from these modes produce 3 additional

hub vibration components (Q, F_x, F_y). Blade radial forces also

contribute to F_x and F_y.

The pricipal equation for application of generalized coordinates

is as follows:

$$(1) \quad \text{Bending Moment} \Big|_{\substack{\text{HAR A} \\ \text{Sta i}}} = \sum_{j=i}^{NM} \text{Modal moment} \Big|_{\substack{\text{Sta i} \\ \text{Mode j}}} \times q \Big|_{\substack{\text{Mode j} \\ \text{HAR A}}}$$

The equation states that the measured blade bending moment

amplitude at station (i) on the blade for a certain harmonic (A) is

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the summed contribution of modal moments at station (i) for mode (j) times generalized coordinates for mode (j) for all modes considered (NM). Note that for each blade station there is a modal moment value for each mode whereas there is only 1 generalized coordinate for each mode for harmonic (A). When a number of blade stations are considered (NS), the left hand side of equation becomes a column matrix (order NS), the modal moments become a rectangular matrix (order NS x NM) and the generalized coordinate becomes a column matrix (order NM) for each harmonic considered.

(2) $(BM_{NS}) = (MM_{NS,NM}) \cdot (q_{NM})$

This equation is a set of (NS) simultaneous linear equations in (NM) unknowns with the generalized coordinates being the unknown variables. The bending moments are measured blade data, and the modal moments are known from a free vibration analysis of the blade. The number of stations where blade bending moments are measured must be at least equal to the number of modes under consideration so that the number of equations is at least equal to the number of unknowns.

The generalized coordinates are found by inverting the modal moment matrix and multiplying it by the measured bending moment matrix.

$(q_{NM}) = (BM_{NS}) \cdot (MM_{NS,NM})^{-1}$

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For the case where the number of stations are greater than the number of modes (NS > NM) so that number of equations are greater than number of unknowns, a linear least square fit is performed to compute the generalized coordinates and an error analysis of the result is included.

The blade root shears and moment of harmonic (A) are then simply computed as follows:

$$(3) \quad \begin{matrix} \text{Root Shear =} \\ \text{Harmonic A} \end{matrix} \quad \sum_{j=1}^{NM} \begin{matrix} \text{Modal Root Shear} \\ \text{Mode j} \end{matrix} \times q_{\substack{\text{Mode j} \\ \text{HAR A}}}$$

$$(4) \quad \begin{matrix} \text{Root Moment} \\ \text{Harmonic A} \end{matrix} \quad \sum_{j=1}^{NM} \begin{matrix} \text{Modal Root Moment} \\ \text{Mode j} \end{matrix} \times q_{\substack{\text{Mode j} \\ \text{HAR A}}}$$

The computation procedure (equation 1 thru 4) is repeated for each harmonic (cosine and sine) thru 5 per rev so that the root shears and moments applicable to 3 and 4 bladed rotors are included.

The fixed system hub loads are computed from the root shears and moments by trignometrically adding the appropriate contributions based on the numberof blades per rotor(N) and also by the root end geometry (Flap hinge E_β, lag hinge E_ζ and pitch axis offset E_o).

The flapping degree of freedom is the source of 3 hub loads components: F_z, M_x, M_y. The hub loads equations for these components are shown below for 4 bladed rotors.

4 Blades

5a $\quad F_{zo} = 4\, f_{zo}$

b $\quad F_{z4c} = 4 f_{z4c}$

c $\quad F_{z4s} = 4 f_{z4s}$

6a $\quad M_{xo} = 2[f_{z1c}\, E_o + f_{z1s}\, E_\beta + M_{\beta 1s}]$

b $\quad M_{x4c} = 2[E_o\,(f_{z3c} + f_{z5c}) - E_\beta\,(f_{z3s} - f_{z5s}) - M_{\beta 3s} + M_{\beta 5s}]$

c $\quad M_{x4s} = 2[E_o(f_{z3s} + f_{z5s}) - E_\beta(-f_{z3c} + f_{z5c}) + M_{\beta 3c} - M_{\beta 5c}]$

7a $\quad M_{yo} = 2[f_{z1s}\, E_o - f_{z1c}\, E_\beta - M_{\beta 1c}]$

b $\quad M_{y4c} = 2[E_o(-f_{z3s} + f_{z5s}) - E_\beta\,(f_{z3c} + f_{z5c}) - M_{\beta 3c} - M_{\beta 5c}]$

c $\quad M_{y4s} = 2[E_o(f_{z3c} - f_{z5c}) - E_\beta\,(f_{z3s} + f_{z5s}) - M_{\beta 3s} - M_{\beta 5s}]$

8 per rev hub loads can be calculated with the above equations by replacing the 3, 4 and 5 harmonic subscripts with 7, 8 and 9 harmonic subscripts, respectively.

APPENDIX E - <u>TABULATION OF GENERALIZED COORDINATE HUB</u>
<u>LOADS DATA</u>

The generalized coordinate method discussed in Appendix D was used to compute the vibratory hub loads from the reverse velocity rotor wind tunnel test - Phase IIB. Table E-1 presents a summary of the generalized coordinate 4/rev fixed system hub loads.

TABLE E-1 GENERALIZED COORDINATE 4/REV HUB LOAD DATA

(PROGRAM C-63)

RUN NO.	CORR NO.	ADVANCE RATIO μ	RPM	SHAFT ANGLE α_s DEG	2P COSINE CYCLIC θ_{2c} DEG	HUB VIBRATORY VERTICAL FORCE F_{z4} LB	HUB VIBRATORY MOMENT M_{xy4} IN LB
84	913 915 917	0.7	1440	5	0 2 4	82 10 100	220 450 510
85	928 930	0.9	1300	5	0 2	40 30	300 456
86	943 945 947	1.2	1120	5	0 2 4	100 40 110	1400 1230 1430
87	954	1.4	960	5	0 2 4	60 60 200	1300 1700 1860
88	1005	0.3	1670	5	0	7	63
89	1011	0.5	1630	5	0	32	250
90	1020 1021 1022	0.79	1360	5	0 2 4	40 70 70	245 245 385
91	1041 1042	1.4	950	5	0 .1	75 20	1709 1815
92	1043 1044	1.6	880	5	0 2	25 65	840 1040
116	1381	1.4	950	7.5	0	55	1300
118	1400	1.95	725	0	0	70	130
121	1584 1586	2.0	700	5	0 %	100 100	337 354
123	1627 1628 1629	1.2	1140	7.5	0 2 4	40 40 30	1150 1100 930

APPENDIX F - MODEL BLADE AND MODEL/TEST STAND DYNAMIC
CHARACTERISTICS

A summary of the dynamic characteristics of the blade and model/ test stand dynamic characteristics are presented herein. This information is presented in Reference 1 and is repeated here with only a brief description of the data. Figure F-1 presents the predicted flapwise frequency spectrum for the RVR model blade. Figure F-2 shows the predicted modal characteristics for the first flapwise mode using a free vibration analysis for both 1/2 and 1 atmosphere. The upper part of the figure shows the percent critical damping for the first flexible mode as a function of rotor speed. Note that a 50 percent reduction in air density results in a 50 percent reduction in critical damping. The predicted impact of the reduction of damping on flap bending moments is shown in the lower half of Figure F-2. A coefficient, that is a modified generalized coordinate for the first mode 3/rev response, is shown for both 1/2 and 1 atmospheres as a function of rotor speed. For rotor speeds near the 3/rev frequency crossing, the reduction in damping stated above has increased the modal amplification so that the benefits obtained from a 50 percent decrease in airloadings are negated.

Figure F-3 shows the measured model rotor head longitudinal acceleration which was recorded during the model checkout. There is a 2/rev amplification near 1350 RPM (182×10^4 on the RPM^2 scale) and 3/rev and 4/rev amplifications at lower rotor speeds. These amplification points verify the presence of a longitudinal model/test stand mode and are compared with pretest predictions in Figure F-4.
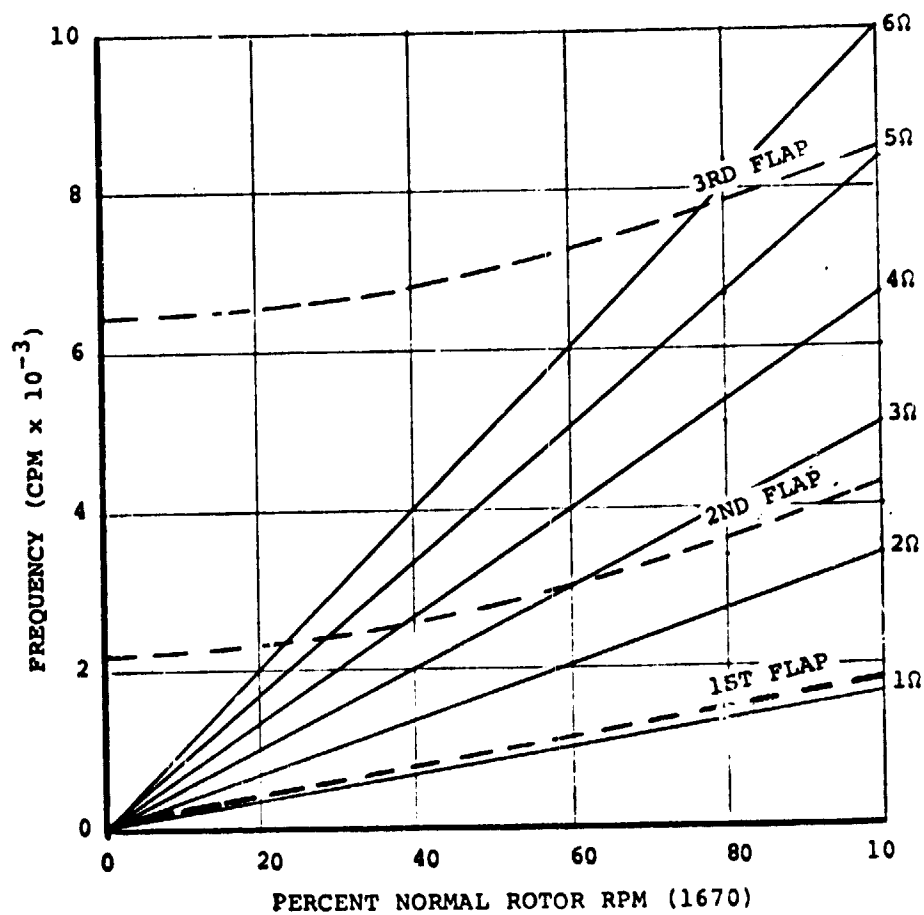
FIGURE F-1   RVR WIND TUNNEL MODEL BLADE PREDICTED
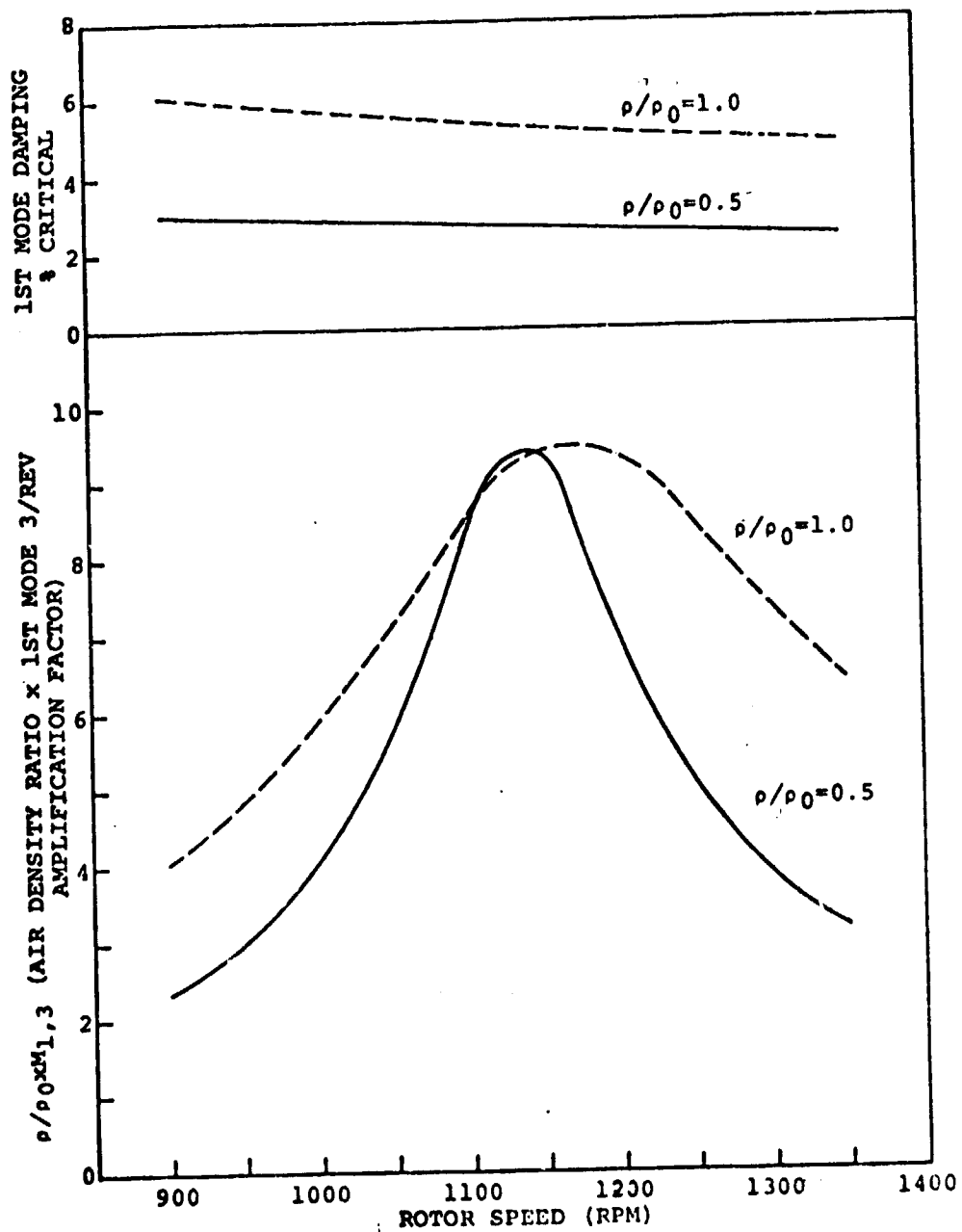   FLAPWISE FREQUENCY SPECTRUM

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FIGURE F-2   RVR PHASE IIB W/T MODEL   PREDICTED MODAL
CHARACTERISTICS FOR 1ST FLEXIBLE FLAP MODE
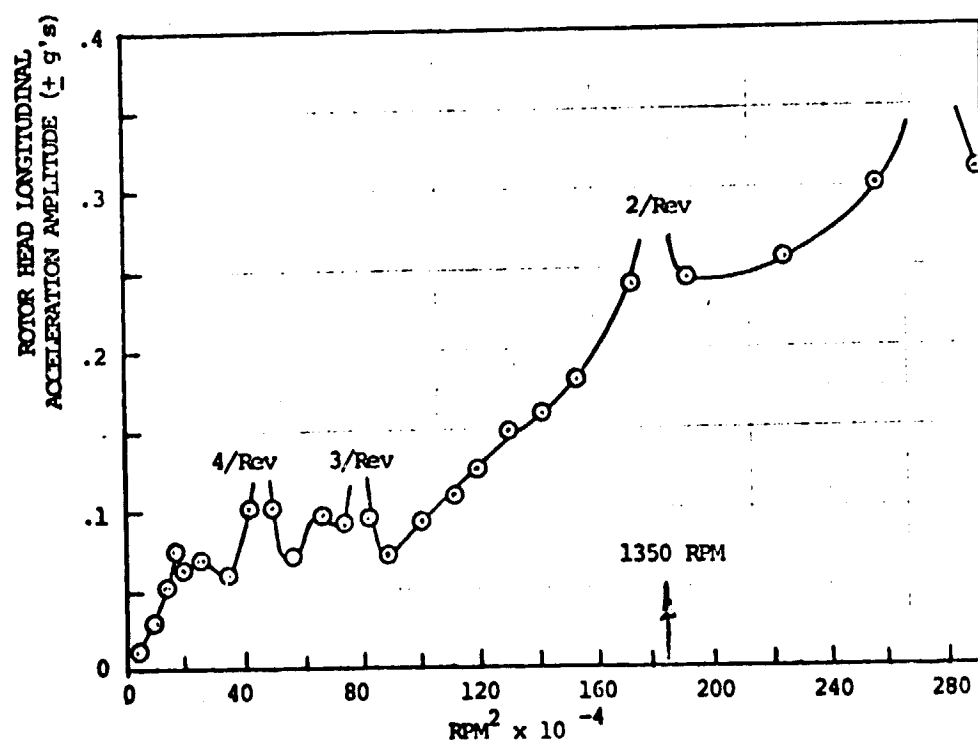AS AFFECTED BY AIR DENSITY

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FIGURE F-3   RVR PHASE II B W/T MODEL EFFECT
OF ROTOR SPEED ON LONGITUDINAL MODEL/
TEST STAND SHAKING

FIGURE F-4   RVR PHASE II B W/T TEST COMPARISON OF
PREDICTED AND MEASURED MODEL/TEST STAND
NATURAL FREQUENCY SPECTRUM

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