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STATISTICALLY PREDICTING MANEUVER LOADS FROM EIGHT-CHANNEL FLIGHT DATA

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FOREWORD

This final technical report summarizes the efforts of Technology Incorporated under contracts NASw-970 and NASW-1335 conducted between August 1964 and December 1967. The work was monitored by Mr. Harvey H. Brown, chief of the Loads and Structures Branch, Office of Advanced Research and Technology, National Aeronautics and Space Administration.

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ABSTRACT

From the data of a given aircraft, a maneuver model technique was developed which represented each maneuver type by a set of normalized parameter time histories, each independent of the given aircraft type. With proper denormalizing, the maneuver model can be applied in statistically predicting the maneuver-induced fatigue loads on any aircraft type. Thus the maneuver model could form a part of the structural design criteria. This technique was used to predict peak fuselage, wing, horizontal tail, and vertical shear load distributions from 450 hours of F-105D eight-channel oscillograph data. Favorable correlation of the predicted load peaks with load peaks calculated in the conventional fashion demonstrated the feasibility of the maneuver model technique. In an independent effort, a computer program was developed to determine the feasibility of automatically recognizing and classifying the maneuvers in eight-channel data digitized on magnetic tape. Using a magnetic tape bearing data from fourteen F-105D flights, an evaluation test showed that the program recognized 90 percent of all maneuvers and correctly classified 90 percent of the maneuvers recognized. This test proved that such a program would reduce manual editing to less than one-tenth of the effort otherwise required.

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SUMMARY

The objective of the effort reported was to demonstrate the feasibility of predicting maneuver loads fatigue spectra by using a set of normalized parameter data broken down by maneuver type and a set of normalizing factors broken down by maneuver type and by flight condition. If feasible, this procedure could be utilized in design criteria where the normalized parameter data by maneuver type would be specified as a "maneuver model." To predict a maneuver fatigue load spectra for a given airplane requires estimating the type and number of maneuvers performed during the life of the airplane and the normalizing factor distributions for each maneuver type. These estimated quantities would then be combined with the specified normalized data to predict the maneuver loads.

The reported effort used a technique based on the maneuver model concept to predict the fuselage, wing, vertical tail, and horizontal tail loads from about 450 in-flight hours of eight-channel oscillograph data recorded during the peacetime operation of F-105D airplanes. First, for each of the four loads, all of the data were processed to calculate load time histories whose peaks were termed "observed loads." Next the oscillograms were reviewed to establish twenty-three distinct and recognizable maneuver types. Then, from the maneuvers comprising each type, nine parameters were normalized in amplitude and time to form normalized data distributions by maneuver type. This process also yielded normalizing factors. Finally, in a simulation of the maneuver model technique to predict loads, the normalized data distributions were denormalized and the resultant data were used to predict the load peak distributions on the fuselage, wing, vertical tail, and horizontal tail. The favorable comparison of the predicted and observed load peak distributions demonstrated the feasibility of the maneuver model technique to predict structural loads with acceptable accuracy. However, yet to be tested is the assumption that the normalized data is independent of

the airplane type. The validity of this assumption would have to be proved before the maneuver model technique could readily use such data to predict the loads of other airplane types.

Since the practical use of the maneuver model technique on a large-scale data reduction basis depends on the extent to which present data editing and processing can be automated, an independent effort sought to develop a computer program capable of automatically recognizing and classifying maneuvers in digital eight-channel data. To evaluate the resultant program, magnetic tapes were prepared with digitized data simulating the eight-channel recordings made during fourteen flights of the F-105D airplanes. Results showed that the program recognized 90 percent of all maneuvers and classified correctly 90 percent of the maneuvers recognized. The effectiveness of the program indicated that computer processing could reduce the manual editing to less than one-tenth of the effort otherwise required.

INTRODUCTION

From the flight data of current aircraft, this study sought to evolve a maneuver model technique capable of predicting a maneuver flight loads spectrum. Such a spectrum would be used in designing new aircraft and in estimating the fatigue life of existing aircraft.

Application of Flight Loads Data to Design Criteria

The design of modern high-performance aircraft is an extremely complex task involving a delicate balance between the low weights required for maximum performance and the high structural strength necessary to withstand the predicted aerodynamic and inertia loads. To verify predicted loads and to provide realistic data for the projection of the loads to be encountered by future aircraft is the purpose of flight loads programs.

The design criteria for in-flight fatigue (Reference 1) consists primarily of a fatigue spectrum of cycles of percent design limit loads derived from three-channel (VGH) flight loads programs and a power spectral density of vertical gust velocities. These criteria, however, are limited to symmetrical vertical loads on the primary lifting surface (the wing). As discussed in Reference 2, such criteria for the other types of loads on other parts of the aircraft may be derived from the data acquired in the so-called eight-channel flight loads data program. This study, therefore, used the eight-channel data recorded during an F-105D flight loads program. The parameters comprising this data are listed in Table 1.

TABLE 1

EIGHT-CHANNEL RECORDED PARAMETERS

a_x - longitudinal c. g. acceleration (positive forward)

a_y - lateral c. g. acceleration (positive right)

a_z - vertical c. g. acceleration (positive up)

p - roll angular velocity (positive right wing down)

q - pitch angular velocity (positive nose up)

r - yaw angular velocity (positive nose right)

P_d - dynamic pressure

P_a - static pressure

Three other required parameters—$\dot{p}$ (roll angular acceleration), $\dot{q}$ (pitch angular acceleration), and $\dot{r}$ (yaw angular acceleration)—are derived by differentiating the recorded analog traces of p, q, and r. And the airspeed, altitude, and Mach number are derived from the dynamic and static pressures. Substituting these data in the rigid-body equations of motion yields a set of structural loads for any component of the aircraft.

Because of the expense and complexity of recording and processing eight-channel oscillograph data, only a limited amount of this type of data now exists. However, digital recorders (predominately magnetic tape) will soon be in service to permit recording eight-channel data in volume and in a form compatible with high-speed digital computers. Since the equation for calculating a structural load is different for each point on the aircraft, the computing technique should be capable of calculating the structural loads from the recorded and derived parameters for any specific load spectrum without having to reprocess all the recorded data.

Maneuver Model Concept

Unique to the maneuver model technique is the individual treatment of the flight loads data for each maneuver type. This technique is based on the belief that each maneuver of a given type will have the same sequence of loads on a particular component of the aircraft structure, the only difference among the maneuvers being the amplitude and the duration of the loads. Therefore, through some suitable method of normalizing the amplitude and the time of the loads, all maneuvers of the same type would have the same time history of maneuver loads.

With this basic concept of the maneuver model, two general procedures would be followed to achieve the study objective: (1) a normalization procedure to develop the maneuver model, and (2) a denormalization procedure to apply the maneuver model. In the first procedure, the maneuver model would be formed after establishing the normalizing definitions. Then after selecting critical time slices and denormalizing the normalized data, the second procedure would apply the maneuver model to calculate the aircraft loads.

Figure 1-a illustrates the steps for the normalization procedure leading to the development of the maneuver model. These steps are as follows:

(1) Separate the recorded eight-channel data into maneuver types.

(2) Normalize in time and amplitude each parameter trace in all maneuvers of each type.

(3) For each maneuver type, combine all normalized parameter traces to form an average normalized parameter time history and to determine the distributions about the average trace at selected time slices.

The normalized data resulting from step 3 comprises the maneuver model. Since the normalization of the parameter amplitudes is intended to make the data independent of the aircraft type, the maneuver model is directly applicable to structural design criteria.

Figure 1-b illustrates the steps for the denormalization procedure to adapt and then apply the maneuver model to calculate, or predict, the fatigue load spectra for a specific structural member in a particular aircraft type. As noted in this figure, the application of the maneuver model requires denormalizing the normalized parameter data. To effect the

denormalizing, however, normalization factor distributions similar to those obtained in forming the maneuver model must be estimated for the particular airplane. The steps in Figure 1-b are as follows:

(1) On the basis of the intended service life and mission mix of the airplane, estimate the total number of maneuvers of each type to be performed during the airplane life.

(2) For each maneuver type, estimate the number of maneuvers in each flight condition (combination of variables such as airspeed, altitude, and weight). The flight condition will determine the coefficients for the loads equations.

(3) For each maneuver type and flight condition, estimate the normalizing factor distributions for each parameter. Available eight-channel flight data on similar types of airplanes will facilitate this estimation.

(4) For each flight condition, calculate the coefficients for the loads equations.

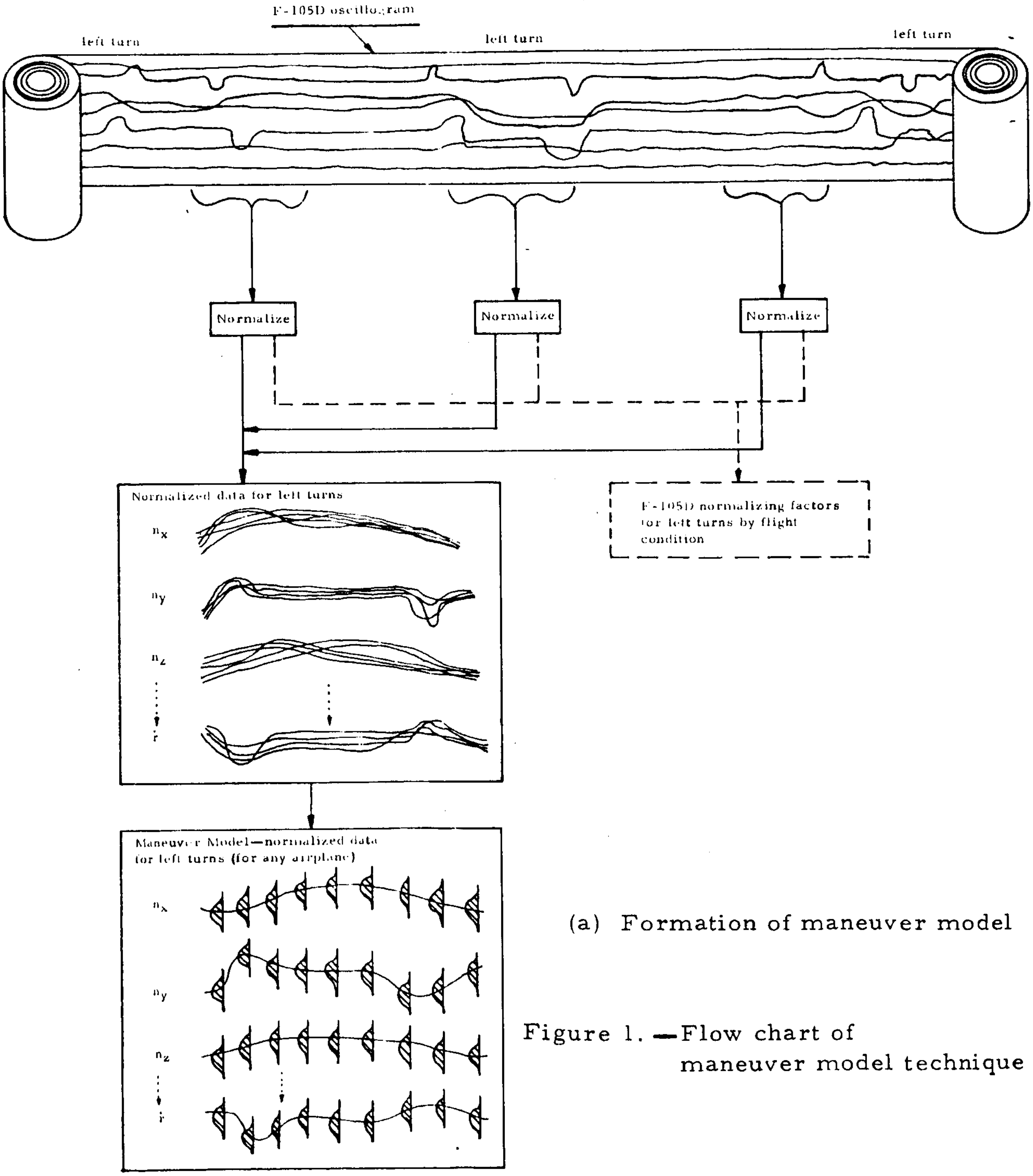
(5) For each maneuver type and flight condition, denormalize the average normalized parameter time histories and calculate an average load time history. Using a suitable peak criteria, locate the peaks, or critical times, on the average load time history. All maneuvers of each maneuver type are assumed to have load peaks only at these critical times.

(6) For each maneuver type, each flight condition, and each load peak time, denormalize each parameter distribution and calculate the probability that the load was above each load level.

(7) From the number of maneuvers in each maneuver type and flight condition combination and from the load probabilities found in step 6, calculate the distribution of the load peak values.

As resulting from step 7, the composite of the load peak distributions for all maneuver types constitutes the maneuver-induced fatigue load spectra.

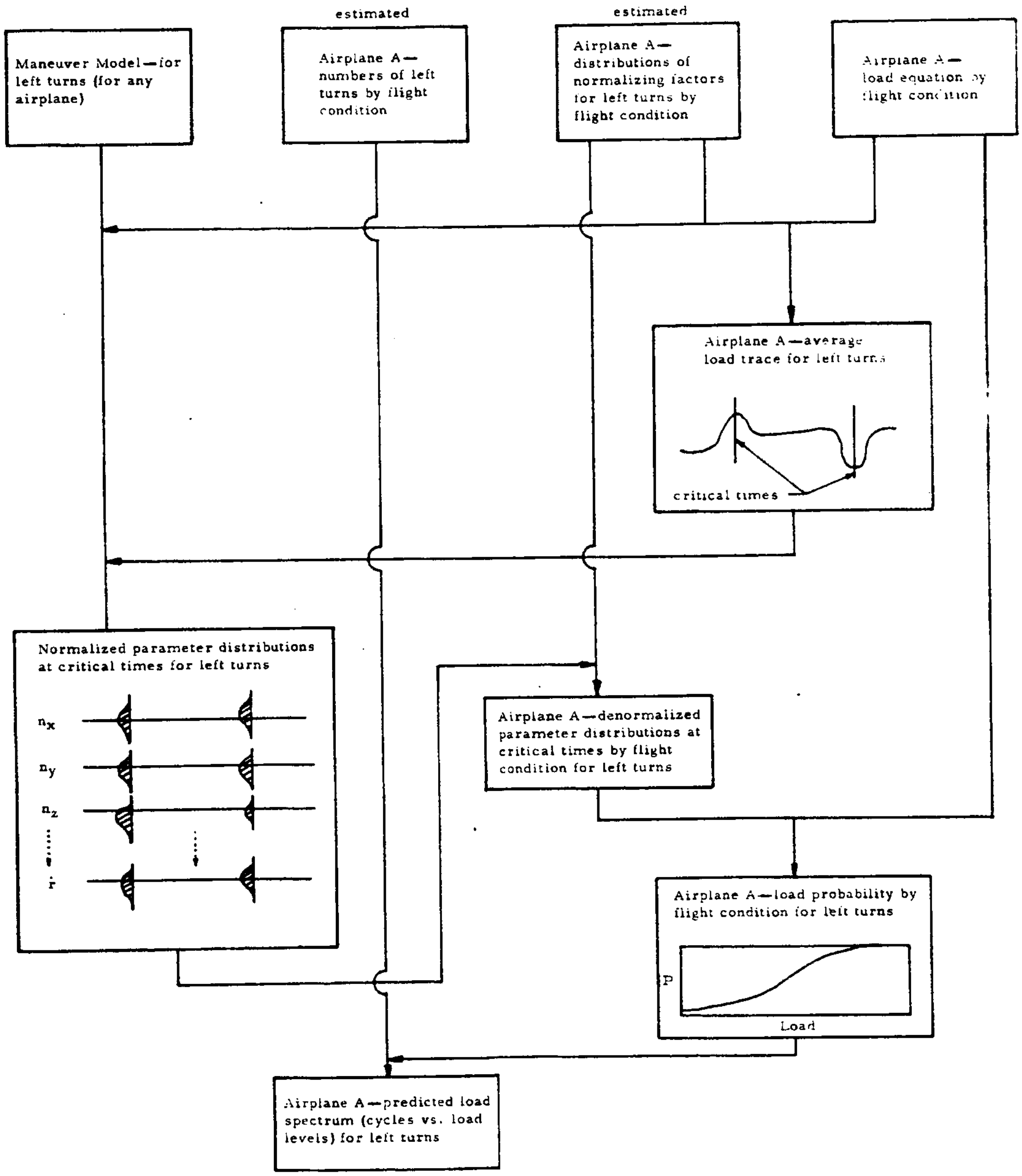
In this feasibility study, the F-105D data was used to form the maneuver model. Then because the normalized data in this model was presumed to be independent of the aircraft type, the model could have been used with the normalizing factors and loads equations for any aircraft type to predict the loads for such an aircraft. However, since the F-105D data was still the only available eight-channel data, the maneuver model was used with the F-105D normalizing factor distributions and loads



(a) Formation of maneuver model

Figure 1. —Flow chart of maneuver model technique

equations to predict the F-105D loads. Moreover, the comparison of the predicted F-105D loads based on the maneuver model with the observed loads derived from the F-105D data provided the means of evaluating the validity of the maneuver model.



(b) Application of maneuver model

Figure 1.—Flow chart of maneuver model technique (concluded)

Limitations of the Maneuver Model

The present maneuver model is limited to conventional fixed-wing aircraft types until its applicability to other aircraft types may be determined by analyzing the recorded data from these other aircraft. Other possible limitations stem from two simplifying assumptions: (1) the independence of the normalized parameters at each selected normalized time and the normalizing factors, and (2) the insignificance of structural elasticity effects on the loads resulting from maneuvers.

Limitations of Other Methods to Calculate Structural Loads

References 2 through 5 present three other methods of calculating maneuver loads on structural components from recorded flight data. Each of these methods requires statistical techniques because of the huge data sample and the variation in the sample due to the uncontrollable effects of different pilot techniques, atmospheric turbulence, geographic topology, and weather conditions.

The method given in References 2 and 3 utilizes discrete samples of the parameters (usually the parameter peak values). This method has some serious limitations, two of which are described below:

The first shortcoming of this method lies in its inability to yield the number of load cycles. Two variables essential to a fatigue load spectrum are the number of load cycles and the magnitude of the peaks in these cycles. Although this method can calculate a probability of exceeding given structural loads in a given number of flights from the recorded and derived parameters, it cannot determine the number of load cycles from them. Knowing the number of recorded parameter peaks does not suffice since the number of peak loads on some of the aircraft structural components does not necessarily correlate with it. For example, since vertical tail loads can be considered basically a function of the lateral load factor n_y and the yaw angular acceleration $\dot{r}$, it would seem reasonable to correlate the number of vertical tail load peaks with the number of peaks of each of these parameters. However, Figure 2, a time history for part of a left turn, shows an instance where n_y and $\dot{r}$ peak at slightly different times with only a single corresponding vertical tail load peak. In other instances, a single vertical tail load peak still appears when only one of the n_y and $\dot{r}$ parameters peaks. Consequently, the total number of vertical tail load peaks is probably more than the total number of either the n_y or $\dot{r}$ peaks but less than the sum of the totals.

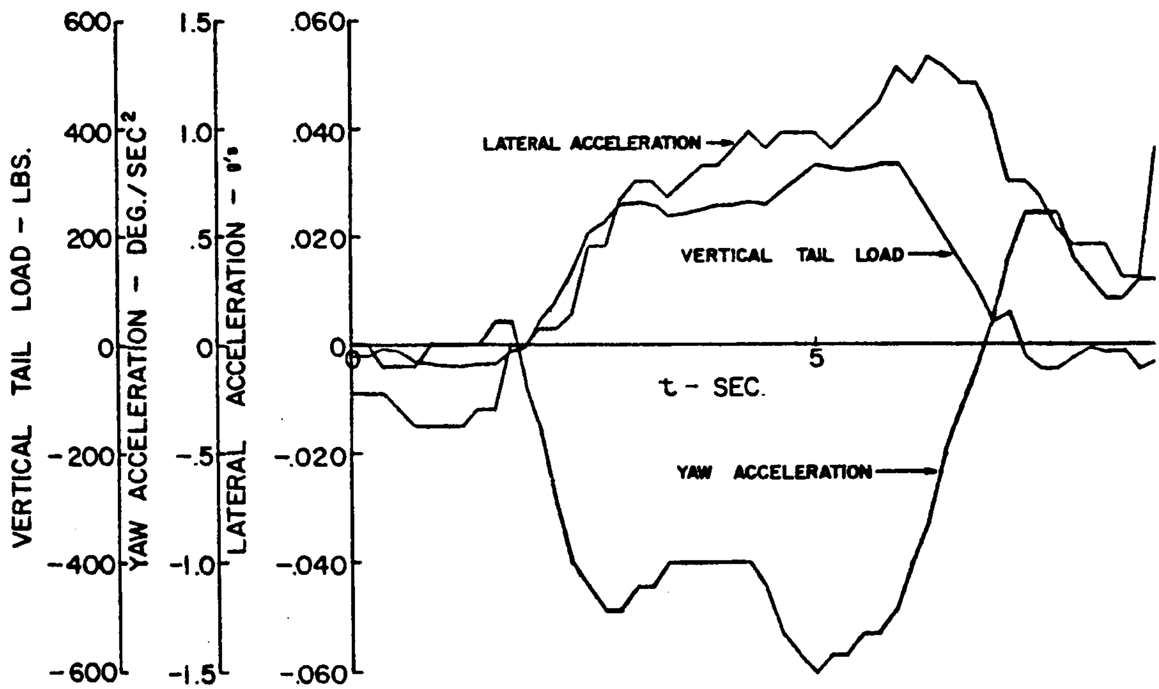


Figure 2. —Sample time histories of tail load, yaw acceleration, and lateral acceleration

The second shortcoming of this method derives from the inherent assumption, not always true, that a peak load occurs when one of the basic parameters peaks since the method samples all parameters only at the instant that one of them peaks. However, as shown in Figure 2, the calculated vertical tail load peak occurs between the n_y and $\dot{r}$ peaks. During the processing of the data, the n_y and $\dot{r}$ values corresponding to the vertical tail load peaks are discarded unless the load peak occurs simultaneously with a parameter peak. Thus the magnitude of loads derived from the processed data is not necessarily correct.

References 4 and 5 present, respectively, the Monte Carlo and power spectral analysis techniques to calculate the maneuver loads. The shortcoming of these techniques is due to their random selection of measured or calculated parameter values to calculate the loads. Since a pilot performs a maneuver to change the aircraft attitude or to meet his various mission requirements, like maneuvers will often be repeated in succession. With such controlled operation the resultant parameter peaks are certainly not random with respect to time.

The shortcomings of these other methods led to the concept of the maneuver model technique with its unique individual treatment of maneuver types to provide a more reasonable method of calculating maneuver loads on aircraft structural components.

Preliminary Feasibility Study of the Maneuver Model Technique

As reported in Reference 6, a preliminary feasibility study of the maneuver model technique was conducted under Contract NASw-970. After the F-105D eight-channel data were processed for a single maneuver type, the technique was used to calculate the loads on the wing, the horizontal tail, and the vertical tail. Then these predicted loads were compared with the observed loads derived from the time histories of the recorded parameters. The favorable results led to the larger scale feasibility program reported here.

SYMBOLS

A/C	aircraft
A_i	correction constant for the ith normalized time slice
a_x	longitudinal acceleration, feet/second^2—positive forward
a_y	lateral acceleration, feet/second^2—positive right
a_z	normal acceleration, feet/second^2—positive up
b	wing span, feet
$\bar{c}$	mean aerodynamic chord, feet
c. g.	center of gravity
C_i	coefficients of the loads equations
C_{L_α}	lift coefficient per degree of α
$C_{L_{i_T}}$	lift coefficient per degree of i_T
$C_{L_{oWB}}$	lift coefficient on the wing and fuselage at $\alpha = 0$
C_{ℓ_β}	rolling moment coefficient per degree of β
$C_{\ell_{\delta_A}}$	rolling moment coefficient per degree of δ_A
$C_{\ell_{\delta_R}}$	rolling moment coefficient per degree of δ_R
$C_{\ell_{\delta_S}}$	rolling moment coefficient due to δ_S per degree of δ_A

C_{ℓ_p}	rolling moment coefficient per radian of pb/2V
C_{ℓ_r}	rolling moment coefficient per radian of rb/2V
C_{m_α}	pitching moment coefficient per degree of α
$C_{m_{i_T}}$	pitching moment coefficient per degree of i_T
C_{m_q}	pitching moment coefficient per radian of $q\bar{c}/2V$
C_{m_o}	pitching moment coefficient at $\alpha = 0$
$C_{m_{o_{HT}}}$	horizontal tail pitching moment coefficient at $\alpha = 0$
C_{n_β}	yawing moment coefficient per degree of β
$C_{n_{\delta_A}}$	yawing moment coefficient per degree of δ_A
$C_{n_{\delta_R}}$	yawing moment coefficient per degree of δ_R
C_{n_p}	yawing moment coefficient per radian of pb/2V
C_{n_r}	yawing moment coefficient per radian of rb/2V
C_{y_β}	side force coefficient per degree of β
$C_{y_{\beta_{VT}}}$	vertical tail side force coefficient per degree of β
$C_{y_{\delta_A}}$	side force coefficient per degree of δ_A
$C_{y_{\delta_R}}$	side force coefficient per degree of δ_R
C_{y_r}	side force coefficient per radian of rb/2V
D/S	degrees/second
D/S/S	degrees/second^2
e'_α	fraction of α at horizontal tail α
g	gravitational constant, feet/second^2
i_T	horizontal tail incidence, degrees
I_x	moment of inertia about the x-axis, slug-feet^2

I_y	moment of inertia about the y-axis, slug-feet^2
I_z	moment of inertia about the z-axis, slug-feet^2
I_{xz}	product of inertia, slug-feet^2
n_x, N_x, NX	longitudinal load factor (a_x/g)
n_y, N_y, NY	lateral load factor (a_y/g)
n_z, N_z, NZ	normal load factor ($a_z/g + 1.0$)
Δn_z, DNZ	incremental normal load factor ($n_z - 1.0$)
p, P	angular roll rate, degrees/second—positive right wing down
$\dot{p}$, PDOT	angular roll acceleration, degrees/second^2
P_a	static pressure, inches of mercury
P_d	dynamic pressure, inches of mercury
Pr[ ]	probability of indicated event
q, Q	angular pitch rate, degrees/second—positive nose up
$\dot{q}$, QDOT	angular pitch acceleration, degrees/second^2
r, R	angular yaw rate, degrees/second—positive nose right
$\dot{r}$, RDOT	angular yaw acceleration, degrees/second^2
S	wing area, feet^2
t	time, seconds
t_i	ith normalized time slice
V	true airspeed, feet/second
V_e	equivalent airspeed, knots
V_F	fuselage shear load, pounds—positive up
ΔV_F	maneuver fuselage shear load ($V_F - V_{F(n_z = 1)}$), pounds

V_{HT}	horizontal tail shear load, pounds—positive up
ΔV_{HT}	maneuver horizontal tail shear load (V_{HT} - $V_{HT_{(n_z = 1)}}$), pounds
V_{VT}	vertical tail shear lead, pounds—positive right
ΔV_{VT}	maneuver vertical tail shear load (V_{VT} - $V_{VT_{(n_z = 1)}}$), pounds
V_W	wing shear load, pounds—positive up
ΔV_W	maneuver wing shear load (V_W - $V_{W_{(n_z = 1)}}$), pounds
W	aircraft instantaneous weight, pounds
W_6	weight on right outboard wing pylon, pounds
x	longitudinal coordinate—positive forward
$\bar{x}$	average of the j peak normalized parameter values
x_i	normalized parameter value at ith normalized time slice
$(x_i)_c$	corrected normalized parameter value at ith normalized time slice
$\bar{x}_i$	average normalized parameter value at ith normalized time slice
x_j	peak normalized parameter value for the jth maneuver
y	lateral coordinate—positive right
z	normal coordinate—positive down
α	angle of attack, degrees—positive nose up
β	angle of sideslip, degrees—positive nose right
δ_A	aileron deflection, degrees—positive right aileron up
δ_R	rudder deflection, degrees—positive left
δ_S	spoiler deflection, degrees—positive right spoiler up
ρ	local atmospheric density, slugs/foot^3

ρ_o standard sea level atmospheric density, slugs/foot^3

σ density ratio (ρ/ρ_o)

Subscripts

c this symbol indicates corrected values in normalized data

i, j dummy indices

$(n_z = 1)$ this symbol indicates level flight values for loads

P this symbol indicates approximate expressions for loads with second-order terms eliminated

SECTION I

PROCEDURES

A. Type and Source of Data Used

Eight-channel data collected with oscillograph recorders in F-105D aircraft were chosen to demonstrate the application of the maneuver model techniques. These data represent 450 hours of the normal peacetime flight of F-105D's operated from the following bases: Bitburg Air Base, Germany, Wheelus Air Base, Libya; Kadena Air Base, Okinawa; and Nellis Air Force Base, Nevada. Of this data, 250 hours were previously reduced and reported in Reference 7.

The recording system included the following sensors: three strain gage accelerometers, each mounted at the airplane's center of gravity and aligned with one of the three major axes of the airplane, to measure the normal (vertical), lateral, and longitudinal acceleration; three potentiometer rate gyros, each aligned with one of the three major axes of the aircraft, to measure the angular rates around these axes, that is, pitch, roll, and yaw; and two pressure transducers, connected to the airplane's pitot-static system, to measure the static and the dynamic pressure. According to the manufacturers of these instruments, the accuracies for the accelerometers and the pressure transducers were ± 1 percent of full scale, and those for the angular rate gyros were ± 3 percent of full scale. Only flight data were recorded since the oscillograph was not turned on until after takeoff when the landing gear was retracted and turned off before landing when the landing gear was extended.

B. Calculations and Definitions

1. Parameters and variables. —To facilitate the descriptions given in this report, the terms "parameters" and "flight condition variables" are defined as follows: "parameters" denotes the airplane motion variables n_x, n_y, n_z, p, q, r, $\dot{p}$, $\dot{q}$, and $\dot{r}$. And "flight condition variables" designates any or all of the variables defining a given set of loads equations; some of the flight condition variables are weight, moments of inertia, airspeed, altitude, Mach number, stores configuration, and fuel weight. The term "flight condition" is used to identify any grouping of flight condition variable values into the complete set required to define the loads equation coefficients.

All flights were categorized by five mission types, as listed in Table 2; and each flight was divided into mission segments, according to the fourteen classifications given in Table 3. The flights were also categorized according to the arrangement of the fuel tanks and the stores on the outboard wing pylons. For this purpose, one configuration for the external fuel tanks and centerline stores and a second for the stores on the outboard pylon were arbitrarily chosen. Table 4 defines these store configurations and gives the identifying codes for them.

TABLE 2

F-105D MISSION TYPES

(1) Special Weapons Delivery

(2) Conventional Bombing and Ground Gunnery

(3) Air-to-Air Gunnery

(4) Air Tactics and Test Flights

(5) Instruments and Navigation

TABLE 3

F-105D MISSION SEGMENT TYPES

(1)	Ascent	(8)	Rockets
(2)	Cruise-out	(9)	Air-to-Air Gunnery
(3)	Loiter	(10)	Air-to-Ground Gunnery
(4)	Low-Angle Bombing	(11)	Refueling
(5)	High-Angle Bombing	(12)	Training
(6)	GAM Delivery	(13)	Clean Cruise
(7)	Special Weapons Delivery	(14)	Descent

Aircraft gross weight at liftoff, when the recorder was turned on, and just before landing, when the recorder was turned off, was based on the flight-line-departure and flight-line-return fuels logged by the field technicians. For the liftoff weight, 2300 pounds was subtracted from the flight-line-departure weight to adjust for the fuel burned during start-up, taxi, and takeoff. And for the "touchdown" weight, 400 pounds was added to the flight-line-return weight to account for the fuel consumed during landing, taxiing, and parking. With the fuel consumption rate during flight assumed constant, a rate of fuel-weight loss was then computed to find the instantaneous gross weight of the aircraft. When external stores were dropped or the aircraft was refueled in flight, the weight was adjusted accordingly.

As supplied by Reference 8, the moments of inertia for a single configuration and a specific gross weight served as base values. As the stores configuration and the fuel weight varied from the base configuration and weight, estimated increments were added to or subtracted from the base moments of inertia. The sequence of fuel tank usage in each flight was assumed to be that recommended in Reference 9. Whenever external stores were dropped in flight, the moments of inertia were modified to the new configuration.

After the oscillogram trace displacements were digitized, they were converted by linear calibration slopes to the corresponding physical units, that is, units of g's, degrees per second, inches of mercury, and minutes. Calibration pulses recorded prior to each flight provided the means of adjusting the appropriate calibration slopes.

The 1959 Standard Atmosphere tables were used to derive the indicated pressure altitude, calibrated airspeed, and indicated Mach number from the dynamic and the static pressure. Then the conversion tables in Reference 10 along with the corrections for the pitot-static position error in Reference 9 were used to convert these parameters to pressure altitude, equivalent airspeed, and true Mach number.

From each of the three angular rate traces of p, q, and r, the corresponding angular accelerations of $\dot{p}$, $\dot{q}$, or $\dot{r}$ were derived by taking the time derivative of the mid-point of the parabola formed through each set of three consecutive readings, where the first reading in each set was the second in the preceding set. In other words, at time t = 2,

$$\dot{p}_2 = \frac{p_3 - p_1}{t_3 - t_1}$$

TABLE 4

STORE CONFIGURATION CODES

External Fuel Tank and ℄ Store Configuration

Code	
1	clean—no auxiliary tanks or ℄ stores
2	BDU on ℄ only
3	bomb-bay tank only
4	bomb-bay tank and 450-gal. tank on each inboard pylon
5	450-gal. tank on each inboard pylon
6	BDU on ℄ and 450-gal. tank on each inboard pylon
7	bomb-bay tank, 650-gal. tank on ℄ pylon and 450-gal. tank on each inboard pylon
8	BDU, 650-gal. tank on ℄ pylon and 450-gal. tank on each inboard pylon
9	multiple stores ejector in bomb bay and 450-gal. tank on each inboard pylon

N.B.: BDU refers to any store of about 2000 lb.

Outboard Pylon Store Configuration

Code	Left Outboard Pylon	Right Outboard Pylon
1	none to 150 lb.	none
2	150 to 500 lb.	50 to 150 lb.
3	none to 150 lb.	50 to 150 lb.
4	150 to 500 lb.	150 to 500 lb.
5	above 500 lb.	none
6	none to 150 lb.	150 to 500 lb.
7	none to 150 lb.	above 500 lb.
8	above 500 lb.	above 500 lb.

2. Loads equations. —To calculate load values from the measured eight-channel data at 1/5-second intervals, a set of loads equations were developed and thresholds for the load peaks were defined. Hereafter the calculated load values are referred to as "observed loads." Appendix F explains the development of the loads equations and gives the observed load peak definitions.

3. Maneuver types. —To distinguish types in recorded data requires identifying the characteristics of each as discussed in the time histories of the parameters. In the study of the F-105D data to evolve distinguishable maneuver types, the criterion was the manner in which the airspeed and altitude traces increased or decreased and the other traces deflected from their normal positions during straight and level flight. As a result, twenty-three maneuver types were judged distinct and identifiable as listed in Table 5.

TABLE 5

F-105D MANEUVER TYPES

(1) Descending left turn	(13) Longitudinal acceleration
(2) Level left turn	(14) Left yaw
(3) Ascending left turn	(15) Right yaw
(4) Descending right turn	(16) Left wing rock
(5) Level right turn	(17) Right wing rock
(6) Ascending right turn	(18) Left cloverleaf
(7) Symmetrical pull-up	(19) Right cloverleaf
(8) Right rolling pull-up	(20) Symmetrical pitch-down
(9) Left rolling pull-up	(21) Inside loop
(10) Right roll	(22) --- (23) ---
(11) Left roll	(24) Left four-point roll
(12) Longitudinal deceleration	(25) Right four-point roll

The absence of maneuver types for Nos. 22 and 23 is explained as follows: Since the evolvement of the maneuver types was concurrent with the development of the computer program, an optimistic twenty-five numbers were allocated to ensure the inclusion of all maneuver types discerned. When the two four-point roll maneuvers were established, they were judged sufficiently different from the others then determined to be numbered last. Then after all maneuver types were established, they were not renumbered to Nos. 22 and 23 because of the effort required to change the computer program and the data already so identified. Appendix B describes and illustrates the maneuver types at length.

4. Normalization procedure to develop maneuver model. —

a. Normalization definitions: A set of criteria was arbitrarily established to normalize the data for each maneuver type. This normalizing was intended so that the time histories of the parameters for each maneuver type could be described independently of the airplane type, the magnitude of the parameter deflections, and the abruptness of the maneuver. To normalize the time of each maneuver, two easily recognized anchor points were chosen as outlined in Table 6 and were assigned two normalized time values. Then, on the basis of these two anchor points, the original time scale was linearly transformed into the normalized time scale. Next the amplitude of each parameter trace in each maneuver was normalized independently by dividing each reading by the maximum deflection of the trace. (Note that in normalizing the n_z trace, the normalized data and maximum deflection were calculated from the incremental normal load factor Δn_z.) These maximum deflections are the "normalizing factors" referred to in the introduction and henceforth will be called "maximum absolute parameter values." These maximum absolute parameter values were stored for each maneuver. At the end of the data processing, the maximum absolute parameter values formed a set of nine maximum absolute parameter distributions for each maneuver type.

TABLE 6

TIME-NORMALIZING CRITERIA

	First Anchor Point		Second Anchor Point	
Man. Type	Description	Normalized Time	Description	Normalized Time
1-3	min. p prior to max. n_z	0.1	max. p in last .4 of maneuver	0.9
4-6	max. p prior to max. n_z	0.1	min. p in last .4 of maneuver	0.9

TABLE 6. —Continued

TIME-NORMALIZING CRITERIA

Man. Type	First Anchor Point: Description	First Anchor Point: Normalized Time	Second Anchor Point: Description	Second Anchor Point: Normalized Time
7	max. q at or prior to max. n_z	0.2	(max. Δn_z)/2 after max n_z	0.45
8	max. q at or prior to max. n_z	0.1	min. p in last .3 of maneuver	0.9
9	max. q at or prior to max. n_z	0.1	max. p in last 3 of maneuver	0.9
10	(max. p)/2 before .6 of maneuver and before max. p	0.2	(max. p)/2 after .5 of maneuver and after max. p	0.75
11	(min. p)/2 before .6 of maneuver and before min. p	0.2	(min. p)/2 after .5 of maneuver and after min. p	0.75
12	first n_x decrease of .015 or greater in first .4 of maneuver	0.1	first n_x increase of .035 or greater after min. n_x in last .5 of maneuver	0.75
13	max. n_x in first .15 of maneuver within 3 readings of first n_x increase of 100% or greater	0.05	min. n_x in last .4 of maneuver within 3 readings of first n_x decrease of 75% or greater	0.95
14	first relative min. r in first .5 of maneuver	0.15	first relative max. r following first anchor point in first .75 of maneuver	0.4
15	first relative max. r in first .5 of maneuver	0.15	first relative min. r following first anchor point in first .75 of maneuver	0.4
16	first relative min. p with a value below -15°/sec in first 35 readings of maneuver	0.15	first relative max. p following first anchor point with a value above +15°/sec.	0.4
17	first relative max. p with a value above +15°/sec in first 35 readings of maneuver	0.15	first relative min. p following first anchor point with a value below -15°/sec	0.4
18	min. p in first .15 of maneuver	0.05	max. n_z in last .5 of maneuver	0.85
19	max. p in first .15 of maneuver	0.05	max. n_z in last .5 of maneuver	0.85
20	min. q in first .5 of maneuver	0.3	(min. Δn_z)/2 after min. n_z	0.7
21	max. n_z in first .5 of maneuver	0.3	max. n_z in last .5 of maneuver	0.8
24	first relative min. p with a value below -25°/sec in the first .5 of maneuver	0.15	fourth relative min. p with a value below -25°/sec and separated from first anchor point by three relative max. p's—each at least 20% greater than its preceding minimum	0.65
25	first relative max. p with a value above +25°/sec in the first .5 of maneuver	0.15	fourth relative max. p with a value above +25°/sec and separated from first anchor point by three relative min. p's—each at least 20% less than its preceding maximum	0.65

Each maneuver type has a definite, uniform pattern of parameter deflections which reflect the change in aircraft controls to effect the desired maneuver. In the midst of this pattern, however, are some random low-magnitude deflections caused by atmospheric turbulence and inadvertent control changes. Whenever all parameter deflections in a maneuver are so low that the random low-magnitude deflections appear significant, the normalizing of that maneuver would yield meaningless normalized data. The following thresholds, therefore, were established to determine whether the parameters defining the characteristic pattern of a maneuver type were sufficiently large to warrant normalizing the maneuver.

Maneuver Type	Thresholds	
Turns (Types 1, 2, 3, 4, 5, 6, 18, and 19)	$n_z \leqq 2.0$ g $-5 \leqq r \leqq 5^\circ$/sec	$-.1 \leqq n_y \leqq .1$ g $-30 \leqq p \leqq 30^\circ$/sec
Pull-ups (Types 7, 8, 9, and 21)	$n_z \leqq 3.0$ g	
Rolls (Types 10, 11, 16, 17, 24, and 25)	$n_z \leqq 2.0$ g	$-30 \leqq p \leqq 30^\circ$/sec
Accel. and Decel. (Types 12 and 13)	$-.2 \leqq n_x \leqq .2$ g	
Yaws (Types 14 and 15)	$-5 \leqq r \leqq 5^\circ$/sec	$-.1 \leqq n_y \leqq .1$ g
Pitch-down (Type 20)	no threshold	

After the maneuvers of Types 1 through 7 and 10 through 19 had been normalized in some 200 hours of data to yield an adequate statistical sample of these types, no more like maneuvers were normalized.

The normalized parameter distributions should be formed at normalized times corresponding to the maximum and minimum loads. But since these loads depend on the aircraft configuration, the structural point of interest, and the relative magnitude of several parameters, the normalized times of their occurrence cannot be determined in advance. Therefore, to provide normalized parameter distributions at sufficient times to permit correlating them later with the time of any load, the normalized parameter distributions at several normalized time slices were formed. A preliminary review of the number and duration of the load peaks in the F-105D data indicated that twenty-five normalized time slices located near expected load peak times would suffice.

b. <u>Formation of maneuver model</u>: The statistical model to predict maneuver loads categorizes maneuvers according to 23 types. As explained in the previous section, the maneuvers of each type found in the sample of F-105D eight-channel data were normalized both in time and in amplitude. Then for each of 25 normalized time slices, the normalized data for each of the nine parameters were stored in frequency tables. Similarly, the maximum absolute values of each parameter for each maneuver were stored in frequency tables along with the associated maneuver type and flight condition.

The selection of a flight condition and maneuver type determined the exact maximum absolute parameter frequency distributions needed for loads predictions. These frequency distributions were converted into probability distributions by dividing each frequency by the number of maneuvers in the data sample of the given flight condition and maneuver type. Then later this same number of maneuvers was used in the process of converting the probabilities of loads into predicted load frequencies. Similarly, the frequencies stored in the normalized parameter data tables were converted into probabilities by dividing by the number of maneuvers which were normalized for the maneuver type.

The normalized data consists of (1) a set of average normalized time histories of the nine aircraft parameters (n_x, n_y, n_z, p, q, r, $\dot{p}$, $\dot{q}$, and $\dot{r}$) for each maneuver type, and (2) a description of how the normalized parameter values would be expected to vary from the average at each of the 25 normalized time slices. An average normalized parameter trace was the time history formed by 25 values, each equal to the mean of the distributions of the normalized parameter values at one of the 25 normalized time slices. For each maneuver type, nine average normalized parameter time histories (one for each parameter) were formed. Maximum positive and maximum negative values of an average normalized parameter time history are the maximum and minimum of the 25 means, respectively.

Each time an individual maneuver was normalized, it contributed a single frequency count to each of the 25 normalized distributions at the 25 normalized time slices for each of the nine parameters. The normalizing procedure was designed to align all peaks of each parameter and the time slices were chosen so that some of the normalized parameter distributions would be oriented as close as possible to all peaks. However, because of the variation inherent in the data, not all parameter traces peaked precisely at a chosen time slice. Consequently, the maximum average normalized parameter value was the mean of a distribution where not all values were peaks. Obviously, such a maximum average normalized parameter value would have been higher if all parameter traces had peaked at that time slice.

The nine average normalized parameter time histories for each maneuver type were used to calculate an average load time history for that maneuver type. Then, all load peaks were assumed to occur at the same normalized times as those in the average load time history. In reality, however, it would be expected that the individual load peaks would be misaligned in the normalized time scale as much as the normalized parameter peaks were misaligned. Thus the load distributions calculated at the normalized time slice corresponding to the average load time history peaks would be an underestimation of the true load peak distribution by an amount proportional to the underestimation of the pertinent maximum average normalized parameter values. To compensate for this, each parameter distribution at each of the 25 normalized time slices was adjusted.

The procedure for adjusting the normalized parameter values is illustrated by the exaggerated example in Figure 3. This figure shows the superimposed normalized traces of the same parameter recorded in three maneuvers and four of the normalized time slices. Each trace has a normalized peak value $\hat{x}_j$. Each normalized time slice t_i has an average normalized parameter value $\bar{x}_i$ which is the mean of the distribution of the three x_i values at that time slice. The maximum average normalized parameter value is $\bar{x}_2$. The adjustment procedure was designed to correct this maximum average value to the average $\bar{\hat{x}}$ of the j individual normalized trace peak values defined by

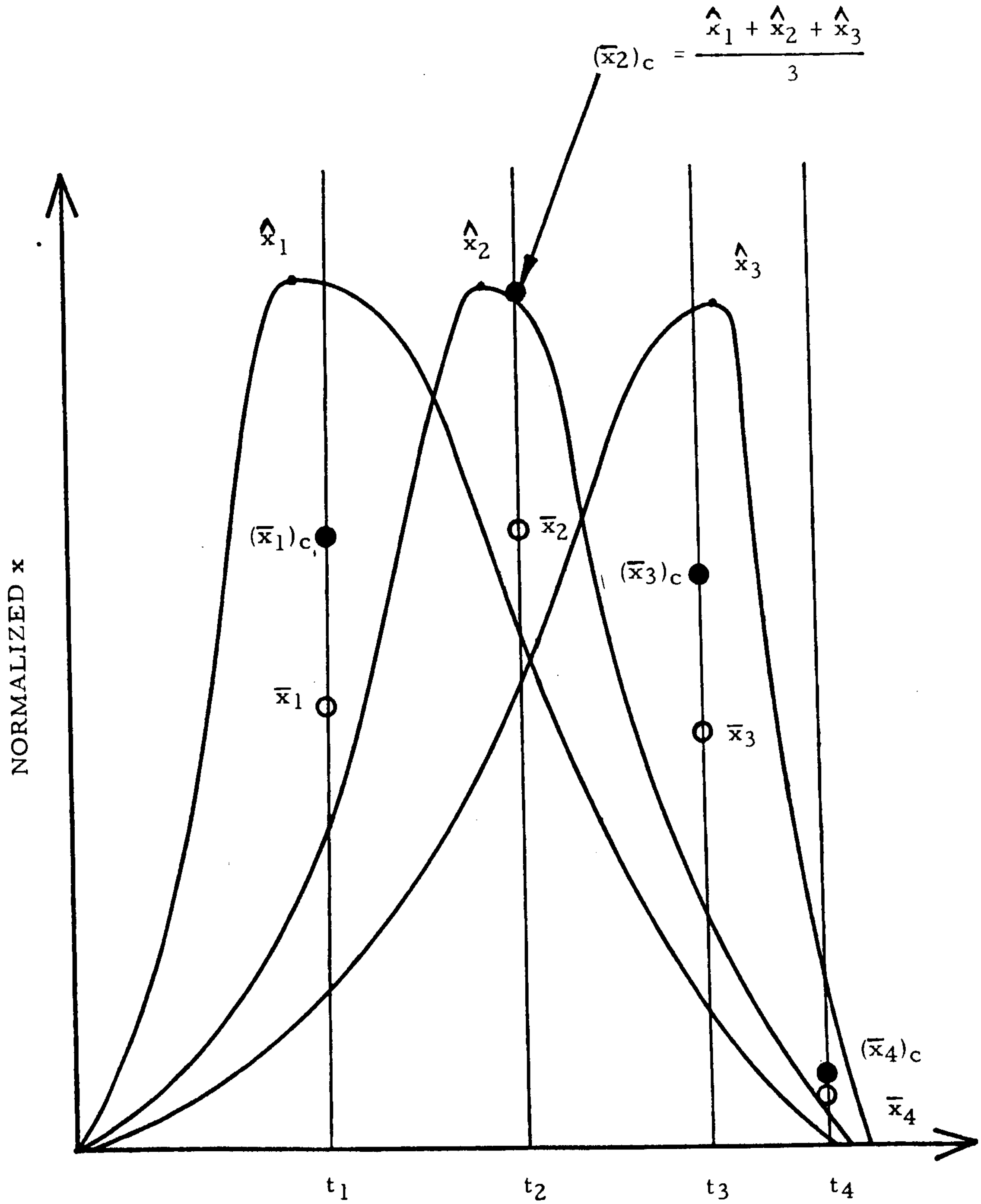
$$\bar{\hat{x}} = \frac{\Sigma \hat{x}_j}{n} = \frac{\hat{x}_1 + \hat{x}_2 + \hat{x}_3}{3}$$

where

$j = 1, 2, \ldots n$
$n = 3$ = number of normalized maneuvers

A positive correction constant A_2 at normalized time slice t_2 (where the maximum average normalized parameter value occurred) was calculated as follows:

$$A_2 = \bar{\hat{x}} - \bar{x}_2 = \left(\frac{\Sigma \hat{x}_j}{n} - \bar{x}_2\right)$$



NORMALIZED t

Figure 3. —Three exaggerated normalized traces of the same parameter to illustrate correction for underestimated load peak distributions

And correction constants A_i for the other normalized time slices t_i (with positive average normalized parameter values) were defined by

$$A_i = \frac{\overline{x}_i}{\overline{x}_2}\left(\frac{\Sigma \hat{x}_j}{n} - \overline{x}_2\right) = \frac{\overline{x}_i}{\overline{x}_2} A_2$$

Then every element x_i of the normalized parameter distribution at the normalized time slices t_i was corrected by adding the correction constant A_i as follows:

$$(x_i)_c = x_i + A_i$$

where

$(x_i)_c$ = element of corrected distribution.

Negative correction constants defined for each normalized time slice t_i where the average normalized parameter value $\overline{x}_i$ was negative were calculated in the same manner except the $\hat{x}_j$ peaks were the minimums of the individual normalized parameter traces and the t_2 normalized time slice corresponded to the minimum average normalized parameter value $\overline{x}_2$.

5. Denormalization procedure to apply maneuver model. —

a. Selection of critical time slices (load peaks): For each parameter in a given maneuver type, an average denormalized time history of the parameter was calculated by finding at each of the 25 time slices the average corrected normalized parameter value from the corrected normalized distribution. Then the average value from the maximum absolute parameter distribution was formed. The product of these two averages gave the average denormalized value of a parameter at each time slice. These average parameter values at each of the 25 time slices were used in the loads equations given in Appendix A to compute the average load time history for each load type.

The coefficients in the loads equations are functions of the flight condition variables. The value assigned to a given flight condition variable was found by calculating a weighted average of the mid-values in 20 ranges of that flight condition variable. The weight used for each mid-value was the number of maneuvers which fell in the corresponding range of the variable.

The calculated average load time histories for each maneuver type were delta loads. The steady load values were constant for each flight condition because they are independent of any parameter variations. The average delta load time histories were necessary to define the predicted load peak criteria since the observed load peak criteria were based on delta load time histories. Throughout the load prediction calculations, the delta load peak distributions were predicted and the corresponding ranges of steady loads were carried along.

Since it was assumed that the average load history describes the load history of all maneuvers of this type, all of the load distributions were predicted at normalized time slices which were peaks of this average load history. The choice of which normalized time slices and of the threshold values to be associated with the time slices was determined by the peak criteria placed on the observed peak loads.

Remembering the threshold values placed on observed peak loads, criteria for choosing the critical normalized times of predicted peak loads from the average load trace were established as follows. First, every occurrence of a maneuver type was assumed to have a load trace with the shape (not the magnitude) of the average load trace. Thus, the first part of the observed peak criteria—the trace must have a rise and fall of 50 percent of the peak value or greater—could be applied to the average load trace because the shape of the trace was independent of the magnitude. Thus every point on the average load trace preceded by a rise of at least 50 percent of its value and followed by a fall of at least 50 percent of its value became a tentative positive load peak. (Tentative negative load peaks had the same criteria except for the sequence of a fall and then a rise.) The rest of the observed peak criteria—the peak value must be outside threshold and the amount of rise and fall must at least equal the threshold value—required that the magnitude of the load trace be known. The tentative peaks were divided into two groups: (1) tentative primary load peaks where the rise and fall of the trace were each equal to or greater than the peak value, and (2) tentative secondary load peaks where the rise or fall or both were less than the peak value but both were greater than 50 percent of the peak value. For the tentative primary load peaks, a threshold value was established which was equal to the observed load peak thresholds. Later during the load probability calculations, whenever a tentative primary load peak time slice had a predicted load frequency distribution with load values equal to or greater than this threshold value, it satisfied the peak criteria. For the tentative secondary peaks, a different threshold value was calculated so that when the peak value was equal to it, both the rise and fall of that peak were at least equal to the observed load peak threshold. The secondary load peak thresholds were at least equal to the observed load peak threshold and were often much greater. Again, whenever a tentative secondary load peak time slice had a predicted load frequency distribution with load values equal to or greater than its threshold, it satisfied the peak criteria. Thus, by assuming that each predicted load trace was identical in shape to the average load trace and by adjusting the load peak threshold for tentative secondary load peaks, the predicted load peak criteria were the same as the observed load peak criteria.

b. <u>Calculation of load peak distributions</u>: After the critical time slices for a given flight condition were selected, the data for each was processed separately. First, each corrected normalized parameter distribution was denormalized by multiplying it by the distribution of the maximum absolute parameter value. The denormalized distributions were found empirically by assuming the independence between each of the corrected normalized parameter distributions and the corresponding maximum absolute parameter distribution. As a result, the denormalized parameter probability distributions expressed the parameter magnitudes at each of the critical time slices in terms of the original units.

For a given maneuver type, the probability of a load peak occurring within a specified load range may be calculated by the combination of the denormalized peak parameter distributions as indicated by the loads equations. The following development illustrates the procedure for the calculation of a wing delta load. First, the wing delta load is defined as

$$\Delta V_{WP} = C_{15}(n_z - 1) + C_{17}p + C_{20}\dot{p} + C_{21}\dot{q}$$

Next the probability of a delta load falling in the range from A to B but not including B may be expressed as

$$Pr\,[A \leq \Delta V_{WP} < B] = Pr\,[A \leq C_{15}\,(n_z - 1) + C_{17}p + C_{20}\dot{p} + C_{21}\dot{q} < B]$$

Then since each denormalized parameter was distributed in 12 ranges and each predicted load in 20 ranges, the foregoing equation for ΔV_{WP} is solved for all 20,736 combinations of the mid-values of the four parameters in the load equation. Whenever a ΔV_{WP} is outside the threshold value, the product of the probabilities of the four parameters Δn_z, p, p, and $\dot{q}$ is calculated. Then the accumulation of these products in the delta load ranges gives the probability for each range. Next these probabilities are converted to a loads spectrum by multiplying the probabilities by the number of maneuvers in the flight condition. As this procedure is repeated for each critical time slice, the number of loads in each range is accumulated. Finally, since a flight condition defines a steady-state load value, the predicted delta loads for all the critical time slices are stored in a steady-state range as calculated by $\Delta V_{W(n_z = 1)} = C_{15} + C_{28}$.

C. Data Processing

As detailed in Appendix G, conventional methods were employed to reduce the F-105D eight-channel oscillograph data. This appendix also describes the computer programs to form the maneuver model and to predict the F-105D load distributions.

D. Computer Program for Maneuver Pattern Recognition

How practically the maneuver model technique can be used to predict the peak loads on the structural points of an aircraft depends largely on the degree to which all phases of the data collecting and processing can be automated. Soon to replace oscillograph recorders for large data samples, the magnetic tape recorders will markedly advance this automation. With such recorders adapted to write data on computer-compatible tapes, the manual aspects of data editing and reading will be eliminated. However, before the maneuver model technique can be applied in the computer processing of magnetic tape data, the computer must have the capability of identifying the maneuver types and of processing their data separately. Therefore, to determine the feasibility of automatically identifying maneuver types, the current research developed a computer program for maneuver pattern recognition.

This program was designed to process a tape with data simulating that recorded during flight. The data would consist of uncalibrated digitizations of the eight recorded parameters (n_x, n_y, n_z, p, q, r, airspeed, and altitude), each sampled about five times per second. Then the output of the program would be a chronological printout of the interesting parameter values in each maneuver followed by the beginning and ending times and the type of the maneuver. The maneuver pattern definitions used in developing the computer program and a simplified flow chart are included in Appendix D.

SECTION II

RESULTS

A. Normalized Data by Maneuver Type

For each of the 23 maneuver types observed in the F-105D data, average normalized time histories were prepared for the nine parameters: n_x, n_y, Δn_z, p, q, r, $\dot{p}$, $\dot{q}$, and $\dot{r}$. As discussed in Section I. B. 4. b, these time histories were adjusted to yield corrected average normalized parameter time histories. For each of the 23 maneuver types, Figure E-1 in Appendix E pairs the uncorrected and corrected plots for each of the nine normalized parameters.

The number of normalized parameter distributions about each of the average normalized values was too large (23 maneuver types x 9 parameters x 25 time slices = 5175) to permit inclusion in this report. To illustrate such distributions, however, Figure E-2 in Appendix E for the descending left turn maneuvers shows the corrected normalized distributions for the nine parameters at the four critical time slices. As seen here, the time slices had average load peaks as follows: the first (No. 5) in both the horizontal and the vertical tail load; the second (No. 12) in both the wing and the fuselage load; the third (No. 17) in the horizontal tail load, and the fourth (No. 19) in the vertical tail load.

Some statistical tests were made to ascertain whether certain normalized distributions could be combined. If these tests showed equality of most of the normalized parameter distributions between two or more maneuver types, the normalized data could be combined into a larger data sample, and such results would suggest also testing the maximum absolute parameter distributions for equality. If the latter distributions also tested equal for the same maneuver types, the number of maneuver types could be reduced in the statistical model.

Since turns provide the largest number of possible maneuver type combinations, they were selected for the initial statistical tests. First, descending left, left, and ascending left turns were compared with the corresponding right turns at several critical time slices. Although the parameters n_y and $\dot{r}$ had a directional difference, they could be compared by inverting the distributions which were stored in ranges symmetrical about the normalized zero. The distributions of the normalized parameters n_y, Δn_z, q, $\dot{q}$, and r were tested for equality by the Kolmogorov-Smirnov test at the 0.05 significance level. The tests on the normalized n_y distributions showed none equal, whereas the tests on all the $\dot{q}$ normalized distributions could not reject equality of the distributions. From a total of 21 tests on Δn_z distributions, 8 tested not to be equal. Therefore, the normalized distributions for left turn maneuver types should not be combined with those for the corresponding right turn maneuver types.

Next, statistical tests were made to compare the descending left, left, and ascending left turns with each other and, similarly, the descending right, right, and ascending right turns with each other to judge whether the altitude change could be removed from the criteria to select turn maneuver types. Again the tests rejected equality of some, but not all, of the normalized parameter distributions. Moreover, since no two turn maneuver types in the data sample had most of their parameter distributions testing equal, none of the maneuver types should be eliminated in future studies.

B. Maximum Absolute Parameter Distributions

As obtained from the normalizing of the F-105D maneuver data, the maximum absolute parameter distributions are the normalizing factor distributions used to denormalize the normalized data preparatory to predicting the F-105D load peaks. In addition to the breakdown according to maneuver type, the maximum absolute parameter distributions were classified by mission segment and flight conditions (combinations of gross weight and Mach number) which most affected the coefficients in the loads equations. A total of 368 combinations of maneuver type, mission segment, and flight condition were used to predict the F-105D loads distributions, each combination requiring a set of nine maximum absolute parameter distributions.

In the selection of the flight conditions, a preliminary survey of the loads equations indicated that gross weight was the most important parameter and that Mach numbers between 0.9 and 1.2 caused a severe change in the horizontal tail loads equation. Because most of the practice external stores on the F-105D's were small and light, stores configuration was not an important parameter for the F-105D peacetime data. Altitude changes also did not seriously affect the loads coefficients. Four mission segment groups were formed as follows: (1) ascent, cruise-out and refueling; (2) low-angle bombing, high-angle bombing, GAM delivery, special weapons delivery, rockets, and air-to-ground gunnery; (3) loiter, air-to-air gunnery, and training; and (4) clean cruise and descent. Ranges of gross weight and Mach number were grouped into flight conditions so that the number of maneuvers for each combination would be as large as possible and never less than three.

To illustrate the general level of maximum absolute parameter values, Table F-1 in Appendix F, a computer printout, lists the composite distributions for each of the nine parameters versus maneuver type. The format limitation of the computer printout required printing each of the distributions in two tables: one for maneuver types 1 through 20, and the second for the remaining maneuver types. The symbols D/S and D/S/S denote degrees per second and degrees per second per second. Section I. B. 3 identifies the codes for the maneuver types. The number of maneuvers in the 450 hours of F-105D data totaled 12, 873.

C. Comparison of Predicted and Observed Loads

The predicted and observed loads are compared in Figures 4 through 7. These figures show composite curves of the number of load peaks per thousand flight hours above each level of maneuver load for each corresponding range of level flight load. The predicted and observed curves match quite closely for fuselage loads (Figure 4), wing loads (Figure 5), and horizontal tail loads (Figure 6). However, the appreciably lower predicted curve in Figure 7 for the vertical tail loads indicated that the prediction technique underestimates the vertical tail load distribution at each level.

To find the source of this underestimation, the predicted and observed vertical tail load peaks for each maneuver type were examined. The findings revealed that the yaw and wing rock maneuvers contributed most of the large vertical tail load peaks but that the percentage of error in these peaks was about the same as that in the peaks of the other maneuver types. However, it was also found that the number of vertical tail load cycles among the observed yaw and wing rock maneuvers varied from two to four per maneuver. On the other hand, the normalized data never predicted more than two and a half such cycles per maneuver for these maneuver types. Apparently, the manual editing should have used a more stringent definition of the number of load cycles per maneuver for those maneuver types. A slight change in this definition should increase the accuracy of the predicted vertical tail load peaks by more than 50 percent in the higher load ranges.

Tables G-1 through G-4 in Appendix G are computer tabulations of observed and predicted distributions of fuselage, wing, horizontal tail, and vertical tail load peaks for each of the 23 maneuver types. However, because of the relatively rare occurrence of maneuver types 20, 21, 24, and 25, their distributions were combined in the tabular presentation. Each load heading in these tables represents the lower limit of a range.

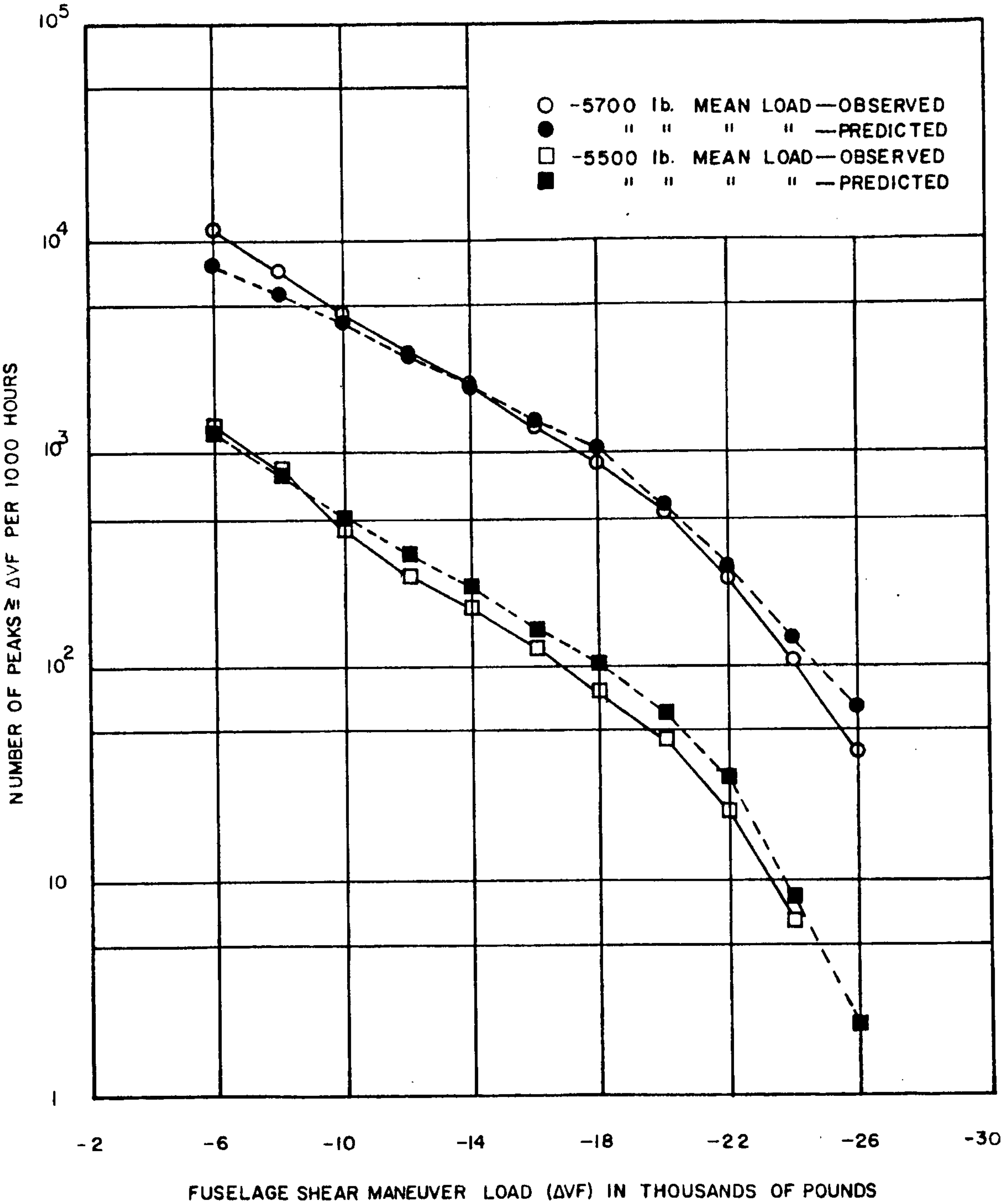


Figure 4. —Plots of composite predicted and observed fuselage load peaks per 1000 hours

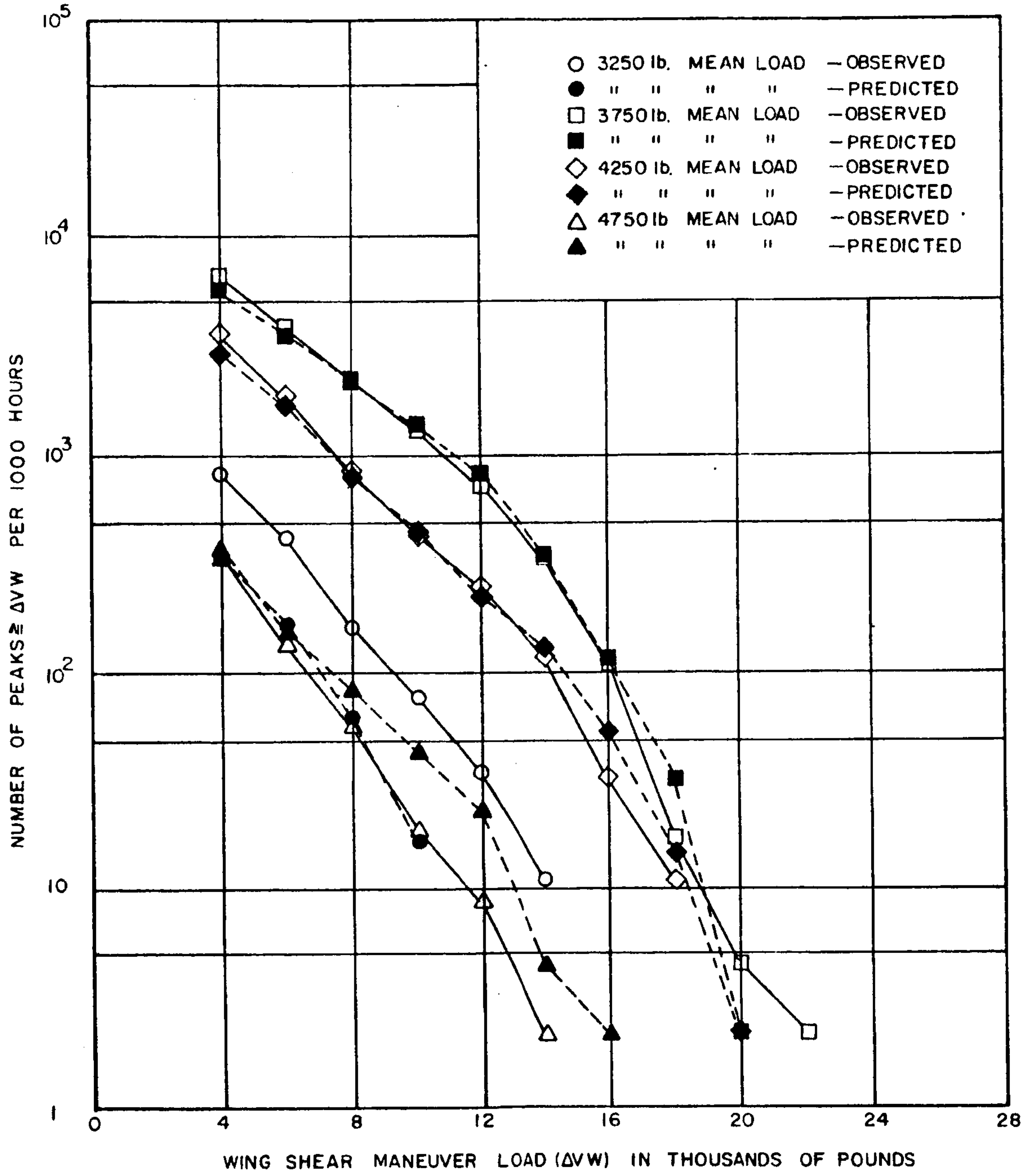


Figure 5. — Plots of composite predicted and observed wing load peaks per 1000 hours

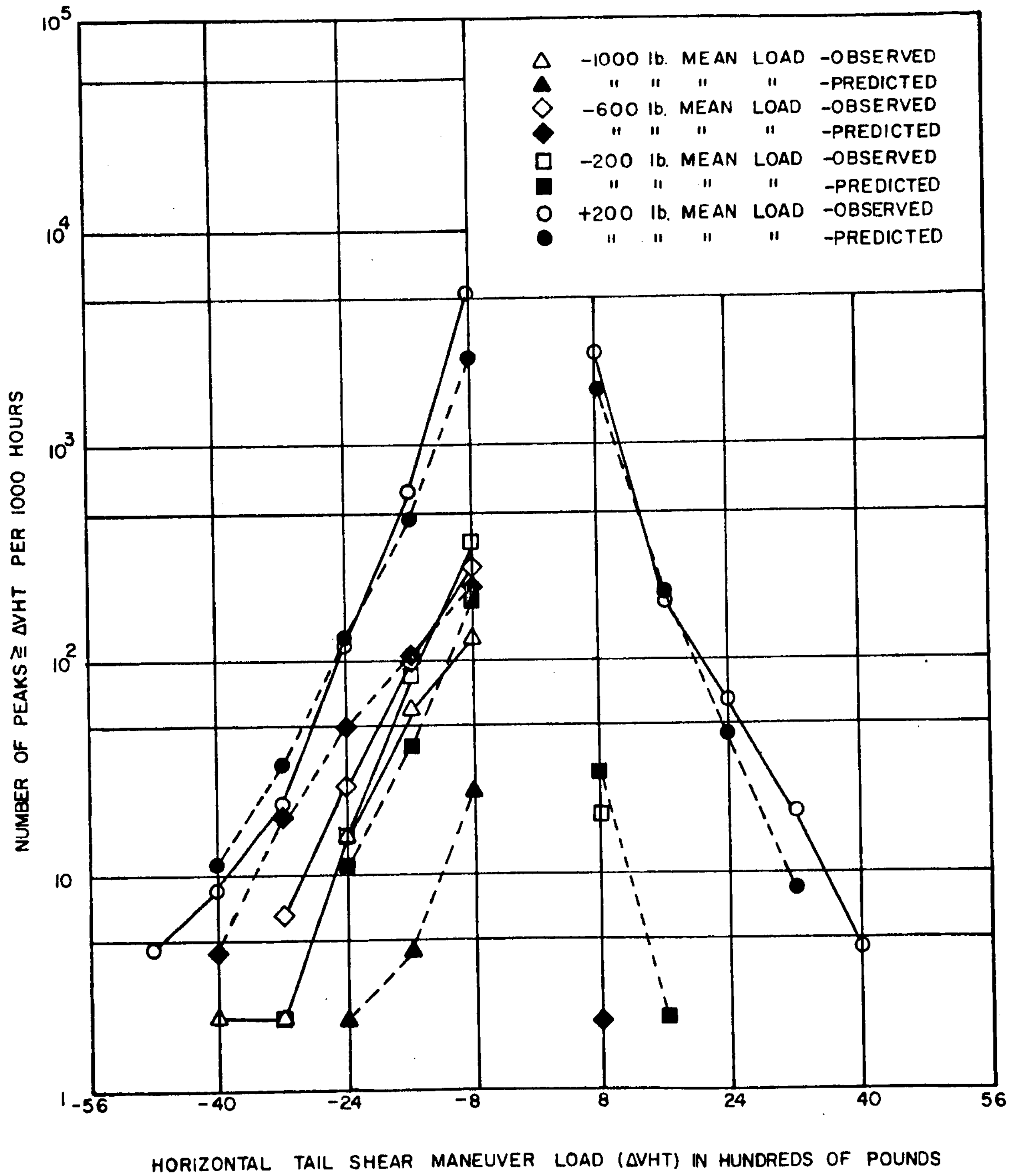


Figure 6. —Plots of composite predicted and observed horizontal tail load peaks per 1000 hours

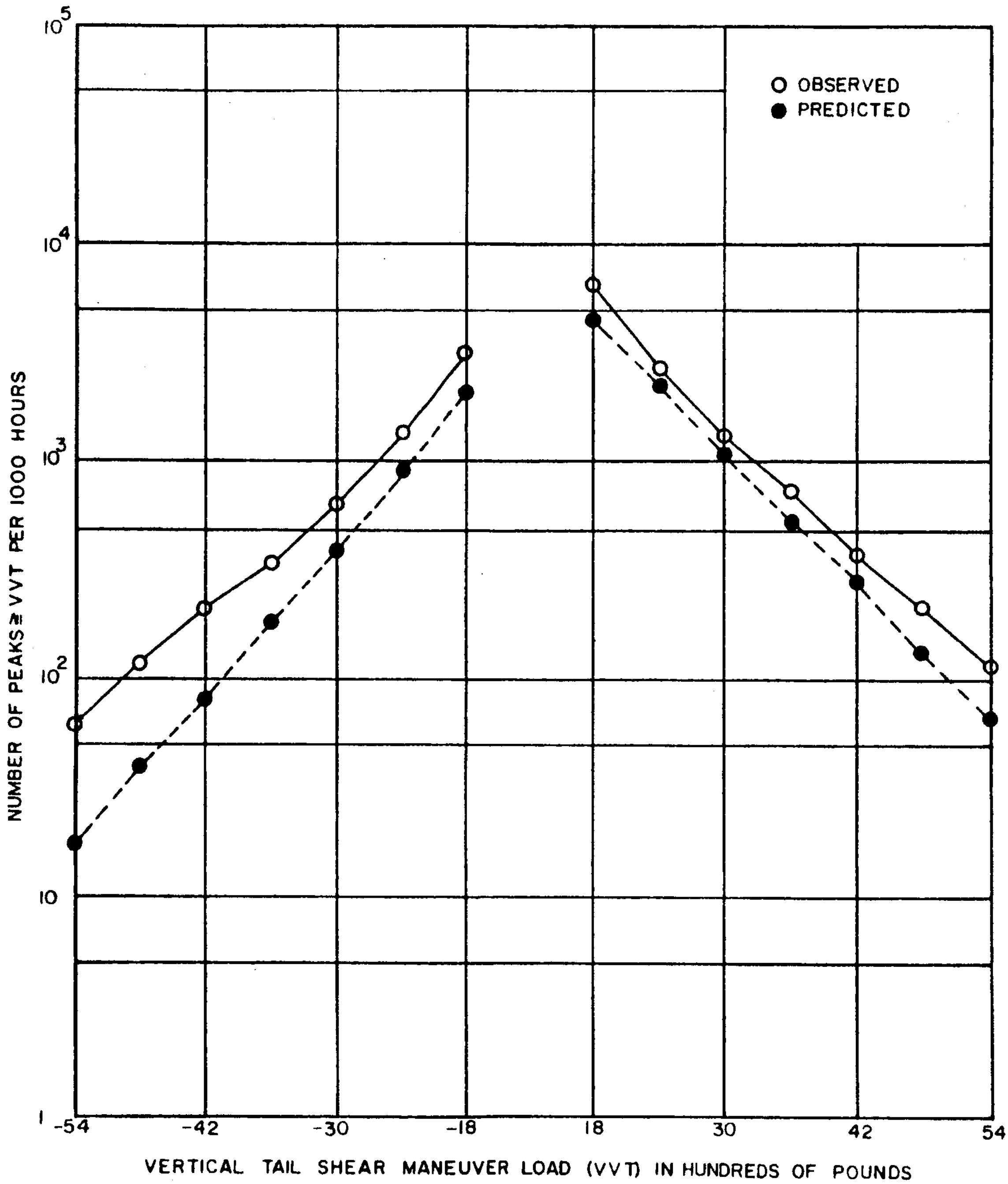


Figure 7. —Plots of composite predicted and observed vertical tail load peaks per 1000 hours

D. Pattern Recognition Evaluation

Three tapes with continuous uncalibrated digital data of about five samples per second for each of the eight recorded parameters (n_x, n_y, n_z, p, q, r, airspeed, and altitude) were used to evaluate the computer program for pattern recognition. These tapes contained actual maneuver data from fourteen F-105D flights with sections of interpolated data inserted between the maneuvers to simulate the continuous data normally recorded during a flight. As a norm for the comparison of the computer recognition, an independent set of pattern recognitions was acquired by manually editing the oscillograms corresponding to the tape data. After 314 maneuvers of various types were recognized by the manual editing and 277 by the computer processing, the numbers of individual types were grouped according to similar maneuver types; for example, the numbers for the six individual types of turn maneuvers were summed under "turns." Tables 7 and 8 summarize the evaluation. Before interpreting the two tables, note the apparent discrepancy between the listing of 284 computer recognitions (254 correct plus 30 incorrect) in Table 7 and the listing of 277 in Table 8. This discrepancy was due to several instances where the computer recognized two maneuvers as one. With this understanding, Table 7 shows the correlation of the computer recognitions with the manual recognitions. As seen here, 254 of the computer recognitions were correct, 30 were incorrect, and another 30 were not recognized; in other words, 81 percent of the 314 manual recognitions had a correct counterpart among the computer recognitions, 9.5 percent had an incorrect correspondence, and another 9.5 percent did not sufficiently conform to the defined maneuver patterns to permit computer recognition of the maneuver type. Table 8 summarizes the validity of the 277 computer recognitions. As stated here, 254 or 92 percent of these recognitions were correct. In addition, the computer separated 91 other short sections of data but did not recognize any maneuver types in them. For each of these sections, however, the computer printed comments identifying those combinations of parameter patterns that made computer recognition impossible. These 91 sections contained the 30 patterns listed in Table 7 as not recognized by the computer.

In summary, excluding the 30 patterns not recognized by the computer, or reducing the 314 manual recognitions by this figure to 284, the computer correctly recognized 90 percent or 254 of the patterns correctly. Now to supplement the computer recognitions by the manual review of the printout, or to recognize the remaining 30 patterns (less than 10 percent of the total), would require much less than 10 percent of the time expended in a completely manual recognition since the computer printed the above-mentioned comments for each of the 91 data sections in which the missing patterns were contained.

TABLE 7

COMPARISON OF MANEUVER PATTERNS RECOGNIZED BY COMPUTER EDITING WITH THOSE RECOGNIZED BY MANUAL EDITING

Maneuver Type	Manual Recognitions	Computer Recognitions		
		Correct	Incorrect	Not Recognized
Turns	215	188	11	16
Pull-ups	50	37	11	2
Rolls	7	3	3	1
Thrust & Drag	6	1	--	5
Cloverleaf	10	7	3	--
Wing Rocks	13	10	1	2
Yaws	11	8	--	3
Pitch-Downs	2	--	1	1
Totals	314 (100%)	254 (81%)	30 (9.5%)	30 (9.5%)

TABLE 8

VALIDITY OF MANEUVER PATTERNS RECOGNIZED BY COMPUTER EDITING

Maneuver Type	Total Recognitions	Correct Recognitions	Incorrect Recognitions
Turns	202	188	14
Pull-ups	40	37	3
Rolls	3	3	--
Thrust & Drag	4	1	3
Cloverleaf	10	7	3
Wing Rocks	10	10	--
Yaws	8	8	--
Pitch-Downs	--	--	--
Totals	277*(100%)	254 (92%)	23 (8%)

* In addition to treating the data in which these recognitions were made. the computer separated 91 other short sections of data but did not recognize any maneuver types in them. As indicated in Table 7, the manual editing recognized 30 maneuvers in these sections.

SECTION III

CONCLUSIONS AND RECOMMENDATIONS

On the basis of the successful prediction of maneuver load peak distributions on the fuselage, wing, horizontal tail, and vertical tail of the F-105D from 450 hours of eight-channel in-flight data collected during peacetime operation, it is concluded that—

(1) The maneuver model loads prediction technique can be adapted to predict such load distributions on a large-scale data reduction basis.

(2) Each of the 23 types of maneuvers observed in the F-105D data can be represented by an average normalized time history and a set of 25 normalized distributions for each parameter.

(3) The normalized data and the set of normalizing factors can be recombined to calculate (or predict) maneuver fatigue load spectra having accuracies consistent with a preliminary fatigue load analysis.

Prepared independently of the loads prediction development, the computer program for pattern recognition can automatically recognize and classify maneuvers in the digital time histories of eight-channel data. The program recognized 90 percent of all maneuvers in fourteen recorded flights of the F-105D, and correctly classified the type of 90 percent of the maneuvers recognized.

In the light of the foregoing results, it is recommended that—

(1) The hypothesis that the normalized data is independent of the aircraft type should be tested by using the F-105D normalized data to predict loads on another aircraft type.

(2) The pattern recognition computer program should be further developed to permit inputs of various types and formats and to yield outputs in a format compatible with the loads prediction computer programs.

(3) The pattern recognition computer program should be tested on some actual magnetic tape flight data and on data from another aircraft type.

APPENDIX A

LOADS EQUATIONS AND OBSERVED LOAD PEAK DEFINITIONS

Development of Loads Equations

Several simplifying assumptions were made to derive a practical set of loads equations. Such assumptions would not likely affect the accuracy of the resultant computations seriously since the accuracy was already limited by the accuracy of the recorded data, the available wind tunnel aerodynamic data, and the available inertia data. These assumptions were as follows:

(1) The airplane responds as a rigid body.

(2) The airplane center of gravity is fixed.

(3) All aerodynamic coefficients are linear functions of α, β, i_T, δ_A, and δ_R.

(4) Body axis aerodynamic coefficients are equal to the stability axis coefficients given in Reference 11.

(5) The shape (not the magnitude) of the pressure distribution and the center of pressure remain fixed on each aerodynamic and control surface.

(6) The airplane mass distribution is always symmetrical about the x, z plane, that is $I_{yz} = I_{xy} = 0$.

(7) The spoiler deflection angle is a linear function of the aileron deflection angle for each combination of Mach number and altitude.

(8) The aerodynamic forces on the external stores are negligible.

(9) The airplane is not exposed to gust; that is, it always flies in a uniform free stream.

These assumptions did not compromise the study objective since the intent was to determine the feasibility of applying a statistical calculation technique to flight loads data, not to calculate loads with strict accuracy. The only requirements, therefore, were that the equations be approximately correct and that the equations used for the "observed" loads also be employed for the statistically predicted loads.

The first step in deriving a set of loads equations requires setting up a balance between the total aerodynamic and inertia forces and between the total aerodynamic and inertia moments acting on an airplane. Since the study excluded forces in the longitudinal direction, the problem was limited to five degrees of freedom with the five unknowns α, β, i_T, δ_A, and δ_R. The five force and moment equations derived for these unknowns are as follows:

$$(1)\quad C_{Y_{\delta_A}} \cdot \delta_A + C_{Y_{\delta_R}} \cdot \delta_R + C_{Y_\beta}\beta = .76578 \frac{n_y W}{V_e^2} - .18045\, C_{Y_r} \frac{\sqrt{\sigma}}{V_e}\, r$$

$$(2)\quad C_{L_\alpha} \cdot \alpha + C_{L_{i_T}} \cdot i_T = .76578 \frac{n_z W}{V_e^2}$$

$$(3)\quad C_{\ell_{\delta_A}} \cdot \delta_A + C_{\ell_{\delta_R}} \cdot \delta_R + C_{\ell_\beta} \cdot \beta = \frac{1}{V_e^2}[.00038268\, I_x\dot{p} - .0000066791\,(I_y - I_z)\, qr$$
$$- .00038268\, I_{xz}\dot{r} - .0000066791\, I_{xz}pq] - .18045\, C_{\ell_r} \frac{\sqrt{\sigma}}{V_e}\, r$$
$$- .18045\, C_{\ell_p} \frac{\sqrt{\sigma}}{V_e}\, p$$

$$(4)\quad C_{m_\alpha} \cdot \alpha + C_{m_{i_T}} \cdot i_T = \frac{1}{V_e^2}[.0011637\, I_y\dot{q} - .000020311\,(I_z - I_x)\, pr - .000020311\, I_{xz}(r^2 - p^2)]$$
$$- C_{m_o} - .059340\, C_{m_q} \frac{\sqrt{\sigma}}{V_e}\, q$$

$$(5)\quad C_{n_{\delta_A}} \cdot \delta_A + C_{n_{\delta_R}} \cdot \delta_R + C_{n_\beta} \cdot \beta = \frac{1}{V_e^2}[.00038268\, I_z\dot{r} - .0000066791\,(I_x - I_y)\, pq$$
$$- .00038268\, I_{xz}\dot{p} + .0000066791\, I_{xz}\, qr]$$
$$- .18045\, C_{n_r} \frac{\sqrt{\sigma}}{V_e}\, r - .18045\, C_{n_p} \frac{\sqrt{\sigma}}{V_e}\, p$$

The four shear load equations were formulated as follows:

Fuselage shear load at Station 277:

$$V_F = V_e^2 \left[.02604\, C_{L_\alpha} \cdot \alpha + .01302\, C_{L_{oWB}} + .00444\, C_{m_q} \frac{\sqrt{\sigma}}{V_e}\, q \right]$$
$$- 6444\, n_z + 76.45\, \dot{q} - 1.333\, qr$$

Vertical tail shear load at Water Line 38:

$$V_{VT} = V_e^2\left[1.302\, C_{Y_{\delta_R}} \cdot \delta_R + 1.302\, C_{Y_{\beta_{VT}}} \cdot \beta + .2355\, C_{Y_r}\frac{\sqrt{\sigma}}{V_e} r + .0523\, C_{\ell_p}\frac{\sqrt{\sigma}}{V_e} p\right]$$

$$- 304.7\, n_y - 1.280\, \dot{p} + .02234\, qr + 3.166\, \dot{r} + .0552\, pq$$

Right horizontal tail shear load at Buttock Line 29:

$$V_{HT} = V_e^2\left[-.380\, C_{m_{o_{HT}}} + .651\, C_{L_{i_T}}(\epsilon'_\alpha \cdot \alpha + i_T) - .0390\, C_{\ell_p}\frac{\sqrt{\sigma}}{V_e} p\right.$$

$$\left.- .01684\, C_{m_q}\frac{\sqrt{\sigma}}{V_e} q\right] - 140.5\, n_z - .002103\,(p^2 + q^2) + 1.680\,\dot{q} - .02936\, rp$$

$$+ .3602\,\dot{p} + .00629\, qr$$

Wing shear load at right wing Station 136.6:

$$V_W = V_e^2\left[.1511(C_{L_\alpha} \cdot \alpha + C_{L_{o_{WB}}}) - 1.428\, C_{\ell_{\delta_A}} \cdot \delta_A - .550\, C_{\ell_{\delta_S}} \cdot \delta_A\right.$$

$$\left.- .1703\, C_{\ell_p}\frac{\sqrt{\sigma}}{V_e} p\right] - (460 + W_6)\, n_z - .000031502\, W_6\,(p^2 + q^2)$$

$$+ (2.01962 + .0035069\, W_6)\,\dot{q}$$

$$- (.035249 + .000061207\, W_6)\, rp + (3.49564 + .0076751\, W_6)\,\dot{p}$$

$$+ (.0610105 + .000133956\, W_6)\, qr$$

(where W_6 = weight on Station 6, right outboard pylon)

The solutions of the five unknowns from the foregoing force and moment equations and then their substitution in the shear loads equations yielded the following loads equations:

$$V_{VT} = C_1 n_y + C_2 p + C_3 r + C_4 \dot{p} + C_5 \dot{r} + C_6 qr + C_7 pq$$

$$V_F = C_8 n_z + C_9 q + C_{10}\dot{q} + C_{11} pr + C_{12} qr + C_{13}(r^2 - p^2) + C_{14}$$

$$V_W = C_{15} n_z + C_{16} n_y + C_{17} p + C_{18} q + C_{19} r + C_{20}\dot{p} + C_{21}\dot{q} + C_{22}\dot{r}$$

$$+ C_{23} pr + C_{24} qr + C_{25}(p^2 + q^2) + C_{26}(r^2 - p^2) + C_{27} pq + C_{28}$$

$$V_{HT} = C_{29}n_z + C_{30}p + C_{31}q + C_{32}\dot{p} + C_{36}\dot{q} + C_{37}rp + C_{38}qr + C_{39}(p^2 + q^2) + C_{40}(r^2 - p^2) + C_{41}$$

In these equations the coefficients C_1 through C_{41} are functions of the aerodynamic coefficients, Mach number, altitude, dynamic pressure, weight, moments of inertia, and so on. The aerodynamic coefficients used in the loads equations were based on wind tunnel data given in Reference 11. Since this source did not contain sufficient information to convert the stability-axis coefficients to body-axis coefficients, the stability-axis data was used to approximate the aerodynamic forces and moments in the body axis system. As stated above, the inertia and weight data was, for the most part, estimated from information in Reference 8 and from the physical dimensions of the airplane in Reference 9.

From the parameter measurements, the computer calculated at 1/5-second intervals values of V_F, V_{VT}, V_{HT}, and V_W. These load values are hereafter referred to as "observed loads."

Definitions for Observed Load Peaks

It was noted that the "observed load" deviated about a steady load value corresponding to straight and level ($n_z = 1$) flight. By setting $n_z = 1$ and $n_y = p = q = r = \dot{p} = \dot{q} = \dot{r} = 0$ in the loads equations, the following steady load equations were obtained:

$$V_{VT(n_z = 1)} = 0$$

$$V_{F(n_z = 1)} = C_8 + C_{14}$$

$$V_{W(n_z = 1)} = C_{15} + C_{28}$$

$$V_{HT(n_z = 1)} = C_{29} + C_{41}$$

The "observed load" deviations, or delta loads, were then defined as

$$\Delta V_{VT} = V_{VT} - V_{VT(n_z = 1)} = V_{VT}$$

$$\Delta V_F = V_F - V_{F(n_z = 1)}$$

$$\Delta V_W = V_W - V_{W(n_z = 1)}$$

$$\Delta V_{HT} = V_{HT} - V_{HT(n_z = 1)}$$

Given these equations, an "observed load" peak could then be defined as a delta load beyond a preset threshold and with a rise and fall (or fall and rise) equal to or greater than both the threshold value and 50 percent of the peak delta load. The following lists the thresholds which were defined as about 10 percent of the design loads in Reference 12.

$$-6000 < \Delta V_F < +6000 \text{ lb.}$$

$$-1800 < \Delta V_{VT} < +1800 \text{ lb.}$$

$$-800 < \Delta_{HT} < 800 \text{ lb.}$$

$$-4000 < \Delta V_W < +4000 \text{ lb.}$$

On the basis of these thresholds, the computer tabulated the delta and steady loads of each "observed load" peak for later comparison with the statistically predicted load peaks.

Because the statistical prediction of loads involves predicting the probabilities for all possible parameter combinations, the number of independent parameters in each load equation should be reduced to that minimum which would yield an accuracy consistent with that expected in the load prediction technique. Consequently, on the basis of the relative magnitude of these terms, the equations to predict loads were reduced to the following approximations, where the subscript "P" denotes an approximated expression:

$$V_{VTP} = C_1 n_y + C_2 p + C_5 \dot{r} + C_7 pq$$

$$V_{FP} = C_8 n_z + C_{10} \dot{q} + C_{14}$$

$$V_{WP} = C_{15} n_z + C_{17} p + C_{20} \dot{p} + C_{21} \dot{q} + C_{28}$$

$$V_{HTP} = C_{29} n_z + C_{31} q + C_{36} \dot{q} + C_{37} rp + C_{41}$$

$$\Delta V_{VTP} = V_{VTP}$$

$$\Delta V_{FP} = V_{FP} - V_{F(n_z = 1)}$$

$$\Delta V_{WP} = V_{WP} - V_{W(n_z = 1)}$$

$$\Delta V_{HTP} = V_{HTP} - V_{HT(n_z = 1)}$$

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APPENDIX B

PARAMETER PATTERNS FOR BASIC MANEUVERS

The application of the maneuver model to predict structural load distributions requires that maneuver types be recognizable in eight-channel data. The parameters most indicative of maneuver types are the three angular velocities, p, q, r; normal acceleration, n_z; lateral acceleration, n_y; and altitude. The airspeed and the longitudinal acceleration, n_x, can sometimes support these parameters. The trace patterns indicative of the basic maneuver types are described below.

The turn maneuver may be identified by the combination of the following trace patterns: (1) a long positive peak in the normal acceleration, n_z, trace; (2) depending on the turn going either right or left, a long positive or negative peak in the yaw rate, r, trace; (3) again depending on the direction of the turn, an early positive or negative peak followed by a late peak of opposite sign in the roll rate, p, trace. In addition, a long positive peak similar to that in the normal acceleration trace appears in the pitch rate, q, trace. The trend in the altitude trace indicates that the turn is ascending, descending, or level. Figures B-1 and B-2 show oscillograph recordings of a descending left turn and a descending right turn, respectively. As variants of the turn maneuver, the left and right cloverleaf maneuvers have the following trace characteristics: the altitude increases and then decreases. However, rather than one positive normal acceleration peak as in the turn maneuver, these maneuvers have two such peaks and the high point in the altitude trace corresponds with the dip between them. The roll, yaw, and pitch rate traces have the same patterns as in a turn maneuver.

A pull-up maneuver may be classified as either a rolling or a symmetrical pull-up depending on whether or not it includes a roll rate peak. A symmetrical pull-up maneuver may be identified by the combination of the following trace patterns: (1) a large positive peak in the normal acceleration trace; (2) a large positive peak in the pitch rate trace occurring simultaneously with the former peak; and (3) an increasing rate of climb or slope in the altitude trace. Figure B-3 shows an oscillograph recording of a symmetrical pull-up. Besides all the characteristic trace patterns of the symmetrical pull-up, a rolling pull-up maneuver has a large positive or negative roll rate and yaw rate peak, both occurring during the duration of a large normal acceleration peak. The sign of the roll rate and yaw rate peaks indicates the direction of the roll. Figure B-4 shows an oscillograph recording of a right rolling pull-up. Although the rolling pull-up maneuver is quite similar to a symmetrical pull-up maneuver followed by an ascending turn maneuver, the two pull-up maneuver types can be distinguished by noting when the roll rate peak begins. If it begins while the normal acceleration is still high, the maneuver is a rolling pull-up. But, if the peak begins when the normal acceleration has returned close to a 1.0 value, there are two maneuvers, that is, a symmetrical pull-up and a turn. As a variant of the symmetrical pull-up maneuver, the symmetrical pitch-down maneuver has a decreasing altitude and a negative normal acceleration. As another variant of the symmetrical pull-up maneuver, the inside-loop maneuver has a sustained pitch rate deflection until the airplane completes the loop. During the inside-loop maneuver, the altitude increases and then returns close to the altitude at the start of the maneuver. Also during this maneuver, the normal acceleration has an early positive peak, a small negative peak at the inverted position, and a late positive peak.

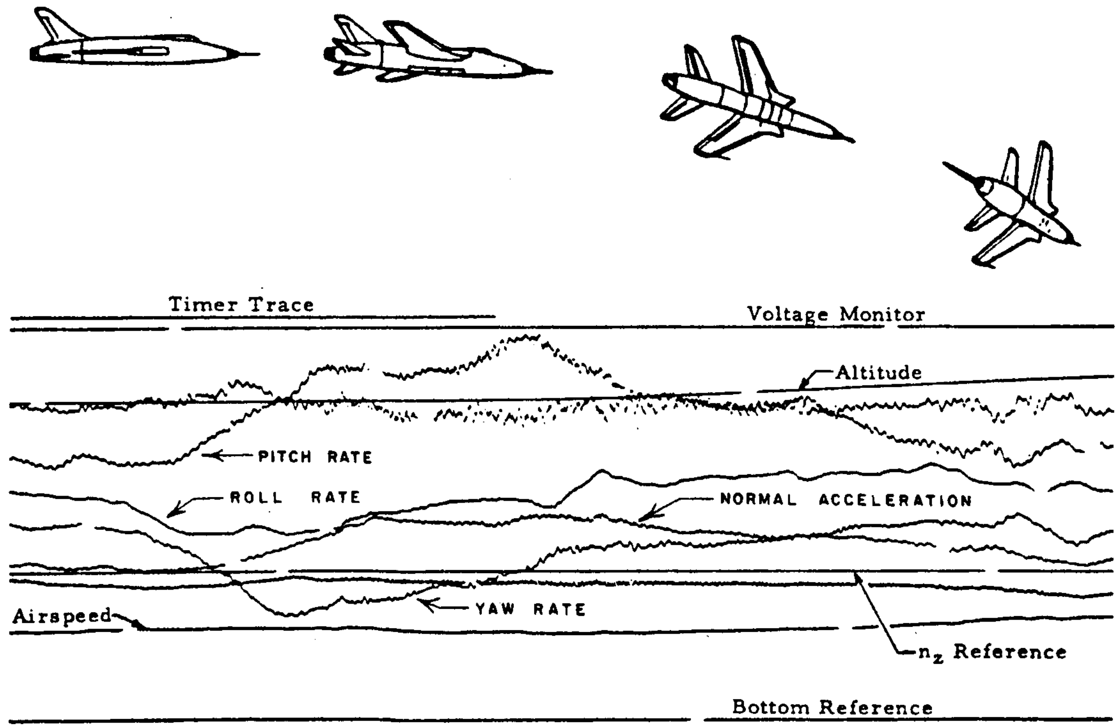

Figure B-1. —Oscillogram showing descending left turn

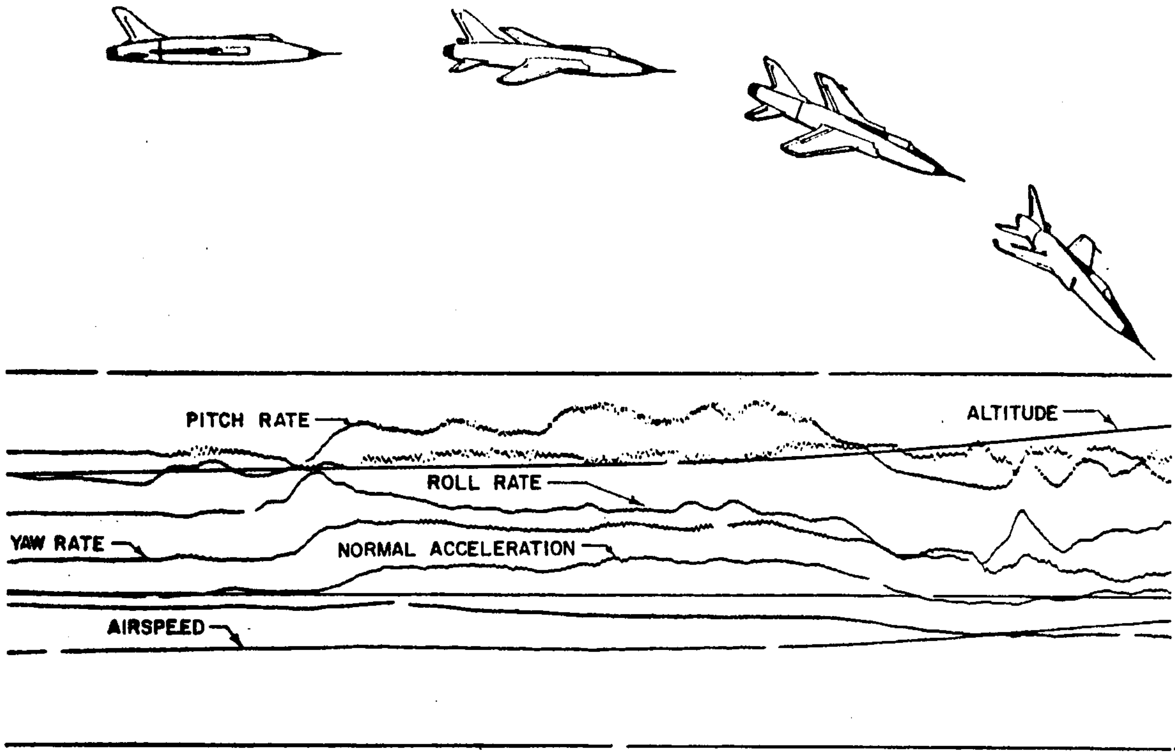

Figure B-2. —Oscillogram showing descending right turn

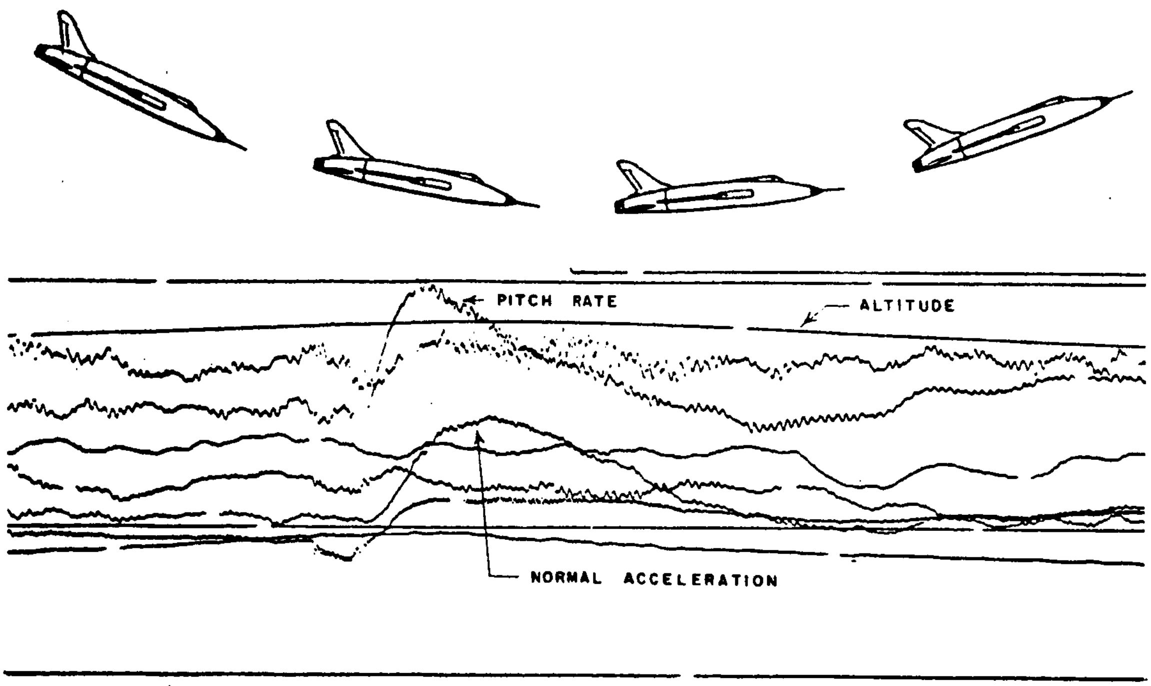

Figure B-3. —Oscillogram showing symmetrical pull-up

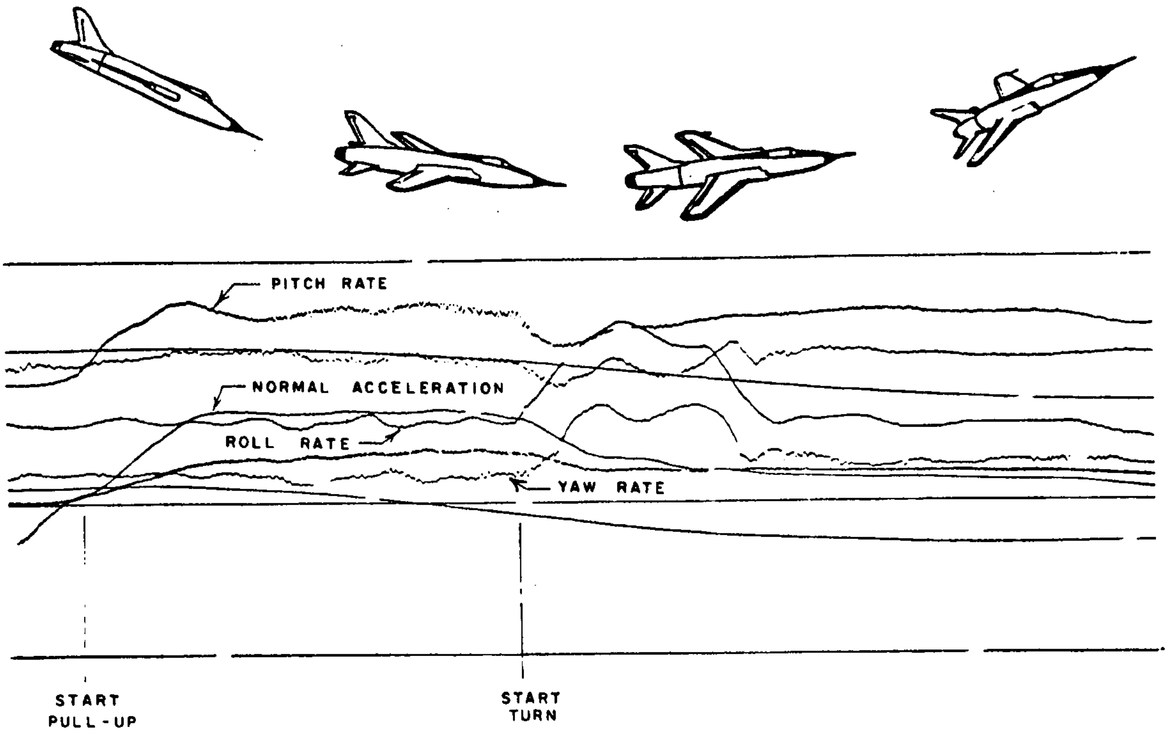

Figure B-4. —Oscillogram showing right rolling pull-up

The yaw maneuver is characterized by a deflection in the yaw rate trace and a large deflection in the lateral acceleration trace. None of the other parameters vary significantly. Figure B-5 illustrates a yaw maneuver. During the recording of the F-105D data, a yaw maneuver was often performed early in a flight by producing a right and left yaw in quick succession (that is, a "rudder kick") to test the rudder control system.

The acceleration and deceleration maneuvers indicate an abrupt power change or the use of either an afterburner or a dive-brake system. A rapid increase or decrease of the longitudinal acceleration characterizes these maneuvers. These changes are of relatively short duration and end as the longitudinal acceleration returns to a normal value. While the airspeed trace increases or decreases, none of the other parameters vary appreciably. Figure B-6 shows a deceleration maneuver.

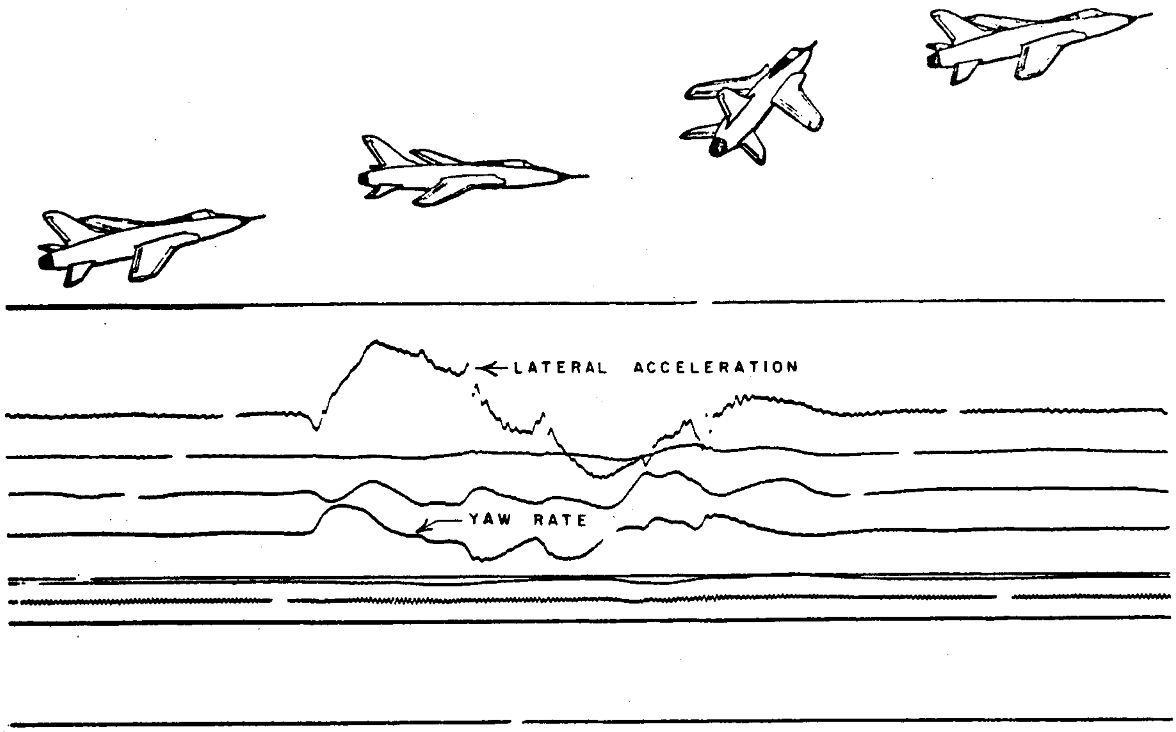

Figure B-5. —Oscillogram showing yaw

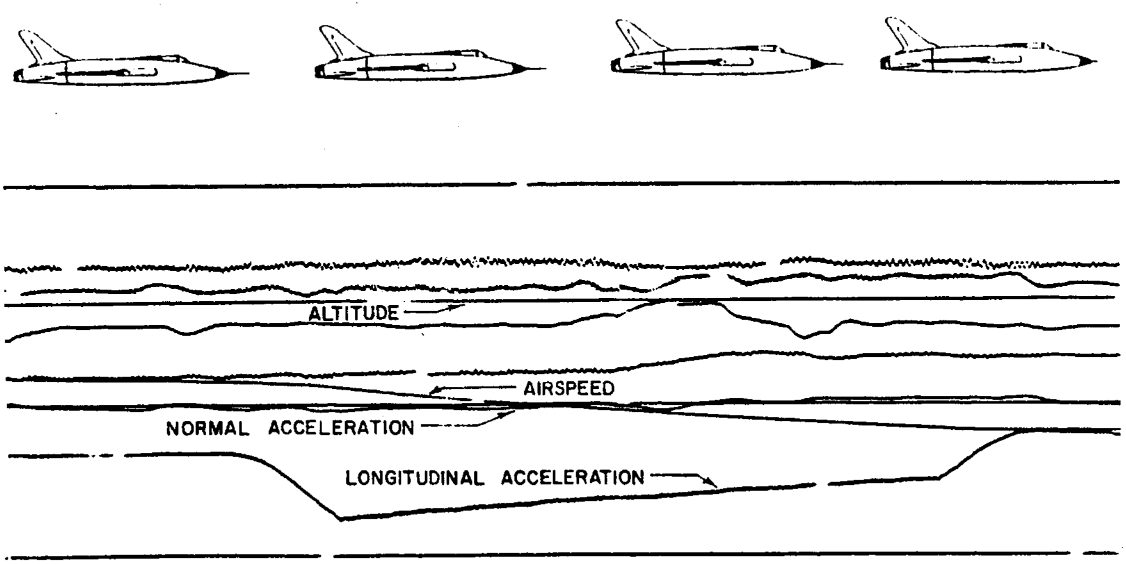

Figure B-6. —Oscillogram showing deceleration maneuver

The roll maneuver is characterized by a long peak in the roll rate trace, p. The yaw rate trace, r, moves first in one direction and then in the other because of the induced yaw and the pilot's subsequent action to correct for the induced yaw. The normal acceleration trace has no significant activity. Figure B-7 shows a roll maneuver. As seen here, a 180-degree roll followed a 180-degree pitching maneuver which ended with the aircraft inverted. Related to the roll maneuver is the wing rock maneuver which is normally characterized by several cycles of roll rate oscillations with roll angles less than 90 degrees. In the wing rock maneuver, the yaw rate also has oscillations which slightly lag those of the roll rate. Also in the wing rock maneuver, the lateral acceleration responds inversely to the slope of the yaw rate trace; that is, the lateral acceleration is positive when the yaw acceleration is negative and the lateral acceleration is negative when the yaw acceleration is positive. As variants of the basic roll maneuvers, the right and left four-point roll maneuvers each have four distinct peaks in the roll rate as it remains positive or negative throughout the maneuver. Like the wing rock maneuvers, the four-point roll maneuvers have the roll and yaw rates oscillating in several cycles with the yaw rate oscillations slightly lagging those of the roll rate and the lateral acceleration responding similarly to the yaw rate deflections.

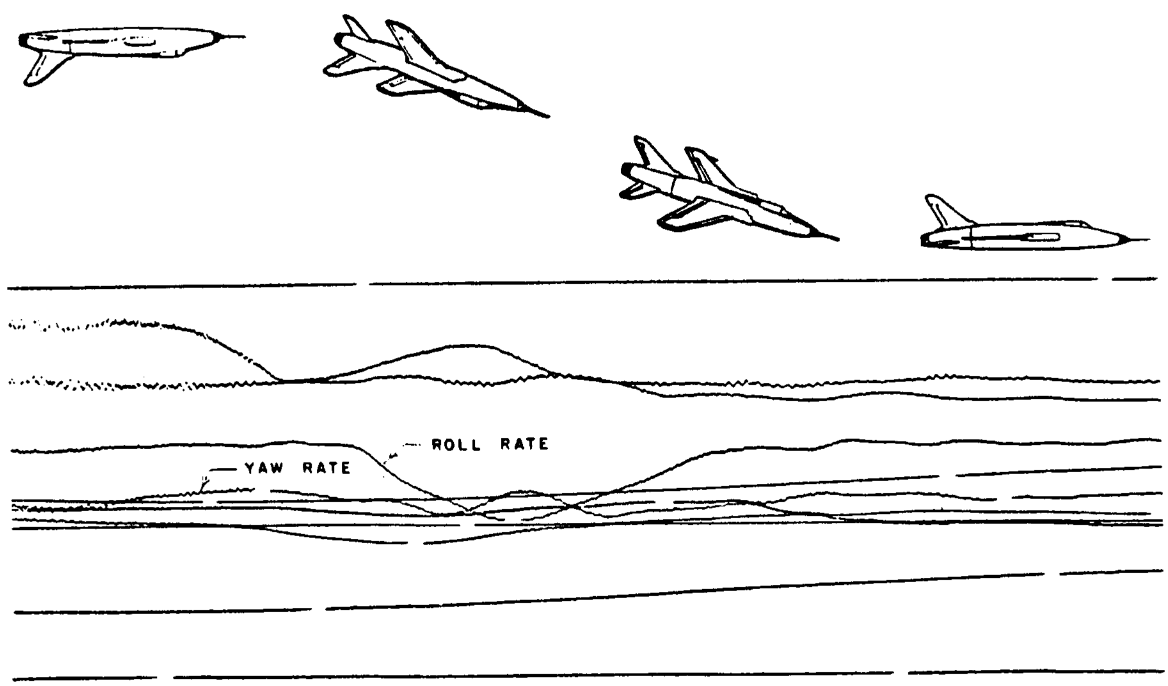

Figure B-7. —Oscillogram showing roll

Although the maneuver types described above include all those observed in the available F-105D data, maneuvers not covered by these types may be expected in other data. Then, either the description of an existing type will have to be enlarged or a new maneuver type defined.

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APPENDIX C

DATA PROCESSING

Data Reduction Methods

The following paragraphs describe the major steps to reduce the F-105D flight loads data used in this study: editing, reading, quality control checking, and computer output checking.

1. Editing. —At the outset of the editing, each oscillogram was reviewed to detect any evidence of instrument malfunctioning and to check the adequacy of the calibration signals. In addition, the supplemental data sheets were inspected to confirm the completeness and correctness of their information.

Next the oscillograms were scanned to mark off the sections to be read. Except for the few instances where turbulence obviously caused the trace deflections, such sections consisted of all maneuvers where any parameter exceeded its normalizing threshold (as defined in Section I. B. 4. a) and those maneuvers where all parameters were within the thresholds but where the pattern of a maneuver type was recognized. Then all selected sections were identified by a base, mission type, mission segment, maneuver type, takeoff and landing configuration, takeoff and landing gross weight, takeoff and landing fuel weight, store weights, takeoff barometric pressure, and calibration information.

2. Reading. —Two procedures governed the reading of the selected maneuver sections: one for sections where at least one parameter exceeded its normalizing threshold, and the second for sections where no parameter exceeded its normalizing threshold. According to the first procedure, the n_x, n_y, n_z, p, q, and r traces were digitized at 0.2-second intervals, and the static and dynamic pressure traces at 2.0-second intervals. The computer later processed this data to calculate the time histories of the observed loads and then to form the time histories of the normalized parameters.

According to the second procedure, only three points of each parameter were digitized in each maneuver section: the first, the maximum, and the last. The computer later processed this data to determine the total number of maneuvers of each type and to complete the maximum absolute parameter distributions at the lower levels. Although the computer calculated the observed loads for these maneuvers, none were large enough to be classified as observed load peaks.

Finally, a preliminary printout of the digitized data was reviewed to detect any obvious reading errors.

3. Quality control checking. —The quality control check served to hold within acceptable limits the inevitable small reading errors resulting from thousands of measurements taken to the nearest 0.005 of an inch. For this check, therefore, randomly selected digitized readings from each flight were compared with the manual measurements of the corresponding points on the oscillogram. Then the differences (or errors) were used to establish and then maintain acceptable limits for the reading deviations. Whenever the data of an entire flight was found acceptable, it was forwarded for computer processing; otherwise, it was reread.

For each of the eight digitized parameters, Table C-1 lists the mean and the standard deviation (σ) of the reading errors found in the quality control check of data from 378 flights. On the assumption of a Gaussian distribution of the reading errors, 95 percent of all measurements should not differ by more than 2σ from the correct value.

TABLE C-1

QUALITY CONTROL READING ERROR STATISTICS

Parameter	Mean of Reading Error	Standard Deviation σ of Reading Error
n_x	0.0003 g	0.006 g
n_y	-0.0006 g	0.006 g
n_z	-0.004 g	0.04 g
p	-0.08°/sec	0.9°/sec
q	-0.014°/sec	0.14°/sec
r	-0.014°/sec	0.15°/sec
Altitude	4 ft.*	84 ft.*
Airspeed	0.1 knot**	2.3 knots**

* at 5000 feet ** at 400 knots

4. Computer output checking.—The computer program was designed to print out comments indicating any data having unusual parameter values or trace patterns when compared with the F-105D theoretical flight envelope and with those expected for a particular combination of maneuver type, mission type, mission segment, and configuration. In the manual review of the printout, the parameter values and supplemental data were checked to detect all large reading errors and to verify the proper classification of all maneuvers. The data of each flight was reprocessed until the printout showed no errors.

Computer Programs to Form Maneuver Model and to Predict F-105D Load Distributions

According to the definitions and procedures described above, the first computer program (Phase I) processed the digitized parameter data and supplemental data to yield the following separate distributions: (1) normalized parameter values (as defined in Section I. B. 4. a) by maneuver type, (2) maximum absolute parameter values by maneuver type and flight condition, and (3) observed load peak values (as defined in Appendix A) by maneuver type and flight condition. The results of Phase I were printed for the computer output check and transcribed on magnetic tape for further processing.

The second computer program (Phase II) combined all acceptable flight data on the Phase I output tapes onto a single Phase II output tape to serve as the input for the third and fourth computer programs.

The third computer program (Phase III) printed tabular distributions of the data contained in the Phase II output tape.

The fourth program (Phase IV), the loads prediction program, first sorted and stored the proper normalized distributions, the maximum absolute parameter distributions, and the observed load distributions. A card input established the maneuver types to be predicted and the exact ranges for the flight condition variables defining the flight condition. Next the fourth program calculated the constants for the loads equations and the average load time histories, as described in Section I. B. 5. a. Then it calculated the predicted load probabilities and multiplied them by the number of maneuvers in the given flight condition to accumulate load frequencies.

The fourth program had three levels of output. Level 1 gave the predictions for one flight condition and the associated values calculated for each of the flight condition variables. Levels 2 and 3 provided composite tables of predicted loads. Level 2 summarized the loads from a specific mission segment group, and Level 3 summarized all Level 2 tables giving predicted loads for all flight conditions of a maneuver type. At each of the three levels, the tables for observed loads were printed for ready comparison. Also available on option at Levels 2 and 3 were composite probability plots presenting the cumulative probability of loads for both the predicted and the observed peaks.

Besides the above-mentioned tape input for the fourth program, a card-input capability was provided to transfer statistical distributions directly from cards and to store them in the computer memory. This added capability gave a greater flexibility in studying prediction techniques.

APPENDIX D

PATTERN RECOGNITION DEFINITIONS

The major effort in developing a pattern recognition computer program is to rigorously define the characteristic parameter patterns in the time history of each maneuver type. To effect the automating of the manual editing as much as possible, all maneuvers should be classified. In addition, the parameter pattern definitions should preclude misclassifications since such would reduce the validity of the entire data sample and, therefore, be worse than no classification at all. Consequently, the objective of the maneuver pattern definitions was twofold: (1) the classification of as many maneuvers as possible in the data, and (2) the rigorous definition of parameter patterns for each maneuver type which would virtually obviate misclassifications.

The loads prediction phase of the current study revealed that no observed nor predicted load peaks could be found in maneuvers where all parameters were below some threshold. In addition, the relatively significant but random deflections caused by turbulence often obscured and confused the patterns of such maneuvers. Therefore, the maneuver pattern definition included the following parameter thresholds which ensured the inclusion of all maneuvers yielding significant load peaks but the exclusion of those not yielding such peaks:

$-0.2\ g < n_x < 0.2\ g$	$-30°/sec < p < 30°/sec$
$-0.1\ g < n_y < 0.1\ g$	$-5°/sec < q < 5°/sec$
$-1.0\ g < \Delta n_z < 1.0\ g$	$-5°/sec < r < 5°/sec$

In the following presentation of the maneuver pattern definitions, the maneuver types are listed generally in the same order that the computer program evaluated the data sections for maneuver types. As shown in the diagram of Figure D-1, the logic flow of the pattern recognition program indicates the actual order in which the maneuver types were tested in the evaluation of each data section.

Wing rock maneuver. —This maneuver type must have three roll rate peaks in alternately opposite directions. A roll rate peak is defined as three consecutive roll rate readings each above 24 counts (approx. 10°/sec.). The last roll rate peak must occur within 12 seconds (60 readings) after the start of the maneuver. There must be no sustained Δn_z deflection defined as five consecutive Δn_z readings each above 49 counts (approx. 1.0 g). This maneuver type ends 0.4 seconds after the third roll rate deflection falls below threshold or below half of the third

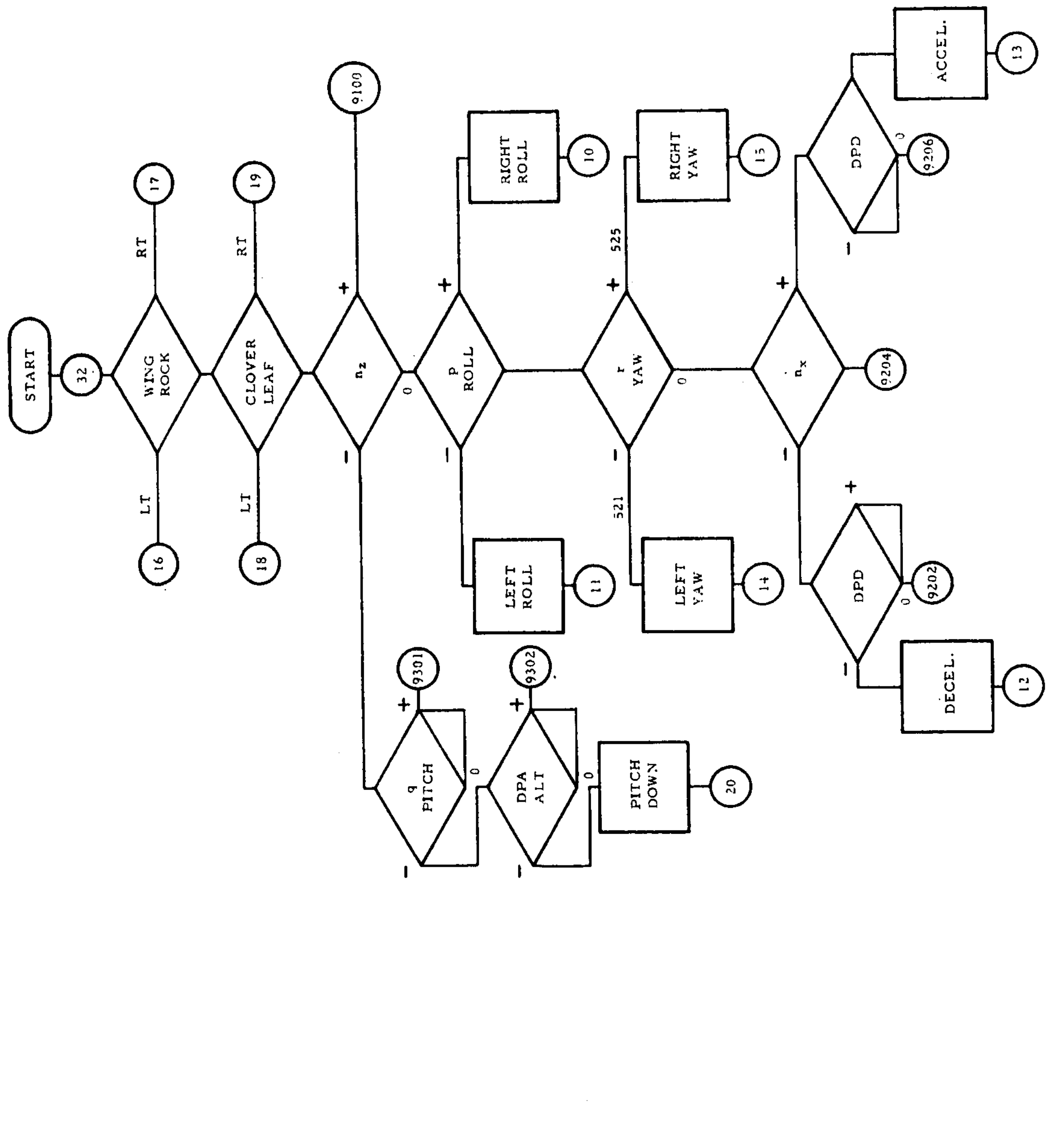


Figure D-1. —Logic flow of pattern recognition program

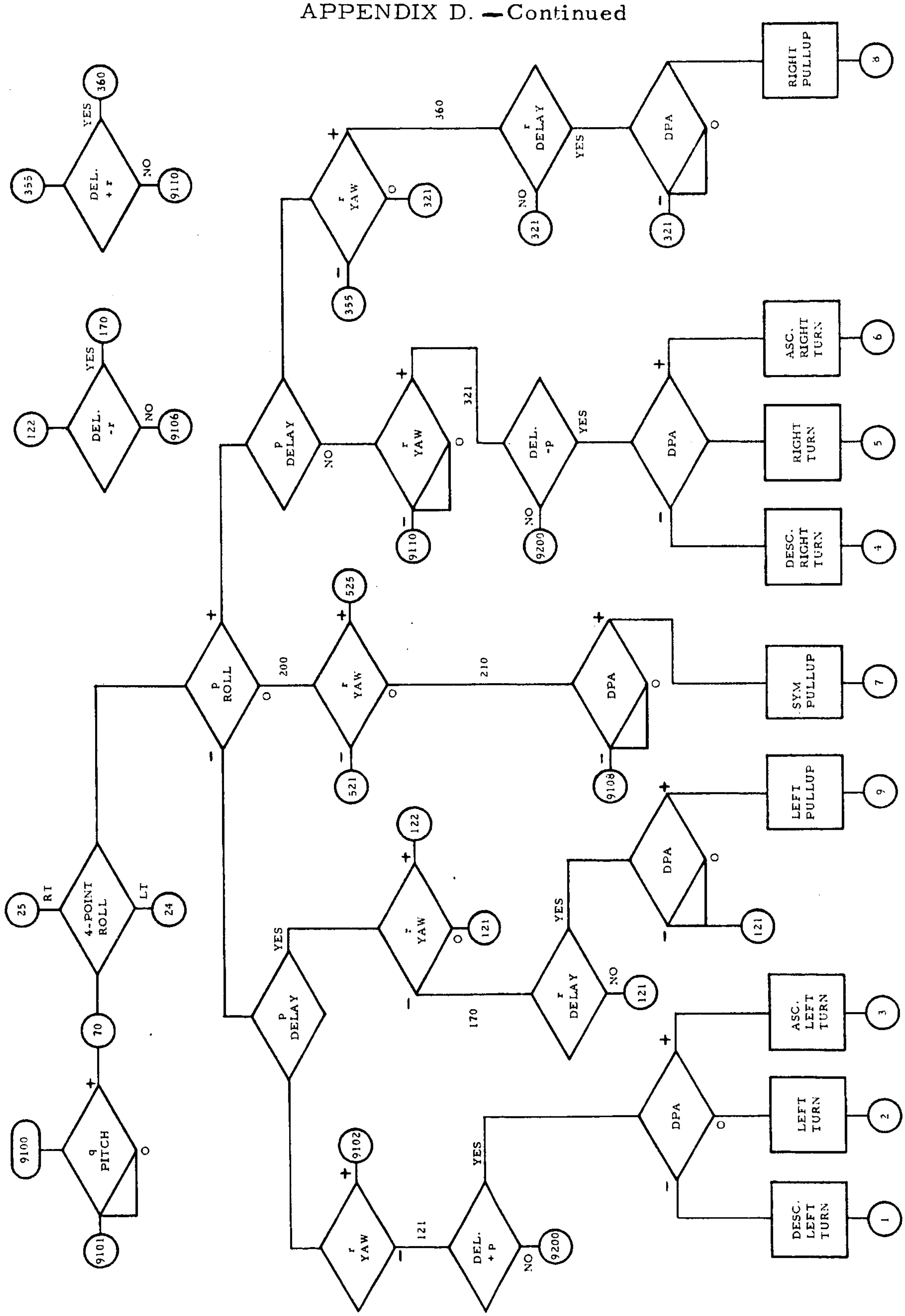


Figure D-1. —Logic flow of pattern recognition program (concluded).

peak value, whichever of the two events occurs later. The maneuver is classified as a left wing rock if the first roll rate is negative or as a right wing rock if the first roll rate is positive.

Clover leaf maneuver. —This maneuver type must have two sustained Δn_z deflections. Each is defined as 65 consecutive readings each above 14 counts (approx. 0.3 g). But neither can be an extremely large Δn_z defined as five consecutive readings each above 99 counts (approx. 2.3 g) since such would more likely reflect a pull-up maneuver. The clover leaf maneuver must also have a sustained yaw rate deflection with 100 consecutive readings each above 14 counts (approx. 1.5°/sec.). If the sustained yaw rate deflects negatively, the maneuver is classified a left clover leaf; but if it deflects positively, the maneuver is classified a right clover leaf. This maneuver type ends 0.4 seconds after whichever of the following events occurs last: the second Δn_z deflection falls below threshold or below half of the second Δn_z peak value, the pitch rate deflection falls below threshold or below half the pitch rate peak value, or the yaw rate deflection falls below threshold or below half the yaw rate peak value.

If none of the foregoing patterns have been detected in a data section, the computer program reviews the Δn_z deflections. If five consecutive Δn_z's occur outside a threshold of $\pm$ 19 counts (approx. $\pm$ 0.45 g), the program checks for a pitch-down maneuver when the n_z deflection is negative or for a four-point roll, a pull-up, or a turn maneuver when the deflection is positive. If such Δn_z's do not appear, the computer checks for a roll, a yaw, a deceleration, or an acceleration maneuver.

Pitch-down maneuver. —This maneuver type must have five consecutive Δn_z readings each below -19 counts (approx. -0.45 g) and five consecutive pitch rate readings each below -14 counts (approx. 1.0°/sec.). In this maneuver type, the pressure altitude normally decreases by at least -15 counts (an approx. 700-foot decrease at 5000 feet); if not, the program still accepts the pattern as a pitch-down maneuver but adds a comment to the classification. This maneuver ends 0.4 seconds after whichever of the following events occurs last: the Δn_z deflection rises above threshold or above half the negative Δn_z peak value or the pitch rate deflection rises above threshold or above half the negative pitch rate peak value.

Roll maneuver. —This maneuver type must have five consecutive roll rate readings each above $\pm$ 74 counts (approx. $\pm$ 27°/sec.) and the integral of the roll rate trace must be greater than $\pm$ 100°. Negative roll rates indicate a left roll, and positive roll rates a right roll. This maneuver type ends 0.4 seconds after whichever of the following events occurs last: the roll rate deflection falls below threshold or below half the roll rate peak value or the Δn_z falls below threshold.

Yaw maneuver. —This maneuver type must have two opposite yaw rate peaks where the first is defined as two consecutive readings each above $\pm$ 24 counts (approx. $\pm$ 2.5°/sec.) and the second peak as one reading above $\pm$ 24 counts. There must not be more than 5 seconds between the peaks nor more than 12 seconds between the maneuver start and the second peak. If the first yaw rate peak is negative, the maneuver is a left yaw; if positive, it is a right yaw. This maneuver type ends 0.4 seconds after the second deflection returns to threshold or to half the second peak value, whichever is later.

Deceleration maneuver. —This maneuver type must have five consecutive negative n_x readings each below -15 counts (approx. -.05 g) and each preceded and followed by at least one positive n_x reading more than 32 counts (approx. +.1 g) above the negative n_x peak value. In this maneuver type, the airspeed normally decreases by -15 counts (an approx. 20-knot decrease at 350 knots) or the altitude increases 20 counts (an approx. 1000-foot increase at 5000 feet); if not, the program still accepts the pattern as a deceleration maneuver but adds a comment to the classification. This maneuver type ends when the n_x deflection rises above threshold.

Acceleration maneuver. —Except for the reversal of the deflection signs, this maneuver type has the same pattern as that defined for the deceleration maneuver.

Four-point roll maneuver. —This maneuver type must have four roll rate peaks each in the same direction and each with five consecutive roll rate readings above $\pm$ 98 counts (approx. $\pm$ 35°/sec.). Between each two adjacent roll rate peaks, the roll rate must fall below 99 counts. In addition, this maneuver type must have five consecutive Δn_z readings each above 19 counts (approx. 0.45 g) and five consecutive pitch rate readings each above 14 counts (approx. 1.0°/sec.). This maneuver type ends 0.4 seconds after the fourth roll rate deflection or the Δn_z value falls below threshold, whichever occurs last. Negative roll rates indicate a left four-point roll, and positive roll rates a right four-point roll.

At this stage, the computer program determines whether the roll rate deflection is sufficient to classify the maneuver a turn or a rolling pull-up. If the maneuver has five or more consecutive Δn_z readings each above 99 counts (approx. 2.3 g), it must also have five roll rate readings each above $\pm$ 59 counts (approx. $\pm$ 22°/sec.) to be classified either of the two types; but if these Δn_z's are lower, the roll rates need only exceed $\pm$ 14 counts (approx. $\pm$ 5.5°/sec.).

Symmetrical pull-up maneuver. —This maneuver type must have five consecutive Δn_z readings each above 19 counts (approx. 0.45 g) and five consecutive pitch rate readings each above 14 counts (approx. 1.0°/sec.). In this maneuver type, no five consecutive roll rate readings can be outside threshold ($\pm$ 59 counts if the five or more Δn_z's are above 99 counts or $\pm$ 14 counts if the Δn_z's are lower), nor can five consecutive yaw rate readings be outside threshold ($\pm$ 46 counts if the five or more Δn_z's are above 99 counts or $\pm$ 14 counts if the Δn_z's are lower). The peak Δn_z reading must be at least 25 counts above the first Δn_z reading. Finally, the altitude normally has a 15-count increase after the beginning of the Δn_z peak; if not, the computer program adds a comment to the symmetrical pullup classification. This maneuver type ends 0.4 seconds after the Δn_z trace falls below threshold or below half the Δn_z peak or the pitch rate trace falls below threshold or below the pitch rate peak value, whichever occurs last.

Right pull-up maneuver. —This maneuver type must have five consecutive Δn_z readings each above 19 counts (approx. 0.45 g) and five consecutive pitch rate readings each above 14 counts (approx. 1.0°/sec.). In addition, it must have five consecutive roll rate readings each above threshold ($\pm$ 59 counts if five or more consecutive Δn_z readings are each above 99 counts or $\pm$ 14 counts if the Δn_z's are lower). The first roll rate reading outside threshold must be delayed at least 0.2 seconds after the first Δn_z reading outside threshold. Moreover, this maneuver type must also have five consecutive yaw rate readings above threshold ($\pm$ 45 counts if the roll rate is below threshold and the five or more consecutive Δn_z's are each above 99 counts; or $\pm$ 14 counts if the Δn_z's are lower). Like the first roll rate reading, the first yaw rate reading outside threshold must be delayed at least 0.2 seconds after the first Δn_z reading outside threshold. The peak Δn_z value must be at least 25 counts above the first Δn_z reading. Finally, the altitude trace normally had a 15-count increase after the beginning of the Δn_z peak. If a maneuver without this altitude increase has five consecutive Δn_z readings each above 99 counts (approx. 2.3 g), the computer program still classifies it a right pull-up and adds a comment. But if a maneuver has neither the altitude increase nor these Δn_z's, the program classifies it a turn and adds a comment. The right pull-up maneuver ends 0.4 seconds after whichever of the following events occurs last: the Δn_z, the pitch rate, the yaw rate, or the negative peak of the roll rate falls below threshold or to half their respective maximum deflection values. The negative roll rate peak used in this definition of the maneuver termination must be within 25 readings before or after the time when the Δn_z and yaw return to threshold.

Left pull-up maneuver. —Except for the reversal of the roll and yaw rate deflections, this maneuver type has the same pattern as that defined for the right pull-up maneuver.

Right turn maneuver. —This maneuver type must have five consecutive Δn_z readings each above 19 counts (approx. 0.45 g), five consecutive pitch rate readings each above 14 counts (approx. 1.0°/sec.), and five consecutive positive roll rate readings each above threshold (+59 counts if five or more consecutive Δn_z readings are above 99 counts or + 14 if the Δn_z's are lower). The first roll rate reading outside threshold must occur before or at the first Δn_z reading outside threshold. In addition, this maneuver type must have five consecutive yaw rate readings each above +14 counts (approx. +1.5°/sec.). The positive roll rate deflection must be followed by a negative roll rate deflection defined by five consecutive readings each below -9 counts (approx. -4.0°/sec.). This maneuver type ends 0.4 seconds after whichever of the following events occurs last: the Δn_z, the pitch rate, the yaw rate, or the negative peak of the roll rate trace falls below threshold or to half their respective maximum deflection values. For the negative roll rate peak used in this definition of the maneuver termination, the computer program first searches for one within 25 readings before or after the time when the Δn_z and yaw rate return to thresold. But not finding such, the program uses that negative roll rate peak which occurs first in the maneuver pattern. If the difference is -15 counts or below, the computer program classifies the maneuver a descending right turn; if between -15 counts and +15 counts, a right turn; and if +15 counts or above, an ascending right turn.

Left turn maneuver. —Except for the reversal of the roll and yaw deflections, this maneuver type has the same pattern as that defined for the right turn maneuver.

Inside loop maneuver. —The few maneuvers of this type were noted too late in the effort to be included in the pattern recognition computer program.

In its present form, the computer program prints in chronological order the data for each section examined for a maneuver. As defined above, such data sections include only those where at least one parameter has deflections outside threshold. At the end of each printout of a data section, it also prints the maneuver type with or without comments and the beginning and ending times of the maneuver or simply comments when no maneuver is recognized. Whenever a recognized maneuver has an unusual pattern, the program prints a comment to that effect along with the maneuver type. With further development, the program will likely print the entire data section only when a comment is generated because a data section has either no recognizable maneuver type or an unusual pattern in a recognized maneuver type. As illustrated in Figure D-1, the numbers above 9100 enclosed in circles indicate the places where the logic not recognizing a maneuver pattern generates a comment giving the reason for no pattern recognition. The numbers between 100 and 1000 also enclosed in circles represent the places where the logic finds a data section with the potential for another maneuver type and accordingly transfers it to another phase. The numbers 1 to 25 again encircled indicate the places where the logic recognizes one of the twenty-three maneuver types and generates the maneuver classification.

APPENDIX E

NORMALIZED DATA

Contents:

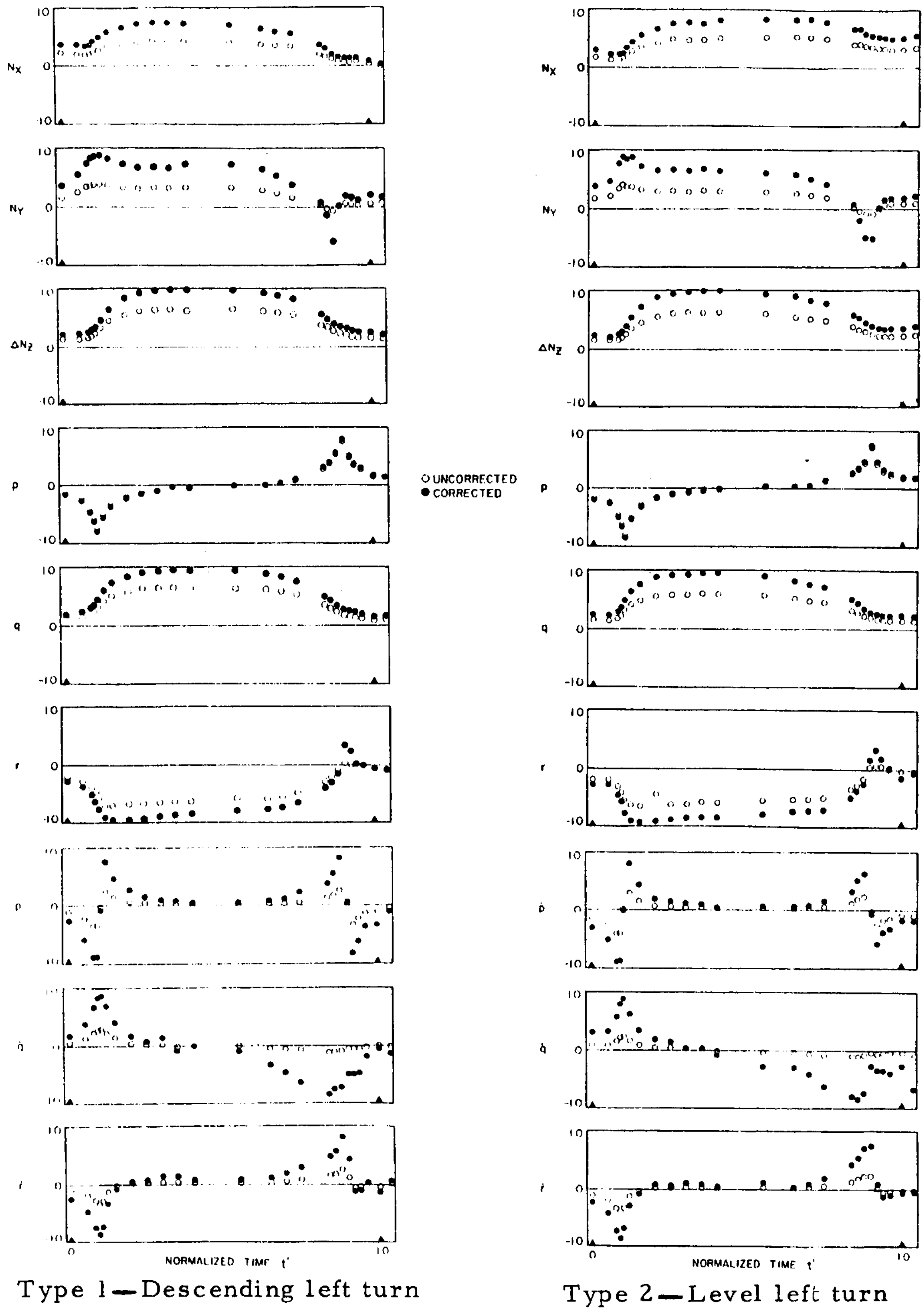
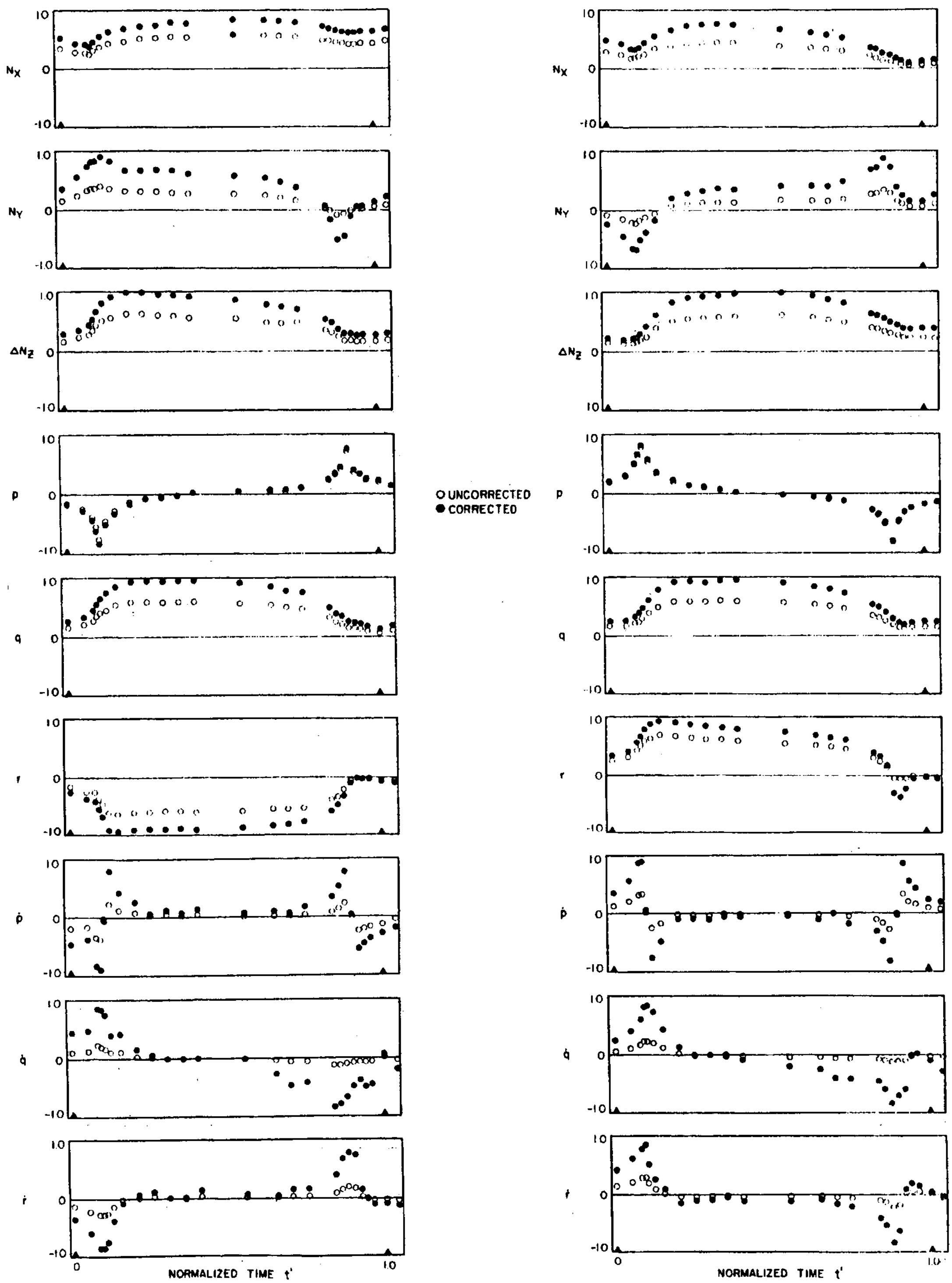


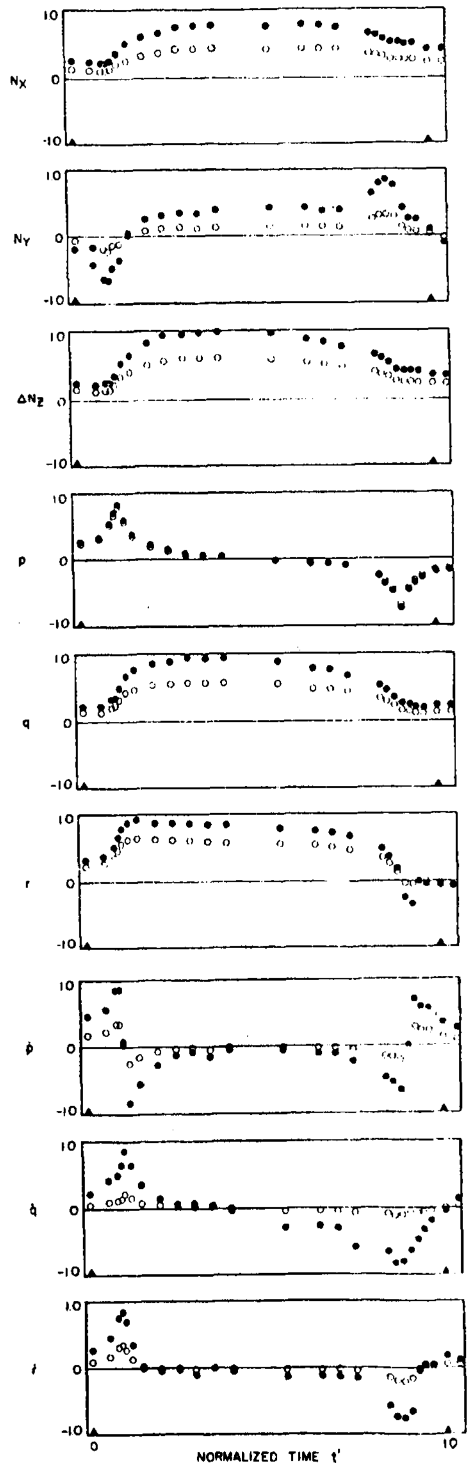
Figure E-1. —Average normalized time histories of parameters in all maneuver types



Type 3—Ascending left turn

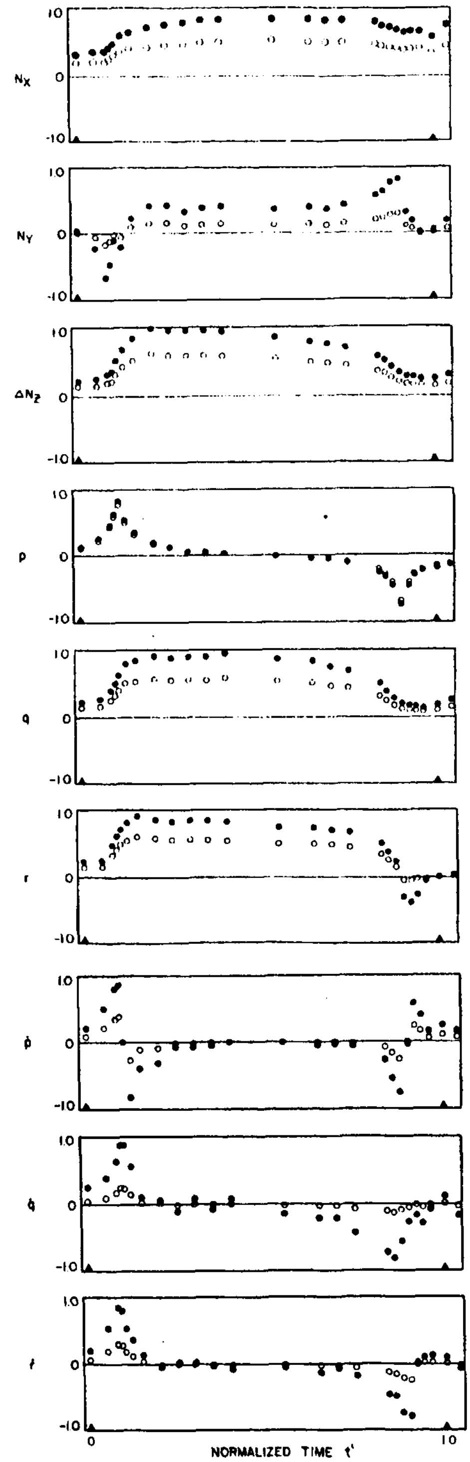
Type 4—Descending right turn

Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)



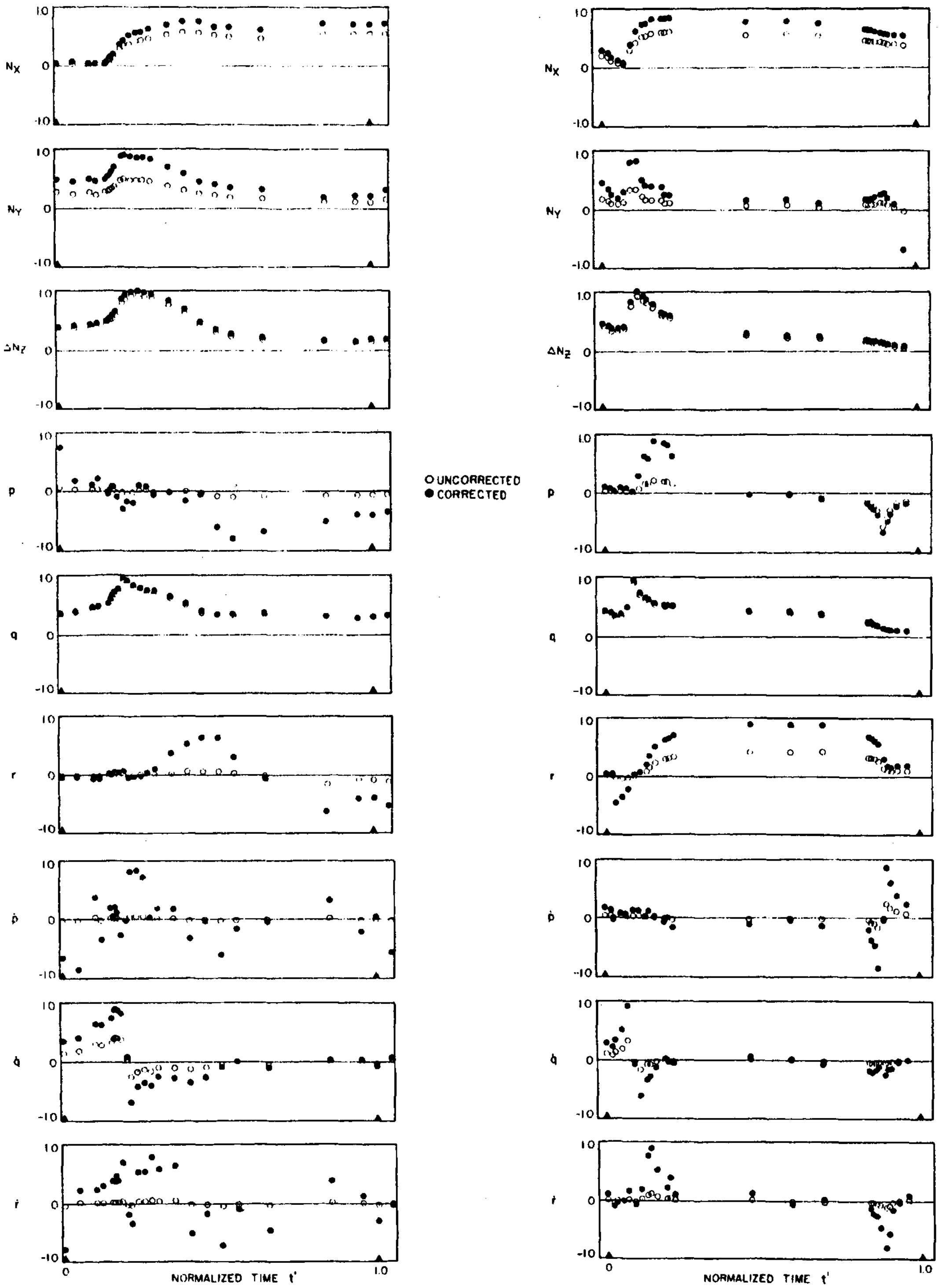
Type 5—Level right turn

O UNCORRECTED
● CORRECTED



Type 6—Ascending right turn

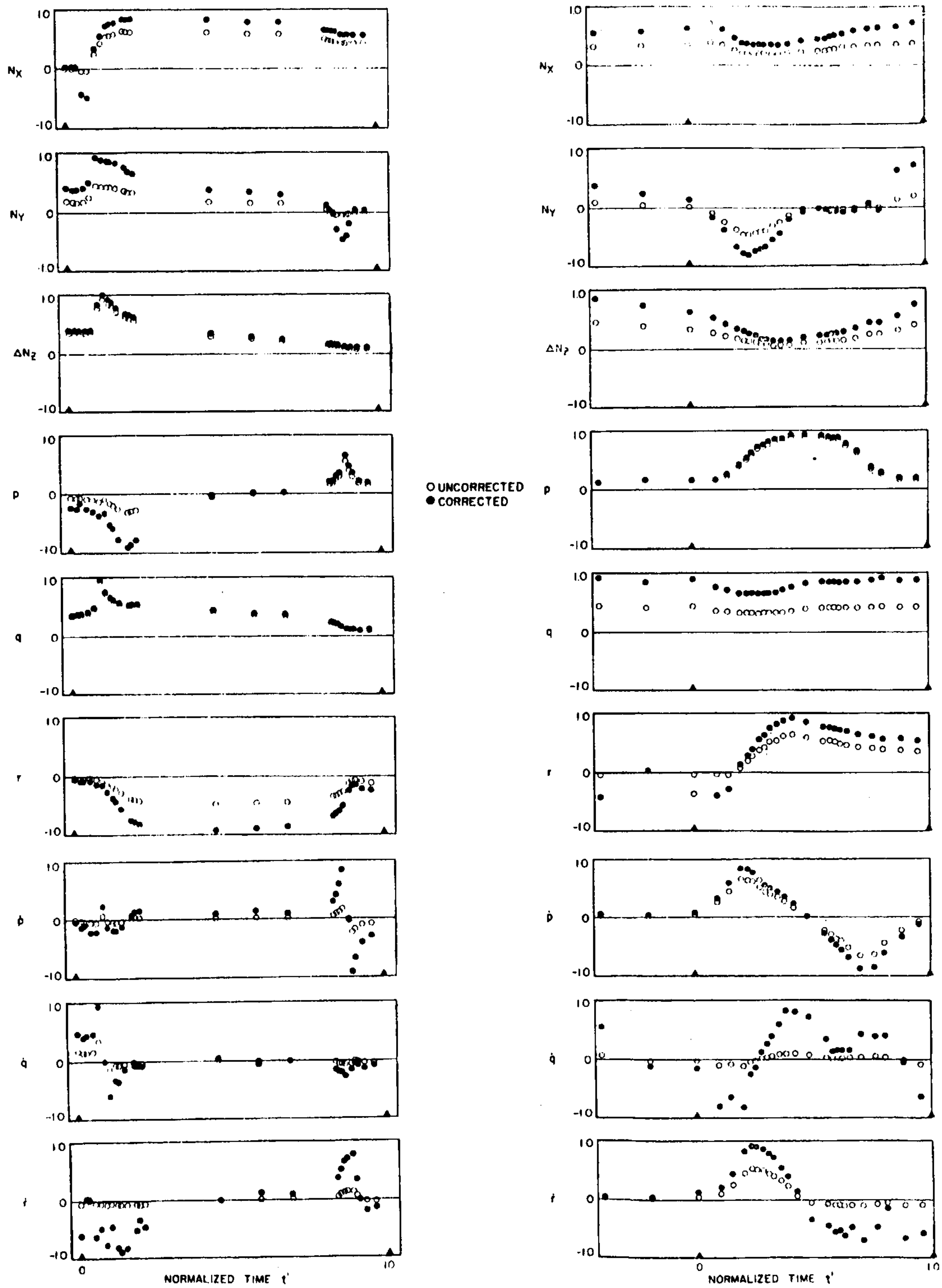
Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)



Type 7—Symmetrical pull-up

Type 8—Right rolling pull-up

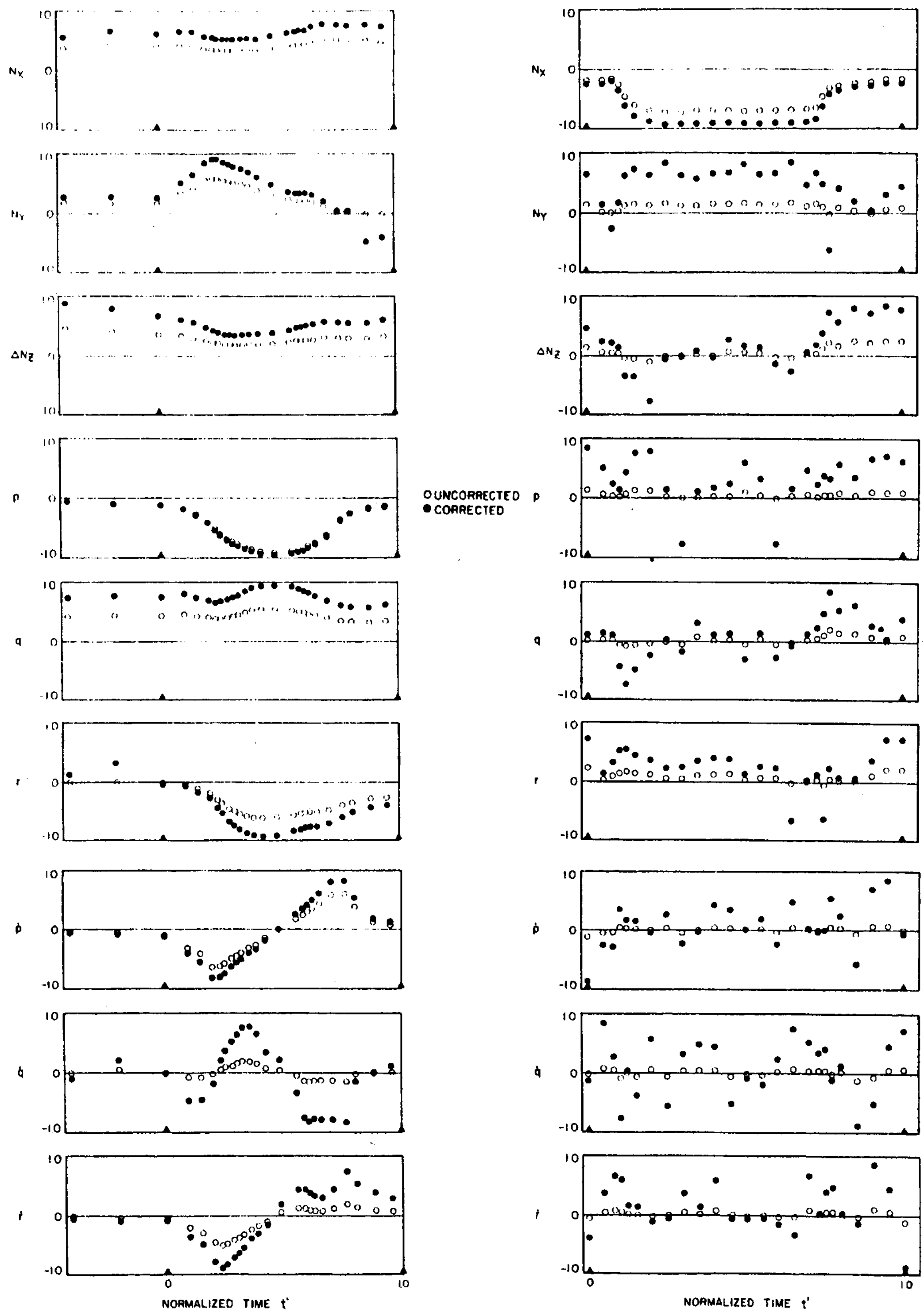
Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)



Type 9—Left rolling pull-up

Type 10—Right roll

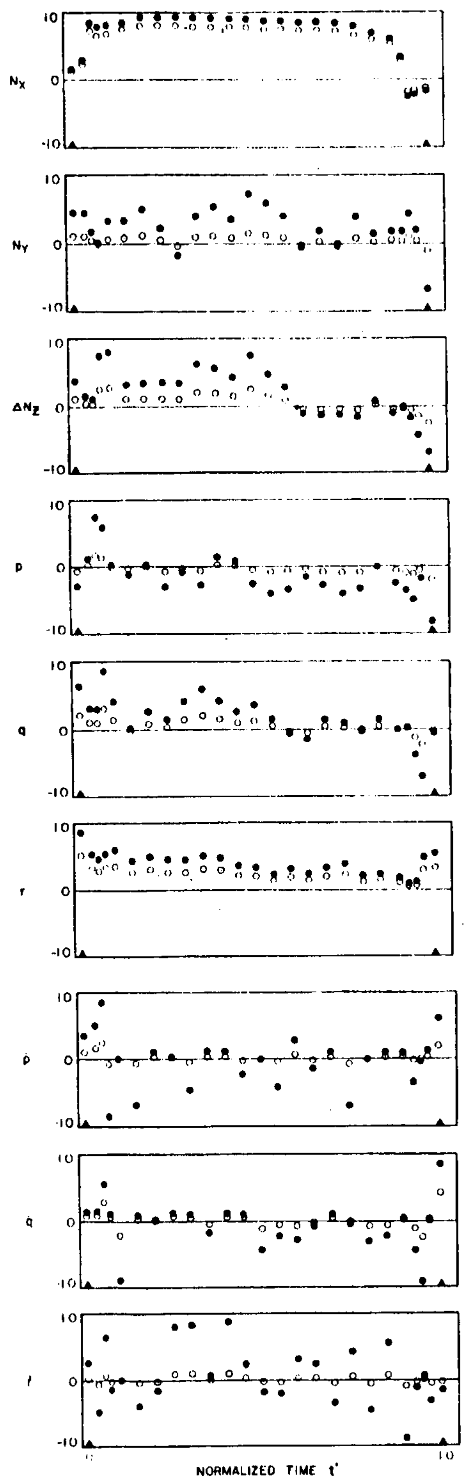
Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)



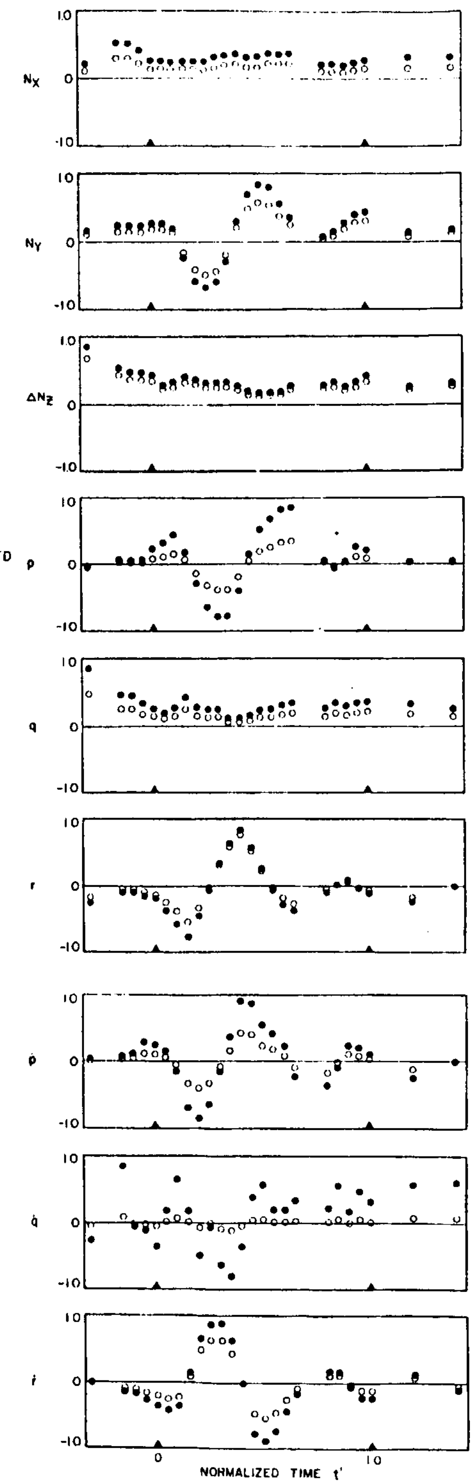
Type 11—Left roll

Type 12—Longitudinal deceleration

Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)

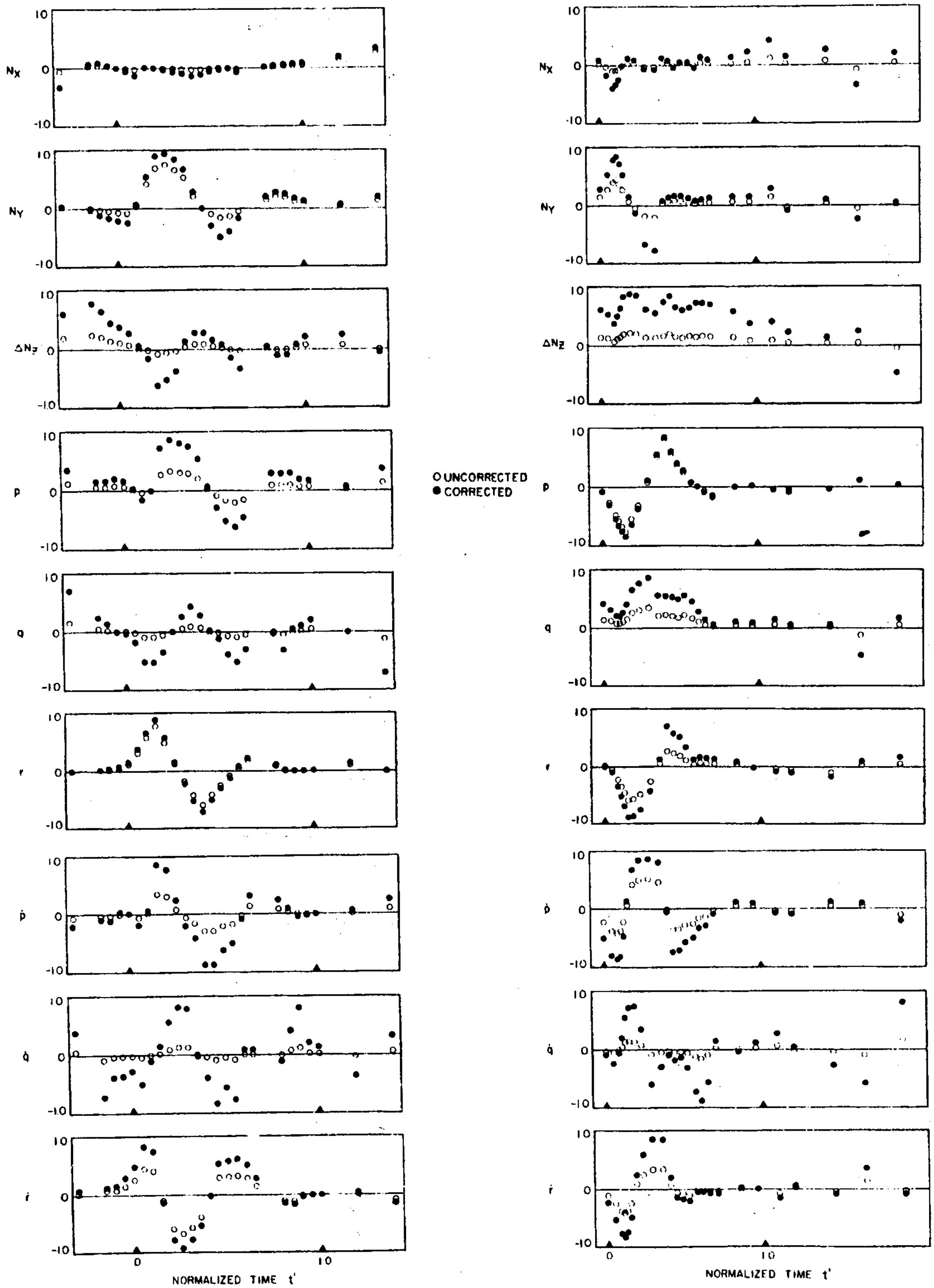


Type 13—Longitudinal acceleration



Type 14—Left yaw

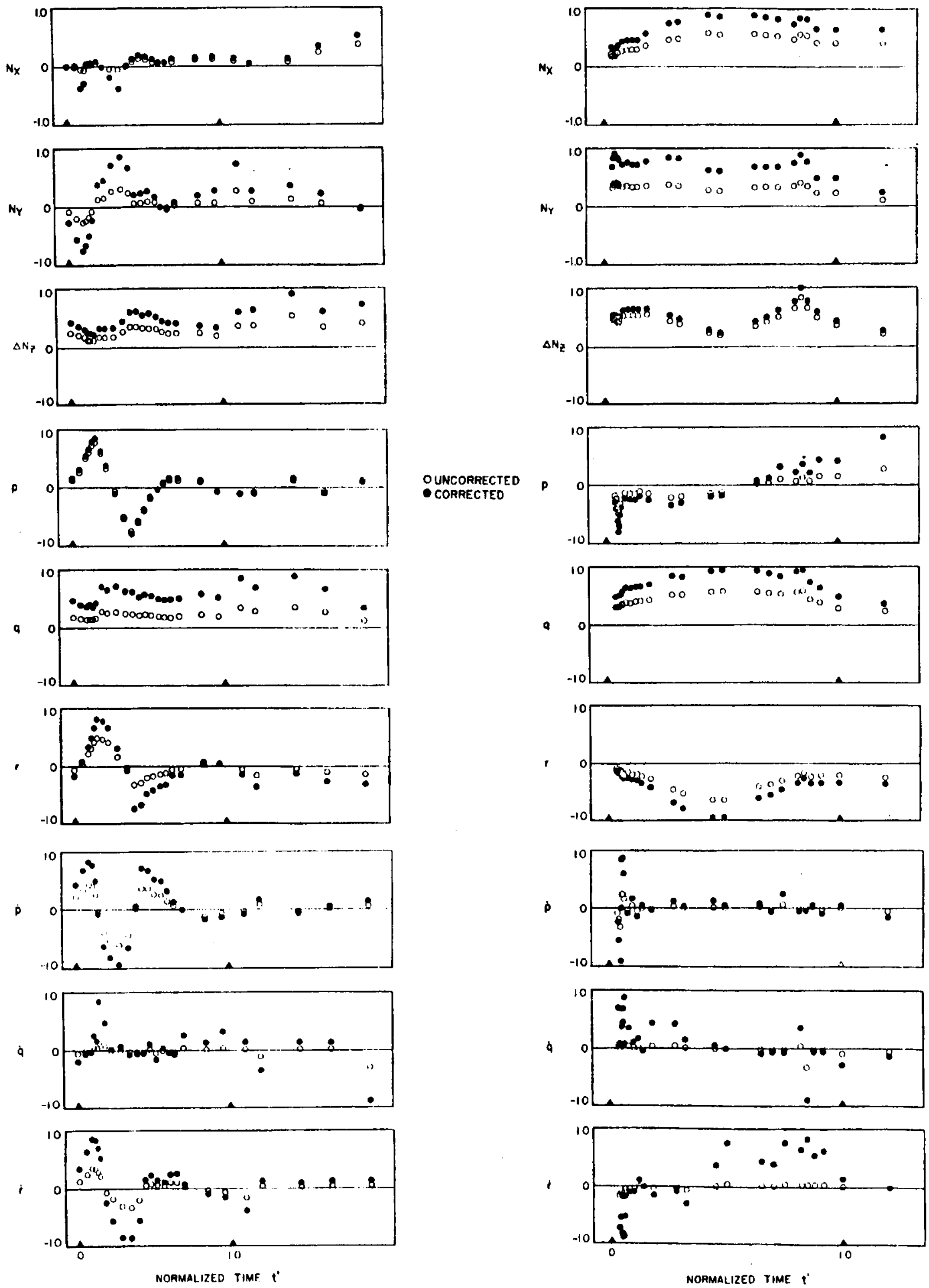
Figure E-1.—Average normalized time histories of parameters in all maneuver types (concluded)



Type 15—Right yaw

Type 16—Left wing rock

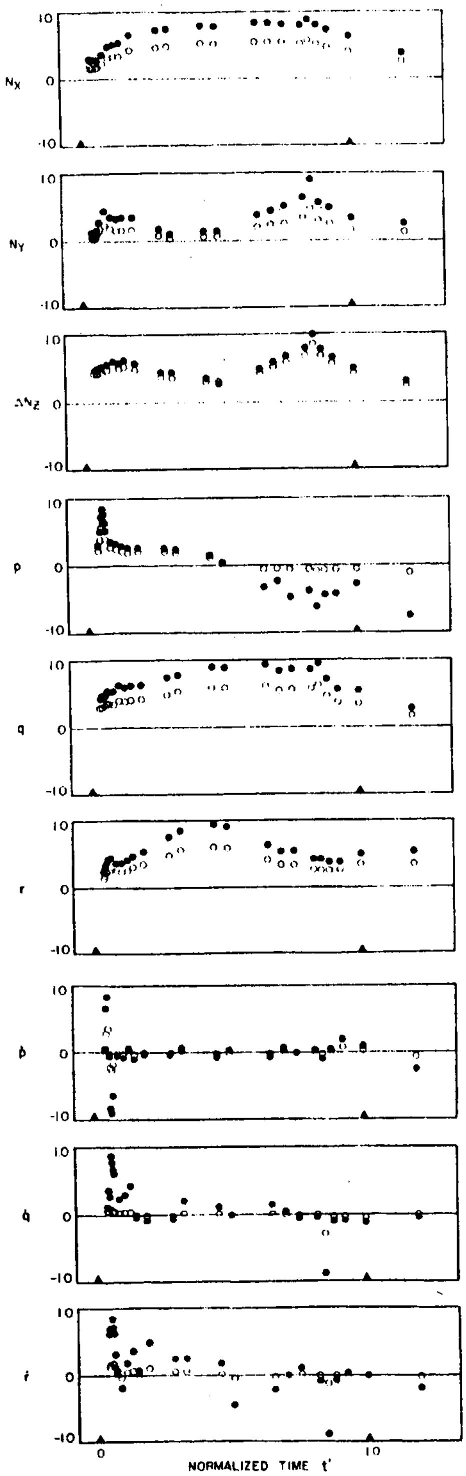
Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)



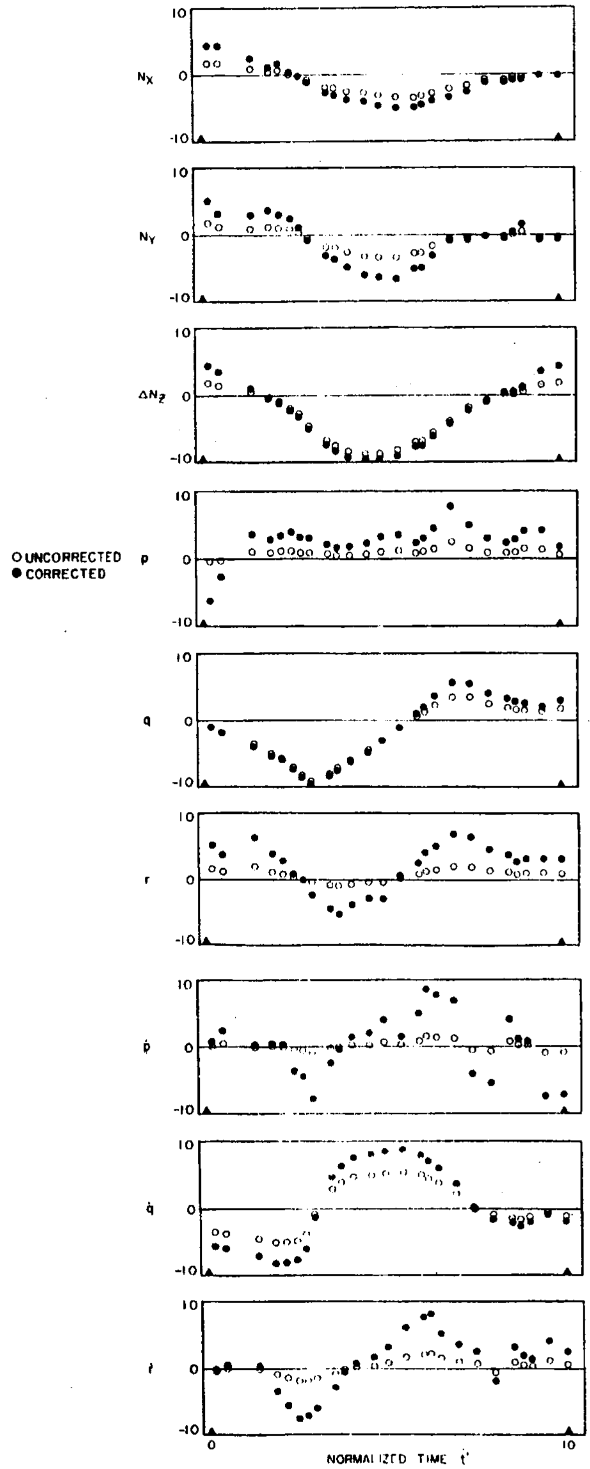
Type 17—Right wing rock

Type 18—Left cloverleaf

Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)

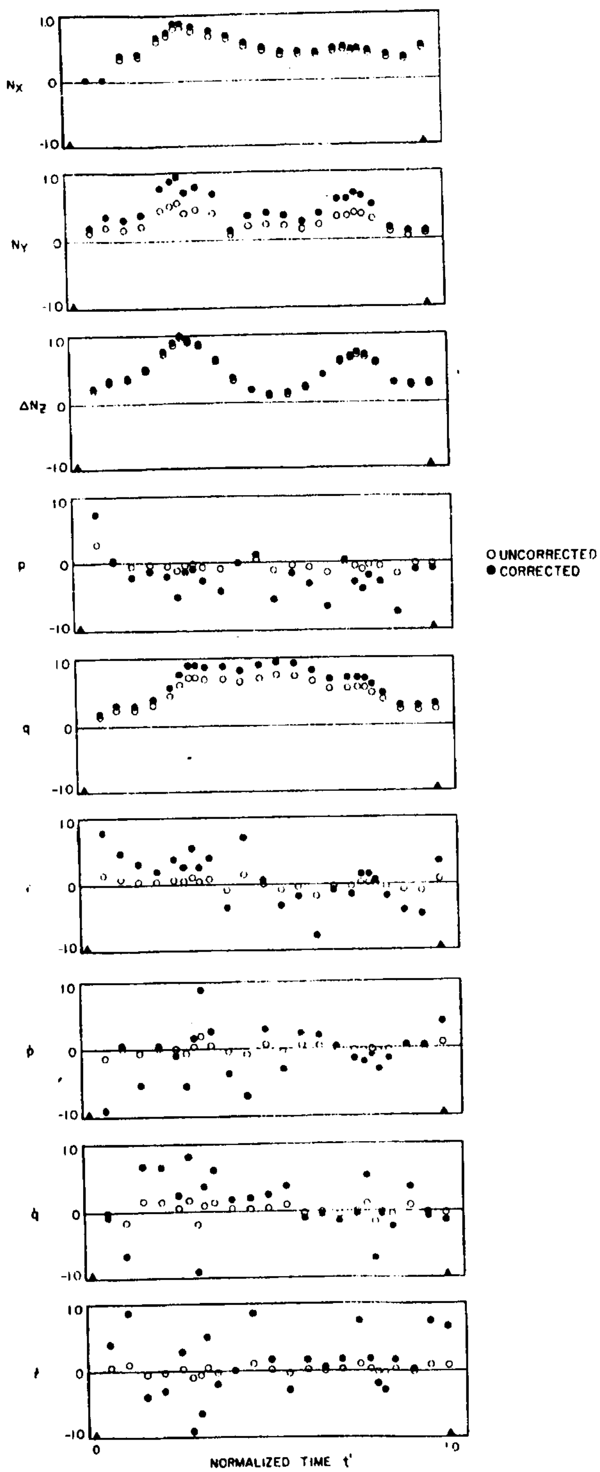


Type 19—Right cloverleaf

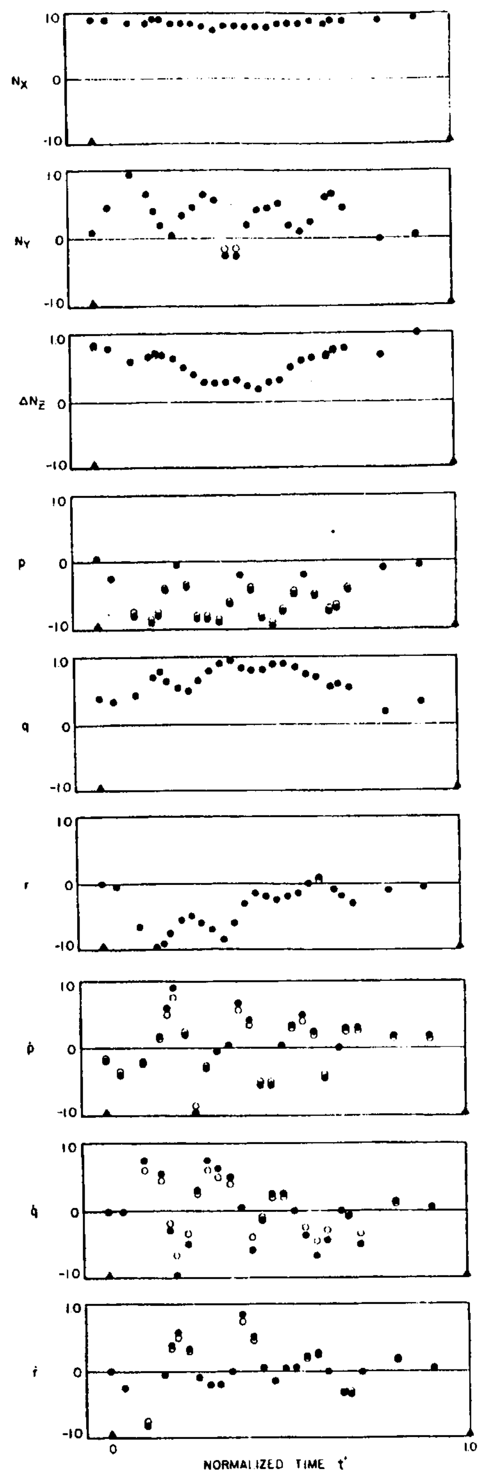


Type 20—Symmetrical pitch-down

Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)

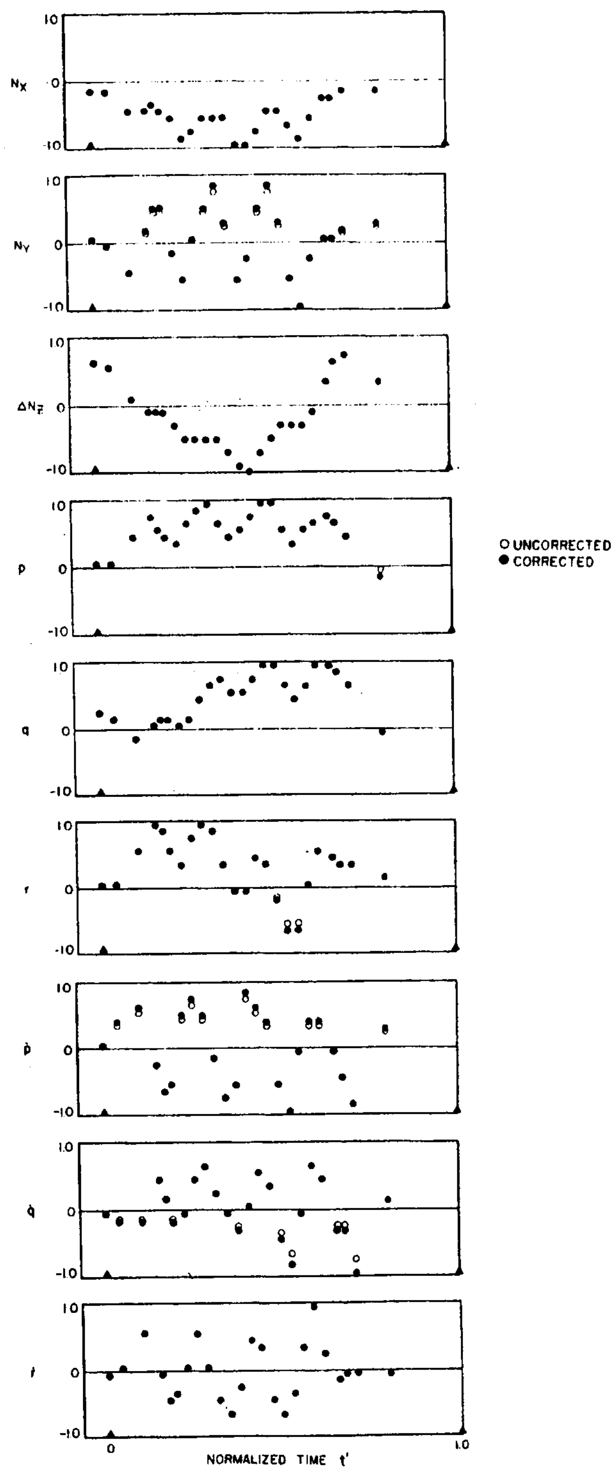


Type 21—Inside loop



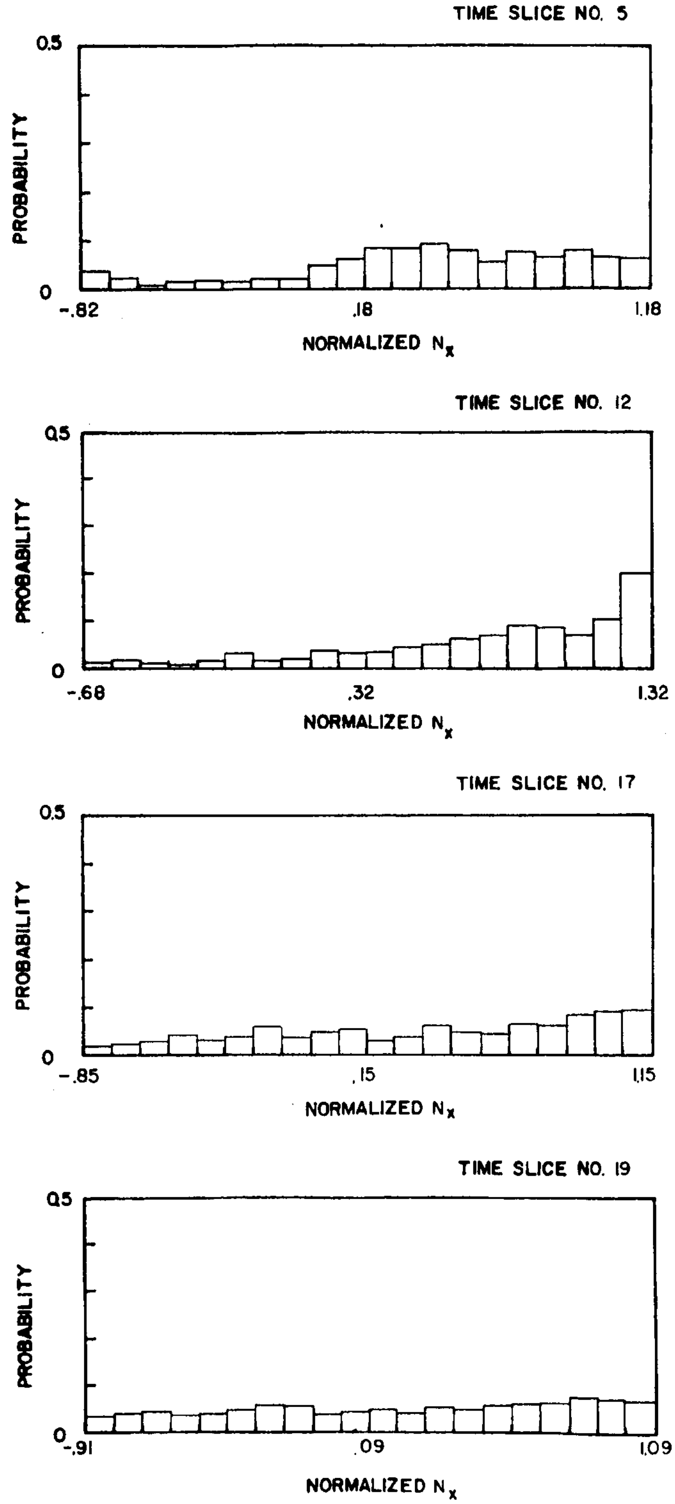
Type 24—Left four-point roll

Figure E-1. —Average normalized time histories of parameters in all maneuver types (continued)



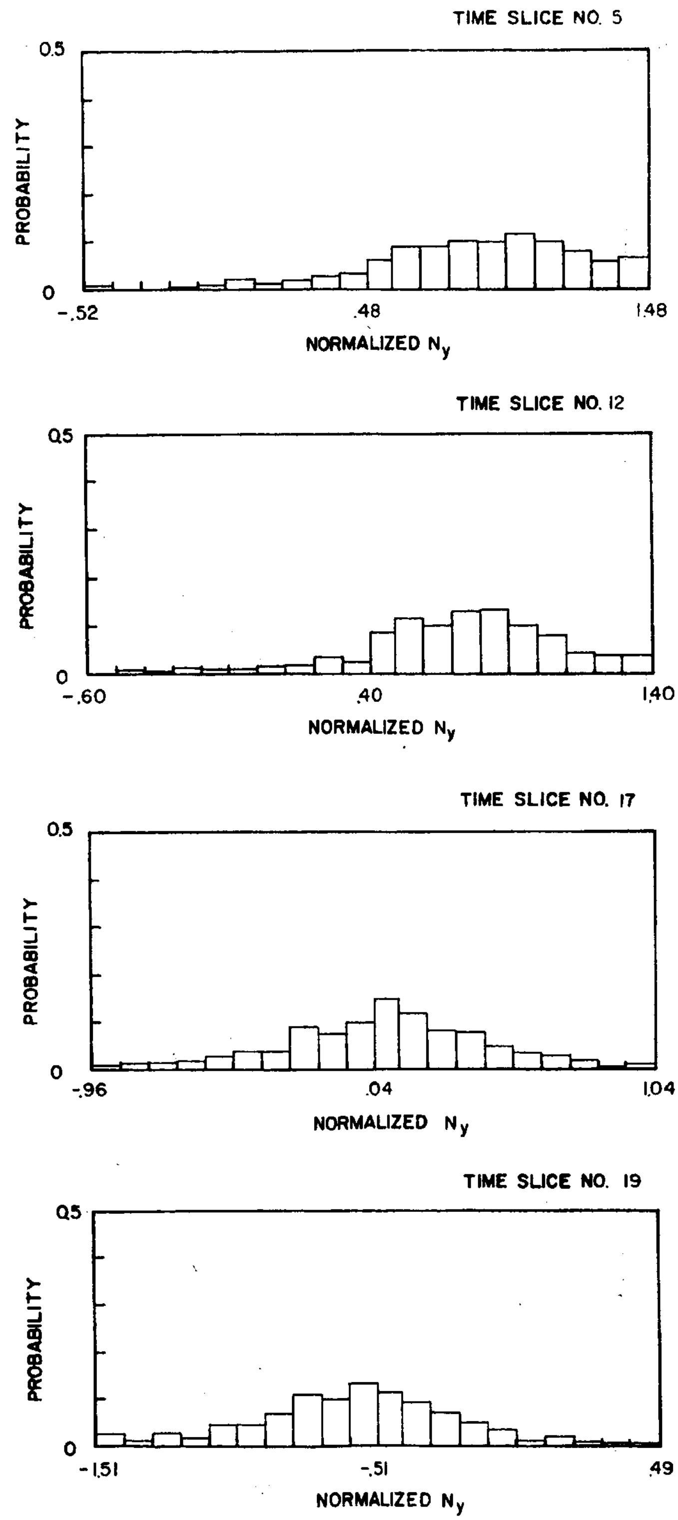
Type 25—Right four-point roll

Figure E-1. —Average normalized time histories of parameters in all maneuver types (concluded)



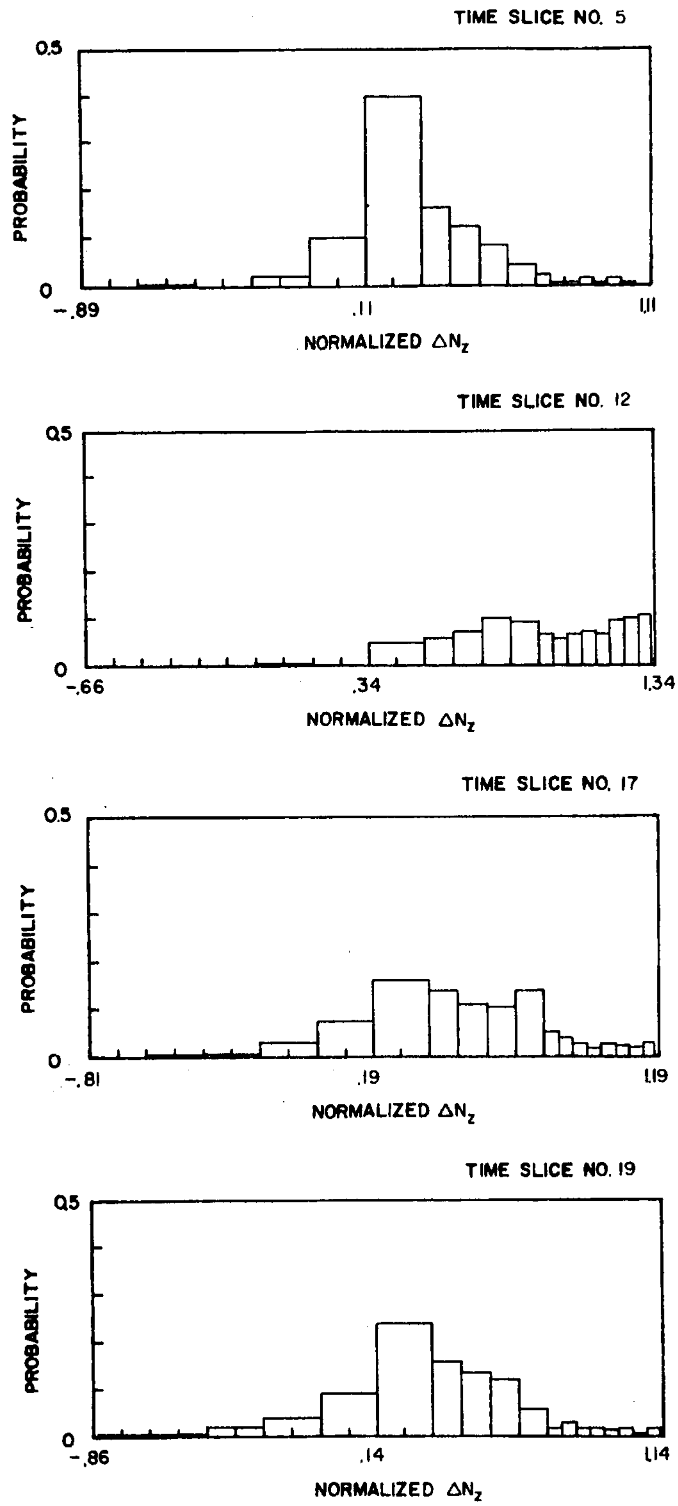
(a) n_x—longitudinal load factor

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver



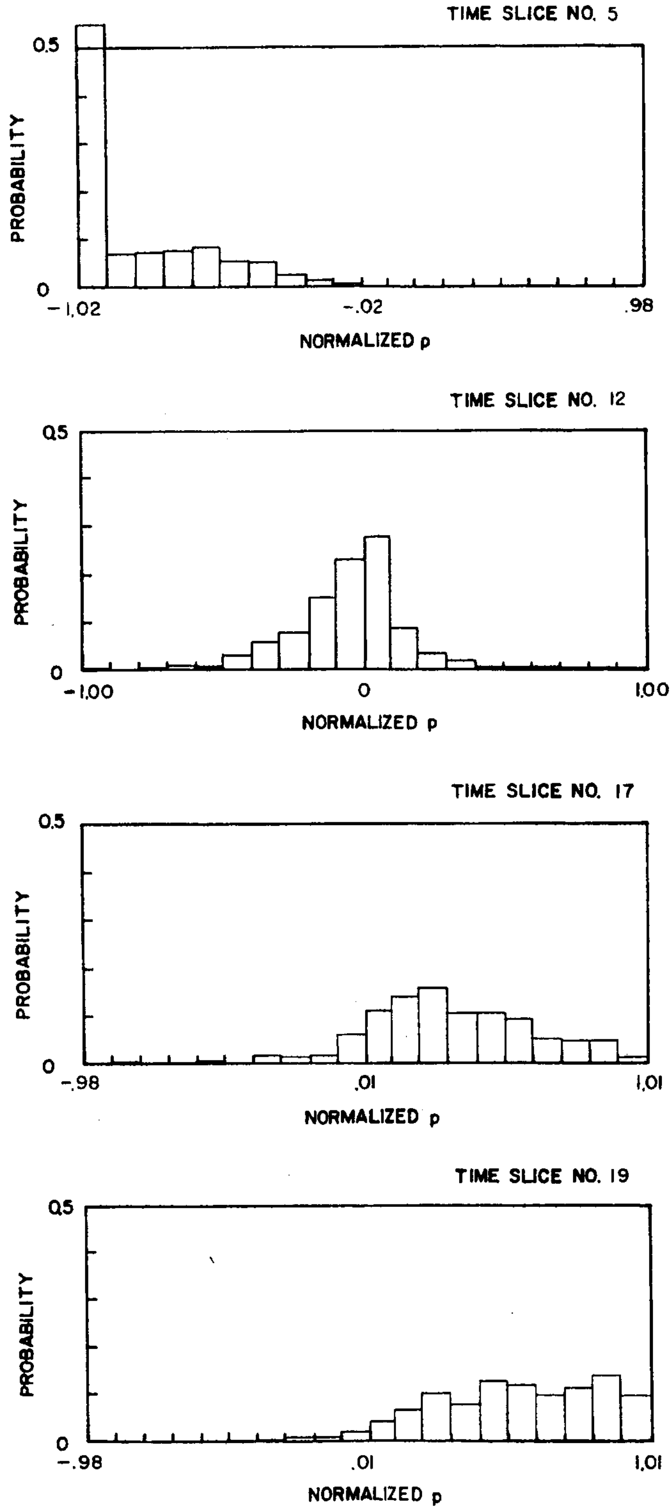
(b) n_y—lateral load factor

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)



(c) Δn_z—incremental normal load factor

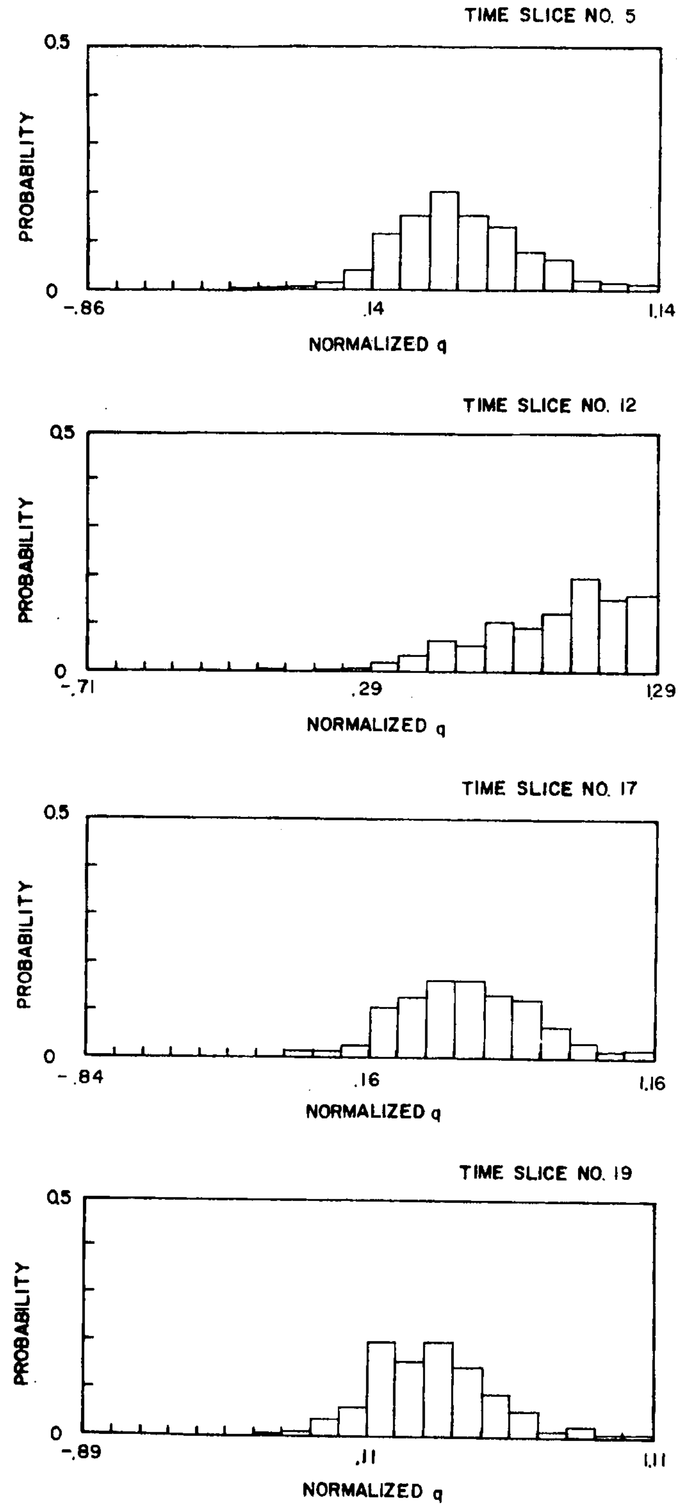
Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)



(d) p—roll angular velocity

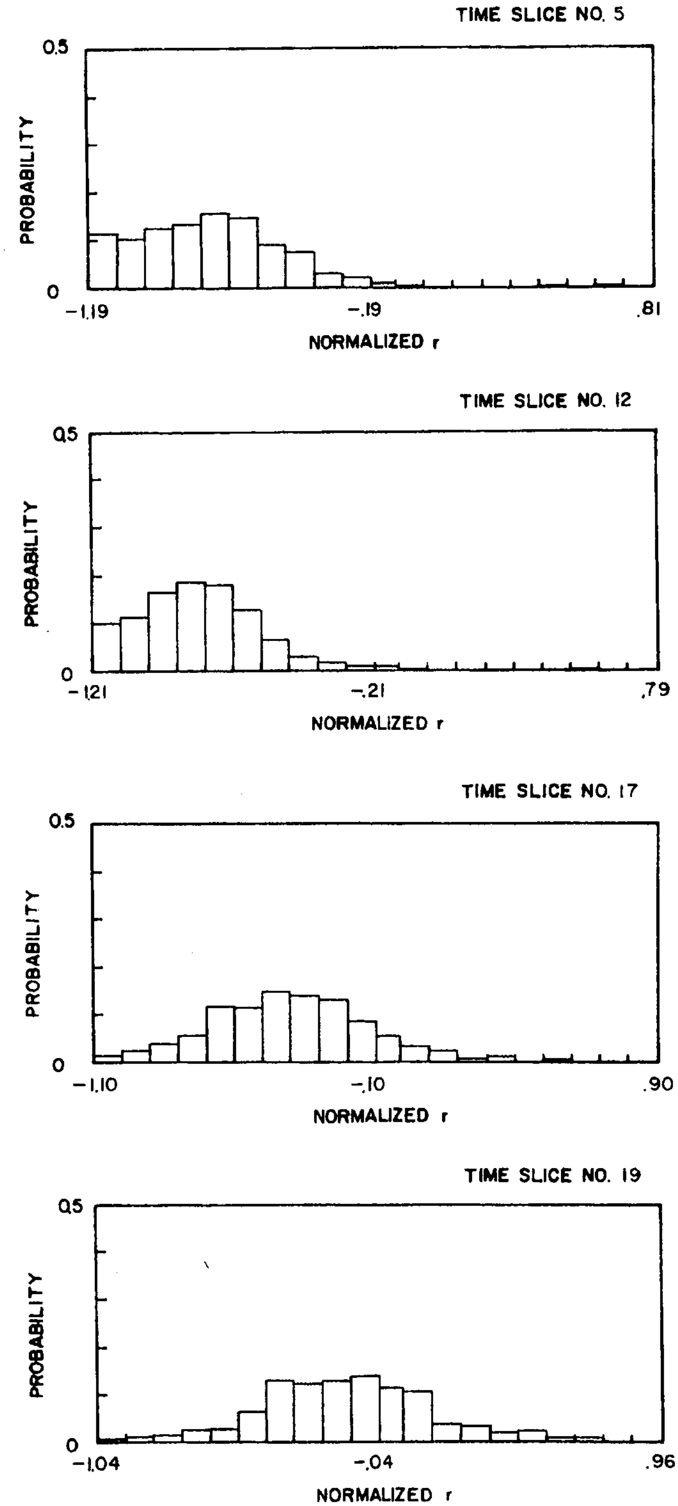
Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)

APPENIDX E. —Continued



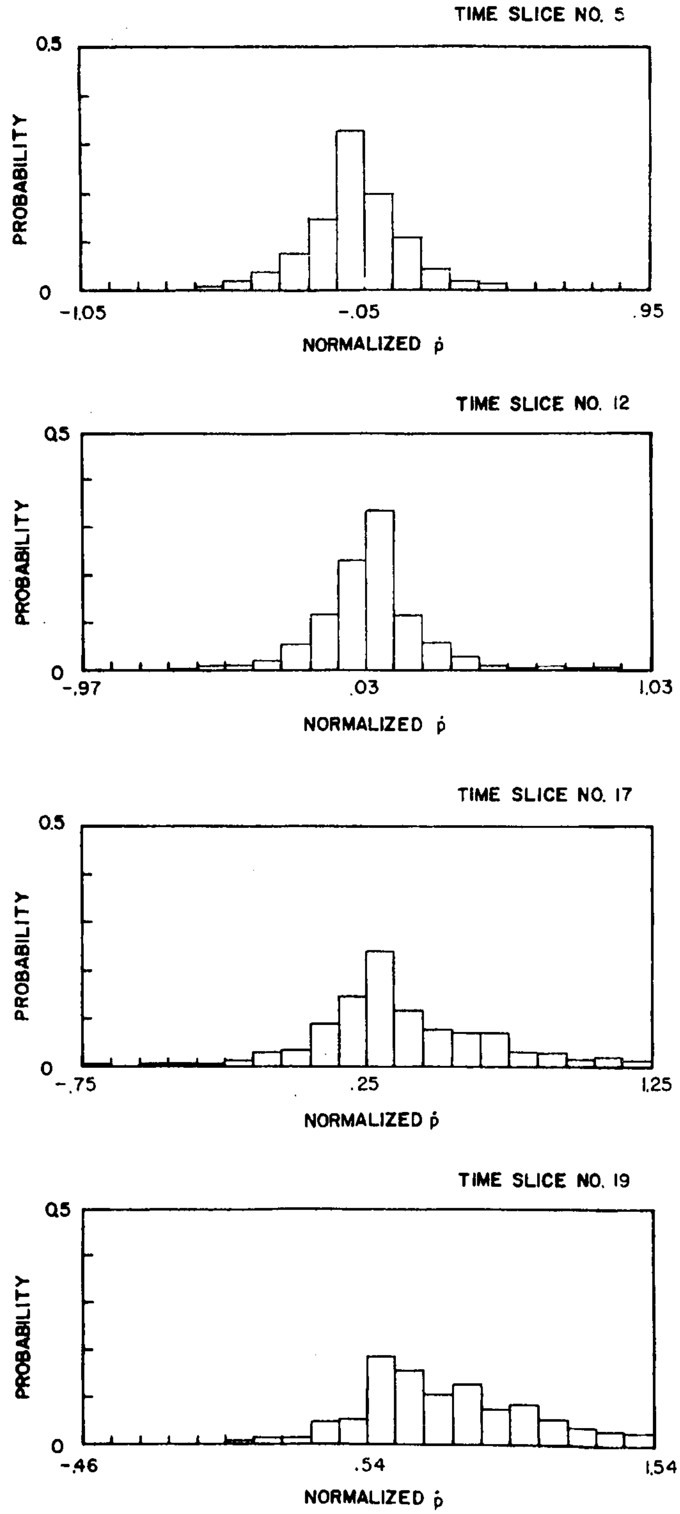
(e) q—pitch angular velocity

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)



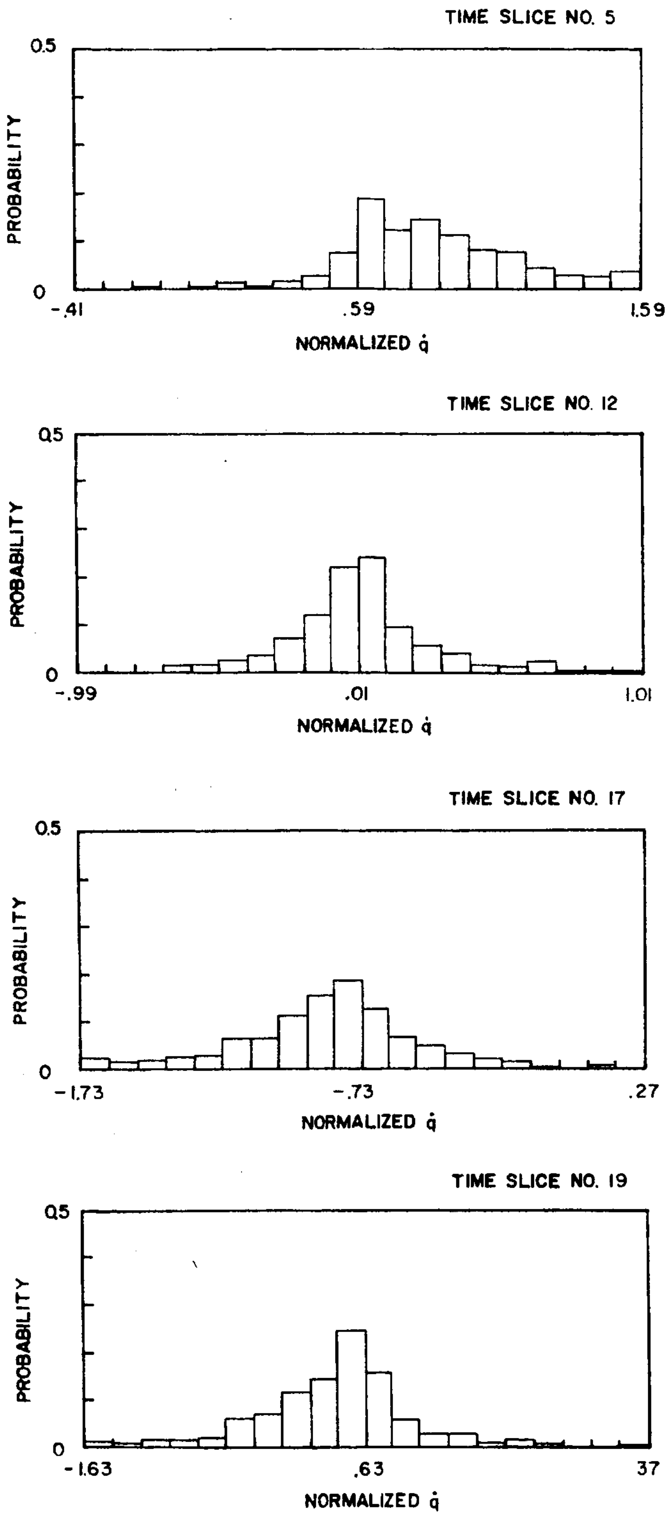
(f) r—yaw angular velocity

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)



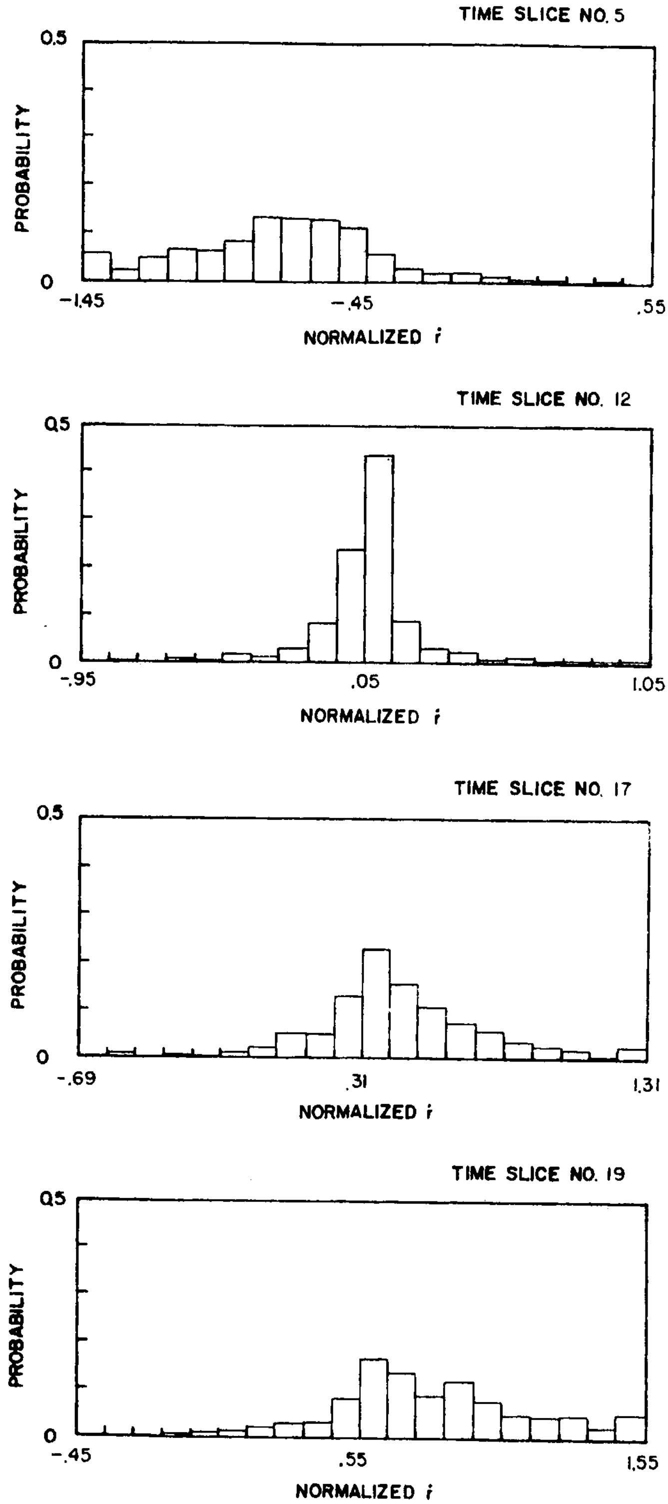
(g) $\dot{p}$—roll angular acceleration

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)



(h) $\dot{q}$—pitch angular acceleration

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (continued)



(i) $\dot{r}$—yaw angular acceleration

Figure E-2. —Corrected normalized parameter distributions in the descending left turn maneuver (concluded)

APPENDIX F

MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS

Contents:

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE

(a) n_x—longitudinal load factor

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS NX G'S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
REL	136	737	43	98	668	58	62	2	4	30	35	6	1	59	63	160	180	5	5	8	2450
.05	277	702	142	208	527	112	145	23	31	60	53	18	22	40	47	139	141	31	24	11	2753
.10	336	417	172	199	308	135	101	26	46	33	43	40	28	28	24	61	71	41	30	7	2146
.15	235	290	196	154	211	146	127	27	90	21	39	82	71	13	18	43	42	19	23	5	1907
.20	239	170	197	149	114	136	131	51	124	25	25	94	50	4	6	20	27	10	9		1561
.25	103	159	86	77	46	55	51	26	97	8	10	75	33	1		11	11	8	2	1	815
.30	57	37	35	38	28	20	40	16	53	5	6	71	21			2	5	1	1		436
.35	37	20	24	21	12	9	25	19	17		2	50	9		1	9	5	2	1		263
.40	33	10	18	14	6	9	28	8	24			33	13			4	5		1		206
.45	19	2	4	7		3	23	6	24	1		22	9		1	2	4	4	1		132
.50	8	1	4	8	1	1	19	12	26		1	5	2		1	1	2	1	1		94
.55	3	2		4	1		12	5	8			5	1			1			1		43
.60	3			1	3		3	1	2			4				1					13
.65								1				1									[illegible]
.70							1					1									[illegible]
.75												1									
TOTAL	1541	2542	966	938	1925	694	768	223	536	183	214	503	260	145	161	459	493	122	[illegible]	[illegible]	[illegible]

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS NX G'S

RANGE	21	22	23	24	25	TOTAL
REL						
.05	4					4
.10	3				1	4
.15	3			1		4
.20	1			1		2
.25						
.30	1					1
.35						
.40	2					2
.45	7					7
.50						
.55						
.60						
.65						
.70						
.75						
TOTAL	21			2	1	

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (continued)

(b) n_y—lateral load factor

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE . Y IN ABS NY G'S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	146	661	132	142	598	138	74	1		14	3	220	140		1	63	95	4	8	19	2459
.03	328	887	258	234	664	196	163	15	23	36	28	192	85	3	2	141	141	41	33	6	3476
.06	392	488	292	226	377	166	162	43	83	46	46	55	22	19	11	98	103	30	23	3	2685
.09	344	257	145	175	157	105	144	63	137	37	37	22	6	30	22	65	71	20	19	1	1857
.12	164	110	74	111	66	33	91	48	86	18	33	14	5	23	31	34	31	16	7		995
.15	93	69	30	55	38	22	61	22	72	7	28	3		21	25	24	17	7	4	1	599
.18	41	32	17	20	12	10	27	13	51	4	9	1	1	17	20	14	14	3	2		308
.21	16	19	7	14	3	7	22	8	36	6	8	1	1	9	16	10	6	1	1	1	192
.24	9	12	5	4	6	4	5	2	22	8	7			4	4	2	5				99
.27	3	3	3		2	3	7	4	8	3	8			6	12	3	6			1	72
.30	4	2	2	3	1		4	1	7	2	3			6	6				1		42
.33		1		4	1		5	1	2		1			1	2	3	2		1		24
.36	1		1				3		4		2			2	2						15
.39		1							3		1			2	2						9
.42								1	1					1							3
.45										1				1							2
.48															1	1	1				3
.51								1		1					3	1	1				7
.63									1						1						2
.76																					
TOTAL	1541	2542	966	988	1925	684	768	223	536	183	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS NY G'S

RANGE	21	22	23	24	25	TOTAL
BEL						
.03	5					5
.06	5					5
.09	3					3
.12	3					3
.15	3			2		5
.18					1	1
.21	2					2
.24						
.27						
.30						
.33						
.36						
.39						
.42						
.45						
.48						
.51						
.63						
.76						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE

(c) Δn_z—incremental normal load factor (continued)

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS DELTA NZ G'S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	94	581	77	59	478	53				3	3	228	122	64	63	170	176	2	1	1	2175
.25	190	671	168	136	565	116	25	1	3	41	25	276	101	50	68	158	170	2	3	9	2748
.50	207	413	191	137	334	126	59	1	6	33	30	45	28	16	18	70	82	9	4	12	1821
.75	215	269	153	158	164	123	80	2	12	25	31	8	6	6	8	33	27	9	9	5	1343
1.00	208	189	121	128	135	86	74	8	10	20	28	1	1	4	2	14	10	23	15	3	1080
1.25	226	122	97	109	90	70	58	9	31	14	20		2	3		9	15	24	21		920
1.50	155	116	63	94	62	41	70	22	38	13	22			1	1	2	6	12	12		730
1.75	111	73	43	68	39	25	59	16	40	16	19					1	3	5	7	1	526
2.00	62	42	24	49	26	16	43	14	44	5	11					1	1	11	14	1	364
2.25	36	17	17	22	18	10	41	23	40	5	12						1	6	2		250
2.50	20	15	3	16	10	6	47	31	46	5	6			1	1			9	3		219
2.75	7	6	3	8	4	6	44	21	62	1	3						1	3	3		172
3.00	4	6	3	3		2	38	23	56	1	1						1	3	2		143
3.25	1	1	1			2	40	21	41		2							3	2		114
3.50	4		1			2	38	15	44		1										105
3.75	1						26	10	28	1						1			1		68
4.00		1		1			13	4	12									1			32
4.25							7	1	17												25
4.50							4	1	4												9
4.75			1				2		2												5
TOTAL	1541	2542	956	988	1925	684	768	223	536	183	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS DELTA NZ G'S

RANGE	21	22	23	24	25	TOTAL
BEL						
.25						
.50						
.75					1	1
1.00	1			1		2
1.25	2					2
1.50	1			1		2
1.75	3					3
2.00	1					1
2.25	2					2
2.50	1					1
2.75	1					1
3.00	3					3
3.25	1					1
3.50	2					2
3.75	1					1
4.00	1					1
4.25	1					1
4.50						
4.75						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (continued)

(d) p—roll angular velocity

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS P D/S

RANGE	1	2	3	4	5	6	7	8	9	10	11
BEL	278	789	247	174	643	167	291	3	6	1	
10.	491	1017	422	348	771	296	324	81	182	9	5
20.	438	427	187	250	348	143	105	80	179	36	36
30.	211	147	84	148	99	43	31	18	95	29	29
40.	78	84	11	40	42	27	9	23	37	36	44
50.	33	44	11	11	13	6	4	5	18	19	29
60.	7	19	3	10	7	2	2	8	11	19	23
70.	4	8		6	2		2	2	3	11	17
80.	1	5	1	1				2	2	10	14
90.		2							1	7	8
100.								1	1	3	4
110.										1	3
120.									1		2
130.										1	
140.											
150.										1	
160.											
170.											
180.											
TOTAL	1541	2542	966	988	1925	684	768	223	536	183	214

RANGE	12	13	14	15	16	17	18	19	20	TOTAL
BEL	418	237	53	52	62	72	39	31	25	3588
10.	81	22	61	89	137	179	49	44	4	4612
20.	9	1	17	12	119	121	20	13	1	2542
30.			10	4	85	71	12	7	2	1125
40.			1		32	30	1	1		496
50.			2	1	16	10		1		223
60.			1	2	3	3		1		121
70.					1	1				57
80.				1	2	2		1		42
90.						4				22
100.					1		1			11
110.										4
120.										3
130.					1					2
140.										
150.										1
160.										
170.										
180.										
TOTAL	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS P D/S

RANGE	21	22	23	24	25	TOTAL
BEL	4					4
10.	5					5
20.	6					6
30.	4					4
40.	1			1		2
50.						
60.				1		1
70.					1	1
80.	1					1
90.						
100.						
110.						
120.						
130.						
140.						
150.						
160.						
170.						
180.						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (continued)

(e) q—pitch angular velocity

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS Q D/S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	224	1124	208	160	925	147	51	3	3	21	7	420	204	110	120	277	304	4	4	4	4320
2.	351	702	300	262	564	229	158	13	30	44	43	84	51	25	30	134	123	29	21	14	3207
4.	376	354	274	232	246	167	166	37	67	38	50	4	5	8	8	36	48	40	34	5	2195
6.	364	175	129	210	120	100	165	57	128	42	51				2	8	9	19	22	6	1607
8.	169	111	46	86	51	32	115	48	142	20	34					1	5	20	9		889
10.	42	49	5	29	15	7	66	40	89	8	14					2	4	10	6	1	387
12.	10	15	3	5	3	1	31	16	39	5	8								3	1	140
14.	4	8		4	1	1	10	4	21	4	4				1						62
16.	1	4	1				2	3	16	1	2			2		1					33
18.							1	2			1									1	5
20.							2		1												3
22.							1														1
24.																					
26.																					
TOTAL	1541	2542	966	988	1925	684	768	223	536	183	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS Q D/S

RANGE	21	22	23	24	25	TOTAL
BEL						
2.						
4.	4				1	5
6.	6			1		7
8.	3			1		4
10.	7					7
12.	1					1
14.						
16.						
18.						
20.						
22.						
24.						
26.						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (continued)

(f) r—yaw angular velocity

DISTRIBUTION IN FREQUENCY COUNTS   X IN MANEUVER TYPE   Y IN ABS R D/S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	238	1119	241	190	944	171	386	11	21	18	13	474	250	18	14	199	231	8	7	29	4562
2.	729	1021	560	516	768	411	316	123	268	65	45	32	10	76	86	174	185	79	64	1	5529
4.	442	324	151	225	192	89	55	64	166	44	71	1		36	41	68	59	30	22	1	2081
6.	123	60	14	52	14	12	9	21	53	31	36	1		10	14	11	11	3	3	1	479
8.	7	13		3	7	1	1	3	13	12	23			2	4	5	3	1	2		100
10.	2	5		1			1	1	11	6	13			1	1	1	3		1		47
12.				1					2	4	5			1	1	1	1	1			17
14.									2	2	5			1							10
16.											2										2
18.											1										1
20.																					
22.										1											1
24.																					
26.																					
28.																					
30.																					
TOTAL	1541	2542	966	988	1925	684	768	223	536	183	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS   X IN MANEUVER TYPE   Y IN ABS R D/S

RANGE	21	22	23	24	25	TOTAL
BEL	4					4
2.	7					7
4.	8					8
6.	1				1	2
8.				2		[illegible]
10.	1					1
12.						
14.						
16.						
18.						
20.						
22.						
24.						
26.						
28.						
30.						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (continued)

(g) $\dot{p}$—roll angular acceleration

DISTRIBUTION IN FREQUENCY COUNTS   X IN MANEUVER TYPE   Y IN ABS P-DOT D/S/S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	319	1078	278	197	930	199	113	1	6	3	3	249	112		1	12	19	23	18	10	3511
10.	200	360	170	132	305	121	164	11	51	13	9	151	107	23	18	69	95	19	26	12	2057
20.	314	418	217	222	313	150	221	63	133	23	22	76	31	35	40	32	79	35	23	6	2503
30.	307	259	144	176	192	124	135	65	141	30	43	22	8	31	37	61	71	22	9	2	1879
40.	180	158	79	117	98	39	66	32	76	25	38	9	2	25	31	64	75	12	11		1137
50.	103	82	35	63	58	28	33	6	53	30	21			10	12	52	45	6	4		641
60.	55	70	19	35	32	13	19	17	23	13	21			8	10	31	33	2	3		404
70.	29	39	11	22	16	7	11	9	13	14	13	1		4	5	27	19		2	2	244
80.	12	24	5	16	10	7	3	9	9	10	16			2	3	19	21		1		167
90.	8	13	4	2	8	4	1	4	8	3	6				2	8	10				81
100.	8	7	1	1	5		1	2	7	4	6			1		3	6	1			53
110.	2	13	1	3	3	1		1	5	3	3			3		9	8	1			56
120.	3	9	1	2	3		1	1	5	6	9			2	1	8	5	1	2		59
140.	1	8	1		1			1	2	4	2					6	4				30
160.		4				1			1	1	1			1		2					11
180.									1								1				2
200.									2		1				1	3	1				8
240.								1		1						2					4
280.																	1				1
320.																1					1
TOTAL	1541	2542	966	988	1925	684	763	223	536	183	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS   X IN MANEUVER TYPE   Y IN ABS P-DOT D/S/S

RANGE	21	22	23	24	25	TOTAL
BEL	2					2
10.	1					1
20.	9					9
30.	2					2
40.	3					3
50.	2					2
60.	1					1
70.				1		1
80.					1	1
90.				1		1
100.						
110.	1					1
120.						
140.						
160.						
180.						
200.						
240.						
280.						
320.						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (continued)

(h) $\dot{q}$—pitch angular acceleration

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS Q-DOT D/S/S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	345	1307	310	240	1070	208	83	3	7	20	11	217	110	62	48	143	159	28	23		4395
2.	280	384	200	193	292	149	97	10	33	46	56	159	84	40	60	128	146	17	17	6	2397
4.	417	330	219	220	261	138	130	30	65	45	45	79	38	21	18	97	75	15	15	4	2262
6.	258	218	125	161	149	89	130	40	90	32	40	31	17	7	12	52	47	23	13	5	1539
8.	140	140	55	86	86	48	102	27	59	14	22	12	5	5	11	15	26	9	5	3	870
10.	55	72	27	33	34	29	55	25	52	11	11	6	3	2	4	11	19	17	6	3	475
12.	22	39	10	26	16	13	44	23	48	7	9	2	2	4	3	5	8	2	7	1	291
14.	7	24	11	14	11	5	40	17	51	2	7					2	2	7	8	2	210
16.	8	14	4	6	4	3	28	9	28	2	7	2		2	2	3	5	2	2	3	134
18.	4	1	3	4	1	1	22	12	37	1	1				1		2		3	1	94
20.		2	2	2			12	10	27	2							1	1			59
22.	2	5		1	1		5	1	7		1		1				1			1	26
24.		2		1			6	6	8								1			1	25
26.		1					6	2	8		1										18
28.	1	1					3	2	2	1	1				1	1		1			14
30.	1	2		1			3	4	14		2				1	1	1			1	31
40.								2						2		1				1	6
50.						1	1														2
60.							1														1
70.																					
TOTAL	1541	2542	966	988	1925	684	768	223	536	183	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS Q-DOT D/S/S

RANGE	21	22	23	24	25	TOTAL
BEL	1					1
2.	7			1		8
4.	2			1	1	4
6.	7					7
8.	2					2
10.	1					1
12.						
14.						
16.						
18.						
20.						1
22.	1					
24.						
26.						
28.						
30.						
40.						
50.						
60.						
70.						
TOTAL	21			2	1	24

TABLE F-1. —MAXIMUM ABSOLUTE PARAMETER DISTRIBUTIONS BY MANEUVER TYPE (concluded)

(i) $\dot{r}$—yaw angular acceleration

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS R-DOT D/S/S

RANGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL
BEL	485	1506	426	341	1212	285	274	12	35	19	11	387	211		1	115	147	46	36	24	5573
2.	454	530	291	269	375	226	271	55	179	39	48	90	35	7	7	119	125	45	39	5	3210
4.	337	267	165	204	221	104	127	79	150	49	60	24	11	28	26	85	105	18	12	1	2073
6.	145	103	44	105	63	41	47	34	71	28	29	4	1	30	32	63	49	8	6		903
8.	74	59	26	40	28	12	25	23	44	17	20	1	1	21	17	31	27	4	2	1	473
10.	21	38	8	16	13	8	12	7	25	5	16	1		17	19	15	13		2		236
12.	13	17	1	7	8	5	6	6	11	9	12	1	1	8	21	16	10				152
14.	6	9	2		3	3	3	3	7	5	6			9	10	6	7	1		1	81
16.	3	9	2	2	2		1	3	5	5	4			8	5	1	4		2		56
18.	3	1	1	1			1		5	4	6			4	6	1	1				34
20.				2					1	1	1			6	5	2	1				19
22.		3								2				1	3	2	1				12
24.									1					5	2						8
26.							1		1		1				4	1					9
28.				1																	1
30.															2						2
34.								1	1								1				3
38.														1	1	1	1				4
42.																					
46.																1					1
TOTAL	1541	2542	966	988	1925	684	768	223	536	133	214	508	260	145	161	459	493	122	99	32	12849

DISTRIBUTION IN FREQUENCY COUNTS X IN MANEUVER TYPE Y IN ABS R-DOT D/S/S

RANGE	21	22	23	24	25	TOTAL
BEL	4					4
2.	12					12
4.	2					2
6.	1			1		2
8.						
10.	1			1		2
12.						
14.					1	1
16.						
18.						
20.	1					1
22.						
24.						
26.						
28.						
30.						
34.						
38.						
42.						
46.						
TOTAL	21			2	1	24

APPENDIX F. —Concluded

APPENDIX G

OBSERVED AND PREDICTED LOAD FREQUENCIES

Contents:

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS

Maneuver Type 1—Descending left turn

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	DEL	-250.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
DEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	1	4	2	8	29	63	143	255	298	0	0	0	0	0	0	3	0	0	806
-56.	0	0	0	0	0	2	3	6	18	50	45	0	0	0	0	0	0	0	0	0	124
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	4	2	10	32	69	161	305	343	0	0	0	0	0	0	3	0	0	930

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	DEL	-250.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
DEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	2	3	1	8	17	38	79	115	112	220	0	0	0	0	0	0	0	0	0	595	1313
-56.	0	0	0	0	1	2	5	8	14	30	42	0	0	0	0	0	0	0	0	0	102	228
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	2	3	1	9	19	43	87	129	142	262	0	0	0	0	0	0	0	0	0	697	1541

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 2—Level left turn

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	1	0	5	12	20	46	103	153	224	0	0	0	0	0	0	2	0	0	566
-56.	0	0	0	0	0	0	1	1	6	19	38	0	0	0	0	0	0	0	0	0	65
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	5	12	21	47	109	172	262	0	0	0	0	0	0	2	0	0	631

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-58.	0	0	1	5	4	14	26	42	78	119	173	0	0	0	0	0	0	0	0	0	462	1842
-56.	0	0	0	0	0	1	2	1	8	21	37	0	0	0	0	0	0	0	0	0	70	700
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	0	0	1	5	4	15	28	43	86	140	210	0	0	0	0	0	0	0	0	0	532	2542

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 3—Ascending left turn

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	1	0	0	1	2	5	9	23	64	109	150	0	0	0	0	0	0	2	0	0	366
-56.	0	0	0	0	1	0	0	2	3	9	20	0	0	0	0	0	0	0	0	0	35
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	0	1	3	5	9	25	67	118	170	0	0	0	0	0	0	2	0	0	401

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	1	0	1	1	6	7	12	27	47	76	118	0	0	0	0	0	0	0	0	0	296	717
-56.	0	0	0	0	1	0	2	1	7	12	20	0	0	0	0	0	0	0	0	0	43	249
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	1	1	7	7	14	28	54	88	138	0	0	0	0	0	0	0	0	0	339	966

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 4—Descending right turn

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	1	0	2	7	25	51	116	140	186	0	0	0	0	0	0	1	0	0	529
-56.	0	0	0	0	0	0	0	3	11	19	24	0	0	0	0	0	0	0	0	0	57
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	2	7	25	54	127	159	210	0	0	0	0	0	0	1	0	0	586

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	1	0	5	5	15	31	55	58	120	147	0	0	0	0	0	0	0	0	0	437	856
-56.	0	0	0	0	0	1	3	5	8	17	17	0	0	0	0	0	0	0	0	0	51	132
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	5	5	16	34	60	66	137	154	0	0	0	0	0	0	0	0	0	488	988

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 5—Level right turn

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	4	14	26	59	93	166	0	0	0	0	0	0	1	0	0	363
-58.	0	0	0	0	0	0	2	2	4	18	29	0	0	0	0	0	0	0	0	0	55
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	4	16	28	63	111	195	0	0	0	0	0	0	1	0	0	418

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	6	13	14	14	56	81	78	0	0	0	0	0	0	0	0	0	262	1374
-58.	0	0	0	0	0	1	1	6	6	11	38	0	0	0	0	0	0	0	0	0	63	551
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	6	14	15	20	62	92	116	0	0	0	0	0	0	0	0	0	325	1925

TABLE G-1.—OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Manuever Type 6—Ascending right turn

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	2	2	7	7	21	35	79	108	0	0	0	0	0	0	2	1	1	265
-56.	0	0	0	0	0	1	0	0	3	9	17	0	0	0	0	0	0	0	0	0	30
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	2	2	8	7	21	38	88	125	0	0	0	0	0	0	2	1	1	295

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	1	2	3	2	8	11	16	32	45	77	0	0	0	0	0	0	0	0	0	197	504
-56.	0	0	0	0	0	1	1	1	7	6	23	0	0	0	0	0	0	0	0	0	39	180
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	2	3	2	9	12	17	39	51	100	0	0	0	0	0	0	0	0	0	236	684

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 7—Symmetrical pull-up

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	8	9	22	50	53	54	48	59	88	103	97	0	0	0	0	0	0	2	0	0	593
-56.	0	1	2	3	6	9	8	5	8	12	28	0	0	0	0	0	0	0	0	0	82
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	10	24	53	59	63	56	64	96	115	125	0	0	0	0	0	0	2	0	0	675

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	11	9	23	47	55	50	42	58	73	85	65	0	0	0	0	0	0	0	0	0	518	625
-56.	0	1	2	6	8	8	8	5	10	11	24	0	0	0	0	0	0	0	0	0	83	143
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	11	10	25	53	63	58	50	63	83	96	89	0	0	0	0	0	0	0	0	0	601	768

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 8—Right rolling pull-up

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	1	2	11	16	30	34	32	24	29	39	42	0	0	0	0	0	0	0	0	0	260
-56.	0	0	1	1	2	2	7	5	5	3	4	0	0	0	0	0	0	0	0	0	30
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	2	12	17	32	36	39	29	34	42	46	0	0	0	0	0	0	0	0	0	290

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	2	5	7	26	20	26	28	21	26	15	8	0	0	0	0	0	0	0	0	0	184	187
-56.	0	0	3	2	3	4	9	5	5	2	2	0	0	0	0	0	0	0	0	0	35	36
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	5	10	28	23	30	37	26	31	17	10	0	0	0	0	0	0	0	0	0	219	223

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 9—Left rolling pull-up

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	8	17	29	47	60	84	68	54	79	88	71	0	0	0	0	0	0	4	0	0	609
-56.	0	2	4	6	4	5	14	10	7	18	7	0	0	0	0	0	0	1	0	0	78
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	19	33	53	64	89	82	64	86	106	78	0	0	0	0	0	0	5	0	0	687

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	15	14	31	43	82	55	46	51	44	48	22	0	0	0	0	0	0	0	0	0	451	467
-56.	1	2	5	5	6	8	6	8	10	10	4	0	0	0	0	0	0	0	0	0	65	69
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	16	16	36	48	88	63	52	59	54	58	26	0	0	0	0	0	0	0	0	0	516	536

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 10—Right roll

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	1	0	1	2	10	6	24	16	27	0	0	0	0	0	0	1	0	0	88
-58.	0	0	0	0	0	0	0	0	1	2	4	0	0	0	0	0	0	0	0	0	7
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	1	2	10	6	25	18	31	0	0	0	0	0	0	1	0	0	95

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	3	1	5	6	4	9	0	0	0	0	0	0	0	0	0	28	153
-58.	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	3	30
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
TOTAL	0	0		0	0	3	1	5	7	4	11	0	0	0	0	0	0	0	0	0	31	183

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 11—Left roll

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	1	1	2	3	10	21	25	27	31	0	0	0	0	0	0	4	1	1	127
-56.	0	0	0	0	0	0	0	1	0	8	8	0	0	0	0	0	0	0	0	0	17
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	1	2	3	10	22	25	35	39	0	0	0	0	0	0	4	1	1	144

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	1	0	1	2	2	2	5	0	0	0	0	0	0	0	0	0	13	178
-56.	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	36
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	1	0	1	2	3	2	6	0	0	0	0	0	0	0	0	0	15	214

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 12—Longitudinal deceleration

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-56.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	384
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	124
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	508

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 13—Longitudinal acceleration

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	170
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	260

APPENDIX G.—Continued

TABLE G-1.—OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 14—Left yaw

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	1	1	0	0	0	5	0	0	0	0	0	0	2	0	0	9
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	1	1	0	0	0	5	0	0	0	0	0	0	2	0	0	9

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 15—Right yaw

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	1	5
-56.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	3
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	2	1	1	8

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	1	4	119
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	1	4	161

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 16—Left wing rock

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	1	0	0	0	0	0	1	2	7	21	0	0	0	0	0	0	0	0	0	32
-56.	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	4
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	0	0	0	0	1	3	7	24	0	0	0	0	0	0	0	0	0	36

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-58.	0	0	0	1	0	0	0	0	3	6	15	0	0	0	0	0	0	0	0	0	25	338
-56.	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	121
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	0	0	0	1	0	0	0	0	3	7	16	0	0	0	0	0	0	0	0	0	27	459

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 17—Right wing rock

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	1	1	1	5	6	16	0	0	0	0	0	0	1	0	0	31
-56.	0	0	0	0	0	0	0	0	1	5	3	0	0	0	0	0	0	0	0	0	9
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	1	1	1	6	11	19	0	0	0	0	0	0	1	0	0	40

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	354
-56.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	493

TABLE G-1.—OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 18—Left cloverleaf

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	1	0	6	8	12	22	28	30	52	0	0	0	0	0	0	2	0	0	161
-56.	0	0	0	0	0	0	1	0	1	2	5	0	0	0	0	0	0	0	0	0	9
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	6	8	13	22	29	32	57	0	0	0	0	0	0	2	0	0	170

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	1	0	3	2	3	6	6	10	12	23	19	0	0	0	0	0	0	0	0	0	85	106
-56.	0	0	0	0	0	1	0	0	2	2	3	0	0	0	0	0	0	0	0	0	8	16
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	3	2	3	7	6	10	14	25	22	0	0	0	0	0	0	0	0	0	93	122

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (continued)

Maneuver Type 19—Right cloverleaf

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	0	1	1	0	5	7	19	15	37	53	0	0	0	0	0	0	0	0	0	138
-56.	0	0	0	0	2	0	0	3	3	3	6	0	0	0	0	0	0	0	0	0	17
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	1	2	5	7	22	18	40	59	0	0	0	0	0	0	0	0	0	155

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	1	0	2	2	2	7	7	13	18	16	0	0	0	0	0	0	0	0	0	68	85
-56.	0	0	0	1	0	0	1	2	1	3	2	0	0	0	0	0	0	0	0	0	10	14
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	3	2	2	8	9	14	21	18	0	0	0	0	0	0	0	0	0	78	99

TABLE G-1. —OBSERVED AND PREDICTED FREQUENCIES OF THE FUSELAGE LOADS (concluded)

Maneuver Types 20, 21, 24, and 25—Symmetrical pitch-down, inside loop, left four-point roll, and right four-point roll

OBSERVED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	2	1	2	5	4	3	7	5	6	2	0	0	0	0	0	0	2	1	1	41
-56.	0	0	0	0	0	0	0	1	0	4	0	0	0	0	0	0	0	0	0	1	6
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	2	1	2	5	4	3	8	5	10	2	0	0	0	0	0	0	2	1	2	47

PREDICTED FREQUENCIES LOAD VF
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-260.	-240.	-220.	-200.	-180.	-160.	-140.	-120.	-100.	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-70.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-68.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-66.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-64.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-62.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-58.	0	2	2	3	5	3	2	5	7	3	2	0	0	0	0	0	0	3	0	0	37	39
-56.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2	4	17
-54.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-52.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	2	2	3	5	3	2	5	7	3	3	0	0	0	0	0	0	4	0	2	41	56

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS

Maneuver Type 1—Descending left turn

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	1	0	0	0	0	25	15	3	2	1	0	0	0	0	0	0	0	0	47
35.	0	0	0	0	0	0	0	289	172	58	12	4	2	0	0	0	0	0	0	0	537
40.	0	0	2	0	0	0	0	148	106	32	12	3	1	0	0	0	0	0	0	0	304
45.	0	0	0	0	0	0	0	15	6	1	1	0	0	0	0	0	0	0	0	0	23
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	3	0	0	0	0	477	299	94	27	8	3	0	0	0	0	0	0	0	911

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	9	5	2	0	0	0	0	0	0	0	0	0	0	16	110
35.	0	0	0	0	0	0	0	141	146	47	16	5	4	0	0	0	0	0	0	0	359	791
40.	0	0	0	0	0	0	0	134	103	41	20	8	4	1	0	0	0	0	0	0	311	574
45.	0	0	0	0	0	0	0	17	9	6	4	1	0	0	0	0	0	0	0	0	37	66
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	301	263	96	40	14	8	1	0	0	0	0	0	0	723	1541

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 2—Level left turn

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	63	41	10	2	0	1	0	0	0	0	0	0	0	117
35.	0	0	0	0	0	0	0	160	84	25	6	3	0	0	0	0	0	0	0	0	278
40.	0	0	0	0	0	0	0	113	50	11	3	3	0	0	0	0	0	0	0	0	180
45.	0	0	0	0	0	0	0	23	5	1	0	0	0	0	0	0	0	0	0	0	29
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	359	180	47	11	6	1	0	0	0	0	0	0	0	604

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	44	31	9	4	0	0	0	0	0	0	0	0	0	88	245
35.	0	0	0	0	0	0	0	106	81	24	12	5	1	0	0	0	0	0	0	0	229	1049
40.	0	0	0	0	0	0	0	116	58	26	7	4	0	0	0	0	0	0	0	0	211	1037
45.	0	0	0	0	0	0	0	16	5	0	0	0	0	0	0	0	0	0	0	0	21	211
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	282	175	59	23	9	1	0	0	0	0	0	0	0	549	2542

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 3—Ascending left turn

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	29	5	2	0	0	0	0	0	0	0	0	0	0	36
35.	0	0	0	0	0	0	0	125	73	25	6	1	1	1	0	0	0	0	0	0	232
40.	0	0	1	0	0	0	0	60	39	7	2	3	0	0	0	0	0	0	0	0	112
45.	0	0	0	0	0	0	0	10	2	0	1	0	0	0	0	0	0	0	0	0	13
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	0	0	224	119	34	9	4	1	1	0	0	0	0	0	0	393

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	11	4	0	0	0	0	0	0	0	0	0	0	0	15	35
35.	0	0	0	0	0	0	0	118	78	30	13	2	2	0	1	0	0	0	0	0	244	555
40.	0	0	0	0	0	0	0	40	22	12	1	0	3	0	0	0	0	0	0	0	78	276
45.	0	0	0	0	0	0	0	14	3	2	0	1	0	0	0	0	0	0	0	0	20	100
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	183	107	44	14	3	5	0	1	0	0	0	0	0	357	966

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 4—Descending right turn

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	12	6	2	0	0	0	0	0	0	0	0	0	0	20
35.	0	0	0	0	0	0	0	159	111	49	17	3	0	1	0	0	0	0	0	0	340
40.	0	0	0	0	0	0	0	84	72	26	3	0	0	0	0	0	0	0	0	0	185
45.	0	0	0	0	0	0	0	9	4	2	0	0	0	0	0	0	0	0	0	0	15
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	264	193	79	20	3	0	1	0	0	0	0	0	0	560

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	5	2	1	0	0	0	0	0	0	0	0	0	0	8	48
35.	0	0	0	0	0	0	0	127	62	24	16	5	2	1	0	0	0	0	0	0	237	527
40.	0	0	0	0	0	0	0	92	58	28	23	3	1	0	0	0	0	0	0	0	205	385
45.	0	0	0	0	0	0	0	7	3	1	0	0	0	0	0	0	0	0	0	0	11	28
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	231	125	54	39	8	3	1	0	0	0	0	0	0	461	988

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 5—Level right turn

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	28	17	5	1	0	0	0	0	0	0	0	0	0	51
35.	0	0	0	0	0	0	0	109	48	16	7	0	0	0	0	0	0	0	0	0	180
40.	0	0	1	0	0	0	0	100	47	17	2	0	0	0	0	0	0	0	0	0	167
45.	0	0	0	0	0	0	0	11	3	2	0	0	0	0	0	0	0	0	0	0	16
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	0	0	248	115	40	10	0	0	0	0	0	0	0	0	0	414

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	12	8	6	4	0	0	0	0	0	0	0	0	0	30	105
35.	0	0	0	0	0	0	0	93	47	22	10	4	0	0	0	0	0	0	0	0	176	373
40.	0	0	0	0	0	0	0	78	33	15	6	1	0	0	0	0	0	0	0	0	133	758
45.	0	0	0	0	0	0	0	14	5	1	1	0	0	0	0	0	0	0	0	0	21	165
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	197	93	44	21	5	0	0	0	0	0	0	0	0	360	1925

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 6—Ascending right turn

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	16	4	2	0	0	0	0	0	0	0	0	0	0	22
35.	0	0	0	0	0	0	0	86	36	12	9	4	2	0	0	0	0	0	0	0	149
40.	0	0	0	0	0	0	0	65	26	11	0	2	0	0	0	0	0	0	0	0	104
45.	0	0	0	0	0	0	0	11	2	2	0	0	0	0	0	0	0	0	0	0	15
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	178	68	27	9	6	2	0	0	0	0	0	0	0	290

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	64	29	20	9	1	3	1	0	0	0	0	0	0	127	333
40.	0	0	0	0	0	0	0	48	37	14	5	2	2	0	1	0	0	0	0	0	109	295
45.	0	0	0	0	0	0	0	6	3	1	0	1	0	0	0	0	0	0	0	0	11	56
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	118	69	35	14	4	5	1	1	0	0	0	0	0	247	684

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 7—Symmetrical pull-up

OBSERVED FREQUENCIES LOAD VH
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-30.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	16	13	4	8	5	4	0	0	0	0	0	0	0	50
35.	0	0	0	0	0	0	0	87	84	57	74	45	45	9	3	1	1	0	0	0	407
40.	0	0	0	0	0	0	0	52	43	30	17	15	17	4	0	0	0	0	0	0	178
45.	0	0	0	0	0	0	0	14	1	4	1	1	0	0	0	0	0	0	0	0	21
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	169	141	95	100	66	67	13	3	1	1	0	0	0	656

PREDICTED FREQUENCIES LOAD VH .
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	3	1	3	0	0	0	0	0	0	0	0	0	0	7	8
35.	0	0	0	0	0	0	0	99	88	50	71	77	37	10	3	1	0	0	0	0	436	518
40.	0	0	0	0	0	0	0	43	28	20	13	11	15	6	2	0	0	0	0	0	138	209
45.	0	0	0	0	0	0	0	9	3	3	2	3	1	0	0	0	0	0	0	0	21	33
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	154	120	76	86	91	53	16	5	1	0	0	0	0	502	768

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 8—Right rolling pull-up

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	3	5	1	1	1	0	0	0	0	0	0	0	0	11
35.	0	0	0	0	0	0	0	34	28	27	37	30	16	4	1	0	0	0	0	0	177
40.	0	0	0	0	0	0	0	16	17	13	13	19	4	1	0	0	0	0	0	0	83
45.	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	53	50	42	51	51	20	5	1	0	0	0	0	0	273

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	15	34	23	49	26	17	4	2	0	0	0	0	0	170	176
40.	0	0	0	0	0	0	0	5	9	6	16	4	2	3	1	0	0	0	0	0	46	47
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	20	43	29	65	30	19	7	3	0	0	0	0	0	216	223

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 9—Left rolling pull-up

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	7	5	7	4	1	0	0	0	0	0	0	0	0	24
35.	0	0	2	0	0	0	0	71	73	74	93	78	40	24	2	0	0	0	0	0	457
40.	0	0	2	0	0	0	0	32	45	30	24	19	16	5	5	0	0	0	0	0	178
45.	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	5
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	4	0	0	0	0	112	126	111	121	98	56	29	7	0	0	0	0	0	664

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	55	46	73	90	86	45	19	8	0	0	0	0	0	422	431
40.	0	0	0	0	0	0	0	8	20	16	7	13	6	7	2	1	0	0	0	0	80	93
45.	0	0	0	0	0	0	0	3	4	2	0	2	0	0	0	0	0	0	0	0	11	12
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	66	70	91	97	101	51	26	10	1	0	0	0	0	513	536

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 10—Right roll

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	2	3	2	0	1	0	0	0	0	0	0	0	0	8
35.	0	0	1	0	0	0	0	18	19	10	4	0	0	0	0	0	0	0	0	0	52
40.	0	0	1	0	0	0	0	13	4	2	2	0	0	0	0	0	0	0	0	0	22
45.	0	0	1	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	5
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	3	0	0	0	0	36	27	14	6	1	0	0	0	0	0	0	0	0	87

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	5	104
40.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	72
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	4	2	1	0	0	0	0	0	0	0	0	0	7	183

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 11—Left roll

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	4
35.	1	1	2	0	0	0	0	31	26	14	5	2	1	0	0	0	0	0	0	0	83
40.	0	0	1	0	0	0	0	20	12	3	1	0	0	0	0	0	0	0	0	0	37
45.	0	0	0	0	0	0	0	6	2	0	1	0	0	0	0	0	0	0	0	0	9
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	3	0	0	0	0	58	42	18	7	2	1	0	0	0	0	0	0	0	133

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
35.	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	126
40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	214

TABLE G-2. — OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 12 — Longitudinal deceleration

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
45.	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	305
40.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	158
45.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	508

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 13—Longitudinal acceleration

OBSERVED FREQUENCIES LOAD VA
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4

PREDICTED FREQUENCIES LOAD VA
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	104
40.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	125
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	260

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 14—Left yaw

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	REL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
REL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
35.	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
40.	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	7

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	REL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
REL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63
35.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68
40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 15—Right yaw

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	REL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
REL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
40.	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	4
45.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	2	0	0	0	0	3	0	1	1	0	0	0	0	0	0	0	0	0	7

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	REL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
REL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	81
40.	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	69
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	161

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 16—Left wing rock

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	3
35.	0	0	0	0	0	0	0	11	2	0	0	0	0	0	0	0	0	0	0	0	13
40.	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	11
45.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	23	5	0	0	1	0	0	0	0	0	0	0	0	29

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	23
35.	0	0	0	0	0	0	0	6	4	0	0	1	0	0	0	0	0	0	0	0	11	190
40.	0	0	0	0	0	0	0	10	5	0	0	0	0	0	0	0	0	0	0	0	15	208
45.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	39
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	0	0	0	0	0	0	0	18	9	0	0	1	0	0	0	0	0	0	0	0	28	459

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 17—Right wing rock

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	9	1	2	1	0	0	0	0	0	0	0	0	0	13
40.	0	0	0	0	0	0	0	9	7	0	0	0	0	0	0	0	0	0	0	0	16
45.	0	0	0	0	0	0	0	4	3	0	0	0	0	0	0	0	0	0	0	0	7
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	22	11	2	1	0	0	0	0	0	0	0	0	0	36

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
35.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	210
40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	224
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	493

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 18—Left cloverleaf

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	8
35.	0	0	1	0	0	0	0	27	18	23	12	3	1	0	0	0	0	0	0	0	85
40.	0	0	0	0	0	0	0	28	15	4	3	1	0	0	0	0	0	0	0	0	51
45.	0	0	0	0	0	0	0	3	3	1	0	1	0	0	0	0	0	0	0	0	8
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	0	0	63	39	28	15	5	1	0	0	0	0	0	0	0	152

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	22	10	10	5	2	2	1	0	0	0	0	0	0	52	67
40.	0	0	0	0	0	0	0	11	11	4	2	1	1	1	0	0	0	0	0	0	31	45
45.	0	0	0	0	0	0	0	3	3	0	0	1	0	0	0	0	0	0	0	0	7	10
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	36	24	14	7	4	3	2	0	0	0	0	0	0	90	122

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (continued)

Maneuver Type 19—Right cloverleaf

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
35.	0	0	0	0	0	0	0	35	14	10	5	2	1	0	0	0	0	0	0	0	67
40.	0	0	0	0	0	0	0	14	13	8	2	2	1	0	0	0	0	0	0	0	40
45.	0	0	0	0	0	0	0	5	2	4	1	0	0	1	0	0	0	0	0	0	13
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	57	31	22	8	4	2	1	0	0	0	0	0	0	125

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	0	0	0	0	0	22	8	8	1	2	1	0	0	0	0	0	0	0	42	54
40.	0	0	0	0	0	0	0	6	9	4	2	1	1	0	0	0	0	0	0	0	23	31
45.	0	0	0	0	0	0	0	1	3	2	2	0	0	1	0	0	0	0	0	0	9	14
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	29	20	14	5	3	2	1	0	0	0	0	0	0	74	99

TABLE G-2. —OBSERVED AND PREDICTED FREQUENCIES OF THE WING LOADS (concluded)

Maneuver Types 20, 21, 24, and 25—Symmetrical pitch-down, inside loop, left four-point roll, and right four-point roll

OBSERVED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	4
35.	0	0	2	0	0	0	0	5	5	11	3	4	2	2	0	0	0	0	0	0	34
40.	0	2	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	8
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	2	2	0	0	0	0	6	9	13	5	5	2	2	0	0	0	0	0	0	46

PREDICTED FREQUENCIES LOAD VW
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-80.	-60.	-40.	-20.	0.	20.	40.	60.	80.	100.	120.	140.	160.	180.	200.	220.	240.	260.	280.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35.	0	0	2	0	0	0	0	3	8	6	3	8	3	1	0	0	0	0	0	0	34	39
40.	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	17
45.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	0	3	0	0	0	0	3	8	6	3	8	3	1	0	0	0	0	0	0	37	56

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS

Maneuver Type 1—Descending left turn

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	7
-8.	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	8
-4.	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	7
0.	0	0	0	0	0	0	2	6	208	0	0	138	4	1	0	0	0	0	0	0	359
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	3	8	227	0	0	138	4	1	0	0	0	0	0	0	381

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-49.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	5	14
-4.	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	10
0.	0	0	0	0	0	0	0	6	90	0	0	88	6	1	0	0	0	0	0	0	191	1517
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	6	99	0	0	88	6	1	0	0	0	0	0	0	200	1541

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 2—Level left turn

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	1	4	9	0	0	0	0	0	0	0	0	0	0	0	14
-12.	0	0	0	0	0	0	1	7	10	0	0	2	0	0	0	0	0	0	0	0	20
-8.	0	0	0	0	0	0	0	0	14	0	0	1	0	0	0	0	0	0	0	0	15
-4.	0	0	0	0	0	0	1	10	293	0	0	165	6	1	0	0	0	0	0	0	476
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	3	21	326	0	0	168	6	1	0	0	0	0	0	0	525

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	7	43
-12.	0	0	0	0	0	0	0	3	8	0	0	0	0	0	0	0	0	0	0	0	11	74
-8.	0	0	0	0	0	0	0	1	11	0	0	3	1	0	0	0	0	0	0	0	16	174
-4.	0	0	0	0	0	0	2	13	143	0	0	101	7	1	0	0	0	0	0	0	267	2251
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	3	17	168	0	0	104	8	1	0	0	0	0	0	0	301	2542

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 3—Ascending left turn

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
-8.	0	0	0	0	0	0	0	3	5	0	0	0	0	0	0	0	0	0	0	0	8
-4.	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4
0.	0	0	0	0	0	0	0	4	109	0	0	54	0	0	0	0	0	0	0	0	167
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	8	118	0	0	54	0	0	0	0	0	0	0	0	180

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3	6
-8.	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	5	11
-4.	0	0	0	0	0	0	0	1	4	0	0	2	0	0	0	0	0	0	0	0	7	28
0.	0	0	0	0	0	0	0	0	49	0	0	41	0	0	0	0	0	0	0	0	90	921
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	4	58	0	0	43	0	0	0	0	0	0	0	0	105	965

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 4—Descending right turn

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
-16.	0	0	0	0	0	0	1	6	4	0	0	0	0	0	0	0	0	0	0	0	11
-12.	0	0	0	0	0	0	0	2	9	0	0	1	0	0	0	0	0	0	0	0	12
-8.	0	0	0	0	0	0	0	0	16	0	0	1	0	0	0	0	0	0	0	0	17
-4.	0	0	0	0	0	0	0	6	162	0	0	106	3	1	0	0	0	0	0	0	278
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	14	192	0	0	108	3	1	0	0	0	0	0	0	319

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3	4
-8.	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	0	0	0	5	20
-4.	0	0	0	0	0	0	1	3	67	0	0	65	2	1	0	0	0	0	0	0	139	964
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	4	72	0	0	67	2	1	0	0	0	0	0	0	147	988

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 5—Level right turn

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
-12.	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	7
-8.	0	0	0	0	0	0	1	1	12	0	0	2	0	0	0	0	0	0	0	0	16
-4.	0	0	0	0	0	0	1	3	10	0	0	0	0	0	0	0	0	0	0	0	14
0.	0	0	0	0	0	0	0	1	119	0	0	75	1	0	0	0	0	0	0	0	196
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	2	6	148	0	0	77	1	0	0	0	0	0	0	0	234

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	23
-8.	0	0	0	0	0	0	1	4	7	0	0	0	0	0	0	0	0	0	0	0	12	74
-4.	0	0	0	0	0	0	0	0	7	0	0	1	0	0	0	0	0	0	0	0	8	189
0.	0	0	0	0	0	0	0	3	67	0	0	52	2	0	0	0	0	0	0	0	124	1639
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	7	83	0	0	53	2	0	0	0	0	0	0	0	146	1925

TABLE G-3.—OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 6—Ascending right turn

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
-8.	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	5
-4.	0	0	0	0	0	0	0	0	4	0	0	2	0	0	0	0	0	0	0	0	6
0.	0	0	0	0	1	0	2	1	84	0	0	58	0	0	1	1	0	0	0	0	148
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	1	0	2	3	92	0	0	60	0	0	1	1	0	0	0	0	160

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	3
-4.	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	5	13
0.	0	0	0	0	0	1	0	1	38	0	0	36	0	0	1	0	0	0	0	0	77	663
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	1	0	2	46	0	0	36	0	0	1	0	0	0	0	0	86	684

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS

Maneuver Type 7—Symmetrical pull-up (continued)

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	2	9	5	0	0	0	0	0	0	0	0	0	0	0	16
-8.	0	0	0	0	0	3	5	7	13	0	0	0	0	0	0	0	0	0	0	0	28
-4.	0	0	0	0	0	1	2	19	40	0	0	3	0	0	0	0	0	0	0	0	65
0.	0	0	0	2	0	1	9	51	250	0	0	84	7	1	0	1	0	0	0	0	406
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	2	0	5	18	86	308	0	0	87	7	1	0	1	0	0	0	0	515

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	2	4	9	12	14	0	0	0	0	0	0	0	0	0	0	0	41	53
-4.	0	0	0	0	0	0	3	5	17	0	0	0	0	0	0	0	0	0	0	0	25	41
0.	0	0	0	0	1	2	9	40	181	0	0	70	14	2	1	0	0	0	0	0	320	674
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	3	6	21	57	212	0	0	70	14	2	1	0	0	0	0	0	386	768

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 8—Right rolling pull-up

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
-12.	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	4
-8.	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
-4.	0	0	0	0	1	1	6	33	130	0	0	41	7	0	0	0	0	0	0	0	219
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	1	1	8	35	133	0	0	41	7	0	0	0	0	0	0	0	226

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	1	1	3	0	0	0	0	0	0	0	0	0	0	0	5	5
-8.	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	5	6
-4.	0	0	0	0	1	3	4	26	53	0	0	31	7	1	0	0	0	0	0	0	126	212
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	1	3	5	28	60	0	0	31	7	1	0	0	0	0	0	0	136	223

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 9—Left rolling pull-up

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	4	5	0	0	2	0	0	0	0	0	0	0	0	11
-4.	0	0	0	0	0	0	1	4	17	0	0	2	0	0	0	0	0	0	0	0	24
0.	0	0	0	0	0	2	18	97	310	0	0	101	4	4	1	0	0	0	0	0	537
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	2	19	105	332	0	0	105	4	4	1	0	0	0	0	0	572

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	4	6
-4.	0	0	0	0	0	0	2	2	6	0	0	0	0	0	0	0	0	0	0	0	10	16
0.	0	0	0	0	2	4	21	46	160	0	0	87	12	1	0	0	0	0	0	0	333	514
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	2	5	24	48	168	0	0	87	12	1	0	0	0	0	0	0	347	536

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 10—Right roll

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	0	0	0	0	0	0	0	3	21	0	0	41	5	3	1	0	0	0	0	0	74
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	3	22	0	0	41	5	3	1	0	0	0	0	0	75

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
0.	0	0	0	0	0	0	0	2	17	0	0	29	2	1	0	0	0	0	0	0	51	178
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	2	17	0	0	29	2	1	0	0	0	0	0	0	51	183

APPENDIX G. —Continued

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 11—Left roll

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	5
-8.	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
-4.	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	7
0.	0	0	0	0	0	0	0	4	47	0	0	52	8	2	0	0	0	0	0	0	113
4.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	5	59	0	0	53	8	2	0	0	0	0	0	0	128

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2	4
-4.	0	0	0	0	0	0	0	0	3	0	0	4	0	0	0	0	0	0	0	0	7	18
0.	0	0	0	0	0	0	1	3	15	0	0	66	10	4	1	0	0	0	0	0	100	192
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	3	19	0	0	71	10	4	1	0	0	0	0	0	109	214

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 12—Longitudinal deceleration

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	0	0	23	0	0	19	0	0	0	0	0	0	0	0	42
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	23	0	0	19	0	0	0	0	0	0	0	0	42

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
-8.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	24
-4.	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	13	463
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	14	508

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 13—Longitudinal acceleration

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	0	0	0	0	0	0	0	0	9	0	0	6	1	0	0	0	0	0	0	0	16
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	9	0	0	6	1	0	0	0	0	0	0	0	15

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
0.	0	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	0	0	0	0	18	246
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	0	0	0	0	18	260

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 14—Left yaw

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2
-12.	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2
-8.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
-4.	0	0	0	0	0	0	1	2	8	0	0	11	0	1	2	0	0	0	0	0	25
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	2	11	0	0	13	0	1	2	0	0	0	0	0	30

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	2	2	8	0	0	10	2	2	0	0	0	0	0	0	26	145
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	2	2	8	0	0	10	2	2	0	0	0	0	0	0	26	145

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 15—Right yaw

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	2	1	0	0	2	1	0	0	0	0	0	0	0	6
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	0	0	0	0	0	0	1	0	18	0	0	18	1	1	0	0	0	0	0	0	39
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	2	19	0	0	20	2	1	0	0	0	0	0	0	45

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
0.	0	0	0	0	0	0	0	2	16	0	0	10	3	0	0	0	0	0	0	0	31	147
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	2	16	0	0	10	3	0	0	0	0	0	0	0	31	161

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 16—Left wing rock

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	1	1	30	0	0	28	3	4	0	0	0	0	0	0	67
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	1	31	0	0	28	3	4	0	0	0	0	0	0	68

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	29
-8.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	25
-4.	0	0	0	0	0	0	1	2	15	0	0	9	2	2	0	0	0	0	0	0	31	405
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	0	0	0	0	0	0	1	2	20	0	0	9	2	2	0	0	0	0	0	0	36	459

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 17—Right wing rock

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	0	0	0	0	0	0	0	3	38	0	0	37	2	1	0	0	0	0	0	0	81
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	3	38	0	0	37	2	1	0	0	0	0	0	0	81

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-3.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
-4.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	41
0.	0	0	0	0	0	0	0	3	29	0	0	0	0	0	0	0	0	0	0	0	32	433
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	3	30	0	0	0	0	0	0	0	0	0	0	0	33	493

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 18—Left cloverleaf

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
-4.	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
0.	0	0	0	0	0	0	1	1	73	0	0	39	2	0	0	0	0	0	0	0	116
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	5	76	0	0	39	2	0	0	0	0	0	0	0	123

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	3
-4.	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3	3
0.	0	0	0	0	0	0	0	4	34	0	0	14	1	0	0	0	0	0	0	0	53	116
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	1	1	6	36	0	0	14	1	0	0	0	0	0	0	0	59	122

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (continued)

Maneuver Type 19—Right cloverleaf

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
-12.	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	6
-8.	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	4
-4.	0	0	0	0	0	0	0	4	117	0	0	78	1	0	0	0	0	0	0	0	200
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	1	0	1	5	126	0	0	78	1	0	0	0	0	0	0	0	212

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3	3
-8.	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	5	8
-4.	0	0	0	0	0	0	0	3	20	0	0	13	1	0	0	0	0	0	0	0	37	88
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	5	25	0	0	13	1	0	0	0	0	0	0	0	45	99

TABLE G-3. —OBSERVED AND PREDICTED FREQUENCIES OF THE HORIZONTAL TAIL LOADS (concluded)

Maneuver Types 20, 21, 24, and 25—Symmetrical pitch-down, inside loop, left four-point roll, and right four-point roll

OBSERVED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
-4.	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	5
0.	0	0	0	0	0	2	0	3	28	0	0	14	3	0	2	0	0	0	0	0	52
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	2	1	6	30	0	0	14	3	0	2	0	0	0	0	0	58

PREDICTED FREQUENCIES LOAD VHT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-72.	-64.	-56.	-48.	-40.	-32.	-24.	-16.	-8.	0.	8.	16.	24.	32.	40.	48.	56.	64.	72.	TOTAL	NUMBER OF MANEUVERS
BEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-40.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-36.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-32.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-28.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	0	0	0	0	1	0	0	5	12	0	0	8	3	0	1	0	0	0	0	0	30	56
4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	1	0	0	5	12	0	0	8	3	0	1	0	0	0	0	0	30	56

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS

Maneuver Type 1—Descending left turn

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	1	1	4	16	48	143	0	0	0	0	0	0	299	80	26	6	5	1	1	631

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	3	3	10	35	110	0	0	0	0	0	0	195	85	26	9	3	2	0	481	1541

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 2—Level left turn

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	2	4	13	18	68	0	0	0	0	0	0	172	77	22	12	3	1	1	393

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	2	5	15	50	0	0	0	0	0	0	121	48	19	7	2	1	0	270	2542

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 3—Ascending left turn

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-35.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	0	5	2	14	47	0	0	0	0	0	0	108	41	9	5	2	3	0	236

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	4	6	26	0	0	0	0	0	0	79	27	10	3	3	0	0	158	966

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 4—Descending right turn

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-35.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	2	1	3	0	9	19	84	0	0	0	0	0	0	174	65	15	5	5	3	0	385

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-35.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	1	3	9	25	72	0	0	0	0	0	0	114	47	17	8	2	1	0	299	989

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 5—Level right turn

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	1	0	4	14	44	0	0	0	0	0	0	104	27	10	6	3	0	0	213

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	4	9	35	0	0	0	0	0	0	73	24	8	4	1	0	0	158	1925

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 6—Ascending right turn

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	0	3	3	12	34	0	0	0	0	0	0	55	27	7	5	3	0	0	149

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	1	1	10	22	0	0	0	0	0	0	43	18	9	0	2	0	0	106	684

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 7—Symmetrical pull-up

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	2	1	1	3	8	21	51	0	0	0	0	0	0	135	62	20	6	4	0	2	318

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	88	37	16	7	3	3	2	156	768

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 8—Right rolling pull-up

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																				
	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	1	1	0	1	5	22	47	0	0	0	0	0	0	72	22	11	6	1	0	2	191

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

STEADY LOAD RANGES	DELTA LOAD RANGES																					
	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	30	14	7	1	2	1	1	56	223

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 9—Left rolling pull-up

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	2	2	3	7	10	20	41	0	0	0	0	0	0	223	109	48	28	5	9	7	514

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	1	0	1	7	17	52	0	0	0	0	0	0	138	79	41	24	11	7	6	384	536

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 10—Right roll

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	2	1	7	5	6	16	23	0	0	0	0	0	0	30	8	4	7	4	0	0	113

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	1	2	3	7	10	17	32	0	0	0	0	0	0	2	2	0	1	0	0	0	77	183

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 11—Left roll

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	1	2	0	7	5	24	0	0	0	0	0	0	48	31	16	16	6	7	6	169

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	1	0	7	9	0	0	0	0	0	0	44	30	14	10	10	1	3	129	214

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 12—Longitudinal deceleration

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	0	0	1	1	4	0	0	0	0	0	0	10	2	1	0	0	0	0	19

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	0	0	2	0	0	0	0	0	0	6	2	0	0	0	0	0	10	508

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 13—Longitudinal acceleration

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	0	0	1	1	4	0	0	0	0	0	0	7	1	1	0	0	0	0	15

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	260

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 14—Left yaw

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	4	8	7	12	19	30	57	0	0	0	0	0	0	56	21	30	13	10	4	7	278

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	2	3	5	10	15	24	31	0	0	0	0	0	0	47	34	22	13	9	4	4	223	145

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 15—Right yaw

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	8	5	6	8	12	31	62	0	0	0	0	0	0	95	42	29	26	17	10	22	373

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	2	3	5	10	13	32	52	0	0	0	0	0	0	39	33	27	18	11	10	11	266	161

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 16—Left wing rock

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	3	4	3	5	16	14	59	0	0	0	0	0	0	56	35	16	9	2	3	3	228

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	2	1	2	5	11	20	43	0	0	0	0	0	0	41	19	11	2	3	0	2	162	459

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 17—Right wing rock

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	4	1	5	3	11	18	41	0	0	0	0	0	0	64	25	11	11	5	3	3	205

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	1	0	0	4	5	9	26	0	0	0	0	0	0	53	33	12	8	3	3	2	154	493

TABLE G-4. —OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 18—Left cloverleaf

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	0	0	1	5	8	0	0	0	0	0	0	15	3	1	0	0	0	0	33

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	7	3	1	0	0	0	0	11	122

TABLE G-4.—OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (continued)

Maneuver Type 19—Right cloverleaf

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	0	1	0	0	2	6	0	0	0	0	0	0	25	6	0	2	1	1	0	44

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	11	4	1	1	1	0	0	18	99

TABLE G-4.—OBSERVED AND PREDICTED FREQUENCIES OF THE VERTICAL TAIL LOADS (concluded)

Maneuver Types 20, 21, 24, and 25—Symmetrical pitch-down, inside loop, left four-point roll, and right four-point roll

OBSERVED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL
TOTAL	0	1	0	0	2	2	4	0	0	0	0	0	0	11	6	2	0	0	0	0	28

PREDICTED FREQUENCIES LOAD VVT
(LOAD VALUES IN HUNDREDS OF POUNDS)

DELTA LOAD RANGES

STEADY LOAD RANGES	BEL	-54.	-48.	-42.	-36.	-30.	-24.	-18.	-12.	-6.	0.	6.	12.	18.	24.	30.	36.	42.	48.	54.	TOTAL	NUMBER OF MANEUVERS
TOTAL	0	0	0	0	1	2	2	0	0	0	0	0	0	7	4	1	0	0	0	0	17	56

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