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Volume I

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**DEVELOPMENT OF
FLIGHT-BY-FLIGHT FATIGUE TEST DATA
FROM STATISTICAL DISTRIBUTIONS OF
AIRCRAFT STRESS DATA**

*UNIVERSITY OF DAYTON
RESEARCH INSTITUTE
DAYTON, OHIO*

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AIR FORCE FLIGHT DYNAMICS LABORATORY, FBE
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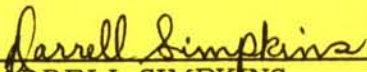
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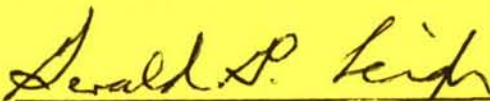
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FOR THE COMMANDER



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The data was then processed by several counting techniques to obtain statistical distributions of the cyclic and mean stress amplitudes, as well as the number of stress cycles per flight for both the ground operations and the in-flight operations. These distributions were then used to generate a series of flight-by-flight test sequences. The sequences were obtained by randomly selecting from the distributions a ground mean, the number of cyclic stresses, and the magnitude of the cyclic stress for each stress cycle of the taxi and ground operations. The process was repeated for the flight operation. These sequences were used to program the closed-loop fatigue machines. Thousands of unique flights with hundred of thousands of stress cycles were generated.

Three different counting techniques were used to determine the statistical distribution of the cyclic stress for each of two aircraft types. Tests were also conducted wherein the cyclic stresses during operations on the ground were omitted, however, a distribution of preflight ground stresses were used as the starting point for each flight.

The report presents the results in terms of the number of flights to failure for 9 sequences of B-58 data and 6 sequences for the F-106 data. A total of 91 specimens were tested. The report concludes that simulated testing sequences can yield the same fatigue life as the original strain gage data recorded on operational aircraft.

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FOREWORD

The efforts reported herein were performed by the Aerospace Mechanics Division of the University of Dayton Research Institute, Dayton, Ohio, under Air Force Contract F33615-73-C-3007, Project 1367, Task No. 0313. The program was sponsored by the Air Force Flight Dynamics Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio.

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SECTION 1

INTRODUCTION

The introduction of closed-loop electrohydraulic fatigue machines in the last few years has made it practical to perform fatigue testing without restrictions on the order of loading or the number of consecutive load cycles of one amplitude. In fact, complete flight-by-flight load simulations are possible.

Schijve in Reference 1 presents a rather complete discussion on the subject of aircraft structure fatigue. The discussion covers the physical and empirical limitations associated with using a linear damage theory and supporting data for life assessment problems involving a variable amplitude load sequence. He noted that flight simulation testing was essential for accurate assessment of fatigue life and crack propagation rate.

The present effort is concerned with establishing methodology for developing simulation sequences. The approach taken included the development of strain based sequences from strain gage data recorded during bomber and fighter aircraft flight operations. During the development of these sequences, the strain gage data were edited to remove small cycles (less than 3800 psi peak to peak) and inactive portions of the flight, but the order in which the remaining peaks occurred during a flight was preserved. The stress magnitudes were expressed in terms of stress relative to zero, in the same manner as the data were recorded, so that there was no requirement to identify the mean and alternating parts of the cycles for these sequences.

The strain gage data was also reduced to obtain statistical data on parameters considered necessary to describe the intensity of the flight-by-flight data. Statistical distributions were obtained for preflight stress, ground and flight 1-g stresses, stress cycles per ground operation, stress

cycles per flight, flight and ground peak stresses. Different counting techniques were used to obtain three sets of distributions of peak stresses resulting from gust, maneuver and taxi induced loadings. These data were used to develop simulated flight-by-flight sequences. It should be noted that G. M. vanDijk in Reference 2 presents several methods whereby one can process flight loads data to obtain statistical parameters that can be used to generate simulated flight data.

The strain based and simulated sequences were applied to coupon specimens, and the resulting fatigue lives compared. Techniques were selected as a result of these comparisons for simulating bomber and fighter aircraft operational load histories. Additional strain based and simulation sequences were developed from alternate bomber and fighter strain gage data as a means of demonstrating the general applicability of the selected simulation techniques for a range of operational flight load intensities.

Volume I of this report provides a description of the data and procedures used to develop the flight-by-flight sequences, the experimental program and a discussion of the results. Volume II provides a description of the computer programs used in generating the simulation sequences.

SECTION 2

RECORDED DATA

2.1 B-58 DATA

The University of Dayton during the period 1965 to 1969 had frequency modulated (FM) magnetic tape recorders installed on 4 of the USAF B-58 bomber aircraft. These recorders were used to collect flight loads data from the aircraft as they were used in the normal operating manner.

The recording program collected time history data on airspeed, altitude, center-of-gravity acceleration, and eight strain gage locations. Several of the strain gage locations were duplicated on the left and right side of the aircraft. For the present effort the strain gage located on the lower side of the spar at wing station 438.3 and span station 56.5 was chosen for the source of data. The stress at this location is sensitive to wing bending loading and is negative when the aircraft is on the ground and is positive when the aircraft is in flight. The time-history strain gage data was processed in terms of stress relative to zero stress using a calibrated value of pre-flight stress, which varies as a function of the aircraft gross weight, as the initial stress value when the aircraft is parked on the ground. All B-58 flights were designated as operational training flights. The mission profiles included the normal mission segments of taxi, take-off, ascent, cruise, descent, and landing as well as special mission segments of supersonic dash, refueling, and low level. The low level mission segments included flights over specified low level courses at constant pressure altitudes and at fixed altitudes above the terrain.

It was decided, based on the mean stress level and the K_T of the test specimen, that the B-58 data could be truncated so that minimum range between one reversal and the next could be 3800 psi. The flight recordings were then processed such that the peak stress of any cycle and the minimum

stress of the cycle were written on digital tape. The position of a switch on the landing gear also was used to identify whether the stress peak occurred when the aircraft was on the ground or in-flight. As each flight was processed the statistical variance of the stress peaks and valleys was calculated by the equation:

$$\text{Stress Variance} = \frac{N \sum_{i=1}^N S_i^2 - \left(\sum_{i=1}^N S_i \right)^2}{N(N-1)} \quad (1)$$

where S is the value of the stress for a peak or valley.

One of the objectives of the project was to investigate the effect that a mild or severe load history might have on the accuracy of a simulation technique; therefore the flights were divided into two sets: a low intensity set and a high intensity set. The variance was used as the parameter to assign a particular flight to either the high or the low intensity set. A value for the variance of the airborne segment of a flight of $30.13 \times 10^6 \text{ (psi)}^2$ was selected as the dividing point. Using this criteria the B-58 data set was divided so that 343 flights were assigned to the low intensity set, defined as Sequence A, and 282 flights were assigned to the high intensity set, defined as Sequence B.

The low intensity data contained 197,448 stress reversals or 98,724 complete cycles. Of these, 2097 were taxi cycles. The total data set contained 194,287 reversals which defined primary peaks (a peak between successive mean crossings) and a total of 3160 secondary reversals that were superimposed on the primary reversals. The average of the 1-g trim stress during the airborne portion of the flight was 12,920 psi with a variance of $12.1 \times 10^6 \text{ (psi)}^2$. This average is the average of the 1-g stresses at the time of a stress reversal for the 193,255 peaks, see Table 1. The high intensity data set contained 86,121 stress reversals or 43,060 complete cycles, and 3226 of these cycles were associated with taxi or

ground operations. A total of 2499 reversals were secondary reversals. Table 1 is a summary of the statistical properties of the low and high intensity data sets for the B-58.

An examination of the table reveals some numbers that require additional explanation. As stated early the dividing line between the low and high intensity flights was based on a value of the variance of $30.13 \times 10^6 (\text{psi})^2$. That number is the variance of the stress reversals about the mean for that particular flight. The variance listed in Table 1 is the variance of all primary peaks about the mean of the entire data set (i. e., 190,438 points). When the variance is calculated for the stress reversals that are primary peaks and the deviation is measured from the instantaneous 1-g trim stress to the stress peak (or valley) then the variance for the Sequence A set is 19.8 ksi^2 and for the Sequence B set is 24.9 ksi^2 . These latter values labeled the 1.0G Variance were calculated as follows.

$$1.0G \text{ Variance} = \frac{\sum_{i=1}^M \sum_{j=1}^{N_i} (S_{ij} - G_i)^2}{\left(\sum_{i=1}^M N_i \right) - 1} \quad (2)$$

where

S_{ij} = value of j^{th} peak or valley stress in the i^{th} flight

N_i = number of stress peaks for flight segment (ground or airborne) for i^{th} flight

M = number of flights in data set

G_i = 1-g trim stress for flight i

Also some comments are required about the means. The mean of the primary peaks is just the simple average of the 190,438 peaks. The mean of the weighted 1-g flight stress is the average of the 1-g trim stress at the time of a stress reversal. The 1-g trim stress values were determined by measuring the average 1-g stress value just preceding each stress reversal

which yielded a time history of the 1-g trim stresses for the entire flight. The fact that the averages of the primary peaks and the weighted 1-g stress are essentially the same is an indication that the deviations of the stress from the 1-g value is the same for increasing and decreasing deviations (i. e., plus and minus incremental stresses). This does not imply that the individual cycles are symmetrical about the 1-g trim value but only that when the total data set is examined there is symmetry between the positive and negative peaks. The fact that the 1-g stress on the ground is different from the preflight stress indicates that some of the data are from landings and some are from the take-off run just prior to lift off. The fact that the mean of the ground data and the mean of the 1-g ground data are different indicates that there are larger negative peaks than positive peaks.

The preflight stress is the true magnitude of the wing stress when the aircraft is parked with engines off. These values were used as the starting point for processing of the strain gage data.

Test sequences were also developed wherein taxi loads were omitted; however one ground load equal to the preflight stress was inserted at the beginning of each flight. The Sequence A data without taxi loads is identified as Sequence C, and the Sequence B data without taxi loads is identified as Sequence D.

2.2 F-106 DATA

The University of Dayton during the period from August 1970 to September 1971 had digital tape recorders installed on four F-106 Interceptors. In addition to the usual VGH data, strain gage data was recorded from a gage on the lower shoulder of spar number four at wing station 472 at buttock line 44.25. The recordings began at engine startup and ended at engine shut down, and therefore include taxi, take-off, and landing as well as the airborne portion of the flight.

The strain gage location was inboard of the landing gear and therefore the stress was tension when the aircraft was on the ground as well as when it was in the air. Consequently the strain at this location was not characterized by the typical ground-air-ground stress reversal. In fact the stress on the ground and the 1-g stress in-flight were the same.

The data was divided into two sets: a low intensity and a high intensity set. The variance, Equation (1), of the stress history was used as the measure of severity. The dividing point between low and high was chosen as $19.36 \times 10^6 \text{ psi}^2$.

The low intensity data set had 381 flights with 52,128 stress reversals; 51,462 of these occurred during the airborne portion of the flight, and 48,446 were primary peaks. The average number of primary peaks per flight was 127. The variance, Equation (2), of the airborne primary peaks about the 1-g trim stress was $11.18 (\text{ksi})^2$.

The high intensity data set had 236 flights with 39,752 stress reversals; 32,636 of the reversals were airborne primary peaks. The average number of stress reversals was 138 and hence there was an average of 76 complete cycles per flight. The variance, Equation (2), of the peaks and valleys about the 1-g trim stress was $28.2 (\text{ksi})^2$.

Table 2 is a summary of some of the more significant facts about the data sets. Sequence E was the low intensity set and Sequence F was the high intensity set.

SECTION 3

TEST SPECIMEN

The test specimen was machined from 7075-T651 aluminum plate. The specimens were machined to the dimensions shown in Figure 1. The stress riser hole in the center of the specimen was first drilled to 0.375-inch diameter on a numerically controlled vertical milling machine. It was later redrilled to 0.386-inch diameter on a bench drill press. The specimens were machined from 1/4 inch rolled plate without any additional machining on the flat faces. In order to eliminate any biasing of the test results due to specimen location within the two plates that were used, the specimens were assigned consecutive numbers from random locations in the plates. The specimen locations are shown in Table 3. The length is the roll direction of the plate which is the 11 inch dimension of the specimen. It was the intent of this effort to use the same specimen that was used on a previous program. That program, the results of which are reported in References 3 and 4, used a specimen that had a 0.375-inch drilled hole in the center. The specimen for the previous program had a fatigue life of 50,500 cycles when tested at a constant amplitude of +5 KSI to +25 KSI net section stress. However, the specimens from the current program with a 0.375-inch diameter drilled hole had a fatigue life in excess of 250,000 cycles for the same loading.

In an attempt to make the fatigue strength of the specimens from the two programs similar, the 0.375-inch hole was reamed to 0.386-inch diameter. This reaming reduced the fatigue life to 67,200 cycles for the constant amplitude loading. Since this life was still greater than the 50,500 from the previous program, the following additional modifications were attempted: (1) the drilled 0.375-inch diameter hole was stress relieved at 200^oF for 24 hours, yielding a fatigue life of 105,200 cycles; (2) the 0.375-inch hole was drilled out to 0.386-inch diameter, yielding a fatigue life of

58,200 cycles; and (3) the 0.375-inch hole was drilled out to 0.386-inch diameter and then stress relieved at 200^oF for 24 hours, yielding a fatigue life of 61,100 cycles. Since the stress relieving after redrilling did not cause any additional reduction in fatigue life the specimens were just redrilled to 0.386-inch diameter without stress relieving. The final configuration had a fatigue life of 58,200 cycles when tested at a constant amplitude of +5 KSI to +25 KSI.

The static material properties of the plates were determined and are presented in Table 4. Tensile specimens were machined from random locations throughout the plates. The results indicate that the plates were uniform in tensile properties.

SECTION 4

TESTING PROCEDURE

All cyclic testing was performed using the University's MTS closed-loop electrohydraulic fatigue test system which was programmed by signals from an FM recorder.

4.1 GENERATION OF TEST SEQUENCE TAPES

The loading spectra which resulted from the editing of the actual flight recordings was a digital tape of peak and valley stresses in the same sequence as they occurred during the flights. Now since 343 flights of Sequences A or C would not contain enough cycles to cause a failure, the 343 flights were arranged in a second and third order to give a test sequence of 1029 flights. The order of the cycles within a given flight was not rearranged. After the 1029 flights were applied to the specimens the same sequence was started again. For the B and D sequences, the 282 flights were rearranged into 5 additional orders to give a test sequence of 1410 flights. Again, the order of the cycles within a given flight was not changed. After the 1410 flights were applied to the specimens the sequence was restarted.

The same procedure was used for the F-106 data. The 381 flights of Sequence E were rearranged 11 times to give a test sequence of 4572 flights. The 236 flights of the Sequence F data were rearranged 14 times to give a test sequence of 3540 flights. As with the B-58 data the order of the cycles within a given flight was not changed during the rearrangement process.

As each flight of the B-58 data set was copied from the original edit files, the preflight stress and two calibration signals were inserted into the data. The preflight stress was inserted at the beginning of the ground

data and the calibrations signals between the ground and airborne data. For spectrums C and D which did not contain taxi cycles the preflight stress was followed immediately by the two calibration signals. Since the F-106 data did not have a negative strain for ground operations the calibration signals were inserted into the data differently. The preflight stress of +8360 psi was written 4 times at the beginning of each flight, a signal equal to +14,960 psi was written 4 times in succession once per flight if and when the stress peak following the calibration value exceeded 16,060 psi. The second calibration signal was inserted this way so that the calibration signal would not introduce an extra stress reversal. If a flight did not have a peak greater than 16,060 psi then the second calibration voltage was omitted for the flight.

After the digital tape was created it was used as an input to the Wright-Patterson Air Force Base Analog/Hybrid computer. The analog signal was generated by fitting half sine waves between the peaks and valleys. The output of the analog/hybrid computer which was in an analog voltage form was recorded on a frequency modulated (FM) tape recorder. The sinusoidal frequency during the digital to analog conversion was 80 Hz, however, when the FM tape was played back into the MTS testing system the tape was slowed down so that the testing frequency was 5 Hz.

Oscillograph playbacks of typical flights are presented in Figure 2. Figure 2(a) and 2(b) are the same B-58 flights with and without taxi cycles. Figure 2(c) is a section from an F-106 spectrum.

In an attempt to control the amount of plasticity at the edge of the stress riser hole the net section stress was limited to 30,000 psi tension. With a stress concentration factor of 2.54 on the net section stress this limited the maximum stress to 76,200 psi. The 0.2% offset yield stress was 75,600 psi. The net section compression stress was limited to -15,000 psi.

4.2 SPECIMEN INSTALLATION

The specimens were installed in the testing machines using the gripping device shown in Figure 3. During installation the bolts were tightened first while the specimen was loaded slightly in tension (100 pounds) then the wedges were tightened. During testing the tensile loads were transferred to the specimen by shear loads on the bolts and the compressive loads were transferred directly to the specimen by the wedges. The use of the wedges in combination with the bolts allowed tension-compression testing without any backlash in the bolt holes. Using the relatively stiff fixture and specimen it was possible to test the specimens without using an anti-buckling fixture.

4.3 CYCLIC TESTING

Cyclic testing was accomplished by using the FM tape signal as the command signal for the closed-loop testing system. The feedback signal for control was from a strain gage type load cell.

The FM recorder/reproducer used was a 14 channel system with two channels used for WOW and flutter compensation so 12 channels were used for test sequence data. Each test sequence (A, B, C, D, E, and F) was limited to approximately 300,000 cycles before the sequence was repeated. At a tape speed of 1.875 inches/second it required three channels to record the 300,000 cycles on 10.5 inch diameter reels. Each channel (track) of the tape contained approximately 100,000 cycles and provided 6 hours of testing time. Sequence A for example started on track 1 continued on track 2 and was completed on track 3. Sequence C started on track 4 continued on track 5 and was completed on track 6. Each track had a section of zero load recorded at the beginning and end of the test sequence. During testing the reproduce recorder would be started, and while the signal was at the zero load level, the output would be connected to the MTS system. After a track was reproduced, the output would be disconnected from the MTS system

while the signal was at zero load, and the tape rewound. The next track would then be used to program the machines. If after tracks 1, 2 and 3, for example, had been used and the specimen had not failed, then testing was continued by using track 1 over again and then track 2 again and so on.

Since the system used is completely analog, it is necessary to monitor the load/cell output to ensure that the gain of the FM system has not changed or that a DC offset has not occurred. The accuracy of the loadings was maintained by monitoring on an oscilloscope the calibration signals which were recorded periodically on the tape. In order to obtain a high sensitivity on the oscilloscope, the load cell output was input into a chopped-beam oscilloscope through two "Tektronic" Model 5A13N Differential Comparator Amplifiers. In using these Differential Comparator Amplifiers, the lower calibration voltage was set on one amplifier and the higher calibration voltage was set on the other amplifier. When the test spectrum was being applied to the specimen and when the periodic calibration pulses occurred, the difference between the actual load cell voltage feedback and the required calibration voltages was displayed on the oscilloscope screen. If both the gain and the DC level were correct then the output during the two calibration pulses would be zero. Since the output should be zero, the sensitivity (vertical deflection) of the oscilloscope could be set very high. The sensitivity was set so that 0.1 inches on the screen was equivalent to 30 psi net section stress. By frequent monitoring of the calibration pulses in the load cell output signal, the stress levels for the calibration signals were maintained within ± 60 psi.

Cyclic testing was conducted on a 24 hour a day 5 days a week basis. The specimens were maintained at zero load over the weekends.

SECTION 5

SIMULATED TEST SEQUENCES

The strain gage data was processed to obtain statistical information on parameters considered appropriate to characterize the intensity of the flight data. Initially these processing efforts were restricted to the strain data that was used in the development of Sequences A and E as explained in Section 4. The strain data was processed to obtain statistical distributions of preflight stress, ground and airborne 1-g stress, stress cycles per ground and airborne operations and peak stresses. It was contemplated that the information on stress peaks could significantly influence test life. Consequently, different counting methods were used to obtain alternate sets of peak stress distributions. Having obtained these data sequences were developed and applied to test specimens to simulate Sequences A and E. The stress peak counting method employed to develop the simulation sequences that produced test lives that correlated with the strain based Sequences A and E test lives was selected for additional evaluation. Sequences were then developed to simulate the strain based Sequences B, C, D, and F.

5.1 B-58 SIMULATIONS

5.1.1 Folded Distribution

The first method used to generate a simulated test spectrum was the folded distribution of combined positive and negative primary peaks. A primary peak is defined as the maximum (or minimum) value of stress occurring between two successive crossings of the 1-g stress level by a continuous stress time-history trace. In order to generate the input data for the simulation program, the actual strain gage data was processed by a computer program to generate statistical distributions, in the form of a cumulative frequency distribution, of incremental stress peaks and valleys.

In order to conserve testing time only those peaks (valleys) greater than ± 3000 psi were used. Thus, an incremental peak stress represents an alternating stress superimposed on a 1-g trim stress.

Separate distributions were generated for the ground operations and the airborne flight segments. The frequency distributions of incremental stress peaks for the B-58 Sequence A data set is presented in Table 5 for the ground operations and also for the airborne operations.

Table 6 is a listing of the folded distribution (i.e., the sum of the negative and positive peaks) for the ground data for the B-58 Sequence A data. Since the parameter that is needed to generate a simulated test sequence is the relative probability, Table 6 lists the sum of the positive and negative peaks for the frequency and cumulative frequency distributions from Table 5 rather than the average of the number of peaks and valleys. The probability listed is the probability of a peak being equal to or greater than the absolute value of the stress value listed. Table 7 is a listing of the same type of data for the airborne flight segments.

Folded distributions of the primary stress peaks were used to generate random test sequences. A flight within the sequence was assembled by the following sequential steps:

- (1) randomly select a preflight stress from the cumulative probability of preflight stress data (Table 8);

- (2) randomly select a ground 1-g trim stress (Table 9);

- (3) randomly select the number of stress cycles for the ground operations for that flight (Table 10);

- (4) randomly select the magnitude of the cyclic stress for the first ground stress cycle (Table 6), add and subtract this value from the ground 1-g trim stress selected in step (2), and continue to repeat step (4) until the number of ground cycles required by step (3) is obtained;

(5) randomly select a 1-g trim stress value from Table 11 for the airborne segment of the flight;

(6) randomly select the number of stress cycles for the airborne segment of that flight (Table 12);

(7) randomly select from Table 7 the magnitude of the cyclic stress for the first stress peak of the airborne segment of the flight, add and subtract this value from the 1-g trim stress selected in step (5) to form the first stress cycle, and repeat step (7) until the number of cycles selected in step (6) is obtained.

A random number between 0.0000000000 and 1.0000000000 was selected by a random number generator then used to interpolate in the appropriate probability table to select values for the parameters in steps (1) thru (7).

This procedure completes the first flight. Now go back to step (1) and repeat the entire procedure until enough flights and cycles are generated to fill one track of the FM tape. The procedure is repeated again for a second and third FM channel.

In the actual simulation of the B-58 Sequence A data the first channel contained 420 flights with 105,651 stress cycles, the second channel 439 flights with 105,393 stress cycles and the third channel 459 flights with 105,303 stress cycles.

Table 13 is a listing of a typical summary sheet for the first 50 flights. The summary sheet is self explanatory except for two items, i.e., the cumulative number of peaks and points. The number of peaks is the sum of the number of ground and airborne stress reversals (2 per cycle), the number of points is equal to the number of peaks plus the number of points used for the preflight stress (4) and the ground calibration pulse (4) and the airborne calibration pulse (4) so that each flight has 12 more points

than peaks except the first flight which has 8 points of zero stress at the beginning. A summary of the total data set on each of the three channels is presented in Table 14. Table 14 also contains the summary data for the entire data set.

Note that there are two variances listed in Table 14 for both the ground and the airborne data. The one labeled stress variance was based on Equation (1) and the one labeled 1.0G Variance was based on Equation (2).

Table 15 is a listing of stress reversals for the start of each channel. This print out is from the digital tape which was used as input to the hybrid computer. A continuous analog signal for each channel was obtained by forcing a half cycle of a sine wave between the digital peaks and valleys. The resulting signals were then recorded on FM tape and later used to program the fatigue machines.

5.1.2 Bivariate Distribution of Positive and Negative Primary Peaks

The second method of generating a simulated test spectrum requires the strain gage data to be processed by a different computer program which sorts the primary peak data into a bivariate distribution of the peak stress in a cycle and the immediately following minimum stress. Table 16 is a listing of the maximum stress and the corresponding minimum stress of each cycle of the ground data for the B-58 Spectrum A data set. In this data set only those cycles wherein the maximum stress was more than 3000 psi greater than the 1-g trim stress were retained. The immediately following minimum did not have to exceed a minimum threshold but could have any value provided it was less than the 1-g trim stress. Table 17 is a bivariate distribution of peaks and corresponding valleys for each cycle of airborne data.

Table 18 is a listing of the cumulative probabilities for the peak stresses of the ground operations data and Table 19 is a listing of the

cumulative probabilities for the immediately following minimum stress for each peak stress for the ground operations data.

Tables 20 and 21 are the same type of data for the airborne segment of the flights.

All other data is the same as that used for the folded distribution described in Paragraph 5.1.1.

The method for generation of a test sequence from this data is the same as described in Paragraph 5.1.1 except for steps 4 and 7. For the bivariate distribution of peaks and valleys method, one must first select a random number and then find the corresponding magnitude of the peak stress (Table 18 for step 4 and Table 20 for step 7). This value of cyclic stress is added to the 1-g trim stress obtained in steps 2 or 5. Next, with a second random number, one selects a minimum stress from the distribution of valleys for that magnitude of peak stress (Table 19 or Table 21). The magnitude of the valley is then subtracted from the 1-g trim stress to determine the extremes of a complete stress cycle.

A summary of the first 50 flights is presented in Table 22.

A summary of the three channels of data used for the simulation of the B-58 data Sequence A is presented in Table 23.

Table 24 is a listing of the start of the data as it appeared on the digital tape that was used as input for the Hybrid computer.

5.1.3 Limited Folded Distribution

The third method used to generate a simulated test spectrum was identified as the Limited Folded Distribution. This method is similar to the Folded Distribution (Paragraph 5.1.1) in that the cyclic stresses are selected from a folded distribution of the primary peaks and are applied symmetrically about the 1-g trim stress; however, the other parameters (preflight stress, number of ground stress peaks per flight, ground 1-g

stress, number of airborne stress peaks per flight and the 1-g stress for the airborne flight segment) were selected from a small discrete distribution. The input data had only a few values for these parameters and the program did not interpolate for intermediate values. Tables 25 through 31 list the input data for the simulation program. Table 32 is a summary listing of the first 50 flights generated by the program. Note that the number of stress reversals for the ground segments have discrete values of 0, 4, 8, 12, and 78 and the airborne segments 74, 238, 454, 784, and 1620, respectively. Also note that the preflight and 1-g trim stress have only a few discrete values.

5.2 F-106 STRESS SIMULATION

5.2.1 Bivariate Distribution of Mean and Alternating Stresses

The basic principle of this method is to form a stress cycle from mean and alternating stress values chosen randomly from a bivariate distribution of mean and alternating stresses. First, a mean stress value is randomly chosen from the cumulative distribution of mean stresses. Then an alternating stress value is randomly chosen from the cumulative distribution of alternating stresses for the chosen mean stress value. A stress cycle is then formed by adding the alternating stress to the mean stress thereby obtaining the peak value of the stress cycle and by subtracting the alternating stress value from the mean the minimum value of the stress cycle is obtained. Separate bivariate tables are used for the ground and airborne data. To complete the description of a flight, the number of ground cycles and the number of airborne cycles for the flight are randomly chosen from the distributions of the number of ground and airborne cycles per flight. The input data for the computer program which generated the simulated flights for the F-106 Sequence E (Low Intensity) data set are presented in Tables 33 through 38. The cumulative distributions are entered with random numbers which are equated to the probabilities.

Summary information for the first 50 flights is presented in Table 39. The variance, Equation (1), of the stress reversals about the mean of the reversals is less than the variance, Equation (2), of the reversals about the 1-g trim value. The 1-g trim stress was taken as a constant value of 8360 psi. The difference in the variance is due to the unsymmetrical nature of the loadings with the positive incremental stresses being larger than the negative incremental stresses. The mean of all of the peaks and valleys is 10,607 psi whereas the 1-g trim stress is 8360.

Using the bivariate distribution of mean and alternating stress 10,094 flights were generated which contained a total of 570,528 stress reversals or half that number of cycles.

The composite summary of all the flights is presented in Table 40.

5.2.2 Separate Positive and Negative Distributions

The second method used to generate simulated flights of the F-106 Sequence E data was identified as the Separate Positive and Negative Distributions. This method requires the random selection of a positive incremental stress and then a negative incremental stress from separate distributions of the primary peaks. The positive incremental stress is added to the 1-g trim stress (8360 psi) to obtain a stress peak and the negative incremental stress is added to the 1-g trim stress to obtain a stress minimum. Separate distributions are used to describe the ground and airborne data. To complete the description of a flight, the number of stress cycles for ground operations and the number of stress cycles for the airborne segment of the flight are selected randomly from distributions of the number of stress cycles for ground and airborne flight segments per flight.

The cumulative probabilities for the incremental stresses for the F-106 Sequence E data are presented in Tables 41 through 44. The

cumulative distribution of the number of stress reversals per flight (not cycles) is presented in Table 45 for the ground operations and in Table 46 for the airborne operations. A summary of the first 50 flights generated by this procedure is presented in Table 47. A summary of all the flights generated is presented in Table 48. There were 12,111 flights with 560,301 stress reversals used to fill three channels of the FM tape.

5.2.3 Limited Separate Positive and Negative Distributions

This method is similar to the method presented in Paragraph 5.2.2. The stress cycles are formed by randomly selecting a positive and a negative incremental stress from separate distributions and adding them to the constant 1-g trim stress 8360 psi. However, the number of cycles in the ground and airborne segments are chosen from a small discrete distribution.

The input data for the computer program is presented in Tables 49 through 54. A summary of the first 50 flights is presented in Table 55.

Table 56 is a presentation of the summary of all the flights for this method of simulation. A total of 12,495 flights with 552,579 stress reversals were generated.

5.3 SIMULATIONS FOR DATA SETS B-58 SEQUENCE B, C, D AND F-106 SEQUENCE F

After tests using the simulated sequences which were discussed in Paragraphs 5.1 and 5.2 were completed, the remaining data sequences were simulated using the best simulation technique for each type aircraft. For the B-58 that was the Bivariate Distribution of Positive and Negative Primary Peaks. For the F-106 the Separate Positive and Negative Distribution was used for the stress data.

5.3.1 B-58 Simulations for Sequence B, C, and D

The B-58 Sequence B data which were the high intensity flights were used to generate a test sequence using the bivariate distribution of peaks and corresponding valleys. This procedure is described in Paragraph 5.1.2. The input data is presented in Tables 57 through 66. The summary data of the simulated flights is presented in Table 67 for the first 50 flights and in Table 68 for the entire test sequence.

The simulated test spectra for the Sequence C and D data, which is really the B-58 low and high intensity data sets but without taxi cyclic stresses, used the same input data as the A and B sequences. The results of the simulation for the first 50 flights for Sequence C simulation is presented in Table 69 and the summary for all the flights in Table 70. The results of the simulation for the first 50 flights for Sequence D simulation is presented in Table 71 and the summary for all the flights in Table 72.

5.3.2 F-106 Simulations for Sequence F

The F-106 high intensity data, Sequence F, was used to generate a sequence of test loads using the method presented in Paragraph 5.2.2.

The input data which was obtained from processing the strain gage data into statistical parameters is presented in Table 73 through 78.

The summary of the first 50 flights is presented in Table 79 and the summary data for all of the Sequence F flights in Table 80.

SECTION 6

TEST RESULTS

All of the testing was conducted in the University's structural test laboratory at a temperature of approximately 72°F. The test specimens were assigned to the various tests in a chronological and sequential order starting with specimen number 1 (see Table 3) for test number 1.

In most instances six specimens were tested for each loading sequence. The final fracture was selected as the event to identify as the fatigue life of the specimen. The ratio of crack growth period to the total flights to failure varied from a minimum of approximately 0.07 (specimens with cracks growing on both sides of the starter hole) to a maximum of 0.22 (specimens with a single crack on one side of the starter hole). The basic test data indicates that on the average 85% of the fatigue life was used to initiate a visible fatigue crack at the starter hole.

6.1 FATIGUE LIFE

The fatigue life of each individual specimen tested with the original B-58 data sequences is presented in Table 81. Table 82 is the results of the F-106 original sequences.

The results of the fatigue tests using simulated test sequences are presented in Table 83 for the B-58 Sequence A and Table 84 for the F-106 Sequence E. The comparison of fatigue lives must be made on the basis of flights to failure, not cycles, since the number of cycles per flight varies with the simulation method and the threshold level.

Since the method which used the bivariate distribution of primary peaks and corresponding valleys (Paragraph 5.1.2) gave acceptable correlations for the B-58 Sequence A data, the limited distribution (Paragraph 5.1.3) was not tested. The remaining sequences of the B-58 data set were

simulated using the method of bivariate distribution of peaks and corresponding valleys. The results of the tests using the simulated spectra for Sequences B, C, and D for the B-58 are presented in Table 85.

The best correlation for the F-106 Sequence E data set was obtained for the limited separate peak and valley distributions; however, the regular separate peak and valley also gave acceptable correlation and since it was more complex (and therefore have broader application) we decided to use the regular separate peak and valley (Paragraph 5.2.2) distributions for the Sequence F simulations. The results for the F-106 simulations for Sequence F are presented in Table 86.

The average life of the tests for each sequence is presented in Table 87. Only the flights to failure are listed in the table since the number of cycles per flight varied depending on the simulation method and the truncation level. The comparison must be made only on the flights since this was the only criterion used in the simulations.

6.2 CRACK GROWTH

The length of the fatigue crack was measured on most of the specimens. The measurements were made with a 30x telescope mounted on a micrometer slide as shown in Figure 4.

The data presented in Figures 5 through 19 show the relationship of crack length versus flights for different test sequences after an initial crack length of 0.3 inch was established. A baseline crack length of 0.3 inch (distance from center of starter hole to crack tip) was selected to provide a common starting point since the start of visible crack growth occurred at different numbers of flights and cycles for the various test sequences. Crack length data is plotted versus flights rather than cycles since the criteria for the threshold stresses were different for each simulation

technique and for the original data. The plots were terminated when one side of the specimen fractured or when a visible crack was established on the opposite side of the starter hole.

SECTION 7

DISCUSSION

Perhaps the best way to visualize the objective and results of this program is to think of the program in two parts, the B-58 data and the F-106 data.

7.1 B-58 DATA CORRELATION

The results of all the testing using the B-58 data is presented pictorially in Figure 20. These results, also see Table 81, indicate that the average number of flights to failure was approximately the same when using the Sequence A or Sequence B spectra. However, Tables 20 and 65, which present the distribution of airborne peaks for Sequence A and Sequence B respectively, show that Sequence A contained over twice the number of peaks in comparison with Sequence B. These tables also show that approximately 50% of the peaks were less than 4,500 psi and that both data sets contained the same number of peaks above 8,000 psi. It would appear therefore that there was little difference in the severity of the Sequence A and Sequence B data sets and that the damage per cycle below stress levels of 5,000 psi was small or non-existent. It would also appear that the use of threshold values below 4,000 psi, in an effort to reduce the testing time requirements, did not significantly affect the fatigue lives.

It should be noted that the separation of the original data into low intensity (Sequence A) and high intensity (Sequence B) data sets was accomplished to demonstrate that the subsequent data simulation methods would be applicable when using different data sets. However, the separation of the B-58 data which is a more gust sensitive aircraft yielded data sets of approximately the same intensity (on a damage per flight basis) except that the low intensity data set contained a significantly larger number of low

value stress peaks. One could also conclude that the operational missions of the B-58 fleet were relatively consistent and that differences in resulting spectra were due to environmental atmospheric conditions.

Referring again to Figure 20 one can see that when the taxi cycles were omitted from the Sequence A original data that the fatigue life increased from 2,536 flights to 3,697 flights. This result was somewhat surprising at first; however, when one considers that when the taxi cycles were omitted the minimum stress on the ground was then the preflight stress and not as negative as the taxi cycles then it is not as surprising. Figure 2(a) and 2(b) depict the difference in the minimum ground stress very dramatically when the taxi cycles are omitted. We now believe that rather than using the preflight stress as the ground stress, if one is omitting taxi cycles, we should use the minimum stress in the ground mission segment (for that flight) as the ground stress. Reference 5 presents some data on this for crack growth but not for crack initiation. For simulations we suggest that one use a distribution of minimum stresses for the ground data rather than a distribution of preflight stresses. In other words, the stress that was used as the ground stress for the Sequence C simulation which is listed as preflight stress (Column 2) in Table 29 should be replaced by the minimum ground stress data (Column 7) of Table 22. Additional insight to the effect of ground cyclic stresses will be obtained as a result of a current testing program (AF 33615-74-C-3007).

The simulated D sequence does not follow the other trends, i.e., for all but the simulated D sequence the simulated sequences using the bivariate distribution of peaks and corresponding valleys have slightly shorter lives than the original strain gage data. No reason for this opposite result is known other than possibly experimental scatter.

The tests using the folded primary peak spectra yielded a much shorter fatigue life and as expected is a more damaging sequence than the real flight situation.

A general comment is in order about the maximum stress in the sequence. As stated before, the maximum net section stress was limited to 30,000 psi; however, at the start of testing we used a truncation level of 34,500 psi and also 33,000 psi. The Sequence A spectrum was used for testing and resulted in longer lives for some of the specimens but also much larger scatter in the fatigue lives. The use of a spectrum that has tensile stresses that induce notch yielding appears to cause residual compressive stresses that cause longer fatigue lives. This phenomenon of retarded crack growth rate and increased fatigue life due to tensile overloads has been well documented in the literature (see, for example, References 5, 6, 7, and 8). When one is using a test sequence that has stresses which could cause yielding at the notch it is very important not to exceed the maximum stress, even the normal scatter in the yield stress of the material may cause yielding in some specimens and not in others.

We believe that the results presented in Figure 20 for the B-58 are a correct representation of the fatigue life of the specimens. The best and also good correlation was obtained using a simulated test sequence wherein the loads were randomly selected from a bivariate distribution of positive primary peaks and corresponding primary valleys.

7.2 F-106 DATA

All of the F-106 data set test results are presented pictorially in Figure 21. The results clearly show the effect of the severity of the two sequences. The E sequence being more mild than the F. Table 44 which is the distribution of primary stress peaks for the E sequence lists 962 stress peaks greater than 10,000 psi whereas Table 76 lists 2419 peaks greater than 10,000 psi for the F sequence. Looking at the cumulative probability one can see that in the E sequence only 6.8% of the primary peaks are greater than 10,000 psi whereas for the F sequence 22.4% are greater than 10,000 psi.

The use of the bivariate distribution of mean and alternating stresses cause a much shorter fatigue life. This was due mostly to the shift in the mean stress from cycle to cycle during the simulation. This result is illustrated in Figure 22. The variance, Equation (2), of the incremental peaks and valleys of the cycles for the simulation using bivariate distributions of mean and alternating stresses was 28.5 KSI^2 as compared to the variance of 22.6 KSI^2 for the simulation using the separate positive and negative distributions of primary peaks. Both variances were calculated using a constant 1-g trim stress for 8360 psi.

The simulation tests using separate distributions of primary peaks and valleys resulted in fatigue lives that were only slightly greater than those using the original strain gage data. The difference in the average life is about 11%; however, there is overlap in the scatter bands as can be seen on Figure 21. The fact that the separate peak and valley and the limited separate peak and valley gave the same fatigue life is not surprising since the F-106 data did not have a variable 1-g trim stress or a GAG cycle.

7.3 CRACK GROWTH CURVES

The crack growth curves presented in Figures 5 through 19 are evidence that the rate of crack growth is dependent on the loading spectrum. The data also indicates that after the crack has propagated to the point where the plots were started there are very few areas where crack growth was arrested for a time.

SECTION 8

CONCLUSIONS

1. The use of a load sequence wherein the stress reversals were arranged by a random selection from a bivariate distribution of the primary peaks and the corresponding valleys yielded fatigue lives that were equivalent to the lives using the original strain gage data for a gust sensitive aircraft.
2. The use of a load sequence wherein the stress reversals were arranged by a random selection from separate distributions of the primary peaks and valleys yielded fatigue lives that were equivalent to the lives using the original strain gage data for a maneuver sensitive aircraft.
3. The proper representation of the minimum stress in a flight is necessary for good simulation. The minimum stress for a good simulation, in which ground cycles are omitted, is the minimum value of the ground stress and not the pre-flight trim stress.
4. Test sequences can be developed that provide proper simulation of strain history data. In addition to the distribution called for in 1 and 2 above, statistical distributions of the number of stress cycles per flight for ground and airborne operations and a distribution of 1-g trim stresses are required.

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8. Impellizzeri, L.F., Cumulative Damage Analysis in Structural Fatigue, ASTM STP462, American Society for Testing and Materials, 1970.

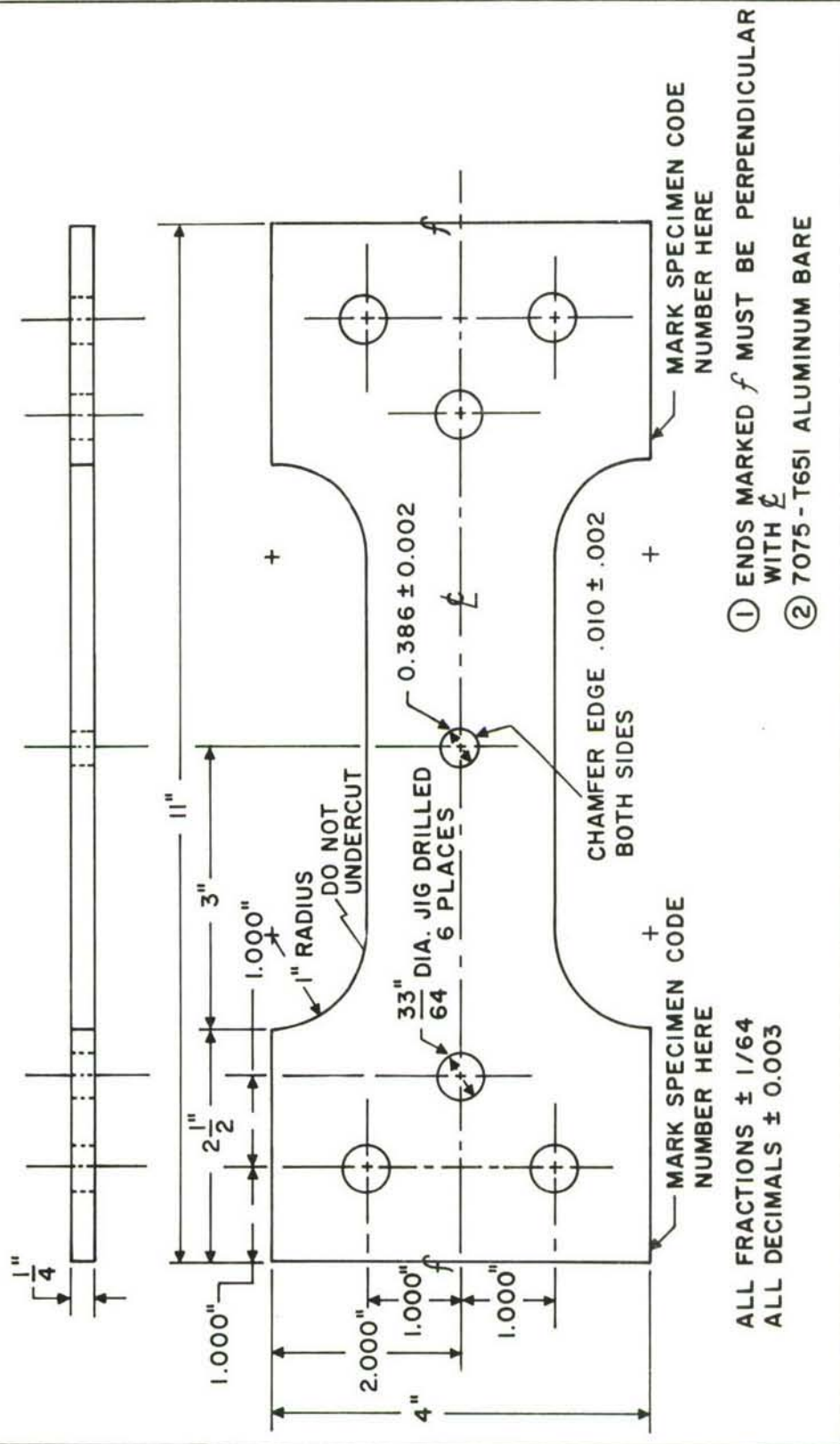


Figure 1. Cyclic Test Specimen.

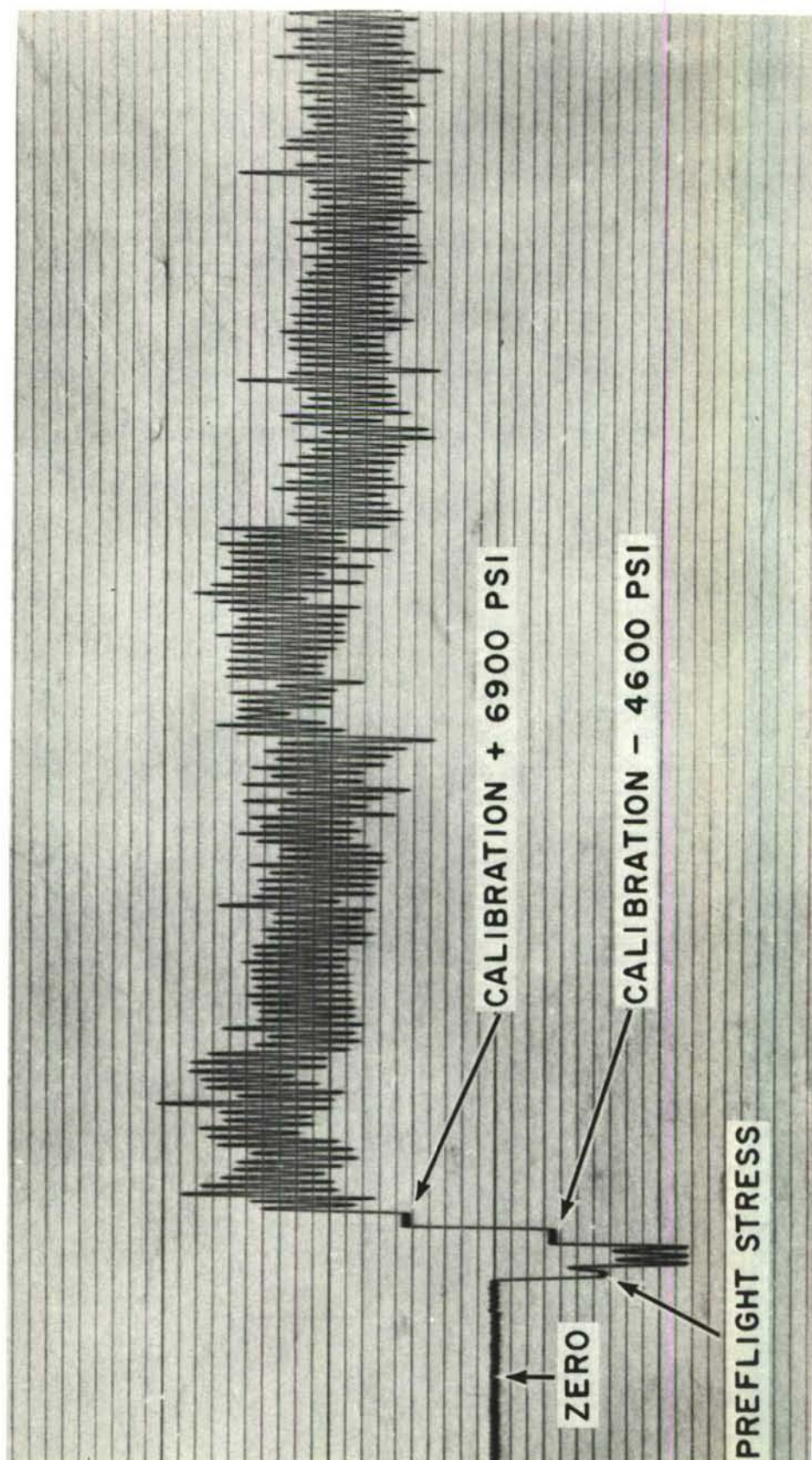


Figure 2(a). Typical Stress Sequence for B-58 Spectrum with Ground Loads.

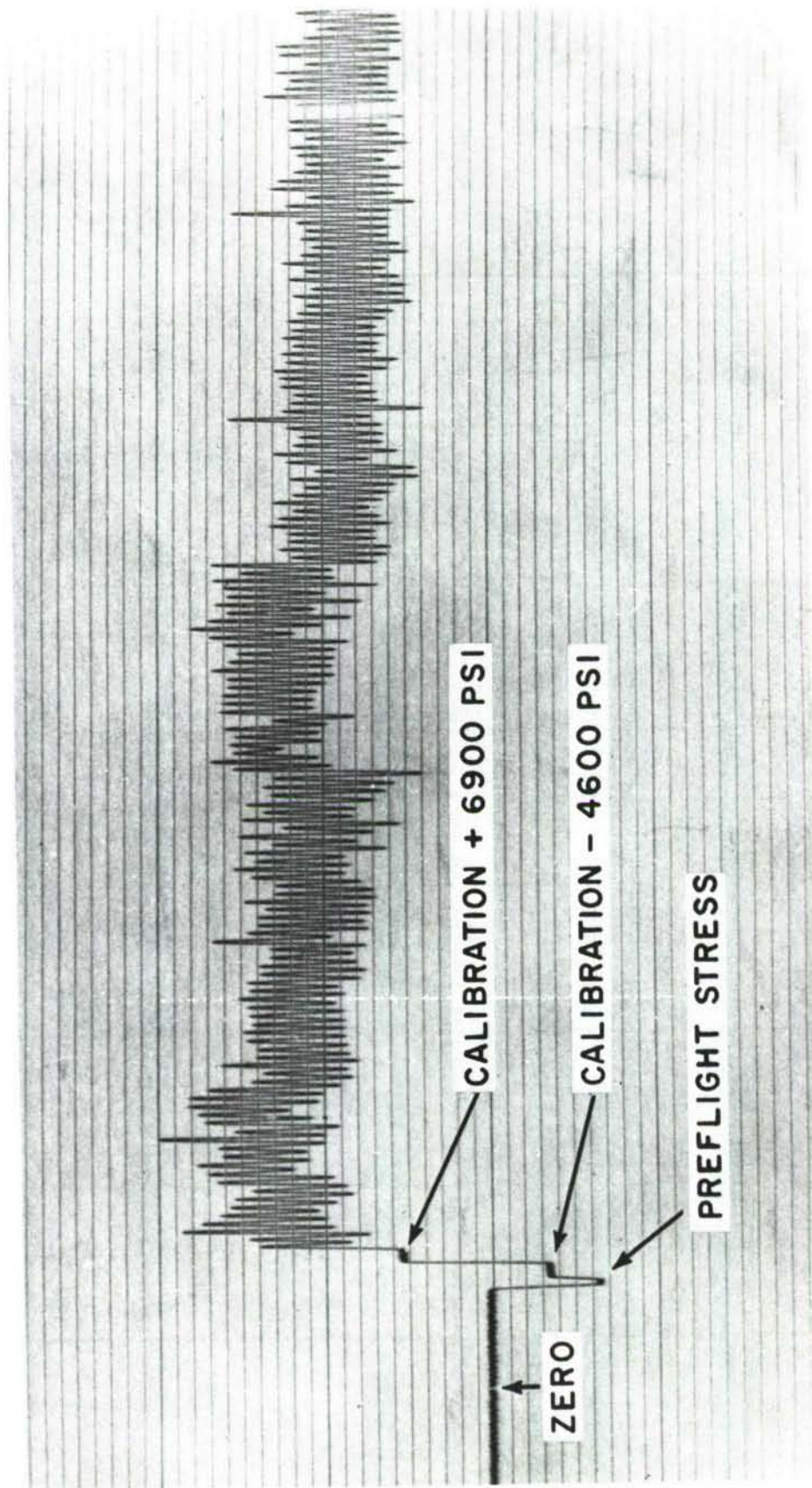


Figure 2(b). Typical Stress Sequence for B-58 Spectrum without Ground Loads.

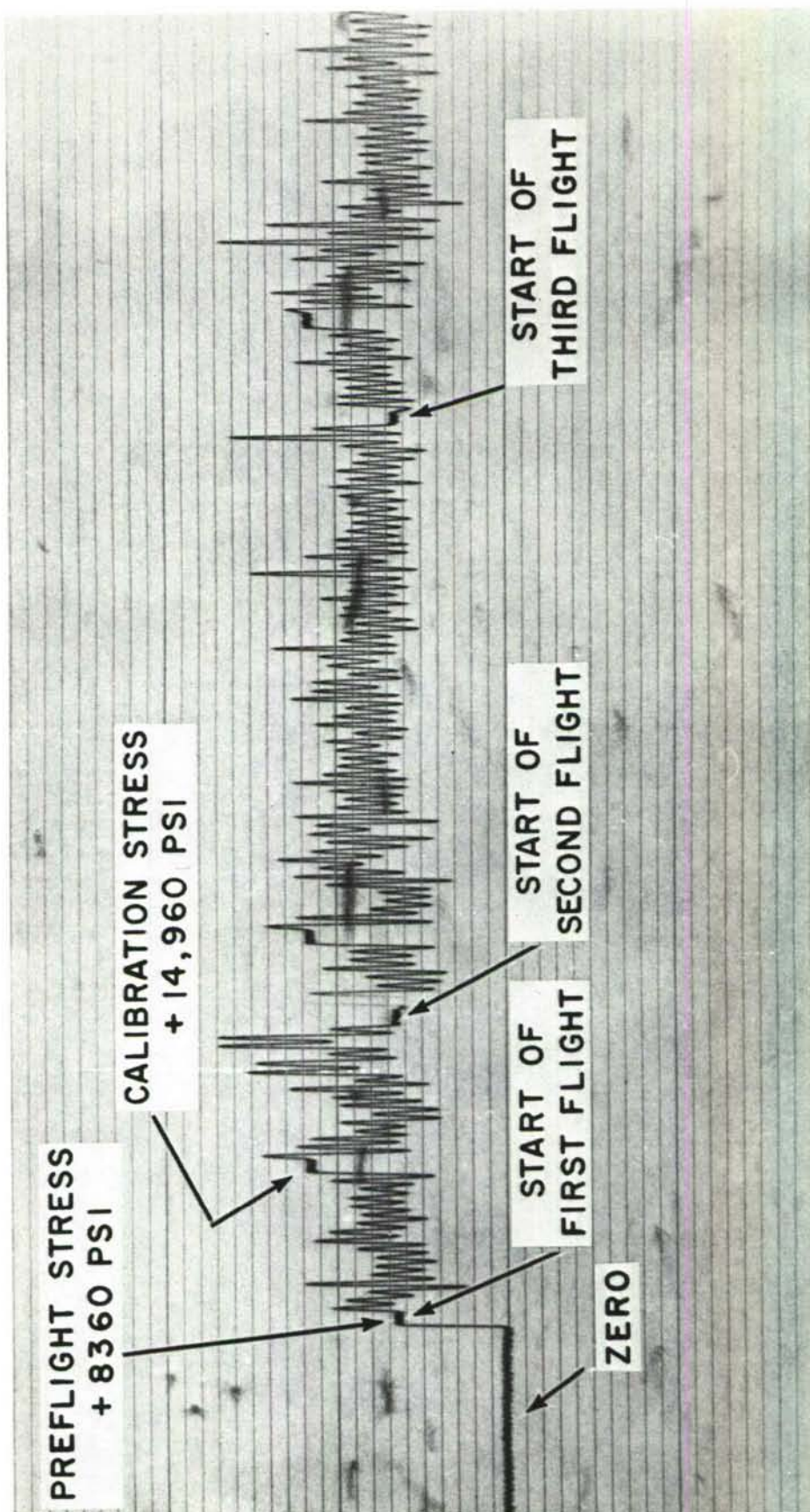


Figure 2(c). Typical Stress Sequence for F-106 Spectrum.

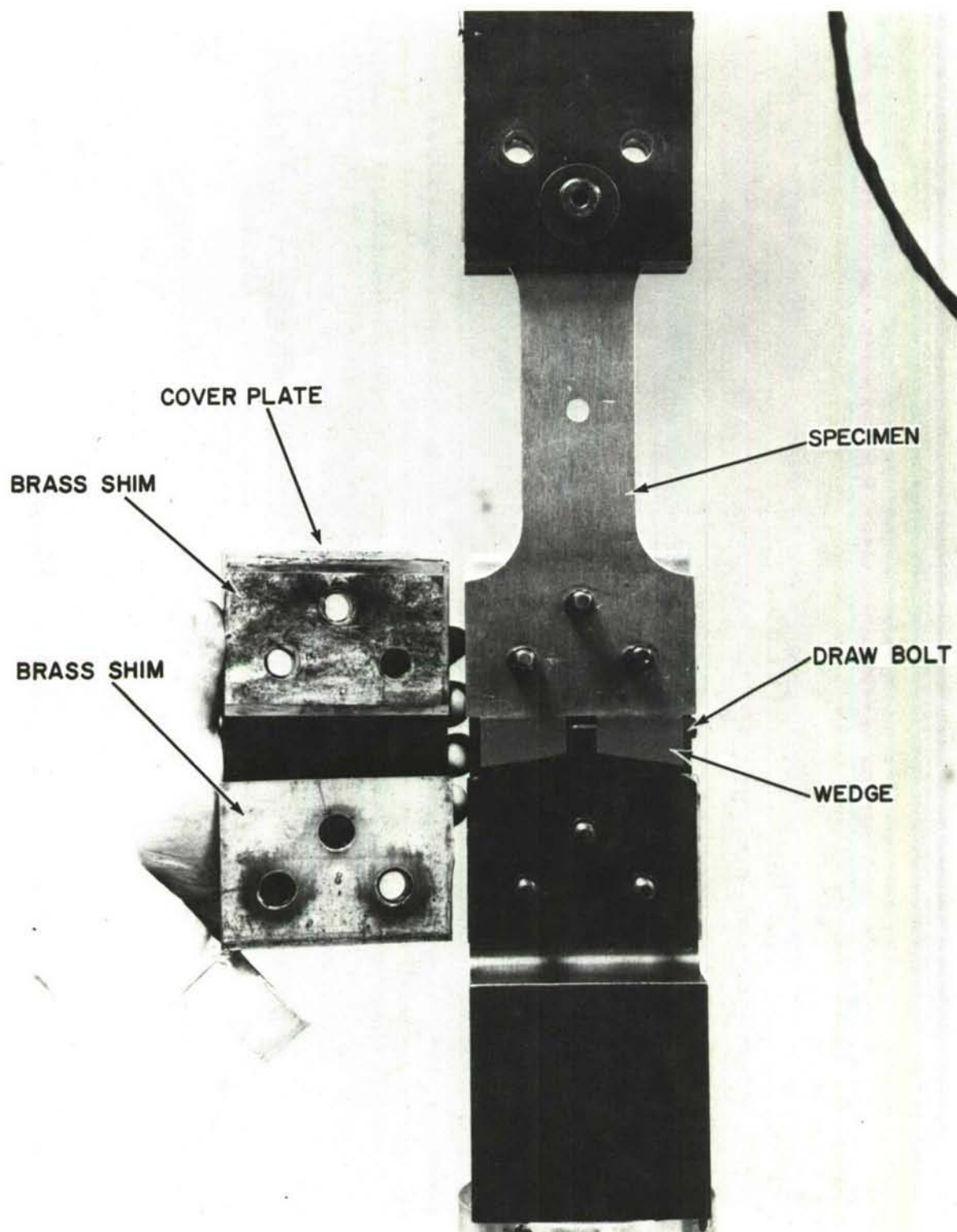


Figure 3. Specimen Installation Procedure.

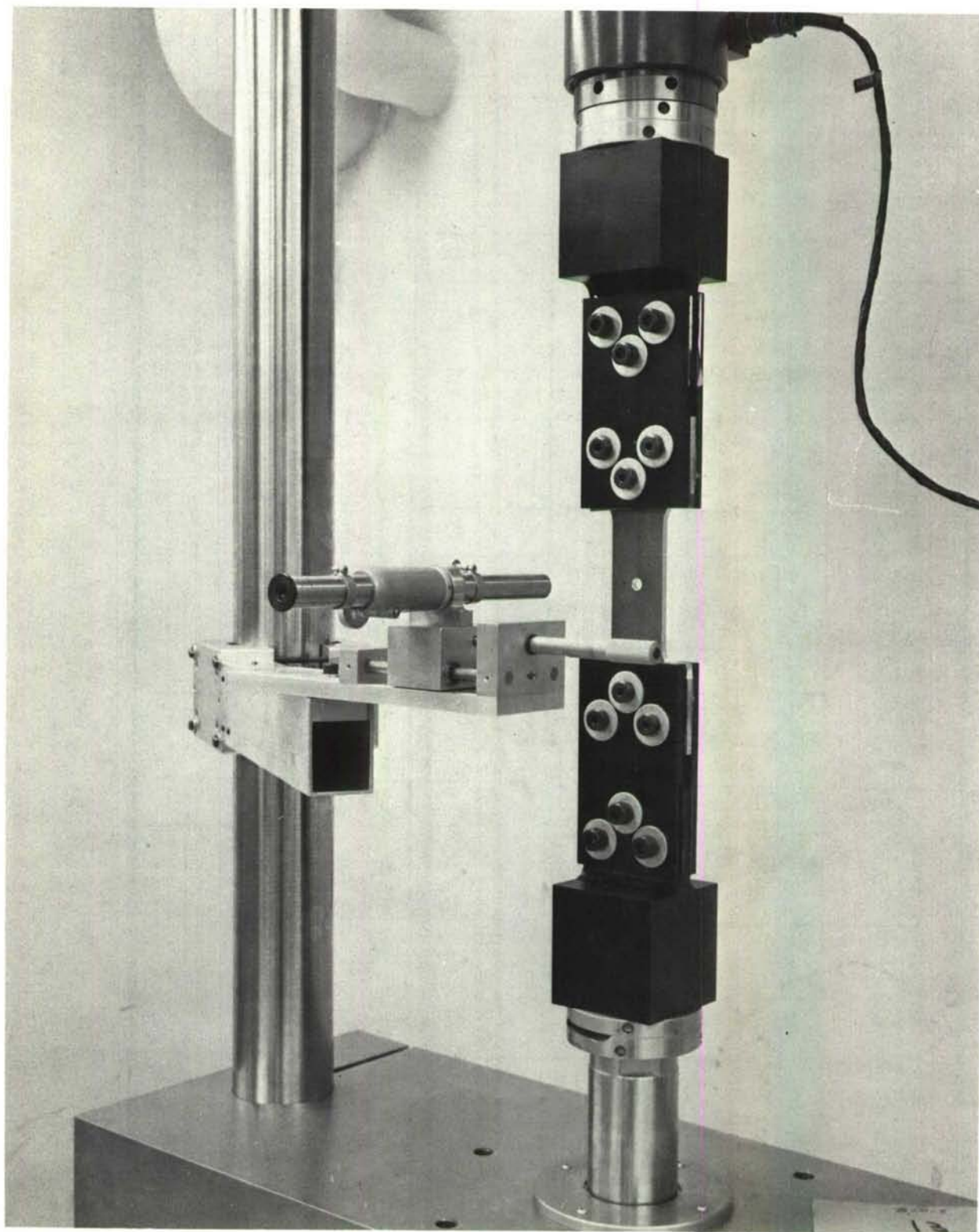
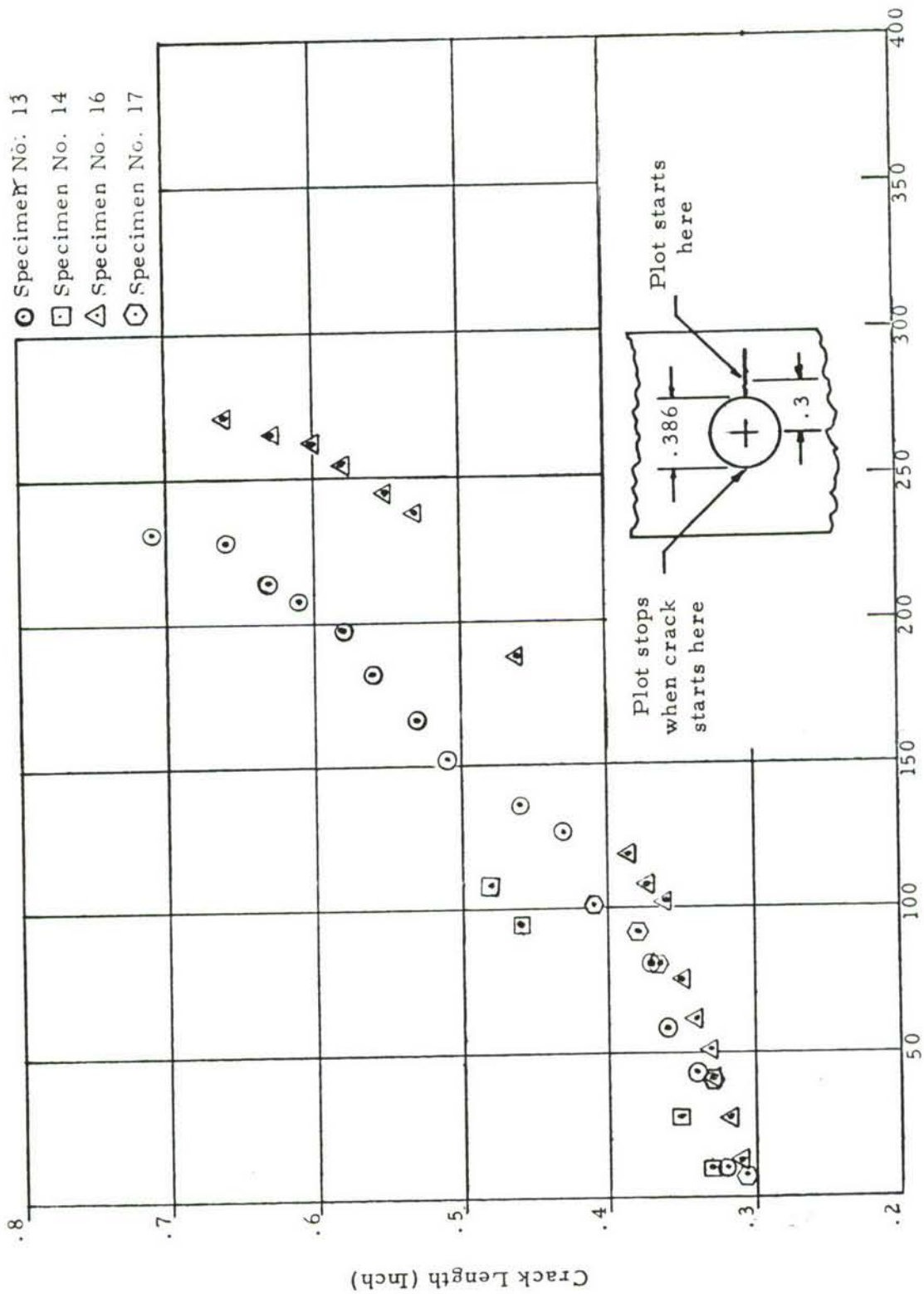
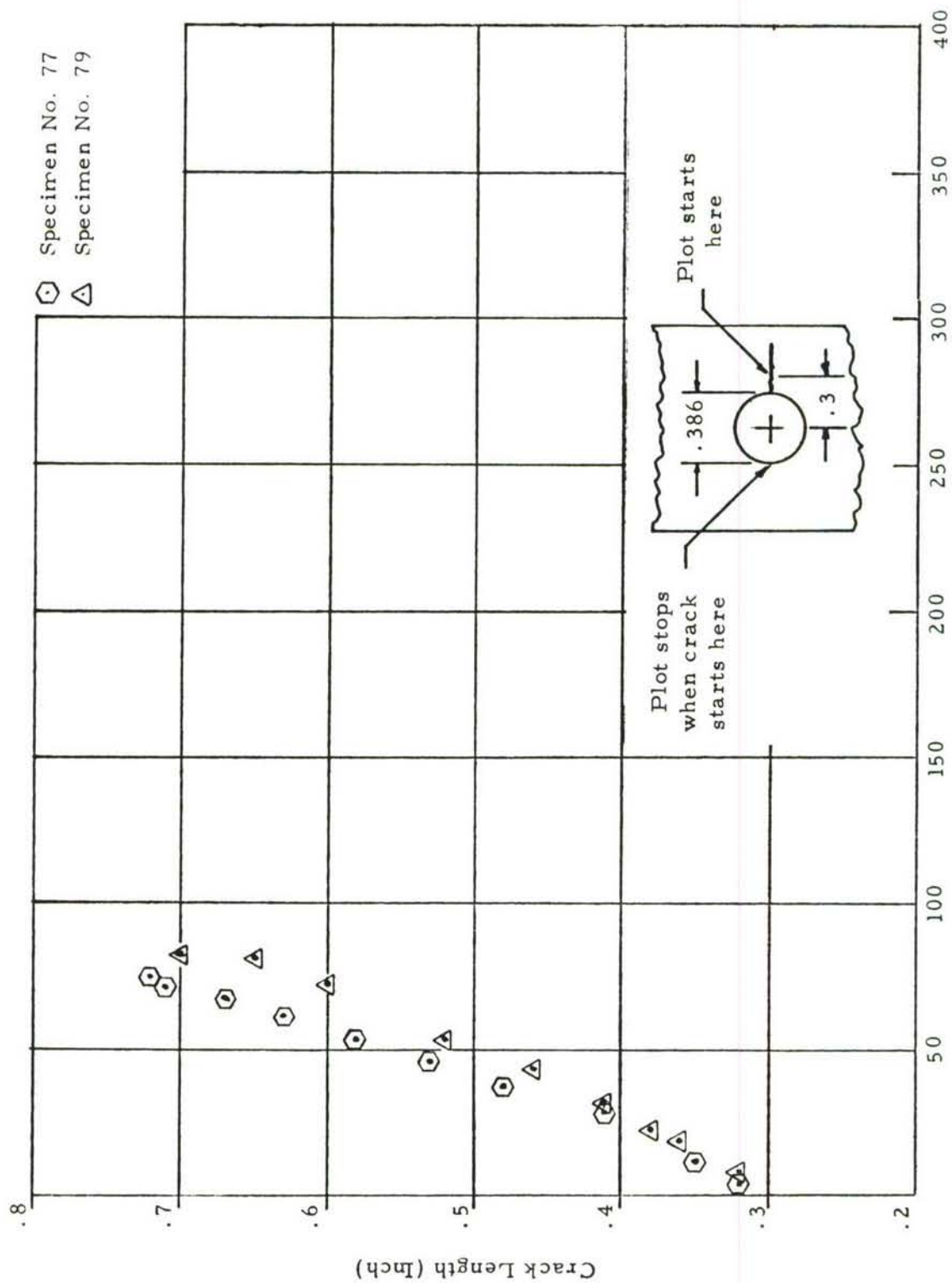


Figure 4. Telescope Setup for Crack-Growth Measurements.



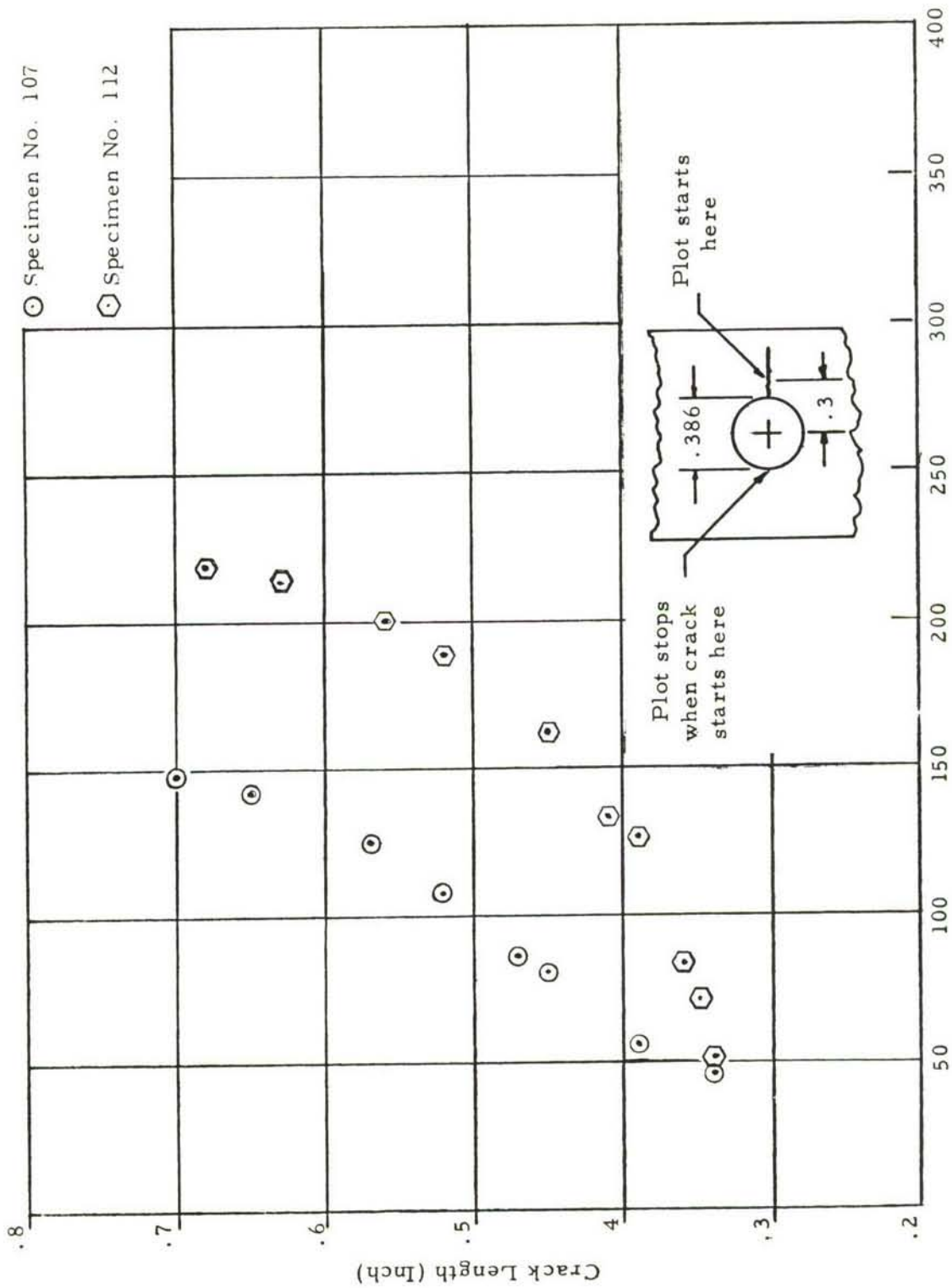
Flights (From Crack = 0.3 Inch)

Figure 5. Crack Length vs Flights, B-58 Sequence A Original Data.



Flights (From Crack = 0.3 Inch)

Figure 6. Crack Length vs Flights, B-58 Sequence A Folded Distribution Data.



Flights (From Crack = 0.3 Inch)

Figure 7. Crack Length vs. Flights, B-58 Sequence A Bivariate Peak and Valley Simulation.

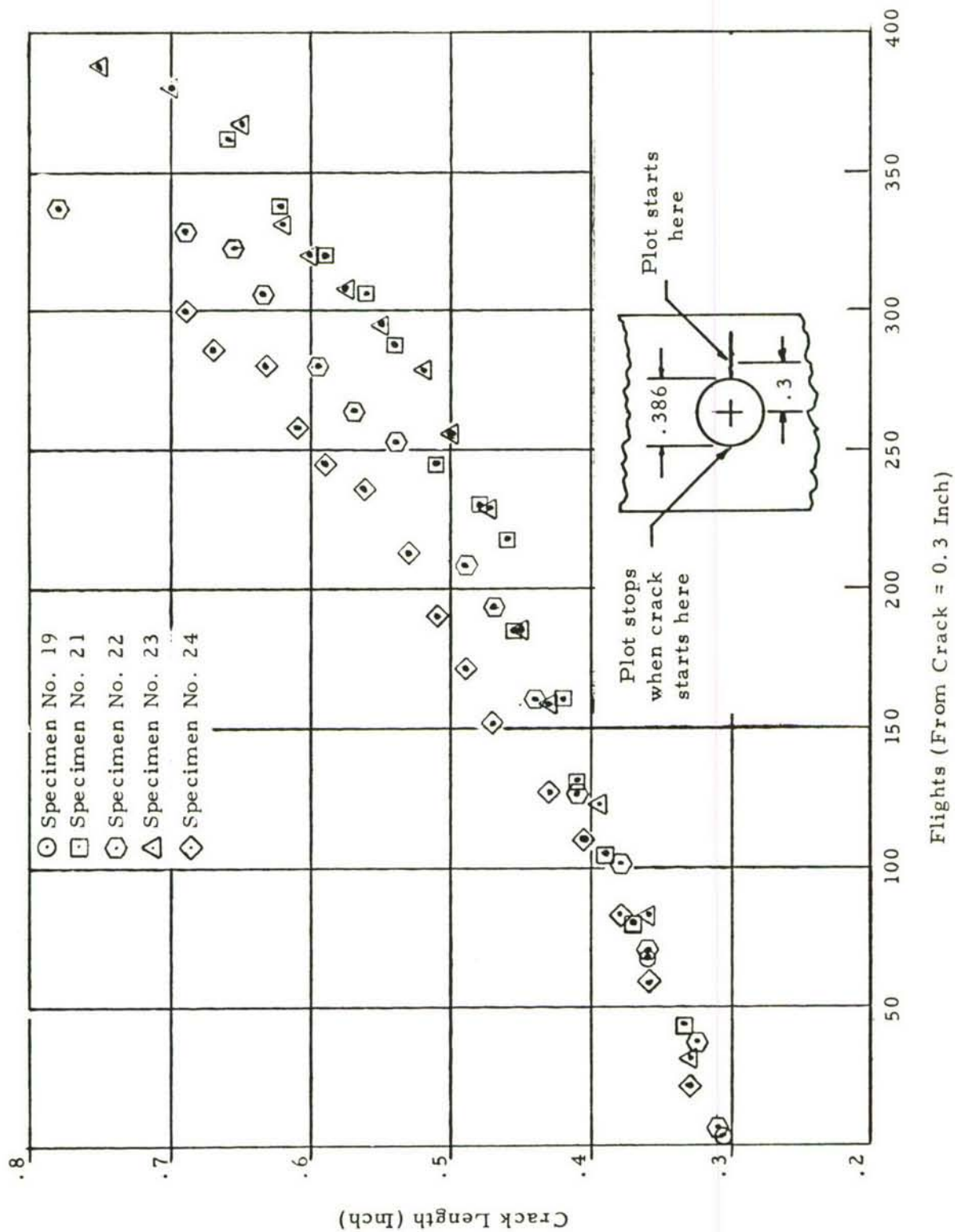
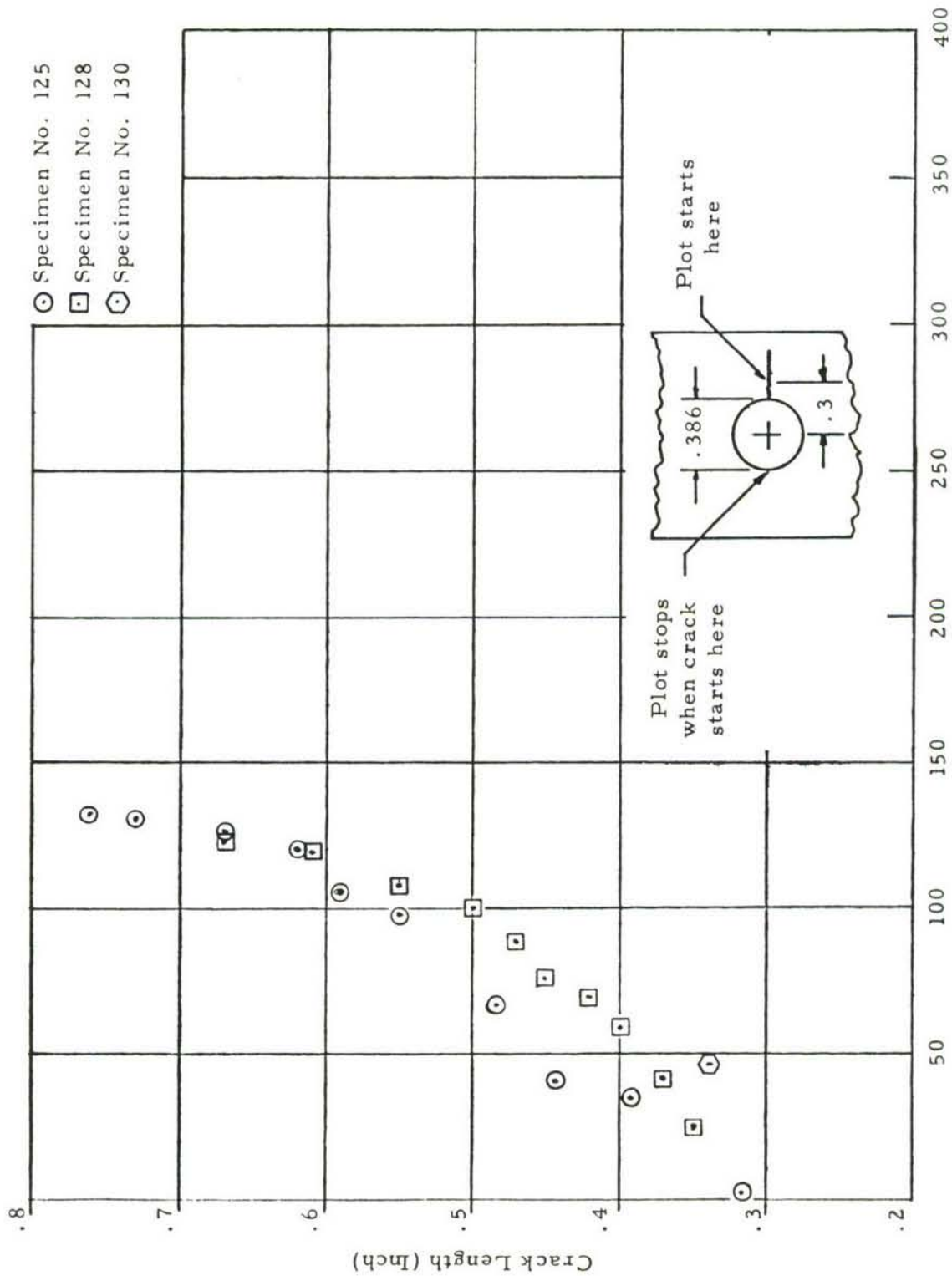


Figure 8. Crack Length vs Flights, B-58 Sequence C Original Data.



Flights (From Crack = 0.3 Inch)

Figure 9. Crack Length vs Flights, B-58 Sequence C Bivariate Peak and Valley Simulation.

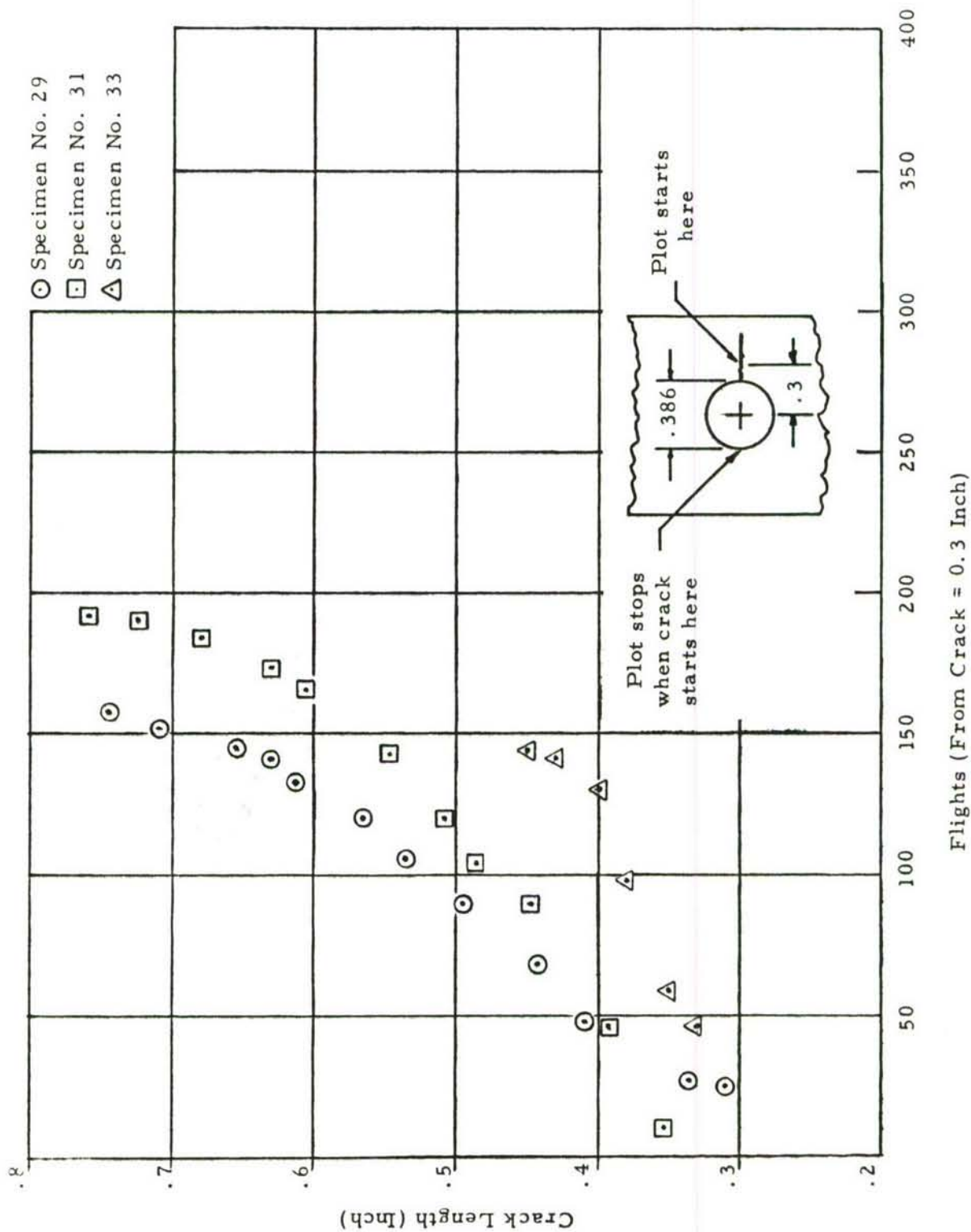
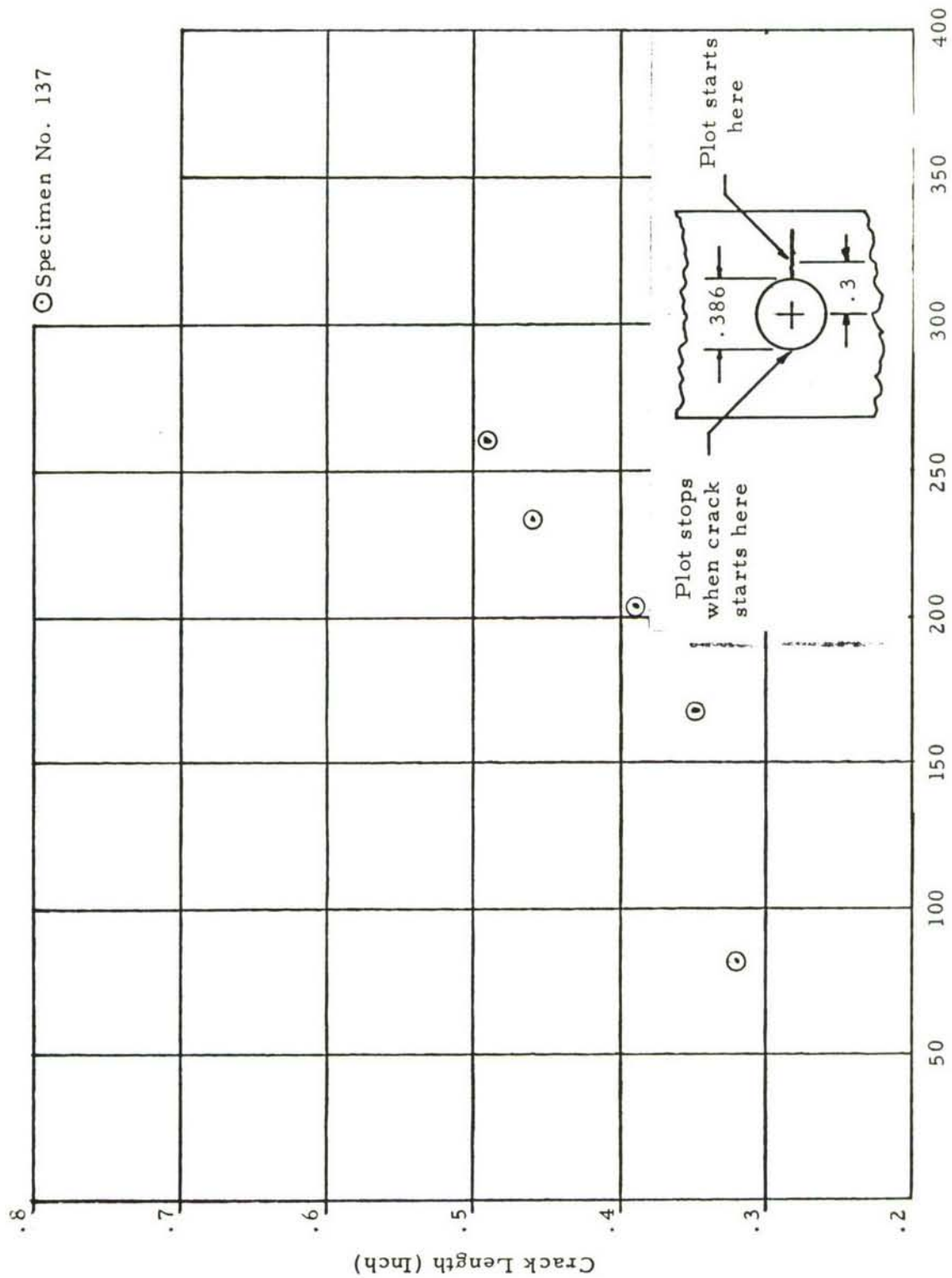
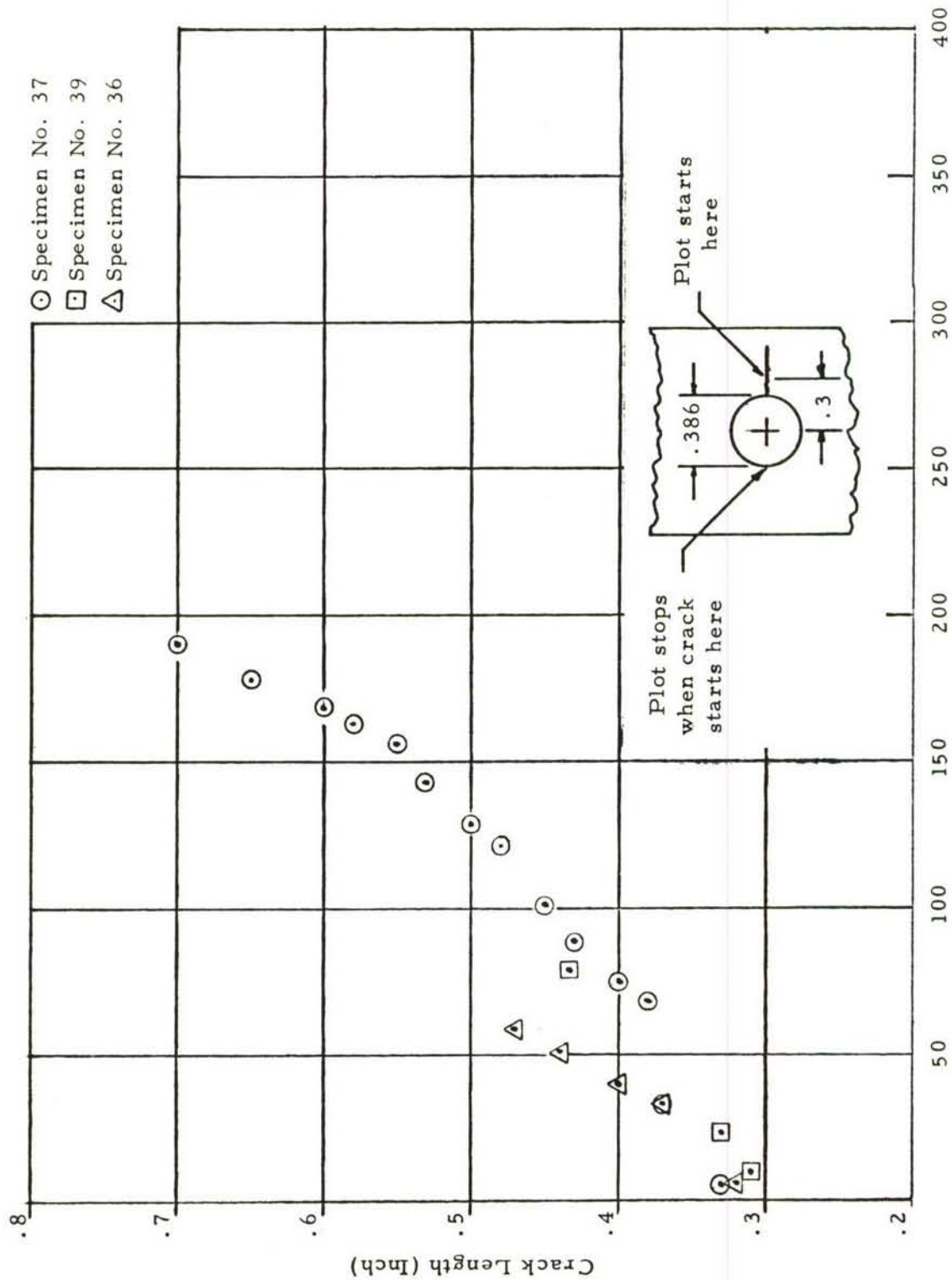


Figure 10. Crack Length vs Flights, B-58 Sequence B Original Data.



Flights (From Crack = 0.3 Inch)

Figure 11. Crack Length vs Flights, B-58 Sequence B Bivariate Peak and Valley Simulation.



Flights (From Crack = 0.3 Inch)

Figure 12. Crack Length vs Flights, B-58 Sequence D Original Data.

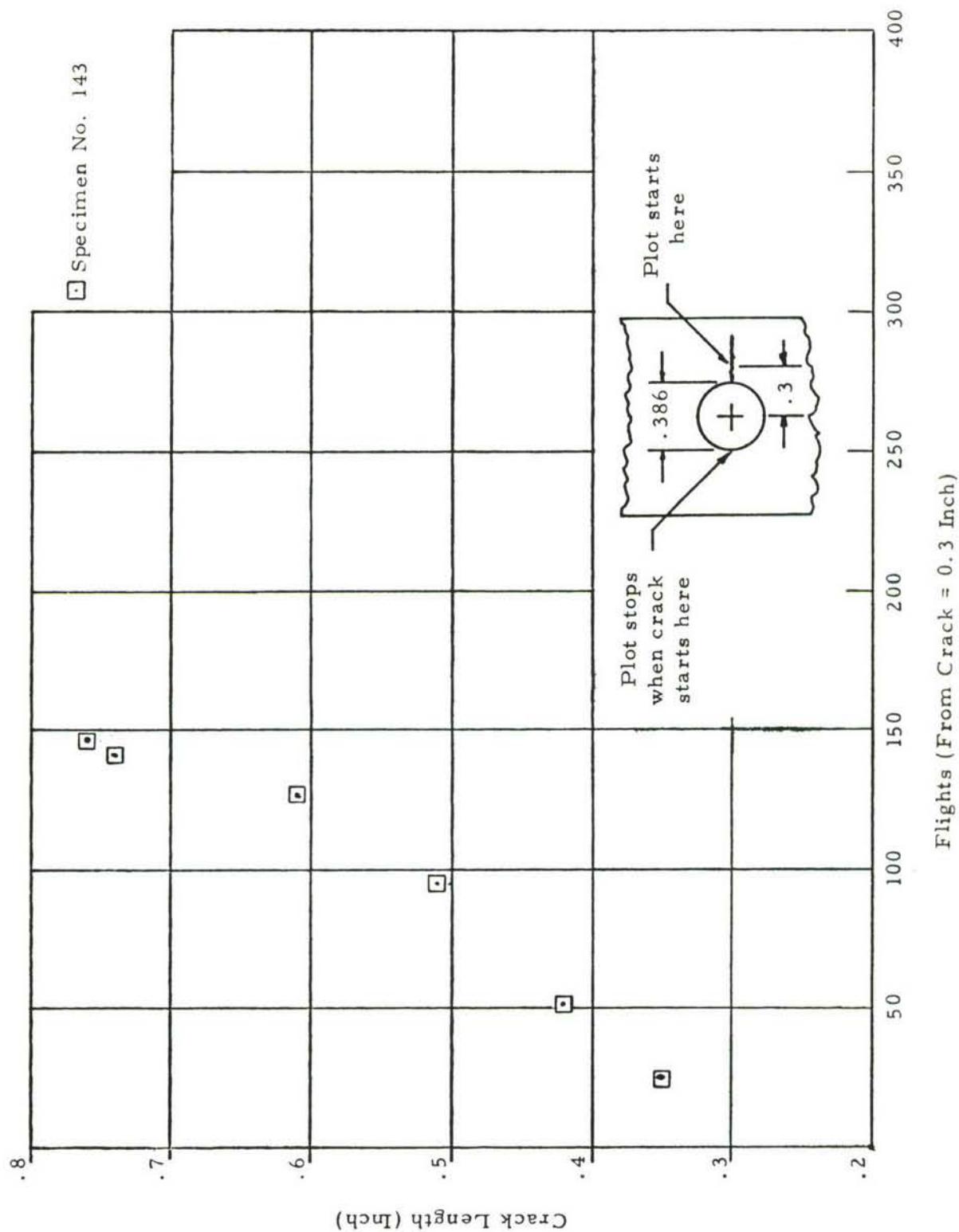
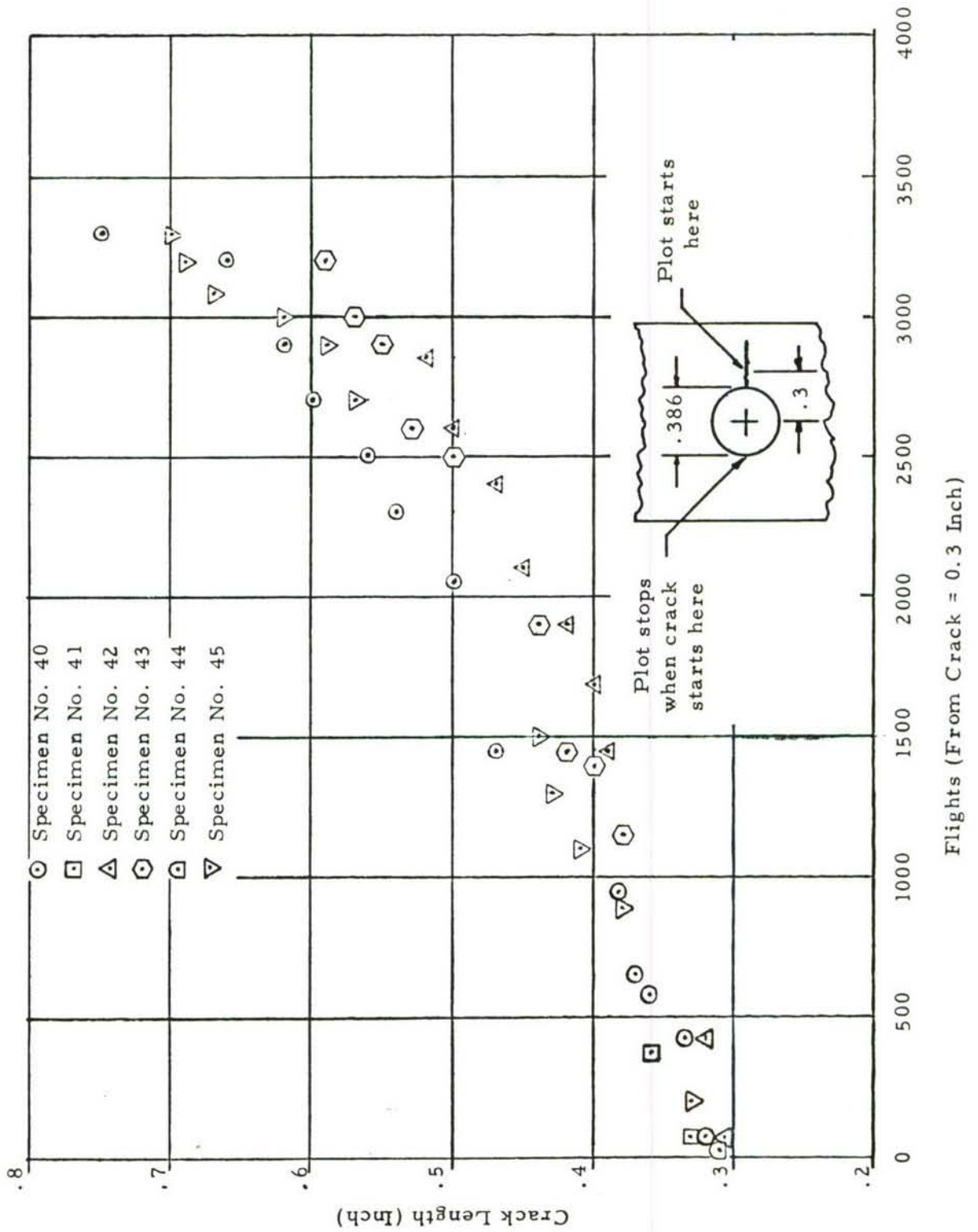


Figure 13. Crack Length vs Flights, B-58 Sequence D Bivariate Peak and Valley Simulation.



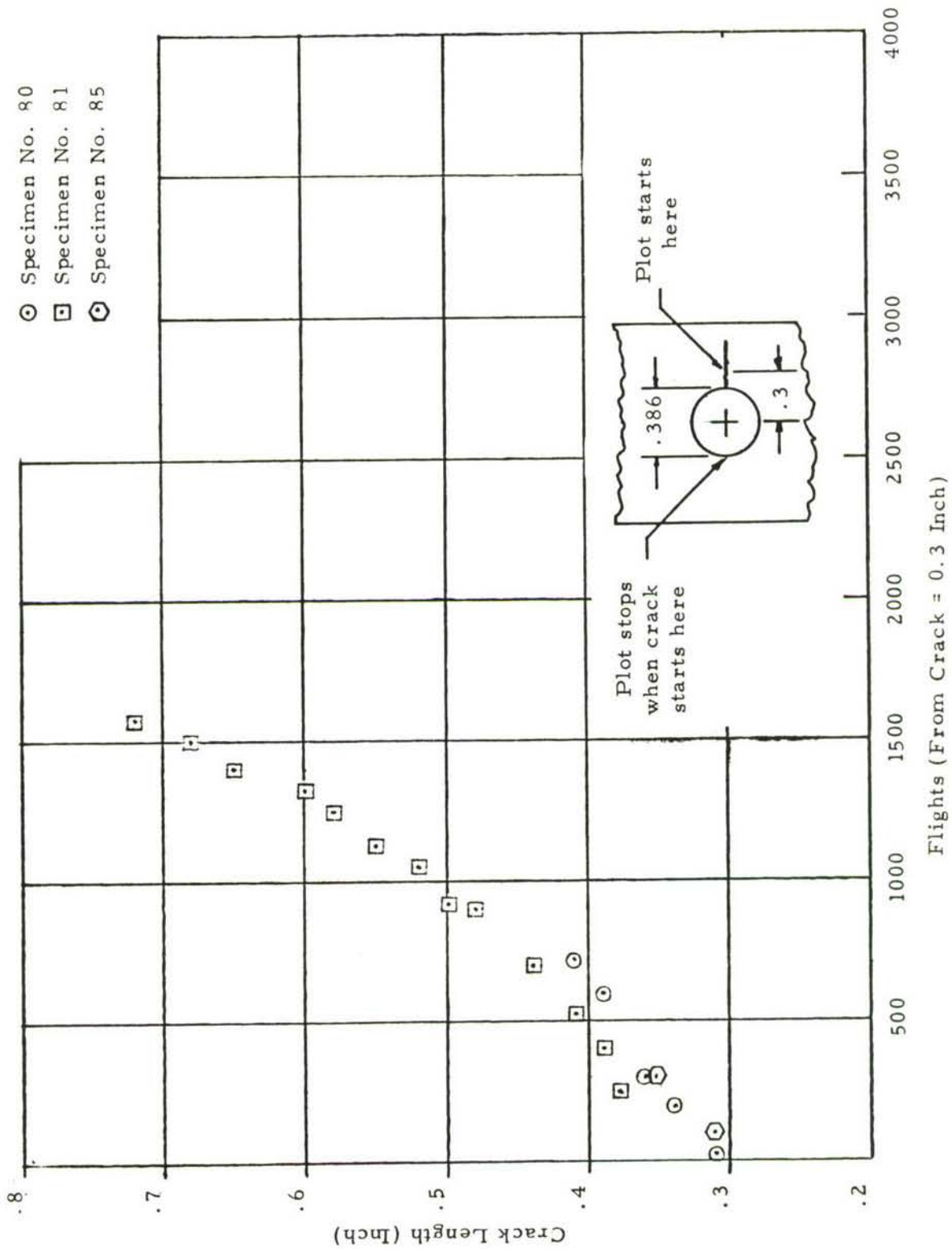


Figure 15. Crack Length vs Flights, F-106 Sequence E Bivariate Mean and Alternating Simulation.

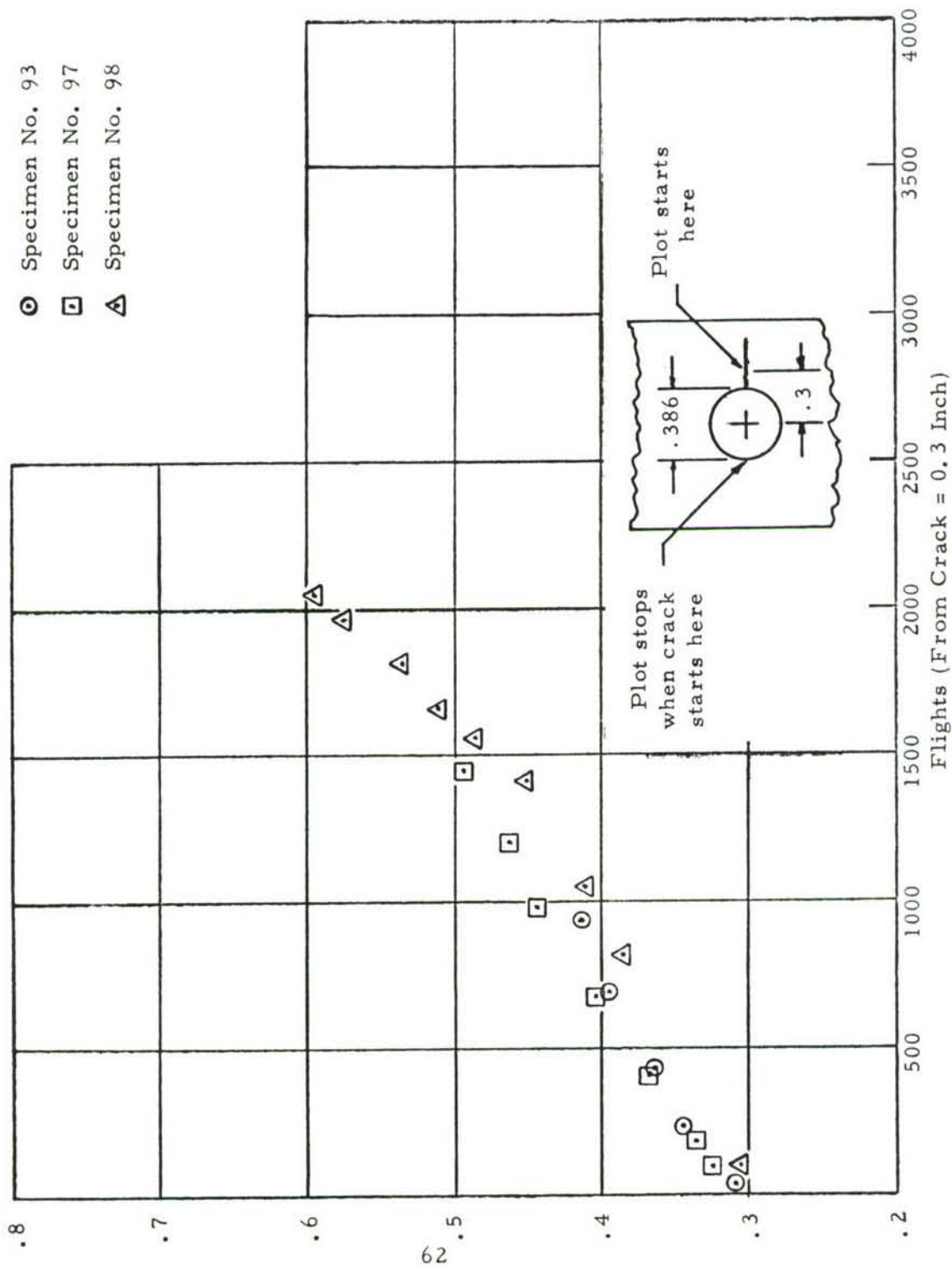


Figure 17. Crack Length vs Flight, F106 Sequence E Separate Peak and Valley Simulation.

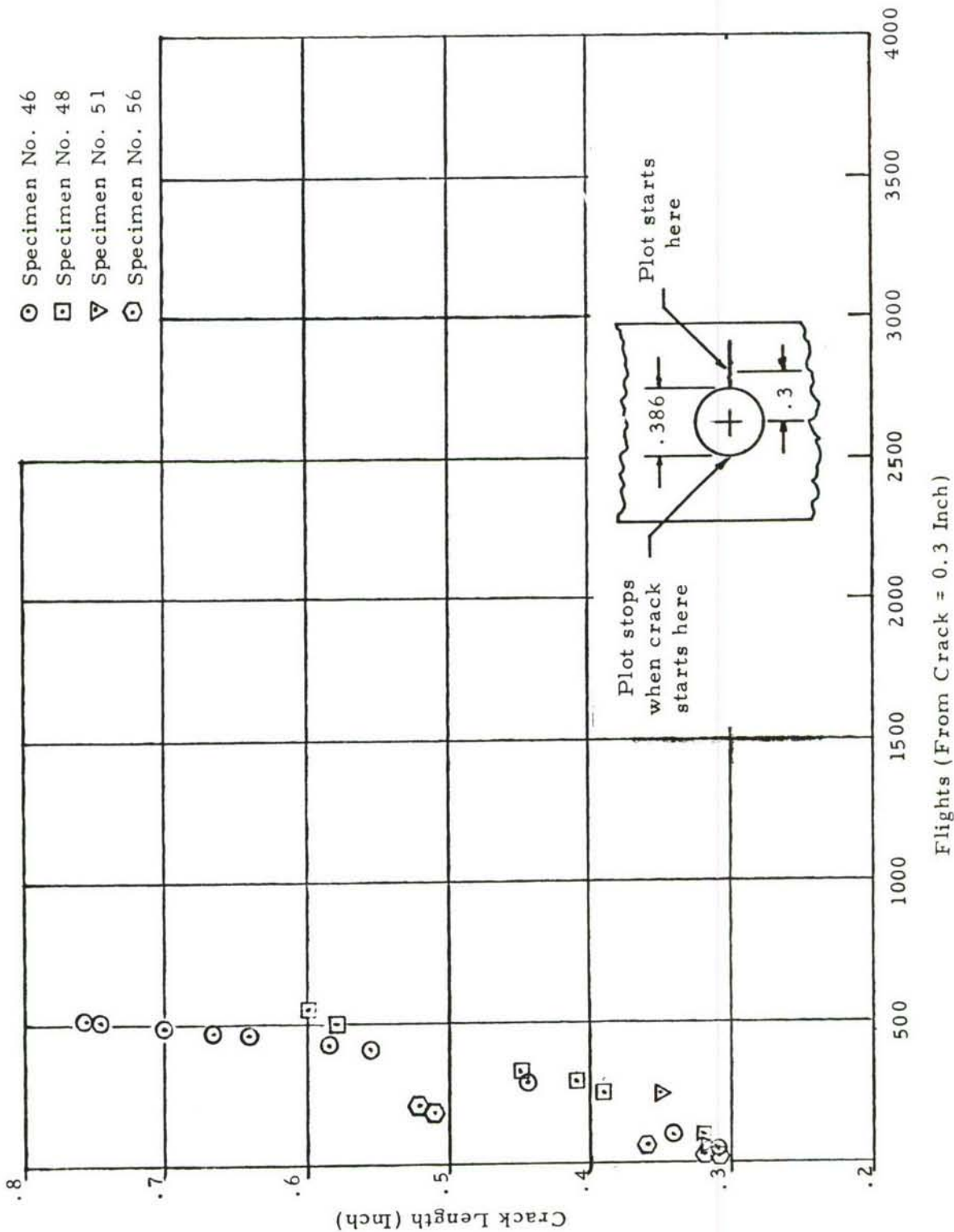
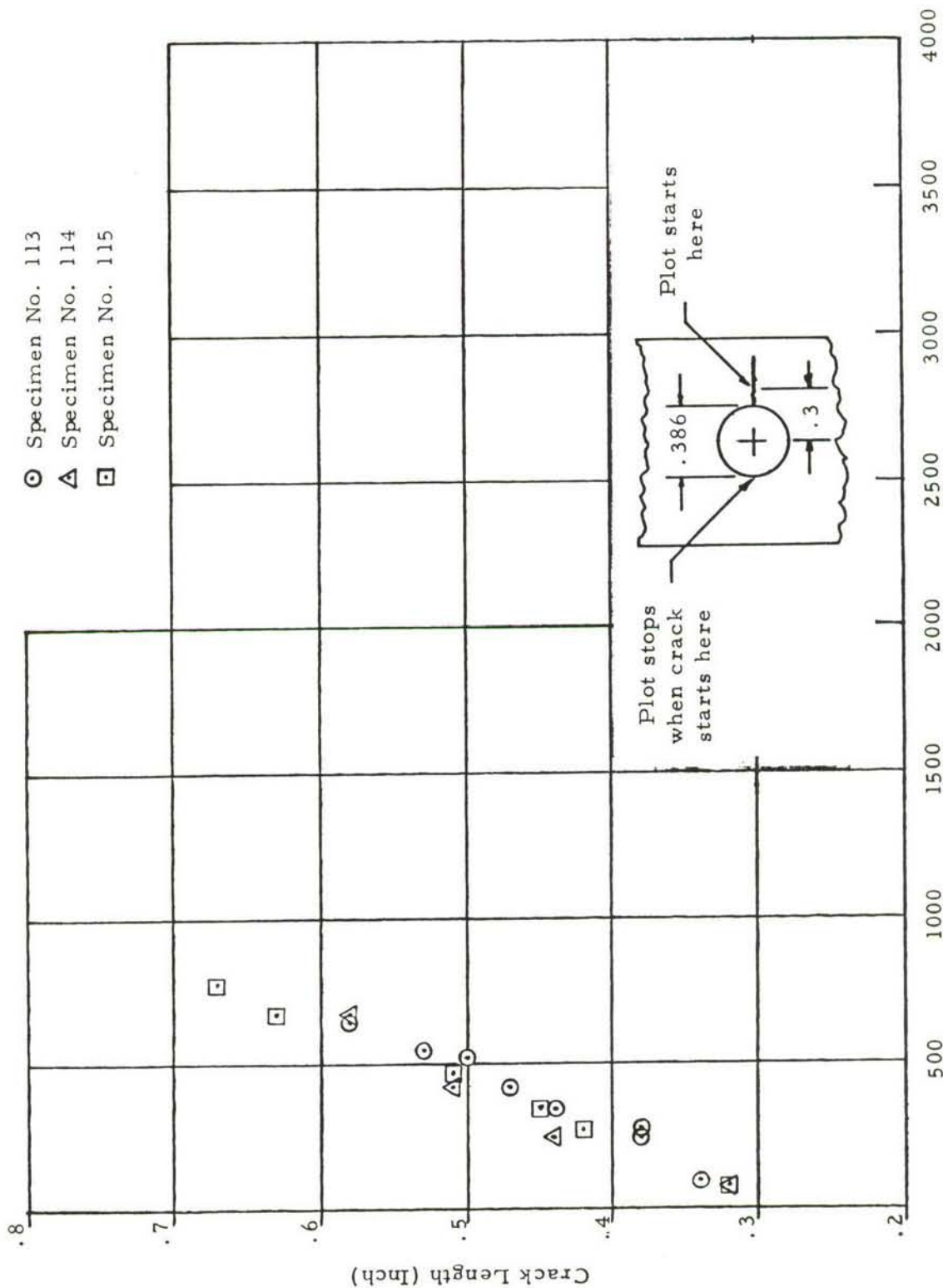


Figure 18. Crack Length vs Flights, F-106 Sequence F Original Data.



Flights (From Crack = 0.3 Inch)

Figure 19 Crack Length vs Flights, F-106 Sequence F Separate Peak and Valley Simulation.

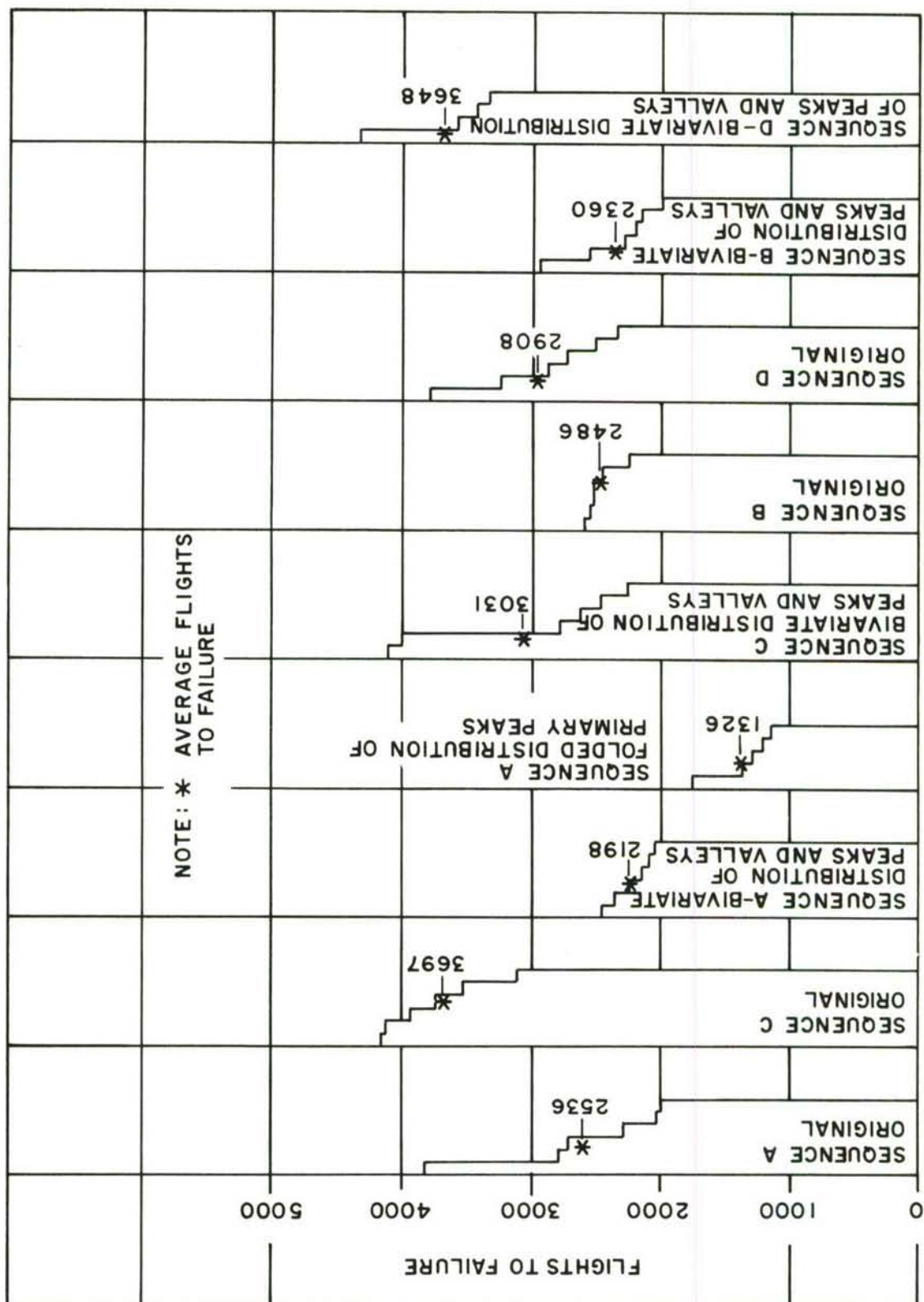


Figure 20. Test Results for All B-58 Data Sets. (Each level represents one specimen.)

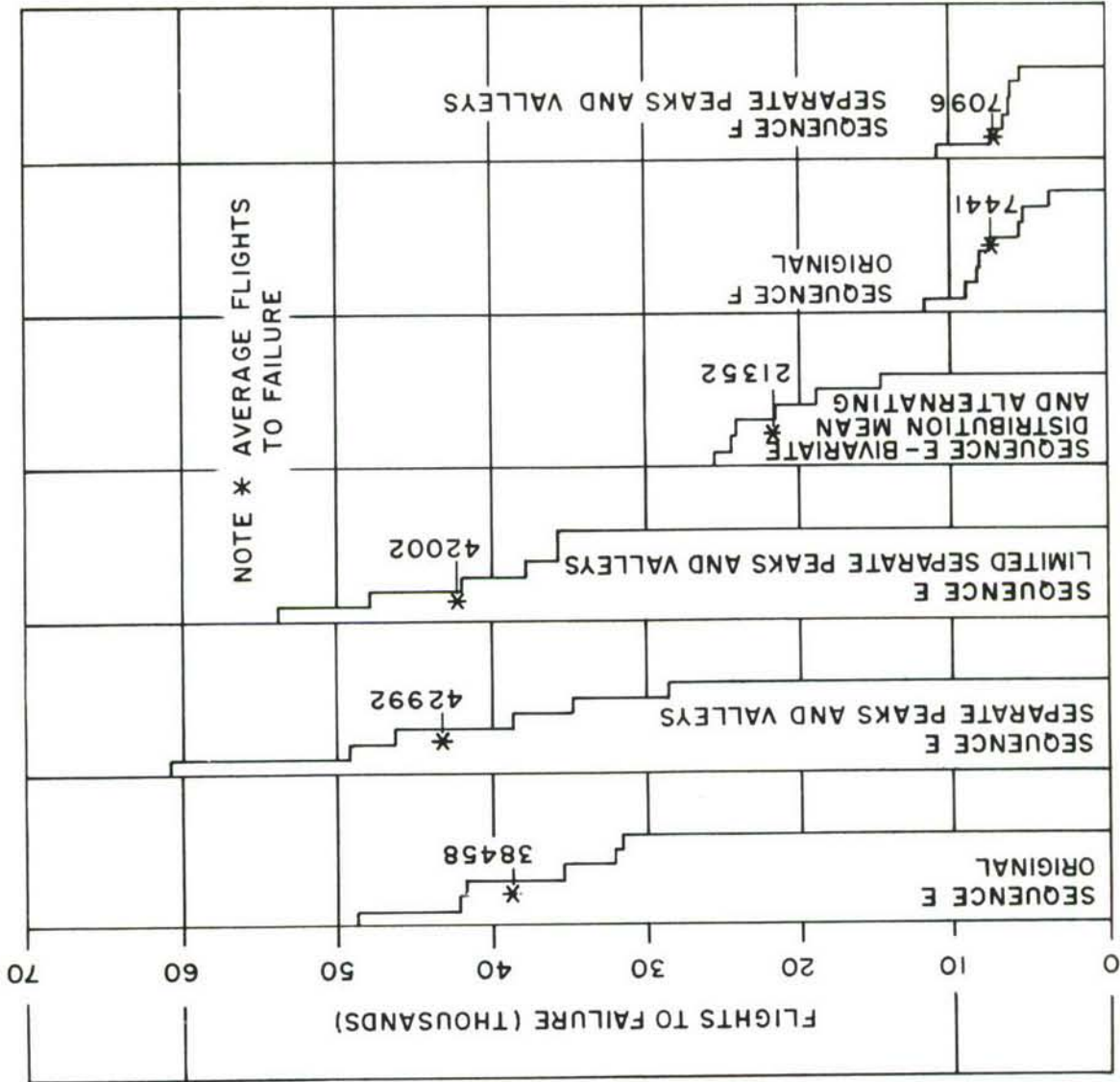
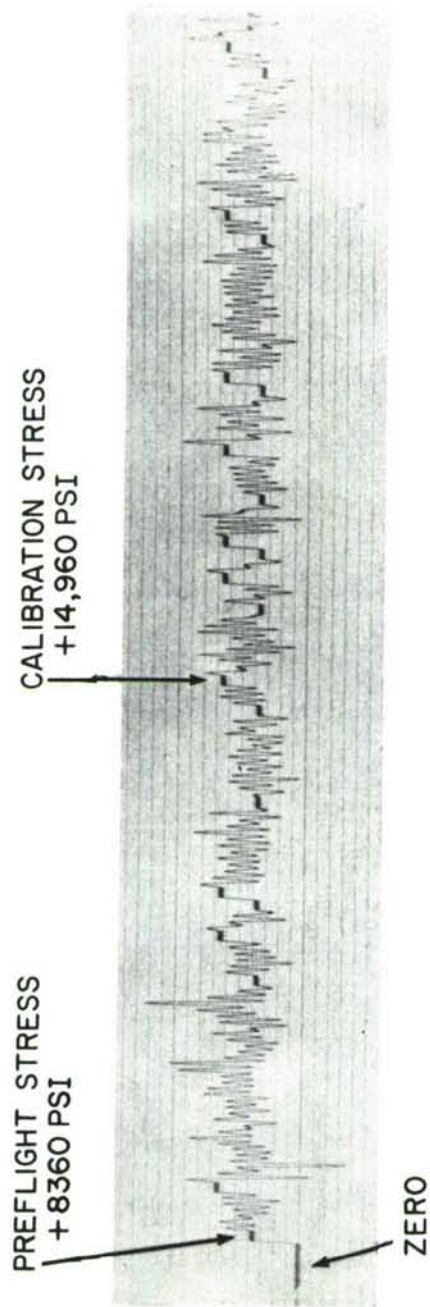
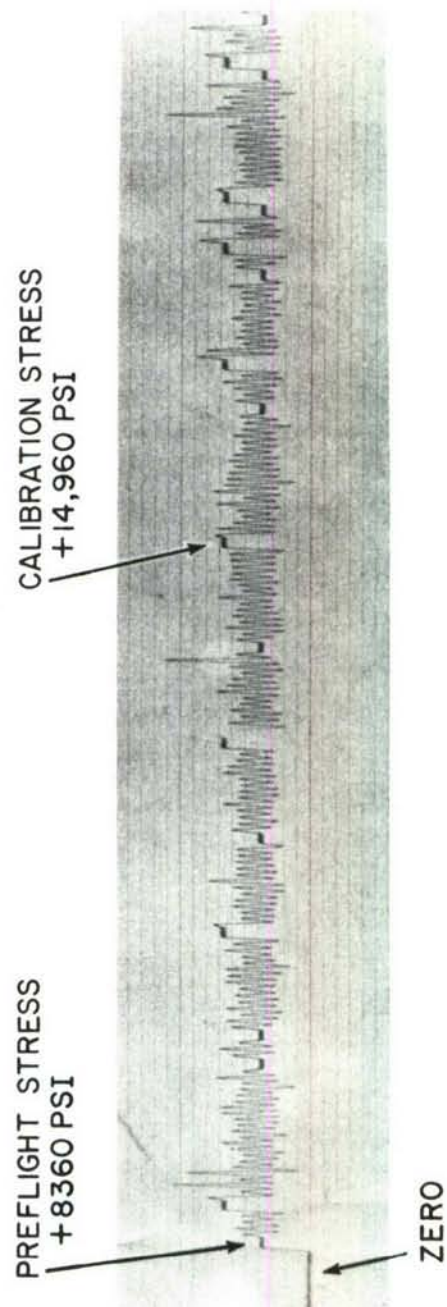


Figure 21. Test Results for All F-106 Data Sets. (Each level represents on specimen.)



(a) F106 Sequence E Bivariate Mean and Alternating Stress Simulation



(b) F106 Sequence E Separate Peak and Valley Simulation

Figure 22. Pictorial Comparison of Time Histories of F-106 Simulations.

TABLE 1
SUMMARY OF LOAD SEQUENCE FOR B-58 DATA
ORIGINAL STRAIN GAGE DATA

	<u>SEQUENCE A</u> Low Intensity 343 flights	<u>SEQUENCE B</u> High Intensity 282 flights
PRIMARY PEAKS		
Airborne Data		
No. of Peaks	190,438	80,727
Mean (psi)	12,905	14,780
Variance (psi) ²	33.2×10^6	41.8×10^6
Ground Data		
No. of Peaks	3849	2896
Mean (psi)	-8047	-8232
Variance (psi) ²	43.2×10^6	46.9×10^6
WEIGHTED 1-g FLIGHT STRESS		
Airborne Data		
No. of Peaks	193,255	82,895
Mean (psi)	12,920	14,690
Variance (psi) ²	12.1×10^6	17.6×10^6
Ground Data		
No. of Peaks	4193	3226
Mean (psi)	-6640	-6373
PREFLIGHT STRESS		
Mean (psi)	-8647	-8729
Variance (psi) ²	4.3×10^4	2.5×10^4
Mean of the No. of Airborne Primary Peaks Per Flight	555.21	286.27
Variance of Above	43.6×10^4	11.2×10^4
Mean of the No. of Ground Primary Peaks Per Flight	11.21	10.31
Variance of Above	447.5	69.7

TABLE 2
SUMMARY OF LOAD SEQUENCE FOR F-106 DATA
ORIGINAL STRAIN GAGE DATA

	<u>SEQUENCE E</u> Low Intensity	<u>SEQUENCE F</u> High Intensity
Number of Flights	381	236
Total No. of Stress Reversals	52,128	39,752
Airborne Primary Peaks	48,446	32,636
Variance of Primary Peaks	11.18(ksi) ²	28.20(ksi) ²
Stress Reversals (Ground Operations)	666	652
1-g Trim Stress (Constant)	8360psi	8360psi

TABLE 3
SPECIMEN ASSIGNMENT CHART

Specimen No. *	Specimen Location Code **	Specimen No. *	Specimen Location Code **	Specimen No. *	Specimen Location Code **
1	C 4-11	34	D 4-4	67	C 7-4
2	C 12-6	35	D 4-11	68	D 3-5
3	C 6-3	36	D 1-7	69	D 1-4
4	C 10-9	37	C 8-9	70	C 6-5
5	C 9-10	38	C 4-6	71	D 2-10
6	D 1-1	39	C 2-3	72	C 11-2
7	C 1-3	40	C 12-7	73	C 7-10
8	D 3-6	41	C 5-1	74	D 2-4
9	C 7-7	42	C 12-2	75	C 11-7
10	C 5-3	43	C 2-8	76	D 2-9
11	C 1-10	44	C 1-1	77	C 5-9
12	C 1-2	45	C 2-7	78	C 7-3
13	C 11-3	46	C 3-11	79	C 3-9
14	D 3-8	47	C 5-4	80	C 9-6
15	C 11-1	48	D 2-3	81	C 12-10
16	C 9-5	49	D 1-10	82	D 2-5
17	C 1-8	50	C 3-6	83	C 3-7
18	C 10-7	51	C 9-4	84	C 1-5
19	C 3-8	52	C 11-6	85	C 1-9
20	C 12-4	53	C 8-8	86	C 10-6
21	C 8-1	54	D 2-2	87	C 1-4
22	C 11-9	55	C 3-1	88	C 6-6
23	D 3-3	56	D 3-9	89	C 10-11
24	C 6-1	57	C 3-2	90	C 7-5
25	C 7-1	58	C 2-4	91	C 7-9
26	D 4-9	59	D 3-1	92	C 3-5
27	D 3-10	60	C 3-10	93	D 1-3
28	D 4-10	61	C 6-2	94	C 9-8
29	C 7-6	62	C 6-7	95	C 4-4
30	C 8-7	63	C 2-5	96	C 2-10
31	C 11-8	64	C 7-2	97	C 9-2
32	C 10-3	65	C 8-5	98	C 11-11
33	C 4-2	66	C 7-11	99	C 12-3

* Refers to specimen number in Test Plan.

** Plate number - row - column.

TABLE 3 (Continued)

Specimen No. *	Specimen Location Code **	Specimen No. *	Specimen Location Code **	Specimen No. *	Specimen Location Code **
100	C 1-6	126	D 3-4	152	C 4-5
101	C 11-4	127	C 10-2	153	C 9-1
102	C 4-10	128	C 5-10	154	D 4-5
103	C 5-7	129	C 12-9	155	C 2-1
104	C 9-9	130	D 3-7	156	D 1-6
105	C 5-11	131	C 6-8	157	C 6-4
106	C 9-11	132	C 10-5	158	C 12-1
107	C 4-3	133	C 11-5	159	C 6-9
108	C 10-4	134	C 2-2	160	C 8-11
109	C 4-9	135	C 5-8	161	C 11-10
110	C 12-8	136	C 9-3	162	C 3-4
111	D 4-2	137	C 12-11	163	C 4-8
112	D 2-7	138	C 8-4	164	D 4-3
113	D 1-9	139	C 10-10	165	C 2-11
114	C 5-5	140	D 3-2	166	D 1-8
115	D 1-11	141	C 3-3	167	D 4-8
116	D 4-7	142	C 8-10	168	C 4-1
117	C 9-7	143	C 8-3	169	C 1-7
118	C 1-11	144	C 10-8	170	D 2-1
119	D 1-2	145	D 3-11	171	D 2-11
120	D 2-6	146	C 5-6	172	C 8-6
121	C 6-10	147	C 5-2	173	C 12-5
122	C 4-7	148	C 7-8	174	C 8-2
123	C 6-11	149	C 2-9	175	D 4-6
124	D 2-8	150	D 4-1	176	C 2-6
125	C 10-1	151	D 1-5		

* Refers to specimen number in Test Plan.

** Plate number - row - column.

TABLE 4

Determination of Static Tensile Properties for 7075-T651 Bare Plate Specimen Material

Specimen Number	Width (in)	Thickness (in)	Maximum Load (lbs)	Yield Strength @ 0.2% (psi)	Ultimate Strength (psi)	Modulus of Elast. ($\times 10^6$ psi)	Total Elongation (%)
C-1-3	0.2498	0.2483	5050	75,000	81,400	9.97	17.3
C-2-6	0.2498	0.2495	5150	76,200	82,600	9.82	17.3
D-2-3	0.2507	0.2488	5100	75,400	81,800	10.6	20.0
C-4-11	0.2501	0.2483	5050	74,900	81,300	9.20	18.7
D-3-10	0.2505	0.2491	5100	75,300	81,700	8.74	20.0
C-6-3	0.2505	0.2493	5125	75,300	82,100	9.15	18.7
D-1-1	0.2508	0.2484	5075	75,400	81,500	10.4	20.0
C-9-5	0.2503	0.2480	5200	77,300	83,800	9.20	18.7
D-3-6	0.2505	0.2495	5200	76,800	83,200	9.60	17.3
C-12-6	0.2494	0.2493	5125	75,600	82,400	9.36	16.0
C-11-1	0.2490	0.2482	5025	75,200	81,300	11.2	20.0
C-10-9	0.2506	0.2490	5025	73,700	80,500	9.61	18.7
C-7-7	0.2500	0.2489	5050	76,300	81,200	10.1	17.3
C-3-8	0.2503	0.2490	5125	75,400	82,200	10.1	17.3
Average				75,600	81,900	9.79	18.4

CUMULATIVE FREQUENCY DISTRIBUTIONS FOR B-58 SEQUENCE A INCREMENTAL STRESS PEAKS

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TYPE OF SIMULATION METHOD USED = 1 WHERE 1 - FOLDED DISTRIBUTIONS
2 - POSITIVE AND NEGATIVE DISTRIBUTIONS
3 - LIMITED FOLDED DISTRIBUTION
4 - RANGE COUNT DISTRIBUTION

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TABLE 6
CUMULATIVE PROBABILITY FOR POSITIVE GROUND PEAK DISTRIBUTION DATA
B-58 SEQUENCE A

VALUE	FREQ. DIST.	CUM. DIST.	PROBABILITY
3000.	938	2580.	1.00000000
4000.	668	1642.	.63643411
5000.	392	974.	.37751938
6000.	227	582.	.22558140
7000.	113	355.	.13759690
8000.	65	242.	.09379845
9000.	53	177.	.06860465
10000.	59	124.	.04806202
12000.	31	65.	.02519380
14000.	11	34.	.01317829
16000.	12	23.	.00891473
18000.	4	11.	.00426357
20000.	7	7.	.00271318
25000.	0	0.	0.00000000

TABLE 7
CUMULATIVE PROBABILITY FOR POSITIVE AIRBORNE PEAK DISTRIBUTION DATA
B-58 SEQUENCE A

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	54567	158592.	1.00000000
4000.	48429	104025.	.65592842
5000.	29660	55596.	.35055993
6000.	14532	25936.	.16353914
7000.	6420	11404.	.07190779
8000.	2667	4984.	.03142655
9000.	1243	2317.	.01460982
10000.	804	1074.	.00677209
12000.	154	270.	.00170248
14000.	55	116.	.00073144
16000.	26	61.	.00038463
18000.	17	35.	.00022069
20000.	14	18.	.00011350
25000.	4	4.	.00002522
30000.	0	0.	0.00000000

TABLE 8
CUMULATIVE PROBABILITY FOR PREFLIGHT STRESS DISTRIBUTION DATA
B-58 SEQUENCE A

VALUE	FREQ	DIST	CUM	DIST	PROBABILITY
-8950.	1		343.		1.00000000
-8900.	13		342.		.99708455
-8850.	27		329.		.95918367
-8800.	52		302.		.88046647
-8750.	47		250.		.72886297
-8700.	46		203.		.59183673
-8650.	52		157.		.45772595
-8600.	31		105.		.30612245
-8550.	17		74.		.21574344
-8500.	14		57.		.16618076
-8450.	9		43.		.12536443
-8400.	6		34.		.09912536
-8350.	2		28.		.08163265
-8300.	1		26.		.07580175
-8250.	2		25.		.07288630
-8200.	1		23.		.06705539
-8150.	1		22.		.06413994
-8100.	15		21.		.06122449
-8000.	3		6.		.01749271
-7800.	1		3.		.00874636
-7600.	2		2.		.00583090
-7400.	0		0.		0.00000000

TABLE 9
CUMULATIVE PROBABILITY FOR GROUND I-G STRESS DISTRIBUTION DATA
B-58 SEQUENCE A

VALUE	FREQ. DIST	CUM. DIST *	PROBABILITY
-13000.	13	313.	1.00000000
-12000.	35	300.	.95846645
-11000.	25	265.	.84664537
-10500.	28	240.	.76677316
-10000.	18	212.	.67731629
-9500.	20	194.	.61980831
-9000.	13	174.	.55591054
-8500.	15	161.	.51437700
-8000.	17	146.	.46645367
-7500.	7	129.	.41214058
-7000.	9	122.	.38977636
-6500.	11	113.	.36102236
-6000.	12	102.	.32587859
-5500.	7	90.	.28753994
-5000.	7	83.	.26517572
-4500.	13	76.	.24281150
-4000.	7	63.	.20127796
-3500.	7	56.	.17891374
-3000.	9	49.	.15654952
-2500.	7	40.	.12779553
-2000.	8	33.	.10543131
-1000.	11	25.	.07987220
0.	5	14.	.04472843
1000.	9	9.	.02875399
2000.	0	0.	0.00000000

* 30 flights did not have any cyclic stresses.

TABLE 10
CUMULATIVE PROBABILITY FOR NUMBER OF GROUND PEAKS PER FLIGHT DATA
B-58 SEQUENCE A

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	30	343.	1.00000000
1.	36	313.	.91253644
2.	41	277.	.80758017
3.	31	236.	.68804665
4.	38	205.	.59766764
5.	20	167.	.48688047
6.	32	147.	.42857143
7.	16	115.	.33527697
8.	24	99.	.28862974
9.	19	75.	.21865889
10.	8	56.	.16326531
11.	7	48.	.13994169
12.	6	41.	.11953353
13.	6	35.	.10204082
14.	1	29.	.08454810
15.	4	28.	.08163265
16.	6	24.	.06997085
17.	2	18.	.05247813
18.	3	16.	.04664723
19.	1	13.	.03790087
20.	1	12.	.03498542
21.	5	11.	.03206997
26.	3	6.	.01749271
101.	2	3.	.00874636
201.	1	1.	.00291545
301.	0	0.	0.00000000

TABLE 11
CUMULATIVE PROBABILITY FOR AIRBORNE 1-G STRESS DISTRIBUTION DATA
B-58 SEQUENCE A

VALUE	FREQ DIST	CUM DIST	PROBABILITY
4000.	3	342.*	1.00000000
5000.	1	339.	.99122807
6000.	4	338.	.98830409
7000.	4	334.	.97660819
8000.	11	330.	.96491228
9000.	16	319.	.93274854
10000.	19	303.	.88596491
10500.	25	284.	.83040936
11000.	24	259.	.75730994
11500.	15	235.	.68713450
12000.	16	220.	.64327485
12500.	27	204.	.59649123
13000.	16	177.	.51754386
13500.	29	161.	.47076023
14000.	17	132.	.38596491
14500.	18	115.	.33625731
15000.	17	97.	.28362573
15500.	16	80.	.23391813
16000.	11	64.	.18713450
16500.	7	53.	.15497076
17000.	7	46.	.13450292
17500.	7	39.	.11403509
18000.	18	32.	.09356725
19000.	8	14.	.04093567
20000.	4	6.	.01754386
21000.	2	2.	.00584795
25000.	0	0.	0.00000000

* One flight did not have any cyclic stresses.

TABLE 12
CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE PEAKS PER FLIGHT DATA
B-58 SEQUENCE A

VALUE	FREQ	DIST	CUM. DIST	PROBABILITY
1.	18	342.*	1.00000000	
26.	25	324.	.94736842	
51.	25	299.	.87426901	
75.	22	274.	.80116959	
101.	23	252.	.73684211	
126.	21	229.	.66959064	
151.	10	208.	.60818713	
176.	16	198.	.57894737	
201.	11	182.	.53216374	
226.	10	171.	.50000000	
251.	12	151.	.47076023	
276.	7	149.	.43567251	
301.	8	142.	.41520468	
326.	7	134.	.39181287	
351.	11	127.	.37134503	
401.	9	116.	.33918129	
451.	6	107.	.31286550	
501.	11	101.	.29532164	
601.	9	90.	.26315789	
701.	12	81.	.23684211	
801.	12	69.	.20175439	
901.	5	57.	.16666667	
1001.	6	52.	.15204678	
1126.	4	46.	.13450292	
1251.	15	42.	.12280702	
1501.	7	27.	.07894737	
1751.	10	20.	.05847953	
2001.	7	10.	.02923977	
2251.	2	3.	.00877193	
2501.	1	1.	.00292398	
3001.	0	0.	0.00000000	

* One flight did not have any cyclic stresses.

SIMULATION PROGRAM RUN ON 05/16/74 AT 20.11.12. SUMMARY OF FLIGHTS ON CHANNEL 1 - B-58 SEQUENCE A FOLDED DISTRIBUTION

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TABLE 15

LISTING OF PEAKS AND VALLEYS AT START OF 3 FM CHANNELS
B-58 SEQUENCE A FOLDED DISTRIBUTION

RECORD NO.	1		
0	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	
-1920	-1912	-1859	} Preflight stress
-1920	-1912	-1859	
-1920	-1912	-1859	
-1920	-1912	-1859	
-916	-1022	-1553	} 1 ground cycle
-2796	-1022	-3200	
995	-1022	-1022	} Calibration = -4600 psi
-3333	-1022	-1022	
-1014	1533	-1022	
-2698	1533	-1022	
-1022	1533	1533	} Calibration = +6900 psi
-1022	1533	1533	
-1022	3777	1533	
-1022	1659	1533	
1533	3479	3204	} 1st airborne stress cycle
1533	1956	1337	
1533	4224	4872	} 2nd airborne stress cycle
1533	1211	-361	
5096	3826	3118	
763	1610	1393	
3990	4044	3363	
1869	1391	1148	
3697	3432	3401	
2163	2004	1110	
4190	4257	2931	
1670	1168	1580	
4197	3682	3044	
1562	1754	1467	
4019	4489	3336	
1841	947	1175	
3924	3667	3872	
1935	1769	639	
3982	4366	3067	
1877	1070	1444	
3877	3399	3179	
1982	2037	1332	
3807	3517	3301	
2052	1919	1210	
3789	3817	3296	
2070	1618	1215	
4405	3638	3153	
1455	1797	1358	
3832	3708	3146	
2028	1728	1365	
4316	4695	3047	
1543	740	1464	
4337	3988	3115	
1522	1447	1396	
4149	3900	3439	
1711	1536	1072	

Scaled Value
+9999 = +45,000 psi
-9999 = -45,000 psi

TABLE 16

FREQUENCY DISTRIBUTION TABLE OF PEAK AND VALLEY STRESSES FOR GROUND DATA
B-58 SEQUENCE A

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.	18000.	20000.	25000.	TOTAL
3000.	10	23	77	151	50	17	9	4	1	2	4	2	0	0	0	0	0	350
4000.	9	33	156	129	49	25	4	2	2	3	1	2	0	0	0	0	0	415
5000.	8	34	96	67	26	15	9	1	0	1	2	0	0	0	0	0	0	249
6000.	5	18	38	24	23	11	5	1	1	3	0	0	0	0	0	0	0	128
7000.	0	9	7	9	13	3	0	1	0	0	0	2	0	0	0	0	0	44
8000.	1	1	5	3	8	1	0	0	0	0	0	1	0	0	0	0	0	20
9000.	0	1	3	3	2	1	1	0	1	0	0	0	0	0	0	0	0	12
10000.	0	2	1	2	1	0	0	0	0	1	0	0	0	0	0	0	0	7
12000.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14000.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
16000.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18000.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	34	121	374	388	172	73	28	9	7	7	10	4	0	0	0	0	0	1227

TABLE 17

FREQUENCY DISTRIBUTION TABLE OF PEAK AND VALLEY STRESSES FOR AIRBORNE DATA
B-58 SEQUENCE A

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.	18000.	20000.	25000.	TOTAL
3000.	4	42	1266	10752	9028	4342	1719	650	239	104	59	16	4	1	3	1	0	28230
4000.	8	295	3766	7614	5795	3139	1321	532	187	73	50	14	2	1	2	2	0	22791
5000.	77	1302	2625	3710	3010	1742	846	368	153	67	35	5	2	2	2	1	0	13947
6000.	406	935	1272	1463	1288	820	410	204	88	41	22	1	2	0	0	0	0	6952
7000.	321	453	558	625	524	368	190	109	47	23	13	4	1	0	0	0	0	3236
8000.	155	195	228	249	215	152	90	49	33	12	10	1	1	0	0	0	0	1393
9000.	84	114	122	116	97	84	54	20	10	10	9	0	1	0	0	0	0	721
10000.	68	75	77	71	65	55	35	14	7	3	3	1	0	0	1	0	0	475
12000.	16	13	15	10	17	9	8	4	0	0	0	1	1	0	0	0	0	94
14000.	8	8	5	9	5	1	4	1	0	0	0	0	0	0	0	0	0	40
16000.	3	2	9	2	1	0	0	1	0	1	0	0	0	0	0	0	0	20
18000.	2	1	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	10
20000.	3	1	3	2	0	0	1	0	0	0	0	0	0	0	0	0	0	4
25000.	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
30000.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1156	3426	9950	24625	20046	10714	4679	1951	765	333	292	43	13	5	8	4	0	77928

TABLE 18

CUMULATIVE PROBABILITY FOR PEAK STRESSES FOR GROUND BIVARIATE TABLE
B-58 SEQUENCE A

VALUE	FREQ-DIST	CUM-DIST	PROBABILITY
3000.	350	1227.	1.00000000
4000.	415	877.	.71475143
5000.	249	462.	.37652812
6000.	128	213.	.17359413
7000.	44	85.	.06927465
8000.	20	41.	.03341483
9000.	12	21	.01711491
10000.	7	9.	.00733496
12000.	0	2.	.00162999
14000.	1	2.	.00162999
16000.	1	1.	.00081500
18000.	0	0.	0.00000000

TABLE 19

CUMULATIVE PROBABILITY TABLE OF PEAK AND VALLEY STRESSES FOR GROUND DATA
B-58 SEQUENCE A

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.	18000.	20000.	25000.
3000.	1.0000	.9714	.9057	.8357	.7543	.6629	.5629	.4571	.3471	.2357	.1229	.0057	0.0000	0.0000	0.0000	0.0000	0.0000
4000.	1.0000	.9783	.8988	.8229	.7420	.6509	.5509	.4441	.3321	.2193	.1045	.0048	0.0000	0.0000	0.0000	0.0000	0.0000
5000.	1.0000	.9679	.8713	.7859	.7009	.6109	.5109	.4041	.2921	.1793	.0680	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6000.	1.0000	.9609	.8509	.7509	.6509	.5509	.4509	.3509	.2509	.1509	.0509	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18000.	1.0000	.9500	.8350	.7350	.6350	.5350	.4350	.3350	.2350	.1350	.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TABLE 20
CUMULATIVE PROBABILITY FOR PEAK STRESS FOR AIRBORNE BIVARIATE TABLE
B-58 SEQUENCE A

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	28230	77920.	1.00000000
4000.	22791	46690.	.63770534
5000.	13947	26899.	.34521304
6000.	6952	12952.	.16622177
7000.	3236	6000.	.07700205
8000.	1390	2764.	.03547228
9000.	721	1374.	.01763347
10000.	475	653.	.00838039
12000.	94	178.	.00228439
14000.	40	84.	.00107803
16000.	20	44.	.00056468
18000.	10	24.	.00030801
20000.	10	14.	.00017967
25000.	4	4.	.00005133
30000.	0	0.	0.00000000

TABLE 21
CUMULATIVE PROBABILITY TABLE OF PEAK AND VALLEY STRESSES FOR AIRBORNE DATA
B-58 SEQUENCE A

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.	18000.	20000.	25000.
3000.	1.0000	.9999	.9994	.9986	.9972	.9950	.9929	.9900	.9862	.9815	.9767	.9710	.9653	.9596	.9538	.9481	.9423
4000.	1.0000	.9996	.9986	.9971	.9949	.9926	.9896	.9858	.9811	.9754	.9697	.9640	.9583	.9525	.9467	.9410	.9352
5000.	1.0000	.9990	.9975	.9955	.9929	.9896	.9857	.9809	.9752	.9685	.9628	.9571	.9514	.9456	.9399	.9342	.9285
6000.	1.0000	.9980	.9959	.9934	.9899	.9859	.9811	.9754	.9687	.9630	.9573	.9516	.9459	.9402	.9345	.9288	.9231
7000.	1.0000	.9968	.9941	.9911	.9871	.9829	.9781	.9724	.9657	.9599	.9542	.9485	.9428	.9371	.9314	.9257	.9200
8000.	1.0000	.9954	.9923	.9890	.9848	.9804	.9756	.9699	.9632	.9574	.9517	.9460	.9403	.9346	.9289	.9232	.9175
9000.	1.0000	.9944	.9910	.9875	.9831	.9784	.9736	.9679	.9612	.9554	.9497	.9440	.9383	.9326	.9269	.9212	.9155
10000.	1.0000	.9938	.9902	.9866	.9821	.9773	.9725	.9668	.9601	.9543	.9486	.9429	.9372	.9315	.9258	.9201	.9144
12000.	1.0000	.9928	.9890	.9853	.9807	.9759	.9711	.9654	.9587	.9529	.9472	.9415	.9358	.9301	.9244	.9187	.9130
14000.	1.0000	.9920	.9881	.9843	.9796	.9748	.9699	.9642	.9575	.9517	.9460	.9403	.9346	.9289	.9232	.9175	.9118
16000.	1.0000	.9910	.9870	.9831	.9783	.9735	.9686	.9629	.9571	.9514	.9457	.9400	.9343	.9286	.9229	.9172	.9115
18000.	1.0000	.9900	.9859	.9820	.9771	.9723	.9674	.9617	.9559	.9502	.9445	.9388	.9331	.9274	.9217	.9160	.9103
20000.	1.0000	.9890	.9848	.9809	.9760	.9711	.9662	.9605	.9547	.9490	.9433	.9376	.9319	.9262	.9205	.9148	.9091
25000.	1.0000	.9880	.9837	.9797	.9748	.9699	.9650	.9593	.9535	.9478	.9421	.9364	.9307	.9250	.9193	.9136	.9079
30000.	1.0000	.9880	.9837	.9797	.9748	.9699	.9650	.9593	.9535	.9478	.9421	.9364	.9307	.9250	.9193	.9136	.9079

STIMULATION PROGRAM RUN ON 07/11/74 AT 18.52.49, SUMMARY OF FLIGHTS ON CHANNEL 4
BIVARIATE DISTRIBUTION OF POSITIVE AND NEGATIVE PRIMARY PEAKS
B-58 SEQUENCE A

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SUMMARY OF DATA ON EACH CHANNEL
BIVARIATE DISTRIBUTION OF POSITIVE AND NEGATIVE PRIMARY PEAKS
B-58 SEQUENCE A

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TABLE 24

LISTING OF PEAKS AND VALLEYS AT START OF 3 FM CHANNELS
BIVARIATE DISTRIBUTION OF POSITIVE AND NEGATIVE PRIMARY PEAKS
B-58 SEQUENCE A

—STEP 1 OF SIMULATION RUN COMPLETE—NEXT STEP COMBINES DATA FROM EACH CHANNEL ONTO TAPE—2—

RECORD NO.	1		
0	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	ground cycles
0	0	0	
0	0	0	
-1863	-1934	-1958	preflight stress
-1863	-1934	-1958	
-1863	-1934	-1958	
-1863	-1934	-1958	
-1503	364	-1022	no ground cycles this flight calibration = -4600 psi
-3280	-859	-1022	
-1317	598	-1022	
-2245	-1381	-1022	
-1022	710	1533	calibration = +6900 psi
-1022	-1143	1533	
-1022	439	1533	
-1022	-1357	1533	
1533	-1022	3055	
1533	-1022	1352	
1533	-1022	2994	
1533	-1022	566	
2668	1533	2957	
936	1533	1056	
2905	1533	3388	
774	1533	1310	
2384	4768	3191	
780	3006	1179	
2491	4624	2908	
362	1975	1144	
4037	4741	2949	
545	2848	1152	
2440	4327	3190	
585	2737	1091	
3432	4319	3088	
372	2763	-223	
3417	4620	3299	
1702	2745	1149	
2981	4612	2823	
734	2569	929	
2410	4477	3180	
1041	2514	1071	
2560	5179	2922	
408	2918	1390	
2515	4494	3367	
943	2689	1554	
2733	4195	3020	
1119	2424	1609	
2706	4334	3658	
213	2607	1578	
2483	4907	3045	
770	3517	1278	
2396	4390	2928	
491	2190	1713	
3490	4260	2921	
152	2744	1327	
2623	4265	3115	

TABLE 25

CUMULATIVE PROBABILITY FOR POSITIVE GROUND PEAK DISTRIBUTION DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	938	2580.	1.00000000
4000.	668	1642.	.63643411
5000.	392	974.	.37751938
6000.	227	582.	.22558140
7000.	113	355.	.13759690
8000.	65	242.	.09379845
9000.	53	177.	.06860465
10000.	59	124.	.04806202
12000.	31	65.	.02519380
14000.	11	34.	.01317829
16000.	12	23.	.00891473
18000.	4	11.	.00426357
20000.	7	7.	.00271318
25000.	0	0.	0.00000000

TABLE 26

CUMULATIVE PROBABILITY FOR POSITIVE AIRBORNE PEAK DISTRIBUTION DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	54567	158592.	1.00000000
4000.	48429	104025.	.65592842
5000.	29660	55596.	.35055993
6000.	14532	25936.	.16353914
7000.	6420	11404.	.07190779
8000.	2667	4984.	.03142655
9000.	1243	2317.	.01460982
10000.	804	1074.	.00677209
12000.	154	270.	.00170248
14000.	55	116.	.00073144
16000.	26	61.	.00038463
18000.	17	35.	.00022069
20000.	14	18.	.00011350
25000.	4	4.	.00002522
30000.	0	0.	0.00000000

TABLE 27

CUMULATIVE PROBABILITY FOR NUMBER OF GROUND PEAKS PER FLIGHT DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	66	343.	1.00000000
4.	162	277.	.80758017
8.	59	115.	.33527697
12.	45	56.	.16326531
78.	11	11.	.03206997
144.	0	0.	0.00000000

TABLE 28

CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE PEAKS PER FLIGHT DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
75.	134	342.	1.00000000
239.	81	208.	.60818713
455.	37	127.	.37134503
784.	38	90.	.26315789
1620.	52	52.	.15204678
2456.	0	0.	0.00000000

TABLE 29

CUMULATIVE PROBABILITY FOR GROUND 1-G STRESS DISTRIBUTION DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-11100.	101	313.	1.00000000
-9060.	66	212.	.67731629
-6800.	56	146.	.46645367
-4250.	41	90.	.28753934
-630.	49	49.	.15654952
2990.	0	0.	0.00000000

TABLE 30

CUMULATIVE PROBABILITY FOR AIRBORNE 1-G STRESS DISTRIBUTION DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
8220.	39	342.	1.00000000
10960.	83	303.	.88596491
12750.	59	220.	.64327485
15040.	122	161.	.47076023
19000.	39	39.	.11403509
22960.	0	0.	0.00000000

TABLE 31
CUMULATIVE PROBABILITY FOR PREFLIGHT STRESS DISTRIBUTION DATA
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-8780.	140	343.	1.00000000
-8590.	175	203.	.59183673
-8030.	28	28.	.08163265
-7470.	0	0.	0.00000000

TABLE 32

SIMULATION PROGRAM RUN ON 05/16/74 AT 20.29.19, SUMMARY OF FLIGHTS ON CHANNEL 7
B-58 SEQUENCE A LIMITED FOLDED DISTRIBUTION

FLT ID	PREFLT STRESS	NUM PEAKS	GROUND DATA				AIRBORNE DATA				TOTAL			
			1.0 G STRESS	MEAN	VARIANCE	MINIMUM	MAXIMUM	1.0 G STRESS	MEAN	VARIANCE	MINIMUM	MAXIMUM	NUM PEAKS	CUMULATIVE NUM PEAKS
7001	-8780	0	0	-10958	-1702E+08	-15000	0	0	10960	-3073E+08	-1508	20412	74	74
7002	-8780	0	0	0	0	0	0	0	10960	-2463E+08	-1613	23533	1628	1702
7003	-8590	0	0	0	0	0	0	0	10960	-2521E+08	-3437	25357	1620	3322
7004	-8780	0	0	-6479	-4815E+08	-15000	3971	0	10960	-2596E+08	9304	28696	82	3404
7005	-8590	8	-6800	-4250	-3616E+08	-13597	5097	74	10960	-2474E+08	3688	26412	1628	5032
7006	-8590	8	-4250	-10875	-2274E+08	-15000	-6469	238	12750	-2573E+08	983	24517	742	5274
7007	-8590	4	-11100	-9060	-2168E+08	-13377	-4743	74	15040	-2569E+08	7046	23034	78	5352
7008	-8590	4	-9060	-10493	-2716E+08	-15000	-5641	454	15040	-2374E+08	2890	27190	458	5810
7009	-8780	0	0	0	0	0	0	0	15040	-2833E+08	9326	30000	784	6594
7010	-8590	4	-630	-630	-6678E+08	-9577	8317	238	19000	-2544E+08	9245	28755	242	6835
7011	-8780	78	-630	-630	-2907E+08	-13053	11793	74	15040	-2587E+08	6193	23887	152	6988
7012	-8590	4	-11100	-9987	-3524E+08	-15000	-3358	74	15040	-2312E+08	6443	23637	78	7066
7013	-8590	4	-6800	-6800	-1657E+08	-10603	-2997	238	12750	-2757E+08	334	25166	242	7338
7014	-8590	4	-630	-630	-5335E+08	-7475	6215	74	15040	-2320E+08	7845	22235	78	7386
7015	-8030	4	-9060	-2060	-2158E+08	-1129	-4991	74	15040	-2318E+08	7594	22486	78	7464
7016	-8780	4	-11100	-10434	-2875E+08	-15000	-4676	238	12750	-2356E+08	2633	22827	242	7706
7017	-8330	8	-630	-630	-3250E+08	-6803	5543	238	8220	-2571E+08	-2514	18954	246	7952
7018	-8590	4	-9060	-9060	-1924E+08	-12927	-5193	454	10960	-2533E+08	-1026	22946	458	8410
7019	-8590	0	0	0	0	0	0	0	15040	-2466E+08	5851	24219	238	8648
7020	-8590	0	0	0	0	0	0	0	10960	-2314E+08	-734	22654	238	8886
7021	-8590	12	-11100	-10926	-1649E+08	-15000	-6236	1620	15040	-2478E+08	2587	27493	1632	10518
7022	-8030	12	-9060	-9047	-1983E+08	-15000	-2967	238	12750	-2413E+08	2315	23185	250	10768
7023	-8590	0	0	0	0	0	0	0	15040	-2675E+08	6975	23105	74	1126
7024	-8590	8	-9060	-8529	-3501E+08	-15000	273	238	10960	-2501E+08	2565	19355	246	11384
7025	-8590	4	-9060	-9034	-3288E+08	-15000	-3017	454	19000	-2375E+08	9178	28822	458	11546
7026	-8780	4	-4250	-2801	-1393E+09	-15000	12295	238	19000	-2513E+08	10232	27768	242	11788
7027	-8590	0	0	0	0	0	0	0	12750	-2557E+08	1332	24468	1620	13408
7028	-8330	4	-9060	-9060	-1507E+08	-12513	-5607	238	15040	-2513E+08	6222	23858	242	13550
7029	-8780	4	-11100	-10923	-2222E+08	-15000	-5554	784	15040	-2415E+08	3885	26195	788	14734
7030	-8590	8	-11100	-10635	-2188E+08	-15000	-5638	1620	10960	-2434E+08	-2799	24719	1628	16066
7031	-8590	4	-11100	-11100	-1695E+08	-14978	-7322	454	10960	-2468E+08	-984	22904	458	16524
7032	-8590	8	-9060	-9060	-2102E+08	-14706	-3614	238	8220	-2542E+08	-435	16875	246	16770
7033	-8590	4	-630	-630	-2380E+08	-5062	-3832	1620	10960	-2542E+08	-4274	16794	1624	18394
7034	-8590	8	-6800	-6800	-3297E+08	-13645	45	238	12750	-2666E+08	-2135	27635	246	18640
7035	-8780	8	-9060	-9060	-1444E+08	-12780	-5340	74	10960	-2519E+08	1077	20843	82	18722
7036	-8590	4	-4250	-4250	-2392E+08	-8834	334	74	19000	-2859E+08	11008	26992	78	18800
7037	-8780	4	-11100	-11100	-1769E+08	-14916	-7284	238	12750	-2656E+08	2762	22738	242	19042
7038	-8590	4	-11100	-10976	-2144E+08	-15000	-6706	1620	12750	-2558E+08	-588	26089	1624	20666
7039	-8030	4	-11100	-10118	-3198E+08	-15000	-4680	238	12750	-2573E+08	1005	24495	242	21938
7040	-8590	0	0	0	0	0	0	0	19000	-3131E+08	9298	28702	238	21146
7041	-8590	0	0	0	0	0	0	0	15040	-3321E+08	3104	26976	74	21220
7042	-8780	8	-11100	-10619	-2015E+08	-15000	-5270	74	15040	-2733E+08	4052	26028	82	21332
7043	-8590	8	-11100	-11136	-2748E+08	-15000	-3963	238	10960	-2653E+08	-569	22488	246	21548
7044	-8780	8	-9060	-8987	-3516E+08	-15000	-1736	238	19000	-2404E+08	7675	30000	246	21794
7045	-8590	78	-630	-630	-3076E+08	-11738	10478	238	15040	-2652E+08	5440	24640	316	22110
7046	-8590	12	-11100	-9369	-5425E+08	-15000	10004	74	8220	-2178E+08	781	15659	86	22196
7047	-8590	4	-11100	-9490	-4611E+08	-15000	-759	1620	15040	-2540E+08	-557	29523	1624	23820
7048	-8590	4	-6800	-6800	-2454E+08	-11970	-1630	1620	15040	-2611E+08	-1023	30030	1624	25444
7049	-8780	8	-11100	-10667	-1928E+08	-15000	-5738	74	15040	-2374E+08	8087	21993	82	25526
7050	-8590	8	-4250	-4250	-4162E+08	-11048	2548	74	15040	-2833E+08	3705	26375	82	25688

TABLE 33

CUMULATIVE PROBABILITY FOR NUMBER OF GROUND CYCLES PER FLIGHT
F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	322	381.	1.00000000
1.	53	59.	.15485564
2.	5	6.	.01574803
3.	1	1.	.00262467
4.	0	0.	0.00000000

TABLE 34

CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE CYCLES PER FLIGHT
F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

VALUE	FREQ DIST	CUM DIST	PROBABILITY
1.	34	381.	1.00000000
5.	42	347.	.91076115
10.	57	305.	.80052493
15.	42	248.	.65091864
20.	35	206.	.54068241
25.	31	171.	.44881890
30.	31	140.	.36745407
35.	25	109.	.28608924
40.	18	84.	.22047244
45.	15	66.	.17322835
50.	8	51.	.13385827
55.	10	43.	.11286039
60.	10	33.	.08661417
65.	4	23.	.06036745
70.	4	19.	.04986877
75.	1	15.	.03937008
80.	1	14.	.03674541
90.	1	13.	.03412073
100.	5	12.	.03149606
120.	2	7.	.01837270
140.	2	5.	.01312336
160.	1	3.	.00787402
180.	2	2.	.00524934
225.	0	0.	0.00000000

TABLE 35

CUMULATIVE PROBABILITY FOR MEAN STRESSES FOR GROUND BIVARIATE TABLE
F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

VALUE	FREQ	DIST	CUM	DIST	PROBABILITY
0.		4		66.	1.00000000
2000.		4		62.	.93939394
4000.		1		58.	.87878788
6000.		4		57.	.86363636
8000.		19		53.	.80303030
10000.		25		34.	.51515152
12000.		7		9.	.13636364
14000.		1		2.	.03030303
16000.		0		1.	.01515152
18000.		1		1.	.01515152
20000.		0		0.	0.00000000

TABLE 36

CUMULATIVE PROBABILITY TABLE OF MEAN AND ALTERNATING STRESSES FOR GROUND DATA
F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

MEAN STRESS	ALTERNATING STRESS															
	2500.	3000.	3500.	4000.	4500.	5000.	5500.	6000.	6500.	7000.	7500.	8000.	8500.	9000.	9500.	10000.
0.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	.5000	.5000	.2500	0.0000	0.0000
2000.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	.7500	.7500	.7500	.7500	.7500	.7500	.5000	0.0000
4000.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6000.	1.0000	.7500	.5000	.2500	.2500	.2500	.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8000.	1.0000	.4737	.2105	.0526	.0526	.0526	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10000.	1.0000	.7200	.6000	.3200	.1233	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12000.	1.0000	1.0000	.8571	.7143	.5714	.4286	.1429	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14000.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
16000.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
18000.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20000.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

TABLE 37

CUMULATIVE PROBABILITY FOR MEAN STRESS FOR AIRBORNE BIVARIATE TABLE
F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	1	10864.	1.00000000
2000.	6	10863.	.99990795
4000.	92	10357.	.99935557
6000.	1040	10765.	.99088733
8000.	3789	9725.	.89515832
10000.	3674	5936.	.54639175
12000.	1293	2252.	.20821050
14000.	530	969.	.08919367
16000.	239	439.	.04040859
18000.	194	200.	.01840943
20000.	57	96.	.00883652
22000.	22	39.	.00358984
24000.	9	17.	.00156480
26000.	8	8.	.00073638
28000.	0	0.	0.00000000

CUMULATIVE PROBABILITY TABLE OF MEAN AND ALTERNATING STRESS FOR AIRBORNE DATA
 F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

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TABLE 39

F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

[illegible]

TABLE 40

SUMMARY OF DATA ON EACH CHANNEL
F-106 SEQUENCE E BIVARIATE DISTRIBUTION OF MEAN AND ALTERNATING STRESSES

***** G R O U N D D A T A *****										***** A I R B O R N E D A T A *****									
CHAN	NUM	HQ. CF	NO. OF	NUM	MAX	MIN	NO. OF	STRESS	MEAN	VARIANCE	STRESS	1.0 G	MAX	MIN	NO. OF	STRESS	MEAN	VARIANCE	1.3 G
NC.	REC	PEAKS	POINTS	FLTS	STRESS	STRESS	PEAKS	VARIANCE	STRESS	STRESS	VARIANCE	STRESS	STRESS	PEAKS	MEAN	VARIANCE	VARIANCE		
1	2572	190012	216032	3396	23198.	-8886.	1170	9414.	.3178E+08	.3289E+08	30000.	30000.	-9520.	188842	10605.	.2337E+08	.2840E+08		
2	2573	190984	216092	3255	22989.	-9182.	1062	9194.	.3382E+08	.3452E+08	30000.	30000.	-9387.	189922	10603.	.2344E+08	.2848E+08		
3	2572	183532	216048	3453	23302.	-9315.	1256	9377.	.3471E+08	.3574E+08	30000.	30000.	-9848.	188276	10612.	.2355E+08	.2863E+08		
TOT	7717	570528	648172	10094	23302.	-9182.	3488	9334.	.3344E+08	.3439E+08	30000.	30000.	-9848.	567040	10607.	.2345E+08	.2850E+08		

TABLE 41

CUMULATIVE PROBABILITY FOR NEGATIVE GROUND PEAK DISTRIBUTION DATA
F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-1500.	55	80.	1.00000000
-3000.	11	25.	.31250000
-4000.	2	14.	.17500000
-5000.	2	12.	.15000000
-7000.	2	10.	.12500000
-12000.	1	8.	.10000000
-14000.	7	7.	.08750000
-15000.	0	0.	0.00000000

TABLE 42

CUMULATIVE PROBABILITY FOR POSITIVE GROUND PEAK DISTRIBUTION DATA
F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	34	80.	1.00000000
4000.	38	46.	.57500000
5000.	3	8.	.10000000
6000.	1	5.	.06250000
7000.	1	4.	.05000000
8000.	1	3.	.03750000
12000.	1	2.	.02500000
14000.	1	1.	.01250000
16000.	0	0.	0.00000000

TABLE 43

CUMULATIVE PROBABILITY FOR NEGATIVE AIRBORNE PEAK DISTRIBUTION DATA
F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-1500.	11014	14107.	1.00000000
-3000.	1957	3093.	.21925285
-4000.	687	1136.	.09052740
-5000.	280	449.	.03182817
-6000.	99	169.	.01197997
-7000.	36	70.	.00496208
-8000.	17	34.	.00241015
-9000.	9	17.	.00120508
-10000.	6	8.	.00056709
-14000.	1	2.	.00014177
-15000.	1	1.	.00007089
-18000.	0	0.	0.00000000

TABLE 44

CUMULATIVE PROBABILITY FOR POSITIVE AIRBORNE PEAK DISTRIBUTION DATA
F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	5688	14107.	1.00000000
4000.	3346	8419.	.50579592
5000.	1583	5073.	.35950870
6000.	1017	3390.	.24030523
7000.	671	2373.	.16821435
8000.	445	1702.	.12054932
9000.	295	1257.	.08910470
10000.	379	962.	.06819310
12000.	213	584.	.04139789
14000.	164	371.	.02629900
16000.	98	207.	.01467357
18000.	54	109.	.00772555
20000.	55	55.	.00389877
25000.	0	0.	0.00000000

TABLE 45

CUMULATIVE PROBABILITY FOR NUMBER OF GROUND PEAKS PER FLIGHT DATA
F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	325	381.	1.00000000
1.	43	56.	.14628153
2.	7	13.	.03412073
3.	3	5.	.01574803
4.	1	3.	.00787402
5.	1	2.	.01524934
11.	1	1.	.00262467
31.	0	0.	0.00000000

TABLE 46

CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE PEAKS PER FLIGHT DATA
F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ	DIST	CUM	DIST	PROBABILITY
1.	147	381.	1.00000000		
26.	109	234.	.61417323		
51.	71	125.	.32808399		
76.	22	54.	.14173228		
101.	18	32.	.08393950		
126.	6	14.	.03574541		
151.	2	8.	.02093738		
201.	3	6.	.01574803		
251.	2	3.	.00787402		
301.	1	1.	.00262457		
501.	0	0.	0.00000000		

F-106 SEQUENCE E SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

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SUMMARY OF DATA ON EACH CHANNEL

***** G R O U N D Q U A *****										***** A I R O R N E D A T A *****									
CH4					NO. OF					STRESS					1.0 G				
NO.	SEC	PEAKS	NO. OF	FLIC	MAX	MIN	NO. OF	MEAN	PEAKS	MAX	MIN	NO. OF	MEAN	VARIANCE	STRESS	1.0 G			
4	0.773	185293	215038	4112	23465.	-7525.	991	10701.	20294E+08	2578E+08	30000.	-9537.	185239	9754.	2075E+08	2270E+08			
5	2.572	187320	215024	3364	20185.	-7573.	944	10792.	2191E+08	2723E+08	30000.	-9094.	186372	9736.	2066E+08	2255E+08			
6	2.773	186691	216067	4036	20124.	-7409.	991	10809.	2103E+08	2703E+08	30000.	-9301.	185700	9750.	2072E+08	2265E+08			
TOT	7.717	561761	649129	12111	20185.	-7525.	2930	10764.	2105E+08	2683E+08	30000.	-9537.	557371	9747.	2071E+08	2263E+08			

TABLE 49

CUMULATIVE PROBABILITY FOR NEGATIVE GROUND **PEAK** DISTRIBUTION DATA
F-106 SEQUENCE E LIMITED SEPARATE **POSITIVE** AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ	DIST	CUM DIST	PROBABILITY
-1500.	55		80.	1.00000000
-3000.	11		25.	.31250000
-4000.	2		14.	.17500000
-5000.	2		12.	.15000000
-7000.	2		10.	.12500000
-12000.	1		9.	.10000000
-14000.	7		7.	.08750000
-15000.	0		0.	0.00000000

TABLE 50

CUMULATIVE PROBABILITY FOR POSITIVE GROUND PEAK DISTRIBUTION DATA
F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	34	90.	1.00000000
4000.	38	46.	.57500000
5000.	3	8.	.10000000
6000.	1	5.	.06250000
7000.	1	4.	.05000000
8000.	1	3.	.03750000
12000.	1	2.	.02500000
14000.	1	1.	.01250000
16000.	0	0.	0.00000000

TABLE 51

CUMULATIVE PROBABILITY FOR NEGATIVE AIRBORNE PEAK DISTRIBUTION DATA
F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-1500.	11014	14107.	1.00000000
-3000.	1957	3093.	.24925285
-4000.	687	1135.	.09052740
-5000.	280	449.	.03182817
-6000.	93	169.	.01197987
-7000.	35	70.	.00495208
-8000.	17	34.	.00241015
-9000.	9	17.	.00120508
-10000.	6	8.	.00056709
-14000.	1	2.	.00014177
-16000.	1	1.	.00007089
-18000.	0	0.	0.00000000

TABLE 52

CUMULATIVE PROBABILITY FOR POSITIVE AIRBORNE PEAK DISTRIBUTION DATA
F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	5588	14107.	1.00000000
4000.	3346	8419.	.59679592
5000.	1683	5073.	.35969870
6000.	1017	3390.	.24030523
7000.	671	2373.	.15821435
8000.	445	1792.	.12064932
9000.	295	1257.	.08910470
10000.	378	952.	.06819310
12000.	213	524.	.04139789
14000.	164	371.	.02629900
16000.	98	207.	.01467357
18000.	54	109.	.00772666
20000.	55	55.	.00389877
25000.	0	0.	0.00000000

TABLE 53

CUMULATIVE PROBABILITY FOR NUMBER OF GROUND PEAKS PER FLIGHT DATA
F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	325	381.	1.00000000
2.	56	56.	.14598163
4.	0	0.	0.00000000

TABLE 54
 CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE PEAKS PER FLIGHT DATA
 F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
27.	256	381.	1.00000000
57.	117	125.	.32808399
257.	8	8.	.02099738
467.	0	0.	0.00000000

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SIMULATION PROGRAM RUN ON 02/16/74 AT 14.03.37, SUMMARY OF FLIGHTS ON CHANNEL
F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

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SUMMARY OF DATA ON EACH CHANNEL

F-106 SEQUENCE E LIMITED SEPARATE POSITIVE AND NEGATIVE DISTRIBUTIONS

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TABLE 57

CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE PEAKS PER FLIGHT DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
1.	8	282.	1.00000000
26.	23	274.	.97163121
51.	23	246.	.87234043
76.	33	223.	.79078014
101.	25	193.	.68439716
126.	18	168.	.59574468
151.	21	150.	.53191489
176.	17	129.	.45744681
201.	15	112.	.39716312
226.	22	97.	.34397163
251.	8	75.	.26595745
276.	8	67.	.23758865
301.	2	59.	.20921986
326.	7	57.	.20212766
351.	8	50.	.17730496
401.	10	42.	.14893617
451.	5	32.	.11347518
501.	7	27.	.09574468
601.	3	20.	.07042199
701.	4	17.	.05028369
801.	2	13.	.04009929
901.	2	11.	.03900709
1001.	3	9.	.03191439
1126.	2	6.	.02127669
1251.	1	4.	.01418440
1501.	1	3.	.01063830
1751.	1	2.	.00709220
2001.	1	1.	.00354610
2251.	0	0.	0.00000000

TABLE 58

CUMULATIVE PROBABILITY FOR GROUND 1-G STRESS DISTRIBUTION DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-14000.	1	270.	1.00000000
-13000.	9	269.	.39629630
-12000.	22	260.	.56296296
-11000.	14	238.	.38148148
-10500.	18	224.	.62962963
-10000.	17	206.	.76296296
-9500.	14	189.	.70000000
-9000.	15	175.	.64814815
-8500.	15	150.	.59259259
-8000.	13	145.	.53703704
-7500.	3	132.	.48888889
-7000.	10	129.	.47777778
-6500.	7	119.	.44074074
-6000.	13	112.	.41481481
-5500.	11	99.	.36666667
-5000.	9	88.	.32592593
-4500.	11	79.	.29259259
-4000.	8	68.	.25185185
-3500.	12	60.	.22222222
-3000.	3	48.	.17777778
-2500.	3	45.	.16666667
-2000.	10	37.	.13703704
-1000.	13	27.	.10000000
0.	5	14.	.05185185
1000.	9	9.	.03333333
2000.	0	0.	0.00000000

TABLE 59

CUMULATIVE PROBABILITY FOR AIRBORNE 1-G STRESS DISTRIBUTION DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

VALUE	FREQ. DIST.	CUM. DIST.	PROBABILITY
5000.	1	282.	1.00000000
7000.	2	281.	.99645390
8000.	1	279.	.98936170
9000.	7	278.	.98581560
10000.	4	271.	.96099291
10500.	10	267.	.94680851
11000.	9	257.	.91134752
11500.	7	248.	.87943262
12000.	22	241.	.85460993
12500.	17	219.	.77659574
13000.	17	202.	.71531206
13500.	19	185.	.65602837
14000.	28	156.	.58865248
14500.	13	138.	.48936170
15000.	13	125.	.44326241
15500.	22	112.	.39716312
16000.	24	90.	.31914894
16500.	11	56.	.23404255
17000.	13	55.	.19503546
17500.	13	42.	.14993617
18000.	14	29.	.10283688
19000.	8	15.	.05319149
20000.	6	7.	.02482270
21000.	1	1.	.00354610
22000.	0	0.	0.00000000

TABLE 60

CUMULATIVE PROBABILITY FOR PREFLIGHT STRESS DISTRIBUTION DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

VALUE	FREQ	DIST	CUM. DIST	PROBABILITY
-8950.	2		282.	1.00000000
-8900.	15		290.	.99290780
-8850.	53		264.	.93617021
-8800.	54		211.	.74822695
-8750.	35		157.	.55673759
-8700.	45		122.	.43262411
-8650.	31		77.	.27304965
-8600.	19		46.	.16312057
-8550.	13		27.	.09574468
-8500.	4		14.	.04964539
-8450.	3		10.	.03546099
-8400.	2		7.	.02482270
-8250.	1		5.	.01773050
-8100.	3		4.	.01418440
-8000.	1		1.	.00354610
-7600.	0		0.	0.00000000

TABLE 61

FREQUENCY DISTRIBUTION TABLE OF PEAK AND VALLEY STRESSES FOR GROUND DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.	TOTAL
3000.	3	21	61	112	32	15	6	5	1	1	2	1	1	0	281
4000.	0	39	123	98	26	8	4	3	2	1	0	0	0	0	304
5000.	3	36	46	38	15	3	1	1	1	0	0	0	0	0	146
6000.	3	13	15	8	4	2	1	0	0	0	0	1	0	0	49
7000.	1	4	3	5	2	0	0	0	0	0	0	0	0	0	15
8000.	2	1	1	0	2	0	1	1	0	0	0	0	0	0	8
9000.	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3
10000.	0	0	2	1	0	0	0	0	0	0	0	0	1	0	4
12000.	1	0	0	3	2	0	0	0	0	0	0	0	0	0	6
14000.	0	0	1	1	0	1	0	0	0	0	1	0	0	0	4
16000.	0	0	0	1	0	2	2	2	1	0	0	0	0	0	8
18000.	1	0	0	0	0	0	0	0	0	0	1	0	1	0	4
20000.	0	2	1	0	0	1	0	0	0	0	0	0	0	0	4
25000.	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2
30000.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	16	116	275	268	97	32	15	12	5	2	6	1	3	0	838

TABLE 62

FREQUENCY DISTRIBUTION TABLE OF PEAK AND VALLEY STRESSES FOR AIRBORNE DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	VALLEY STRESS					7000.	8000.	9000.	10000.	12000.	14000.	16000.	18000.	20000.	25000.	30000.
3000.	1	34	421	355	3135	1673	731	304	143	85	46	16	5	3	1	2	1	0	0	0	0	0	0
4000.	3	94	1510	3183	2244	1325	622	254	122	56	42	13	5	5	1	0	0	0	0	0	0	0	0
5000.	26	501	1268	1709	1371	794	375	153	93	49	43	12	1	1	0	1	0	0	0	0	0	0	0
6000.	185	449	680	756	655	446	256	150	61	48	26	9	3	0	0	0	0	0	0	0	0	0	0
7000.	167	227	383	340	324	260	115	40	30	32	21	6	2	0	0	0	1	0	0	0	0	0	0
8000.	97	120	169	174	137	103	71	49	27	12	13	6	1	0	0	0	0	0	0	0	0	0	0
9000.	67	67	90	43	69	71	37	27	11	5	9	2	0	0	0	0	0	0	0	0	0	0	0
10000.	40	45	76	74	76	50	36	27	14	5	9	3	0	0	0	0	0	0	0	0	0	0	0
12000.	19	15	19	27	16	19	17	7	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14000.	5	7	5	10	5	3	6	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16000.	2	3	2	3	4	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18000.	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20000.	3	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25000.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30000.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	619	1571	4588	9906	8118	4744	2263	1073	515	299	206	70	21	9	2	4	2	0	0	0	0	0	0

PEAK	VALLEY	STRESS
TOTAL		
3000.	10232	
4000.	9469	
5000.	6432	
6000.	3715	
7000.	1940	
8000.	940	
9000.	551	
10000.	459	
12000.	156	
14000.	44	
16000.	18	
18000.	7	
20000.	7	
25000.	1	
30000.	0	
TOTAL	34010	

TABLE 63

CUMULATIVE PROBABILITY FOR PEAK STRESS FOR GROUND BIVARIATE TABLE
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

VALUE	FREQ. DIST.	CUM. DIST.	PROBABILITY
3000.	261	938.	1.00000000
4000.	304	567.	.66467780
5000.	145	253.	.30190931
6000.	49	197.	.12784466
7000.	15	58.	.06921241
8000.	8	43.	.05131265
9000.	3	35.	.04174611
10000.	4	32.	.03618616
12000.	6	28.	.03341289
14000.	4	22.	.02625298
16000.	8	18.	.02147971
18000.	4	10.	.01153317
20000.	4	6.	.00715990
25000.	2	2.	.00238663
30000.	0	0.	0.00000000

TABLE 64

CUMULATIVE PROBABILITY TABLE OF PEAK AND VALLEY STRESSES FOR GROUND DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.
3000.	1.0000	.9833	.9140	.8203	.7278	.6139	.4805	.3391	.2214	.0178	.0142	.0071	.0036	0.0000
4000.	1.0000	1.0000	.8717	.6571	.4571	.2592	.0329	.0197	.0099	.0033	0.0000	0.0000	0.0000	0.0000
5000.	1.0000	.9795	.7323	.4151	.1433	.0411	.0205	.0137	.0063	0.0000	0.0000	0.0000	0.0000	0.0000
6000.	1.0000	.8980	.6327	.3255	.1633	.0816	.0408	.0204	.0204	.0204	.0204	0.0000	0.0000	0.0000
7000.	1.0000	.8333	.6687	.4557	.1333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8000.	1.0000	.7500	.6250	.5000	.3000	.2500	.2500	.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9000.	1.0000	1.0000	1.0000	1.0000	.5667	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10000.	1.0000	1.0000	1.0000	.5300	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	0.0000
12000.	1.0000	.9333	.8333	.3333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14000.	1.0000	1.0000	1.0000	.7500	.3000	.5000	.2500	.2500	.2500	.2500	.2500	0.0000	0.0000	0.0000
16000.	1.0000	1.0000	1.0000	1.0000	.1000	.7500	.6250	.3750	.1250	0.0000	0.0000	0.0000	0.0000	0.0000
18000.	1.0000	.7500	.7500	.7500	.7500	.5000	.5000	.5000	.5000	.5000	.5000	.2500	.2500	0.0000
20000.	1.0000	1.0000	.5000	.2500	.2500	.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25000.	1.0000	1.0000	1.0000	1.0000	1.0000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	0.0000
30000.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TABLE 65

CUMULATIVE PROBABILITY FOR PEAK STRESS FOR AIRBORNE BIVARIATE TABLE
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

VALUE	FREQ	DIST	CUM	DIST	PROBABILITY
3000.	10232		34910.		1.00000000
4000.	9468		23778.		.69914731
5000.	6432		14310.		.42075820
6000.	3716		7878.		.23163775
7000.	1940		4152.		.12237577
8000.	960		2222.		.05533373
9000.	551		1242.		.03251567
10000.	458		691.		.02031755
12000.	156		233.		.00685093
14000.	44		77.		.00226404
16000.	18		33.		.00097030
18000.	7		15.		.00044105
20000.	7		6.		.00023522
25000.	1		1.		.00002940
30000.	0		0.		0.00000000

TABLE 66

CUMULATIVE PROBABILITY TABLE OF PEAK AND VALLEY STRESSES FOR AIRBORNE DATA
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

PEAK STRESS	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	12000.	14000.	16000.	18000.	20000.	25000.	30000.
3000.	.9393	.9396	.9397	.9398	.9399	.9400	.9401	.9402	.9403	.9404	.9405	.9406	.9407	.9408	.9409	.9410	.9411	.9412
4000.	.8893	.8896	.8897	.8898	.8899	.8900	.8901	.8902	.8903	.8904	.8905	.8906	.8907	.8908	.8909	.8910	.8911	.8912
5000.	.8493	.8496	.8497	.8498	.8499	.8500	.8501	.8502	.8503	.8504	.8505	.8506	.8507	.8508	.8509	.8510	.8511	.8512
6000.	.8093	.8096	.8097	.8098	.8099	.8100	.8101	.8102	.8103	.8104	.8105	.8106	.8107	.8108	.8109	.8110	.8111	.8112
7000.	.7693	.7696	.7697	.7698	.7699	.7700	.7701	.7702	.7703	.7704	.7705	.7706	.7707	.7708	.7709	.7710	.7711	.7712
8000.	.7293	.7296	.7297	.7298	.7299	.7300	.7301	.7302	.7303	.7304	.7305	.7306	.7307	.7308	.7309	.7310	.7311	.7312
9000.	.6893	.6896	.6897	.6898	.6899	.6900	.6901	.6902	.6903	.6904	.6905	.6906	.6907	.6908	.6909	.6910	.6911	.6912
10000.	.6493	.6496	.6497	.6498	.6499	.6500	.6501	.6502	.6503	.6504	.6505	.6506	.6507	.6508	.6509	.6510	.6511	.6512
12000.	.6093	.6096	.6097	.6098	.6099	.6100	.6101	.6102	.6103	.6104	.6105	.6106	.6107	.6108	.6109	.6110	.6111	.6112
14000.	.5693	.5696	.5697	.5698	.5699	.5700	.5701	.5702	.5703	.5704	.5705	.5706	.5707	.5708	.5709	.5710	.5711	.5712
16000.	.5293	.5296	.5297	.5298	.5299	.5300	.5301	.5302	.5303	.5304	.5305	.5306	.5307	.5308	.5309	.5310	.5311	.5312
18000.	.4893	.4896	.4897	.4898	.4899	.4900	.4901	.4902	.4903	.4904	.4905	.4906	.4907	.4908	.4909	.4910	.4911	.4912
20000.	.4493	.4496	.4497	.4498	.4499	.4500	.4501	.4502	.4503	.4504	.4505	.4506	.4507	.4508	.4509	.4510	.4511	.4512
25000.	.3693	.3696	.3697	.3698	.3699	.3700	.3701	.3702	.3703	.3704	.3705	.3706	.3707	.3708	.3709	.3710	.3711	.3712
30000.	.2893	.2896	.2897	.2898	.2899	.2900	.2901	.2902	.2903	.2904	.2905	.2906	.2907	.2908	.2909	.2910	.2911	.2912

TABLE 67

B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

***** G R A D U A T A *****										***** A I R 3 0 P N E D A T A *****										***** TOTAL *****									
FLY	ID	PEAKS	NUM	1.0 G	STRESS	VARIANCE	MINIMUM	MAXIMUM	STRESS	MEAN	STRESS	MINIMUM	MAXIMUM	STRESS	PEAKS	NUM	NUM	POINTS											
4001	8415	6	-1222.8	-112.44	1277E+08	-15000	-7762	164	12691	13211	-2413E+08	2903	24469	170	170	130													
4002	-8606	6	-1348	-430	1611E+08	-3831	5734	254	13992	19701	-2555E+08	9416	30000	250	462	462													
4003	-8806	2	-5659	-33.1	1801E+08	-6952	-930	32	13489	16941	-3061E+08	3470	26084	34	464	503													
4004	-8741	4	-1615	-3.6	1249E+08	-4161	2569	214	13014	13437	-2633E+08	3176	24879	218	682	733													
4005	-8766	4	1015	1297	633E+08	-9444	8216	44	13317	16149	-2508E+08	7251	24027	48	730	748													
4006	-8709	82	-6839	-4233	1656E+08	-15000	9848	184	13730	15035	-2303E+08	3934	25637	270	1000	1043													
4007	-8462	10	-681	419	212E+08	-4439	6951	126	12412	12665	-2377E+08	3287	22587	136	1136	1223													
4008	-8792	8	-3368	-8275	2021E+08	-1319E	-2739	100	15947	15841	-2753E+08	2337	25488	104	1284	1343													
4009	-8723	4	-6905	-5512	3039E+08	-10604	30	32	13614	1252	-2549E+08	11570	26568	36	1280	1396													
4010	-8733	0	0	0	0	0	0	0	20	13261	13977	-2523E+08	5939	23164	20	1300	1428												
4011	-8753	0	0	0	0	0	0	0	120	12790	17532	-2377E+08	5331	27553	120	1430	1566												
4012	-8563	2	-11611	-11404	1884E+08	-14473	-8335	110	17157	15155	-2786E+08	5210	29532	112	1532	1684													
4013	-8760	0	0	0	0	0	0	0	1076	14479	14964	-2531E+08	115	29083	1076	2608	2772												
4014	-8773	2	-10635	-9316	2899E+08	-13723	-6109	332	15077	15810	-2559E+08	5412	28984	334	2942	3118													
4015	-8864	4	-3084	-8111	1809E+08	-1247	3395	42	13548	14198	-2437E+08	3672	23227	96	3038	3226													
4016	-8676	6	-8621	-7320	1759E+08	-15317	9837	130	6364	6603	-2194E+08	2213	17086	136	3174	3346													
4017	-8735	4	-4176	-127	3564E+08	-7324	9330	56	13397	13970	-2553E+08	5433	21904	60	3234	3446													
4018	-8747	4	-11431	-10264	3033E+08	-15000	-4625	42	14357	14644	-2334E+08	5528	22547	46	3280	3504													
4019	-8754	4	-1145	-11406	3444E+08	-15000	-7793	80	17182	18074	-2551E+08	9334	22824	84	3364	3600													
4020	-8556	6	-1625	-358	1475E+08	-4634	3230	462	15509	12335	-2543E+08	4376	28861	88	4232	4440													
4021	-8756	12	-4339	-323	3251E+08	-15000	5749	68	13772	16650	-2647E+08	6997	22293	80	4312	4572													
4022	-8784	2	-6055	-743	3021E+08	-	-8630	856	694	15134	16495	-2473E+08	2349	30000	666	4978	5250												
4023	-8625	8	-4619	-3143	3079E+08	-10597	1072	253	13091	15674	-2271E+08	10792	30000	266	5244	5523													
4024	-8720	0	0	0	0	0	0	0	472	9621	9796	-2473E+08	-954	22142	472	5716	6012												
4025	-8726	6	-5624	-4357	2649E+08	-10500	103E	52	13607	15948	-2523E+08	12121	28330	68	5784	6032													
4026	-8641	6	-10643	-1015	1946E+08	-13000	-4861	144	14013	15456	-2563E+08	2819	24639	150	5934	6254													
4027	-8748	2	-2043	-2143	2437E+08	-5893	1237	238	13607	15982	-2293E+08	3945	29019	240	6174	6515													
4028	-8680	2	-9762	-953	2332E+08	-13197	-5539	80	13533	17397	-2547E+08	9711	30000	88	6262	6508													
4029	-8824	8	-5032	-3326	1666E+08	-8430	865	114	10885	12500	-2579E+08	2224	23061	122	6384	6740													
4030	-8744	4	-12000	-10379	1666E+08	-15000	-6210	130	13727	15981	-2595E+08	4761	24520	134	6518	6846													
4031	-8747	8	-6555	-571	2236E+08	-13095	211E	182	13542	13735	-2702E+08	3709	27410	190	6708	7088													
4032	-8533	4	-9926	-6159	3514E+08	-13007	-5046	248	12510	12961	-2320E+08	3783	22950	252	6960	7352													
4033	-8674	4	-9636	-5433	3281E+08	-15000	-3726	190	17085	17594	-2750E+08	6488	30000	194	7154	7558													
4034	-8755	6	-8277	-732	1174E+08	-11552	-3665	134	13666	11114	-2470E+08	2258	19503	144	7298	7714													
4035	-8451	6	-4891	-3744	1196E+08	-12468	-5733	202	14725	15777	-2508E+08	5362	21234	206	7504	7932													
4036	-8563	8	-4830	-3731	1136E+08	-7458	870	60	13490	13605	-1970E+08	6954	21466	68	7572	8012													
4037	-8640	2	-266	-170	2891E+08	-2479	5372	162	1416	13873	-2603E+08	3844	26764	164	7736	8130													
4038	-8803	8	-10258	-710	3509E+08	-15000	2967	1132	13373	13809	-2503E+08	-1322	23466	140	8876	9340													
4039	-8706	4	-2153	711	1215E+08	-8478	1541E	294	13151	13706	-2344E+08	3229	24077	304	9180	9656													
4040	-8810	10	-9544	-9714	1706E+08	-15000	-5159	200	10554	14026	-2392E+08	3769	28515	210	9390	9879													
4041	-8845	0	0	0	0	0	0	0	80	3858	10313	-2543E+08	-2054	20904	80	9470	9970												
4042	-8655	18	-7503	-7124	1752E+08	-13225	-1545	150	14169	14466	-2482E+08	3355	24570	168	9638	10150													
4043	-8710	2	-4267	-337	2411E+08	-9849	-725	26	12932	13135	-2561E+08	3032	21269	28	9666	10130													
4044	-8676	4	-5071	-336	2616E+08	-8743	1430	4	12515	12419	-2895E+08	6715	17077	8	9674	10210													
4045	-8530	2	-2870	-2171	3226E+08	-6207	1825	100	10795	11442	-2535E+08	8423	23006	102	9776	10334													
4046	-8706	4	-7622	-7037	1246E+08	-10235	-3452	172	12003	14634	-2547E+08	2631	23611	176	9952	10512													
4047	-8756	8	-1372	-734	1288E+08	-4398	3908	102	15679	15812	-2846E+08	3756	26221	110	10062	10634													
4048	-8611	10	-5344	-432	1876E+08	-12725	326	28	11800	11423	-3077E+08	1105	21628	38	10100	10654													
4049	-8727	0	0	0	0	0	0	0	232	17952	19522	-2240E+08	9544	29317	232	10332	10928												
4050	-8519	4	-9184	-834	2000E+08	-12885	-4392	242	15635	15965	-2589E+08	2239	29317	246	10578	11156													

TABLE 68

SUMMARY OF DATA ON EACH CHANNEL
B-58 SEQUENCE B BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

CHAN NO.	REC NO.	NO. OF PEAKS	NO. OF PCPTS	FLTS	MIN	MAX	MIN	MAX	STRESS	MEAN	STRESS	1.0 G	VARIANCE	STRESS	1.0 G	VARIANCE	STRESS	1.0 G	VARIANCE	STRESS	1.0 G	VARIANCE
4	2578	203020	215500	172	29449.	29449.	-15000.	-15000.	-5714.	3664E+08	2374E+08	2374E+08	2374E+08	30000.	-15000.	200168	15054.	3258E+08	2543E+08	14877.	3258E+08	2551E+08
5	2573	203224	216116	173	28247.	28247.	-15000.	-15000.	-5481.	3468E+08	2209E+08	2209E+08	2209E+08	30000.	-15000.	200904	14877.	3258E+08	2551E+08	14877.	3258E+08	2551E+08
6	2574	203574	216202	101	26080.	26080.	-15000.	-15000.	-6051.	3508E+08	2357E+08	2357E+08	2357E+08	30000.	-15000.	201362	15154.	3334E+08	2539E+08	15154.	3334E+08	2539E+08
TOT	7725	618818	548818	246	29449.	29449.	-15000.	-15000.	-5844.	3532E+08	2315E+08	2315E+08	2315E+08	30000.	-15000.	602434	15031.	3291E+08	2544E+08	15031.	3291E+08	2544E+08

TABLE 69

SIMULATION PROGRAM RUN ON 08/01/74 AT 18.49.55, SUMMARY OF FLIGHTS ON CHANNEL 4
B-58 SEQUENCE C BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

FLI	PREFLI	***** G R C U N C *****				***** A I R P O R N E *****				***** T O T A L *****			
		NUM	STRESS	MINIMUM	MAXIMUM	MEAN	VARIANCE	STRESS	MINIMUM	MAXIMUM	NUM	STRESS	PEAKS
10	STRESS	PEAKS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	NUM	STRESS	PEAKS
4001	-8751.	0	0.	0.	0.	14223.	.2287E+08	5564.	24184.	356	356	376	376
4002	-8647.	0	0.	0.	0.	15041.	.1974E+08	7129.	23132.	74	434	456	456
4003	-8571.	0	0.	0.	0.	13671.	.2386E+08	6499.	22229.	34	469	512	512
4004	-8554.	0	0.	0.	0.	12778.	.2176E+08	3157.	26469.	470	938	994	994
4005	-8557.	0	0.	0.	0.	9171.	.2200E+08	-4791.	11458.	72	1010	1078	1078
4006	-8304.	0	0.	0.	0.	14770.	.2142E+08	8329.	26752.	138	1149	1228	1228
4007	-8876.	0	0.	0.	0.	18754.	.2329E+08	9286.	30000.	443	1596	1638	1638
4008	-8673.	0	0.	0.	0.	12645.	.2105E+08	-3458.	23260.	113	1714	1818	1818
4009	-8715.	0	0.	0.	0.	15052.	.2179E+08	5809.	29266.	846	2560	2576	2576
4010	-8780.	0	0.	0.	0.	18885.	.2289E+08	10149.	30000.	658	3219	3346	3346
4011	-8672.	0	0.	0.	0.	14839.	.2385E+08	6471.	30000.	176	3394	3534	3534
4012	-8446.	0	0.	0.	0.	11591.	.2349E+08	1561.	23038.	170	3564	3716	3716
4013	-8557.	0	0.	0.	0.	15807.	.2282E+08	6037.	29130.	222	3786	3950	3950
4014	-8046.	0	0.	0.	0.	13578.	.2283E+08	4036.	25044.	384	4170	4346	4346
4015	-8221.	0	0.	0.	0.	13654.	.2400E+08	2237.	22470.	96	4266	4454	4454
4016	-8734.	0	0.	0.	0.	20584.	.2313E+08	9470.	30000.	1282	5548	5748	5748
4017	-8702.	0	0.	0.	0.	12482.	.2362E+08	4075.	23636.	90	5638	5850	5850
4018	-8750.	0	0.	0.	0.	15343.	.2160E+08	5475.	25918.	424	6062	6286	6286
4019	-8352.	0	0.	0.	0.	19141.	.2058E+08	11636.	27742.	82	6144	6380	6380
4020	-8556.	0	0.	0.	0.	13186.	.2185E+08	8911.	30300.	540	6684	6932	6932
4021	-8547.	0	0.	0.	0.	9339.	.2168E+08	368.	18405.	232	6916	7175	7175
4022	-8643.	0	0.	0.	0.	15125.	.2248E+08	7552.	24379.	112	7028	7300	7300
4023	-8403.	0	0.	0.	0.	12336.	.2256E+08	1379.	21738.	344	7412	7696	7696
4024	-8544.	0	0.	0.	0.	9542.	.2425E+08	3975.	22179.	46	7458	7754	7754
4025	-8459.	0	0.	0.	0.	13672.	.2034E+08	3953.	19537.	48	7506	7814	7814
4026	-8515.	0	0.	0.	0.	15539.	.2011E+08	8739.	20133.	12	7519	7938	7938
4027	-8607.	0	0.	0.	0.	13768.	.2181E+08	3203.	25345.	652	8170	8502	8502
4028	-8697.	0	0.	0.	0.	12624.	.1999E+08	5930.	20524.	64	8234	8578	8578
4029	-8761.	0	0.	0.	0.	15048.	.2337E+08	3772.	28522.	331	8572	8924	8924
4030	-8410.	0	0.	0.	0.	7542.	.2182E+08	-2517.	19943.	732	9354	9722	9722
4031	-8755.	0	0.	0.	0.	6232.	.2350E+08	-5423.	20350.	624	9982	10352	10352
4032	-8477.	0	0.	0.	0.	17916.	.2171E+08	9072.	27430.	242	10264	10556	10556
4033	-8342.	0	0.	0.	0.	15123.	.2241E+08	6905.	20973.	18	10282	10585	10585
4034	-8665.	0	0.	0.	0.	12333.	.2123E+08	3774.	22175.	104	10386	10402	10402
4035	-8644.	0	0.	0.	0.	12733.	.2206E+08	3785.	22912.	268	10654	11042	11042
4036	-8498.	0	0.	0.	0.	11503.	.1999E+08	3603.	21581.	140	10794	11234	11234
4037	-8550.	0	0.	0.	0.	12604.	.1936E+08	5453.	18248.	18	10812	11364	11364
4038	-8564.	0	0.	0.	0.	11357.	.1936E+08	4515.	18298.	44	10856	11320	11320
4039	-8751.	0	0.	0.	0.	8538.	.2123E+08	-975.	16990.	260	11116	11592	11592
4040	-8542.	0	0.	0.	0.	13515.	.2273E+08	5035.	23350.	124	11240	11728	11728
4041	-8736.	0	0.	0.	0.	9315.	.2043E+08	1709.	17938.	82	11322	11822	11822
4042	-8654.	0	0.	0.	0.	15160.	.1954E+08	5961.	22912.	194	11516	12028	12028
4043	-8537.	0	0.	0.	0.	15861.	.2328E+08	5549.	24435.	112	11628	12152	12152
4044	-8720.	0	0.	0.	0.	13209.	.2242E+08	4549.	25665.	282	11910	12446	12446
4045	-8759.	0	0.	0.	0.	10582.	.2192E+08	4084.	19559.	38	11948	12446	12446
4046	-8703.	0	0.	0.	0.	11775.	.1807E+08	5140.	18235.	36	11984	12544	12544
4047	-8594.	0	0.	0.	0.	6950.	.2442E+08	-4570.	17662.	182	12166	12738	12738
4048	-8658.	0	0.	0.	0.	10211.	.2130E+08	861.	19552.	312	12478	13062	13062
4049	-8522.	0	0.	0.	0.	10631.	.2338E+08	3510.	17296.	14	12492	13048	13048
4050	-8880.	0	0.	0.	0.	8072.	.2231E+08	-1358.	19139.	878	13370	13978	13978

TABLE 70

SUMMARY OF DATA ON EACH CHANNEL
B-58 SEQUENCE C BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

***** G R O U N D D A T A *****																	***** A I R B O R N E D A T A *****																
CHAN NO.	NUM REC	NO. OF PEAKS	NC. OF PCINTS	NUM FLTS	MAX STRESS	MIN STRESS	NO. OF PEAKS	NO. OF STRESS MEAN	STRESS VARIANCE	1.0 G VARIANCE	MAX STRESS	MIN STRESS	NC. OF PEAKS	NO. OF STRESS MEAN	STRESS VARIANCE	1.0 G VARIANCE																	
4	2574	210158	216138	457	0.	0.	0.	0.	0.0.	0.	30000.	-14106.	210158	13766.	.3400E+08	.2248E+08																	
5	2585	211506	217142	435	0.	0.	0.	0.	0.0.	0.	30000.	-12353.	211906	13865.	.3294E+08	.2250E+08																	
6	2577	210674	216462	481	0.	0.	0.	0.	0.0.	0.	30000.	-15000.	210674	13983.	.3294E+08	.2256E+08																	
TOT					7737	532738	649742	1413	0.	0.	0.0.	0.	0.	0.0.	0.	30000.	-15000.	632738	13872.	.3330E+08	.2251E+08												

TABLE 71

SIMULATION PROGRAM RUN ON 08/01/74 AT 18.50.02, SUMMARY OF FLIGHTS ON CHANNEL 4
B-58 SEQUENCE D BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

***** G F C U N D D A T A *****										***** A I R B O R N E D A T A *****										TOTAL				CUMULATIVE			
FLY	REFLT	NUM	1.0 G	STRESS	MEAN	VARIANCE	MINIMUM	MAXIMUM	PEAKS	NUM	1.0 G	STRESS	MEAN	VARIANCE	MINIMUM	MAXIMUM	STRESS	PEAKS	NUM	STRESS	PEAKS	NUM	STRESS	PEAKS	NUM		
4001	-8555	0	0	0	0	0	0	0	0	244	17111	12126	2505E+08	5591	27460	244	244	244	244	244	244	244	244	244	244		
4002	-8774	0	0	0	0	0	0	0	0	156	17632	18107	2586E+08	3293	30000	156	400	432	400	432	400	432	400	432			
4003	-8709	0	0	0	0	0	0	0	0	63	16203	16594	2485E+08	5111	27372	63	468	512	468	512	468	512	468	512			
4004	-8834	0	0	0	0	0	0	0	0	100	17140	17127	2458E+08	6031	26102	100	568	624	568	624	568	624	568	624			
4005	-8833	0	0	0	0	0	0	0	0	123	12646	13033	2281E+08	4330	24384	123	596	639	596	639	596	639	596	639			
4006	-8579	0	0	0	0	0	0	0	0	76	13109	13583	2706E+08	2627	24658	76	772	852	772	852	772	852	772	852			
4007	-9583	0	0	0	0	0	0	0	0	248	10864	11011	2644E+08	1900	23561	248	1020	1112	1020	1112	1020	1112	1020	1112			
4008	-8755	0	0	0	0	0	0	0	0	448	13001	13615	2581E+08	1173	30000	448	1468	1572	1468	1572	1468	1572	1468	1572			
4009	-8664	0	0	0	0	0	0	0	0	102	12029	12541	2509E+08	2895	23118	102	1570	1686	1570	1686	1570	1686	1570	1686			
4010	-8625	0	0	0	0	0	0	0	0	172	12404	12674	2675E+08	3477	22166	172	1742	1930	1742	1930	1742	1930	1742	1930			
4011	-8745	0	0	0	0	0	0	0	0	106	16074	16740	2485E+08	9372	26562	106	1848	1988	1848	1988	1848	1988	1848	1988			
4012	-8756	0	0	0	0	0	0	0	0	294	15956	16321	2661E+08	1074	28502	294	2142	2294	2142	2294	2142	2294	2142	2294			
4013	-8719	0	0	0	0	0	0	0	0	162	13588	13610	2525E+08	5781	27058	162	2304	2453	2304	2453	2304	2453	2304	2453			
4014	-8549	0	0	0	0	0	0	0	0	88	14547	14946	2368E+08	6009	24737	88	2392	2568	2392	2568	2392	2568	2392	2568			
4015	-9528	0	0	0	0	0	0	0	0	105	10250	10636	2463E+08	7259	24552	105	2498	2685	2498	2685	2498	2685	2498	2685			
4016	-9677	0	0	0	0	0	0	0	0	565	10659	11183	2443E+08	1765	23568	565	3064	3264	3064	3264	3064	3264	3064	3264			
4017	-8918	0	0	0	0	0	0	0	0	216	12615	13195	2448E+08	1671	25785	216	3280	3492	3280	3492	3280	3492	3280	3492			
4018	-8930	0	0	0	0	0	0	0	0	156	11925	12452	2547E+08	2610	25576	156	3436	3650	3436	3650	3436	3650	3436	3650			
4019	-8694	0	0	0	0	0	0	0	0	85	19734	19899	2731E+08	9307	25044	85	3522	3758	3522	3758	3522	3758	3522	3758			
4020	-8640	0	0	0	0	0	0	0	0	248	14105	14535	2609E+08	1240	28802	248	3770	4018	3770	4018	3770	4018	3770	4018			
4021	-8534	0	0	0	0	0	0	0	0	122	7611	8158	2671E+08	577	21304	122	3892	4152	3892	4152	3892	4152	3892	4152			
4022	-8775	0	0	0	0	0	0	0	0	189	16572	16527	2696E+08	4695	30000	189	4080	4352	4080	4352	4080	4352	4080	4352			
4023	-8720	0	0	0	0	0	0	0	0	142	16325	17165	2232E+08	5917	25471	142	4222	4503	4222	4503	4222	4503	4222	4503			
4024	-8659	0	0	0	0	0	0	0	0	230	17053	17431	2517E+08	5175	30000	230	4512	4808	4512	4808	4512	4808	4512	4808			
4025	-8675	0	0	0	0	0	0	0	0	20	15386	15723	1948E+08	9808	21000	20	4532	4840	4532	4840	4532	4840	4532	4840			
4026	-8649	0	0	0	0	0	0	0	0	25	16515	17350	2854E+08	11187	28350	25	4558	4878	4558	4878	4558	4878	4558	4878			
4027	-8584	0	0	0	0	0	0	0	0	952	7431	7787	2515E+08	6251	25356	952	5510	5842	5510	5842	5510	5842	5510	5842			
4028	-8754	0	0	0	0	0	0	0	0	80	15440	15499	2739E+08	3536	28413	80	5590	5934	5590	5934	5590	5934	5590	5934			
4029	-8548	0	0	0	0	0	0	0	0	136	14675	15300	2644E+08	3262	28316	136	5786	6142	5786	6142	5786	6142	5786	6142			
4030	-8912	0	0	0	0	0	0	0	0	28	14165	14723	3367E+08	5976	22312	28	5814	6142	5814	6142	5814	6142	5814	6142			
4031	-8670	0	0	0	0	0	0	0	0	76	21619	22175	2341E+08	13747	30300	76	5890	6270	5890	6270	5890	6270	5890	6270			
4032	-8705	0	0	0	0	0	0	0	0	104	15644	16377	2994E+08	6449	30300	104	5998	6390	5998	6390	5998	6390	5998	6390			
4033	-8527	0	0	0	0	0	0	0	0	340	21035	21549	2543E+08	4333	30300	340	6338	6742	6338	6742	6338	6742	6338	6742			
4034	-8734	0	0	0	0	0	0	0	0	36	13628	13907	2247E+08	7323	23513	36	6374	6790	6374	6790	6374	6790	6374	6790			
4035	-8745	0	0	0	0	0	0	0	0	512	15277	15801	2610E+08	3737	30300	512	6886	7314	6886	7314	6886	7314	6886	7314			
4036	-8849	0	0	0	0	0	0	0	0	88	19527	19889	2471E+08	8060	28420	88	6974	7414	6974	7414	6974	7414	6974	7414			
4037	-8578	0	0	0	0	0	0	0	0	172	8200	8555	2497E+08	2907	21331	172	7146	7508	7146	7508	7146	7508	7146	7508			
4038	-8478	0	0	0	0	0	0	0	0	350	14337	14709	2614E+08	4580	30300	350	7456	7950	7456	7950	7456	7950	7456	7950			
4039	-8710	0	0	0	0	0	0	0	0	32	15545	16145	2071E+08	10638	24364	32	7528	8004	7528	8004	7528	8004	7528	8004			
4040	-8778	0	0	0	0	0	0	0	0	142	16104	16664	2465E+08	5671	29718	142	7670	8158	7670	8158	7670	8158	7670	8158			
4041	-8535	0	0	0	0	0	0	0	0	178	12283	12622	2341E+08	4104	23495	178	7848	8348	7848	8348	7848	8348	7848	8348			
4042	-8593	0	0	0	0	0	0	0	0	29	12875	13315	2193E+08	5824	21831	29	7876	8388	7876	8388	7876	8388	7876	8388			
4043	-8593	0	0	0	0	0	0	0	0	88	13876	14441	2130E+08	7044	22503	88	7964	8448	7964	8448	7964	8448	7964	8448			
4044	-8637	0	0	0	0	0	0	0	0	262	16103	16628	2532E+08	4537	25977	262	8226	8722	8226	8722	8226	8722	8226	8722			
4045	-8908	0	0	0	0	0	0	0	0	124	11502	12249	2722E+08	1230	23843	124	8350	8898	8350	8898	8350	8898	8350	8898			
4046	-8626	0	0	0	0	0	0	0	0	272	14333	14721	2561E+08	3527	25431	272	8622	9142	8622	9142	8622	9142	8622	9142			
4047	-8538	0	0	0	0	0	0	0	0	150	14569	15175	2599E+08	6235	30000	150	8782	9354	8782	9354	8782	9354	8782	9354			
4048	-8506	0	0	0	0	0	0	0	0	124	20135	20674	2533E+08	12024	30000	124	8906	9430	8906	9430	8906	9430	8906	9430			
4049	-8588	0	0	0	0	0	0	0	0	190	15589	16366	2741E+08	5623	27412	190	9096	9632	9096	9632	9096	9632	9096	9632			
4050	-8703	0	0	0	0	0	0	0	0	228	11866	12426	2420E+08	2208	24447	228	9324	9932	9324	9932	9324	9932	9324	9932			

TABLE 72

SUMMARY OF DATA ON EACH CHANNEL
B-58 SEQUENCE D BIVARIATE DISTRIBUTION OF PEAKS AND VALLEYS

***** G R O U N D C A T A ***** A I R B O R N E D A T A *****																
CHAN	NUM	NO. OF	NC. OF	NUM	MAX	MIN	NO. CF	STRESS	STRESS	1.0 G	MAX	MIN	NO. OF	STRESS	STRESS	1.0 G
NO.	REC	PEAKS	POINTS	FLTS	STRESS	STRESS	PEAKS	MEAN	VARIANCE	VARIANCE	STRESS	STRESS	PEAKS	MEAN	VARIANCE	VARIANCE
4	2572	205182	216010	901	0.	0.	0	0.0.	0.	0.	30000.	-15000.	205182	15077.	.3262E+08	.2544E+08
5	2572	205060	216044	914	0.	0.	0	0.0.	0.	0.	30000.	-15000.	205060	14691.	.3321E+08	.2552E+08
6	2577	205634	216454	917	0.	0.	0	0.0.	0.	0.	30000.	-15000.	206634	15036.	.3218E+08	.2539E+08
TOT	7721	615876	648508	2832	0.	0.	0	0.0.	0.	0.	30000.	-15000.	616876	14935.	.3270E+08	.2545E+08

TABLE 73

CUMULATIVE PROBABILITY FOR NEGATIVE GROUND PEAK DISTRIBUTION DATA
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-2000.	19	67.	1.00000000
-4000.	1	28.	.50574468
-10000.	1	27.	.57446909
-12000.	2	26.	.55319149
-14000.	12	24.	.51063830
-16000.	12	12.	.25531915
-18000.	0	0.	0.00000000

TABLE 74

CUMULATIVE PROBABILITY FOR POSITIVE GROUND PEAK DISTRIBUTION DATA
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	22	47.	1.00000000
4000.	6	25.	.53191489
5000.	12	10.	.40425532
6000.	1	7.	.14893617
7000.	2	6.	.12765957
10000.	2	4.	.08513638
12000.	2	2.	.04255319
14000.	0	0.	0.00000000

TABLE 75

CUMULATIVE PROBABILITY FOR NEGATIVE AIRBORNE PEAK DISTRIBUTION DATA
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
-1500.	8977	10793.	1.00000000
-3000.	1308	2716.	.25164458
-4000.	647	1318.	.12211519
-5000.	304	671.	.06216992
-6000.	157	367.	.03400352
-7000.	97	210.	.01945706
-8000.	42	113.	.01046975
-9000.	31	71.	.00657834
-10000.	24	40.	.00370611
-12000.	10	16.	.00149244
-14000.	3	6.	.00055592
-16000.	2	3.	.00027796
-20000.	1	1.	.00009265
-25000.	0	0.	0.00000000

TABLE 76

CUMULATIVE PROBABILITY FOR POSITIVE AIRBORNE PEAK DISTRIBUTION DATA
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
3000.	3031	10793.	1.00000000
4000.	4943	7762.	.71916983
5000.	1112	5819.	.53914574
6000.	837	4787.	.43611600
7000.	629	3870.	.35855574
8000.	497	3241.	.30029722
9000.	325	2744.	.25423886
10000.	588	2419.	.22412675
12000.	411	1831.	.15964699
14000.	377	1420.	.13156676
16000.	297	1043.	.09663671
18000.	232	756.	.07004540
20000.	524	524.	.04854999
25000.	0	0.	0.00000000

TABLE 77

CUMULATIVE PROBABILITY FOR NUMBER OF GROUND PEAKS PER FLIGHT DATA
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

VALUE	FREQ DIST	CUM DIST	PROBABILITY
0.	200	236.	1.00000000
1.	27	36.	.15254237
2.	2	9.	.03813559
3.	2	7.	.02966102
4.	1	5.	.02119644
7.	2	4.	.01694915
9.	1	2.	.00847458
11.	1	1.	.00423729
12.	0	0.	0.00000000

TABLE 78

CUMULATIVE PROBABILITY FOR NUMBER OF AIRBORNE PEAKS PER FLIGHT DATA
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

VALUE	FREQ	DIST	CUM	DIST	PROBABILITY
1.	40		236.		1.00000000
26.	80		196.		.93050847
51.	59		116.		.49152542
76.	33		57.		.24152542
101.	11		24.		.10160492
126.	5		13.		.05509475
151.	5		8.		.0389831
176.	1		3.		.01271186
201.	2		2.		.00847458
251.	0		0.		0.00000000

F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

[illegible]

TABLE 80
SUMMARY OF DATA ON EACH CHANNEL
F-106 SEQUENCE F SEPARATE POSITIVE AND NEGATIVE STRAIN DISTRIBUTIONS

***** G R O U N D A T A *****										***** A I R B O R N E D A T A *****									
CHAN	NUM	NO. OF	NO. OF	MIN	MAX	STRESS	MEAN	STRESS	1.0 G	MAX	MIN	NO. OF	STRESS	MEAN	VARIANCE	STRESS	1.0 G		
NO.	OFF	PEAKS	POINTS	FLTS	STRESS	STRESS	PEAKS	STRESS	VARIANCE	STRESS	STRESS	PEAKS	STRESS	MEAN	VARIANCE	STRESS	VARIANCE		
4	2572	10245	215014	363	2241.	-9629.	1101	8887.	.6735E+08	30000.	-15000.	189165	10734.	.4023E+08	.4585E+08				
5	2573	18455	215084	390	2219.	-9609.	1171	9137.	.6365E+08	30000.	-14903.	188245	10726.	.4026E+08	.4586E+08				
6	2572	143817	215009	323	2249.	-9635.	1158	8944.	.6464E+08	30000.	-15000.	188659	10737.	.4043E+08	.4607E+08				
TOT	7717	553539	648107	9866	22349.	-9635.	3630	8992.	.6412E+08	30000.	-15000.	566109	10732.	.4030E+08	.4593E+08				

TABLE 81
TEST RESULTS FOR B-58 DATA SET
ORIGINAL STRAIN GAGE DATA

Specimen Number	Sequence	Failure		Average No. Cycles/Flights
		Cycles	Flights	
13	A	564,937	1956	
14	A	782,822	2723	
15	A	767,827	2667	
16	A	559,334	1939	
17	A	1,166,998	3710	
18	A	<u>638,366</u>	<u>2221</u>	
	Average	746,714	2536	294
19	C	1,139,028	4047	
21	C	1,036,393	3679	
22	C	976,482	3466	
23	C	864,875	3048	
24	C	1,153,512	4096	
25	C	<u>1,104,352</u>	<u>3850</u>	
	Average	879,107	3697	237
26	B	367,520	2421	
29	B	398,787	2598	
30	B	344,768	2260	
31	B	389,847	2554	
32	B	388,495	2542	
33	B	<u>388,490</u>	<u>2542</u>	
	Average	379,651	2486	152
34	D	369,141	2511	
35	D	401,207	2717	
36	D	340,371	2338	
37	D	422,166	2887	
38	D	478,542	3211	
39	D	<u>556,902</u>	<u>3786</u>	
	Average	428,054	2908	147

Sequence A has a $\bar{\sigma}^2$ value of 19.8 ksi².

Sequence C same flight cycles as Spectrum A but ground (taxi) cycles removed. Ground stress set equal to pre-flight refueling stress.

Sequence B has a $\bar{\sigma}^2$ value of 24.9 ksi².

Sequence D same flight cycles as Spectrum B but ground (taxi) cycles removed. Ground stress set equal to pre-flight refueling stress.

TABLE 82
TEST RESULTS FOR F-106 DATA SET
ORIGINAL STRAIN GAGE DATA

Specimen Number	Sequence	Failure		Average No. Cycles/Flight
		Cycles	Flights	
40	E	2,180,569	31,882	
41	E	2,855,495	41,743	
42	E	2,430,610	35,052	
43	E	2,850,984	41,703	
44	E	3,337,040	48,777	
45	E	<u>2,161,772</u>	<u>31,593</u>	
	Average	2,636,078	38,458	<u>68.5</u>
46	F	461,041	5,472	
47	F	465,350	5,530	
48	F	323,386	3,843	
49	F	704,095	8,371	
50	F	987,347	11,781	
51	F	682,153	8,092	
56	F	743,264	8,933	
57	F	<u>631,791</u>	<u>7,480</u>	
	Average	624,803	7,441	<u>83</u>

Sequence E has a $\bar{\sigma}^2$ value of 18.23×10^6
Sequence F has a $\bar{\sigma}^2$ value of 41.90×10^6

$\bar{\sigma}^2$ is a weighted average which was calculated by the following equation

$$\bar{\sigma}_{\text{weighted}}^2 = \frac{\sum_{i=1}^N \bar{\sigma}_i^2 n_i}{\sum_{i=1}^N n_i}$$

where

$\bar{\sigma}_i^2$ = variance of flight i about the mean of the
absolute stress peaks and valleys of flight i
 n_i = number of stress reversals in flight i
 N = number of flights in data set

TABLE 83
TEST RESULTS FOR SIMULATED B-58 SEQUENCE A

Specimen Number	Sequence	Failure		Average No. Cycles/Flight
		Cycles	Flights	
75	A	414,810	1712	
76	Folded	270,010	1127	
77	See	320,866	1335	
78	Paragraph	286,890	1197	
79	5.1.1	<u>302,445</u>	<u>1262</u>	
	Average	319,004	1326	<u>240</u>
107	A	471,162	2084	
108	Bivariate	502,945	2219	
109	Peak & Valley	540,842	2417	
110	See	457,182	2018	
111	Paragraph	497,683	2123	
112	5.1.2	<u>532,120</u>	<u>2325</u>	
	Average	500,322	2198	<u>227</u>

TABLE 84

TEST RESULTS FOR SIMULATED F-106 SEQUENCE E

Specimen Number	, Sequence	Failure		Average No. Cycles/Flight
		Cycles	Flights	
	E			
80	Bivariate	536,792	18,931	
81	Mean &	676,273	23,951	
82	Alternating	595,466	21,116	
83	See	442,538	14,616	
84	Paragraph	683,415	24,187	
85	5.2.1	<u>716,849</u>	<u>25,312</u>	
	Average	608,555	21,352	<u>28.5</u>
	E			
86	Separate	1,065,420	46,169	
87	Peak &	1,410,488	60,982	
88	Valleys	799,311	34,667	
89	See	886,290	38,339	
91	Paragraph	661,348	28,593	
92	5.2.2	<u>1,137,803</u>	<u>49,204</u>	
	Average	993,443	42,992	<u>23.1</u>
	E			
93	Limited	785,727	35,575	
94	Separate	1,184,699	53,586	
95	Peak &	923,274	41,752	
96	Valley	786,942	35,630	
97	See	837,690	37,852	
98	Paragraph	1,052,178	47,619	
	5.2.3			
	Average	<u>928,418</u>	<u>42,002</u>	<u>22.1</u>

TABLE 85

TEST RESULTS FOR SIMULATED B-58 SEQUENCE B, C, AND D

Specimen Number	Sequence	Failure Cycles	Flights	Average No. Cycles/Flight
125	C	556,685	2487	
126	Bivariate	910,042	4071	
127	Peak and	888,343	3981	
128	Valley	620,371	2770	
130	See	581,368	2607	
131	Paragraphs 5.1.2 and 5.4.1	505,582	2268	
	Average	<u>677,065</u>	<u>3031</u>	<u>223</u>
132	B	264,329	2161	
133	Bivariate	315,276	2547	
134	Peak and	360,874	2959	
135	Valley	243,023	1998	
136	See	282,724	2295	
137	Paragraphs 5.1.2 and 5.4.1	269,424	2201	
	Average	<u>289,275</u>	<u>2360</u>	<u>122</u>
140	D	414,844	3564	
141	Bivariate	499,617	4300	
142	Peak and	385,938	3315	
143	Valley	397,527	3413	
	See Paragraphs 5.1.2 and 5.4.1			
	Average	<u>424,481</u>	<u>3648</u>	<u>116</u>

TABLE 86
TEST RESULTS FOR SIMULATED F-106
SEQUENCE F

Specimen Number	Sequence	Failure		Average No. Cycles/Flight
		Cycles	Flights	
113	F	192,248	6721	
114	Separate	209,853	7344	
115	Peak & Valleys	308,147	10736	
116	See	175,749	6175	
117	Paragraphs	158,982	5557	
118	5.2.2 and	172,224	6043	
	5.4.2			
	Average	<u>202,867</u>	<u>7096</u>	<u>28.6</u>

TABLE 87
TEST DATA SUMMARY

Method	Specimens	Cycles/ Flight	Tape, Channels	Average Flights to Failure
<u>B-58 DATA SET</u>				
B58 Seq. A Original Data	13-18	294	21, 1-3	2,536
B58 Seq. A Folded Dist. Simulation	75-79	240	25, 1-3	1,326
B58 Seq. A Bivariate P&V Simulation	107-112	227	31, 12-14	2,198
B58 Seq. C Original Data	19, 21-25	237	21, 4, 5	3,697
B58 Seq. C Bivariate P&V Simulation	125-128, 130, 131	223	33, 1-3	3,031
B58 Seq. B Original Data	26, 29-33	152	21, 8, 9, 11	2,486
B58 Seq. B Bivariate P&V Simulation	132-137	122	33, 4-6	2,360
B58 Seq. D Original Data	34-39	147	21, 12-14	2,908
B58 Seq. D Bivariate P&V Simulation	140-143	116	33, 8, 9, 11	3,648
<u>F106 DATA SET</u>				
F106 Seq. E Original Data	40-45	68.5	19, 1-3	38,458
F106 Seq. E Bivariate Mean & Alt Sim.	80-85	28.5	26, 1-3	21,352
F106 Seq. E Separate P&V Simulation	86-89, 91, 92	23.1	26, 4-6	42,992
F106 Seq. E Limited Separate P&V Sim.	93-98	22.1	26, 8, 9, 11	42,002
F106 Seq. F Original Data	46-51, 56, 57	83	19, 8, 9, 11	7,441
F106 Seq. F Separate P&V Simulation	113-118	28.6	31, 1-3	7,096