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PROPELLANT SURVEILLANCE REPORT LGM-30 A, B, F & G STAGE I TP-HI--ETC(U)  
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UNITED STATES AIR FORCE

PROPELLANT  
SURVEILLANCE REPORT  
LGM-30A, B, F&G STAGE I  
TP-H 1043

PROPELLANT LAB SECTION

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(6) PROPELLANT SURVEILLANCE REPORT  
LGM-30 A, B, F & G STAGE I  
TP-H1043 AFT CLOSURE PROPELLANT

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## ABSTRACT

This report contains propellant test results from cartons of TP-H1043 propellant representing selected batches used in the aft closure of First Stage Minuteman Motors. Data from TP-H1043 propellant obtained from the aft closures of the LCM-30 A, B, F, and G Motors are reported in regression analyses for the sixth time and the fifth time using the G085 Computer System. In previous reports, A, B, F, and G data were combined for statistical analysis. For this report, a separate statistical analysis was made for A and B (wing 2) and F and G (wing 6). The statistical analysis includes regressions and covariance analysis. Testing was accomplished in accordance with MMWRBA Project M8293C.

An analysis of all parameters indicate that no significant degradation is anticipated for at least two years past the oldest data point.

Each point on the regression plot represents all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot. The data range at any age can be found by suitable inquiry of the G085 System.

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| <u>Report Nr</u> | <u>Title</u>                                     | <u>Report Date</u> |
|------------------|--------------------------------------------------|--------------------|
|                  | LGM-30 First Stage, Wing I Test Reports          |                    |
| 29D              | Zero Time Test Results (Aft Closure)             | 9 Jun 64           |
| 29E              | Zero Time (Aft Closure Supplement 1)             | 24 Jun 64          |
| 32B              | Zero Time, Wings II-V Test Results (Aft Closure) | 18 Mar 65          |
| 185              | ATP Phase I, Wing VI Series III                  | Jun 70             |
| 195              | ATP Phase III, Wing II-V                         | Nov 70             |
| 239              | Propellant Surveillance Report (TP-H1043)        | Apr 72             |
| 288              | Propellant Surveillance Report (TP-H1043)        | Mar 74             |
| 337              | Propellant Surveillance Report (TP-H1043)        | Feb 76             |
| 385              | Propellant Surveillance Report (TP-H1043)        | Dec 77             |
| 424              | Propellant Surveillance Report (TP-H1043)        | Nov 79             |

# GLOSSARY OF TERMS AND ABBREVIATIONS

|                     |                                                                                                                                                                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aging Trend         | A change in properties or performance resulting from aging of material or component                                                                                                                                                                                                                         |
| CSA                 | Cross Sectional Area                                                                                                                                                                                                                                                                                        |
| DB                  | Dogbone                                                                                                                                                                                                                                                                                                     |
| Degradation         | Gradual deterioration of properties or performance                                                                                                                                                                                                                                                          |
| E                   | Modulus (psi), defined as stress divided by strain along the initial linear portion of the curve                                                                                                                                                                                                            |
| EB                  | End Bonded                                                                                                                                                                                                                                                                                                  |
| EGL                 | Effective Gage Length                                                                                                                                                                                                                                                                                       |
| em                  | Strain at maximum stress                                                                                                                                                                                                                                                                                    |
| er                  | Strain at rupture                                                                                                                                                                                                                                                                                           |
| "F" ratio           | The ratio of the variance accounted for by the regression function to the random unexplained variance. The regression function having the most significant "F" ratio is used for plotting data. The ratio is also used in detecting significant changes in random variation between succeeding time points. |
| JANNAF              | Joint Army, Navy, NASA, Air Force Committee                                                                                                                                                                                                                                                                 |
| MAGCP               | Propellant Lab Section at OOAMA                                                                                                                                                                                                                                                                             |
| OOAMA               | Ogden Air Materiel Area, Air Force Logistics Command                                                                                                                                                                                                                                                        |
| Regression Equation | The general form of the regression equation is $Y = a + bx$                                                                                                                                                                                                                                                 |
| Regression Line     | Line representing mean test values with respect to time                                                                                                                                                                                                                                                     |
| $S_b$               | Standard error of estimate of the regression coefficient                                                                                                                                                                                                                                                    |
| $S_e$ or $S_{Y.X}$  | Standard deviation of the data about the regression line                                                                                                                                                                                                                                                    |

# GLOSSARY OF TERMS AND ABBREVIATIONS (cont)

|                           |                                                                                                                                                                                                                        |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SM                        | Maximum Stress                                                                                                                                                                                                         |
| Sr                        | Stress at rupture                                                                                                                                                                                                      |
| Standard<br>Deviation(S ) | Square root of variance                                                                                                                                                                                                |
| Strain Rate               | Crosshead speed divided by the EGL                                                                                                                                                                                     |
| "t" test                  | A statistical test used to detect significant differences between a measured parameter and an expected value of the parameter (determines if regression slope differs from zero at the 95% confidence level)           |
| Variance                  | The sum of squares of deviations of the test results from the mean of the series after division by one less than the total number of test results                                                                      |
| 3 Sigma Band              | The area between the upper and lower 3 sigma limit. It can be expected that 99.73% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed. |
| 90-90 Band                | It can be stated with 90% confidence that 90% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed.                                      |

## INTRODUCTION

### A. PURPOSE:

Quality assurance tests have been conducted for 14 1/2 years on First Stage LGM-30 TP-H1043 aft closure propellant.

Statistical analysis of the tests performed, as directed by Engineering, should provide early warning if serious degradation trends occur. Evaluation of the propellant provides data that can be put directly into engineering reliability and service life predictions. Testing was performed in accordance with MMWRBA Directive GTD-1C, Amendments 1 and 2.

### B. BACKGROUND:

TP-H1043 propellant is used in the aft closure of the LGM-30 A, B, F, and G First Stage Motors.

This test period represents the sixth time that TP-H1043 propellant has been reported by regression analysis. This is also the fifth time that data has been processed utilizing the G085 System.

### C. SAMPLING PLAN:

As many as four aft closures are cast from the one TP-H1043 propellant mix. In order to reduce the number of tests, only one batch from each mix will be tested to obtain uniform test results. The selected batches are from the same batch as those previously tested and reported in MANCP Reports 185(70), 195(70), 239(72), 288(74), 385(77), and 424(79).

Low rate tensile, high rate tensile and hardness tests were performed on each propellant batch mix.

## STATISTICAL ANALYSIS

Analysis of covariance was selected as a method of statistically comparing regression trend lines from wing 2 and wing 6 data. Although both groups of data are from the same population, they have undergone unknown biasing and will be handled separately. This was discovered during the analysis of covariance test. Therefore, these two groups of data will no longer be statistically placed in the same regressions.

Linear regression analysis was selected as the method for data evaluation. Data from different time periods were used to establish a least squares trend line for the data. The variance about the regression line, obtained using individual values of the dependent variable, was used to compute a tolerance interval such that at the 90% confidence level, 90% of the sample distribution fall within this interval. This tolerance interval was extrapolated to a maximum of 24 months. The "t" values and the significance of this statistic, which are reported for each regression model, give an indication of the "statistical significance" of the slope of the trend line as compared to a line of zero slope.

Each point on the regression analysis is a calculation of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet accompanying each regression plot. The data range at any age can be found by suitable inquiry of the G085 System.

The analysis of covariance uses lower experimental error and a more precise comparison among treatments (wings). The regressions may differ in slope direction, elevation, or in residual variances. The most convenient approach is to compare the residual variance first, then the

slopes, and lastly the elevations. The residual mean squares are compared by the two-tailed F-test at the 5% significant level. The null hypothesis that Wing 2 and Wing 6 population residual variances are statistically equal must be rejected in all comparisons. The scatter of the points about the individual regression lines suggests that the differences in slope and elevation may be attributed to sampling variations.

The slight difference in slope and trend directions found in Wing 2 and Wing 6 data are mostly due to differences in sample quantities and number of test periods represented. However, all regression slopes are statistically close to a linear line of zero slope regardless of the direction. Additional Wing 6 testing should provide the required number of samples which should provide compatibility with the Wing 2 test results.

## TEST RESULTS

### A. LOW RATE TENSILE:

The strains at maximum stress for wing two and wing six regressions (Fig 1 and 2), show a statistically significant decreasing slope. The analysis of covariance (Table 2), shows a statistically significant difference in variance and elevation with no significant difference in slope.

For maximum stress the wing two regression shows a statistically decreasing slope and the wing six regression shows a non-significant slope (Fig 3 and 4). The analysis of covariance shows a statistically significant difference for variance, slope, and elevation (Table 3).

The strain at rupture, for wing 2, shows a statistically significant increasing slope with a statistically significant decreasing slope for the wing six regression (Fig 5 and 6). The analysis of covariance shows a statistically significant difference for variance, slope, and elevation (Table 4).

The stress at rupture regression for wing two shows a statistically significant decreasing slope with a non-significant slope for wing six (Fig 7 and 8). The analysis of covariance shows a statistically significant difference for variance, slope, and elevation (Table 5).

Modulus regressions show a statistically significant decreasing slope for wing two and a non-significant slope for wing six (Fig 9 and 10). The analysis for covariance shows a statistically significant difference for variance, slope, and elevation (Table 6).

### B. HIGH RATE TENSILE:

The strain at maximum stress regression for wing two shows a statistically significant decreasing slope and the wing six regression shows a statistically significant increasing slope (Fig 11 and 12). The analysis of covariance shows a statistically significant difference for variance, slope, and elevation (Table 7).

The maximum stress regression shows a statistically significant decreasing slope, with wing six regression showing a statistically significant increasing slope (Fig 13 and 14). The analysis for covariance shows a statistically significant difference for variance and slope with no significant difference for elevation (Table 8).

Strain at rupture regressions show a statistically significant decreasing slope for wing two and a statistically significant increasing slope for wing six (Fig 15 and 16). The analysis for covariance shows a statistically significant difference for variance, slope, and elevation (Table 9).

Stress at rupture regressions shows a statistically non-significant slope for wing two and wing six (Fig 17 and 18). The analysis for covariance shows a statistically significant difference for variance, slope, and elevation (Table 10).

Modulus regressions show a statistically significant increasing slope for wing two and a statistically significant decreasing slope for wing six (Fig 19 and 20). The analysis for covariance shows a statistically significant difference for variance, slope, and elevation (Table 10).

#### C. HARDNESS:

Shore A initial hardness regressions for wing two and wing six show statistically significant increasing slopes (Fig 21 and 22). The analysis for covariance shows a statistically significant difference for variance, slope, and elevation (Table 11).

Shore A ten second hardness regressions show a statistically significant increasing slope for wing two and a statistically significant decreasing slope for wing six (Fig 23 and 24). The analysis for covariance

shows a statistically significant difference for variance and slope with no difference for elevation (Table 12).

Shore C initial hardness regression shows a statistically significant decreasing slope for wing two and wing six (Fig 25 and 26). Analysis for covariance shows a statistically significant difference for variance and elevation with no difference for slope (Table 13).

Shore C ten second hardness regressions show a statistically significant decreasing slope (Fig 27 and 28). Analysis for covariance shows a statistically significant difference for variance, slope, and elevation (Table 14).

## CONCLUSIONS AND RECOMMENDATIONS

Wing two and wing six data cannot be combined for statistical analysis.

For both wing two and wing six, the slopes of the regressions are gradual and close to a line of zero slope. From this analysis, the propellant degradation is gradual and the propellant service life may be extended for at least two years beyond the date of the last testing.

It is recommended that testing be continued to assure service life extension and confirm present trends.

TABLE 1  
ANALYSIS OF COVARIANCE  
COMPARISON OF REGRESSIONS AT THE 5 % SIGNIFICANT LEVEL

| ** TYPE **             |                      | ** REGRESSIONS ** |       |           |
|------------------------|----------------------|-------------------|-------|-----------|
| TEST                   |                      | VARIANCE          | SLOPE | ELEVATION |
| TENSILE -- LOW RATE -- | strain at max stress | S.                | N.S.  | S.        |
|                        | max stress           | S.                | S.    | S.        |
|                        | strain at rupture    | S.                | S.    | S.        |
|                        | stress at rupture    | S.                | S.    | S.        |
|                        | modulus              | S.                | S.    | S.        |
|                        |                      |                   |       |           |
|                        | -- HIGH RATE --      |                   |       |           |
|                        | strain at max stress | S.                | S.    | S.        |
|                        | max stress           | S.                | S.    | N.S.      |
|                        | strain at rupture    | S.                | S.    | S.        |
| HARDNESS -- SHORE A -- | stress at rupture    | S.                | S.    | S.        |
|                        | modulus              | S.                | S.    | S.        |
|                        |                      |                   |       |           |
|                        | initial              | S.                | S.    | S.        |
|                        | 10-sec.              | S.                | S.    | N.S.      |
|                        |                      |                   |       |           |
| -- SHORE C --          | initial              | S.                | N.S.  | S.        |
|                        | 10-sec.              | S.                | S.    | S.        |

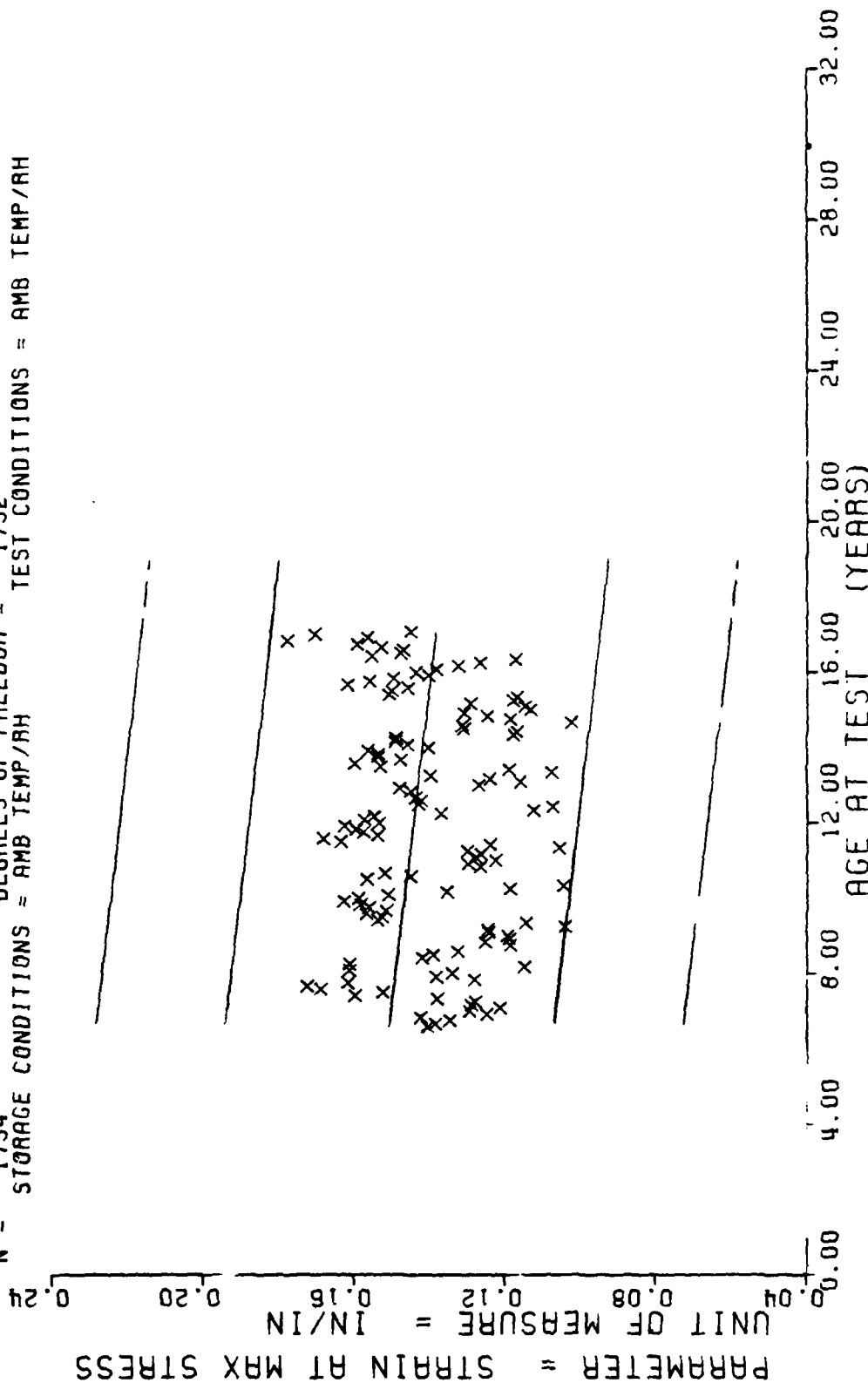
N.S.=Not significantly different  
S. =Significantly different

[illegible]

STAGE 1, 416.2, TP-H1043, STAIN AT MAX GTP45, LOW RATE, CHS=2.0

This sample size summary is applicable to figure 1, 3, 5, 7, and 9

$Y = ((+1.5842743E-01) + (-9.8519768E-05) * X)$   
 $F = +4.2054089E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_r = +2.6238808E-02$   
 $R = -1.5310393E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +1.5192150E-05$   
 $L = +6.4849124E+00$  SIGNIFICANCE OF L = SIGNIFICANT  $S_t = +2.5936854E-02$   
 $N = 1754$  DEGREES OF FREEDOM = 1752  
 STORAGE CONDITIONS = AMB TEMP/ RH TEST CONDITIONS = AMB TEMP/ RH



STAGE 1. WING 2. IP-H1043. STRAIN AT MAX STRESS. LOW RATE. CHS=2.0

Figure 1

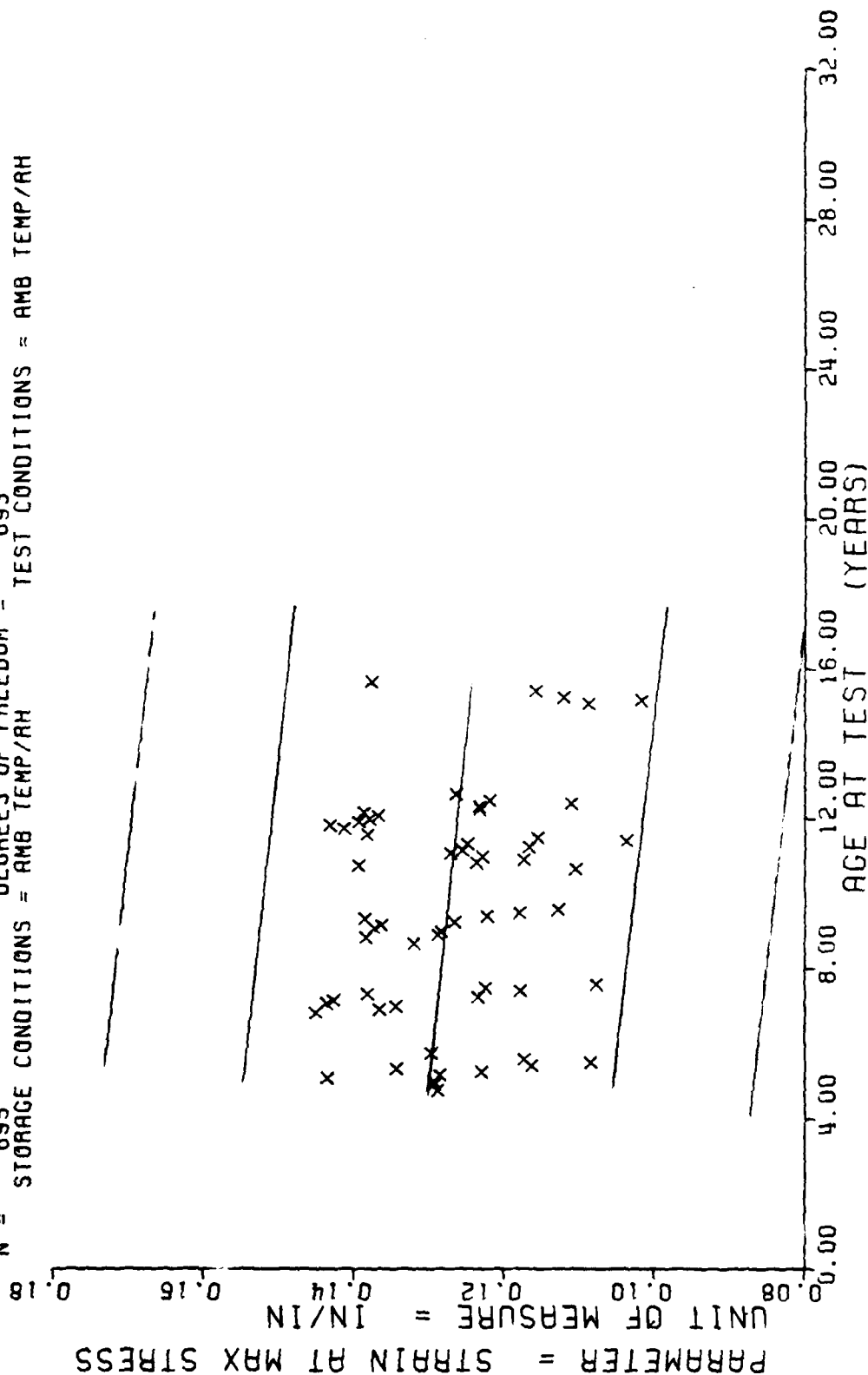
\*\*\* SAMPLE SIZE SUMMARY \*\*\*

| AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 57           | 1          | 106          | 24         | 147          | 14         |              |            |
| 58           | 0          | 110          | 18         | 148          | 15         |              |            |
| 60           | 3          | 111          | 27         | 149          | 12         |              |            |
| 61           | 6          | 112          | 16         | 150          | 5          |              |            |
| 62           | 0          | 117          | 24         | 152          | 3          |              |            |
| 63           | 6          | 116          | 14         | 161          | 5          |              |            |
| 64           | 3          | 115          | 9          | 162          | 3          |              |            |
| 65           | 0          | 120          | 3          | 163          | 1          |              |            |
| 66           | 9          | 129          | 3          | 165          | 2          |              |            |
| 67           | 0          | 130          | 6          | 168          | 3          |              |            |
| 69           | 3          | 171          | 15         |              |            |              |            |
| 72           | 6          | 132          | 26         |              |            |              |            |
| 73           | 6          | 133          | 20         |              |            |              |            |
| 74           | 30         | 134          | 30         |              |            |              |            |
| 80           | 12         | 135          | 17         |              |            |              |            |
| 86           | 0          | 136          | 18         |              |            |              |            |
| 87           | 15         | 137          | 21         |              |            |              |            |
| 88           | 3          | 138          | 18         |              |            |              |            |
| 89           | 18         | 139          | 3          |              |            |              |            |
| 90           | 3          | 141          | 3          |              |            |              |            |
| 91           | 3          | 142          | 6          |              |            |              |            |
| 104          | 2          | 143          | 30         |              |            |              |            |
| 106          | 3          | 144          | 20         |              |            |              |            |
| 107          | 12         | 145          | 18         |              |            |              |            |
| 108          | 21         | 146          | 24         |              |            |              |            |

STAGE 1, WING 1, 12-H1043, LIPAD AT MAX SHUT-ON, LOW PATH, CHS=2.0

This sample size summary is applicable to figure 2, 4, 6, 8, and 10

$Y = ((+1.3280526E-01) + (-4.5849890E-05) \times X)$   
 $F = +5.4767541E+00$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_t = +1.4474361E-02$   
 $R = -8.8549404E-02$  SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +1.9591905E-05$   
 $t = +2.3402466E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $S_t = +1.4427901E-02$   
 $N = 695$  DEGREES OF FREEDOM = 693  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH





$Y = ((+1.9440499E+02) + (-2.1261750E-01) * X)$   
 F = +1.4901312E+02 SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_r = +3.0974085E+01$   
 R = -2.7990167E-01 SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +1.7417537E-02$   
 t = +1.2207093E+01 SIGNIFICANCE OF t = SIGNIFICANT  $S_t = +2.9744490E+01$   
 N = 1755 DEGREES OF FREEDOM = 1753  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH

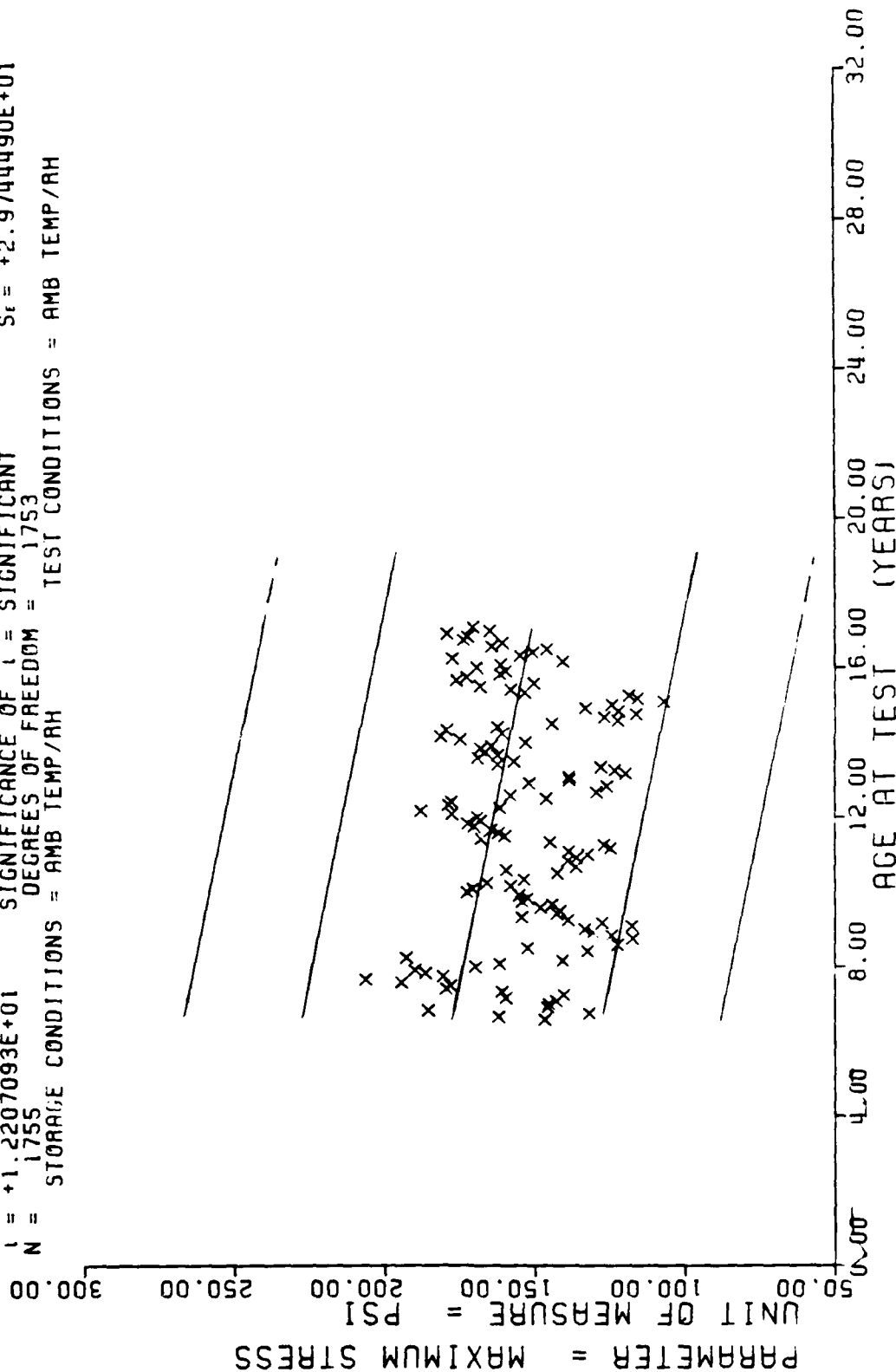




TABLE 3

ANALYSIS OF COVARIANCE  
COMPARISON OF REGRESSION LINES

ANALYSIS OF COVARIANCE COMPARES REGRESSIONS, TP-HIGH, CFE=2.0 MAX STRESS, KING-2/B

| SOURCE                    | D.F. | SUM XX      | CORRELATED SUM SQUARES | SUM XY      | SUM YX       | COEFFICIENTS | D.F.        | DEVIATIONS FROM REGRESSION | SUM SQ. | MEAN SQ. |
|---------------------------|------|-------------|------------------------|-------------|--------------|--------------|-------------|----------------------------|---------|----------|
| 1. TOTAL                  | 1754 | 0.29163E+07 | -0.62007E+06           | 0.14033E+07 | -0.21262     | 1753         | 0.15509E+07 | 854.74                     |         |          |
| 2. BETWEEN                | 244  | 0.59233E+05 | -1.2497                | 0.59233E+05 | -0.41474E-01 | 243          | 0.32130E+06 | 460.71                     |         |          |
| 3. WITHIN                 |      |             |                        |             |              |              |             |                            |         |          |
| 4. BETWEEN                | 244  | 0.30587E+07 | -0.64256E+06           | 0.20051E+07 | -0.18570     | 244          | 0.16657E+07 | 770.61                     |         |          |
| 5. TOTAL                  | 2449 | 1.35357E+07 | -1.57591E+06           | 0.16027E+07 |              | 2448         | 0.15985E+07 |                            |         |          |
| DIFFERENCE BETWEEN SLOPES |      |             |                        |             |              |              |             |                            |         |          |
| 1. BETWEEN                | 1    | 770.56      | 66656                  | 57406       |              | 1            | 13592       | 13592                      |         |          |
| 2. TOTAL                  | 2448 | 1.35357E+07 | -1.57591E+06           | 0.16027E+07 |              | 2447         | 0.15985E+07 |                            |         |          |
| DIFFERENCE ADJUSTED MEANS |      |             |                        |             |              |              |             |                            |         |          |
| 1. BETWEEN                | 1    | 770.56      | 66656                  | 57406       |              | 1            | 65.52       | 65.52                      |         |          |
| 2. TOTAL                  | 2448 | 1.35357E+07 | -1.57591E+06           | 0.16027E+07 |              | 2447         | 0.15985E+07 |                            |         |          |

STEP 1:

COMPARISON BETWEEN RESIDUAL VARIABLES : F = 1.91 (DF=1753, 692)

IF COEFFICIENCY OF RESIDUAL VARIABLES IS IDENTICAL WITH STEP 2.

STEP 2:

COMPARISON OF REGRESSION TREND LINE SLOPES : F = 17.90 (DF = 1, 2448)

COMPARISON OF REGRESSION TREND LINE DEVIATIONS : F = 189.05 (DF = 1, 2447)

STATISTICALLY DIFF.

STATISTICALLY DIFF.  
STATISTICALLY DIFF.

$Y = ((+2.7902915E-01) + (+5.6128604E-05) \cdot X)$   
 $F = +4.3818054E+00$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_1 = +4.5822020E-02$   
 $R = +4.9947882E-02$  SIGNIFICANCE OF R = SIGNIFICANT  $S_0 = +2.6813758E-05$   
 $t = +2.0932762E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $S_e = +4.5777885E-02$   
 $N = 1754$  DEGREES OF FREEDOM = 1752  
 STORAGE CONDITIONS = AMB TEMP/4H TEST CONDITIONS = AMB TEMP/4H

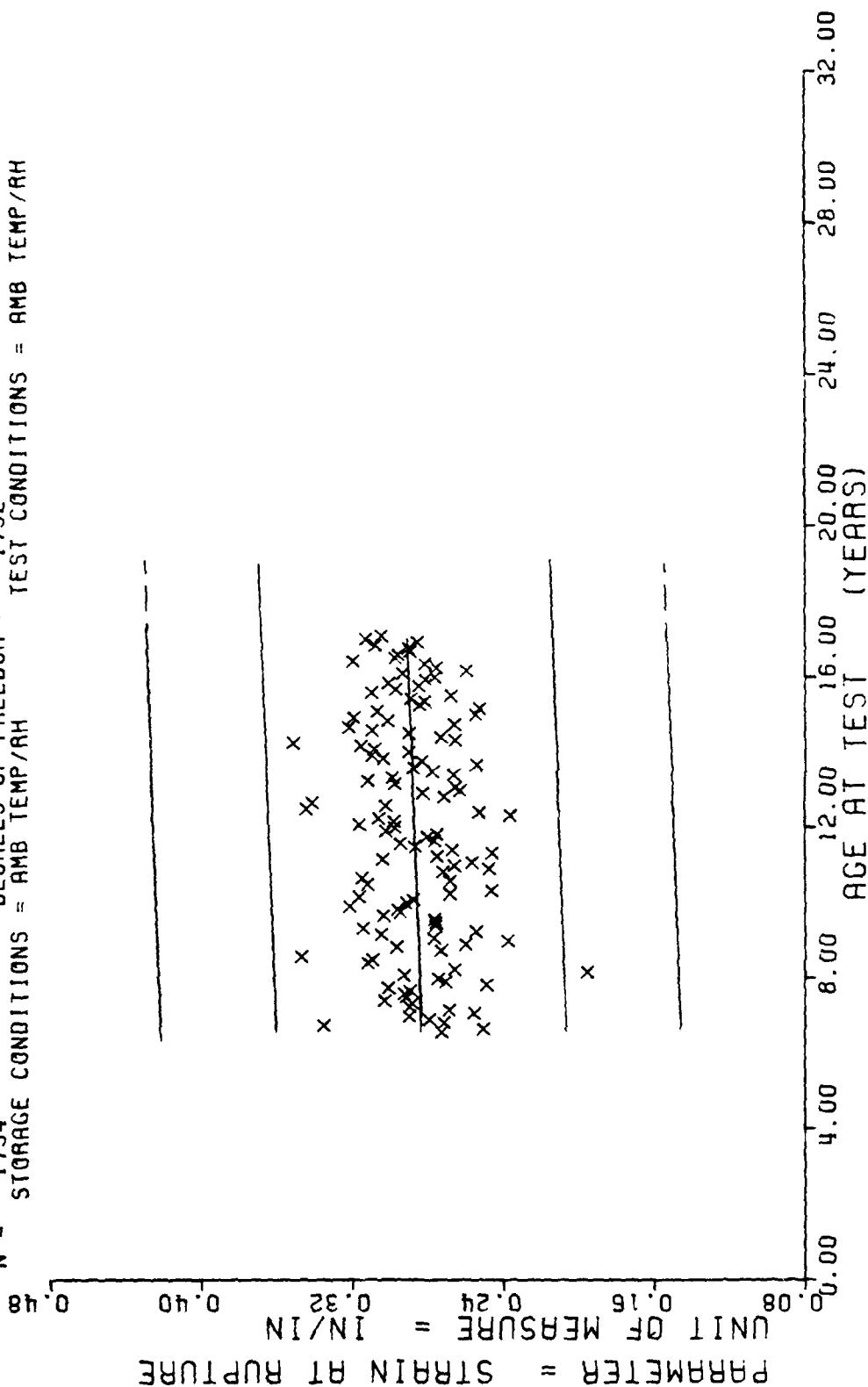
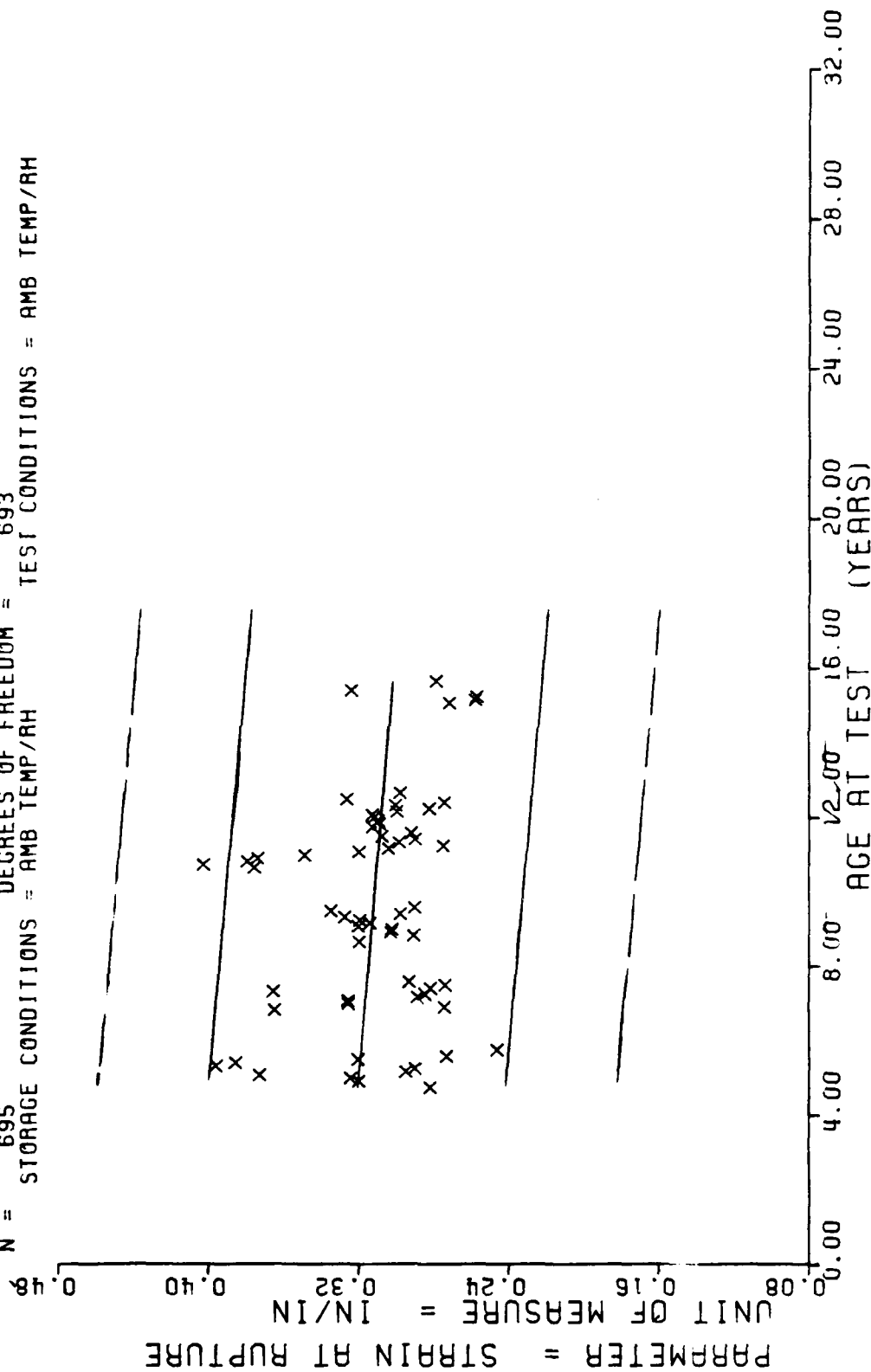


Figure 5

$Y = ((+3.2906807E-01) + (-1.4962635E-04) \times X)$   
 $F = +5.7256720E+00$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_t = +4.6205637E-02$   
 $R = -9.0523197E-02$  SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +6.2530927E-05$   
 $t = +2.3928376E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $S_t = +4.6049121E-02$   
 $N = 695$  DEGREES OF FREEDOM = 693  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1. WING 6. IP-H1043. STRAIN AT RUPTURE. LOW RATE. CHS-2.0

Figure 6

TABLE 4

UNITED STATES OF AMERICA  
DEPARTMENT OF JUSTICE  
FEDERAL BUREAU OF INVESTIGATION  
WASHINGTON, D. C. 20535

9/2/94 • 3MILLION IN 1500 • 225000 • 49TH-41ST STS IN STATION

[illegible][illegible]

U. 10272-02  
S. 41  
C. 41

1

1947年1月17日 1947年1月17日

| DATE | TIME | LOCATION | WIND  | WAVE | SEA  | TEMP | WIND | WAVE | SEA  | TEMP |
|------|------|----------|-------|------|------|------|------|------|------|------|
| 1947 | 0.36 | 17       | 75.10 | 3.47 | 5.47 | 5.47 | 5.47 | 5.47 | 5.47 | 5.47 |

[illegible]

STATISTICALLY DIFF.

COMPARISON OF REGIONAL VARIABLES :  $F = 1.01100 = 0.97, 0.1752$

IF NO CORRELATION OF REGIONAL VARIABLES IN 1960 CORRELATION WITH 1959 : 0.

STATISTICALLY DIFF.

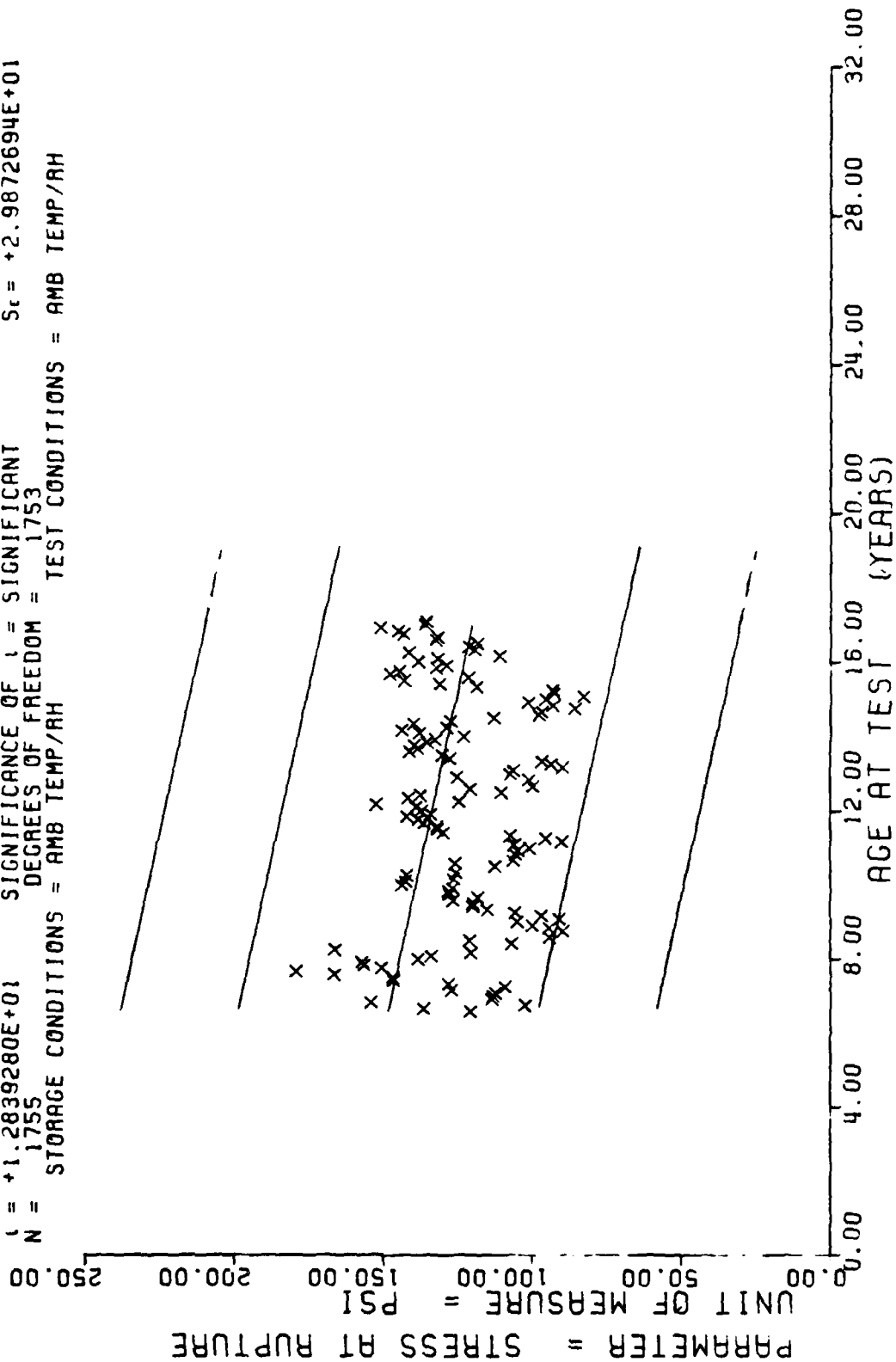
COMPARISON OF REGIONAL VARIABLES :  $F = 9.2100 = 1.02045$

COMPARISON OF REGIONAL VARIABLES :  $F = 148.1100 = 1.4448$

STATISTICALLY DIFF.

[illegible]

$F = +1.6484712E+02$  SIGNIFICANCE OF F = (-2.2459252E-01) \* X)  
 $R = -2.9317956E-01$  SIGNIFICANT  
 $t = +1.2839280E+01$  SIGNIFICANT  
 $N = 1755$  DEGREES OF FREEDOM = 1753  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1. WING 2. IP-H1043. STRESS AT RUPTURE. LOW RATE. CHS-2.0

Figure 7

$Y = ((+1.1935827E+02) + (+4.2891356E-02) \times X)$   
 $F = +3.9107742E-01$  SIGNIFICANCE OF F = NOT SIGNIFICANT  $G_1 = +5.0486385E+01$   
 $R = +2.3748831E-02$  SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_1 = +6.8586463E-02$   
 $I = +6.2536183E-01$  SIGNIFICANCE OF I = NOT SIGNIFICANT  $S_2 = +5.0508548E+01$   
 $N = 695$  DEGREES OF FREEDOM = 693  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

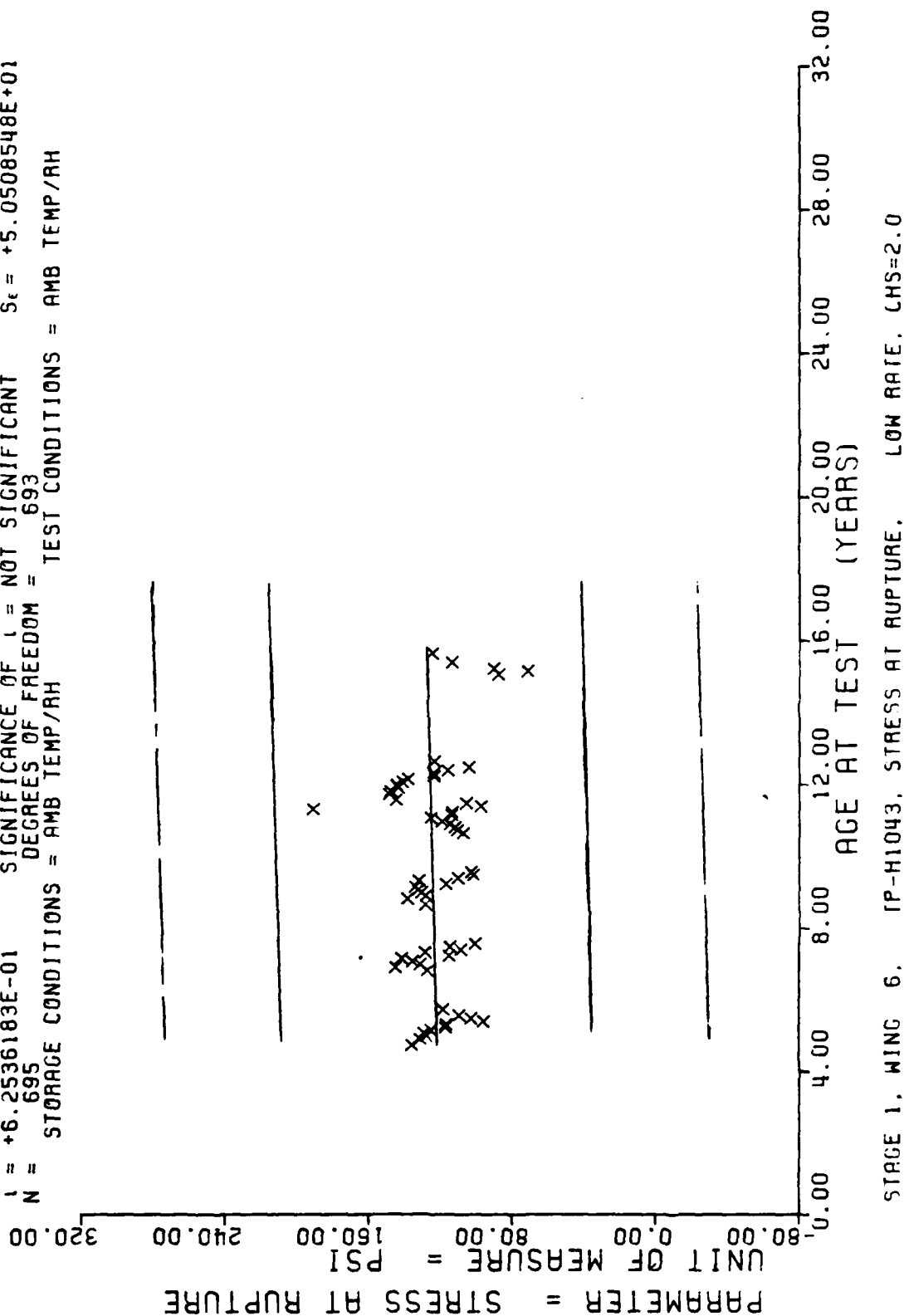


Figure 8

TABLE 5

# ANALYSIS OF COVARIANCE COMPARISON OF REGRESSION LINES

[illegible]

1131

COEFFICIENTS OF VARIATION:  $F = 2.00$  (F = 6.93, 1755)

IF PROPORTION OF RESIDUAL VARIANCES IS THE SAME WITH STEP 2.

2712

CC-PAT LSON OF REGRESSIOW TIME LINE SAMPLES : F= 24.02 (LF= 1.2446)

(255701 = J1 : S1011VAF17 T177 717M 00ISS 00934 40 1001140400)

$Y = ((+2.8298920E+03) + (-3.7111880E+00) * X)$   
 $F = +7.4885681E+01$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = -2.0246208E-01$  SIGNIFICANCE OF R = SIGNIFICANT  
 $I = +8.6536513E+00$  SIGNIFICANCE OF I = SIGNIFICANT  
 $N = 1754$  DEGREES OF FREEDOM = 1752  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

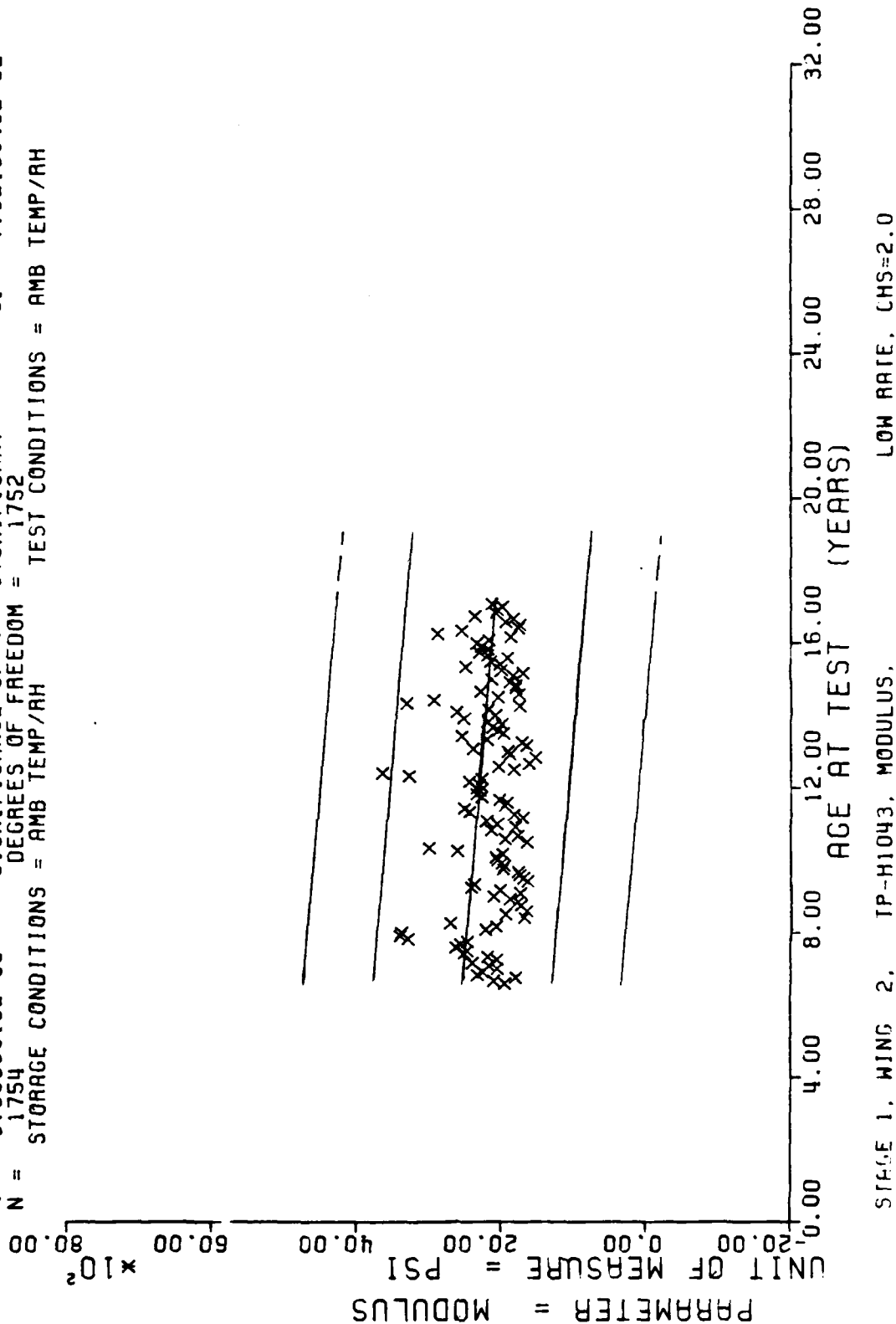


Figure 9

$Y = ((+2.2911536E+03) + (-1.7806905E-01) * X)$   
 F = +4.0031866E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma_e = +2.0716877E+02$   
 R = -2.4027628E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_e = +2.8143981E-01$   
 I = +6.3270741E-01 SIGNIFICANCE OF I = NOT SIGNIFICANT  $S_e = +2.0725834E+02$   
 N = 695 DEGREES OF FREEDOM = 693  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

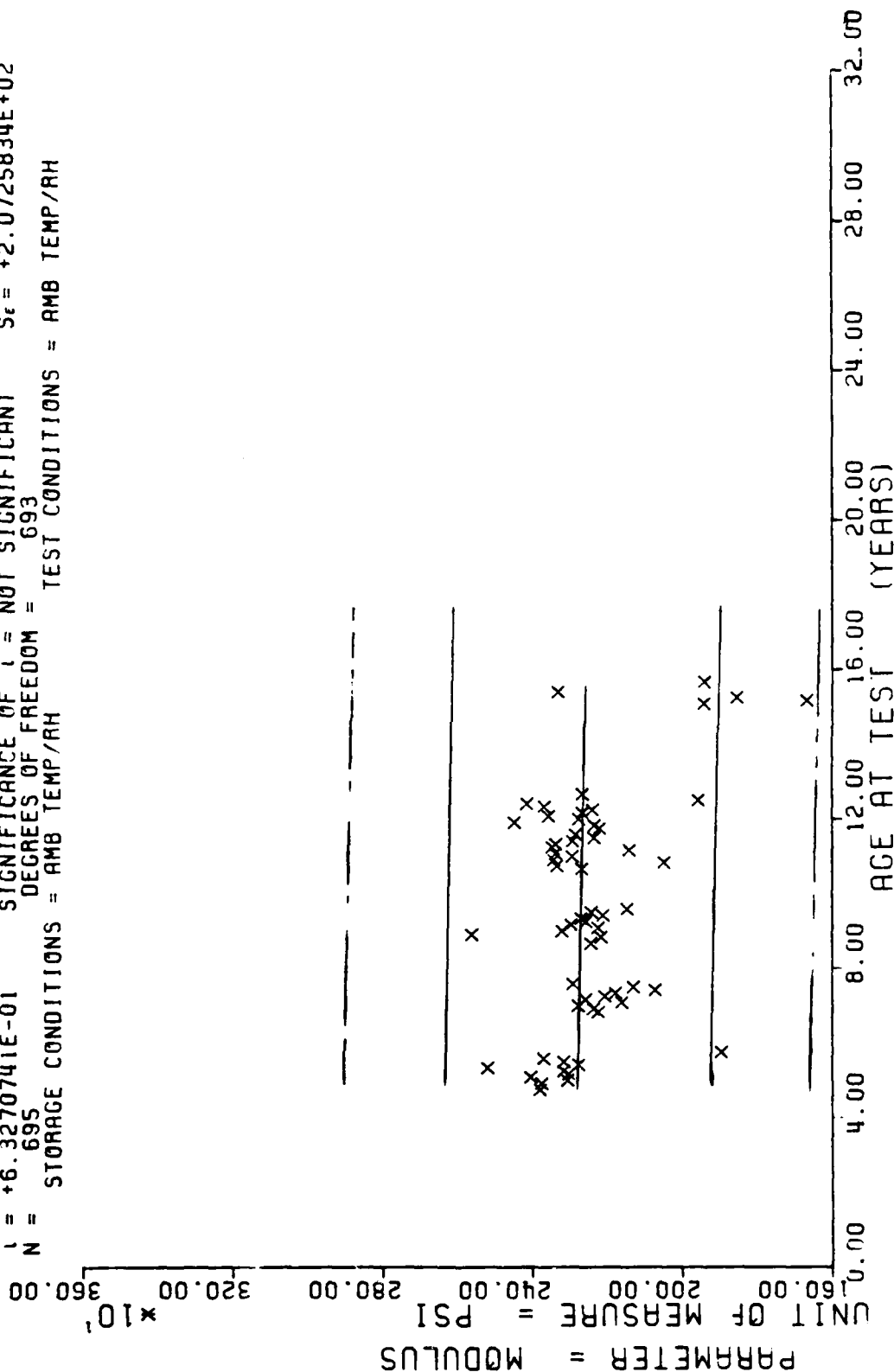


Figure 10

UNITED STATES DEPARTMENT OF JUSTICE  
FEDERAL BUREAU OF INVESTIGATION

.....

EVALUATIONS FROM REGRESSION  
SUG. SW.                      10/21/56.

0.03521E+09  
0.03777E+08  
0.50607E+00  
42550.

0.5-0.57 + 0.6 0.3-0.37 + 0.4

U.S. 767:1+07 U. 576742+0

\*\*\*\*\*

U. 64471. + U7 U. 64474L + (

STEP 1:  
COMPANY 10% BELONG TO THE JUDICIAL AUTHORITY : £ = 14,081,09 = 1750,69 €  
TOTAL CONTRIBUTION TO THE STATE : £ = 14,081,09 = 1750,69 €

```
STEP 6:
(COMPATIBLE) INTERLEAVE : F= 16.00(LF= 16248)
(COMPATIBLE) INTERLEAVE : F= 16.72(LF= 16692)
```

[illegible]

STAGE 1, WHICH 2, TD-H1043, STRAIN AT MAX STRESS, HIGH FATI, CUS=1750.0

This sample size summary is applicable to figures 11, 13, 15, 17, and 19

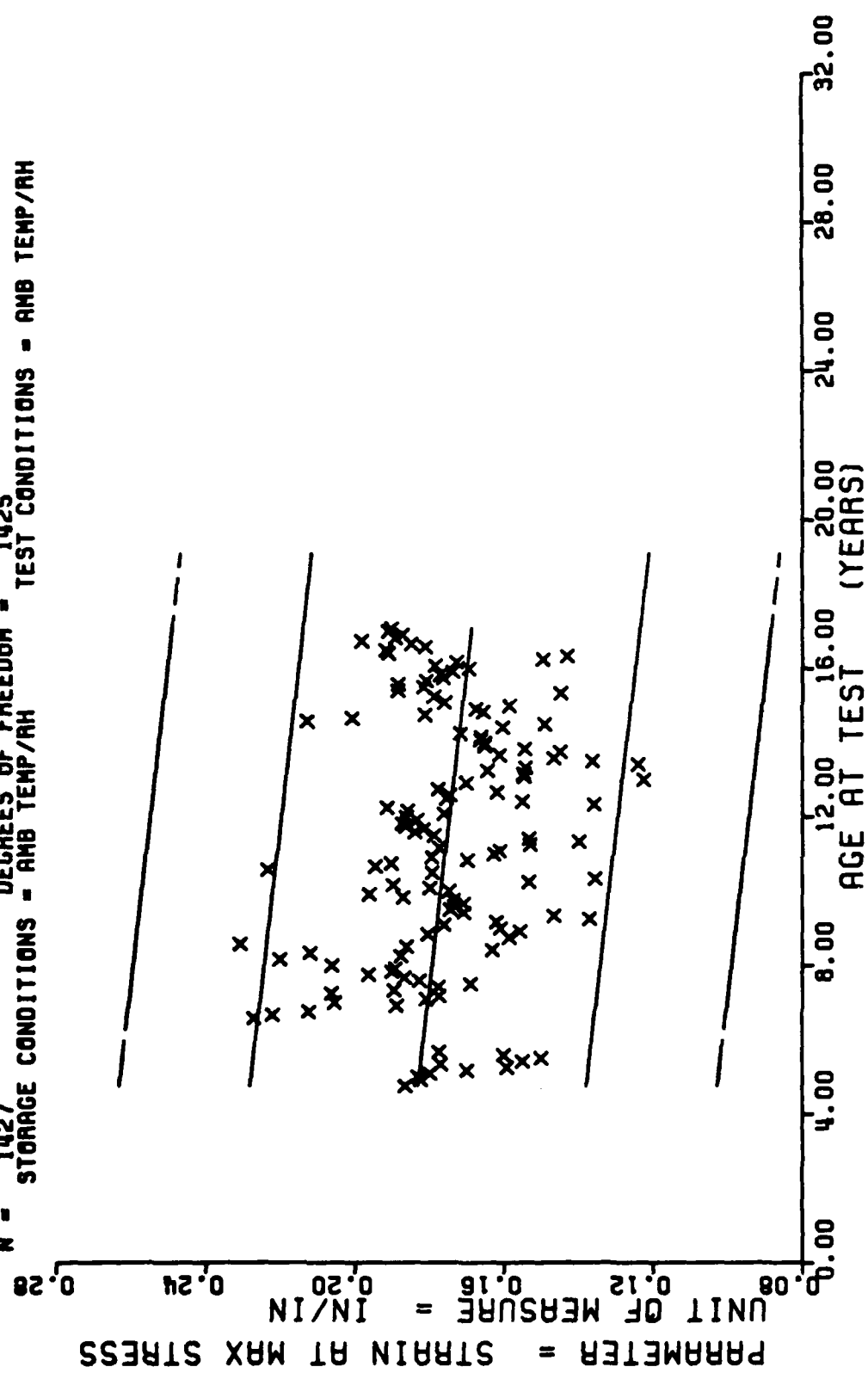
\*\*\* SA HILL SITE SUMMARY \*\*\*

| AGE<br>(105) | NR<br>SAMP | AGE<br>(105) | NR<br>SAMP |
|--------------|------------|--------------|------------|
| 82           | 3          | 132          | 22         |
| 83           | 15         | 133          | 26         |
| 84           | 24         | 134          | 17         |
| 85           | 24         | 135          | 15         |
| 86           | 18         | 136          | 25         |
| 87           | 21         | 137          | 21         |
| 88           | 19         | 138          | 18         |
| 89           | 20         | 139          | 6          |
| 90           | 19         | 140          | 3          |
| 91           | 9          | 141          | 6          |
| 105          | 3          | 142          | 15         |
| 107          | 3          | 143          | 27         |
| 108          | 9          | 144          | 27         |
| 109          | 23         | 145          | 21         |
| 110          | 20         | 146          | 24         |
| 111          | 21         | 147          | 18         |
| 112          | 21         | 148          | 15         |
| 113          | 21         | 149          | 15         |
| 114          | 10         | 150          | 12         |
| 115          | 22         |              |            |
| 116          | 12         |              |            |
| 127          | 3          |              |            |
| 129          | 3          |              |            |
| 130          | 9          |              |            |
| 131          | 21         |              |            |

STAGE 1. VING 0. TP-H1043. STEADY AT MAX STRESS. HIGH RATE. CHS=1750.0

This sample size summary is applicable to figures 12, 14, 16, 18 and 20

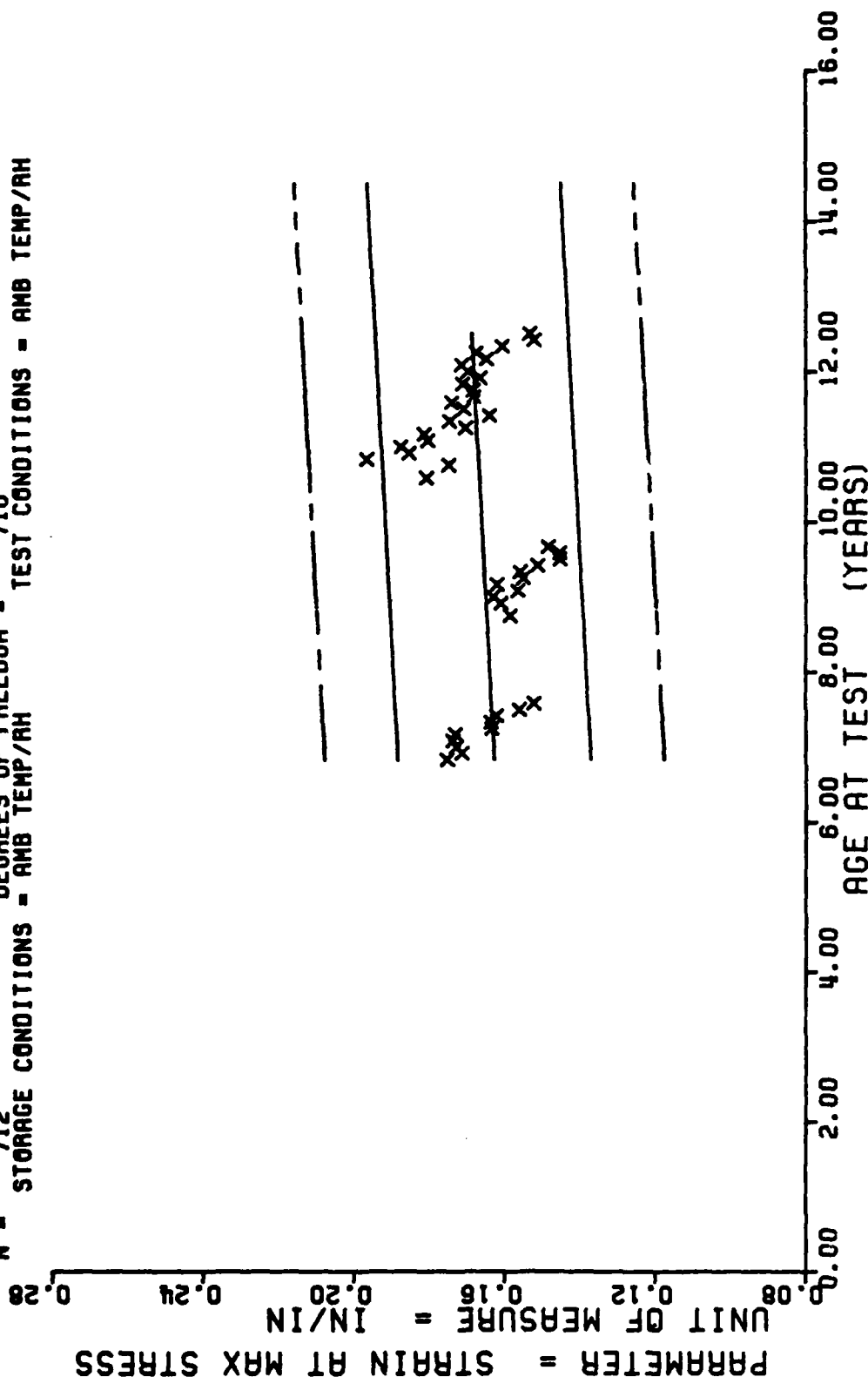
$F = +3.2622844E+01$  SIGNIFICANCE OF F =  $(-9.8356168E-05)$  \* X)  
 $R = -1.5004990E-01$  SIGNIFICANT  
 $t = +5.7291225E+00$  SIGNIFICANT  
 $N = 1427$  DEGREES OF FREEDOM = 1425  
 STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = AMB TEMP/AM



STAGE 1. WING 2. TP-H1043. STRAIN AT MAX STRESS, HIGH RATE, CHS=1750.0

Figure 11

Y = (( +1.5541790E-01 ) + ( +8.7935927E-05 ) \* X )  
 F = +1.2422184E+01 SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_f$  = +1.5135254E-02  
 R = +1.3113031E-01 SIGNIFICANCE OF R = SIGNIFICANT  $S_r$  = +2.4949837E-05  
 t = +3.5245090E+00 SIGNIFICANCE OF t = SIGNIFICANT  $S_t$  = +1.5015126E-02  
 N = 712 DEGREES OF FREEDOM = 710  
 STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = AMB TEMP/AM



STAGE 1, WING 6. TP-H1043. STRAIN AT MAX STRESS. HIGH RATE. CHS=1750.0

Figure 12

THE UNIVERSITY OF CHICAGO

[illegible]

| Account | Debit  | Credit | Balance |
|---------|--------|--------|---------|
| 10101   | 1.1500 |        | 1.1500  |
| 10102   | 1.1500 |        | 1.1500  |
| 10103   | 1.1500 |        | 1.1500  |
| 10104   | 1.1500 |        | 1.1500  |
| 10105   | 1.1500 |        | 1.1500  |
| 10106   | 1.1500 |        | 1.1500  |
| 10107   | 1.1500 |        | 1.1500  |
| 10108   | 1.1500 |        | 1.1500  |
| 10109   | 1.1500 |        | 1.1500  |
| 10110   | 1.1500 |        | 1.1500  |
| 10111   | 1.1500 |        | 1.1500  |
| 10112   | 1.1500 |        | 1.1500  |
| 10113   | 1.1500 |        | 1.1500  |
| 10114   | 1.1500 |        | 1.1500  |
| 10115   | 1.1500 |        | 1.1500  |
| 10116   | 1.1500 |        | 1.1500  |
| 10117   | 1.1500 |        | 1.1500  |
| 10118   | 1.1500 |        | 1.1500  |
| 10119   | 1.1500 |        | 1.1500  |
| 10120   | 1.1500 |        | 1.1500  |
| 10121   | 1.1500 |        | 1.1500  |
| 10122   | 1.1500 |        | 1.1500  |
| 10123   | 1.1500 |        | 1.1500  |
| 10124   | 1.1500 |        | 1.1500  |
| 10125   | 1.1500 |        | 1.1500  |
| 10126   | 1.1500 |        | 1.1500  |
| 10127   | 1.1500 |        | 1.1500  |
| 10128   | 1.1500 |        | 1.1500  |
| 10129   | 1.1500 |        | 1.1500  |
| 10130   | 1.1500 |        | 1.1500  |
| 10131   | 1.1500 |        | 1.1500  |
| 10132   | 1.1500 |        | 1.1500  |
| 10133   | 1.1500 |        | 1.1500  |
| 10134   | 1.1500 |        | 1.1500  |
| 10135   | 1.1500 |        | 1.1500  |
| 10136   | 1.1500 |        | 1.1500  |
| 10137   | 1.1500 |        | 1.1500  |
| 10138   | 1.1500 |        | 1.1500  |
| 10139   | 1.1500 |        | 1.1500  |
| 10140   | 1.1500 |        | 1.1500  |
| 10141   | 1.1500 |        | 1.1500  |
| 10142   | 1.1500 |        | 1.1500  |
| 10143   | 1.1500 |        | 1.1500  |
| 10144   | 1.1500 |        | 1.1500  |
| 10145   | 1.1500 |        | 1.1500  |
| 10146   | 1.1500 |        | 1.1500  |
| 10147   | 1.1500 |        | 1.1500  |
| 10148   | 1.1500 |        | 1.1500  |
| 10149   | 1.1500 |        | 1.1500  |
| 10150   | 1.1500 |        | 1.1500  |
| 10151   | 1.1500 |        | 1.1500  |
| 10152   | 1.1500 |        | 1.1500  |
| 10153   | 1.1500 |        | 1.1500  |
| 10154   | 1.1500 |        | 1.1500  |
| 10155   | 1.1500 |        | 1.1500  |
| 10156   | 1.1500 |        | 1.1500  |
| 10157   | 1.1500 |        | 1.1500  |
| 10158   | 1.1500 |        | 1.1500  |
| 10159   | 1.1500 |        | 1.1500  |
| 10160   | 1.1500 |        | 1.1500  |
| 10161   | 1.1500 |        | 1.1500  |
| 10162   | 1.1500 |        | 1.1500  |
| 10163   | 1.1500 |        | 1.1500  |
| 10164   | 1.1500 |        | 1.1500  |
| 10165   | 1.1500 |        | 1.1500  |
| 10166   | 1.1500 |        | 1.1500  |
| 10167   | 1.1500 |        | 1.1500  |
| 10168   | 1.1500 |        | 1.1500  |
| 10169   | 1.1500 |        | 1.1500  |
| 10170   | 1.1500 |        | 1.1500  |
| 10171   | 1.1500 |        | 1.1500  |
| 10172   | 1.1500 |        | 1.1500  |
| 10173   | 1.1500 |        | 1.1500  |
| 10174   | 1.1500 |        | 1.1500  |
| 10175   | 1.1500 |        | 1.1500  |
| 10176   | 1.1500 |        | 1.1500  |
| 10177   | 1.1500 |        | 1.1500  |
| 10178   | 1.1500 |        | 1.1500  |
| 10179   | 1.1500 |        | 1.1500  |
| 10180   | 1.1500 |        | 1.1500  |
| 10181   | 1.1500 |        | 1.1500  |
| 10182   | 1.1500 |        | 1.1500  |
| 10183   | 1.1500 |        | 1.1500  |
| 10184   | 1.1500 |        | 1.1500  |
| 10185   | 1.1500 |        | 1.1500  |
| 10186   | 1.1500 |        | 1.1500  |
|         |        |        |         |

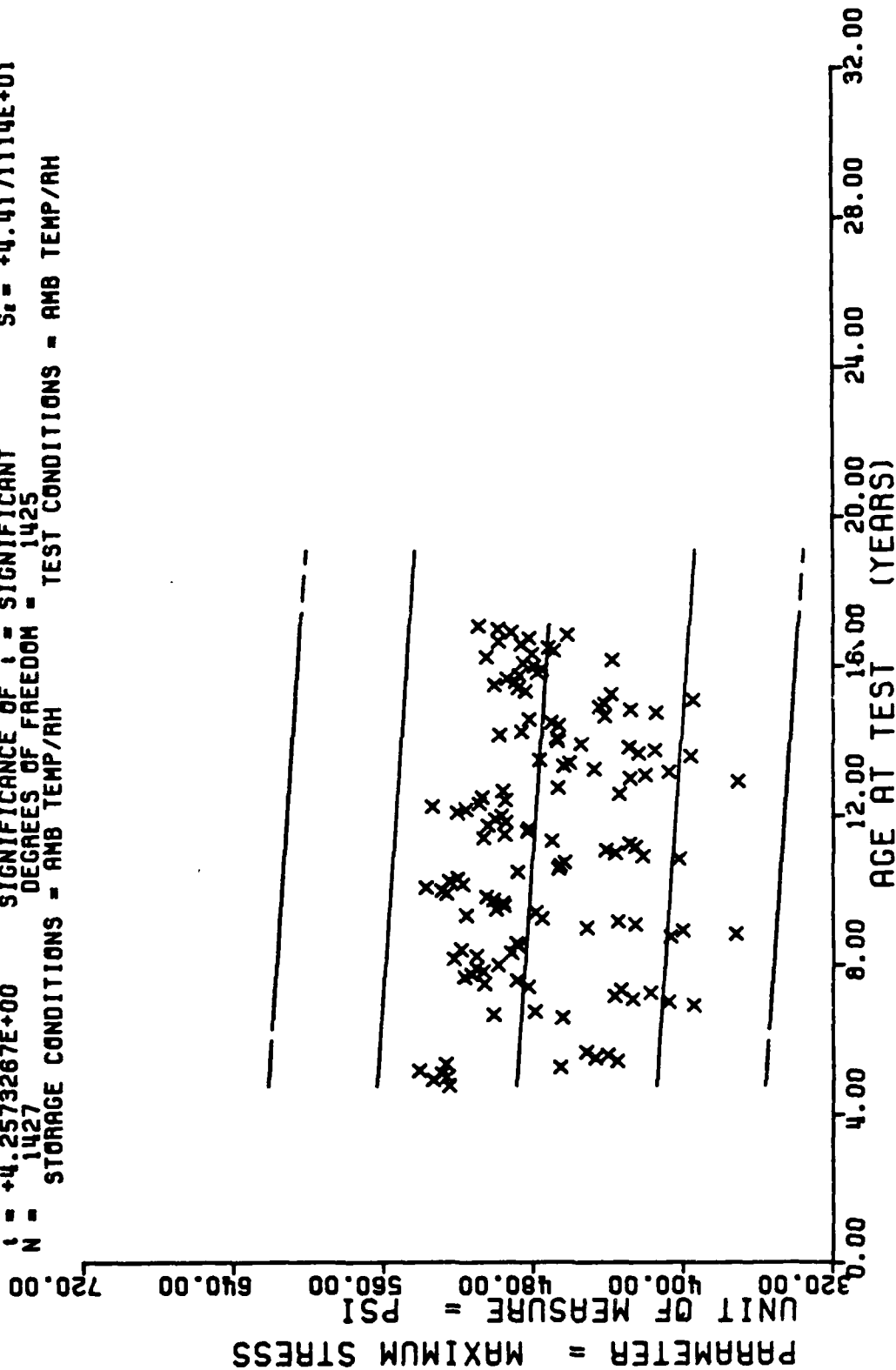
[illegible][illegible]

## STATISTICALLY DIFF.

1112

[illegible]

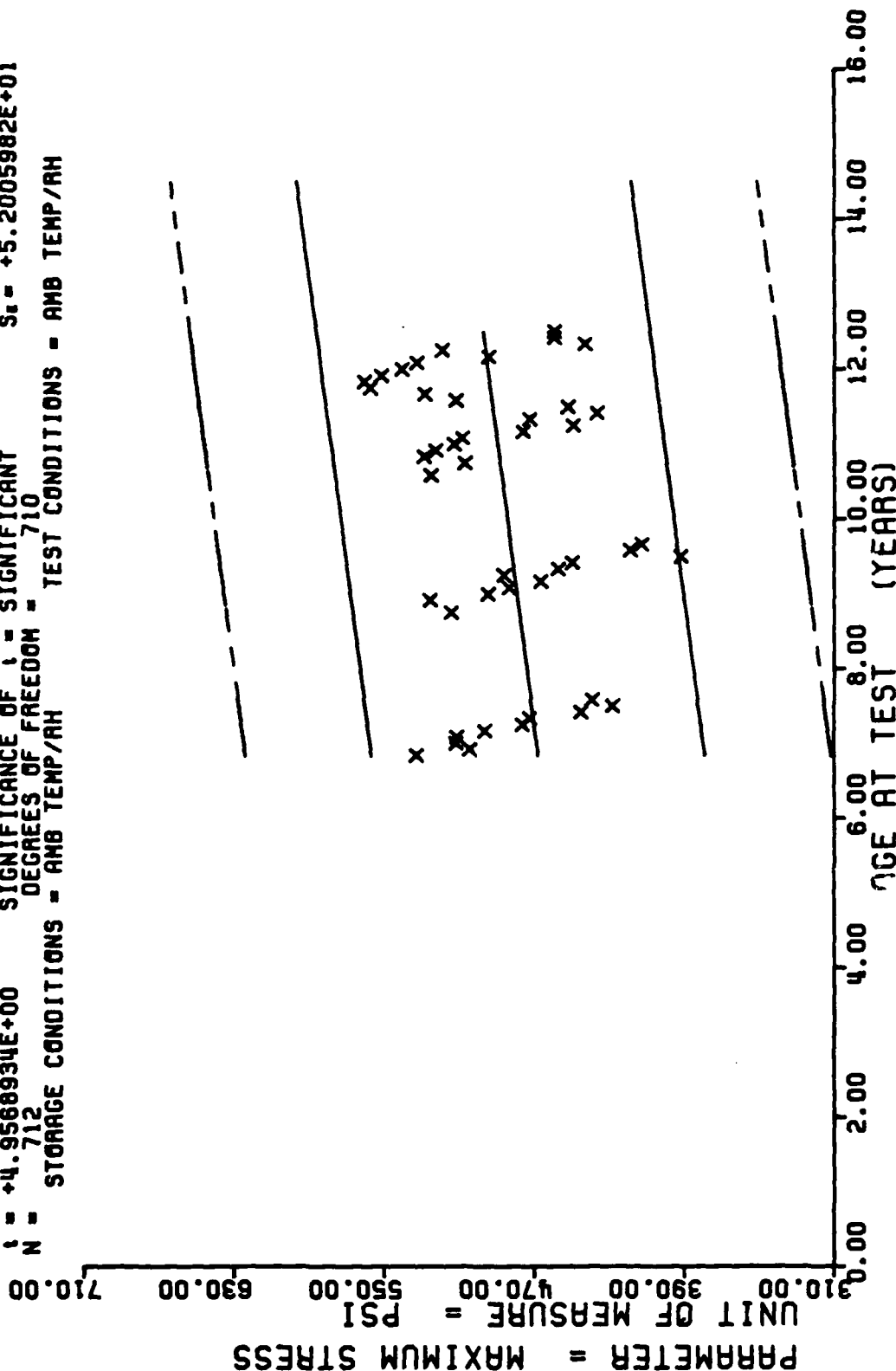
$Y = (( +4.9569479E+02 ) + ( -1.2070152E-01 ) * X)$   
 $F = +1.8124830E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_1 = +4.4435547E+01$   
 $R = -1.1206888E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_0 = +2.8351481E-02$   
 $t = +4.2573267E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $S_1 = +4.4171114E+01$   
 $N = 1427$  DEGREES OF FREEDOM = 1425  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1. WING 2. TP-H1043, MAXIMUM STRESS. HIGH RATE, CHS-1750.0

Figure 13

$Y = ((+4.3251480E+02) + (+4.2895280E-01) * X)$   
 $F = +2.4570792E+01$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = +1.8289117E-01$  SIGNIFICANCE OF R = SIGNIFICANT  
 $t = +4.9568934E+00$  SIGNIFICANCE OF t = SIGNIFICANT  
 $N = 712$  DEGREES OF FREEDOM = 710  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH

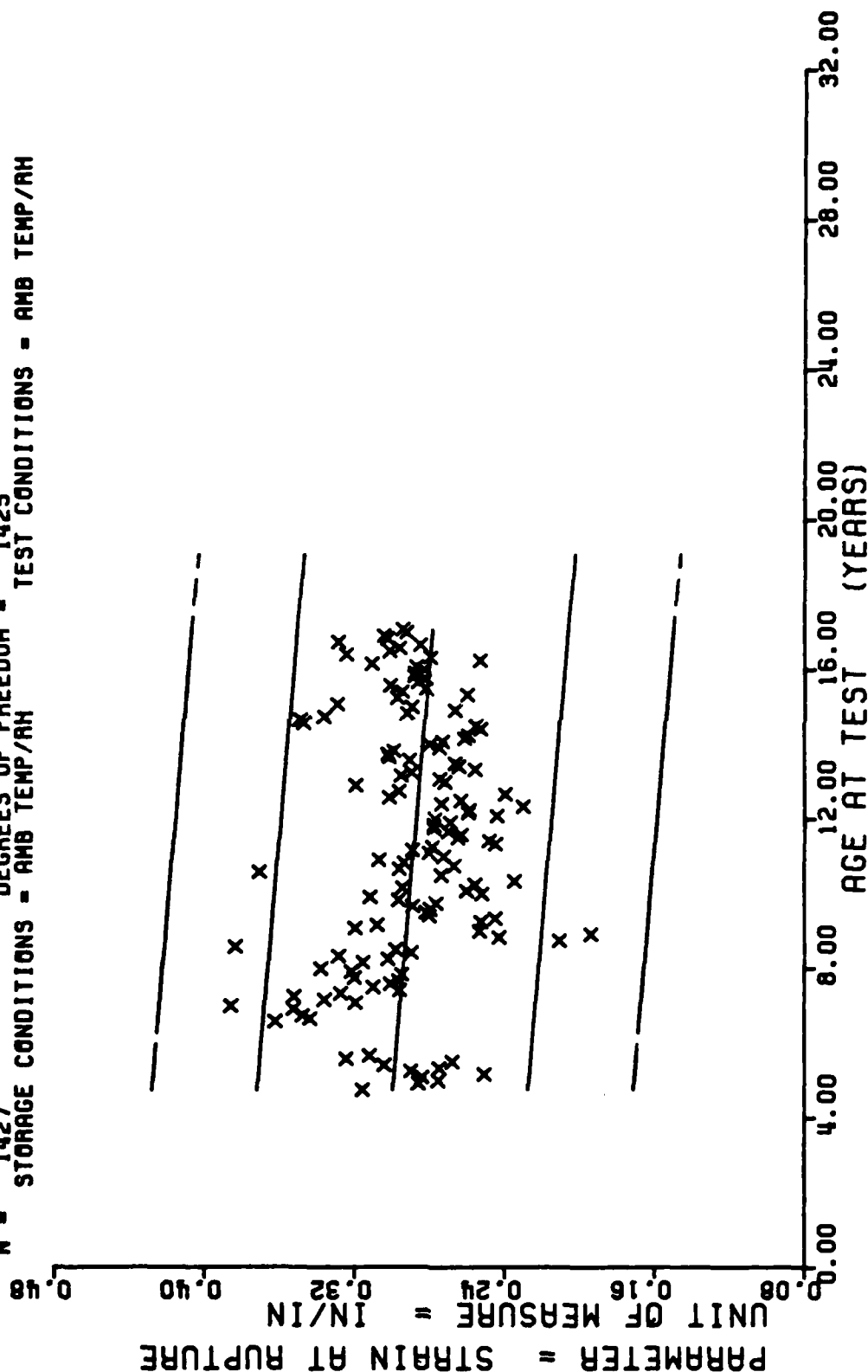


STAGE 1, WING 6. TP-H1043. MAXIMUM STRESS. HIGH RATE. CHS-1750.0

Figure 14



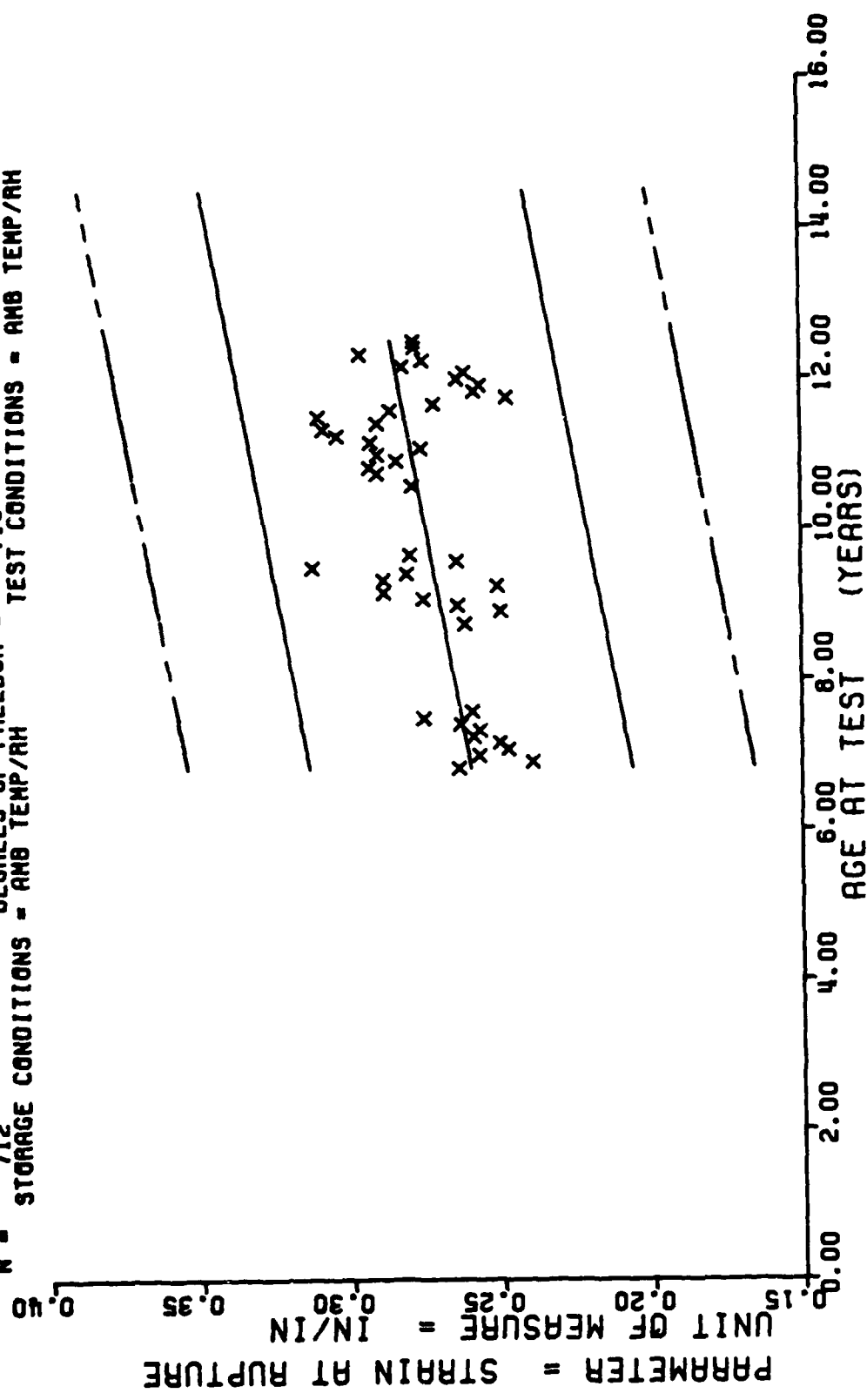
$Y = ((+3.0778857E-01) + (-1.4608721E-04) * X)$   
 $F = +2.8331608E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma_1 = +4.3167986E-02$   
 $R = -1.3962180E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_1 = +2.7445844E-05$   
 $t = +5.3227444E+00$  SIGNIFICANCE OF t = SIGNIFICANT  $S_2 = +4.2760147E-02$   
 $N = 1427$  DEGREES OF FREEDOM = 1425  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1, WING 2, TP-H1043, STRAIN AT RUPTURE, HIGH RATE, CHS=1750.0

Figure 15

$Y = ((+2.2861467E-01) + (+3.8023994E-04) \times X)$   
 $F = +5.3969088E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $G = +3.2451213E-02$   
 $R = +2.6445591E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_0 = +5.2039305E-05$   
 $I = +7.3067837E+00$  SIGNIFICANCE OF I = SIGNIFICANT  $S_1 = +3.1317909E-02$   
 $N = 712$  DEGREES OF FREEDOM = 710  
 STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = AMB TEMP/AM



STAGE 1. WING 6. TP-H1043. STRAIN AT RUPTURE. HIGH RATE, CHS=1750.0

Figure 16

TABLE 9

ANALYSIS OF COVARIANCE  
COMPARISON OF REPRESSION EFFECTS

ANALYSIS OF COVARIANCE (COMPARING REPRESSIONS) : F = 11.43, D.F. = 17, S.E. DIFFERENCE = 7.4

| SOURCE     | D.F. | SS          | MS       | XY     | YY          | COEFFICIENTS | D.F.    | SS          | MS          | DEVIATIONS FROM REPRESSION |
|------------|------|-------------|----------|--------|-------------|--------------|---------|-------------|-------------|----------------------------|
| TOTAL      | 711  | 0.242738+07 | 0.341306 | 0.7473 | 0.146092-03 | 1425         | 2.0055  | 0.146092-03 | 0.146092-03 | 0.146092-03                |
| REPRESSION | 711  | 0.242738+07 | 0.341306 | 0.7473 | 0.146092-03 | 710          | 0.62535 | 0.62535     | 0.62535     | 0.62535                    |

| COEFFICIENT | D.F. | SS          | MS       | XY     | YY          | COEFFICIENTS | D.F.   | SS          | MS          | DEVIATIONS FROM REPRESSION |
|-------------|------|-------------|----------|--------|-------------|--------------|--------|-------------|-------------|----------------------------|
| REPRESSION  | 711  | 0.242738+07 | 0.341306 | 0.7473 | 0.146092-03 | 1425         | 2.0055 | 0.146092-03 | 0.146092-03 | 0.146092-03                |

36

DIFFERENCE BETWEEN REPRESSIONS : F = 1.075051-01 0.875051-01

| COEFFICIENT | D.F. | SS          | MS       | XY     | YY          | COEFFICIENTS | D.F.   | SS          | MS          | DEVIATIONS FROM REPRESSION |
|-------------|------|-------------|----------|--------|-------------|--------------|--------|-------------|-------------|----------------------------|
| REPRESSION  | 711  | 0.242738+07 | 0.341306 | 0.7473 | 0.146092-03 | 1425         | 2.0055 | 0.146092-03 | 0.146092-03 | 0.146092-03                |

| COEFFICIENT | D.F. | SS          | MS       | XY     | YY          | COEFFICIENTS | D.F.   | SS          | MS          | DEVIATIONS FROM REPRESSION |
|-------------|------|-------------|----------|--------|-------------|--------------|--------|-------------|-------------|----------------------------|
| REPRESSION  | 711  | 0.242738+07 | 0.341306 | 0.7473 | 0.146092-03 | 1425         | 2.0055 | 0.146092-03 | 0.146092-03 | 0.146092-03                |

DIFFERENCE BETWEEN REPRESSIONS : F = 1.075051-01 0.875051-01

STEP 1:

COMPARISON BETWEEN REPRESSIONS : F = 1.075051-01 0.875051-01

IF REPRESSIONS ARE EQUAL, REPRESSIONS ARE EQUAL, REPRESSIONS ARE EQUAL

STEP 2:

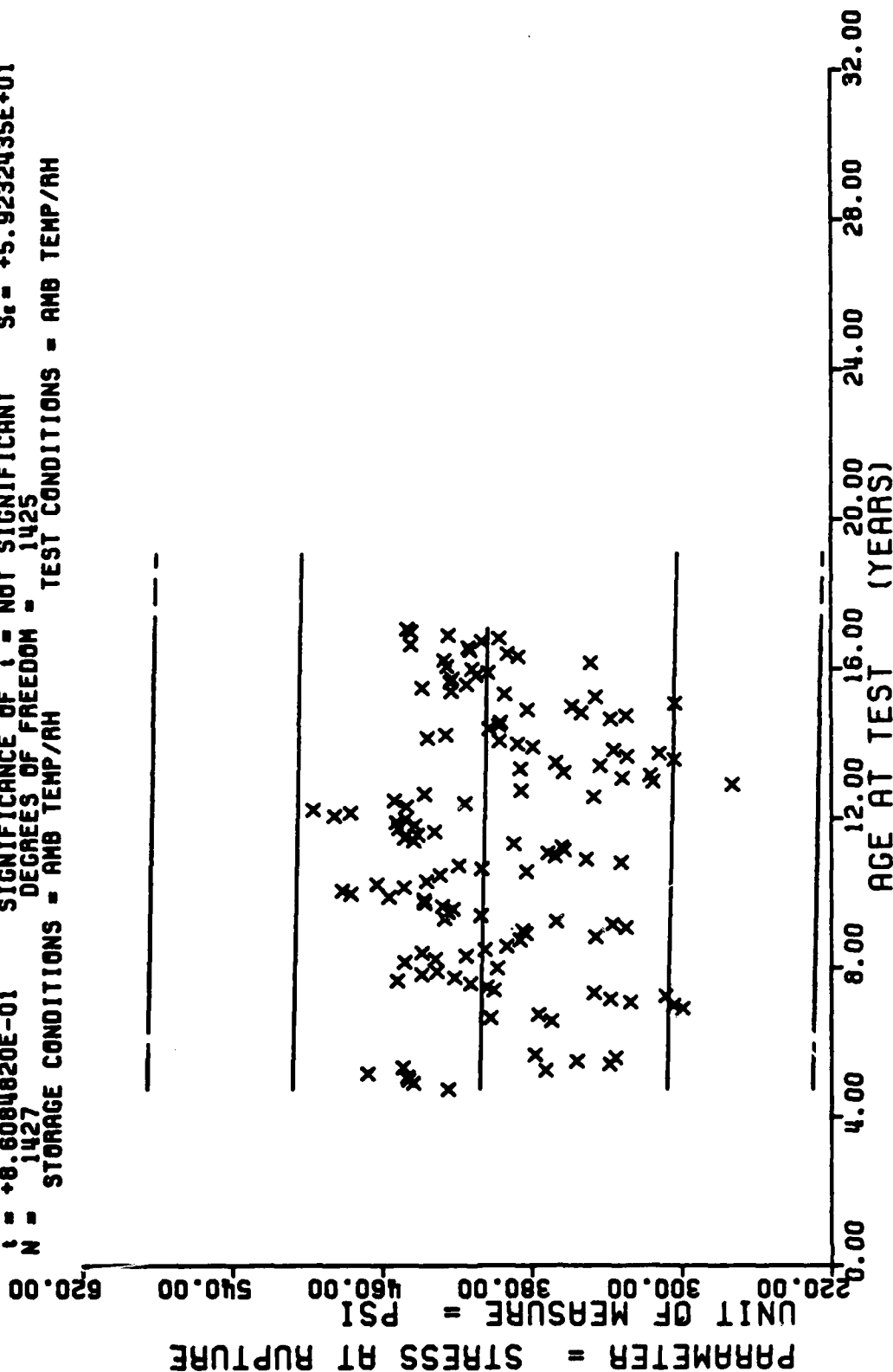
COMPARISON BETWEEN REPRESSIONS : F = 1.075051-01 0.875051-01

COMPARISON BETWEEN REPRESSIONS : F = 1.075051-01 0.875051-01

STATISTICALLY DIFF.

STATISTICALLY DIFF.  
STATISTICALLY DIFF.

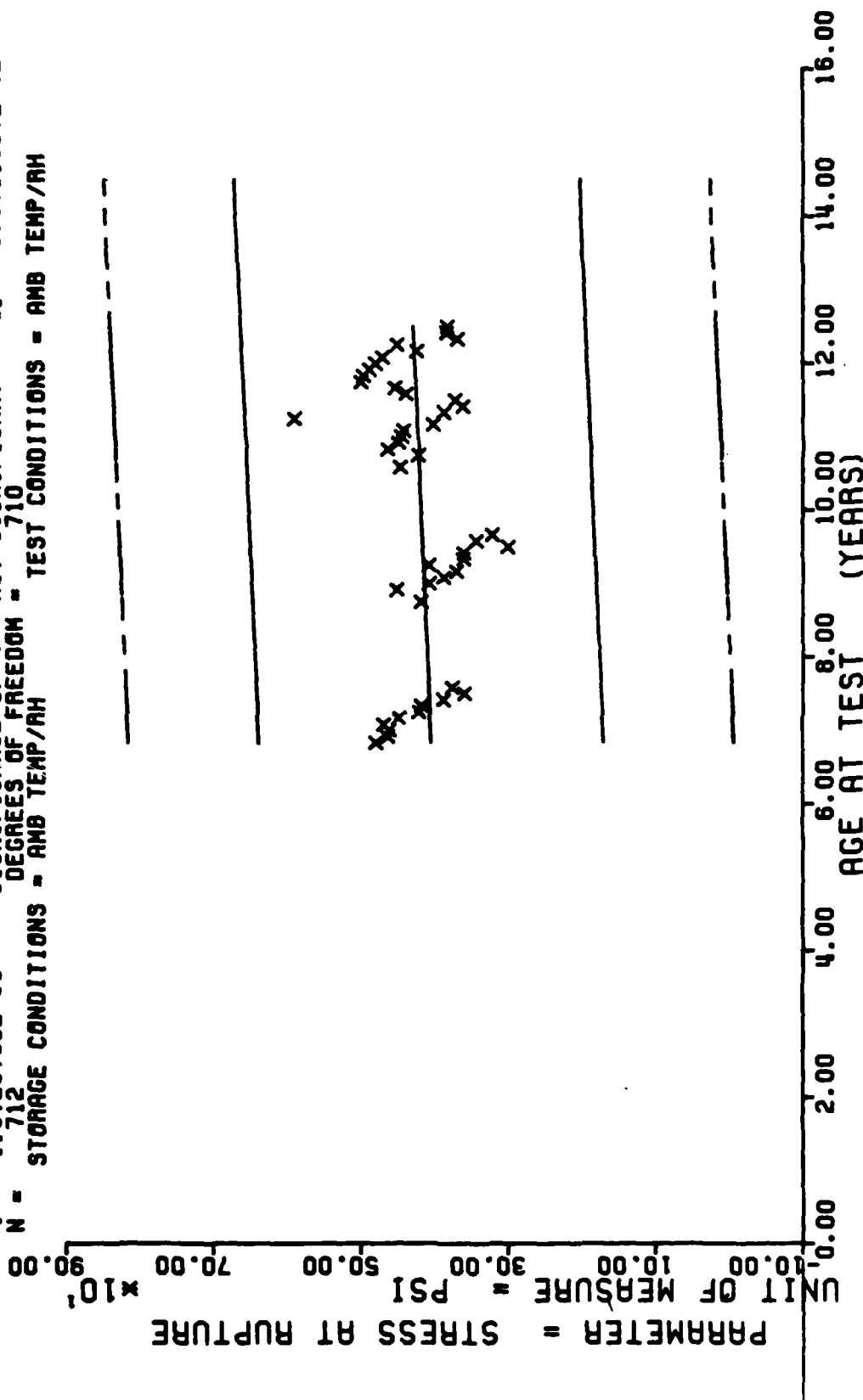
$Y = ((+4.0950908E+02) + (-3.2726309E-02) * X)$   
 $F = +7.4105963E-01$  SIGNIFICANCE OF F = NOT SIGNIFICANT  $S_1 = +5.9227057E+01$   
 $R = -2.2798498E-02$  SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_2 = +3.8018676E-02$   
 $t = +8.6084620E-01$  SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_3 = +5.9232435E+01$   
 $N = 1427$  DEGREES OF FREEDOM = 1425  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1. WING 2. TP-H1043. STRESS AT RUPTURE. HIGH RATE. CHS=1750.0

Figure 17

$Y = ((+3.7477006E+02) + (+3.5808746E-01) \times X)$   
 $F = +2.4739415E+00$  SIGNIFICANCE OF F = NOT SIGNIFICANT  $\sigma^2 = +1.3715301E+02$   
 $R = +5.8926442E-02$  SIGNIFICANCE OF R = NOT SIGNIFICANT  $S_e = +2.2766402E-01$   
 $t = +1.5728768E+00$  SIGNIFICANCE OF t = NOT SIGNIFICANT  $S_e = +1.3701107E+02$   
 $N = 712$  DEGREES OF FREEDOM = 710  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1. WING 6. TP-H1043, STRESS AT RUPTURE, HIGH RATE, CHS-1750.0

Figure 18

# ANALYSIS OF COVARIANCE COMPARISONS OF REGRESSION LINES

ANALYSIS OF COVARIATES (LUMPAKES REGRESSION), TP-111043, CFS=1750, STPS RUPTURE, W=2/E

[illegible]

COMPARISON BETWEEN FESTIVAL VARIABLES:  $F = 5.55 (df = 7) (0.1425)$

• 2. HIS AIR MAIL TO THE SECRETARY OF THE ARMY

DATE OF RECEIPT THE SPTS : F = 9.7.1955

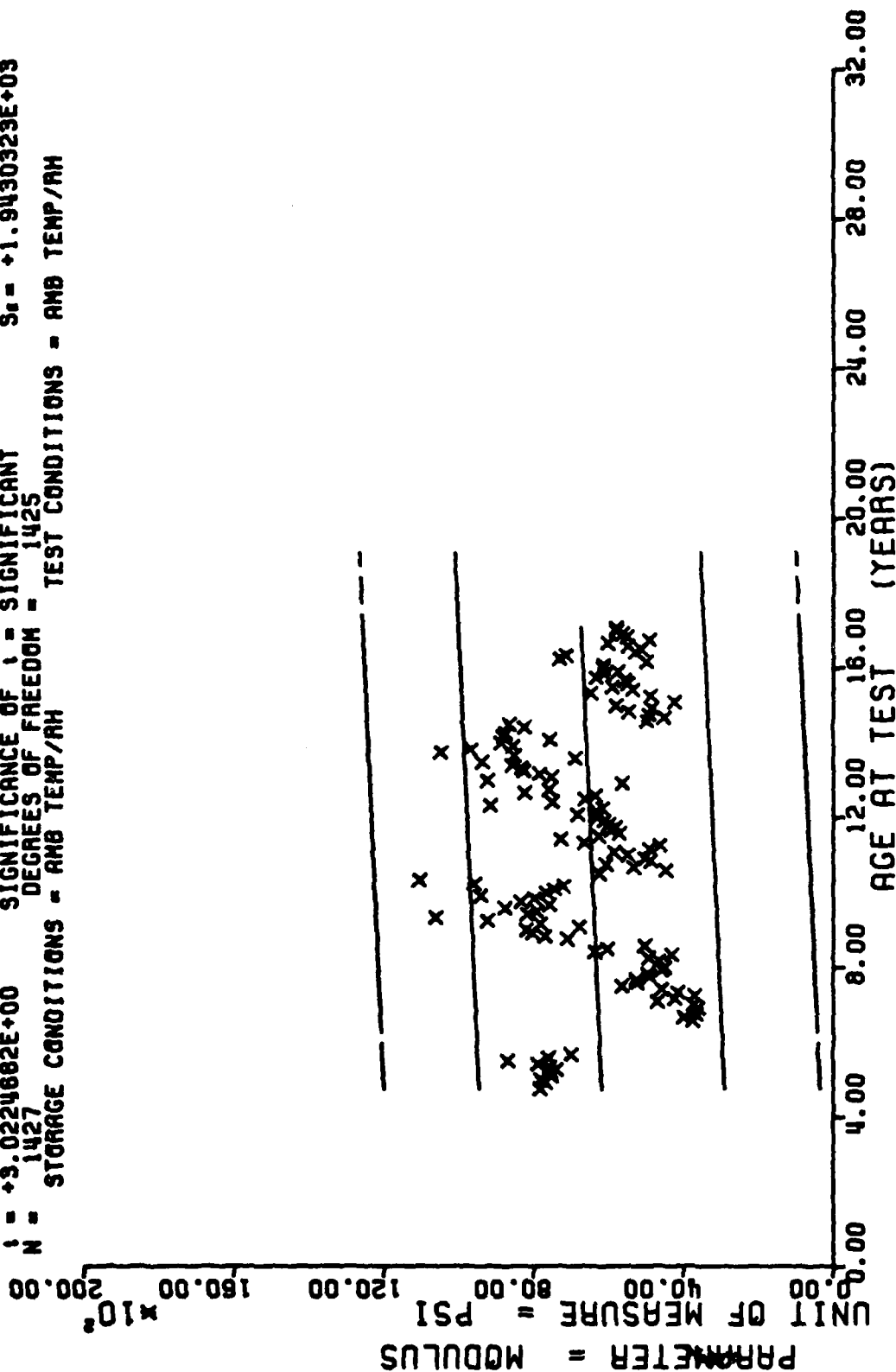
# STUDENTS FIRST YEAR

(defn **is-prime?** [n]
 (if (= 1 n)
 false
 (loop [divisor 2]
 (if (>= divisor n)
 true
 (if (zero? (mod n divisor))
 false
 (recur (+ divisor 1)))))))

**STATISTICALLY DIFF.**

STATISTICALLY DIFF.  
STATISTICALLY DIFF.

$Y = ((+5.9570324E+03) + (+3.7894605E+00) \times X)$   
 $F = +9.1353145E+00$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = +7.9811723E-02$  SIGNIFICANCE OF R = SIGNIFICANT  
 $S = +3.0224662E+00$  SIGNIFICANCE OF S = SIGNIFICANT  
 $N = 1427$  DEGREES OF FREEDOM = 1425  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1, WING 2, TP-H1043, MODULUS, HIGH RATE, CHS-1750.0

Figure 19

$Y = ((+1.0009277E+04) + (-2.1326746E+01) \times X)$   
 $F = +2.8875846E+01$  SIGNIFICANCE OF F = SIGNIFICANT  $G = +2.4348426E+03$   
 $R = -1.9768794E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_0 = +3.9687957E+00$   
 $I = +5.9736084E+00$  SIGNIFICANCE OF I = SIGNIFICANT  $S_1 = +2.3884712E+03$   
 $N = 712$  DEGREES OF FREEDOM = 710  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

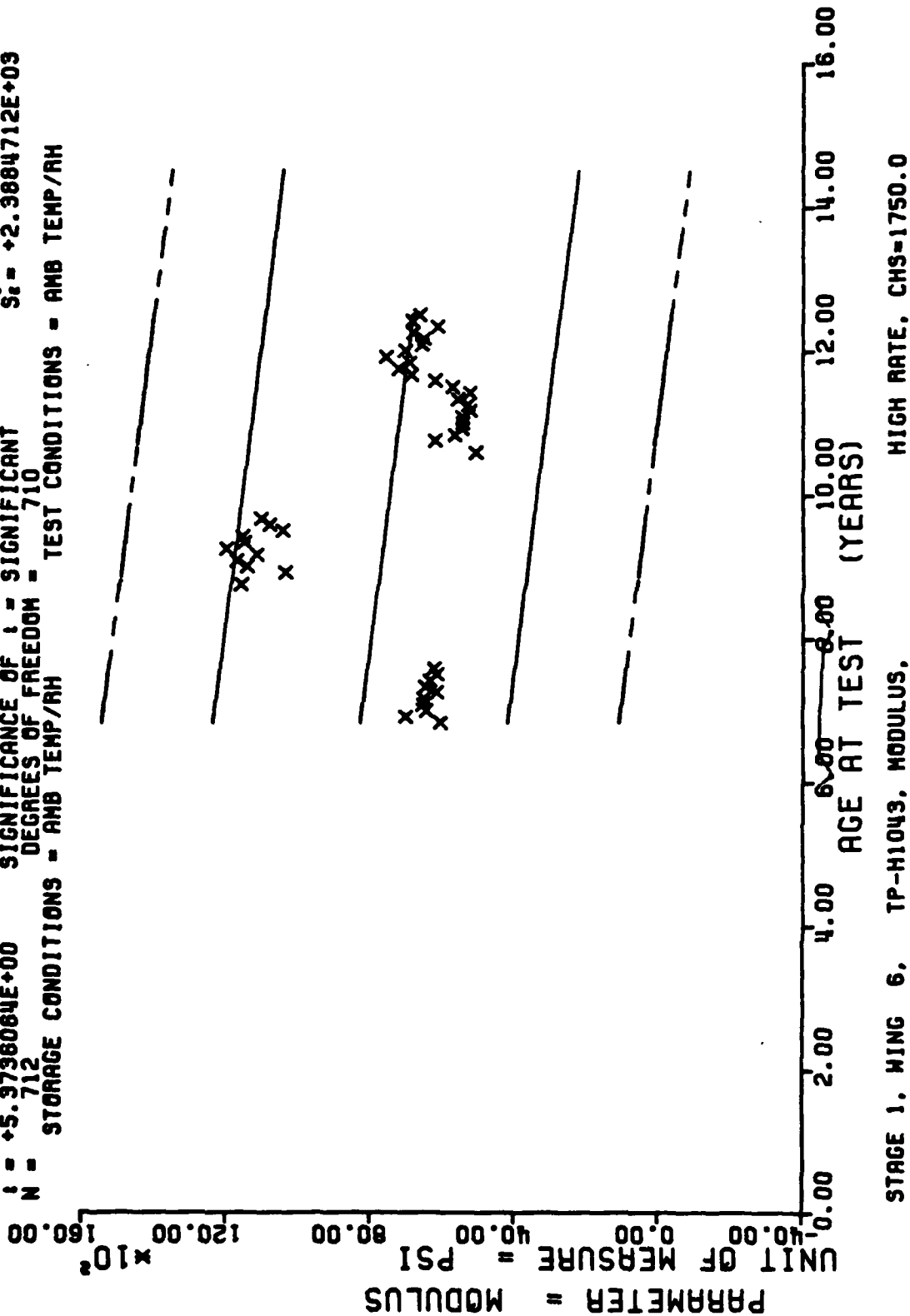


Figure 20

ANALYSIS OF CONCENTRATIONS OF  
POLYMERIZATION OF POLYMERIZATION

[illegible]
$$\begin{aligned} \text{AF}(E_{\text{eff}}) &= 1 * 0.2111 \text{E}+07 - 0.2501 \text{E}+07 \quad 0.4749 \text{E}+09 * \\ \text{FCVAL} &+ 213 * 0.5100 \text{E}+07 - 0.6156 \text{E}+07 \quad 0.1007 \text{E}+11 * \\ &\quad * 2137 \quad 0.1004 \text{E}+11 \end{aligned}$$
[illegible]

STATISTICALLY DIFF.  
STATISTICALLY DIFF.

\*\*\* SAMPLE SIZE SUMMARY \*\*\*

| AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 56           | 5          | 92           | 9          | 120          | 20         | 148          | 15         | 185          | 20         |
| 58           | 5          | 93           | 6          | 121          | 40         | 149          | 9          | 186          | 20         |
| 59           | 10         | 94           | 11         | 123          | 20         | 150          | 5          | 187          | 10         |
| 60           | 5          | 95           | 6          | 124          | 13         | 151          | 5          | 190          | 10         |
| 61           | 15         | 96           | 3          | 126          | 6          | 152          | 5          | 191          | 10         |
| 62           | 10         | 98           | 1          | 127          | 3          | 153          | 5          | 192          | 10         |
| 63           | 10         | 99           | 1          | 128          | 12         | 155          | 5          | 193          | 50         |
| 64           | 10         | 101          | 10         | 130          | 6          | 156          | 10         | 194          | 10         |
| 65           | 10         | 102          | 11         | 131          | 15         | 158          | 25         | 195          | 35         |
| 66           | 10         | 103          | 15         | 132          | 19         | 159          | 5          | 196          | 25         |
| 67           | 11         | 105          | 10         | 133          | 25         | 160          | 5          | 197          | 10         |
| 68           | 5          | 106          | 5          | 134          | 14         | 161          | 15         | 198          | 10         |
| 78           | 2          | 107          | 15         | 135          | 17         | 163          | 5          | 199          | 5          |
| 80           | 4          | 108          | 20         | 136          | 11         | 164          | 5          | 200          | 15         |
| 81           | 1          | 109          | 15         | 137          | 21         | 165          | 10         | 201          | 5          |
| 82           | 2          | 110          | 15         | 138          | 3          | 166          | 25         | 202          | 15         |
| 83           | 1          | 111          | 10         | 139          | 9          | 167          | 10         | 203          | 10         |
| 84           | 1          | 112          | 20         | 140          | 15         | 168          | 15         | 204          | 20         |
| 85           | 5          | 113          | 15         | 141          | 9          | 169          | 5          | 205          | 15         |
| 86           | 4          | 114          | 20         | 142          | 18         | 170          | 10         |              |            |
| 87           | 3          | 115          | 10         | 143          | 12         | 171          | 15         |              |            |
| 88           | 1          | 116          | 20         | 144          | 8          | 173          | 15         |              |            |
| 89           | 7          | 117          | 15         | 145          | 16         | 174          | 5          |              |            |
| 90           | 5          | 118          | 40         | 146          | 18         | 181          | 10         |              |            |
| 91           | 4          | 119          | 10         | 147          | 3          | 184          | 5          |              |            |

STAGE 1, WING 2. TP-H1043. HARDNESS SHORE A, INITIAL

This sample size summary is applicable to figures 21 and 23

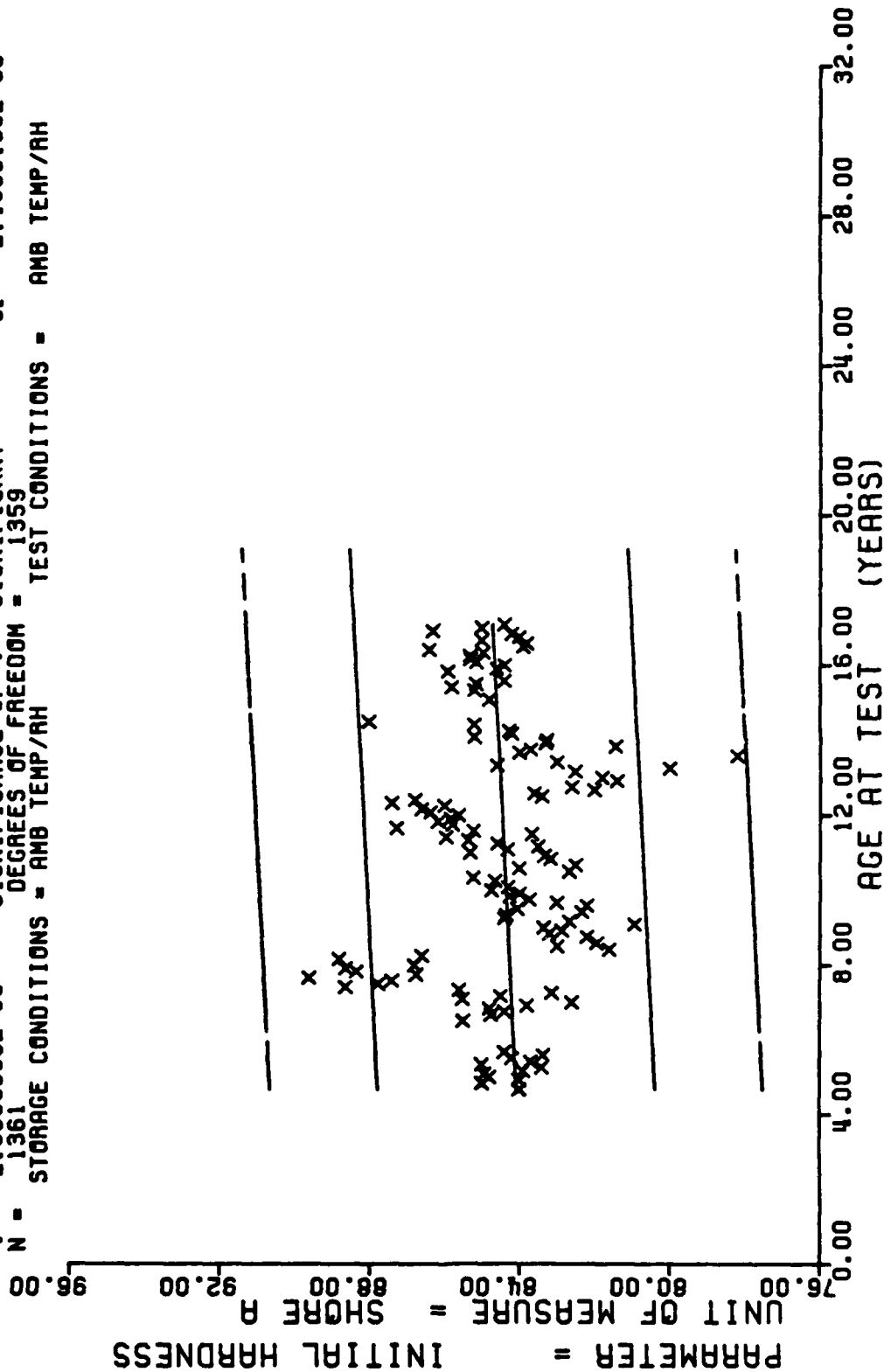
\*\*\* SAMPLE SIZE SUMMARY \*\*\*

| AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP |
|--------------|------------|--------------|------------|
| 82           | 12         | 146          | 35         |
| 83           | 15         | 147          | 40         |
| 84           | 24         |              |            |
| 85           | 27         |              |            |
| 86           | 15         |              |            |
| 87           | 18         |              |            |
| 88           | 21         |              |            |
| 89           | 21         |              |            |
| 90           | 9          |              |            |
| 91           | 9          |              |            |
| 106          | 5          |              |            |
| 107          | 5          |              |            |
| 108          | 10         |              |            |
| 109          | 20         |              |            |
| 110          | 25         |              |            |
| 111          | 15         |              |            |
| 112          | 15         |              |            |
| 113          | 20         |              |            |
| 114          | 15         |              |            |
| 115          | 20         |              |            |
| 141          | 15         |              |            |
| 142          | 15         |              |            |
| 143          | 30         |              |            |
| 144          | 55         |              |            |
| 145          | 25         |              |            |

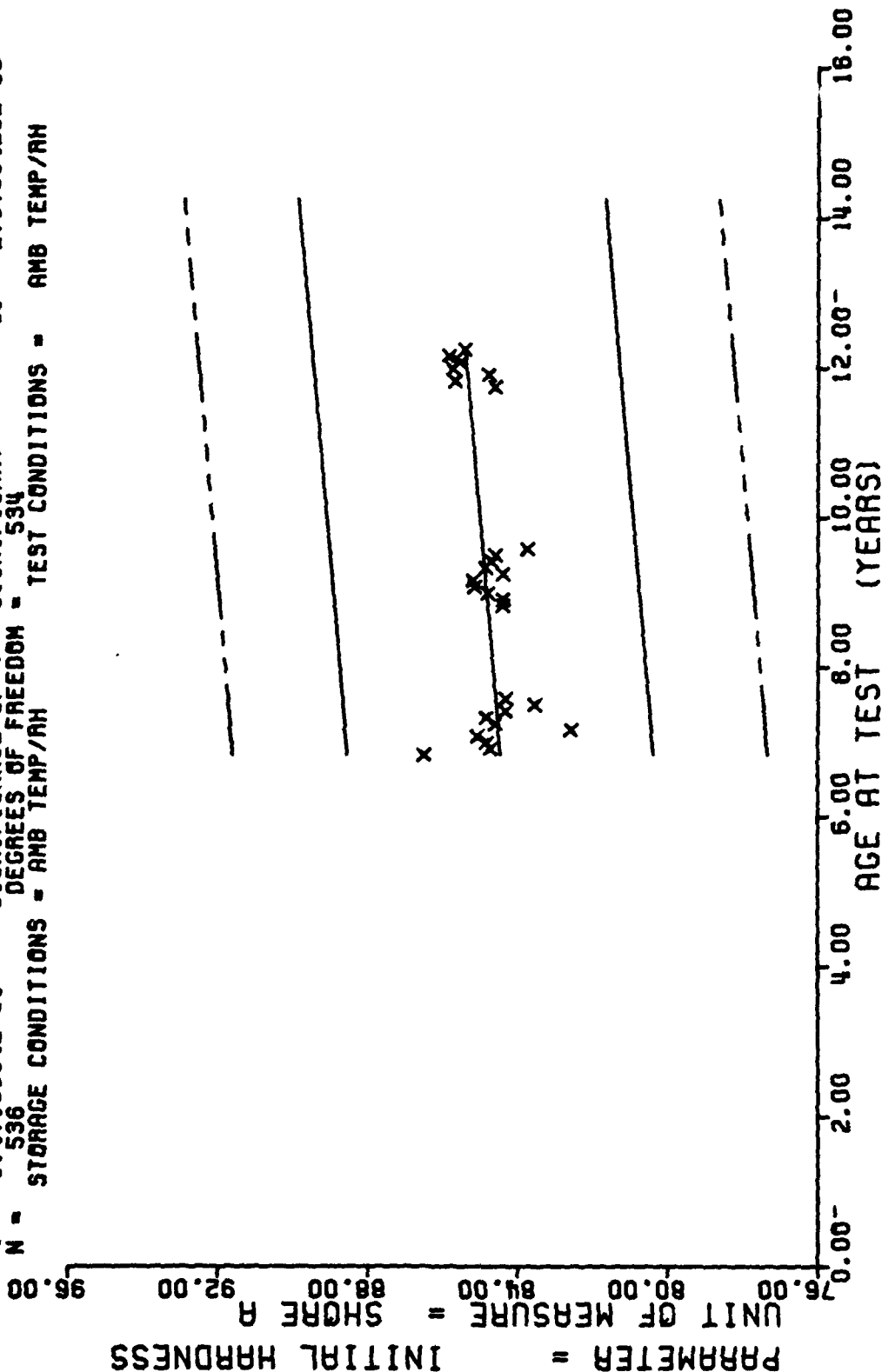
STAGE 1, WING 6, TP-H1043, HARDNESS SHORE A, INITIAL

This sample size summary is applicable to figures 22 and 24

$Y = ((+8.3844469E+01) + (+4.2421133E-03) \times X)$   
 $F = +8.2137571E+00$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = +7.7509104E-02$  SIGNIFICANCE OF R = SIGNIFICANT  
 $t = +2.8659653E+00$  SIGNIFICANCE OF t = SIGNIFICANT  
 $N = 1361$  DEGREES OF FREEDOM = 1359  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



$F = +1.2048420E+01$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = +1.4854207E-01$  SIGNIFICANCE OF R = SIGNIFICANT  
 $t = +3.4710834E+00$  SIGNIFICANCE OF t = SIGNIFICANT  
 $N = 536$  DEGREES OF FREEDOM = 534  
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1, WING 6, TP-H1043, HARDNESS SHORE A, INITIAL

Figure 22

ANALYSIS OF COVARIANCE  
COMPARISONS OF REGRESSION LINES

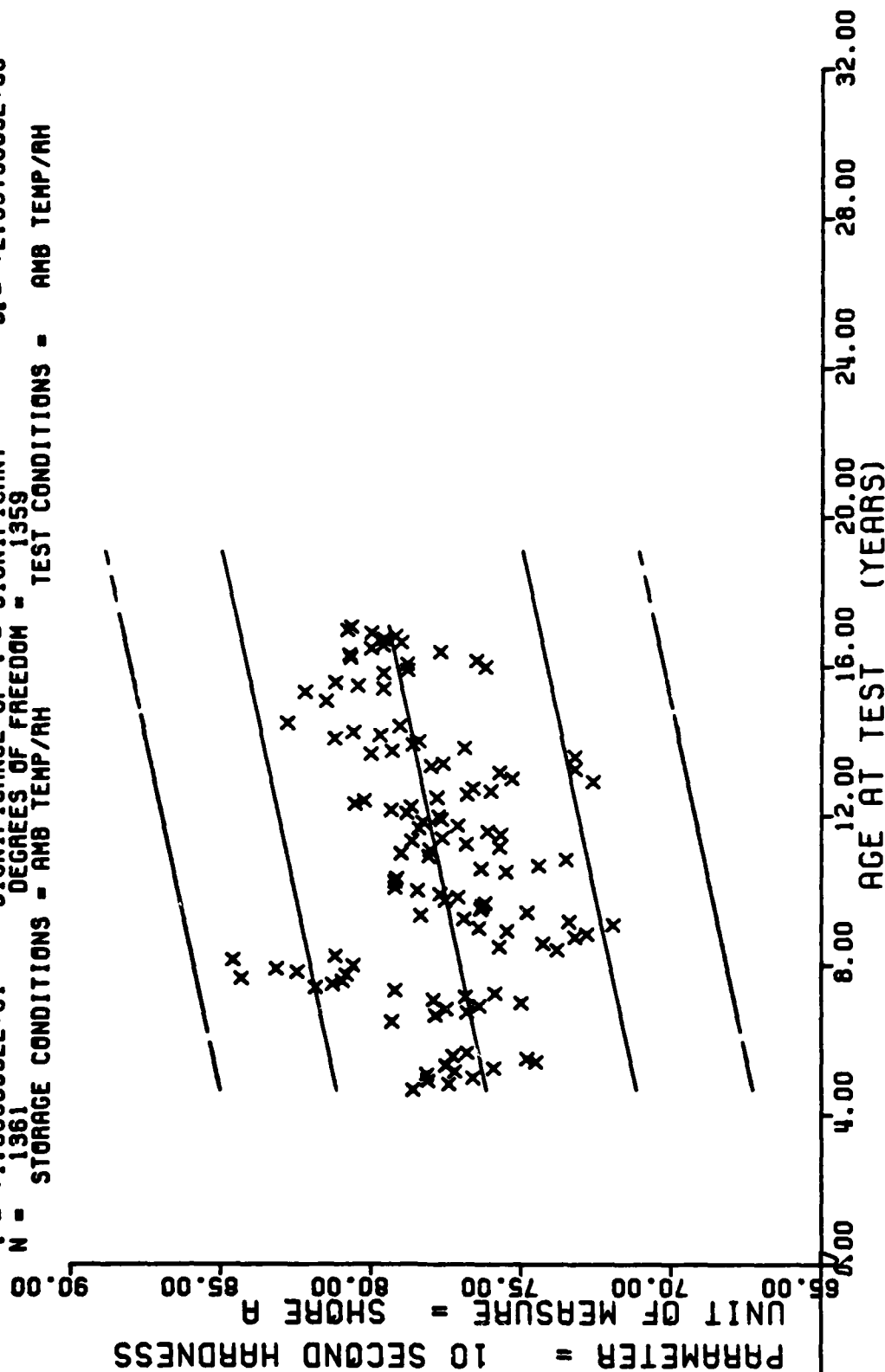
| SUBJECT | D.F. | SUM XX | SUM XY | SUM YY | * COEFFICIENTS * | * REGRESSION * | DEVIATIONS FROM REGRESSION | SUM OF SQUARES |
|---------|------|--------|--------|--------|------------------|----------------|----------------------------|----------------|
| 1       | 1    | 1      | 1      | 1      | 1                | 1              | 1                          | 1              |
| 2       | 1    | 2      | 2      | 2      | 2                | 2              | 2                          | 2              |
| 3       | 1    | 3      | 3      | 3      | 3                | 3              | 3                          | 3              |
| 4       | 1    | 4      | 4      | 4      | 4                | 4              | 4                          | 4              |
| 5       | 1    | 5      | 5      | 5      | 5                | 5              | 5                          | 5              |
| 6       | 1    | 6      | 6      | 6      | 6                | 6              | 6                          | 6              |
| 7       | 1    | 7      | 7      | 7      | 7                | 7              | 7                          | 7              |
| 8       | 1    | 8      | 8      | 8      | 8                | 8              | 8                          | 8              |
| 9       | 1    | 9      | 9      | 9      | 9                | 9              | 9                          | 9              |
| 10      | 1    | 10     | 10     | 10     | 10               | 10             | 10                         | 10             |
| 11      | 1    | 11     | 11     | 11     | 11               | 11             | 11                         | 11             |
| 12      | 1    | 12     | 12     | 12     | 12               | 12             | 12                         | 12             |
| 13      | 1    | 13     | 13     | 13     | 13               | 13             | 13                         | 13             |
| 14      | 1    | 14     | 14     | 14     | 14               | 14             | 14                         | 14             |
| 15      | 1    | 15     | 15     | 15     | 15               | 15             | 15                         | 15             |
| 16      | 1    | 16     | 16     | 16     | 16               | 16             | 16                         | 16             |
| 17      | 1    | 17     | 17     | 17     | 17               | 17             | 17                         | 17             |
| 18      | 1    | 18     | 18     | 18     | 18               | 18             | 18                         | 18             |
| 19      | 1    | 19     | 19     | 19     | 19               | 19             | 19                         | 19             |
| 20      | 1    | 20     | 20     | 20     | 20               | 20             | 20                         | 20             |
| 21      | 1    | 21     | 21     | 21     | 21               | 21             | 21                         | 21             |
| 22      | 1    | 22     | 22     | 22     | 22               | 22             | 22                         | 22             |
| 23      | 1    | 23     | 23     | 23     | 23               | 23             | 23                         | 23             |
| 24      | 1    | 24     | 24     | 24     | 24               | 24             | 24                         | 24             |
| 25      | 1    | 25     | 25     | 25     | 25               | 25             | 25                         | 25             |
| 26      | 1    | 26     | 26     | 26     | 26               | 26             | 26                         | 26             |
| 27      | 1    | 27     | 27     | 27     | 27               | 27             | 27                         | 27             |
| 28      | 1    | 28     | 28     | 28     | 28               | 28             | 28                         | 28             |
| 29      | 1    | 29     | 29     | 29     | 29               | 29             | 29                         | 29             |
| 30      | 1    | 30     | 30     | 30     | 30               | 30             | 30                         | 30             |
| 31      | 1    | 31     | 31     | 31     | 31               | 31             | 31                         | 31             |
| 32      | 1    | 32     | 32     | 32     | 32               | 32             | 32                         | 32             |
| 33      | 1    | 33     | 33     | 33     | 33               | 33             | 33                         | 33             |
| 34      | 1    | 34     | 34     | 34     | 34               | 34             | 34                         | 34             |
| 35      | 1    | 35     | 35     | 35     | 35               | 35             | 35                         | 35             |
| 36      | 1    | 36     | 36     | 36     | 36               | 36             | 36                         | 36             |
| 37      | 1    | 37     | 37     | 37     | 37               | 37             | 37                         | 37             |
| 38      | 1    | 38     | 38     | 38     | 38               | 38             | 38                         | 38             |
| 39      | 1    | 39     | 39     | 39     | 39               | 39             | 39                         | 39             |
| 40      | 1    | 40     | 40     | 40     | 40               | 40             | 40                         | 40             |
| 41      | 1    | 41     | 41     | 41     | 41               | 41             | 41                         | 41             |
| 42      | 1    | 42     | 42     | 42     | 42               | 42             | 42                         | 42             |
| 43      | 1    | 43     | 43     | 43     | 43               | 43             | 43                         | 43             |
| 44      | 1    | 44     | 44     | 44     | 44               | 44             | 44                         | 44             |
| 45      | 1    | 45     | 45     | 45     | 45               | 45             | 45                         | 45             |
| 46      | 1    | 46     | 46     | 46     | 46               | 46             | 46                         | 46             |
| 47      | 1    | 47     | 47     | 47     | 47               | 47             | 47                         | 47             |
| 48      | 1    | 48     | 48     | 48     | 48               | 48             | 48                         | 48             |
| 49      | 1    | 49     | 49     | 49     | 49               | 49             | 49                         | 49             |
| 50      | 1    | 50     | 50     | 50     | 50               | 50             | 50                         | 50             |
| 51      | 1    | 51     | 51     | 51     | 51               | 51             | 51                         | 51             |
| 52      | 1    | 52     | 52     | 52     | 52               | 52             | 52                         | 52             |
| 53      |      |        |        |        |                  |                |                            |                |

|       |         |             |        |         |                |      |        |        |        |
|-------|---------|-------------|--------|---------|----------------|------|--------|--------|--------|
| COLIC | + 1895* | 0.25222E+07 | 14044. | 96.47.5 | * 0.556441-62* | 1994 | 9564.5 | 5.0498 | 5.0370 |
|-------|---------|-------------|--------|---------|----------------|------|--------|--------|--------|

|      |  |         |                |        |         |   |      |        |
|------|--|---------|----------------|--------|---------|---|------|--------|
| CITL |  | * 1986* | U.S. \$735K+07 | 9332.4 | \$751.5 | * | 1.95 | 9713.6 |
|------|--|---------|----------------|--------|---------|---|------|--------|

| STEP 2:                                                                                                   | COMPARISON OF REGRESSION LINE SLOPES : F = | STATISTICALLY DIFF. |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------|
| COMPARISON OF FORDS SUB TREND LINE SLOPES : F = <td>5.10 (F = 1.1, 193)</td> <td>STATISTICALLY DIFF.</td> | 5.10 (F = 1.1, 193)                        | STATISTICALLY DIFF. |
| COMPARISON OF FORDS SUB TREND LINE SLOPES : F = <td>30.5 (F = 1.1, 194)</td> <td>STATISTICALLY DIFF.</td> | 30.5 (F = 1.1, 194)                        | STATISTICALLY DIFF. |

$Y = ((+7.4920583E+01) + (+2.1984429E-02) * X)$   
 $F = +1.2096331E+02$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma = +3.0856057E+00$   
 $A = +2.8589157E-01$  SIGNIFICANCE OF A = SIGNIFICANT  $S_0 = +1.9988875E-03$   
 $t = +1.0998332E+01$  SIGNIFICANCE OF t = SIGNIFICANT  $S_t = +2.9579063E+00$   
 $N = 1361$  DEGREES OF FREEDOM = 1359  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1. WING 2. TP-M1043. HARDNESS SHORE A, 10-SECOND

Figure 23

STAGE 1. WING 6, TP-H1043, HARDNESS SHORE A, 10-SECOND

Figure 24

TABLE 13

ANALYSIS OF COVARIANCE  
COMPARISON OF REGRESSION LINES

| ANALYSIS OF COVARIANCE, COMPARES REGRESSIONS, W/ING2/6, TP-H1043, MARINESS SH-A, IUSC |      |             |                       |        |              |            |              |       |         |                            |          |
|---------------------------------------------------------------------------------------|------|-------------|-----------------------|--------|--------------|------------|--------------|-------|---------|----------------------------|----------|
| * * *                                                                                 |      | * * *       |                       | * * *  |              | * * *      |              | * * * |         | * * *                      |          |
| SOURCE                                                                                | D.F. | SUM XX      | CORRECTED SUM SQUARES | SUM XY | SUM YY       | REGRESSION | COEFFICIENTS | D.F.  | SUM SW. | DEVIATIONS FROM REGRESSION | MEAN SW. |
| W/TP10                                                                                | 1    | 0.218977+07 | 46141.                | 12950. | 0.218977-01  | 1459       | 11692.       | 1     | 0.7503  |                            |          |
| W/2SA10                                                                               | 1    | 0.332421+06 | -5449.6               | 5474.5 | -0.204271-01 | 504        | 3205.5       | 1     | 0.0035  |                            |          |
| W/6SA10                                                                               | 1    |             |                       |        |              |            |              |       |         |                            |          |
| W/PRO10                                                                               | 1    | 0.252221+07 | 36692.                | 16425. | 0.153411-01  | 1094       | 15631.       | 1     | 7.5754  |                            |          |
| W/TOTAL                                                                               | 5    |             |                       |        |              |            |              |       |         |                            |          |
| DIFFERENCE BETWEEN SLOPES                                                             |      |             |                       |        |              |            |              |       |         |                            |          |
| W/TP10                                                                                | 1    | 0.211301+06 | 1256.6                | 20100  |              |            |              | 1     | 733.45  |                            |          |
| W/2SA10                                                                               | 1    | 0.273351+07 | 59448.                | 16445. |              |            |              | 1     | 29.742  |                            |          |
| W/TOTAL                                                                               | 1    |             |                       |        |              |            |              |       |         |                            |          |

\*\*\* SAMPLE SIZE SUMMARY \*\*\*

| AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP | AGE<br>(MOS) | NR<br>SAMP |
|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| 56           | 5          | 92           | 2          | 120          | 20         | 148          | 15         | 185          | 25         |
| 58           | 5          | 93           | 4          | 121          | 40         | 149          | 9          | 186          | 20         |
| 59           | 10         | 94           | 7          | 123          | 20         | 150          | 5          | 187          | 10         |
| 60           | 5          | 95           | 4          | 124          | 15         | 151          | 5          | 190          | 10         |
| 61           | 15         | 96           | 3          | 126          | 6          | 152          | 5          | 191          | 10         |
| 62           | 10         | 98           | 1          | 127          | 3          | 153          | 5          | 192          | 10         |
| 63           | 10         | 99           | 1          | 128          | 12         | 155          | 5          | 193          | 50         |
| 64           | 10         | 101          | 10         | 130          | 6          | 156          | 10         | 194          | 10         |
| 65           | 10         | 102          | 11         | 131          | 11         | 158          | 30         | 195          | 35         |
| 66           | 10         | 103          | 15         | 132          | 19         | 159          | 5          | 196          | 25         |
| 67           | 11         | 105          | 10         | 133          | 25         | 160          | 5          | 197          | 10         |
| 68           | 5          | 106          | 5          | 134          | 14         | 161          | 15         | 198          | 10         |
| 78           | 2          | 107          | 15         | 135          | 17         | 162          | 5          | 199          | 5          |
| 80           | 4          | 108          | 20         | 136          | 11         | 164          | 5          | 200          | 15         |
| 81           | 1          | 109          | 15         | 137          | 21         | 165          | 10         | 201          | 5          |
| 82           | 2          | 110          | 15         | 138          | 3          | 166          | 25         | 202          | 15         |
| 83           | 1          | 111          | 10         | 139          | 9          | 167          | 10         | 203          | 10         |
| 84           | 1          | 112          | 20         | 140          | 15         | 168          | 15         | 204          | 20         |
| 85           | 5          | 113          | 15         | 141          | 9          | 169          | 5          | 205          | 15         |
| 86           | 4          | 114          | 20         | 142          | 18         | 170          | 10         |              |            |
| 87           | 3          | 115          | 10         | 143          | 12         | 171          | 15         |              |            |
| 88           | 1          | 116          | 20         | 144          | 8          | 173          | 10         |              |            |
| 89           | 4          | 117          | 15         | 145          | 16         | 174          | 5          |              |            |
| 90           | 4          | 118          | 40         | 146          | 18         | 181          | 10         |              |            |
| 91           | 2          | 119          | 10         | 147          | 3          | 184          | 5          |              |            |

STAGE 1. WING 2. TP-H1043, HARDNESS SHURE C. INITIAL

This sample size summary is applicable to figures 25 and 27

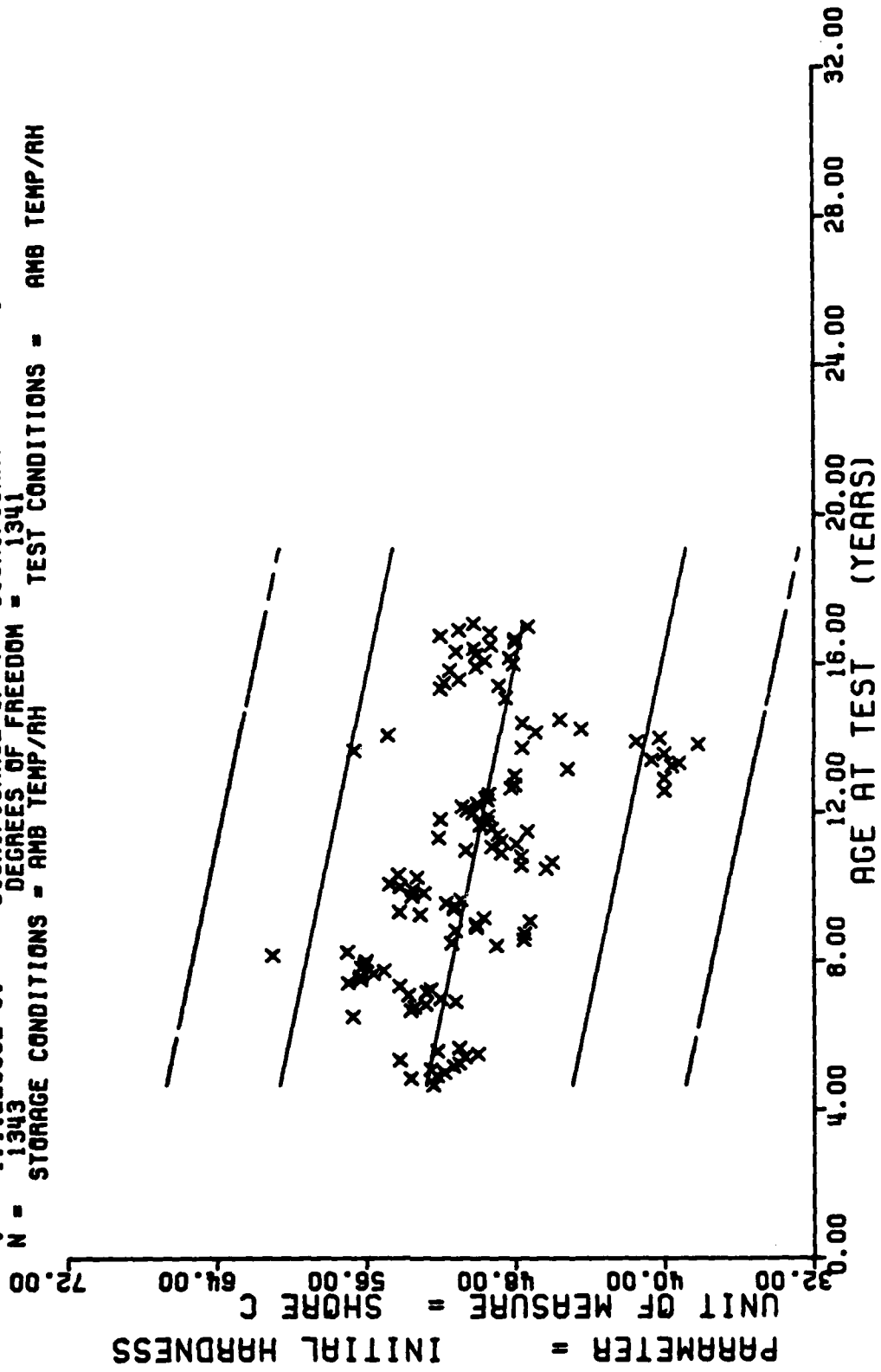
\*\*\* SAMPLE SIZE SUMMARY \*\*\*

| AGE<br>(MDS) | NR<br>SAMP | AGE<br>(MDS) | NR<br>SAMP |
|--------------|------------|--------------|------------|
| 82           | 12         | 146          | 35         |
| 83           | 15         | 147          | 40         |
| 84           | 24         |              |            |
| 85           | 27         |              |            |
| 86           | 15         |              |            |
| 87           | 18         |              |            |
| 88           | 21         |              |            |
| 89           | 21         |              |            |
| 90           | 9          |              |            |
| 91           | 9          |              |            |
| 107          | 5          |              |            |
| 108          | 10         |              |            |
| 109          | 20         |              |            |
| 110          | 25         |              |            |
| 111          | 15         |              |            |
| 112          | 15         |              |            |
| 113          | 20         |              |            |
| 114          | 15         |              |            |
| 115          | 20         |              |            |
| 140          | 5          |              |            |
| 141          | 15         |              |            |
| 142          | 15         |              |            |
| 143          | 30         |              |            |
| 144          | 50         |              |            |
| 145          | 25         |              |            |

STAGE 1. WING C. TP-H:043. HARDNESS SHORE C. INITIAL

This sample size summary is applicable to figures 26 and 28

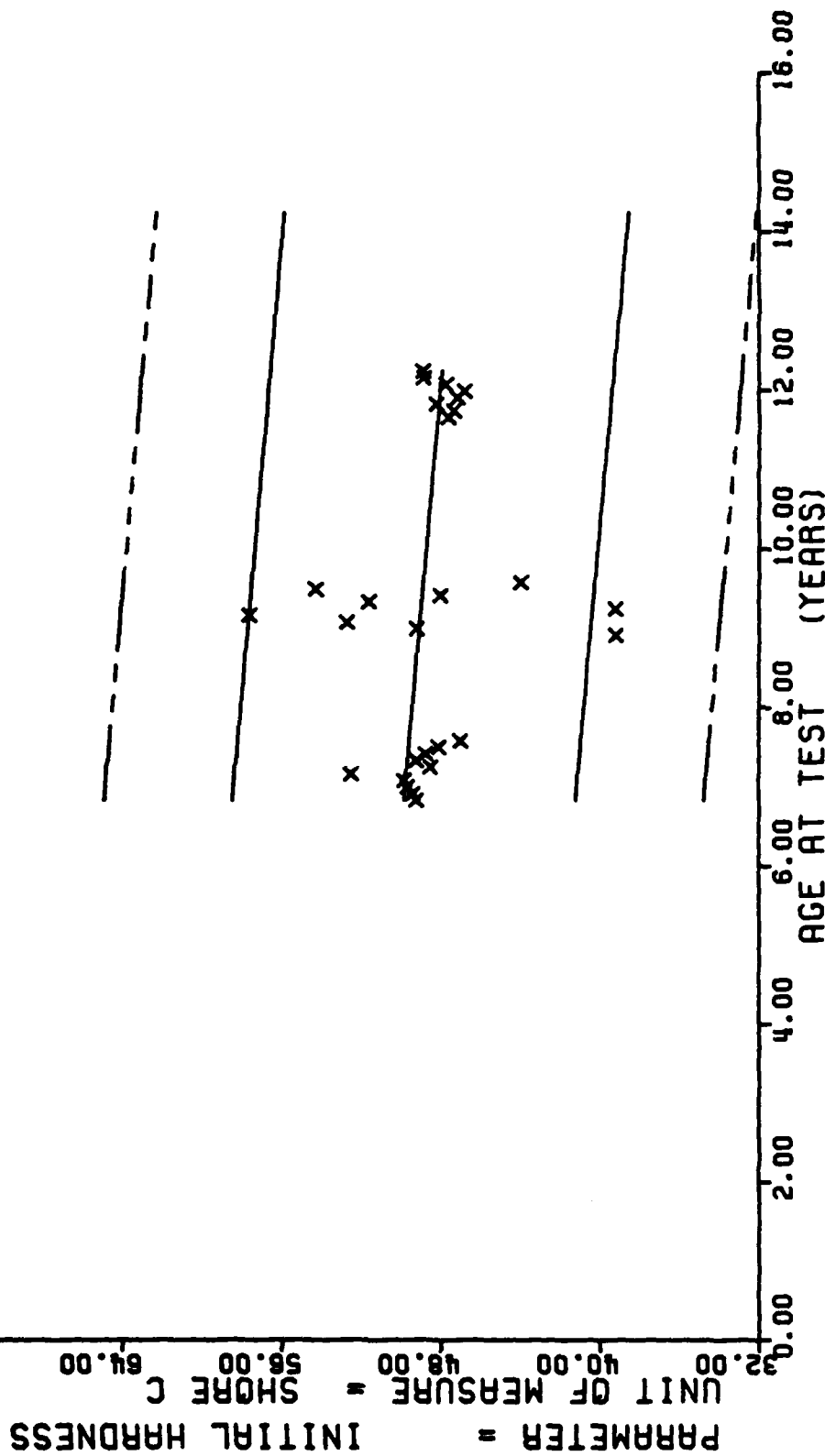
$Y = ((+5.4760067E+01) + (-3.5216968E-02) * X)$   
 $F = +1.2371085E+02$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma^2 = +4.8468345E+00$   
 $R = -2.9062164E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +3.1662708E-03$   
 $t = +1.1122538E+01$  SIGNIFICANCE OF t = SIGNIFICANT  $S_e = +4.6393645E+00$   
 $N = 1343$  DEGREES OF FREEDOM = 1341  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1. WING 2. TP-H1043. HARDNESS SHORE C. INITIAL

Figure 25

$Y = ((+5.2305275E+01) + (-2.9923191E-02) \times X)$   
 $F = +1.1732180E+01$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = -1.4729848E-01$  SIGNIFICANCE OF R = SIGNIFICANT  
 $t = +3.4252271E+00$  SIGNIFICANCE OF t = SIGNIFICANT  
 $N = 531$  DEGREES OF FREEDOM = 529  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH





$Y = ((+3.4481323E+01) + (-5.6467131E-03) \times X)$   
 $F = +5.1275630E+00$  SIGNIFICANCE OF F = SIGNIFICANT  
 $R = -6.1718078E-02$  SIGNIFICANCE OF R = SIGNIFICANT  
 $t = +2.2644122E+00$  SIGNIFICANCE OF t = SIGNIFICANT  
 $N = 1343$  DEGREES OF FREEDOM = 1341  
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

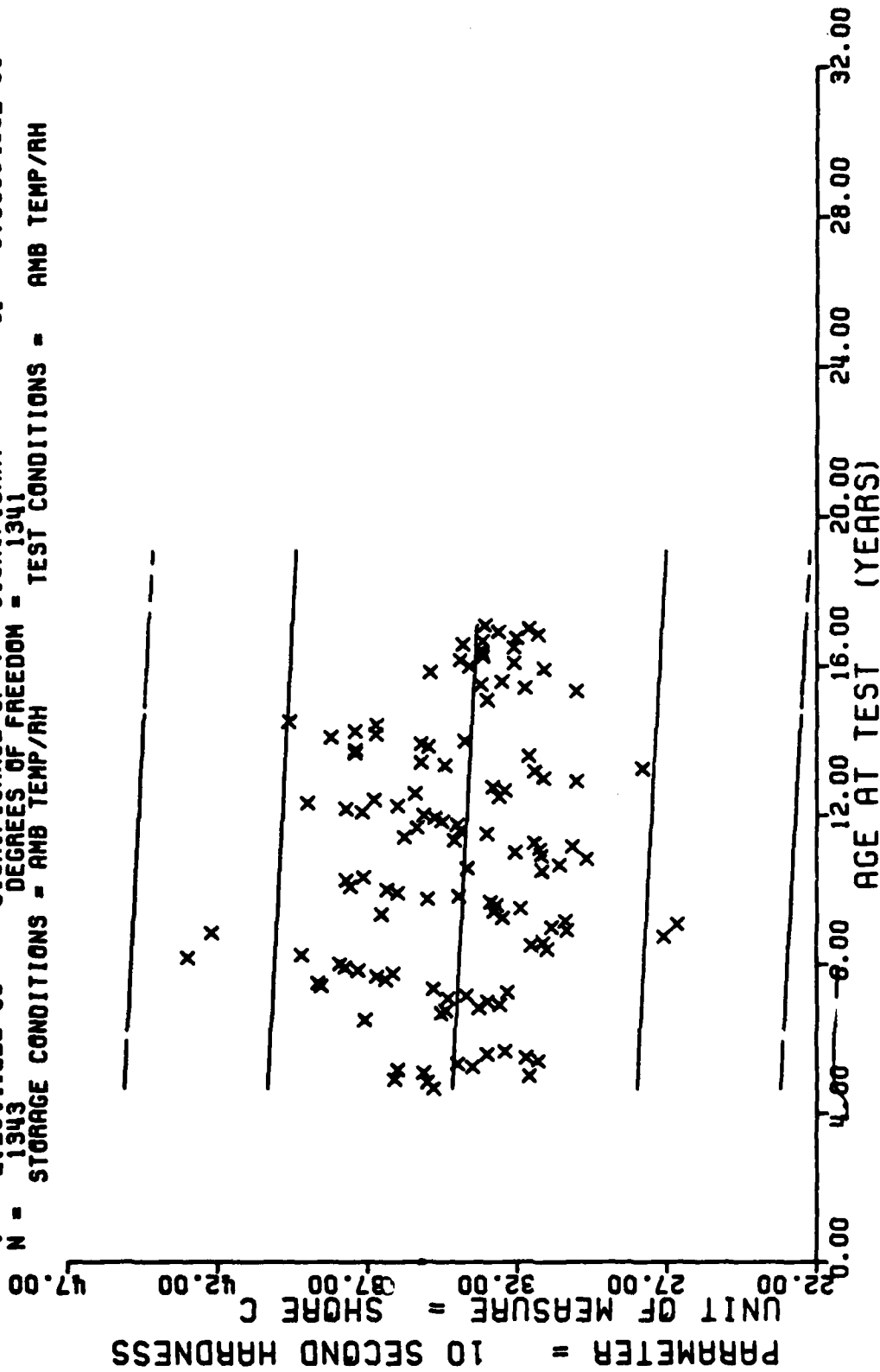
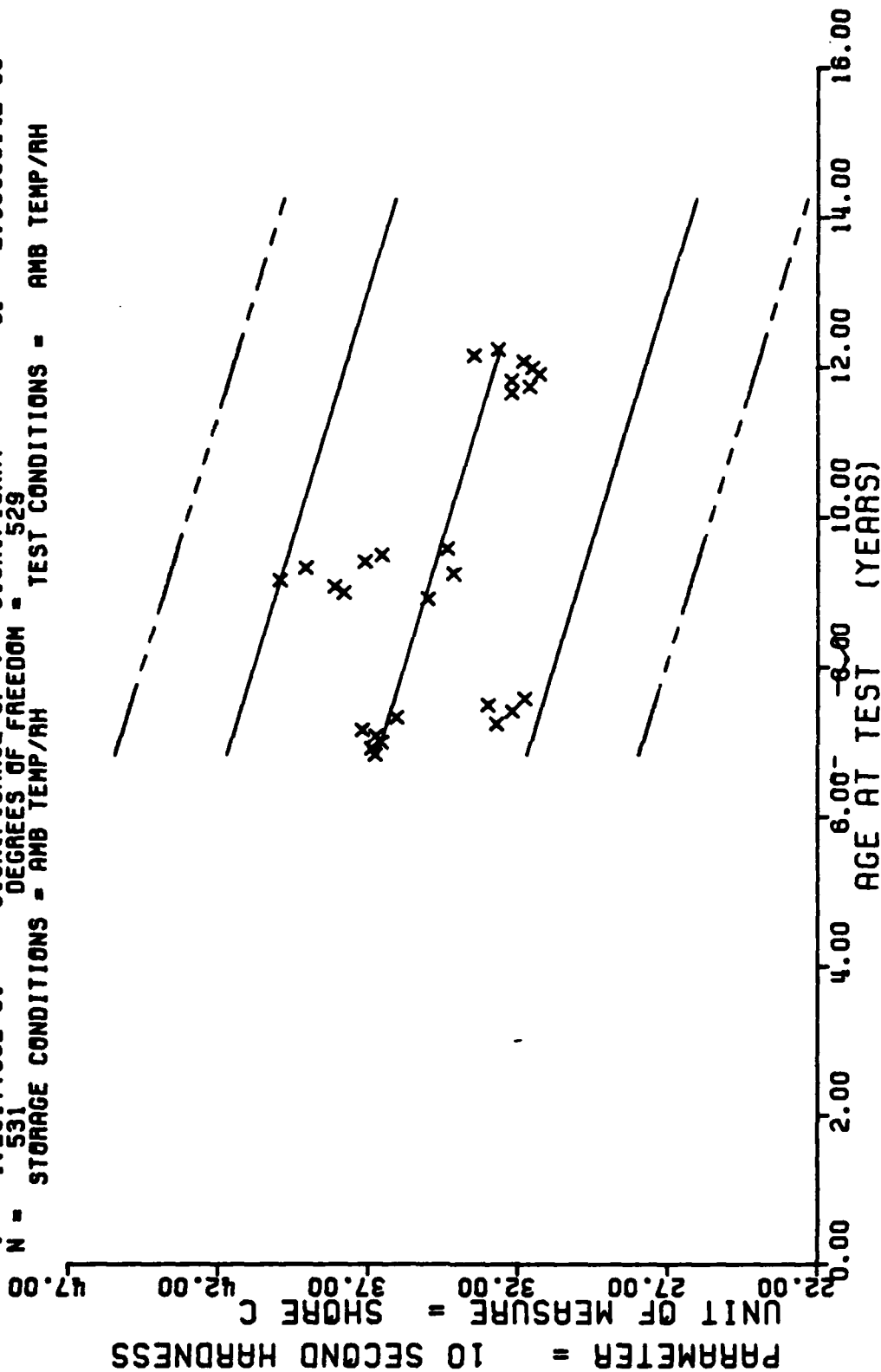


Figure 27

$Y = (( +4.1881612E+01 ) + ( -6.9309273E-02 ) \times X)$   
 $F = +1.5889372E+02$  SIGNIFICANCE OF F = SIGNIFICANT  $\sigma^2 = +3.3088612E+00$   
 $R = -4.7803612E-01$  SIGNIFICANCE OF R = SIGNIFICANT  $S_e = +5.0575856E-03$   
 $t = +1.2517736E+01$  SIGNIFICANCE OF t = SIGNIFICANT  $S_e = +2.9090514E+00$   
 $N = 531$  DEGREES OF FREEDOM = 529  
 STORAGE CONDITIONS = AMB TEMP/AMB TEST CONDITIONS = AMB TEMP/AMB





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| 18. SUPPLEMENTARY NOTES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |                                                                  |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)<br>Solid Propellant<br>Minuteman<br>Aft Closure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |                                                                  |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>This report contains propellant test results from cartons of TP-H1043 propellant representing selected batches used in the aft closure of First Stage Minuteman Motors. Data from TP-H1043 propellant obtained from the aft closures of the LGM-30 A, B, F, and G Motors are reported in regression analyses for the sixth time and the fifth time using the G085 Computer System. In previous reports, A, B, F, and G data were combined for statistical analysis. For this report, a separate statistical analysis was made for A and B (wing 2) and |                       |                                                                  |

F and G (wing 6). The statistical analysis includes regressions and covariance analysis. Testing was accomplished in accordance with MMWRBA Project M8293C.

An analysis of all parameters indicate that no significant degradation is anticipated for at least two years past the oldest data point.

Each point on the regression plot represents all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system.

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