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Interlaboratory Comparison of Heat Release Data from Aircraft Panels

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Lawrence T. Fitzgerald

March 1986

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16. Abstract

A computer program was developed to correlate and statistically analyze laboratory and full-scale fire test data. The program and its usage is presented in this report. Also, the results of a roundrobin test program utilizing the Ohio State University Rate of Heat Release (OSU) test apparatus are described. Data from the roundrobin was used to show the capabilities of the newly developed computer program. The results of the roundrobin indicated that reproducibility between laboratories had increased and that a further increase could be expected with greater standardization of equipment and procedures.

17. Key Words

Correlation
Roundrobin
Rank Correlation
Heat Release
Reproducibility

18. Distribution Statement

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EXECUTIVE SUMMARY

This report contains the results of a roundrobin test program between the Federal Aviation Administration (FAA) Technical Center and three members of Aerospace Industries Association (AIA) (Boeing, Douglas and Heath Tecna, the latter represented by Ohio State University), utilizing the Ohio State University rate of heat release apparatus. The results of the testing are presented and analyzed utilizing a newly developed computer program to correlate and statistically analyze test data. The results show a large improvement in test data reproducibility between laboratories due to increased standardization of equipment and procedures. As an example, the percent relative standard deviation for the 2-minute integrated heat release from a 5-watt per square centimeter exposure, using the thermopile measurement method, was reduced from 25.16 percent to 5.44 percent. Analysis of the data indicates that further improvements in reproducibility (lower than 10 percent) could be gained by greater standardization of equipment and procedures.

INTRODUCTION

PURPOSE.

The purpose of this report is twofold:

1. To compare and analyze data obtained by different laboratories during round-robin testing with the Ohio State University Rate of Heat Release Apparatus.

2. Describe and illustrate the use of a computer program for the storage and statistical analysis of laboratory test data.

BACKGROUND.

In order to determine the reproducibility of the Ohio State University (OSU) apparatus, the Federal Aviation Administration (FAA) Technical Center and the Aerospace Industries Association of America, Inc. (AIA) conducted a series of tests, utilizing the same aircraft interior materials at three different laboratories (FAA Technical Center, Boeing, and Douglas). The results of that series showed a lack of consistent test results between laboratories. The FAA and AIA subsequently agreed to various modifications to the equipment and test methodology aimed at improving its between-laboratory reproducibility. A second roundrobin was then conducted using the same materials and laboratory participants, and joined by Ohio State University, representing Heath Tecna, an AIA member.

DISCUSSION

TEST EQUIPMENT.

The OSU Rate of Heat Release Apparatus and test format, as outlined in ASTM E-906, was utilized initially, with various modifications later agreed to by the test participants. The first series of tests was conducted as outlined in appendix A, of reference 1 and the second in appendix B, of reference 1. There were still some slight remaining variations in test equipment and/or procedures between laboratories, in spite of attempts to completely standardize.

COMPUTER HARDWARE.

MAINCORR is currently operating on a Data General Model 10/SP Desktop computer and utilizes the folowing peripherals:

- all hardcopy printed output is performed on an NEC Spinwriter Model #7710 Letter Quality printer.

- all hardcopy graphic output is plotted on a Hewlett Packard Model #755 8-pen Plotter with automatic sheet feed.

- all CRT plotting is performed on a Data General Model 10/SP Color System Console.

The Model 10/SP Desktop computer is equipped with one fifteen (15) megabyte disk drive used for database storage and 512 kilobytes of internal memory (RAM).

COMPUTER SOFTWARE.

MAINCORR is a statistics program, written in the programming language, Fortran IV, for the purpose of comparing various fire test data for aircraft cabin materials that will determine the validity and consistency of these test data.

Table 1 is a list of statistics the user is currently able to obtain from the program MAINCORR.

MAINCORR is also capable of producing X-Y coordinate plots which show the relationship between two tests for each material. The relationship is compared by a one-to-one correspondence line and the least square best fit line of the data values. A bargraph compares the data of each material for up to four tests.

Operation, selection, and data selection is accomplished by MAINCORR through a series of screen queries (tables 2 through 5). Each operation leads the user through its own set of screens.

The data base setup to handle the material information consists of four separate files. Each file holds a laboratory title and a pointer to the next file. Only the last file contains the data that is processed. This file structure reduces the number of input-output seeks to a maximum of four before the required data are accessed.

Currently, the data base is set up to accept up to 20 tests. Each test is capable of accepting 20 apparatuses, and each apparatus is capable of accepting 20 data variables. Under each data variable is the material test result. As of this printing, 25 materials are included. The total number of data points allowed in the file is 10,000, expandable to 64,000.

This program consists of 12 modules, one main program and 11 subroutines. Figures 1 through 3 illustrate the program flow. Two subroutines are utilized for input to the data base, one subroutine for output from the data base, three subroutines for graphical output of data, three subroutines for statistical purposes and two subroutines for editing purposes. Figure 4 is a brief program description.

TEST MATERIALS.

In-service aircraft interior materials were supplied by AIA for use in the round-robin test series. These materials included ceiling panels, sidewalls, stowage bins, and partitions. In this report the materials will only be referred to by a reference number. Three thermoplastic materials were also supplied by the FAA, (ABS, polycarbonate, and Ultem™). A description of the materials is contained in reference 2, appendix A. In addition, five types of composite panels used by the FAA in full-scale testing were supplied and included in some of the testing. Those panels are listed as epoxy/fiberglass, epoxy/Kevlar™, phenolic/fiberglass, phenolic/Kevlar, and phenolic/graphite, which is a general description of the facings, and are described in more detail in reference 2.

TEST RESULTS.

Table 6 lists the various parameters reported by each laboratory for both roundrobins. For the first roundrobin three laboratories participated (FAA, Boeing, and Douglas). The Ohio State University was an additional participant (using the thermopile only) in the second roundrobin.

For each of the materials tested, three samples were run, with the average of those three runs being reported. This report does not deal with internal laboratory repeatability, therefore, only the average values were utilized.

Because of the vast amount of data it was necessary to limit the scope of comparison. Since the main reason for the testing was to develop the OSU apparatus into a more reproducible laboratory test for use in regulating the usage of aircraft interior panels, and since the FAA released an Notice of Proposed Rule Making (NPRM) specifying the OSU apparatus and stating acceptance criteria, the criteria outlined in that NPRM were utilized to limit the number of parameters for comparison. Therefore, the parameters used for the first roundrobin were the thermopile measured 2-minute integrated heat release, at a sample exposure of 5 watts per square centimeter (hereinafter referred to as just watts) and the oxygen depletion measured 2-minute integrated heat release at 5 watts. For the second roundrobin the important parameters were the thermopile 2-minute integrated heat release and the thermopile peak heat release rate, both measured at a sample exposure of 3.5 watts.

A summary of the derivation of those parameters is as follows:

Initially, it was determined that the 5 watt 2-minute integrated heat release data gave the best correlation with full-scale test results. At first it was not determined which method of measuring heat release worked best, so either thermopile or oxygen depletion could be used. The first roundrobin also indicated a major problem in reproducibility. The percent standard deviation between laboratories for the 2-minute integrated heat release at 5 watts was 40.0 for oxygen depletion and 25.2 for thermopile.

Modifications were made in the OSU equipment and procedures by FAA and AIA in order to improve reproducibility. During those changes it was discovered that the heat flux transducer used in calibrating the FAA's equipment was in error. The 5-watt data from the first roundrobin was in reality taken at approximately 3.8 watts. When the test data with the modified OSU equipment was analyzed, the 3.5-watt data correlated better with full-scale test results. Figure 5 shows the correlation between the FAA's data before and after the modifications to the OSU equipment. The recommended pass/fail criteria for NPRM 85-10 was adjusted accordingly (reference 3).

Although there was a large difference in the absolute values of heat release measured by the two vintages of the OSU equipment, figure 5 indicates a reasonably good correlation. Perhaps more surprising was the excellent correlation between the thermopile and oxygen depletion methods for measuring heat release. Figures 6 and 7 and tables 7 through 10 show that relationship utilizing the FAA data. Figures 8 through 11 show that the relationship was almost as true for the other laboratories. Because of this extremely good correlation and the higher cost and complexity of the oxygen measurements, it was recommended that the thermopile measurement method only be required. The peak thermopile reading requirement that was added later because of its good correlation to full-scale tests as well as perceived need to exclude materials with the following behavior: high peak heat release rate (burning rate) but relatively low integrated heat release due to insufficient mass, or low integrated heat release at 2 minutes but high heat release rates after 2 minutes.

A check of the percent standard deviation from the two roundrobins (table 11) showed a vast improvement in reproducibility. As a result of all of the aforementioned, the remainder of this report will focus on the second roundrobin data at 3.5-watts measured with the thermopile for both 2-minute integrated heat release and peak heat release rate.

A graphical comparison of data is shown in figures 12 through 15. Figures 12 and 13 show data from all four laboratories for the inservice materials, including the three thermoplastics. Figures 14 and 15 show FAA-supplied panel data from three laboratories, OSU not included.

For a good statistical comparison of the data, a complete statistical package can be obtained from the computer program, or an abridged summary is available. Appendix B is the full printout of the statistical package of the data presented in figures 12 through 15. Tables 12 and 13 show the abridged summary of the statistical package for all four laboratories, for all of the materials tested, at 3.5-watts, for both peak heat release rate and 2-minute integrated heat release measured by thermopile. It should be noted that the most important statistic is probably the average coefficient of variance, or percent standard deviation, as it is also known. The values of 16.42 for peak heat release rate and 14.41 for the 2-minute integrated heat release are slightly higher than previous values because of the addition of the FAA-supplied Panels.

Tables 14 through 25 and figures 16 through 21 show the correlation of the various laboratories with the FAA data. What the data show are that there is a very good correlation between laboratories and that the differences in data is not random, but is to a large extent, a constant offset between laboratories. On the correlation curves, the solid line is the best fit curve and the dashed line is a perfect one-to-one correspondence. Note the offset, in most cases, between the two lines. This indicated that improvement could still be made to reduce the deviation between laboratories.

A prediction of improved reproducibility by better standardization of the OSU test methodology can be made by the following analysis.

The percent standard deviation of each laboratory, for peak and 2-minute integrated heat release, compared to the FAA data, was calculated (tables 26 through 31). Then, assuming that the FAA data are consistently at the low deviation and the other laboratories are at the high deviation, the percentage that should be subtracted from each laboratory in order to bring it in line with FAA's data are shown in table 32. These calculated, corrected percentages were subtracted from each data point of each laboratory, and tables 33 and 34, and figures 22 and 23, show the results of an analysis of the modified data. Note that the average coefficient of variance (percent standard deviation) has greatly improved, indicating that further standardization of the OSU test methodology should improve the consistency of test data (reproducibility) between laboratories.

CONCLUSIONS

1. The reproducibility of the OSU test data between laboratories has been improved by greater standardization of equipment and procedures.

2. Further improvement in reproducibility can be expected with additional standardization.

REFERENCES

1. Hill, R. G., Eklund, T. I., and Sarkos, C. P., Aircraft Interior Panel Test Criteria Derived from Full-Scale Fire Tests, Federal Aviation Administration, Report DOT/FAA/CT-85/23, September 1985.

2. Filipczak, R., et al, Correlation of Small-Scale Tests With Performance During Full-Scale Cabin Fire Tests, FAA report in progress.

3. Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins; Notice of Proposed Rulemaking Reopening of Comment Period, DOT/FAA, Federal Register, Vol. 50, No. 144, p. 30,447, July 26, 1985.

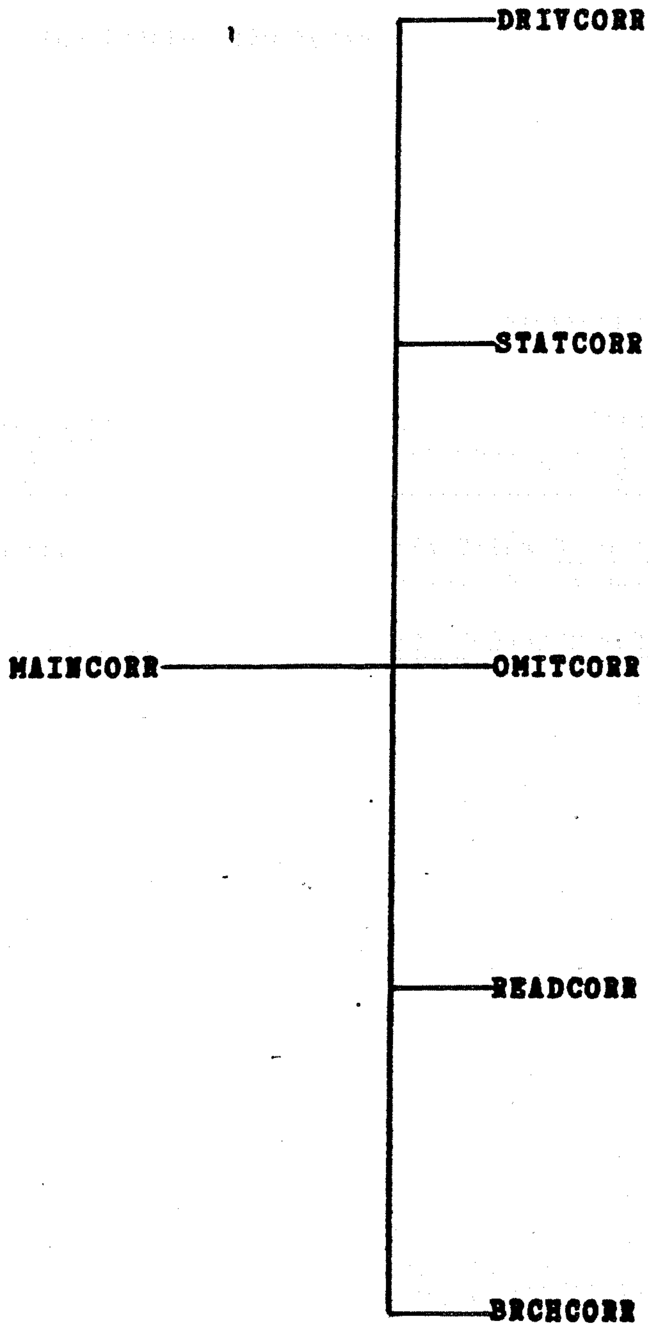

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FIGURE 1. LEVEL ONE - PROGRAM FLOW DIAGRAM

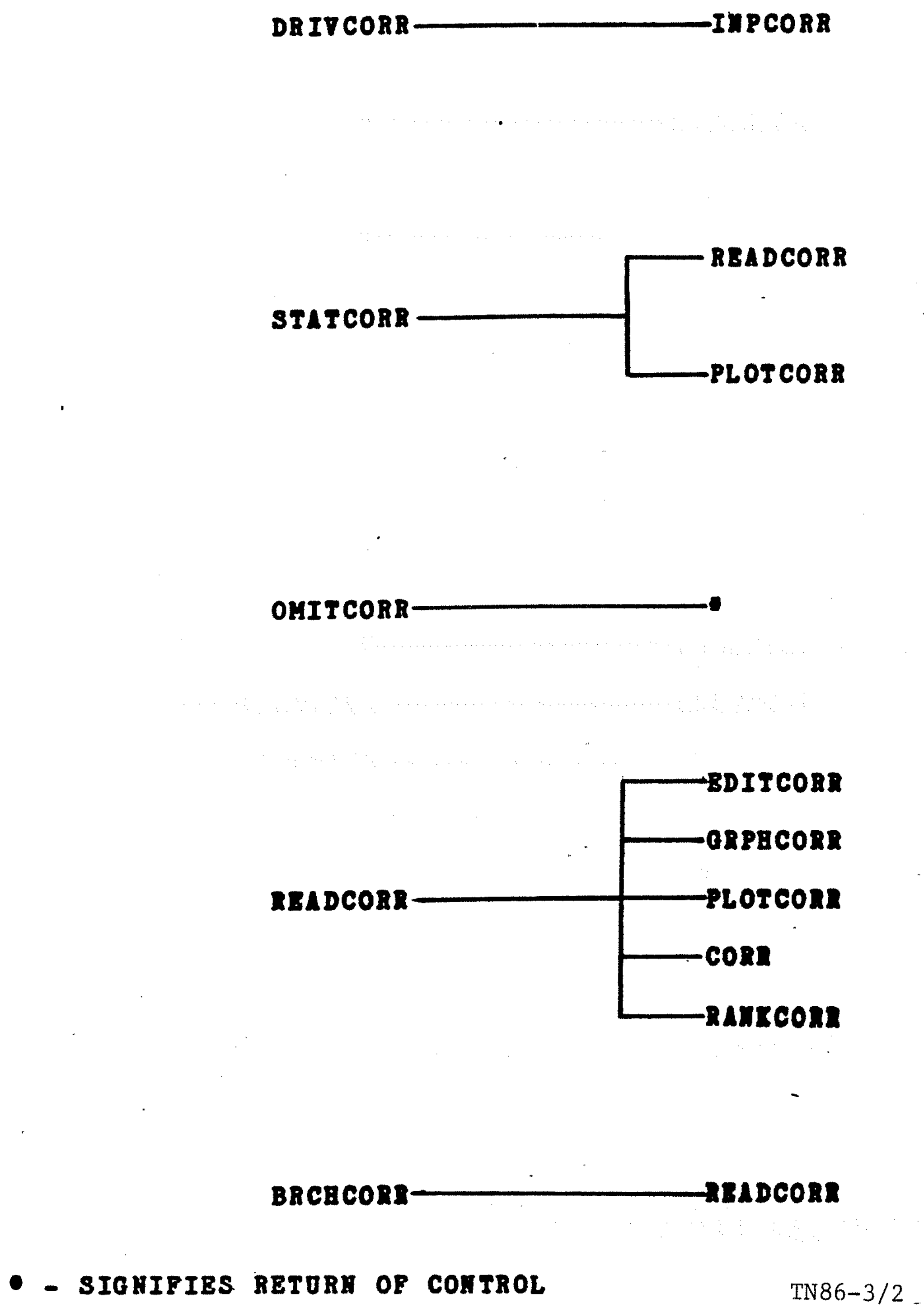
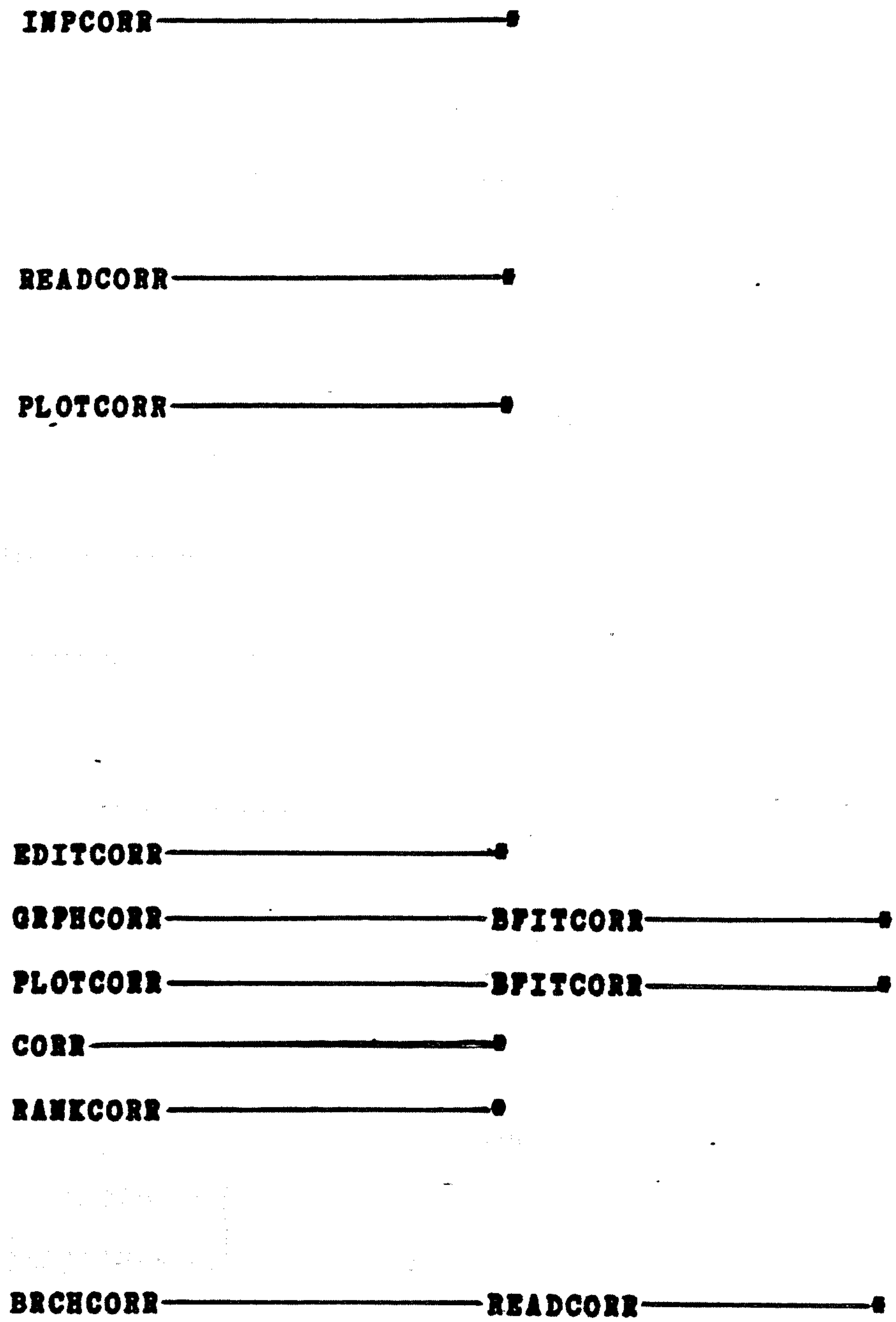


FIGURE 2. LEVEL TWO - PROGRAM FLOW DIAGRAM



*** - SIGNIFIES RETURN OF CONTROL**

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FIGURE 3. LEVEL THREE - PROGRAM FLOW DIAGRAM
LEVEL FOUR - PROGRAM FLOW DIAGRAM

TITLE : MAINCORR

FUNCTION : Main program.
initializes arrays
opens data files
driver for subroutines

SUBROUTINE CALLS : DRIVCORR, STATCORR, OMITCORR, READCORR, BRCHCORR

SUBROUTINE : DRIVCORR

FUNCTION : Sets up screens for user input
accepts data input

CALLED BY : MAINCORR

SUBROUTINE CALLS : INPCORR

SUBROUTINE : INPCORR

FUNCTION : Accepts data from keyboard and
inserts data into data base

CALLED BY : DRIVCORR

SUBROUTINE CALLS : NONE

SUBROUTINE : STATCORR

FUNCTION : Prints statistics on each material
or prints summary of all materials
statistics include :
maximum, minimum, range, average,
variance, standard deviation,
coefficient of variance

CALLED BY : MAINCORR

SUBROUTINE CALLS : READCORR,BFITCORR

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FIGURE 4. PROGRAM AND ROUTINE DESCRIPTIONS (1 of 3 SHEETS)

SUBROUTINE : **OMITCORR**

FUNCTION : Bypasses certain materials, so that these are not figured in any processing performed by any routines.

CALLED BY : MAINCORR

SUBROUTINE CALLS : NONE

SUBROUTINE : **READCORR**

FUNCTION : Sets up user screens for access to data base. Reads data from data base files.

CALLED BY : MAINCORR, STATCORR, BRCHCORR

SUBROUTINE CALLS : CORR, RANKCORR, PLOTCORR, GRPHCORR, EDITCORR

SUBROUTINE : **BRCHCORR**

FUNCTION : Creates bar graphs on the Hewlett-Packard plotter (model no. 7550A)

CALLED BY : MAINCORR

SUBROUTINE CALLS : READCORR

SUBROUTINE : **PLOTCORR**

FUNCTION : Creates one to one correspondence graphs on plotter and optionally plots best fit line

CALLED BY : READCORR

SUBROUTINE CALLS : BFITCORR

FIGURE 4. PROGRAM AND ROUTINE DESCRIPTIONS (2 of 3 SHEETS)

__SUBROUTINE__ : GRPHCORR

__FUNCTION__ : Creates one to one correspondence graphs on terminal screen and optionally plots best fit line

__CALLED BY__ : READCORR

__SUBROUTINE CALLS__ : BFITCORR

__SUBROUTINE__ : CORR

__FUNCTION__ : Performs a one to one simple correlation of two user selected data sets

__CALLED BY__ : READCORR

__SUBROUTINE CALLS__ : NONE

__SUBROUTINE__ : RANKCORR

__FUNCTION__ : Performs rank difference method of correlation on two user selected data sets

__CALLED BY__ : READCORR

__SUBROUTINE CALLS__ : NONE

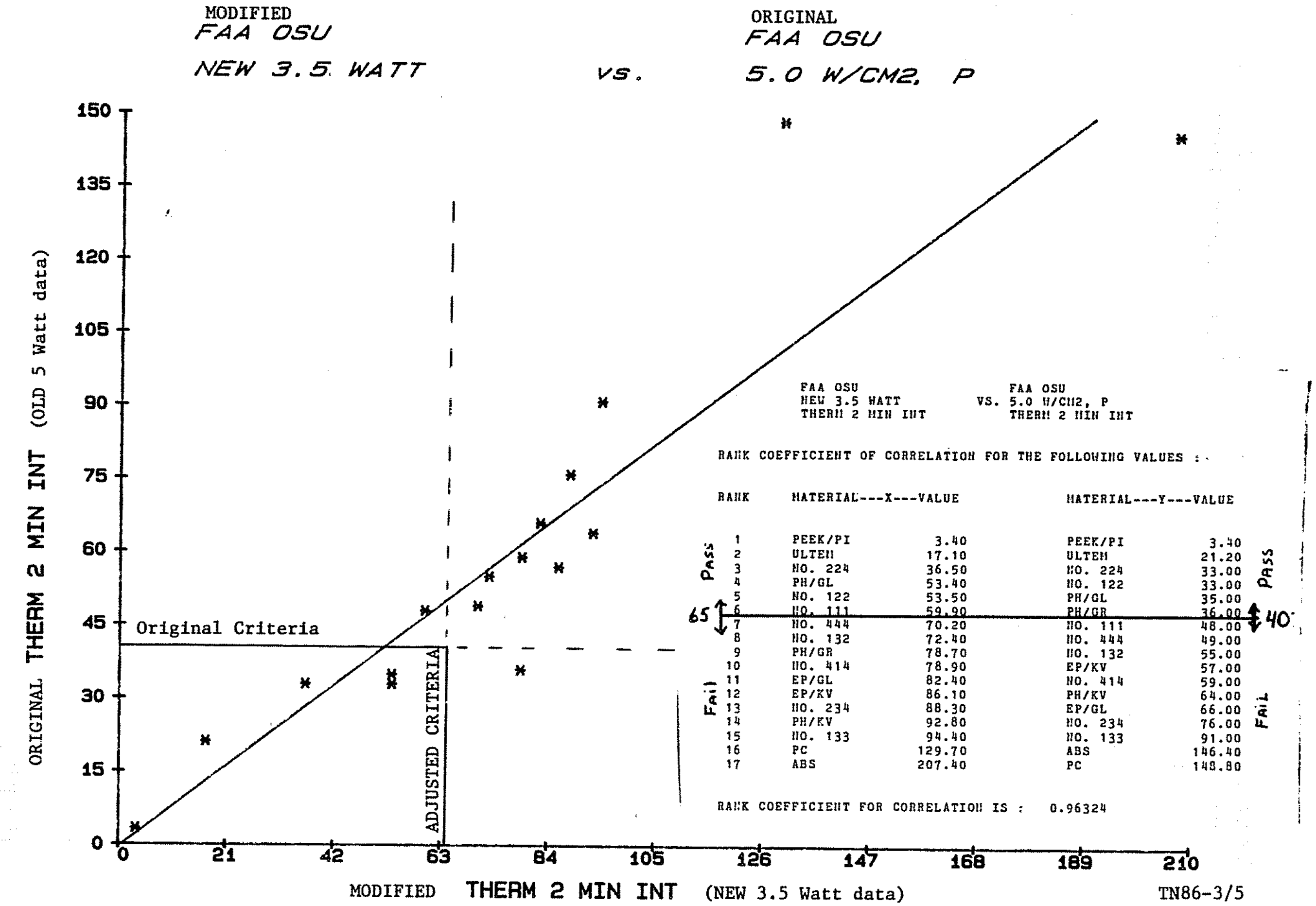
__SUBROUTINE__ : EDITCORR

__FUNCTION__ : Corrects, changes, inserts and/or deletes any data that is stored in the data base

__CALLED BY__ : READCORR

__SUBROUTINE CALLS__ : NONE

FIGURE 4. PROGRAM AND ROUTINE DESCRIPTIONS (3 of 3 SHEETS)



FAA OSU
NEW 3.5 WATT
THERM 2 MIN INT

VS.

FAA OSU
5.0 W/CM2, P
THERM 2 MIN INT

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	PEEK/PI	3.40	PEEK/PI	3.40
2	ULTEM	17.10	ULTEM	21.20
3	NO. 224	36.50	NO. 224	33.00
4	PH/GL	53.40	NO. 122	33.00
5	NO. 122	53.50	PH/GL	35.00
6	NO. 111	59.90	PH/GR	36.00
7	NO. 444	70.20	NO. 111	48.00
8	NO. 132	72.40	NO. 444	49.00
9	PH/GR	78.70	NO. 132	55.00
10	NO. 414	78.90	EP/KV	57.00
11	EP/GL	82.40	NO. 414	59.00
12	EP/KV	86.10	PH/KV	64.00
13	NO. 234	88.30	EP/GL	66.00
14	PH/KV	92.80	NO. 234	76.00
15	NO. 133	94.40	NO. 133	91.00
16	PC	129.70	ABS	146.40
17	ABS	207.40	PC	148.80

RANK COEFFICIENT FOR CORRELATION IS : 0.96324

FIGURE 5. CORRELATION BETWEEN FIRST AND SECOND ROUNDROBIN (FAA)

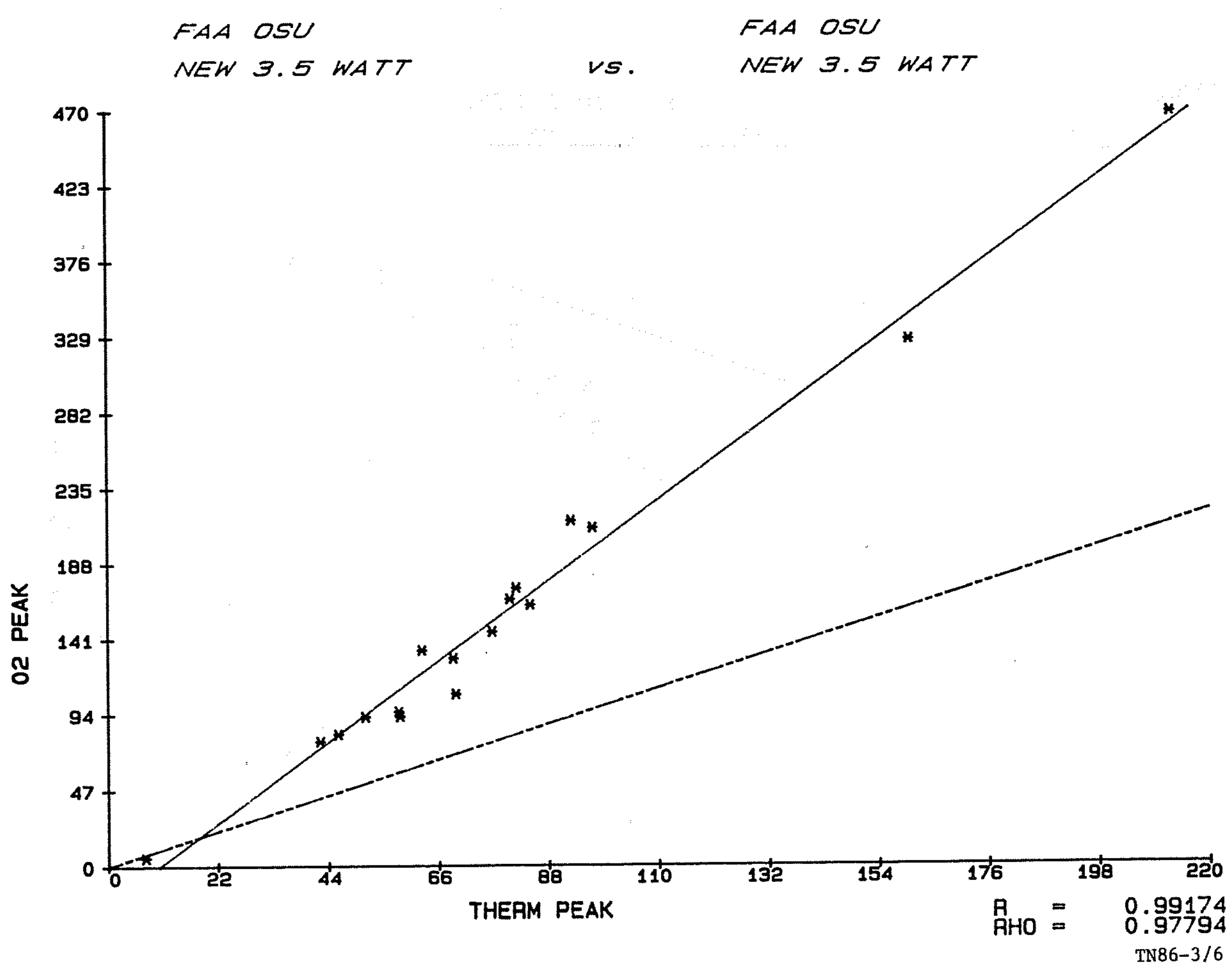


FIGURE 6. BEST FIT RELATIONSHIP BETWEEN O2 AND THERMOPILE PEAK (FAA - SECOND ROUNDROBIN)

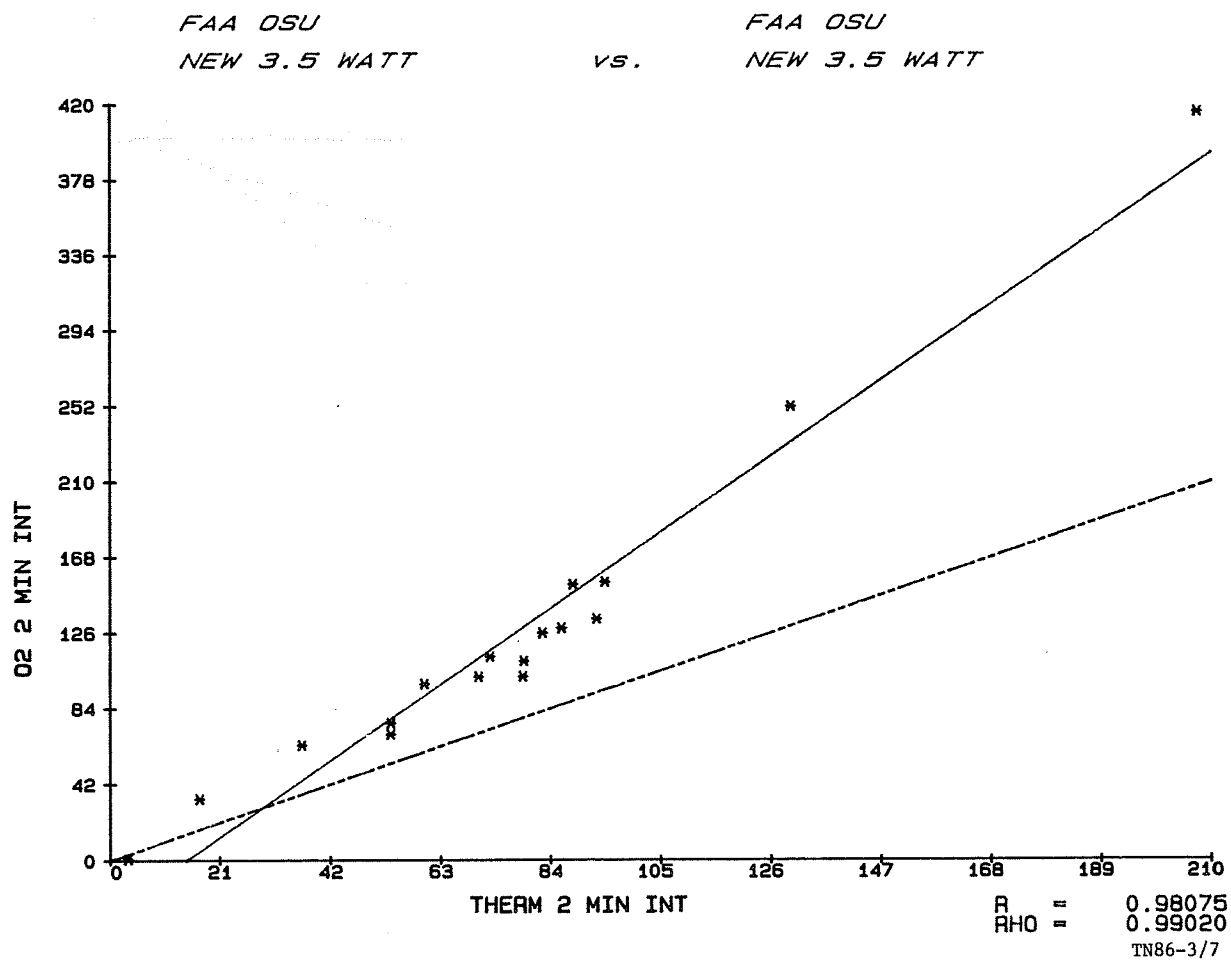


FIGURE 7. BEST FIT RELATIONSHIP BETWEEN O2 AND THERMOPILE 2-MINUTE INTEGRATION (FAA - SECOND ROUNDROBIN)

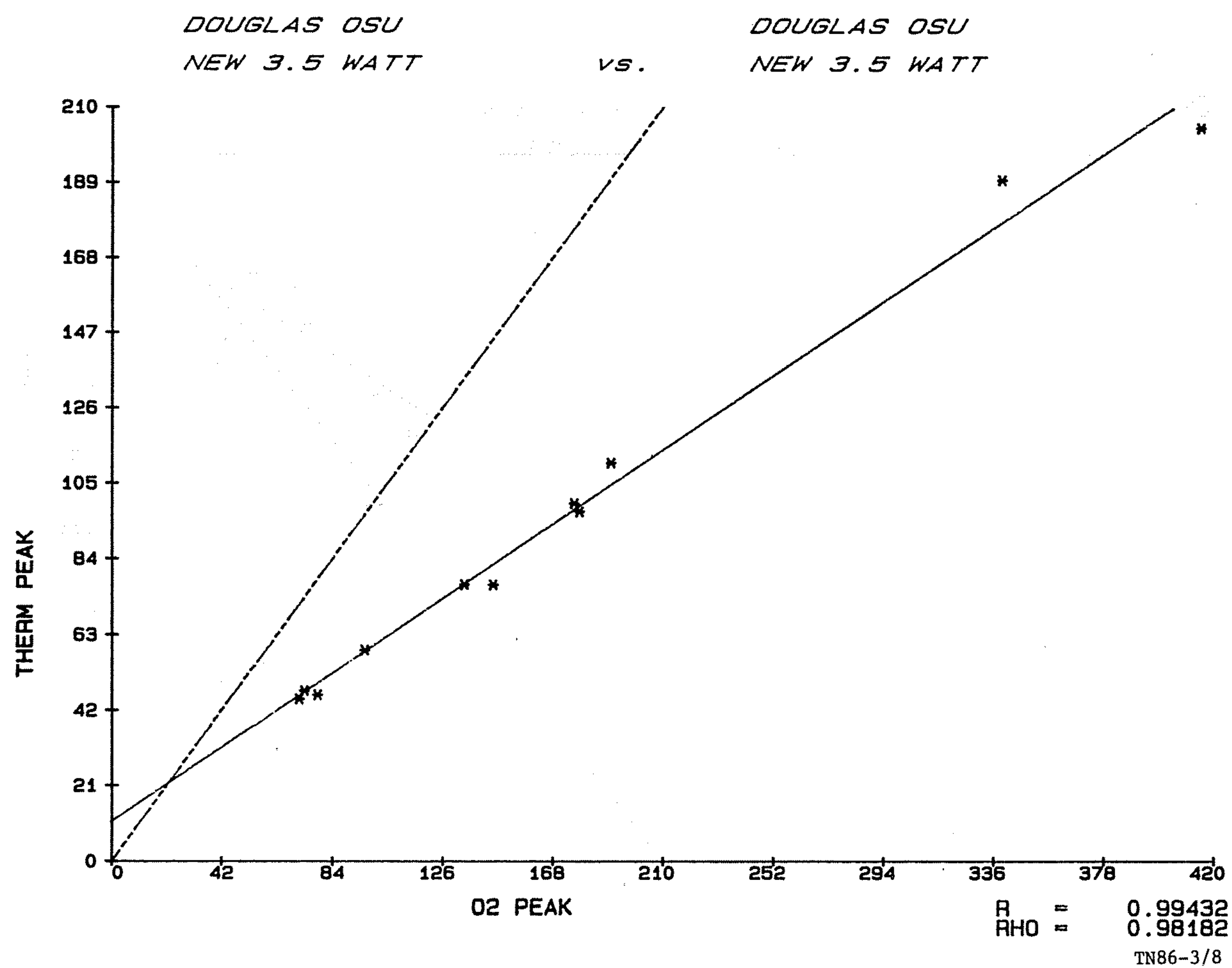


FIGURE 8. BEST FIT RELATIONSHIP BETWEEN O2 AND THERMOPILE PEAK
(DOUGLAS - SECOND ROUNDROBIN)

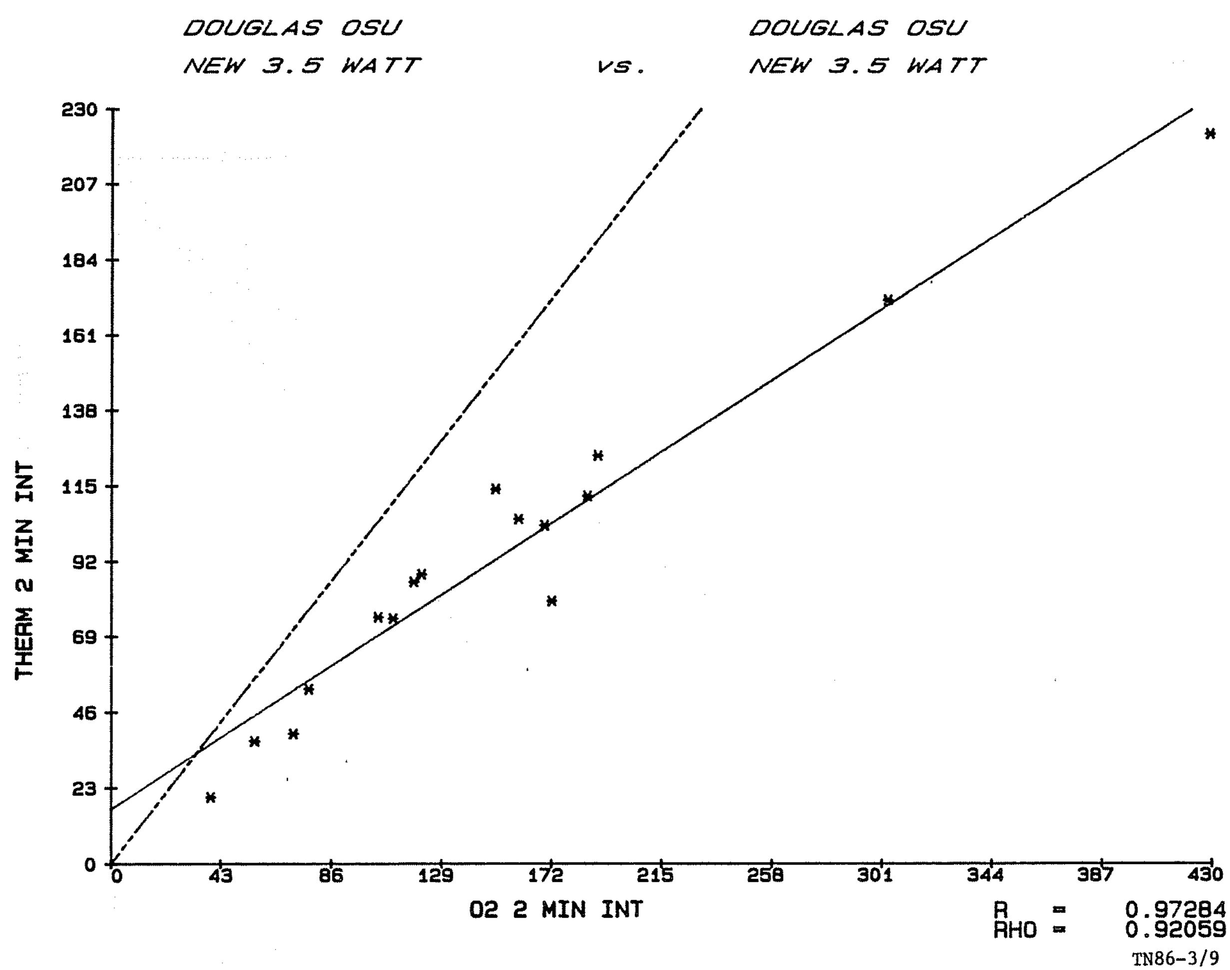


FIGURE 9. BEST FIT RELATIONSHIP BETWEEN O2 AND THERMOPILE 2-MINUTE INTEGRATION (DOUGLAS - SECOND ROUNDROBIN)

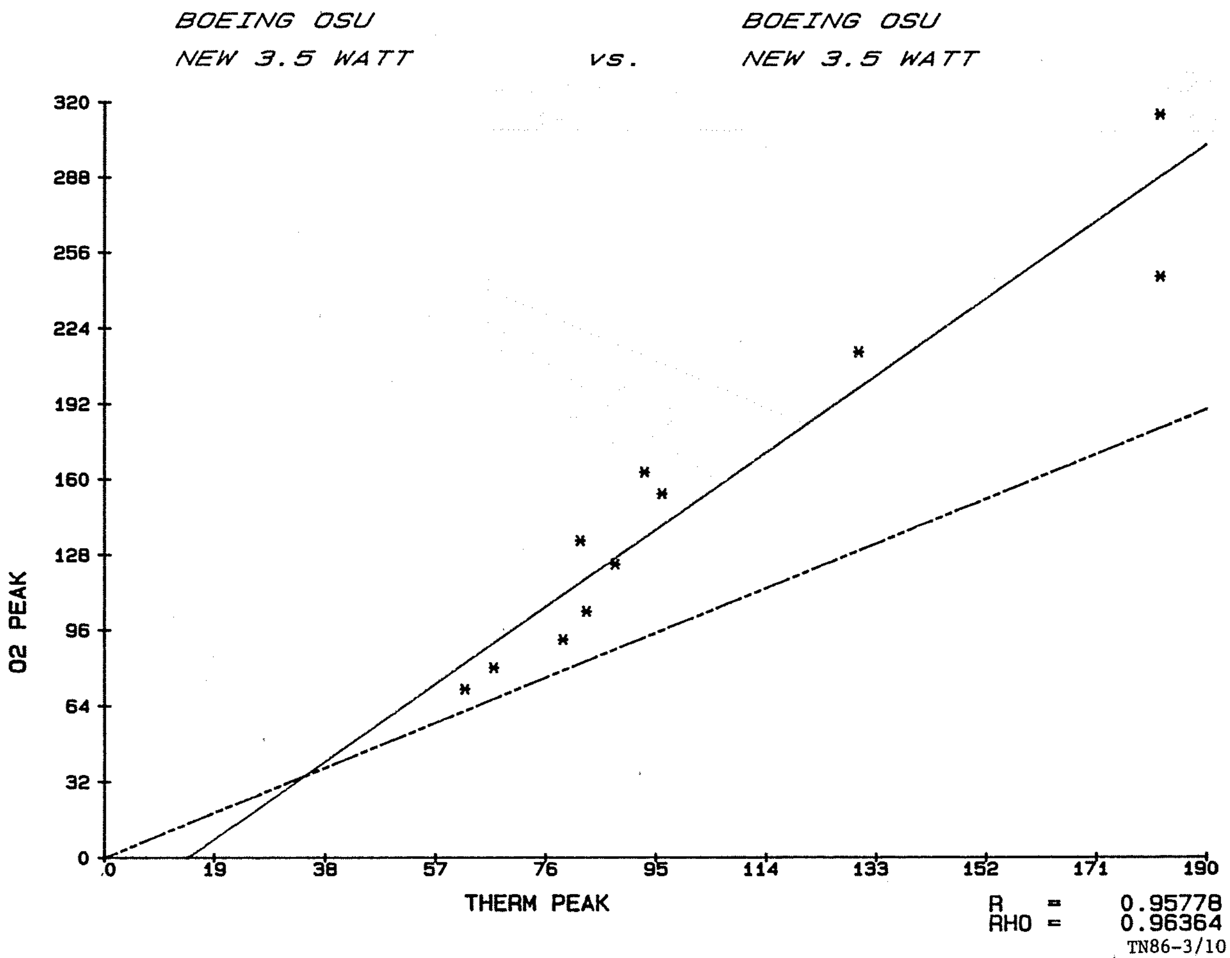


FIGURE 10. BEST FIT RELATIONSHIP BETWEEN O2 AND THERMOPILE PEAK
(BOEING - SECOND ROUNDROBIN)

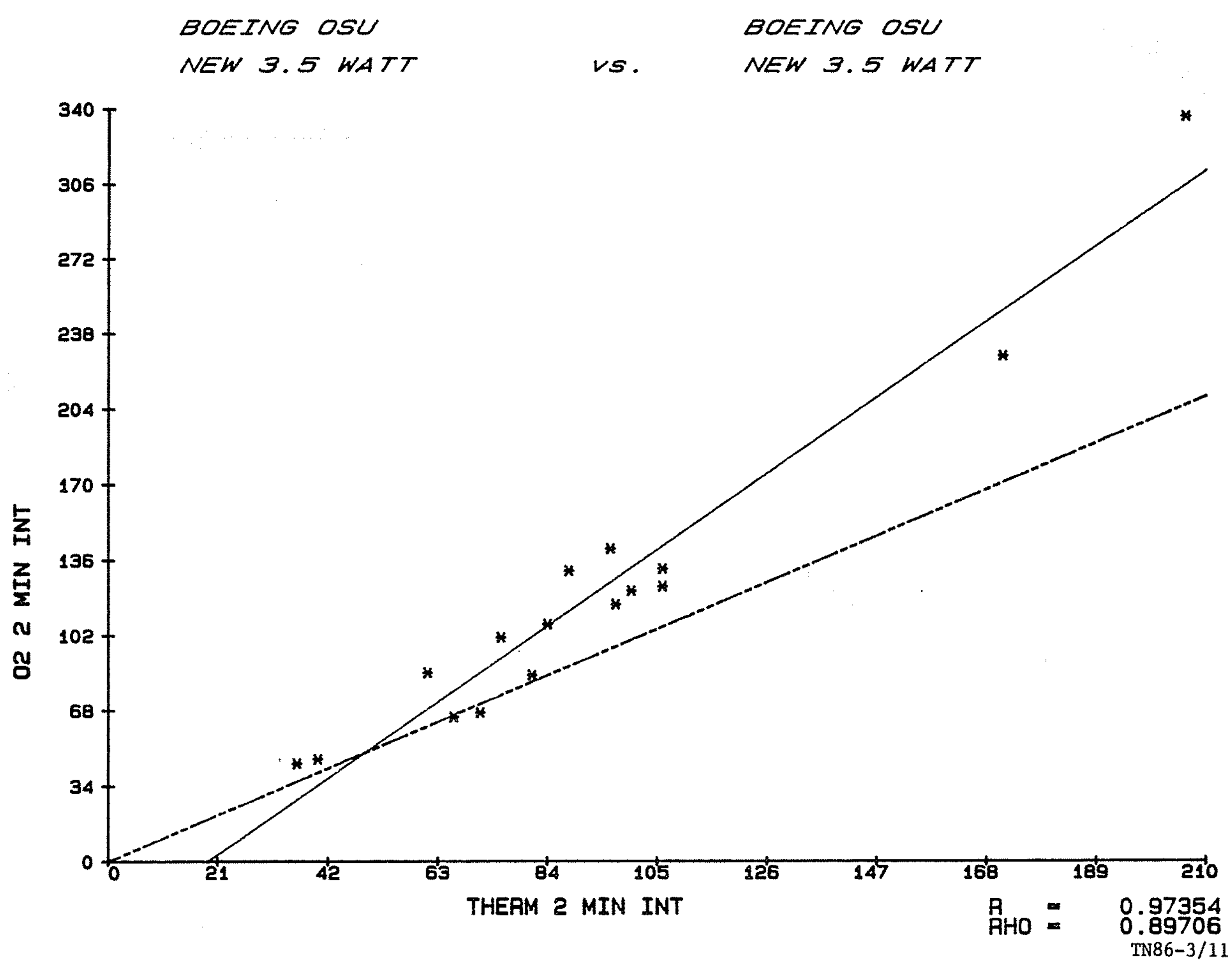


FIGURE 11. BEST FIT RELATIONSHIP BETWEEN O2 AND THERMOPILE 2-MINUTE INTEGRATION (BOEING - SECOND ROUNDROBIN)

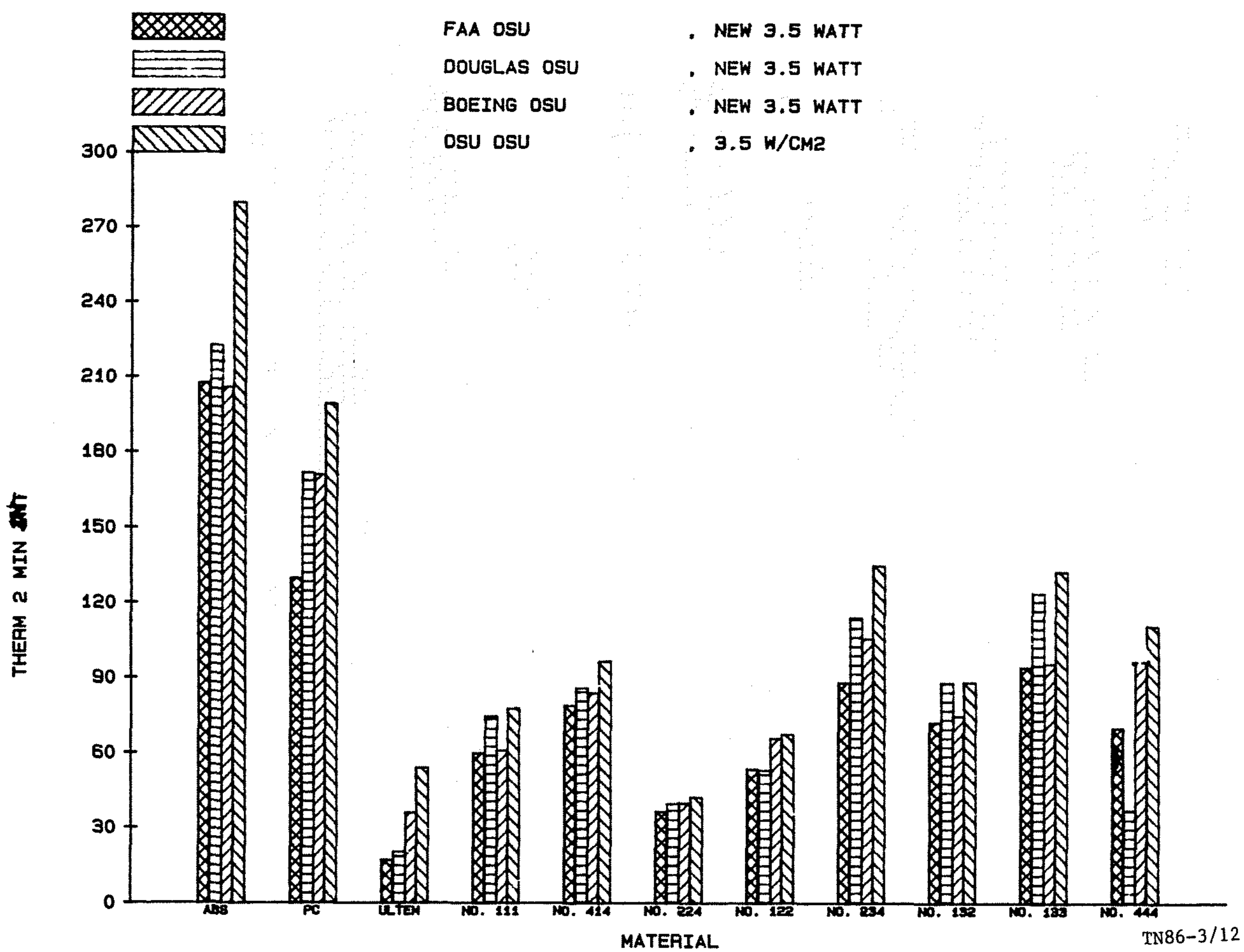


FIGURE 12. GRAPHICAL COMPARISON OF DATA (NON FAA PANELS) THERMOPILE 2-MINUTE INTEGRATION

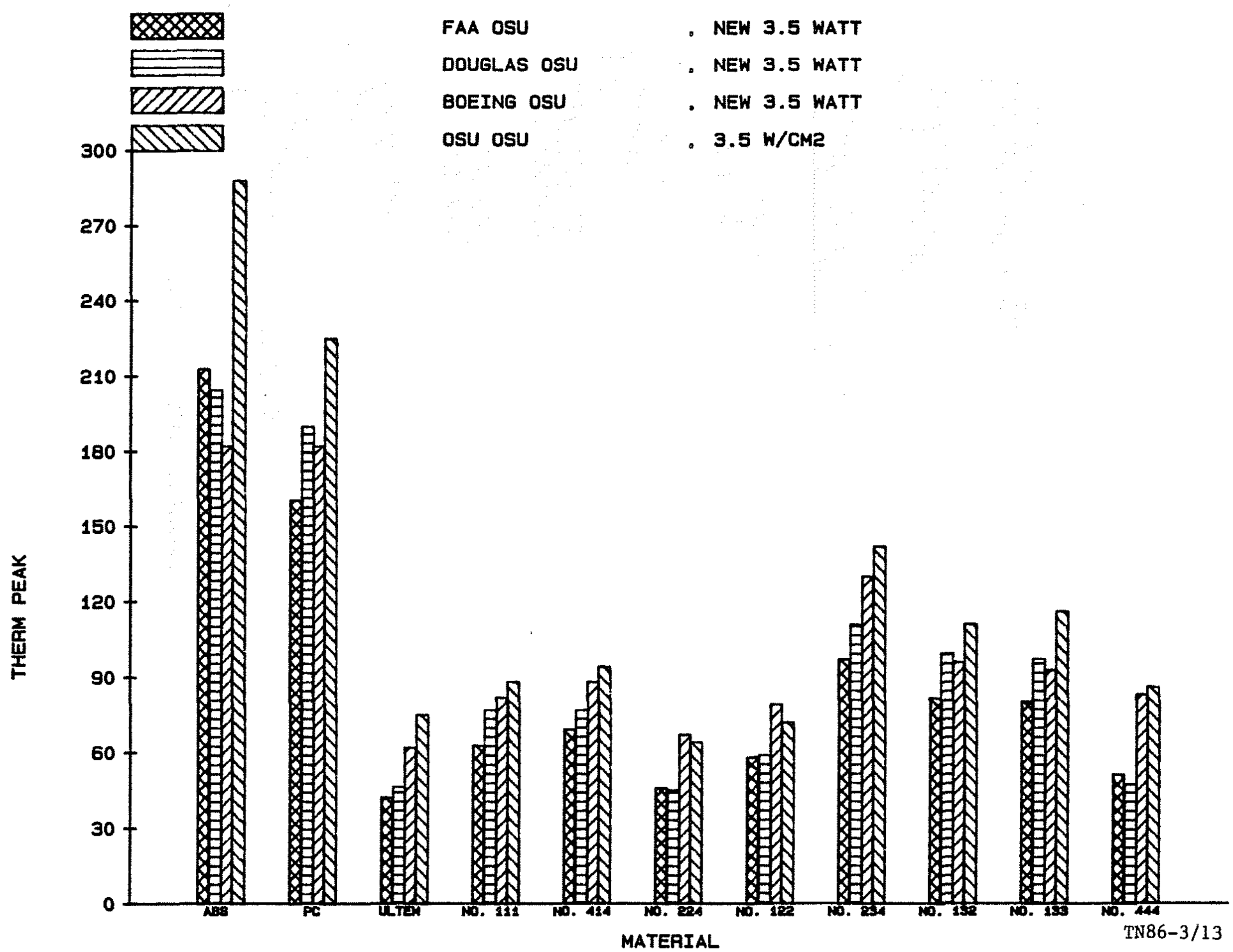


FIGURE 13. GRAPHICAL COMPARISON OF DATA (NON FAA PANELS) THERMOPILE PEAK

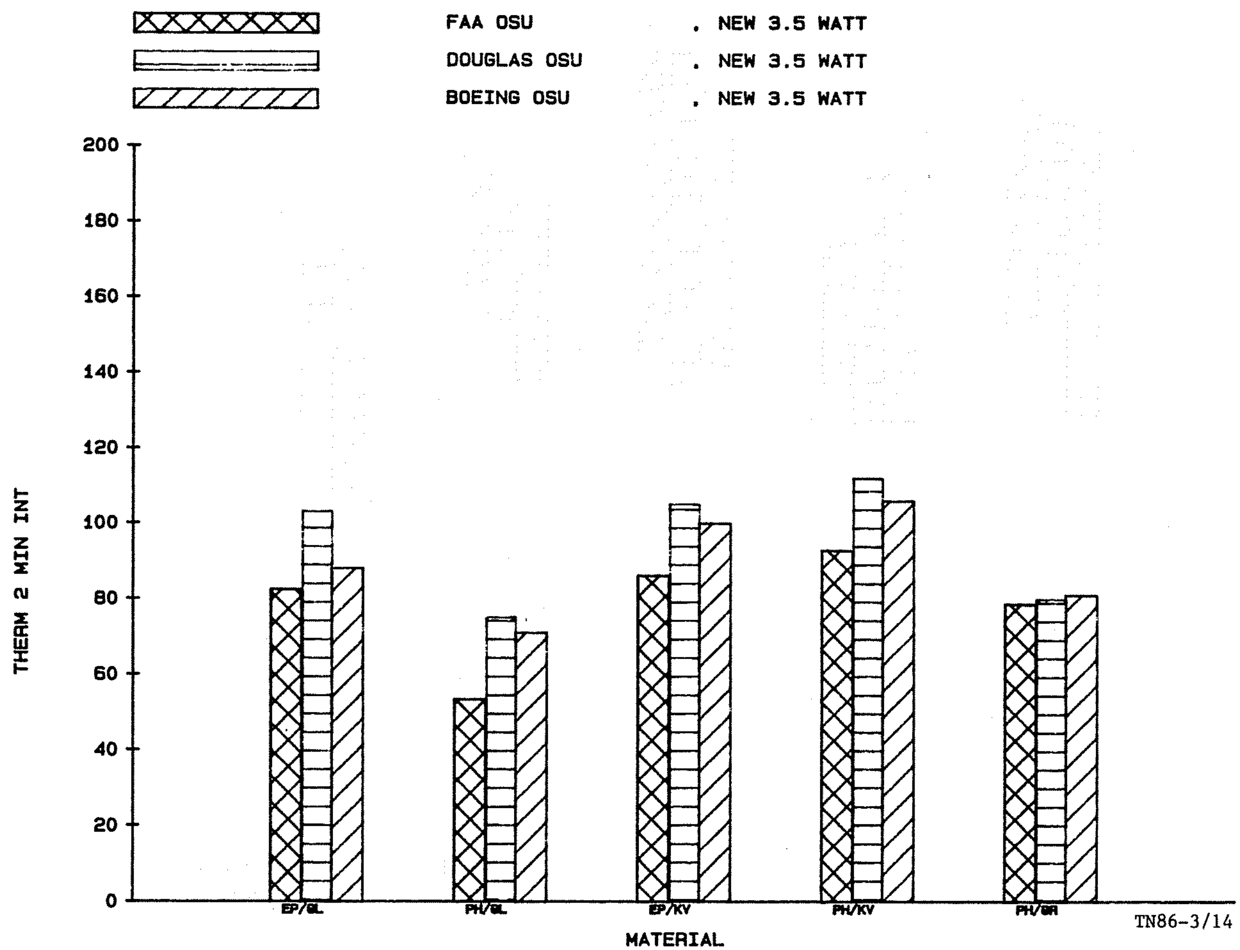


FIGURE 14. GRAPHICAL COMPARISON OF DATA (FAA PANELS ONLY) THERMOPILE 2-MINUTE INTEGRATION

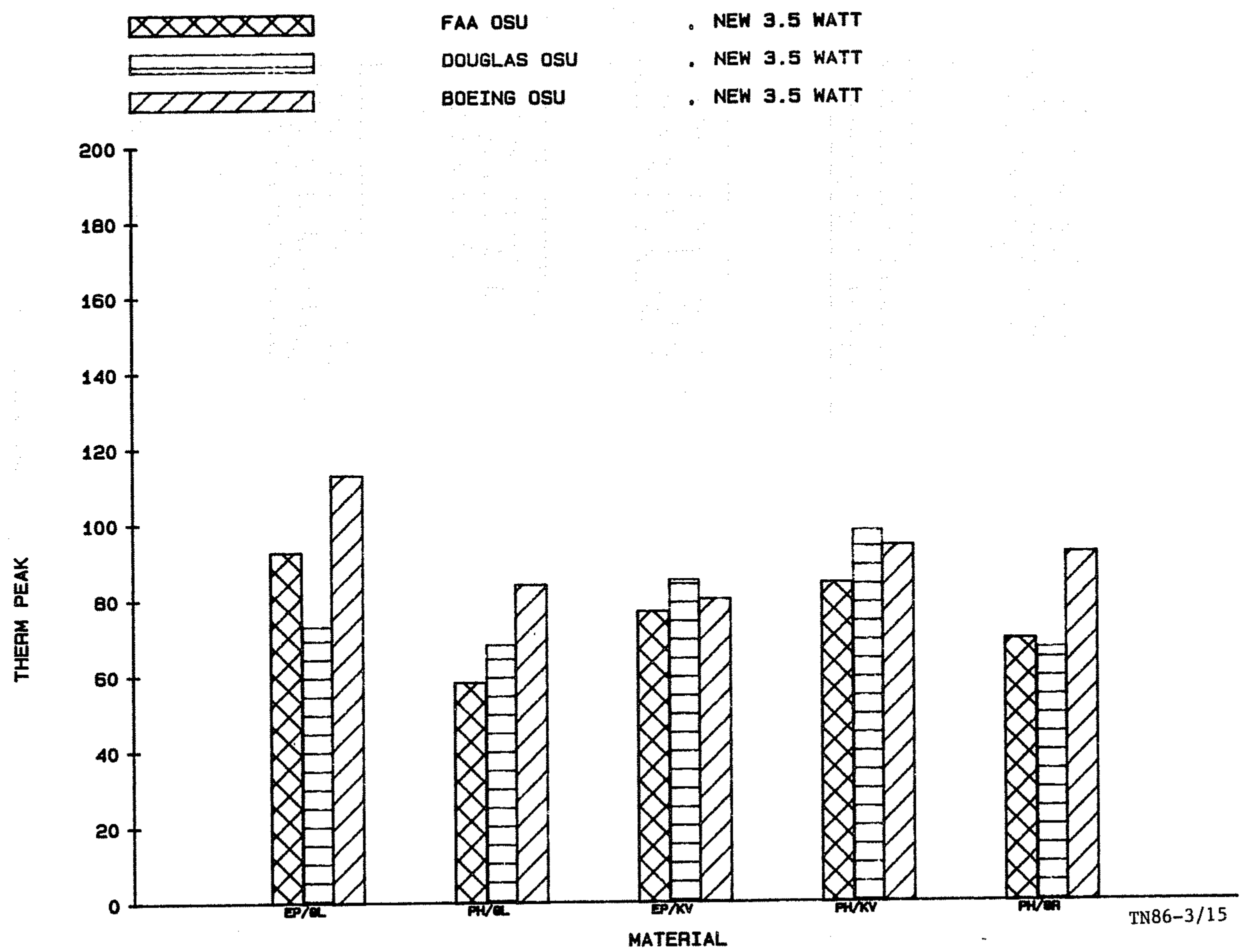


FIGURE 15. GRAPHICAL COMPARISON OF DATA (FAA PANELS ONLY) THERMOPILE PEAK

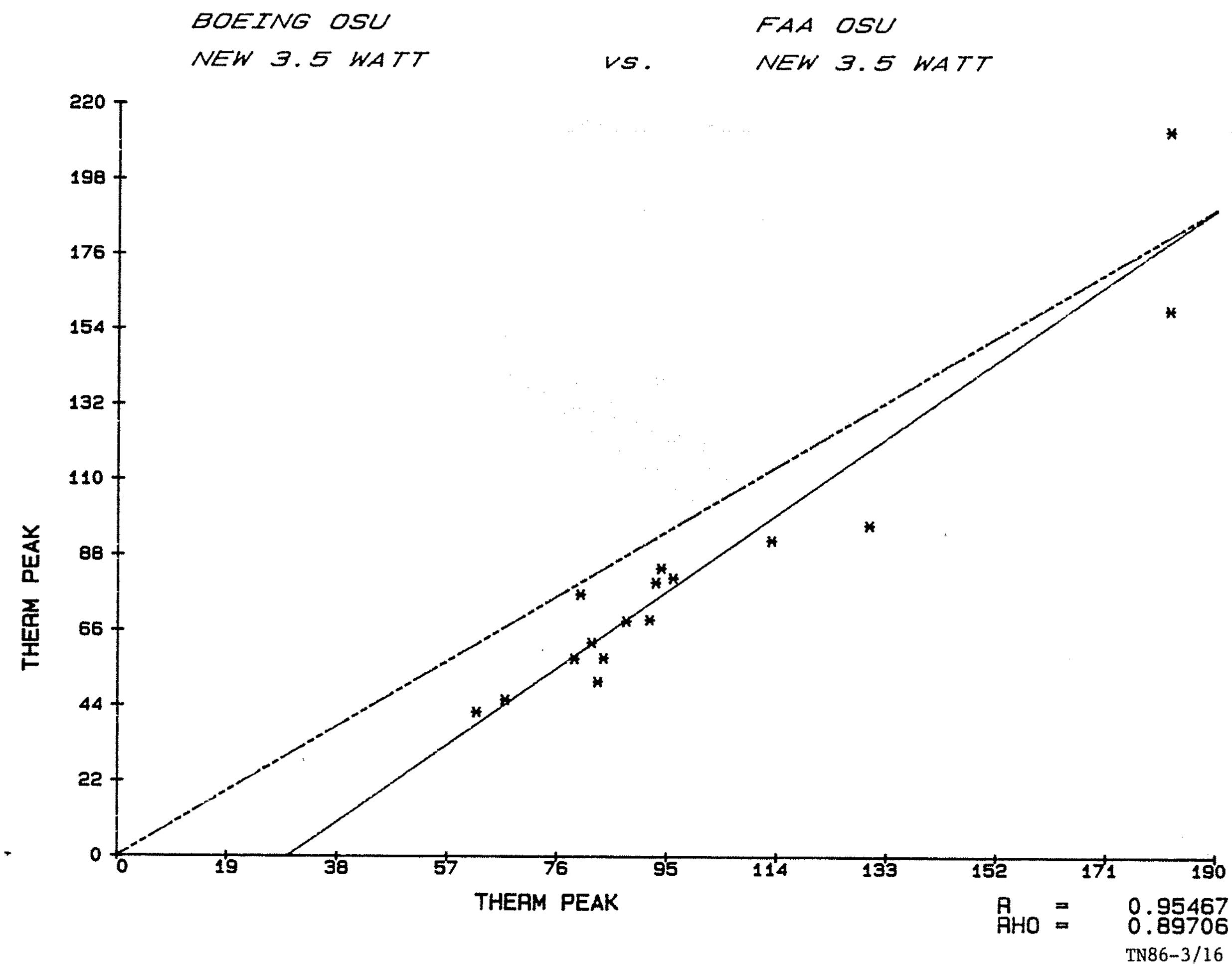


FIGURE 16. BEST FIT RELATIONSHIP OF TWO LABORATORIES (THERMOPILE PEAK - BOEING VERSUS FAA)

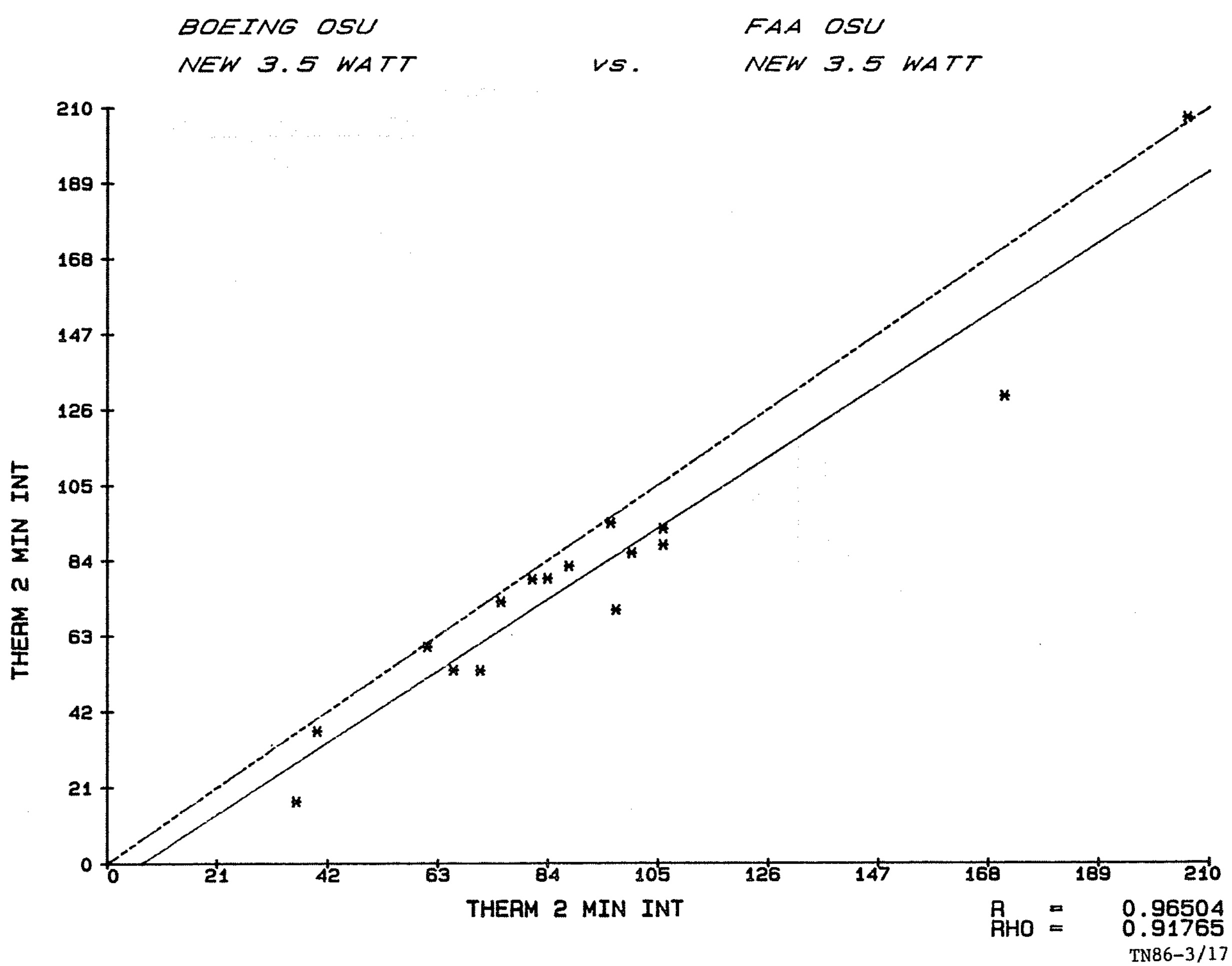


FIGURE 17. BEST FIT RELATIONSHIP OF TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - BOEING VERSUS FAA)

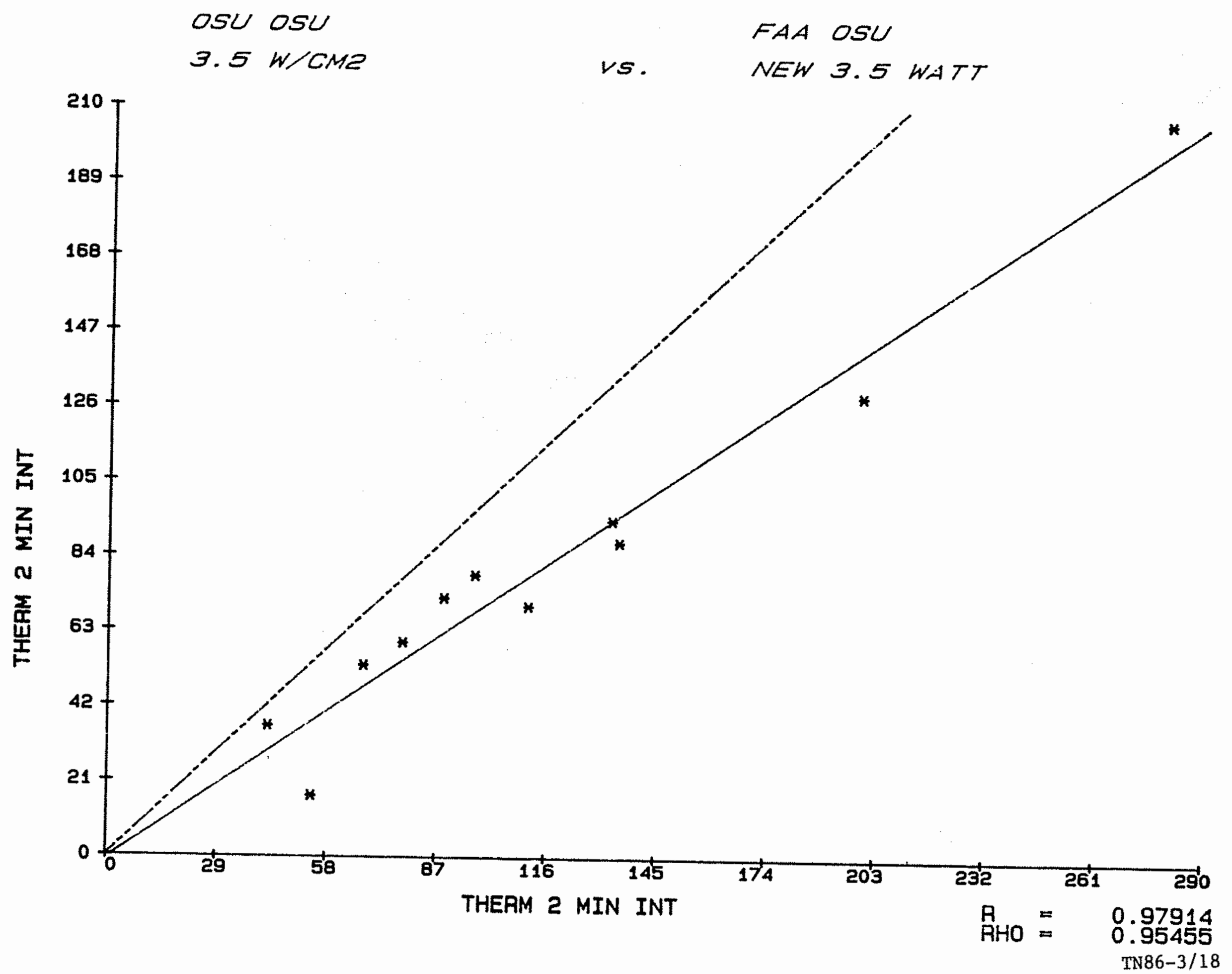


FIGURE 18. BEST FIT RELATIONSHIP OF TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - OSU VERSUS FAA)

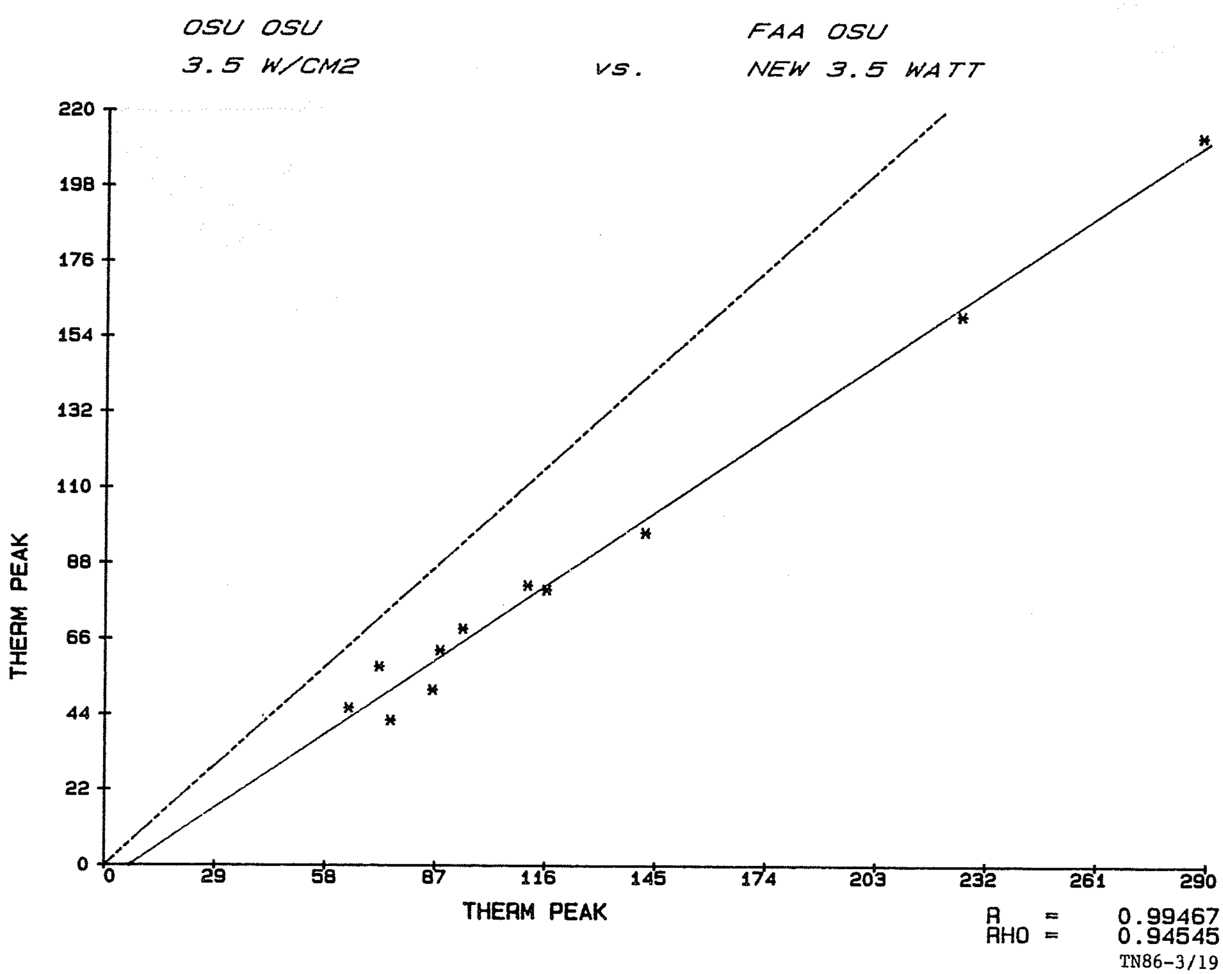


FIGURE 19. BEST FIT RELATIONSHIP OF TWO LABORATORIES (THERMOPILE PEAK - OSU VERSUS FAA)

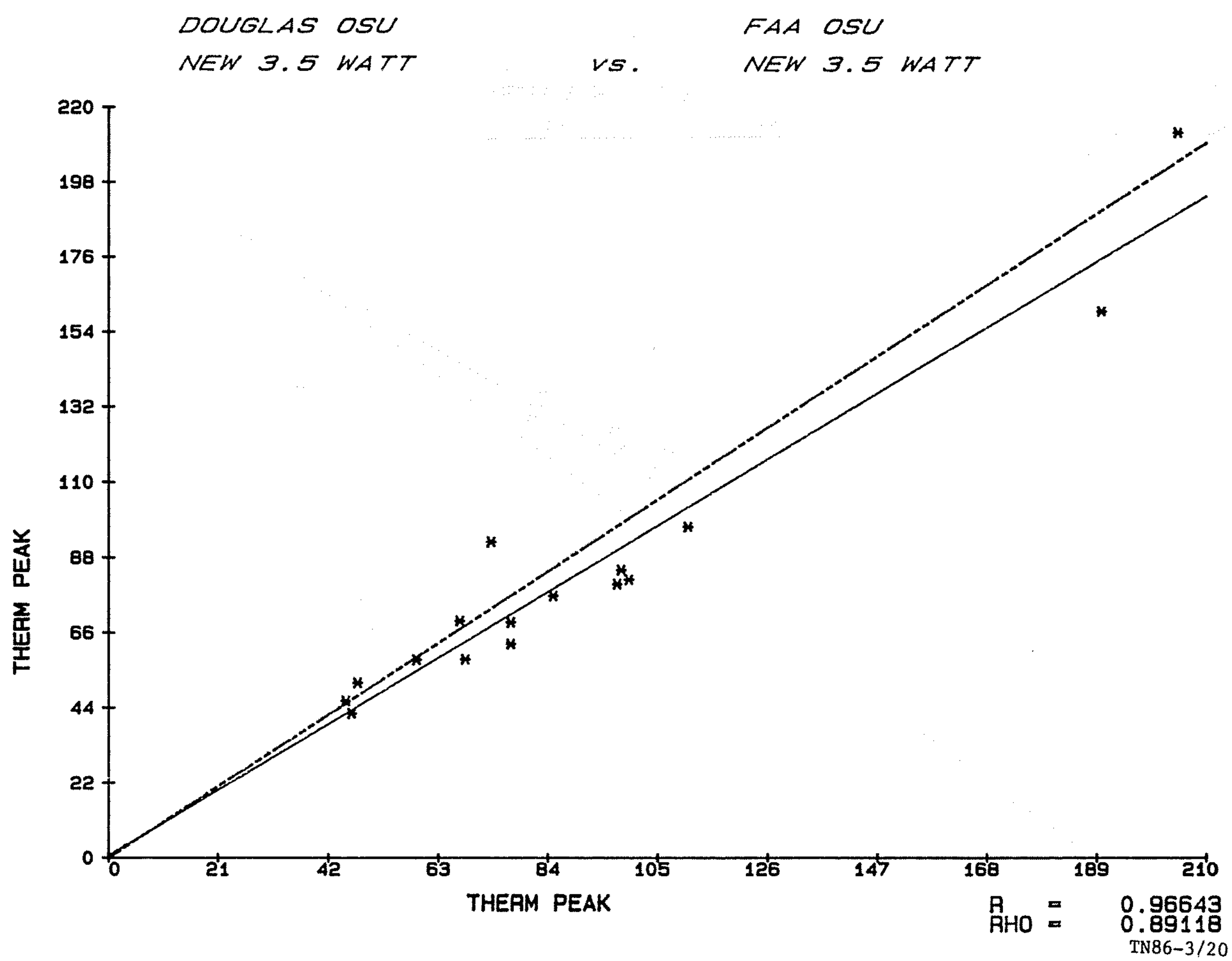


FIGURE 20. BEST FIT RELATIONSHIP OF TWO LABORATORIES (THERMOPILE PEAK - DOUGLAS VERSUS FAA)

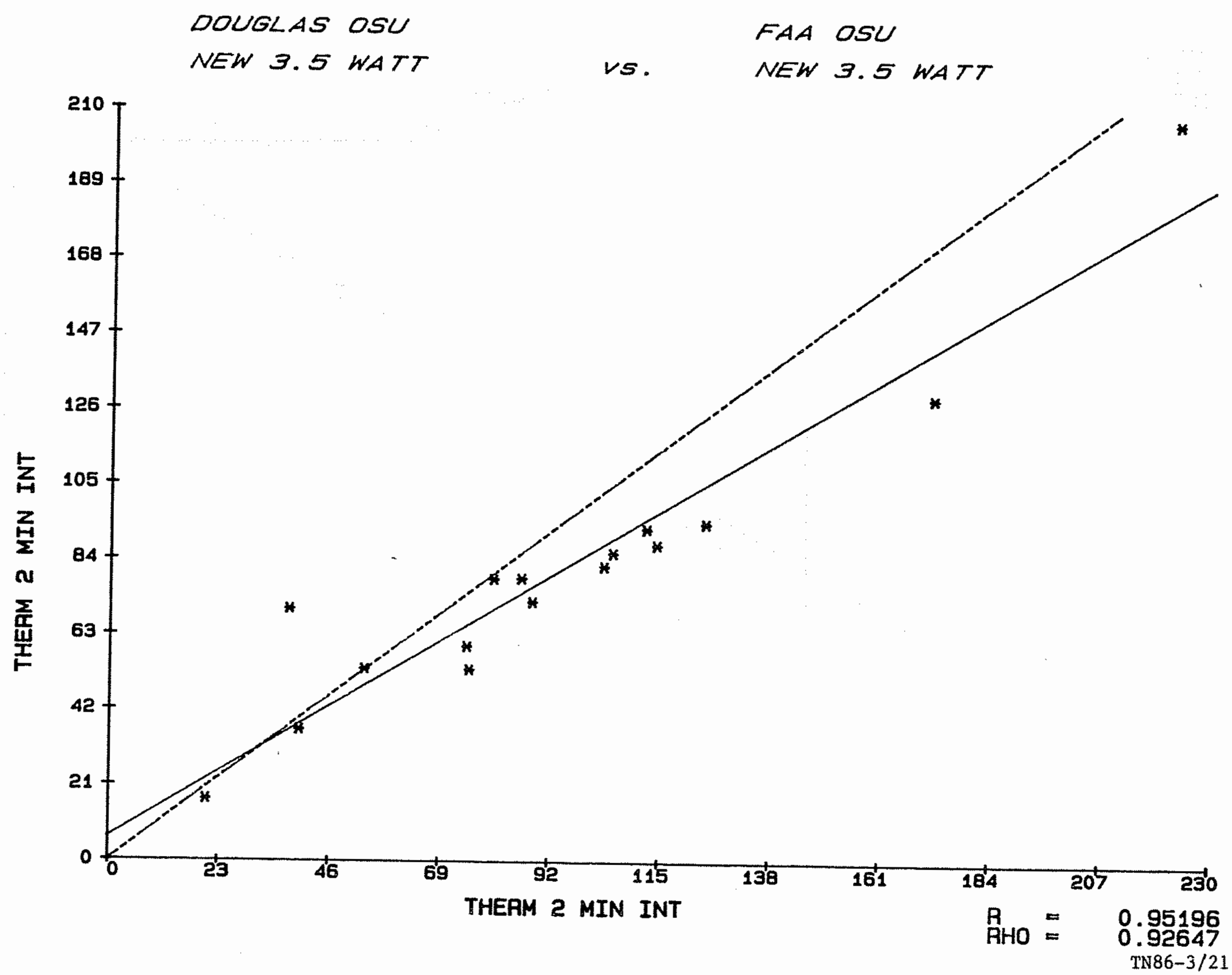


FIGURE 21. BEST FIT RELATIONSHIP OF TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - DOUGLAS VERSUS FAA)

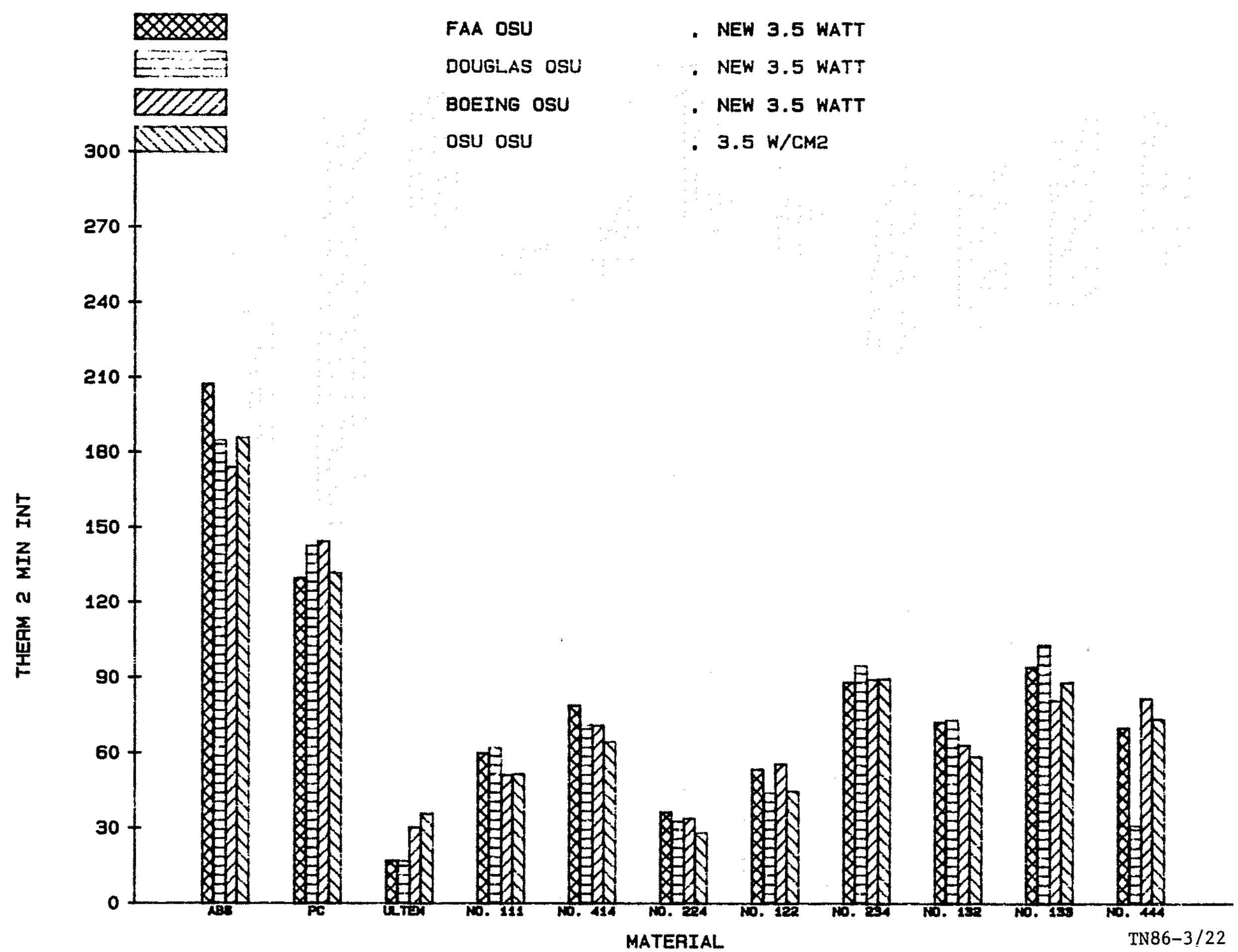


FIGURE 22. GRAPHICAL COMPARISON OF MODIFIED DATA (NON FAA PANELS) THERMOPILE 2-MINUTE INTEGRATION

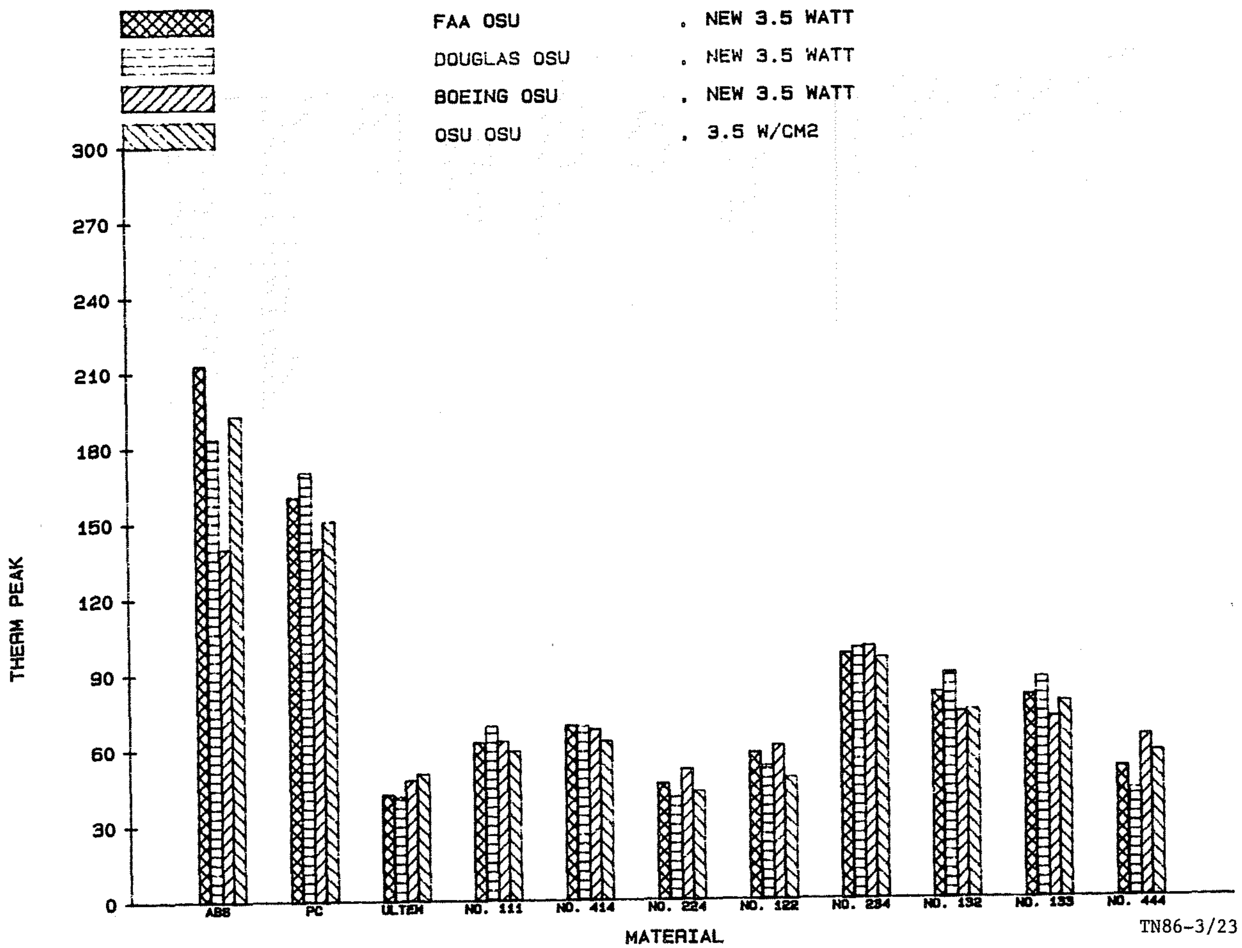


FIGURE 23. GRAPHICAL COMPARISON OF MODIFIED DATA (NON FAA PANELS) THERMOPILE PEAK

TABLE 1. DESCRIPTION OF STATISTICS

1. Correlation : $R = (n\Sigma XY - \Sigma X\Sigma Y)/\sqrt{(n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}$

2. Rank Correlation : $RHO = 1 - ((6\Sigma(u - v)^2) / (n(n^2 - 1)))$
   where u is rank number of X values
   where v is rank number of Y values
   (note : largest to smallest)

3. Maximum

4. Minimum

5. Range : Maximum - Minimum

6. Average : Xbar = X/n

7. Standard Deviation : $S = \sqrt{(\Sigma X^2 - (\Sigma X)^2/n)/(n-1)}$

8. Variance : $SS = \Sigma((X - (X/n))^2/n$

9. Coefficient of Variance : Sr = (100 * S)/ Xbar

10. Average Standard Deviation : Sbar = S/n

11. Average Coefficient of Correlation : Srbar = Sr/n

TABLE 2. OPTIONS LIST SCREEN

```
              1 - INPUT DATA
              2 - CORR DATA
              3 - EDIT DATA
              4 - OMIT DATA
              5 - PLOT DATA ON SCREEN
              6 - PLOT DATA ON PLOTTER
              7 - BAR CHARTS
              8 - STATISTICS
              9 - END
ENTER SELECTION : 2
```

TABLE 3. TEST SELECTION SCREEN

```
 1 - FAA OSU
 2 - RADIANT PANEL TEST
 3 - LIMITING O2 INDEX
 4 - C133 PANELS ONLY
 5 - VERT. BUNSEN BURNER
 6 - DOUGLAS OSU
 7 - BOEING OSU
 8 - OSU OSU
 9 - O2 BOMB CALORIMETER
10 - C133 TEST
ENTER TEST NO. : 1
```

TABLE 4. APPARATUS SELECTION SCREEN

```
1 - 2.5 W/CM2, P
2 - 5.0 W/CM2, P
3 - 5.0 W/CM2, N
4 - 7.5 W/CM2, P
5 - 3.5 W/CM2, P
6 - NEW 5 WATT
7 - NEW 3.5 WATT
APPARATUS NO. : 6
```

TABLE 5. DATA SELECTION SCREEN

1 - 02 2 MIN INT

2 - THERM 2 MIN INT

3 - 02 PEAK

4 - THERM PEAK

5 - 02 1 MIN INT

6 - THERM 1 MIN INT

7 - 02 3 MIN INT

8 - THERM 3 MIN INT

9 - 02 5 MIN INT

10 - THERM 5 MIN INT

ENTER DATA # : 1

TABLE 6. TEST PARAMETERS

	THERMOPILE 5w and 3.5w					OXYGEN DEPLETION 5w and 3.5w				
LAB	1min.	2min.	3min.	5min.	Peak	1min.	2min.	3min.	5min.	Peak
FAA	X	X	X	X	X	X	X	X	X	X
BOEING	X	X	X	X	X	X	X	X	X	X
DOUGLAS	X	X	X	X	X	X	X	X	X	X
OSU*	X	X	X	X	X					

* Second Round Robin only.

TABLE 7. RANK COMPARISONS OF 02 AND THERMOPILE PEAK
(FAA - SECOND ROUNDROBIN)

FAA OSU NEW 3.5 WATT THERM PEAK	VS.	FAA OSU NEW 3.5 WATT 02 PEAK

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	PEEK/PI	7.50	PEEK/PI	5.40
2	ULTEM	42.30	ULTEM	77.40
3	NO. 224	45.90	NO. 224	81.70
4	NO. 444	51.30	NO. 444	92.50
5	NO. 122	58.00	PH/GL	92.70
6	PH/GL	58.20	NO. 122	95.80
7	NO. 111	62.70	PH/GR	106.50
8	NO. 414	69.00	NO. 414	128.80
9	PH/GR	69.40	NO. 111	133.80
10	EP/KV	76.80	EP/KV	145.40
11	NO. 133	80.30	PH/KV	162.30
12	NO. 132	81.60	NO. 133	165.90
13	PH/KV	84.40	NO. 132	172.70
14	EP/GL	92.60	NO. 234	210.30
15	NO. 234	97.00	EP/GL	214.80
16	PC	160.30	PC	326.90
17	ABS	212.90	ABS	468.10

RANK COEFFICIENT FOR CORRELATION IS : 0.97794

TABLE 8. CORRELATION OF 02 AND THERMOPILE PEAK
(FAA - SECOND ROUNDROBIN)

FAA OSU NEW 3.5 WATT THERM PEAK	VS.	FAA OSU NEW 3.5 WATT 02 PEAK

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
EP/GL	92.60	214.80
PH/GL	58.20	92.70
EP/KV	76.80	145.40
PH/KV	84.40	162.30
PH/GR	69.40	106.50
PEEK/PI	7.50	5.40
ABS	212.90	468.10
PC	160.30	326.90
ULTEM	42.30	77.40
NO. 111	62.70	133.80
NO. 414	69.00	128.80
NO. 224	45.90	81.70
NO. 122	58.00	95.80
NO. 234	97.00	210.30
NO. 132	81.60	172.70
NO. 133	80.30	165.90
NO. 444	51.30	92.50

THE COEFFICIENT IS: 0.99174

TABLE 9. RANK COMPARISONS OF O2 AND THERMOPILE 2-MINUTE INTEGRATION (FAA - SECOND ROUNDROBIN)

FAA OSU NEW 3.5 WATT THERM 2 MIN INT	VS.	FAA OSU NEW 3.5 WATT O2 2 MIN INT

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	PEEK/PI	3.40	PEEK/PI	0.70
2	ULTEM	17.10	ULTEM	33.70
3	NO. 224	36.50	NO. 224	63.40
4	PH/GL	53.40	PH/GL	69.40
5	NO. 122	53.50	NO. 122	75.50
6	NO. 111	59.90	NO. 111	97.40
7	NO. 444	70.20	NO. 444	101.50
8	NO. 132	72.40	PH/GR	101.60
9	PH/GR	78.70	NO. 414	110.20
10	NO. 414	78.90	NO. 132	112.60
11	EP/GL	82.40	EP/GL	125.80
12	EP/KV	86.10	EP/KV	128.50
13	NO. 234	88.30	PH/KV	133.60
14	PH/KV	92.80	NO. 234	152.60
15	NO. 133	94.40	NO. 133	154.00
16	PC	129.70	PC	251.50
17	ABS	207.40	ABS	415.90

RANK COEFFICIENT FOR CORRELATION IS : 0.99020

TABLE 10. CORRELATION OF O2 AND THERMOPILE 2-MINUTE INTEGRATION (FAA - SECOND ROUNDROBIN)

FAA OSU NEW 3.5 WATT THERM 2 MIN INT	VS.	FAA OSU NEW 3.5 WATT O2 2 MIN INT

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
EP/GL	82.40	125.80
PH/GL	53.40	69.40
EP/KV	86.10	128.50
PH/KV	92.80	133.60
PH/GR	78.70	101.60
PEEK/PI	3.40	0.70
ABS	207.40	415.90
PC	129.70	251.50
ULTEM	17.10	33.70
NO. 111	59.90	97.40
NO. 414	78.90	110.20
NO. 224	36.50	63.40
NO. 122	53.50	75.50
NO. 234	88.30	152.60
NO. 132	72.40	112.60
NO. 133	94.40	154.00
NO. 444	70.20	101.50

THE COEFFICIENT IS: 0.98075

TABLE 11. PERCENT STANDARD DEVIATION BETWEEN LABS (ROUNDROBIN INSERIVCE MATERIALS)

	OLD 5 Watt 02	OLD 5 Watt Therm.	NEW 5 Watt 02	NEW 5 Watt Therm.	NEW 3.5 Watt 02	NEW 3.5 Watt Therm.
2 Min. Int.	42.04	25.16	8.40	5.44 (8.76*)	11.55	12.13(17.95)*

*Including Ed Smith's Data.

TABLE 12. STATISTICAL SUMMARY OF DATA THERMOPILE 2-MINUTE INTEGRATION

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT
DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT
BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT
OSU OSU	3.5 W/CM2	THERM 2 MIN INT

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 12.32

AVERAGE COEFFICIENT OF VARIANCE = 14.09

CORRELATION COEFFICIENT = 0.87619

TABLE 13. STATISTICAL SUMMARY OF DATA THERMOPILE PEAK

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM PEAK
DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK
BOEING OSU	NEW 3.5 WATT	THERM PEAK
OSU OSU	3.5 W/CM2	THERM PEAK

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 13.73

AVERAGE COEFFICIENT OF VARIANCE = 14.46

CORRELATION COEFFICIENT = 0.85283

TABLE 14. RANK COMPARISON BETWEEN TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - BOEING VERSUS FAA)

BOEING OSU		FAA OSU
NEW 3.5 WATT	VS.	NEW 3.5 WATT
THERM 2 MIN INT		THERM 2 MIN INT

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X	---VALUE	MATERIAL---Y	---VALUE
1	ULTEM	36.00	ULTEM	17.10
2	NO. 224	40.00	NO. 224	36.50
3	NO. 111	61.00	PH/GL	53.40
4	NO. 122	66.00	NO. 122	53.50
5	PH/GL	71.00	NO. 111	59.90
6	NO. 132	75.00	NO. 444	70.20
7	PH/GR	81.00	NO. 132	72.40
8	NO. 414	84.00	PH/GR	78.70
9	EP/GL	88.00	NO. 414	78.90
10	NO. 133	96.00	EP/GL	82.40
11	NO. 444	97.00	EP/KV	86.10
12	EP/KV	100.00	NO. 234	88.30
13	NO. 234	106.00	PH/KV	92.80
14	PH/KV	106.00	NO. 133	94.40
15	PC	171.00	PC	129.70
16	ABS	206.00	ABS	207.40

RANK COEFFICIENT FOR CORRELATION IS : 0.91765

TABLE 15. RANK COMPARISON BETWEEN TWO LABORATORIES (THERMOPILE PEAK - BOEING VERSUS FAA)

BOEING OSU NEW 3.5 WATT THERM PEAK		FAA OSU NEW 3.5 WATT THERM PEAK
	VS.	

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	ULTEM	62.00	ULTEM	42.30
2	NO. 224	67.00	NO. 224	45.90
3	NO. 122	79.00	NO. 444	51.30
4	EP/KV	80.00	NO. 122	58.00
5	NO. 111	82.00	PH/GL	58.20
6	NO. 444	83.00	NO. 111	62.70
7	PH/GL	84.00	NO. 414	69.00
8	NO. 414	88.00	PH/GR	69.40
9	PH/GR	92.00	EP/KV	76.80
10	NO. 133	93.00	NO. 133	80.30
11	PH/KV	94.00	NO. 132	81.60
12	NO. 132	96.00	PH/KV	84.40
13	EP/GL	113.00	EP/GL	92.60
14	NO. 234	130.00	NO. 234	97.00
15	PC	182.00	PC	160.30
16	ABS	182.00	ABS	212.90

RANK COEFFICIENT FOR CORRELATION IS : 0.89706

TABLE 16. CORRELATION BETWEEN TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - BOEING VERSUS FAA)

BOEING OSU NEW 3.5 WATT THERM 2 MIN INT		FAA OSU NEW 3.5 WATT THERM 2 MIN INT
	VS.	

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
EP/GL	88.00	82.40
PH/GL	71.00	53.40
EP/KV	100.00	86.10
PH/KV	106.00	92.80
PH/GR	81.00	78.70
ABS	206.00	207.40
PC	171.00	129.70
ULTEM	36.00	17.10
NO. 111	61.00	59.90
NO. 414	84.00	78.90
NO. 224	40.00	36.50
NO. 122	66.00	53.50
NO. 234	106.00	88.30
NO. 132	75.00	72.40
NO. 133	96.00	94.40
NO. 444	97.00	70.20

THE COEFFICIENT IS: 0.96504

TABLE 17. CORRELATION BETWEEN TWO LABORATORIES (THERMOPILE PEAK - BOEING VERSUS FAA)

BOEING OSU NEW 3.5 WATT THERM PEAK	VS.	FAA OSU NEW 3.5 WATT THERM PEAK

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
EP/GL	113.00	92.60
PH/GL	84.00	58.20
EP/KV	80.00	76.80
PH/KV	94.00	84.40
PH/GR	92.00	69.40
ABS	182.00	212.90
PC	182.00	160.30
ULTEM	62.00	42.30
NO. 111	82.00	62.70
NO. 414	88.00	69.00
NO. 224	67.00	45.90
NO. 122	79.00	58.00
NO. 234	130.00	97.00
NO. 132	96.00	81.60
NO. 133	93.00	80.30
NO. 444	83.00	51.30

THE COEFFICIENT IS: 0.95467

TABLE 18. CORRELATION BETWEEN TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - OSU VERSUS FAA)

OSU OSU 3.5 W/CM2 THERM 2 MIN INT	VS.	FAA OSU NEW 3.5 WATT THERM 2 MIN INT

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	NO. 224	42.30	ULTEM	17.10
2	ULTEM	53.90	NO. 224	36.50
3	NO. 122	67.50	NO. 122	53.50
4	NO. 111	77.80	NO. 111	59.90
5	NO. 132	88.50	NO. 444	70.20
6	NO. 414	96.80	NO. 132	72.40
7	NO. 444	111.00	NO. 414	78.90
8	NO. 133	133.00	NO. 234	88.30
9	NO. 234	135.00	NO. 133	94.40
10	PC	199.00	PC	129.70
11	ABS	280.00	ABS	207.40

RANK COEFFICIENT FOR CORRELATION IS : 0.95455

TABLE 19. RANK COMPARISON BETWEEN TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - OSU VERSUS FAA)

OSU OSU 3.5 W/CM2 THERM 2 MIN INT	VS.	FAA OSU NEW 3.5 WATT THERM 2 MIN INT

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
ABS	280.00	207.40
PC	199.00	129.70
ULTEM	53.90	17.10
NO. 111	77.80	59.90
NO. 414	96.80	78.90
NO. 224	42.30	36.50
NO. 122	67.50	53.50
NO. 234	135.00	88.30
NO. 132	88.50	72.40
NO. 133	133.00	94.40
NO. 444	111.00	70.20

THE COEFFICIENT IS: 0.97914

TABLE 20. RANK COMPARISON BETWEEN TWO LABORATORIES (THERMOPILE PEAK - OSU VERSUS FAA)

OSU OSU 3.5 W/CM2 THERM PEAK	VS.	FAA OSU NEW 3.5 WATT THERM PEAK

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	NO. 224	64.00	ULTEM	42.30
2	NO. 122	72.00	NO. 224	45.90
3	ULTEM	75.00	NO. 444	51.30
4	NO. 444	86.00	NO. 122	58.00
5	NO. 111	88.00	NO. 111	62.70
6	NO. 414	94.00	NO. 414	69.00
7	NO. 132	111.00	NO. 133	80.30
8	NO. 133	116.00	NO. 132	81.60
9	NO. 234	142.00	NO. 234	97.00
10	PC	225.00	PC	160.30
11	ABS	288.00	ABS	212.90

RANK COEFFICIENT FOR CORRELATION IS : 0.94545

TABLE 21. CORRELATION BETWEEN TWO LABORATORIES (THERMOPILE PEAK - OSU VERSUS FAA)

OSU OSU
3.5 W/CM2
THERM PEAK

VS.

FAA OSU
NEW 3.5 WATT
THERM PEAK

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
ABS	288.00	212.90
PC	225.00	160.30
ULTEM	75.00	42.30
NO. 111	88.00	62.70
NO. 414	94.00	69.00
NO. 224	64.00	45.90
NO. 122	72.00	58.00
NO. 234	142.00	97.00
NO. 132	111.00	81.60
NO. 133	116.00	80.30
NO. 444	86.00	51.30

THE COEFFICIENT IS: 0.99467

TABLE 22. RANK COMPARISON BETWEEN TWO LABORATORIES (THERMOPILE PEAK - DOUGLAS VERSUS FAA)

DOUGLAS OSU
NEW 3.5 WATT
THERM PEAK

VS.

FAA OSU
NEW 3.5 WATT
THERM PEAK

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	NO. 224	45.20	ULTEM	42.30
2	ULTEM	46.33	NO. 224	45.90
3	NO. 444	47.46	NO. 444	51.30
4	NO. 122	58.76	NO. 122	58.00
5	PH/GR	67.01	PH/GL	58.20
6	PH/GL	68.03	NO. 111	62.70
7	EP/GL	73.00	NO. 414	69.00
8	NO. 414	76.84	PH/GR	69.40
9	NO. 111	76.84	EP/KV	76.80
10	EP/KV	84.98	NO. 133	80.30
11	NO. 133	97.18	NO. 132	81.60
12	PH/KV	97.97	PH/KV	84.40
13	NO. 132	99.44	EP/GL	92.60
14	NO. 234	110.74	NO. 234	97.00
15	PC	189.84	PC	160.30
16	ABS	204.53	ABS	212.90

RANK COEFFICIENT FOR CORRELATION IS : 0.89118

TABLE 23. CORRELATION BETWEEN TWO LABORATORIES (THERMOPILE PEAK - DOUGLAS VERSUS FAA)

DOUGLAS OSU
NEW 3.5 WATT
THERM PEAK

VS.

FAA OSU
NEW 3.5 WATT
THERM PEAK

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
EP/GL	73.00	92.60
PH/GL	68.03	58.20
EP/KV	84.98	76.80
PH/KV	97.97	84.40
PH/GR	67.01	69.40
ABS	204.53	212.90
PC	189.84	160.30
ULTEM	46.33	42.30
NO. 111	76.84	62.70
NO. 414	76.84	69.00
NO. 224	45.20	45.90
NO. 122	58.76	58.00
NO. 234	110.74	97.00
NO. 132	99.44	81.60
NO. 133	97.18	80.30
NO. 444	47.46	51.30

THE COEFFICIENT IS: 0.96643

TABLE 24. RANK COMPARISON BETWEEN TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - DOUGLAS VERSUS FAA)

DOUGLAS OSU
NEW 3.5 WATT
THERM 2 MIN INT

VS.

FAA OSU
NEW 3.5 WATT
THERM 2 MIN INT

RANK COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES :

RANK	MATERIAL---X---VALUE		MATERIAL---Y---VALUE	
1	ULTEM	20.34	ULTEM	17.10
2	NO. 444	37.29	NO. 224	36.50
3	NO. 224	39.55	PH/GL	53.40
4	NO. 122	53.11	NO. 122	53.50
5	NO. 111	74.58	NO. 111	59.90
6	PH/GL	75.03	NO. 444	70.20
7	PH/GR	80.00	NO. 132	72.40
8	NO. 414	85.88	PH/GR	78.70
9	NO. 132	88.14	NO. 414	78.90
10	EP/GL	103.06	EP/GL	82.40
11	EP/KV	104.98	EP/KV	86.10
12	PH/KV	111.98	NO. 234	88.30
13	NO. 234	114.13	PH/KV	92.80
14	NO. 133	124.30	NO. 133	94.40
15	PC	171.76	PC	129.70
16	ABS	222.61	ABS	207.40

RANK COEFFICIENT FOR CORRELATION IS : 0.92647

TABLE 25. CORRELATION BETWEEN TWO LABORATORIES (THERMOPILE 2-MINUTE INTEGRATION - DOUGLAS VERSUS FAA)

[illegible]		[illegible]
NEW 3.5 WATT	VS.	NEW 3.5 WATT
THERM 2 MIN INT		THERM 2 MIN INT

COEFFICIENT OF CORRELATION FOR THE FOLLOWING VALUES:

MATERIAL	X	Y
EP/GL	103.06	82.40
PH/GL	75.03	53.40
EP/KV	104.98	86.10
PH/KV	111.98	92.80
PH/GR	80.00	78.70
ABS	222.61	207.40
PC	171.76	129.70
ULTEM	20.34	17.10
NO. 111	74.58	59.90
NO. 414	85.88	78.90
NO. 224	39.55	36.50
NO. 122	53.11	53.50
NO. 234	114.13	88.30
NO. 132	88.14	72.40
NO. 133	124.30	94.40
NO. 444	37.29	70.20

THE COEFFICIENT IS: 0.95196

TABLE 26. STATISTICAL SUMMARY OF DATA - DOUGLAS VERSUS FAA THERMOPILE 2-MINUTE INTEGRATION

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT
DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT

--------------MATERIALS--------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 8.49

AVERAGE COEFFICIENT OF VARIANCE = 10.04

CORRELATION COEFFICIENT = 0.90499

TABLE 27. STATISTICAL SUMMARY OF DATA - DOUGLAS VERSUS FAA THERMOPILE PEAK

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM PEAK
DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 5.35

AVERAGE COEFFICIENT OF VARIANCE = 5.98

CORRELATION COEFFICIENT = 0.95514

TABLE 28. STATISTICAL SUMMARY OF DATA - BOEING VERSUS FAA THERMOPILE 2-MINUTE INTEGRATION

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT
BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 5.78

AVERAGE COEFFICIENT OF VARIANCE = 8.09

CORRELATION COEFFICIENT = 0.93485

TABLE 29. STATISTICAL SUMMARY OF DATA - BOEING VERSUS FAA THERMOPILE PEAK

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM PEAK
BOEING OSU	NEW 3.5 WATT	THERM PEAK

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 10.19

AVERAGE COEFFICIENT OF VARIANCE = 12.22

CORRELATION COEFFICIENT = 0.85749

TABLE 30. STATISTICAL SUMMARY OF DATA - OSU VERSUS FAA THERMOPILE 2-MINUTE INTEGRATION

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT
OSU OSU	3.5 W/CM2	THERM 2 MIN INT

--------------MATERIALS-------------

ABS	PC
ULTEM	NO. 111
NO. 414	NO. 224
NO. 122	NO. 234
NO. 132	NO. 133
NO. 444	

FOR THE PRECEEDING 11 MATERIALS :

AVERAGE STANDARD DEVIATION = 17.11

AVERAGE COEFFICIENT OF VARIANCE = 18.21

CORRELATION COEFFICIENT = 0.78887

TABLE 31. STATISTICAL SUMMARY OF DATA - OSU VERSUS FAA THERMOPILE PEAK

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM PEAK
OSU OSU	3.5 W/CM2	THERM PEAK

--------------MATERIALS-------------

ABS	PC
ULTEM	NO. 111
NO. 414	NO. 224
NO. 122	NO. 234
NO. 132	NO. 133
NO. 444	

FOR THE PRECEEDING 11 MATERIALS :

AVERAGE STANDARD DEVIATION = 18.17

AVERAGE COEFFICIENT OF VARIANCE = 17.87

CORRELATION COEFFICIENT = 0.79179

TABLE 32. CALCULATED CORRECTIVE PERCENTAGES

Douglas		Boeing		OSU	
Peak	2 min.	Peak	2 min.	Peak	2 min.
-11.62	-19.16	-23.11	-11.57	-33.03	-33.61

TABLE 33. STATISTICAL SUMMARY OF MODIFIED DATA - FOUR TESTS THERMOPILE 2-MINUTE INTEGRATION

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT
DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT
BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT
OSU OSU	3.5 W/CM2	THERM 2 MIN INT

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 5.99

AVERAGE COEFFICIENT OF VARIANCE = 9.48

CORRELATION COEFFICIENT = 0.95142

TABLE 34. STATISTICAL SUMMARY OF MODIFIED DATA - FOUR TESTS THERMOPILE PEAK

STATISTICS SUMMARY

LAB AND TEST	EXPOSURE	MEASUREMENT
FAA OSU	NEW 3.5 WATT	THERM PEAK
DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK
BOEING OSU	NEW 3.5 WATT	THERM PEAK
OSU OSU	3.5 W/CM2	THERM PEAK

--------------MATERIALS-------------

EP/GL	PH/GL
EP/KV	PH/KV
PH/GR	ABS
PC	ULTEM
NO. 111	NO. 414
NO. 224	NO. 122
NO. 234	NO. 132
NO. 133	NO. 444

FOR THE PRECEEDING 16 MATERIALS :

AVERAGE STANDARD DEVIATION = 6.94

AVERAGE COEFFICIENT OF VARIANCE = 8.27

CORRELATION COEFFICIENT = 0.92784

APPENDIX A

MATERIAL CODES

APPENDIX A

MATERIAL CODES

FAA Material	**1. EP/GL - Epoxy Fiberglass**
	2. PH/GL - Phenolic Fiberglass
	3. EP/KV - Epoxy Kevlar
	4. PH/KV - Phenolic Kevlar
	5. PH/GR - Phenolic Graphite
	6. PEEK/PI - Polyetheretherketone / Polyimide
Boeing Material	**7. NO. 111 - 747 Ceiling**
	8. NO. 122 - 757 Sidewall
	9. NO. 132 - 757 Partition
	10. NO. 133 - 767 Partition
McDonnell Douglas Material	**11. NO. 224 - MD80 Sidewall**
	12. NO. 234 - MD80 Partition
	13. NO. 414 - MD80 Ceiling
	14. NO. 444 - MD80 Stowage
Thermo Plastics	**15. ABS - Acrylonitrile-butadiene-styrene**
	16. PC - Polycarbonate
	17. ULTEM - Polyetherimide**

*** - DuPont Trademark**
**** - General Electric Trademark**

APPENDIX B

COMPLETE STATISTICS OF SECOND ROUNDROBIN

- THERMOPILE 2-MINUTE INTEGRATED HEAT RELEASE
- THERMOPILE PEAK HEAT RELEASE RATE

MATERIAL CODE : ABS

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	207.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	222.61
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	206.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	280.00

MAXIMUM........................	280.00
MINIMUM........................	206.00
RANGE..........................	74.00
AVERAGE........................	229.00
VARIANCE.......................	909.35
STANDARD DEVIATION.............	30.16
COEFFICIENT OF VARIANCE........	13.1682

MATERIAL CODE : PC

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	129.70
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	171.76
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	171.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	199.00

MAXIMUM........................	199.00
MINIMUM........................	129.70
RANGE..........................	69.30
AVERAGE........................	167.86
VARIANCE.......................	612.74
STANDARD DEVIATION.............	24.75
COEFFICIENT OF VARIANCE........	14.7461

MATERIAL CODE : ULTEM

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	17.10
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	20.34
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	36.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	53.90

MAXIMUM........................	53.90
MINIMUM........................	17.10
RANGE..........................	36.80
AVERAGE........................	31.83
VARIANCE.......................	213.37
STANDARD DEVIATION.............	14.61
COEFFICIENT OF VARIANCE........	45.8837

MATERIAL CODE : NO. 111

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	59.90
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	74.58
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	61.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	77.80

MAXIMUM........................	77.80
MINIMUM........................	59.90
RANGE..........................	17.90
AVERAGE........................	68.32
VARIANCE.......................	63.38
STANDARD DEVIATION.............	7.96
COEFFICIENT OF VARIANCE........	11.6531

MATERIAL CODE : NO. 414

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	78.90
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	85.88
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	84.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	96.80

MAXIMUM........................	96.80
MINIMUM........................	78.90
RANGE..........................	17.90
AVERAGE........................	86.39
VARIANCE.......................	42.61
STANDARD DEVIATION.............	6.53
COEFFICIENT OF VARIANCE........	7.5556

MATERIAL CODE : NO. 224

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	36.50
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	39.55
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	40.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	42.30

MAXIMUM........................	42.30
MINIMUM........................	36.50
RANGE..........................	5.80
AVERAGE........................	39.59
VARIANCE.......................	4.27
STANDARD DEVIATION.............	2.07
COEFFICIENT OF VARIANCE........	5.2171

MATERIAL CODE : NO. 122

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	53.50
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	53.11
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	66.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	67.50

MAXIMUM.......................	67.50
MINIMUM.......................	53.11
RANGE.........................	14.39
AVERAGE.......................	60.03
VARIANCE......................	45.49
STANDARD DEVIATION............	6.74
COEFFICIENT OF VARIANCE........	11.2362

MATERIAL CODE : NO. 234

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	88.30
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	114.13
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	106.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	135.00

MAXIMUM.......................	135.00
MINIMUM.......................	88.30
RANGE.........................	46.70
AVERAGE.......................	110.86
VARIANCE......................	281.50
STANDARD DEVIATION............	16.78
COEFFICIENT OF VARIANCE........	15.1347

MATERIAL CODE : NO. 132

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	72.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	88.14
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	75.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	88.50

MAXIMUM.......................	88.50
MINIMUM.......................	72.40
RANGE.........................	16.10
AVERAGE.......................	81.01
VARIANCE......................	54.30
STANDARD DEVIATION............	7.37
COEFFICIENT OF VARIANCE........	9.0960

MATERIAL CODE : NO. 133

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	94.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	124.30
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	96.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	133.00

MAXIMUM........................	133.00
MINIMUM........................	94.40
RANGE..........................	38.60
AVERAGE........................	111.92
VARIANCE.......................	289.51
STANDARD DEVIATION.............	17.01
COEFFICIENT OF VARIANCE........	15.2020

MATERIAL CODE : NO. 444

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	70.20
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	37.29
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	97.00
4	OSU OSU	3.5 W/CM2	THERM 2 MIN INT	111.00

MAXIMUM........................	111.00
MINIMUM........................	37.29
RANGE..........................	73.71
AVERAGE........................	78.87
VARIANCE.......................	791.27
STANDARD DEVIATION.............	28.13
COEFFICIENT OF VARIANCE........	35.6646

FOR THE PRECEEDING 11 MATERIALS :

AVERAGE STANDARD DEVIATION	=	14.74
AVERAGE COEFFICIENT OF VARIANCE	=	16.78
CORRELATION COEFFICIENT	=	0.87967

MATERIAL CODE : ABS

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	212.90
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	204.53
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	182.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	288.00

MAXIMUM........................	288.00
MINIMUM........................	182.00
RANGE..........................	106.00
AVERAGE........................	221.86
VARIANCE.......................	1585.98
STANDARD DEVIATION.............	39.82
COEFFICIENT OF VARIANCE........	17.9504

MATERIAL CODE : PC

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	160.30
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	189.84
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	182.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	225.00

MAXIMUM........................	225.00
MINIMUM........................	160.30
RANGE..........................	64.70
AVERAGE........................	189.28
VARIANCE.......................	542.27
STANDARD DEVIATION.............	23.29
COEFFICIENT OF VARIANCE........	12.3024

MATERIAL CODE : ULTEM

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	42.30
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	46.33
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	62.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	75.00

MAXIMUM........................	75.00
MINIMUM........................	42.30
RANGE..........................	32.70
AVERAGE........................	56.41
VARIANCE.......................	169.38
STANDARD DEVIATION.............	13.01
COEFFICIENT OF VARIANCE........	23.0727

MATERIAL CODE : NO. 111

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	62.70
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	76.84
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	82.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	88.00

MAXIMUM........................	88.00
MINIMUM........................	62.70
RANGE..........................	25.30
AVERAGE........................	77.38
VARIANCE.......................	87.48
STANDARD DEVIATION.............	9.35
COEFFICIENT OF VARIANCE........	12.0865

MATERIAL CODE : NO. 414

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	69.00
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	76.84
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	88.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	94.00

MAXIMUM........................	94.00
MINIMUM........................	69.00
RANGE..........................	25.00
AVERAGE........................	81.96
VARIANCE.......................	93.90
STANDARD DEVIATION.............	9.69
COEFFICIENT OF VARIANCE........	11.8234

MATERIAL CODE : NO. 224

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	45.90
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	45.20
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	67.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	64.00

MAXIMUM........................	67.00
MINIMUM........................	45.20
RANGE..........................	21.80
AVERAGE........................	55.52
VARIANCE.......................	100.69
STANDARD DEVIATION.............	10.03
COEFFICIENT OF VARIANCE........	18.0716

MATERIAL CODE : NO. 122

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	58.00
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	58.76
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	79.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	72.00
			MAXIMUM........................	79.00
			MINIMUM........................	58.00
			RANGE..........................	21.00
			AVERAGE........................	66.94
			VARIANCE.......................	79.47
			STANDARD DEVIATION.............	8.91
			COEFFICIENT OF VARIANCE........	13.3174

MATERIAL CODE : NO. 234

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	97.00
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	110.74
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	130.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	142.00
			MAXIMUM........................	142.00
			MINIMUM........................	97.00
			RANGE..........................	45.00
			AVERAGE........................	119.93
			VARIANCE.......................	299.68
			STANDARD DEVIATION.............	17.31
			COEFFICIENT OF VARIANCE........	14.4339

MATERIAL CODE : NO. 132

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	81.60
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	99.44
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	96.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	111.00
			MAXIMUM........................	111.00
			MINIMUM........................	81.60
			RANGE..........................	29.40
			AVERAGE........................	97.01
			VARIANCE.......................	110.03
			STANDARD DEVIATION.............	10.49
			COEFFICIENT OF VARIANCE........	10.8127

MATERIAL CODE : NO. 133

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	80.30
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	97.18
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	93.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	116.00

MAXIMUM........................	116.00
MINIMUM........................	80.30
RANGE..........................	35.70
AVERAGE........................	96.62
VARIANCE.......................	163.84
STANDARD DEVIATION.............	12.80
COEFFICIENT OF VARIANCE........	13.2476

MATERIAL CODE : NO. 444

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	51.30
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	47.46
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	83.00
4	OSU OSU	3.5 W/CM2	THERM PEAK	86.00

MAXIMUM........................	86.00
MINIMUM........................	47.46
RANGE..........................	38.54
AVERAGE........................	66.94
VARIANCE.......................	311.32
STANDARD DEVIATION.............	17.64
COEFFICIENT OF VARIANCE........	26.3584

FOR THE PRECEEDING 11 MATERIALS :

AVERAGE STANDARD DEVIATION = 15.67

AVERAGE COEFFICIENT OF VARIANCE = 15.77

CORRELATION COEFFICIENT = 0.85934

MATERIAL CODE : EP/GL

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	82.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	103.06
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	88.00

MAXIMUM........................	103.06
MINIMUM........................	82.40
RANGE..........................	20.66
AVERAGE........................	91.15
VARIANCE.......................	76.08
STANDARD DEVIATION.............	8.72
COEFFICIENT OF VARIANCE........	9.5690

MATERIAL CODE : PH/GL

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	53.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	75.03
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	71.00

MAXIMUM........................	75.03
MINIMUM........................	53.40
RANGE..........................	21.63
AVERAGE........................	66.48
VARIANCE.......................	88.22
STANDARD DEVIATION.............	9.39
COEFFICIENT OF VARIANCE........	14.1288

MATERIAL CODE : EP/KV

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	86.10
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	104.98
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	100.00

MAXIMUM........................	104.98
MINIMUM........................	86.10
RANGE..........................	18.88
AVERAGE........................	97.03
VARIANCE.......................	63.81
STANDARD DEVIATION.............	7.99
COEFFICIENT OF VARIANCE........	8.2332

MATERIAL CODE : PH/KV

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	92.80
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	111.98
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	106.00

MAXIMUM........................	111.98
MINIMUM........................	92.80
RANGE..........................	19.18
AVERAGE........................	103.59
VARIANCE.......................	64.22
STANDARD DEVIATION.............	8.01
COEFFICIENT OF VARIANCE........	7.7360

MATERIAL CODE : PH/GR

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM 2 MIN INT	78.70
2	DOUGLAS OSU	NEW 3.5 WATT	THERM 2 MIN INT	80.00
3	BOEING OSU	NEW 3.5 WATT	THERM 2 MIN INT	81.00

MAXIMUM........................	81.00
MINIMUM........................	78.70
RANGE..........................	2.30
AVERAGE........................	79.90
VARIANCE.......................	0.89
STANDARD DEVIATION.............	0.94
COEFFICIENT OF VARIANCE........	1.1787

FOR THE PRECEEDING 5 MATERIALS :

AVERAGE STANDARD DEVIATION	=	7.01
AVERAGE COEFFICIENT OF VARIANCE	=	8.17
CORRELATION COEFFICIENT	=	0.61949

MATERIAL CODE : EP/GL

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	92.60
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	73.00
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	113.00
			MAXIMUM........................	113.00
			MINIMUM........................	73.00
			RANGE..........................	40.00
			AVERAGE........................	92.87
			VARIANCE.......................	266.73
			STANDARD DEVIATION.............	16.33
			COEFFICIENT OF VARIANCE........	17.5864

MATERIAL CODE : PH/GL

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	58.20
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	68.03
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	84.00
			MAXIMUM........................	84.00
			MINIMUM........................	58.20
			RANGE..........................	25.80
			AVERAGE........................	70.08
			VARIANCE.......................	113.04
			STANDARD DEVIATION.............	10.63
			COEFFICIENT OF VARIANCE........	15.1723

MATERIAL CODE : EP/KV

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	76.80
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	84.98
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	80.00
			MAXIMUM........................	84.98
			MINIMUM........................	76.80
			RANGE..........................	8.18
			AVERAGE........................	80.59
			VARIANCE.......................	11.32
			STANDARD DEVIATION.............	3.36
			COEFFICIENT OF VARIANCE........	4.1741

MATERIAL CODE : PH/KV

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	84.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	97.97
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	94.00

MAXIMUM.......................	97.97
MINIMUM.......................	84.40
RANGE.........................	13.57
AVERAGE.......................	92.12
VARIANCE......................	32.46
STANDARD DEVIATION............	5.70
COEFFICIENT OF VARIANCE........	6.1841

MATERIAL CODE : PH/GR

NO	LAB AND TEST	EXPOSURE	MEASUREMENT	VALUE
1	FAA OSU	NEW 3.5 WATT	THERM PEAK	69.40
2	DOUGLAS OSU	NEW 3.5 WATT	THERM PEAK	67.01
3	BOEING OSU	NEW 3.5 WATT	THERM PEAK	92.00

MAXIMUM.......................	92.00
MINIMUM.......................	67.01
RANGE.........................	24.99
AVERAGE.......................	76.14
VARIANCE......................	126.78
STANDARD DEVIATION............	11.26
COEFFICIENT OF VARIANCE........	14.7889

FOR THE PRECEEDING 5 MATERIALS :

AVERAGE STANDARD DEVIATION	=	9.46
AVERAGE COEFFICIENT OF VARIANCE	=	11.58
CORRELATION COEFFICIENT	=	0.12990