U.S. Department
of Transportation
**Federal Aviation
Administration**

Technical Center

Atlantic City Int'l Airport
New Jersey 08405

February 22, 1995

Dear International Aircraft Materials Fire Test Working Group Member:

Enclosed please find a copy of the Minutes Package from our February 7-8, 1995, meeting held at Douglas Aircraft Company in Long Beach, California.

Our next meeting will be held in France in June. A package containing detailed information will be forwarded under separate cover.

Thank you for your continued participation in this Working Group.

Sincerely yours,

Richard G. Hill
Program Manager

Enclosure

INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING MINUTES

Held at Douglas Aircraft Company, Long Beach, California

February 7-8, 1995

TUESDAY, FEBRUARY 7, 1995

EXPLANATION OF TASK GROUPS - R. HILL (FAA TECHNICAL CENTER)

TASK GROUP LEADER PRESENTATIONS

#1 CONTINUED AIRWORTHINESS - R. HILL (FAA TECHNICAL CENTER)

Explained background on establishment of this Task Group. Status and review of results of Continued Compliance testing and study done by FAATC personnel. A Report will be published on these findings within the next year. Announced publication of Report #DOTFAACTTN94/16--"The Effects of Wear on Fireblocking Layer Material Effectiveness". Contact April Horner if you would like a copy of this report. Conclusion: visual inspection of fire block covers is the best way to tell how these materials are going to perform and it is not a durability problem, but a tear or puncture. Copies of the results of recent testing are included.

Maybe this Task Group should look at what type of tear/damage is acceptable and what type of tear/damage is not acceptable. To date we have not been able to acquire any of the fire-resistant foams that have been in service for 2 to 3 years. If anyone in the Working Group can help us acquire these, please let us know. We need to decide what information we want to include in the Handbook based on these findings. This Task Group is now going to take a look at materials other than seats that should be looked into for Continued Compliance--what kind of testing can we do to prove this is not a big problem or that it is?

#2 PRODUCTION QUALITY ASSURANCE - P. CAHILL (FAA TECHNICAL CENTER)

Gave brief update of Task Group activities. At the October 1994 meeting, Task Group members were asked to send Pat their organization's Quality Assurance procedures/programs if they were interested.

#3 MINOR CHANGES TO QUALIFIED MATERIALS - R. JOHNSON (FAA TECHNICAL CENTER)

I have received quite a bit of data and am presently preparing it to go to a statistician to be analyzed.

#4 MATERIAL SYSTEMS RENOVATION & REPAIR PROCEDURES - T. MARKER (FAA TECHNICAL CENTER)

Reviewed this Task Group's purpose and some of the group's work.

SEPARATE TASK GROUP MEETINGS WERE HELD

-

TASK GROUP LEADER REPORTS

#1 CONTINUED AIRWORTHINESS

A small Task Group chaired by C.L. Foushee with other mateial manufacturers involved was established to define what should be meant by the terms in the TSO about durability and maintainability supplied by material manufacturers. (Minimum durability and maintainability of materials). Continued compliance of interior panels was also discussed. Accufleet will supply samples of used interior panels for testing by FAA Technical Center. Continued compliance of interior fabric materials was also discussed.

#2 PRODUCTION QUALITY ASSURANCE

D. Hill: We are taking this to mean that everyone is satisfied with the requirements worldwide and that there Is no need to have any other advisory material on quality control. Is that correct? Is everyone satisfied that all we have to do is quote the regulations in the advisory materials? That is what it sounds like your conclusion is out of this Task Group. Some discussion took place on the possibility of general guidelines to be included in advisory material--there must be a minimum we should establish for everyone. C. Lewis: what assures us that the product the smaller manufacturer is putting out meets the requirements? It sounds like ultimately there appears to be different standards depending on who is doing what. C. Story (McGee): we, the manufacturer, set our own standards. D. Hill: but, there is no minimum at this time.

A copy of the Task Group minutes is included in this package.

#3 MINOR CHANGES TO QUALIFIED MATERIALS

F. Tiangsing: what kind of tests does this apply to? D. Johnson: Bunsen burner and Heat Release tests on panels and decorative laminates (this concerns color changes only). It is detailed in our recommendation. We will make all of our original data available.

A copy of the Task Group minutes is included in this package.

#4 MATERIAL SYSTEMS RENOVATION AND REPAIR

D. Hill: If there is anyone who thinks we should be looking at smaller issues or areas that you feel are important, we will look at any data that you put together and tabulate to present as a case to us--put together a package of test information and generalize it so that we can get a blanket statement from you to convince us that you have a solution to one of your smaller problem areas.

A copy of the Task Group minutes is included in this package.

BLANKET AND PILLOW DISCUSSION

P. Cahill: There is no test required for blankets and pillows at this time. She explained her work to date on this issue. Displayed results of vertical, match, and horizontal tests she did on blankets (in-service and new) supplied by various airlines. Pat showed a video of the tests she performed on the blankets. She will now look at in-service blankets she recently received from various airlines. She asked for any suggestions on additional tests for blankets and which of the tests she conducted should be used for blankets.

J. Davis (Accufleet): Showed a video of tests Accufleet ran on blankets. He agrees that flammability tests for blankets are an important issue.

D. Hill: Any comments or suggestions? C. Story: Why not issue a letter stating that this group does not feel that current test methods are adequate for pillows and blankets so that airlines know? D. Hill: We want to come up with a solution before we create the problem, so we can put something out maybe in some advisory material. G. Danker (Akro Fireguard): what about calling manufacturers of blankets for other than aircraft use for their fire retardant standards. D. Hill: Pat has been working with Govmark to try to obtain some of these standards. If anyone has any information on this, please get a copy to her.

NEW TOPICS

D. Hill: We have some new topics that Working Group members have requested we address at this meeting to see if there is any interest from this working group in establishing test methods or working on these issues.

CARGO FIRE COVER (KLM): The cargo blanket covers for Class B Combi's. What type of test method should we use for the new cargo fire covers? C. Lewis: Is there a different outside group (other than this working group) addressing this issue? D. Hill: no. KLM asked if there was another test other than the oil burner test for cargo liners or a full-scale test that can be used for these cargo blanket covers? L. Walker: The intent was to meet the Oil Burner Cargo Liner Test. Member question: How are these blankets used? Thrown over cargo or tightly covering cargo palette?

FIRE TESTING OF OVEN INSERTS - (S. Campbell-Douglas): There is a TSO writing committee for Oven Inserts. I was asked to address this topic to this Working Group. What is this Group's thoughts or comments on this topic? D. Hill: As a Group our consensus is that we do not want to get involved. D. Hill: Asked S. Campbell to find out where this came from and what test is developed. S. Campbell: I will get that information to you.

D. Hill: Are there any other new areas anyone would like to investigate or discuss?

WEDNESDAY, FEBRUARY 8, 1995

ONGOING ROUND ROBIN TESTING UPDATES-R. Johnson (FAA Technical Center)

R. Johnson: Background on Round Robin for Heat Flux Transducers. Reviewed results of Heat Flux Transducer Round Robin.

A copy of his presentation is included in this package.

RUSSIAN ROUND ROBIN

R. Johnson: I have a report on the results of this Round Robin. Report Title: "Round-Robin Comparison of Heat Release Apparatus"-#DOT/FAA/CT-TN94/42. Contact April Horner if you would like a copy of this report.

HEAT FLUX MEASUREMENT AND CALIBRATION-N. Keltner

Gave some details on joint NIST and NSF Workshop on Heat Flux Measurement and Calibration. The January 1995 meeting was the first of the workshops held.

A copy of the presentation is included in this package.

HEAT FLUX TRANSDUCER DISCUSSION

D. Hill: What are your thoughts on this? Should we be mandating in more precise detail the method for inserting the calorimeter into the chamber? Should we specify how to mount transducer and insert it and the length of time it should be exposed?

M. O'Bryant: I think the more standardized it is the better. R. Felder: We should make the procedure more standardized, since we have standards for the equipment.

D. Hill: Do you want to get a group together to work on tightening the standards for insertion and placement of transducers?

L. Walker: Give some additional guidance on inserting the transducer, etc.

D. Hill: We hope to put some guidance in the videos when we update them.

L. Walker: We have 5 labs that all get different readings. Maybe we could video tape each lab and compare the tapes. D. Hill: Maybe that could be a round robin for comparison.

D. Hill: I would like 4 or 5 labs to create a Task Group to discuss this issue and put together some suggestions on specifications/standards for use of heat flux transducers. The FAATC will not participate in this Task Group, but we would like the group to update us in a month or two on its status. Is there anyone from industry interested? M. O'Bryant-Boeing. R. Felder: Why don't you wait until the Round Robin on the Transducers is concluded. J. Peterson: Wait until that part of the Round Robin is complete and see if this is still as big of an issue. D. Hill: We will wait until the next meeting to see what the consensus is.

OSU STANDARD MATERIAL-R. Felder (Schneller, Inc.)

R. Felder- A copy of his presentation is included in this package.

There was some discussion on a standard phenolic resin with a known history.

S. Campbell: What is purpose of using a standard panel. R. Felder: To have a standard panel available as a reference material that would show the same numbers consistently.

M. O'Bryant: We should run a Round Robin voluntarily once a year where each lab runs the standard panel in their lab once a week to test consistency.

D. Hill: We are getting ready to run something similar internationally.

D. Hill: Would anyone in industry be interested in a quality control type task group to be given time at the next meeting to meet? We will assist you in setting up the program if you want. (Include a response form with minutes--if there is decent response, we will set aside time during the next meeting for this task group to meet). {It will be called Lab Quality Control Task Group Interest Response Form}

FAA TECHNICAL CENTER - OVERVIEW OF RECENT WORK/PROJECTS - R. HILL

Topics Covered:
-Russian Heat Release Chamber Evaluation (Russian Round Robin)
-Full-Scale Burnthrough Testing
-Onboard Cabin Water Spray System Testing
-International Halon Replacement Working Group
-Regulatory Support/Accident Investigation
S. Hasselbrack (Boeing): I want to make everyone aware of the following: seat fire blocking test-similarity of dress coverings-the label does not match what the dress coverings are actually made of-these coverings contain a lot of synthetics-we are not getting what we think we are getting (fabric blends).

D. Hill: Would it be worthwhile to look into another small-scale test that represents the oil burner test for the fabrics (cloth)?

S. Hasselbrack: We could ask the manufacturers to do a wet chemistry on these fabrics. Should we get manufacturers to do a laboratory analysis on the fabrics?

D. Hill: Sally, write something up for us on what your suggestions are on this (ie: using another test or wet chemistry analysis, etc.) If anyone has input, contact Sally Hasselbrack at Boeing with your input. Sally, send your write-up to April Horner.

D. Hill: Are there any other problems with the test methods?

L. Walker: We have had a couple of incidences where a manufacturer has had to change the chemical make-up of the foam because of environmental requirements. These manufacturers do not tell anyone about the changes and do not retest or check the materials after they are changed. These changed materials are not meeting the bunsen burner tests.

D. Hill: We will write something in the Fire Test Handbook to address that the changes in the raw material may not meet the specifications. This will be written as an alert in the Handbook.

FIRE TEST HANDBOOK PUBLICATION

The Handbook is presently being prepared for a final review by the FAA Northwest Mountain Region. After final review and edits are completed, it will be published

VIEWING OF TEST METHOD VIDEOS (OSU/OIL BURNER-SEATS/OIL BURNER-CARGO LINERS)

Working Group members were asked for input on updating these videos. Please fax any suggestions you have to April Horner at 609-646-5229.

NEXT MEETING

The next meeting will be held in June. A package containing complete details will be mailed under separate cover.

FEBRUARY 7-8, 1995

TASK GROUP LEADER MINUTES

TASK GROUP #2- PRODUCTION QUALITY ASSURANCE (Pat Cahill)

The Quality Assurance Task Group was joined by Mr. Layton Walker of the Los Angeles Aircraft Certification Office. The group felt that AC 21-31 and ISO 9000 would be worthwhile quality control references for inclusion in the Handbook. Both documents provide information and guidance concerning compliance with certification procedures for products and parts.

TASK GROUP #3 - MINOR CHANGES TO QUALIFIED MATERIALS (Richard Johnson)

Those in attendance were:

Robert Stacho
Karen Forest
Don Cardis
Reinhard Felder
Beth McGee
Chuck Story
Ingo Weichert
Richard M. Johnson

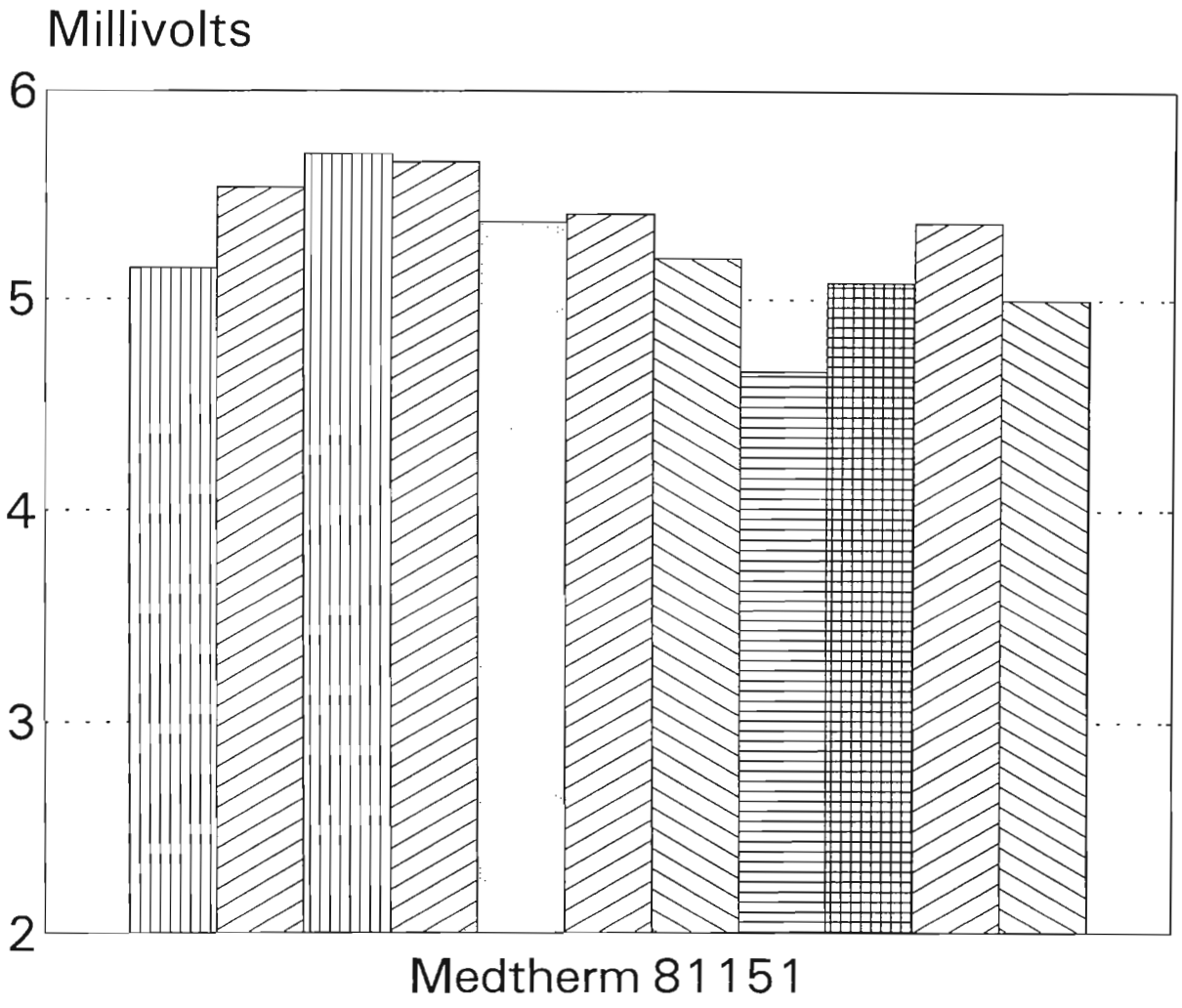
There was a discussion on present procedures at various ACO regions. Present desired procedures would be more compatible in all regions. A letter of intent was finally drafted with input from all those present and an outline accepted. The letter describes practices used by ACO's regarding retesting materials that were previously qualified and have been changed by color or texture only. An analysis and statistical report was given by Ingo Weichert (Daimler-Benz Aerospace Airbus), and this format was accepted to be expanded for support of reduced testing of qualified materials with color/texture change only. This will be presented to the proper Directorate with the supporting documentation available. The expanded date is being assembled by Reinhard Felder (Schneller).

TASK GROUP #4- MATERIAL SYSTEMS RENOVATION AND REPAIR

See attached notes.

GARDON GAGE, R/R

Millivolts @ 3.5 Watts

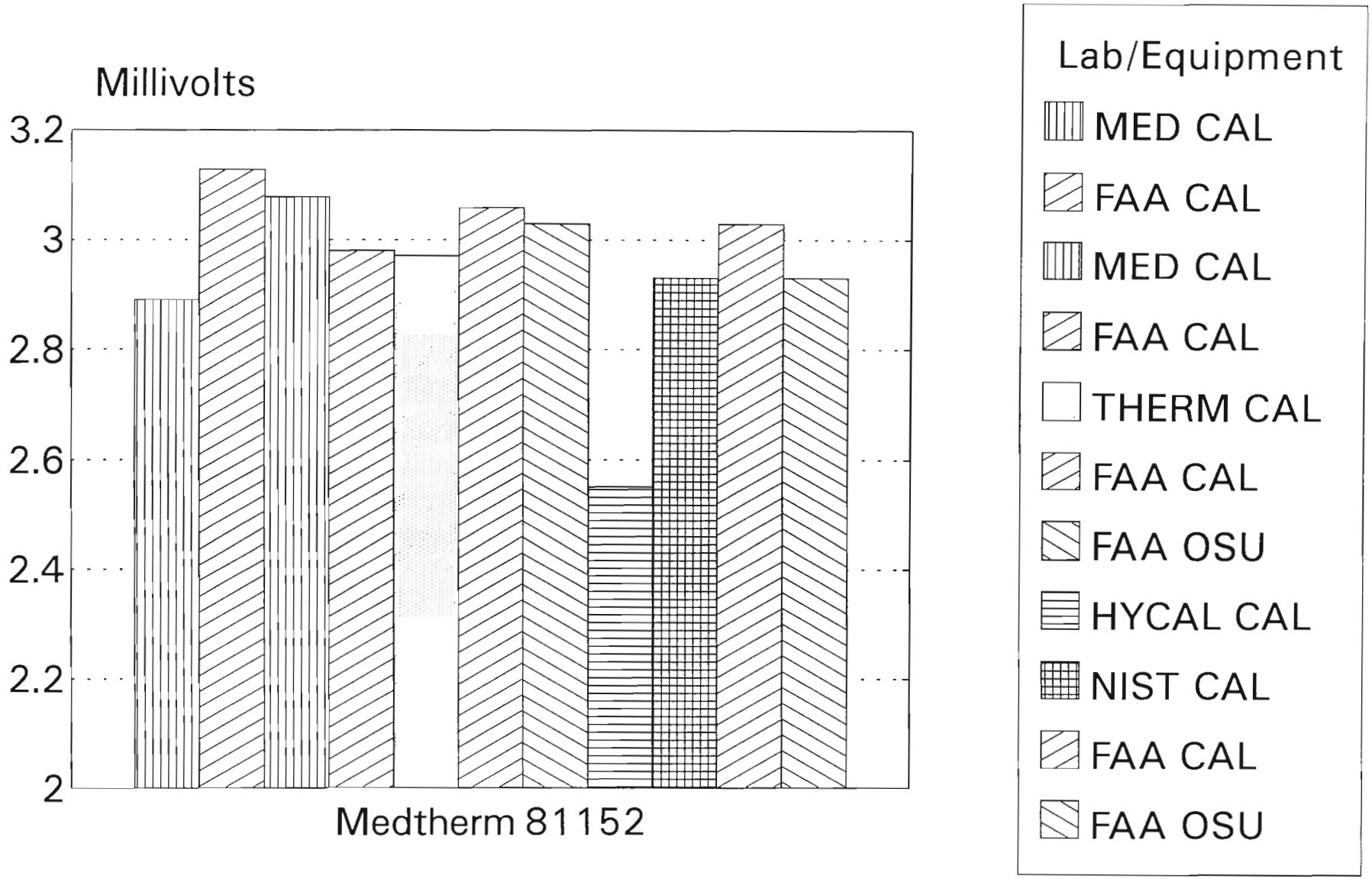


Lab/Equipment

- MED CAL
- FAA CAL
- MED CAL
- FAA CAL
- THERM CAL
- FAA CAL
- FAA OSU
- HYCAL CAL
- NIST CAL
- FAA CAL
- FAA OSU

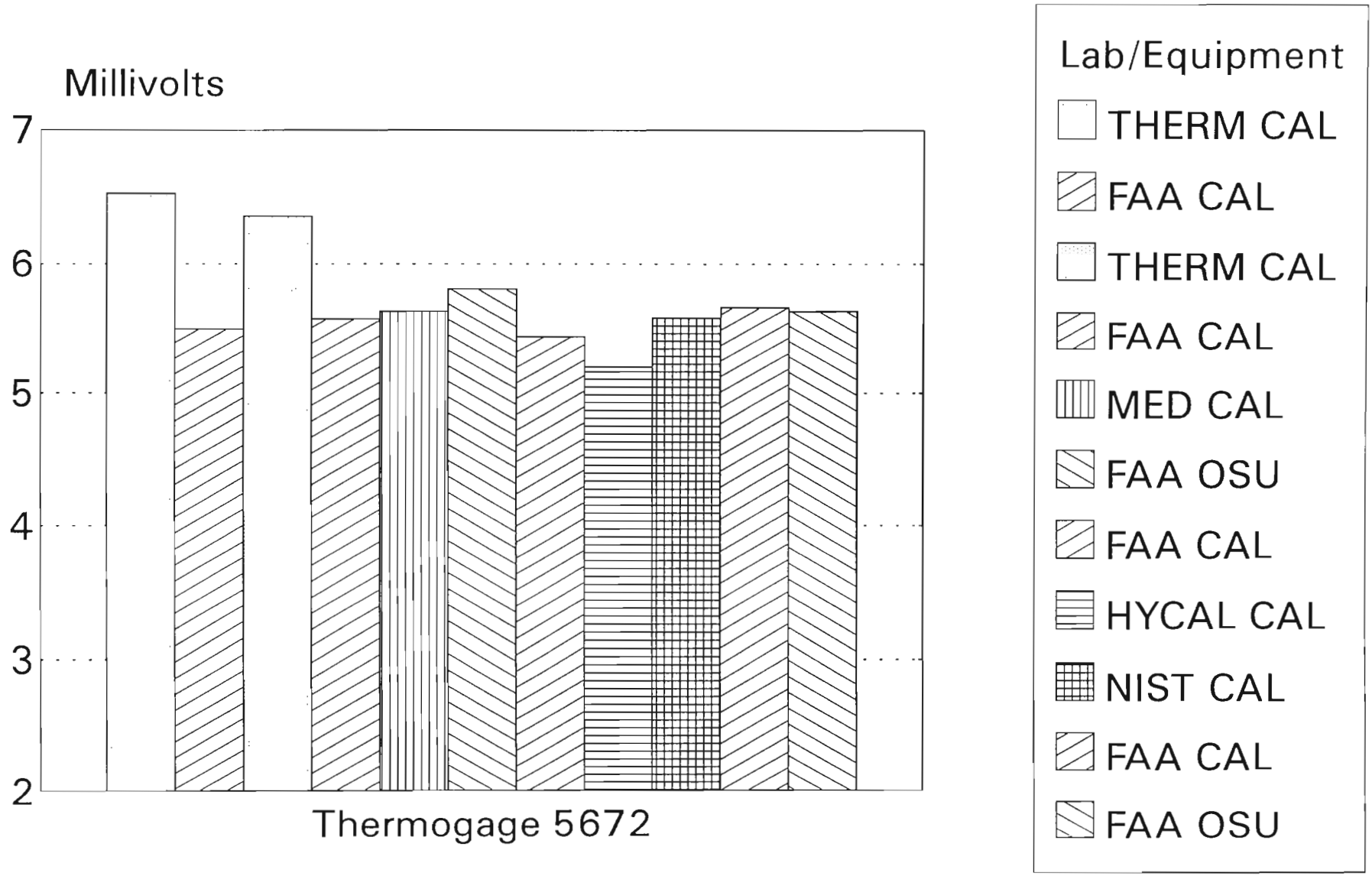
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



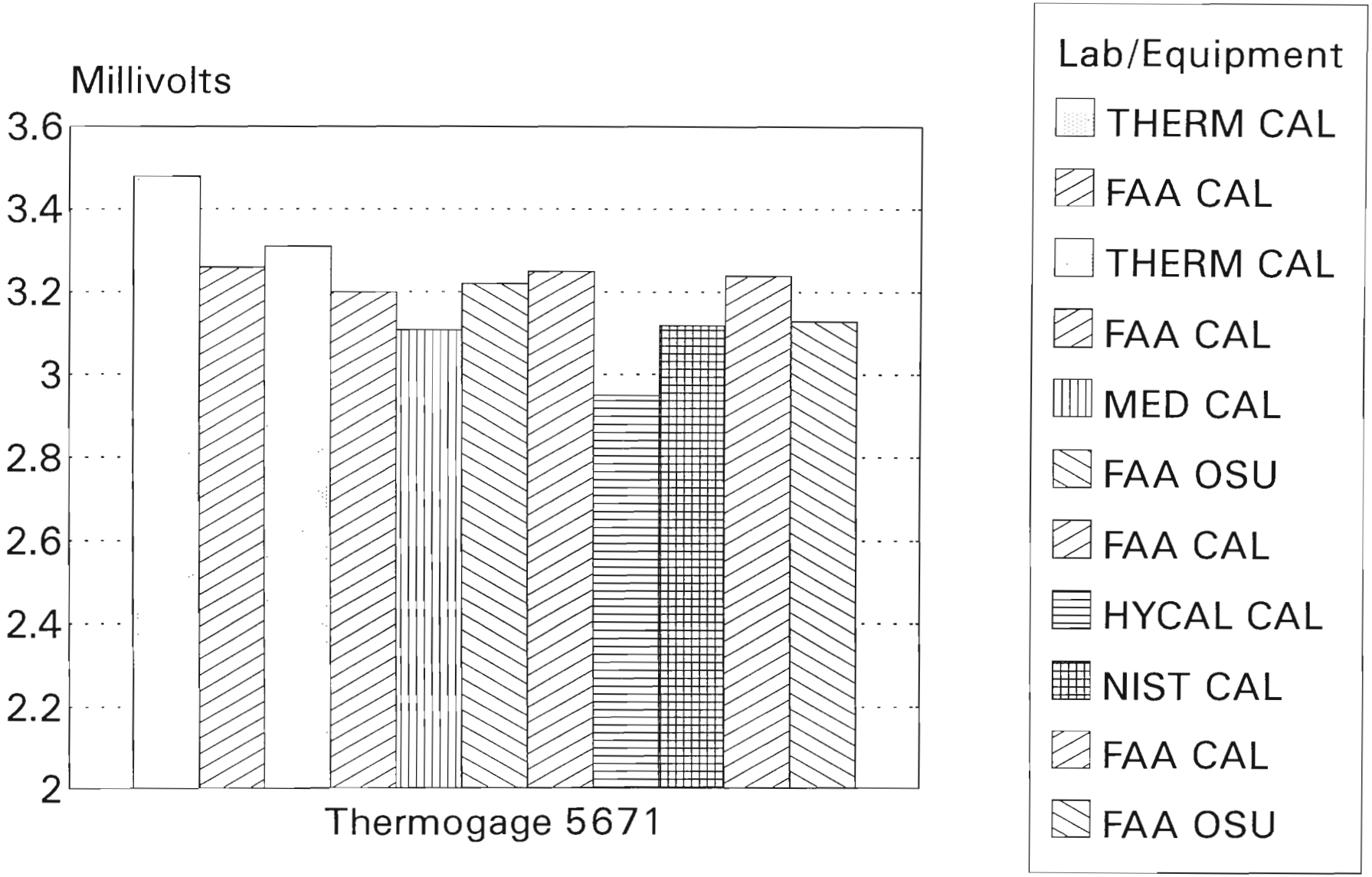
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



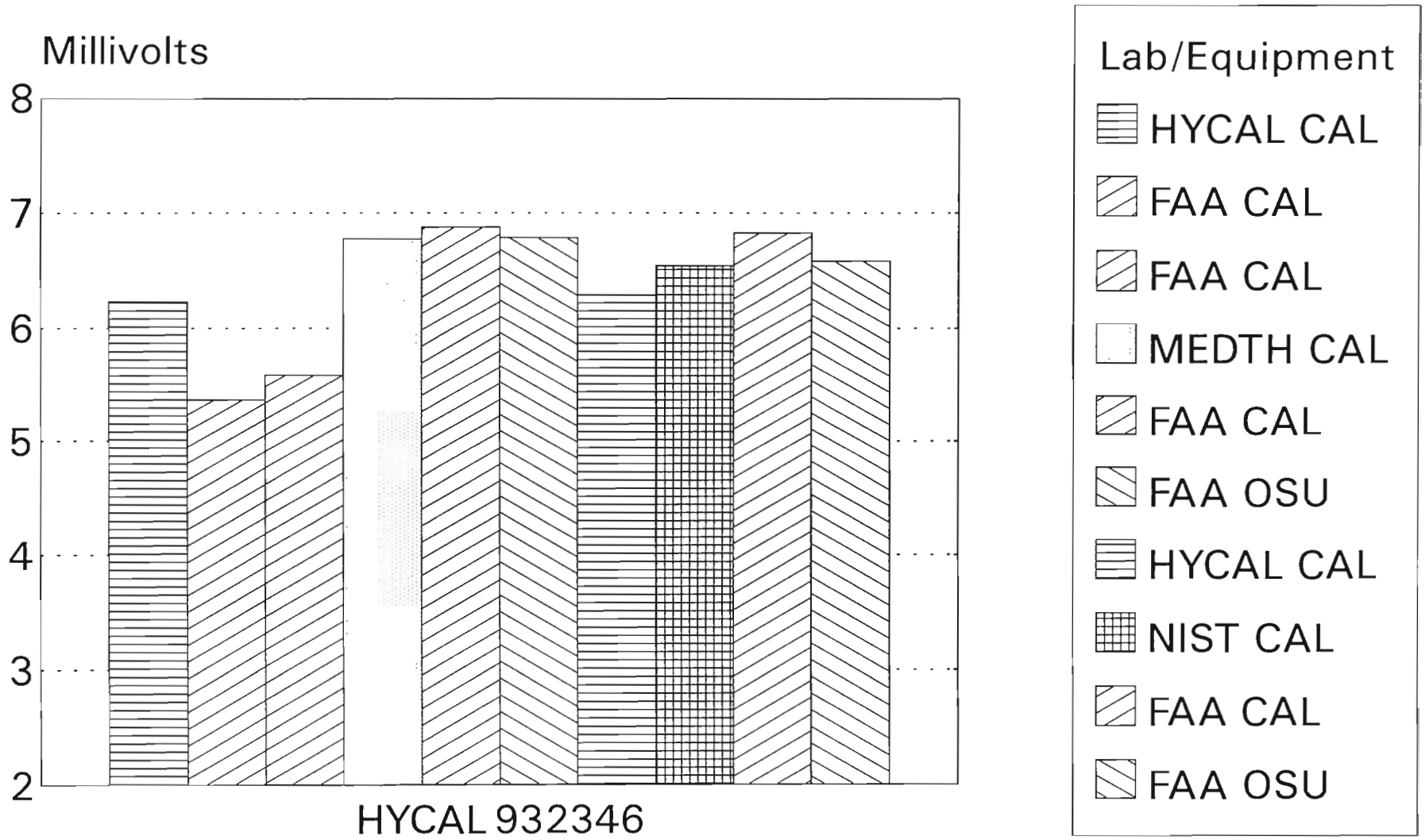
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



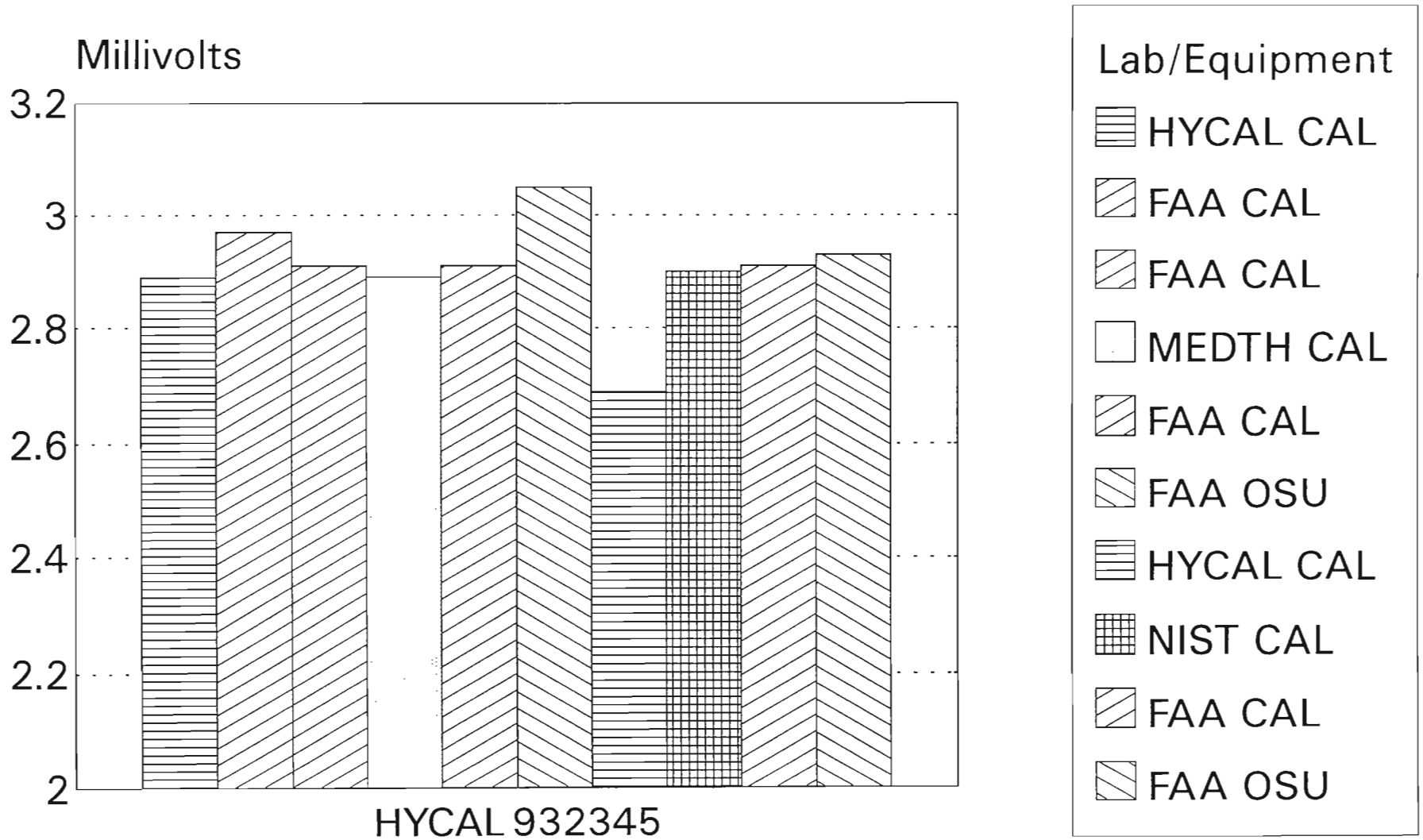
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



GARDON GAGE, R/R

Millivolts @ 3.5 Watts



Subgroup 4, Material Systems Renovation and Repair
Meeting Minutes, Summary

Renovation/Refurbishment

In terms of renovation/refurbishment, I proposed a new method by which qualification tests could be run on an interior panel that has been painted or decorative laminated (fig 1). Most participants seemed receptive to this format, provided some adjustments could be made. To clarify this proposal: if an aircraft interior is type certified to meet 100/100, then it must continue to do so after the refurbishment procedure; if the aircraft interior is type certified to meet 65/65/200, then it must also continue to do so after the refurbishment, no exceptions.

The qualification test would involve the build-up of the actual material "system" using the substrate followed by the dec laminate or paint, whichever the case. This material system would then be required to pass either the 100/100 test or the 65/65/200 tests, depending on the type certification.

If, for any reason, the actual base panel cannot be obtained for these qualification tests, then the proposed qualification procedure would allow for the tests to be run on three different "surrogate" substrates of the same construction as the original (i.e. honeycomb, crush core, thermoplastic etc). The actual numbers would be determined by a simple calculation method. For example, let's take the case of an airline who wishes to install a decorative laminate over their honeycomb sidewall panels in a 100/100 type certified aircraft. The original sidewall panels produced a HR Total of 70, and a HR peak of 75, but are no longer being produced, and the airline has no spare panels. The decorative laminate would then have to be tested over three surrogate honeycomb type panels for qualification. The surrogates used in these tests must be within plus or minus 10 units of the 70/75. The qualification tests might procede as follows:

surrogate panel 1: 65/65, surrogate panel 1 with dec lam: 70/70
surrogate panel 2: 70/70, surrogate panel 2 with dec lam: 80/80
surrogate panel 3: 75/75, surrogate panel 3 with dec lam: 90/90

In this particular example, the worst increase due to the installation of this decorative laminate was on surrogate number 3, which resulted in an increase of 15/15. In order to obtain a final number that takes into account for the synergistic effects of the materials, a safety factor of 5/5 is added, for a grand total of 20/20. This 20/20 would be added to the original 70/75 to produce a final number of 90/95, which is less than 100/100, so it is an acceptable refurbishment prcedure. The qualification procedure would have to be repeated if the decorative is to be used on any other types of interior panels, for example crush cores or thermoplastics.

This refurbishment procedure would be applicable only when the original substrates cannot be obtained, but the original O.S.U. data is available. *This procedure would not be applicable if the original panels are so old that they lack any O.S.U. test data, since there is no possibility of these panels passing the 100/100 test anyway.* In terms of smoke testing, the finished material system would have to pass the 200 D_s over all of the surrogates (if the type certificate is 65/65/200).

Comments/Discussion

The first item discussed surrounded the proposed use of *three* surrogate panels for qualification testing. According to one group member, there are currently only *two* types of crush core panels available: one using glass construction, the other using graphite construction. It will be recommended that any surrogate testing using crush core panels will involve the use of both the glass and graphite panels, and probably an additional glass and graphite panel which uses a different curing process, for example.

The next item that was discussed involved the difficulty in obtaining the original base panel O.S.U. numbers required to proceed with the above mentioned qualification procedure. It seems logical that if

an operator wishes to refurbish his interior and is having difficulty obtaining this data, that he would be able to apply enough pressure on the manufacturer to produce it. To help out, a group member has proposed to develop a data base which would be usable and obtainable by the airlines who are in this predicament. The data base would provide the base panel O.S.U. rate of heat release numbers for a variety of aircraft type (it might be useful to have the data tabulated according to aircraft serial number).

Another item that was discussed with the proposed qualification method was the safety factor. I will be contacting various working group participants to try to obtain some data which reflects how much scatter is typical when decoratives or paints are used. From this, the proposed safety factor (5/5) could be adjusted accordingly. In any event, an operator who backs up his claim with data is in a better position than the operator who is giving his best guess when it comes to certifying a particular refurbishment. For example, some operators active in the working group have displayed data on numerous tests performed on the various interior systems. If these operators feel that the safety factor can be reduced to 3/3 or less during this type of qualification procedure, and have sufficient data to suport this trend, then they will most likely be permitted to do so.

Some operators who participated in the sub-group meetings discussed other problems with the above proposed qualification method. In particular, these operators discussed how their 65/65/200 type certified interiors are already very close to the 65/65 limit. They expressed their concern over not being able to meet the proposed criteria in the event that they wish to refurbish their interior, since some of their aircraft's interior sidewall panels cannot be "stripped" of the original decorative laminate (Boeing manufactured panels cannot be stripped of their decoratives, since they are bonded using a two-part thermoset adhesive; Airbus manufactured panels are strippable from the PSU down, and Douglas panels are completely strippable). In many cases, the operators claim that an additional decorative, piggybacked over the existing one, or painting of these panels is their only option for refurbishing. Either of these two options is likely to raise the numbers above the 65/65 limit, with the operators already hesitant at piggybacking since it adds weight. The only other option the operator has if his interior is showing signs of wear is to replace the panels with new ones, supplied by the airframe manufacturer, which could prove to be a rather costly approach, claim the operators. Additionally, the operators expressed their displeasure that by replacing the worn panels with new ones, the colors don't match up exactly due to the ultra-violet degrading of the surface of the original panels.

One operator proposed that the refurbished interiors could be qualified on a percentage basis (i.e. if the average surface area of all the panels does not exceed 65/65, then some areas could be allowed to be over 65/65, provided they don't exceed 70/70 or 75/75, for example). This would make for a very complicated qualification procedure, however, since the actual surface area of the panels which exceed 65/65 would have to be calculated, etc.

Repair

The discussion and recommendations pertaining to the repair and patching of cargo compartment liners is complete. The subgroup recommended several test criteria for qualifying a cargo liner patch, in addition to the current criteria of burnthrough resistance and patch adhesion. These additional criteria were based on technical information obtained during previous group sessions.

The issues surrounding repair have focused primarily on the use of fillers for making repairs to interior sidewall and ceiling panels, as well as stowage bin doors. Fillers are available in a variety of consistensies, each aimed at performing a specific function. Spray fillers may be used for minor surface imperfections such as scratches, whereas a brush filler may be used for deeper gouges or chips. Extensive damage would be repaired using a spatula or putty type filler. There are currently no regulations governing the use of fillers, and it has become evident that quick action is necessary since many of the fillers that are currently in use are somewhat flammable. Presently, fillers are permitted for use on any non-O.S.U. aircraft interior, to any extent. The fillers are, in actuality, being used in both 100/100 and 65/65/200 type certified interiors because there are no regulations governing them. *It is contradictory to implement numerous cabin flammability standards which govern interior material use, and at the same time permit the widespread use of these more flammable filling materials.*

In order to qualify a filler for use in an aircraft cabin, there are currently two possible solutions. The first solution is actually a two-part test involving a spray and brush filler test and then a separate spatula filler test. In the spray/brush filler test, a 6" by 6" substrate (identical to the type it is to be used on in service) would be coated with a representative thickness of each, and tested in the O.S.U. chamber where it would have to pass either 100/100 or 65/65/200, depending on the type certification of the aircraft. During the spatula filler test, a 6" by 6" layer of the material would be tested in the O.S.U. in a special sample holder. The thickness of the filler would have to reflect what would likely be used in service. This is critical, since testing has shown that the thickness of the filler will dictate the heat release rate produced. The pass/fail criteria would be based on the best available materials, thereby eliminating the less than desirable materials.

The other solution would be to test the fillers as they would actually be in service, or as part of a material *system.* A typical test specimen would likely involve the base substrate, a representative thickness of spatula filler, brush filler, and spray filler, followed by the decorative laminate or paint. The entire system would have to pass either the 100/100 or 65/65/200, depending on the type certification. The only problem with this type of test is that a fairly flammable filler could probably pass the 100/100 test, and maybe even the 65/65/200 if the spray filler or topcoat of paint used over the spatula filler is very flame retardent. The test could be a vehicle to get less than desirable materials into the cabin that may not be used in the same manner that they are tested (e.g. large quantities/surface areas of spatula filler covered by a decorative only).

The results of the filler only tests conducted at the Tech Center in January were discussed. The test methods which utilized various diameter holes did not produce results that would appropriately rank the materials, for various reasons. To begin with, the heat sink effect was too dominant when using a small, centralized hole in a stainless steel plate because the surrounding surface area of steel was too great. This caused a dramatic and steady decrease in the total heat release rate, overriding any contribution made by the burning of the filler. The total (net) heat release rate was actually less than zero during many of the tests. The other problem with a small, centralized hole in a steel plate is that the pilot flame does not impinge on the filler; the filler is thereby exposed to the radiant heat source only. It was evident that the only method of filler testing that would produce results differentiating the various materials (ranking) would be some type of 6" by 6" sample holder which could eliminate the heat sink effect and the pilot flame problem.

Comments/Discussion

One group member expressed concern over adopting the filler *system* test method. He felt that by using this method, a greater amount of certification testing would result because a system test would presumably have to be run for each cabin material that the filler would be intended for use on. Coversely, by adopting the filler only test method where spray/brush and spatula fillers are isolated, these materials could be used universally throughout the cabin once they meet the pass/fail criteria (this is only partially true, since the proposed spray/brush filler tests would still have to be tested over the actual substrate, or representative surrogates, which would involve as much testing as would be required in the filler system approach).

I have discussed the filler issues with representatives from the Aircraft Certification Office (Seattle), and they have suggested a two-tiered approach. The **first step** would involve a questionaire distributed to the group participants on the issue of the filler *system* test. The questionaire would likely have two or three possible methods for running the system test (e.g. substrate/.125" spatula filler/brush filler/etc. or substrate/.250" spatula filler/brush filler/etc.) The respondents would be asked for their choice and some reasoning for it. The **second step** would involve the on-going development of a filler only test, as a group task. The issues would involve the thickness of the spatula filler test, the possibility of various thickness spatula filler tests, what type of spray/brush filler test, could the spray/brush fillers be qualified over aluminum substrate, etc. Anyone interested in being included in the filler questionaire (besides the subgroup participants) should contact me by fax at (609) 485-5580 or phone (609) 485-6469.

SUBGROUP 4
MATERIAL SYSTEMS RENOVATION & REPAIR

MATERIAL SYSTEMS RENOVATION

METHOD OF QUALIFICATION TESTING

USE OF SURROGATE MATERIALS FOR QUALIFICATION

SYNERGISTIC PROBLEMS

MATERIAL SYSTEMS REPAIR

FILLER REPAIRS

DEVELOPMENT OF TEST METHOD

CARGO LINER PATCHING/REPAIR ✓

RENOVATION/REFURBISHMENT

QUALIFICATION PROCESS REPEATED FOR OTHER INTERIOR PANELS

HONEYCOMB
CRUSH CORE
THERMOPLASTIC
ALUMINUM
} SIDEWALL, STOWAGE BIN GALLEY PANEL, ETC.

QUALIFICATION PROCESS APPLICABLE ONLY WHEN:

ORIGINAL SUBSTRATE UNAVAILABLE

ORIGINAL O.S.U. TEST DATA IS AVAILABLE

QUALIFICATION PROCESS NOT *ALLOWED IF:*

ORIGINAL PANELS ARE LACKING O.S.U. TESTING DATA

SMOKE TESTING: D_S < 200 (3 PANELS)

RENOVATION/REFURBISHMENT

{ OR + } = 65/65/200

ANY COMBINATION — ORIGINAL BASE PANEL

IF ORIGINAL BASE PANELS CANNOT BE OBTAINED, THEN:

PROPOSED METHOD: TEST OR + 3 SURROGATE PANELS (+/- 10 OF ORIG O.S.U.) NEGOTIABLE

EXAMPLE: ORIGINAL BASE PANEL HRR/HRP = 45/50

TEST PANEL 1 BASELINE = 55/55, TEST PANEL 1 WITH = 60/60
TEST PANEL 2 BASELINE = 50/50, TEST PANEL 2 WITH = 57/57
TEST PANEL 3 BASELINE = 40/40, TEST PANEL 3 WITH = 49/49

WORST CASE (9/9) + FUDGE FACTOR (5/5) = 14/14

ADD 14/14 TO ORIGINAL 45/50 = 59/64 "ACCEPTABLE"

REPAIR

PRIMARY TYPES OF FILLER REPAIRS

MINOR SURFACE IMPERFECTIONS, SCRATCHES

DEEP SCRATCHES, CHIPS

MORE EXTENSIVE DAMAGE, DENTS, CRACKS, HOLES

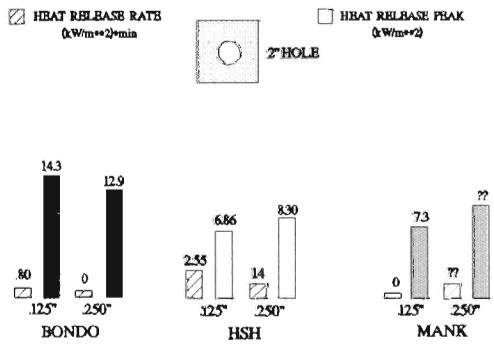
POSSIBLE TEST METHODS:

#1 *QUALIFY SPRAY AND BRUSH FILLERS LIKE PAINTS* +
FILLER ONLY TEST (SPATULA)
SAMPLE HOLDER SIZE? THICKNESS?

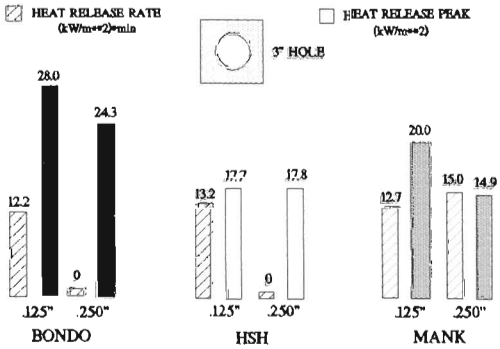
OR

#2 *SUBSTRATE/FILLER/LAMINATE/PAINT TEST*
FILLER "HIDDEN" UNDER LAMINATE?

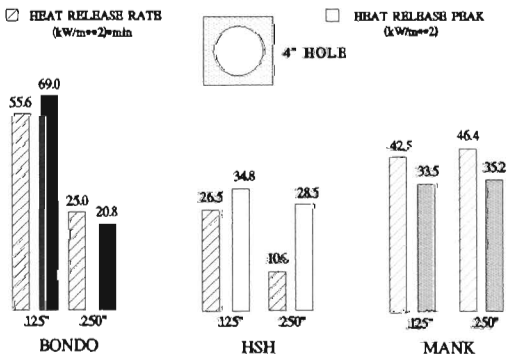
FILLER TESTS IN O.S.U. CHAMBER



FILLER TESTS IN O.S.U. CHAMBER



FILLER TESTS IN O.S.U. CHAMBER



FILLER TESTS IN O.S.U. CHAMBER

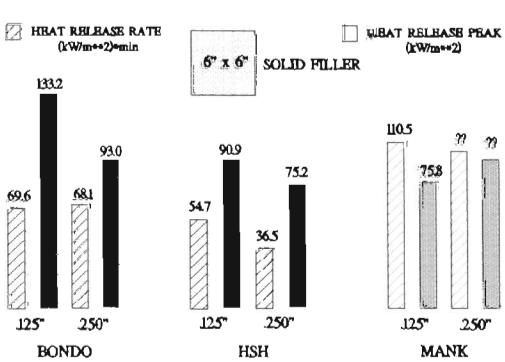


fig. 1

ATTENDEE LIST-- INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

FEBRUARY 7-8, 1995

First	Last	Company	Country	Phone	Fax
Sajjad	Aziz	Accufleet		713-999-0033	713-999-0055
Bob	Barnette	Starr Aircraft, Inc.		903-893-1106	903-893-0551
Steve	Beare	DuPont Company		302-999-2240	302-999-2718
Hanns-Joerg	Betz	Lufthansa Technik	Germany	49 69 696 4612	49 69 696 4617
Victoria	Bousman	Hoechst Celanese Corporation		818-796-0626	818-796-4942
Mark	Broekaert	HSH Aerospace Finishes	Belgium	32 2 267 2670	32 2 267 4934
John	Buckley	Buckley Enterprises		805-255-9842	805-255-9842
Robert	Byerly			(area code?) 295-7537	
Pat	Cahill	FAA Technical Center		609-485-6571	609-646-5229
Scott	Campbell	Douglas Aircraft Company		310-497-6171	310-982-0775
Don	Cardis	Schneller, Inc.		216-673-1400	216-673-7327
Bruno	Carriere	Aerospatiale	France	33-61-18-09-06	33-61-18-04-95
Herbert	Curry	Herb Curry, Inc.		812-831-7769	812-831-7252
George	Danker	AKRO Fireguard Products, Inc.		913-888-7172	913-888-7372
James	Davis	Accufleet		713-999-8800	713-999-9066
Laurence	Drouet-Fleurizelle	Aerospatiale	France	33 61 18 18 70	33 61 18 29 34
Ian	Elliott	Skyline Products		503-995-6395	503-995-8425
Skip	Face	HSH Interplan- USA, Inc.		714-444-1549	714-444-1649
Reinhard	Felder	Schneller, Inc.		216-673-1400	216-673-7327
Karen	Forest	FAA Aircraft Certification Office		708-294-7697	708-294-7834
C.L.	Foushee	Albany International Research Compan		206-746-8111	206-641-8844
Anthony	Fredericks	Chestnut Ridge Foam, Inc.		407-290-5917	
Jeff	Gardlin	FAA Aircraft Certification Division		206-227-2136	206-227-1100 or 1320
Shingo	Hagihara	Showa Aircraft Company		206-290-7399	206-355-4075
Sally	Hasselbrack	Boeing Commercial Airplane Group		206-342-9947	206-717-0460
Hans	Helsdingen	HSH Aerospace Finishes	Belgium	32 226 7 9460	32 226 7 4934
George	Hewitt	Independent FAA-DER		206-455-0413	
Richard	Hill	FAA Technical Center		609-485-5997	609-646-5229
Hiroshi	Horigome	JAMCO America, Inc.		206-347-4735	206-355-0237
A.	Horner	FAA Technical Center		609-485-4471	609-646-5229
Gilberto	Imamura	Jamco America Inc.		206-347-4735	206-290-5153
Richard	Johnson	FAA Technical Center		609-485-6573	609-646-5229
Konstantin	Kallergis	DLR	Germany	2203 601 2168	2203 643 95
Ned	Keltner	KTech		505-268-3379	505-266-4512
Larry	Kopp	K & K Services		310-421-7638	310-421-7638
Wolfgang	Lampa	Daimler-Benz Aerospace Airbus	Germany	49 421 538 3484 or 49 421 538 2746	49 421 538 4180
Tom	Leenheer	Fokker	Holland	20 605 2864	20 605 3300
Claude	Lewis	Transport Canada-Aviation	Canada	613-990-5906	613-996-9178
H. Lee	Lipscomb	Southern Mills		404-969-1000/800-241-8630	404-969-6846
Kevin	Loveall	TA Manufacturing Company		818-240-4600	818-241-3948
Tim	Marker	FAA Technical Center			

First	Last	Company	Country	Phone	Fax
Beth	McGee	Douglas Aircraft Company		310-982-7003	310-496-9300
Giovanni	Modugno	Aviointeriors	Italy	39 773 689 296	39 773 63 1546
Wolfgang	Morgenroth	Luftfahrt-Bundesamt	Germany	49 531 2355 258	49 531 2355 254
Krister	Naeslund	Transwede Airways AB	Sweden	46 8 593 650 23	46 8 593 622 54
Mike	O'Bryant	Boeing Commercial Airplane Group		206-342-8050	206-342-5727
Michael	O'Donnell	Imi Tech Corporation		360-336-5054	360-336-5182
Dale	Onderak	Schneller, Inc.		216-673-1400	216-673-7327
Peggy	Quinn			602-546-4737	
Duane	Randall	AKRO Fireguard Products, Inc.		913-888-7172	913-888-7372
Carole	Sagraves	Langenthal Corporation		910-969-9551	910-969-2833
Tim	Shark	Schneller, Inc.		216-673-1400	216-673-7327
Steven	Sharpe	Mt. Jefferson Woolen		503-327-2203	503-327-2206
Bob	Stacho	Los Angeles ACO	90712	310-627-5334	310-627-5210
Chuck	Story	McGee Plastics		412-776-2220	412-776-9696
Jonas	Talandis	Atlas Electric Devices		312-327-4520	312-327-5787
Frank	Tiangsing	FAA Aircraft Certification Division		206-227-2121	206-227-1100
Aad	Visser	KLM Royal Dutch Airlines	Netherlands	20 649 39 38	20 648 82 33
Layton	Walker	FAA Aircraft Certification Office		310-627-5339	310-627-5210
Jim	Walnock	DuPont Company		302-999-2088	302-999-4750 or 5034
Christopher	Webb	Hunting Aviation	England	959540505	959 570 253
Ingo	Weichert	Daimler-Benz Aerospace Airbus	Germany	40 7437 5624	40 7437 2052

PROJECT STATUS

PROJECT APPROACH :

1. *Gather used seat materials*
2. *Evaluate in-service aircraft seats and compare to gathered material*
3. *If wear is comparable between gathered material and in-service seats then fire test gathered material*
4. *Issue report containing results*

IN-SERVICE SEAT EVALUATIONS :

Airports visited:

- *Atlantic City International*
- *Newark International*
- *Stewart Field (Newburgh, NY)*

Aircraft visited:

- *8 - Shorts 360*
- *4 - ATR 42*
- *6 - Embraer EMB 120RT*
- *9 - M^{c}Donnell-Douglas DC-9 / MD-80*
- *1 - Boeing 727*
- *1 - Boeing 737*
- *1 - Airbus Industries A300*

General Notes:

- *Total seats inspected = 176 (129 are horizontal cushion only)*
- *Wear approximates the used material tested at the Technical Center*

SEAT BURNER TEST PROGRESS :

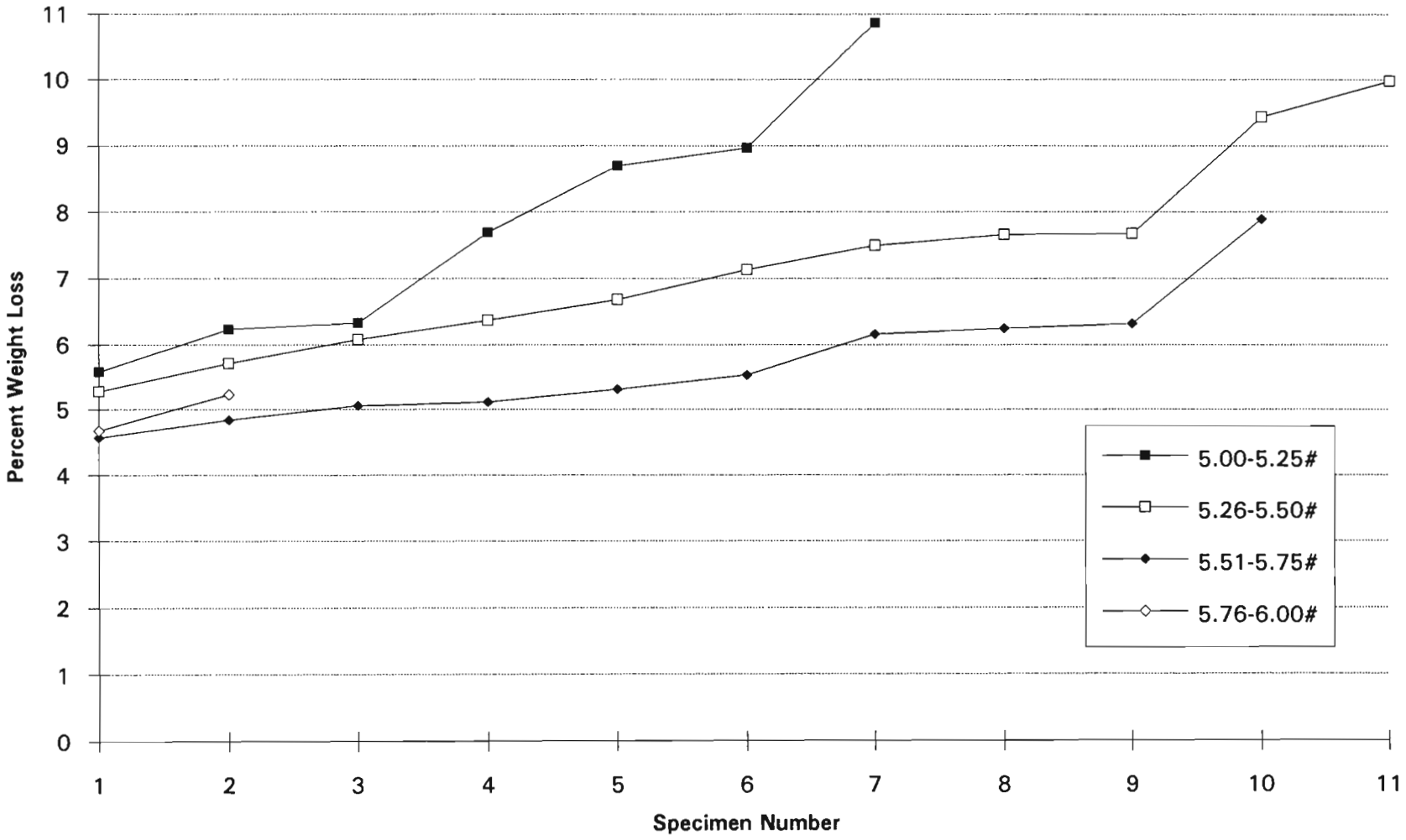
- *38 cushions sets tested; PBI, Kevlar, and Nomex blends only*
- *8 cushion sets were tested in stock sizes to determine fire endurance vs. wear*
  CONCLUSION:
  Too many variables in stock configuration - wide performance scatter (7.27% → 27.47% weight loss)
- *30 cushion sets burned in standard size; stock dress cover material and seat foam removed and replaced with materials from the Technical Center*
- *30 standard tests; 4.57% → 10.87% weight loss*
  CONCLUSIONS:
  1. *No significant problems noted to date*
  2. *Mechanical integrity of FBL is critical; small pentrations not significant although dependent upon proximity to flame*

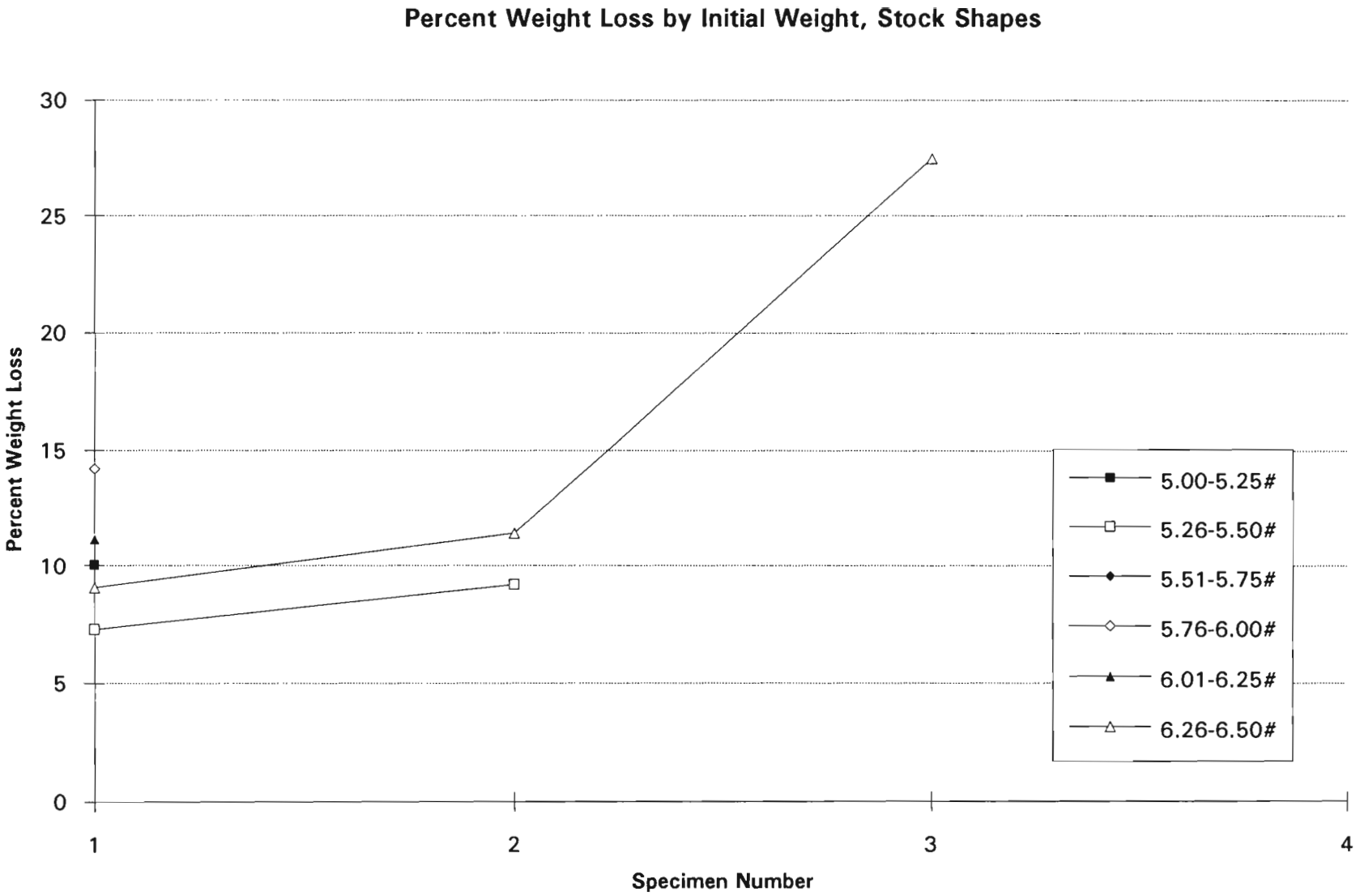
IN-SERVICE SEAT TALLIES

Seat Construction Breakdown by Airport			
ACY			
Total seats examined:	*109*		
PBI blends :	48	44	
Kevlar/Nomex blends :	11	10.1	
FR foams :	9	8.26	
Other :	41	37.6	100
EWR			
Total seats examined:	*37*		
PBI blends :	19	51.4	
Kevlar/Nomex blends :	18	48.6	
FR foams :	0	0	
Other :	0	0	100
SWF			
Total seats examined:	*30*		
PBI blends :	21	70	
Kevlar/Nomex blends :	9	30	
FR foams :	0	0	
Other :	0	0	100
TOTALS			
Total seats examined:	176		
PBI blends :	88	50	
Kevlar/Nomex blends :	38	21.6	
FR foams :	9	5.11	
Other :	41	23.3	100

Seats Examined by Aircraft Type	
Shorts 360	30
ATR 42	16
EMB 120RT	25
Subtotal	71
DC 9/MD 80	83
B727	10
B737	6
A300	6
Subtotal	105
TOTAL	176

Percent Weight Loss by Initial Weight, Standard Shapes




Percent Weight Loss by Initial Weight, Stock Shapes
30
25
20
15
10
5
0
Percent Weight Loss
1
2
3
4
Specimen Number
5.00-5.25#
5.26-5.50#
5.51-5.75#
5.76-6.00#
6.01-6.25#
6.26-6.50#

SCHNELLER, INC.

O.S.U.
ROUND ROBIN
FEBRUARY, 1995

O.S.U. ROUND ROBIN

SCHNELLER, INC.

O.S.U. ROUND ROBIN

STANDARD PANEL

- ALBANY INTERNATIONAL RESEARCH
- BOEING COMMERCIAL AIRPLANE
- DOUGLAS AIRCRACT COMPANY
- F.A.A. TECH CENTER
- G.E. PLASTICS
- SCHNELLER, INC.

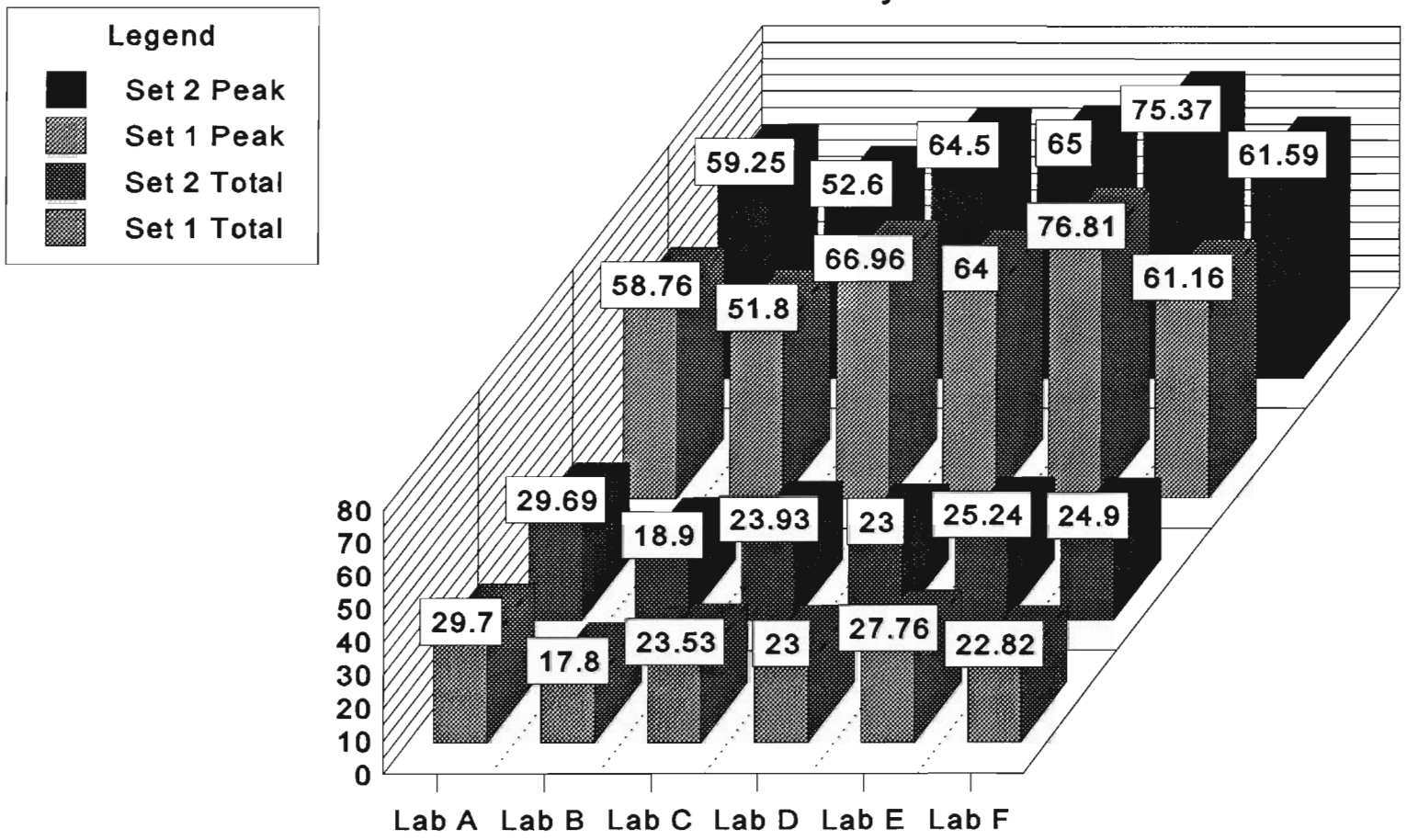
O.S.U. ROUND ROBIN

AIRESCO PANEL
February, 1995

	SET 1		SET 2		COMBINED	
	Ave Total	Ave Peak	Ave Total	Ave Peak	Ave Total	Ave Peak
LAB A:	29.70	58.76	29.69	59.25	29.69	59.00
LAB B:	17.80	51.80	18.90	52.60	18.35	52.20
LAB C:	23.53	66.96	23.93	64.50	23.73	65.73
LAB D:	23.00	64.00	23.00	65.00	23.00	64.50
LAB E:	27.76	76.81	25.24	75.37	26.50	76.09
LAB F:	22.82	61.16	24.90	61.59	23.86	61.38
MEAN:	24.10	63.25	24.28	63.05	24.19	63.15
STD. DEV:	3.82	7.68	3.19	6.87	3.45	7.26

OSU ROUND ROBIN

AIRESCO Panel February 1995

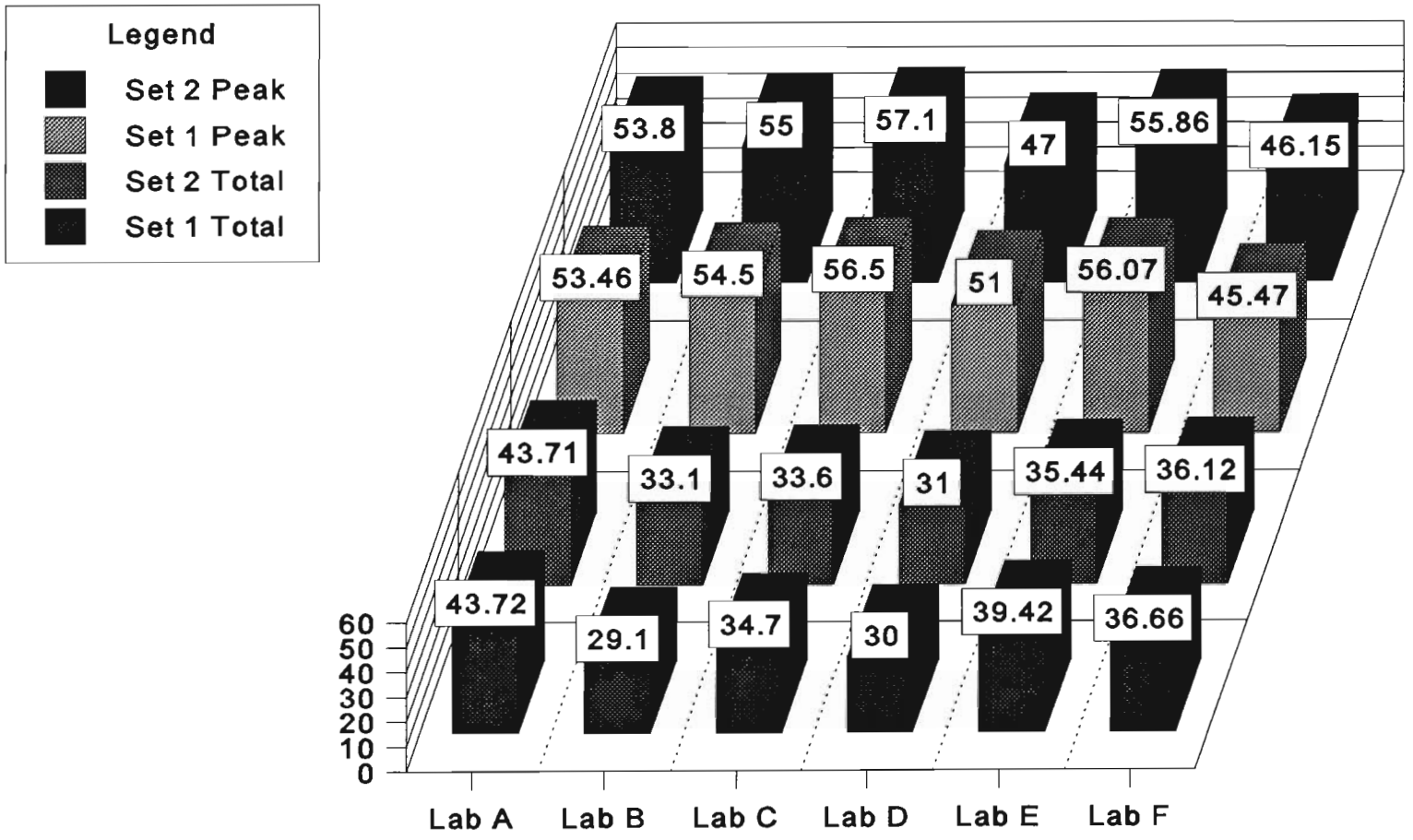


SCHNELLER STANDARD CORE
February, 1995

	SET 1		SET 2		COMBINED	
	Ave Total	Ave Peak	Ave Total	Ave Peak	Ave Total	Ave Peak
LAB A:	43.72	53.46	43.71	53.80	43.71	53.63
LAB B:	29.10	54.50	33.10	55.00	31.10	54.75
LAB C:	34.70	56.50	33.60	57.10	34.15	56.80
LAB D:	30.00	51.00	31.00	47.00	30.50	49.00
LAB E:	39.42	56.07	35.44	55.86	37.43	55.96
LAB F:	36.66	45.47	36.12	46.15	36.39	45.81
MEAN:	35.60	52.83	35.50	52.48	35.55	52.66
STD. DEV:	5.10	3.76	4.03	4.30	4.44	3.95

OSU ROUND ROBIN

Schneller Standard Core February 1995



AIRESCO PANEL
February, 1995

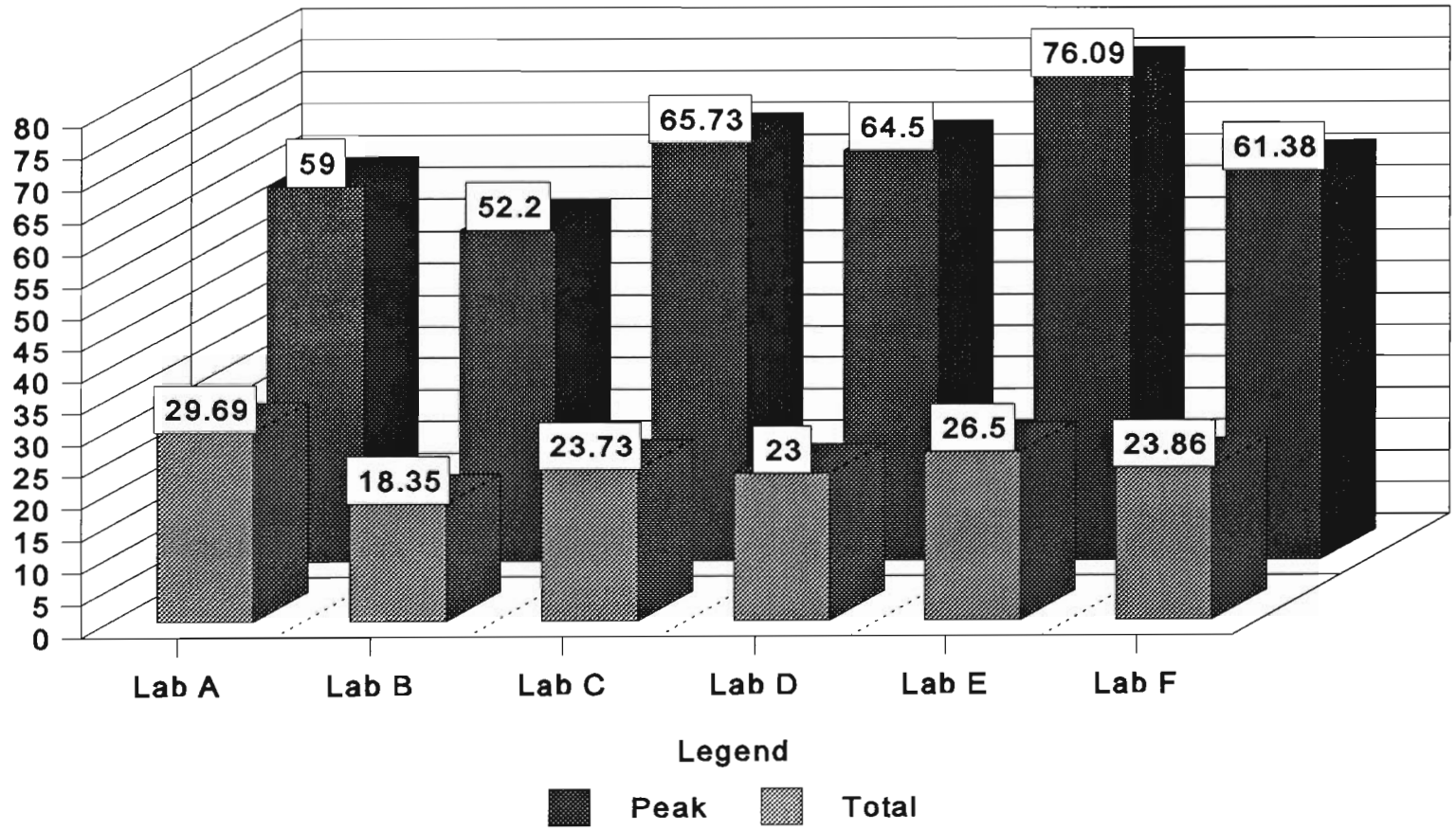
	Set 1 Peak	Set 2 Peak	Set 1 Total	Set 2 Total
LAB A:	58.76	59.25	29.70	29.69
LAB B:	51.80	52.60	17.80	18.90
LAB C:	66.96	64.50	23.53	23.93
LAB D:	64.00	65.00	23.00	23.00
LAB E:	76.81	75.37	27.76	25.24
LAB F:	61.16	61.59	22.82	24.90
MEAN:	63.25	63.05	24.10	24.28
STD. DEV:	7.68	6.87	3.82	3.19

OVERALL

	PEAK	TOTAL
MEAN:	63.15	24.19
STD DEV:	7.00	3.38

OSU ROUND ROBIN

AIRESCO Panel Overall February, 1995



SCHNELLER STANDARD CORE
February, 1995

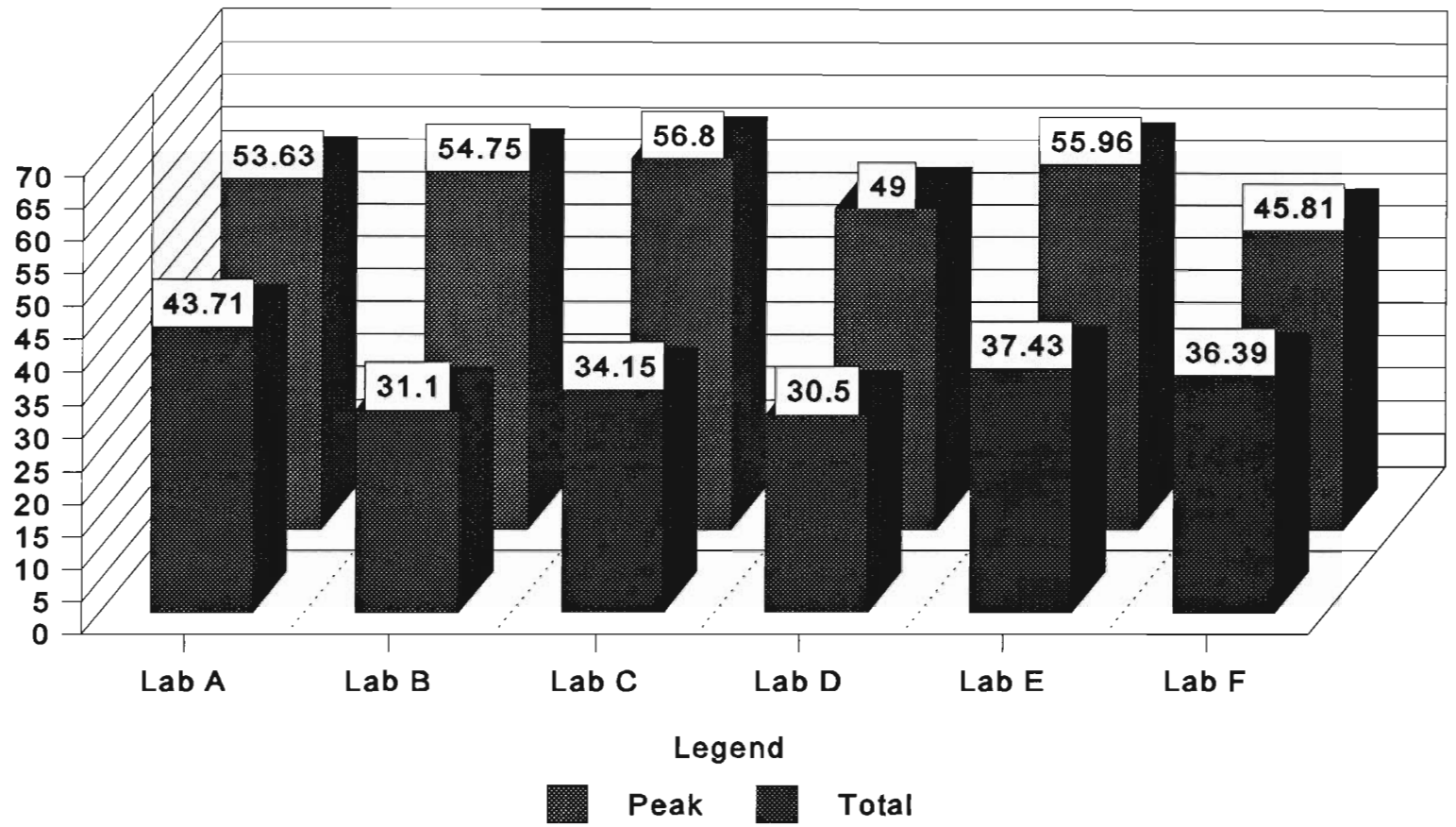
	Set 1 Peak	Set 2 Peak	Set 1 Total	Set 2 Total
LAB A:	53.46	53.80	43.72	43.71
LAB B:	54.50	55.00	29.10	33.10
LAB C:	56.50	57.10	34.70	33.60
LAB D:	51.00	47.00	30.00	31.00
LAB E:	56.07	55.86	39.42	35.44
LAB F:	45.47	46.15	36.66	36.12
MEAN:	52.83	52.48	35.60	35.50
STD. DEV:	3.76	4.30	5.10	4.03

OVERALL

	PEAK	TOTAL
MEAN:	52.66	35.54
STD DEV:	3.88	4.42

OSU ROUND ROBIN

Schneller Standard Core Overall Feb. 95



O.S.U. ROUND ROBIN

"DATA SHEET"
LAB A

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	51.76	26.38
	Run 2	62.65	30.85
	Run 3	61.86	31.87
	Average	58.76	29.70
Set B:	AIRSCO PANEL		
	Run 1	58.84	30.10
	Run 2	57.90	28.01
	Run 3	61.02	30.96
	Average	59.25	29.69
Set C:	SCHNELLER STANDARD CORE		
	Run 1	54.20	45.45
	Run 2	53.91	44.36
	Run 3	52.26	41.34
	Average	53.46	43.72
Set D:	SCHNELLER STANDARD CORE		
	Run 1	55.25	44.47
	Run 2	51.79	42.70
	Run 3	54.38	43.96
	Average	53.80	43.71

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB B

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	54.30	19.70
	Run 2	52.20	21.70
	Run 3	48.80	12.10
	Average	51.80	17.80
Set B:	AIRSCO PANEL		
	Run 1	50.40	12.50
	Run 2	53.70	18.40
	Run 3	53.60	25.90
	Average	52.60	18.90
Set C:	SCHNELLER STANDARD CORE		
	Run 1	49.80	26.90
	Run 2	54.40	28.60
	Run 3	59.30	31.80
	Average	54.50	29.10
Set D:	SCHNELLER STANDARD CORE		
	Run 1	54.40	30.40
	Run 2	55.70	36.80
	Run 3	54.80	32.10
	Average	55.00	33.10

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB C

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	71.40	16.40
	Run 2	64.20	27.10
	Run 3	65.30	27.10
	Average	66.96	23.53
Set B:	AIRSCO PANEL		
	Run 1	65.80	26.10
	Run 2	62.90	24.10
	Run 3	64.80	21.60
	Average	64.50	23.93
Set C:	SCHNELLER STANDARD CORE		
	Run 1	54.10	29.80
	Run 2	58.20	40.20
	Run 3	57.30	34.20
	Average	56.50	34.70
Set D:	SCHNELLER STANDARD CORE		
	Run 1	61.80	39.30
	Run 2	52.60	26.90
	Run 3	56.90	34.70
	Average	57.10	33.60

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB D

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	65.00	24.00
	Run 2	63.00	21.00
	Run 3	65.00	23.00
	Average	64.00	23.00
Set B:	AIRSCO PANEL		
	Run 1	63.00	22.00
	Run 2	63.00	21.00
	Run 3	68.00	26.00
	Average	65.00	23.00
Set C:	SCHNELLER STANDARD CORE		
	Run 1	60.00	34.00
	Run 2	45.00	31.00
	Run 3	47.00	26.00
	Average	51.00	30.00
Set D:	SCHNELLER STANDARD CORE		
	Run 1	43.00	32.00
	Run 2	43.00	24.00
	Run 3	54.00	37.00
	Average	47.00	31.00

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB E

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	74.56	23.13
	Run 2	78.07	26.73
	Run 3	77.02	33.43
	Average	76.81	27.76
Set B:	AIRSCO PANEL		
	Run 1	73.32	24.80
	Run 2	77.64	25.03
	Run 3	75.17	25.10
	Average	75.37	25.24
Set C:	SCHNELLER STANDARD CORE		
	Run 1	50.52	34.05
	Run 2	62.85	42.77
	Run 3	54.84	41.44
	Average	56.07	39.42
Set D:	SCHNELLER STANDARD CORE		
	Run 1	53.61	36.21
	Run 2	63.46	36.54
	Run 3	50.52	33.59
	Average	55.86	35.44

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB F

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	62.95	24.12
	Run 2	58.75	21.68
	Run 3	60.14	18.23
	Run 4	62.81	27.27
	Average	61.16	22.82
Set B:	AIRSCO PANEL		
	Run 1	61.68	27.21
	Run 2	62.77	25.65
	Run 3	64.70	26.68
	Run 4	57.23	20.06
	Average	61.59	24.90
Set C:	SCHNELLER STANDARD CORE		
	Run 1	43.56	35.90
	Run 2	45.29	33.86
	Run 3	45.34	37.58
	Run 4	47.71	39.29
	Average	45.47	36.66
Set D:	SCHNELLER STANDARD CORE		
	Run 1	46.38	31.53
	Run 2	47.00	37.23
	Run 3	46.64	39.83
	Run 4	44.57	35.91
	Average	46.15	36.12

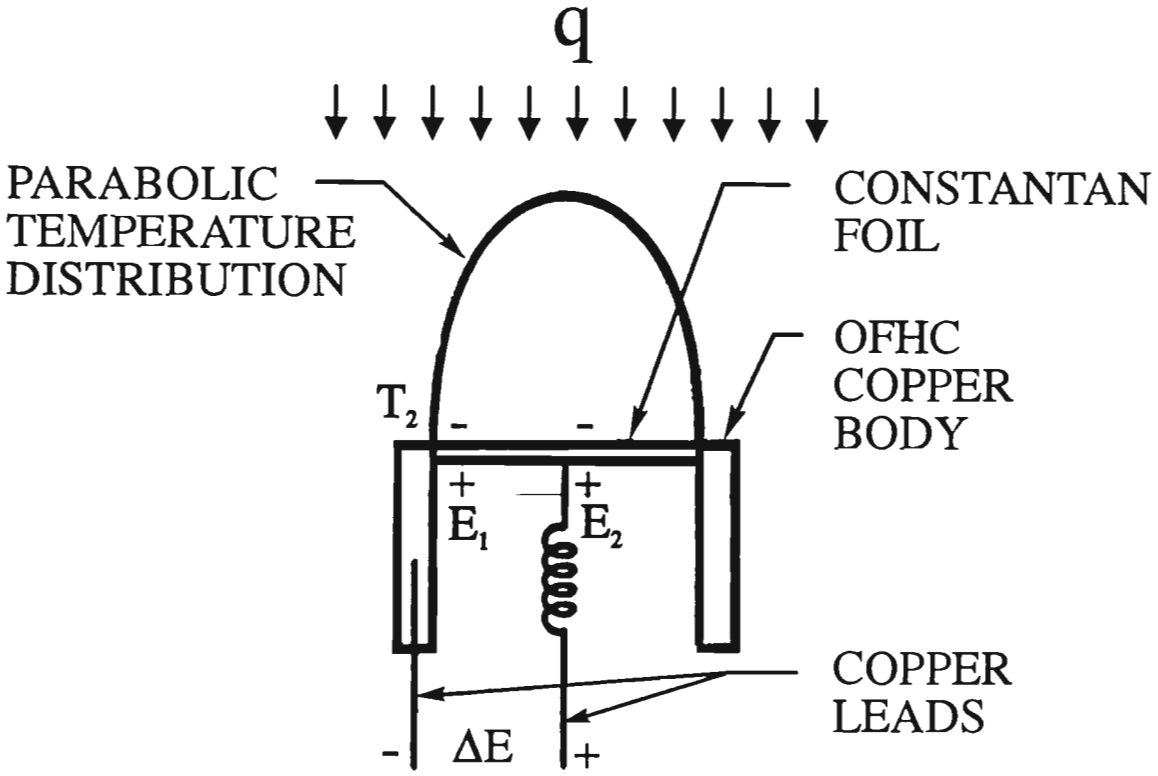
Ktech CORP.

Heat Flux Measurement and Calibration

Ned Keltner
Ktech Corporation

Heat Flux Measurements

Circular Foil Heat Flux Gauge (Gardon Gauge) Designed for Radiant Heat Flux Measurement.



Heat Drain - Either by Water Cooling the Body or with Sufficient Thermal Mass

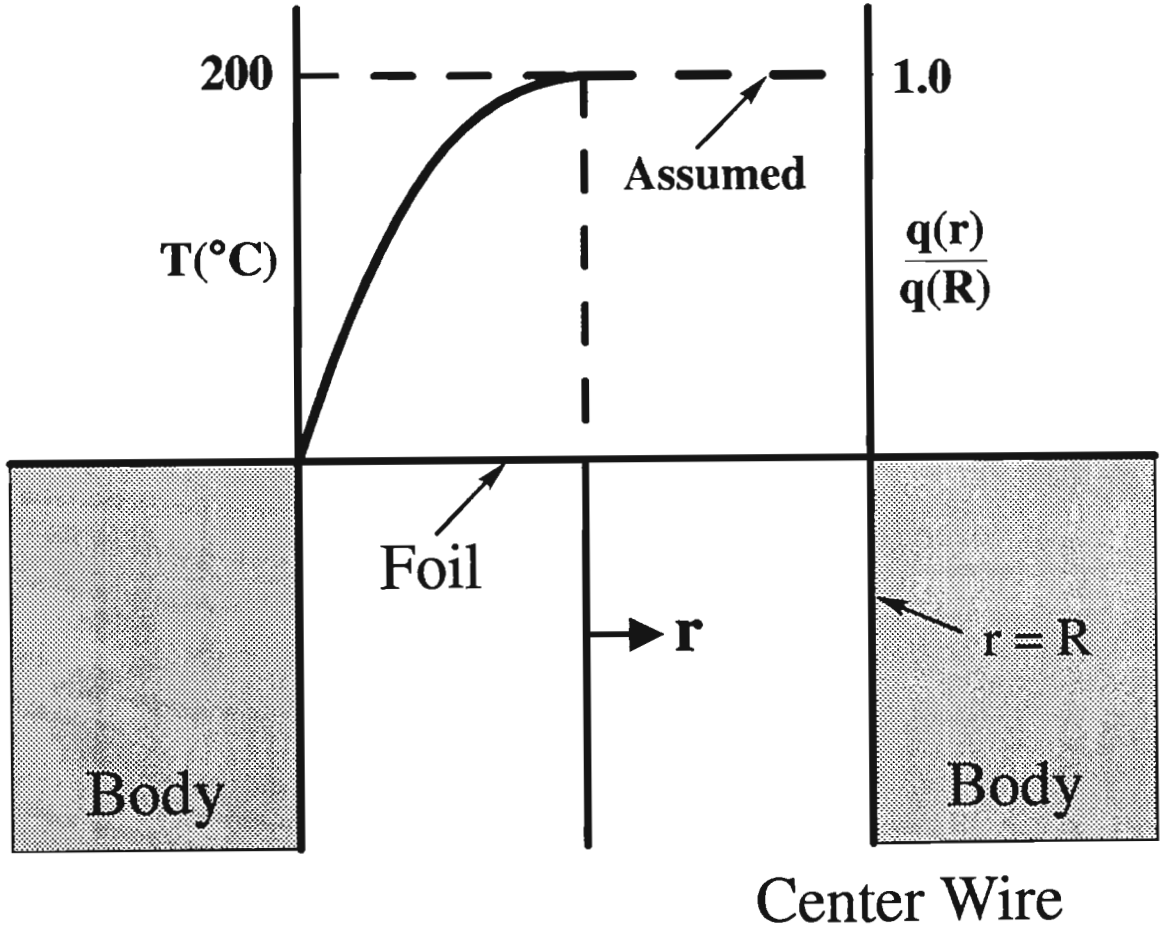
Problems to Consider:

- Absorptivity of the Sensor Coating is not Uniform Over the Radiation Spectrum.
- Condensation and Soot Deposition on these Sensors can Create Additional Problems.
- If the Sensor is Used to Measure Total Heat Flux, a Large Convective Fraction can Result in Changes of the Calibration Constant. (Up to 25%)

Temperature and Heat Flux

Distributions for Gardon Gauges Under Different Heating Conditions

Radiation Only

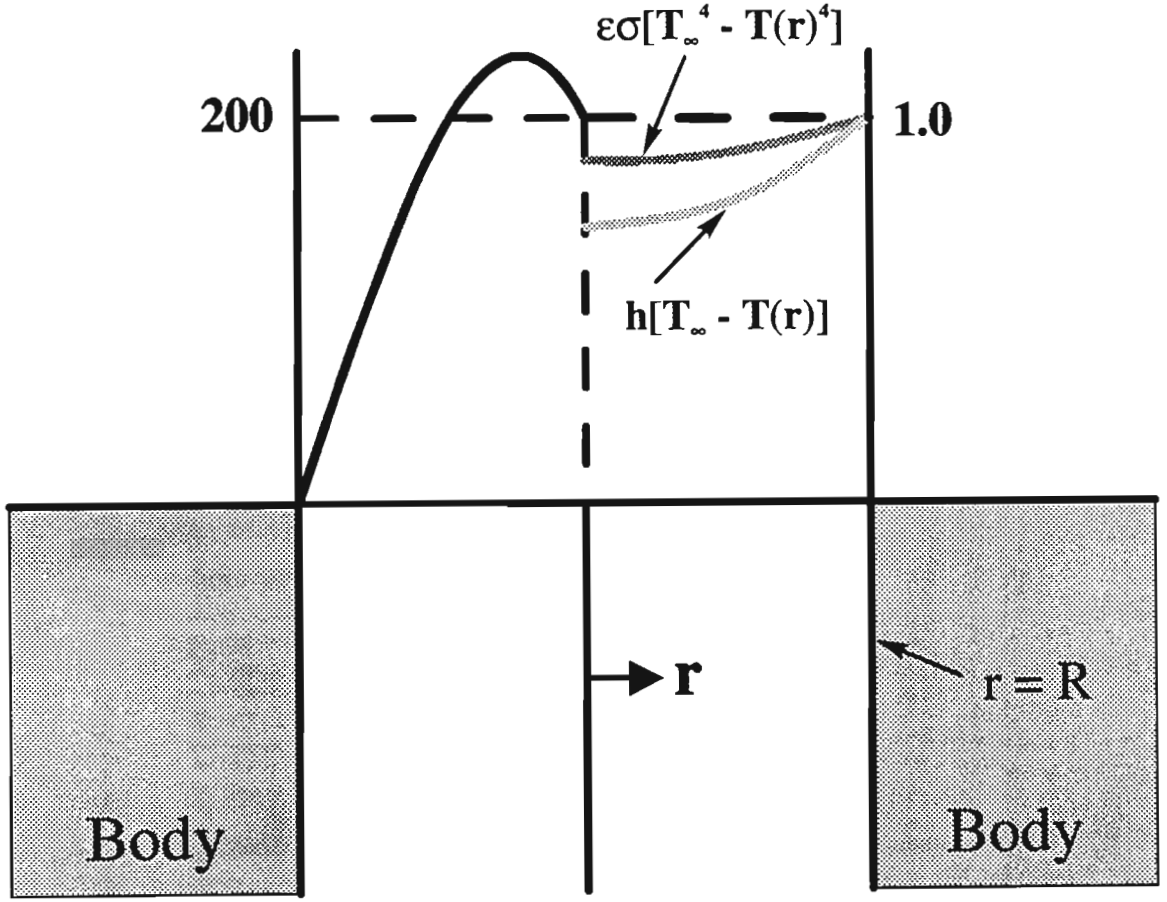


Traditional or ideal gauge analysis ignores center wire, dangerous because it affects both sensitivity and response time.

Temperature and Heat Flux

Distributions for Gardon Gauges Under Different Heating Conditions

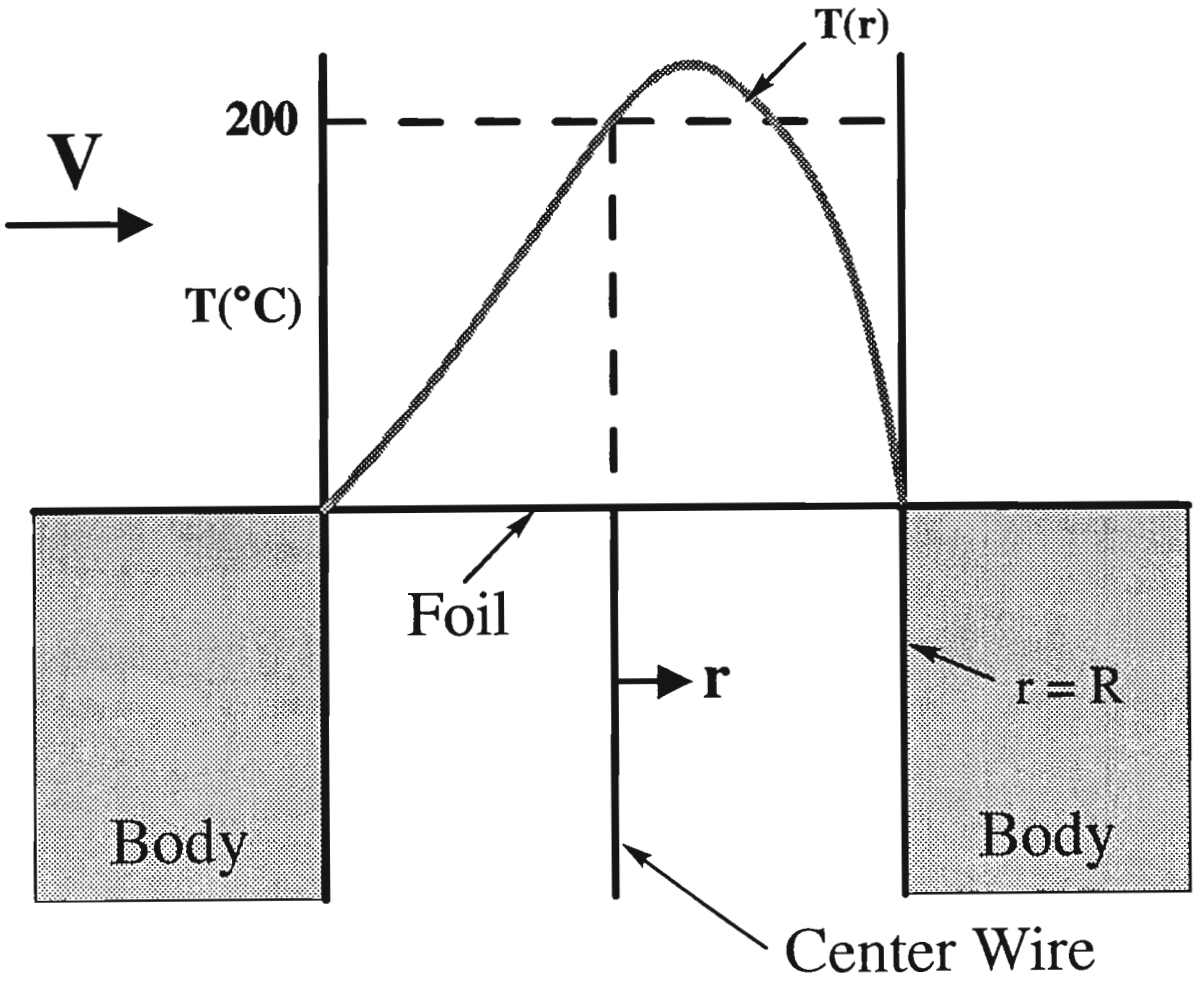
Radiation or Stagnation Flow ($T_\infty = 1000°$)



Temperature and Heat Flux

Distributions for Gardon Gauges Under Different Heating Conditions

Shear Flow



Heat flux depends on free stream temperature, velocity, angle of attack, mounting, etc. Because T(r) depends on all of these parameters, it is basically impossible to analyze.

Ktech CORP.

Gardon Gauges

- Accuracy
  - ASTM Standard E511 - ±3%
  - FAA Round Robin - ±15%
- Total Heat Flux Capability
  - Advertised as such
  - Reality - be very careful

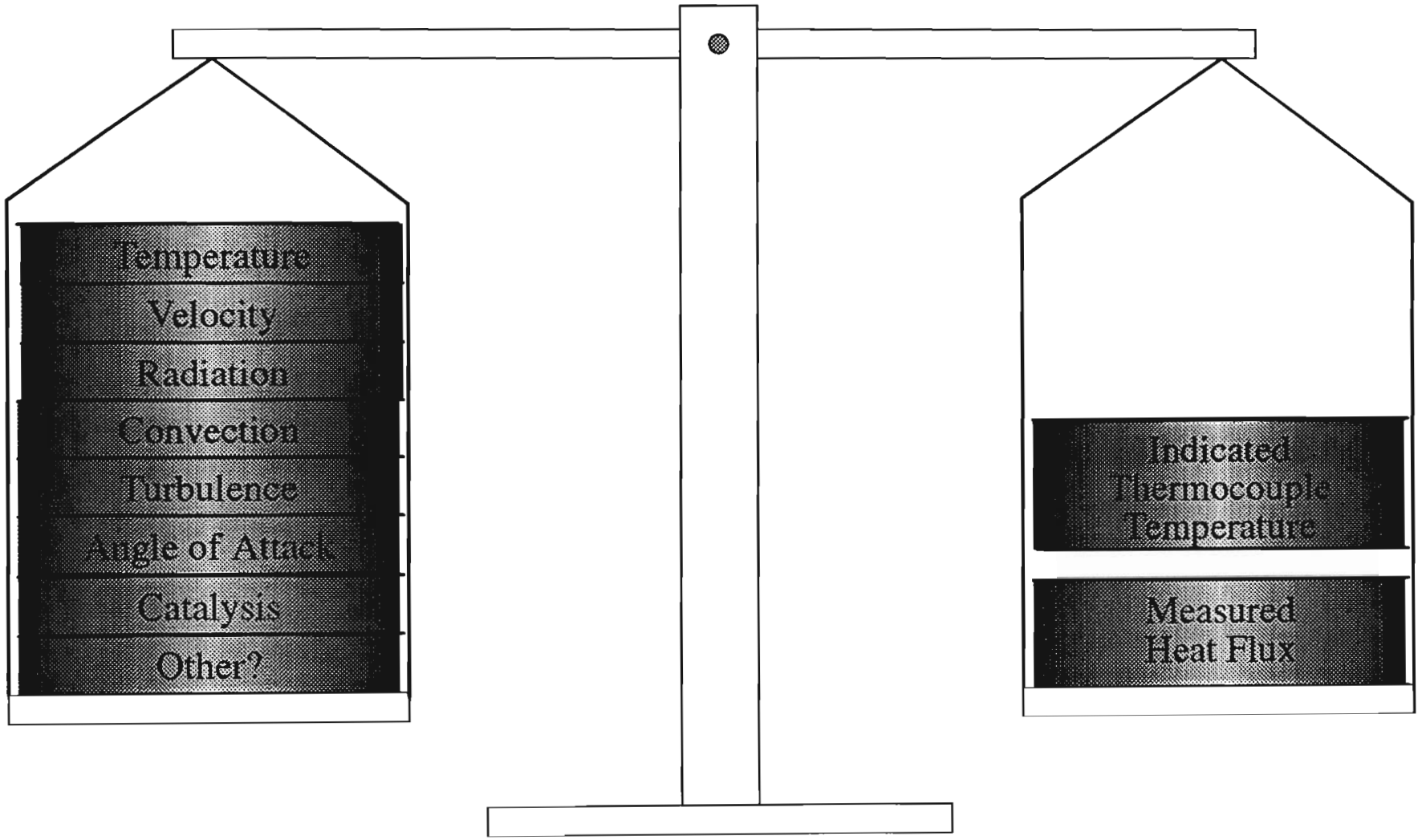
Ktech CORP.

Gardon Gauges

- Different radiative/convective sensitivities proper range selection can minimize effect
- Use in Stagnation Flow - OK w/calibration
- Use in Shear Flow - Difficult to Impossible
- Coatings - Diffuse and Flat and Durable?
- User Concerns - condensation and deposition
- Sensor versus Surface Temperature effects

Ktech CORP.

Simplified Models for Thermal Transducers



Ktech CORP.

Measurement Magic vs Lying with Statistics

- MM can be more effective
- MM is more difficult to find
- Many researchers do not know or will not admit that MM is present in their experiments

LIST OF ATTENDEES
INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST
WORKING GROUP MEETING
Hosted by Douglas Aircraft Company, Long Beach, California
February 7-8, 1995

NAME	ORGANIZATION/ AFFILIATION	ADDRESS	PHONE/FAX
LAYTON WALKER	LA ACO	3960 PARAMOUNT BLVD LAKEWOOD CA	PHONE: 310 627 5339 FAX: 310 627 5210
JOHN BUCKLEY	BUCKLEY ENT.	23428 VIA GAYO VALENCIA CA 91355	PHONE: 805-255-9842 FAX: SAME
LARRY KOPP	K & K SERVICES	4702 PIMENTA LAKEWOOD, CA 90712	PHONE: 310-421-7638 FAX: SAME
TIM MARKER	FAA TECH CTR	ATLANTIC CITY INT'L AIRPORT	PHONE: 609 485-6469 FAX: 609 485-5580
Jeff Gardlin	FAA, Transport Stds Staff	1601 Lind Ave S.W. Renton WA 98055	PHONE: 206-227-2136 FAX: -1100/1320
FRANK TIANGSING	"	"	PHONE: 206-227-2121 FAX: -1100/1320
NED KELTNER	KTECH CORP.	901 PENNSYLVANIA ALBQ., NM 87110	PHONE: 505-268-3379 FAX: 505-266-4512
CLAUDE LEWIS	(UNCHANGED)	(UNCHANGED)	PHONE: FAX: (UNCHANGED)
DON CARDIS	SCHNELLER INC	6019 POWDERMILL RD KENT OHIO 44240	PHONE: 216-673-1400 FAX:
DALE ONDERAK	SCHNELLER INC.	6019 POWDERMILL KENT OH 44240	PHONE: 216-675-1400 FAX: 216-673-7327
TIMOTHY SHARK	SCHNELLER INC	ABOVE	PHONE: — FAX:

LIST OF ATTENDEES
INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

Hosted by Douglas Aircraft Company, Long Beach, California

February 7-8, 1995

NAME	ORGANIZATION/ AFFILIATION	ADDRESS	PHONE/FAX
CHUCK STORY	MAGEE PLASTICS COMPANY	303 BRUSH CREEK ROAD WARRENDALE, PA 15086-7595	PHONE: (412) 776-2220 FAX: (412) 776-9696
Scott Campbell	Douglas Aircraft	3855 Lakewood Blvd Long Beach, CA 90846 Dept EDB M/C 802-27	PHONE: (310) 497 6171 FAX: (310) 982 0775
TIM ELLIOTT	SKYLINE PRODUCTS	495, TERRITORIAL Rd HARRISBURG OREGON 97446	PHONE: (503) 995-6395 FAX: (503) 995 8425
INGO WEICHERT	DAIMLER-BENZ AEROSPACE AIRBUS	DEPT. TK 723 21111 HAMBURG GERMANY	PHONE: +49-40-7437-5624 FAX: +49-40-7437-6090
REINHARD FELDER	SCHNELLER	6019 POWDERMILL RD KENT, OH 44240	PHONE: 216 673 1400 FAX: 216 673 7327
HANNS-JÖRG BETZ	LUFTHANSA TECHNIK	AIRPORT AREA WEST DEPT. FRA WF22 60546 FRANKFURT	PHONE: 49-69-696-4612 FAX: 49-69-696-4617
KONSTANTIN KALLERGIS	DLR	LINDER HÖHE D-51147 COLOGNE GERMANY	PHONE: +49-2203-601-2108 FAX: +49-2203-64395
GEORGE HEWITT	INDEPENDENT FAA-DER (FAA DER NM 279)	9433 NE 25TH ST. BELLEVUE, WA. 98004	PHONE: (206) 455-0413 FAX: ———
Krister Naeslund	Transwede Airway eng. dep.	Box 135 19046 Stockholm-Arlanda Sweden	PHONE: 08-59365023 FAX: 08-59362254
Bob BARNETTE	STARR Aircraft INC.	5236 Hwy 1417 SHERMAN TX 75090	PHONE: 903-899-1106 FAX: 903-893-0551
LEE LIPSCOMB	SOUTHERN MILLS, INC.	P.O. BOX 289 6501 MALL BLVD. UNION CITY, GA. 30291	PHONE: 404-969-1000 FAX: 404-969-6846

LIST OF ATTENDEES
INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST
WORKING GROUP MEETING

Hosted by Douglas Aircraft Company, Long Beach, California

February 7-8, 1995

NAME	ORGANIZATION/ AFFILIATION	ADDRESS	PHONE/FAX
W. H. "SKIP" FACE	HSH INTERPLAN USA, INC.	17451-G MT. HERRMANN ST. FOUNTAIN VALLEY, CA 92708	PHONE: 714/444-1549 FAX: 714/444-1649
HANS HELSDINGEN	H.SH AEROSPACE FINISHES	H. DRAPSSTR. 6B STROMBEEK BELGIUM	PHONE: 32 2 267 2670 FAX: 32 2 267 4934
MARC BROEKAERT	HSH AEROSPACE FINISHES	ID.	PHONE: ID. FAX:
C. L. FOUSHEE	Albany Internal Research Co	1814 130th PL S.E., BELLEVUE, WA. 98005	PHONE: 206-746-5111 FAX: 206-641-8844
Michael O'Donnell	Imi Tech Corp	307 South First St Mt. Vernon WA 98273	PHONE: 360-336-5054 FAX: 360-336-5182 Note New Area Code *
DUANE RANDALL	AKZO FIREGUARD	9001 Rosehill ROAD, LENEXA KS. 66215	PHONE: 913-888-7172 FAX: 913-888-7372
GEORGE DANKER	AKZO FIREGUARD PRODUCTS	9001 ROSEHILL RD LENEXA, KS 66215	PHONE: 913,888,7172 FAX: 913,888,7372
WOLFGANG LAMPA	DAIMLER-BENZ AEROSPACE AIRBUS	28199 BREMEN HUENEFELDSTR. 1-5	PHONE: 49.421.538.3484 FAX: 49.421.538.4180
CARRIERE Bruno	AEROSPATIALE	316 Route de Bayonne 31060 Toulouse	PHONE: (33) 61-18.09.06 FAX: (33) 61-18.04-95
SAJJAD AZIZ	ACCUFLEET	16511 HEDGECROFT DRIVE, HOUSTON TX 77060	PHONE: 713 999 0033 FAX: 713 999 0055
IAN ELLIOTT	SKYLINE PROD	495 TERRITORIAL HARRISBURG OR	PHONE: 503 995-6395 FAX: 503 995-8425

LIST OF ATTENDEES
INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST
WORKING GROUP MEETING
Hosted by Douglas Aircraft Company, Long Beach, California
February 7-8, 1995

NAME	ORGANIZATION/ AFFILIATION	ADDRESS	PHONE/FAX
A. Visser	KLM Royal Dutch Airlines	Schiphol Amsterdam	PHONE: SAME FAX: SAME.
Gilberto Imamura	JAMCO America	1018 80th Street S.W. Everett WA 98203	PHONE: (206) 347-4735 FAX: (206) 290-5153
Hiroshi Horigome.	JAMCO AMERICA.	"	PHONE: FAX: "
Jonas Talandis	Atlas Fire Science	4114 N. Ravenswood Chicago IL U.S.A.	PHONE: 312/3274520 FAX: 312/3275787
Wolfgang Hoffenroth	LBA	Postfach 3054 D-38020 Braunschweig	PHONE: 49/5312355258 FAX: 49/5312355254
Tom Leenheer	Fokker Aircraft	P.O box 7600 Schiphol Amsterdam	PHONE: (0)20 6052061 FAX: (0)20-6053300
Beth McGee	DAC	4855 Lakewood Blvd (801-38), Long Beach, CA 90846	PHONE: 310)982-7003 FAX: 310)496-9300
Robert M. Byerly	TA Mfg Co	1370 Commerce Park Dr Lancaster, PA 17601	PHONE: (717) 295-7537 FAX: (717)295-7537
Kevin Lovcall	TA Mfg. Co.	375 West Arden Ave Glendale, CA 91209	PHONE: (818) 240-4600 FAX: (818) 241-3948
AL FREDERICKS	CHESTUT RIDGE FOAM INC	8628 SUGAR PALM CT ORLANDO FL 32835	PHONE: (407) 290-5917 FAX: SAME
HERB CURRY	GE PLASTICS	ONE LEXAN LANE Bldg 30 MT VERNON IN 47620	PHONE: (812) 831 7769 FAX: (812) 831 7252

LIST OF ATTENDEES
INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST
WORKING GROUP MEETING
Hosted by Douglas Aircraft Company, Long Beach, California
February 7-8, 1995

NAME	ORGANIZATION/ AFFILIATION	ADDRESS	PHONE/FAX
JAMES WALNOCK	E.I DuPont de Nemours Company, INC.	CHESTNUT RUN PLAZA BUILDING 712 WILMINGTON, DE 19880-0712	PHONE: 302-999-2088 FAX: 302-999-4750
Richard M. Johnson	FAA	FAATC	PHONE: FAX:
Karen E. Forest	FAA Chicago ACO	2300 E. Devon Ave. Des Plaines, IL 60018	PHONE: 708-294-7697 FAX: 708-294-7834
Robert Stacho	FAA - Los Angeles Aircraft Cert. Office	3960 Paramount Blvd Lakewood, CA	PHONE: 310-627-5334 FAX: 310-627-5210
CAROLE SAGRAVES	LANGENTHAL CORP	1300 LANGENTHAL DR RURAL HALL, NC 27045	PHONE: 910 969 9551 FAX: 910 969 2833
Mike O'Bryant	Boeing Co	PO Box 3707 Seattle WA 98124	PHONE: 206-342-8650 FAX:
GIOVANNI MODUGNO	AVIOINTERIORS	VIA APPIA KM 66,400 LATINA ITALY	PHONE: ++39 7736891 FAX: ++39 7736315[illegible]
Steve Beare	DuPont	Chestnut Run Plaza Bldg 715 Wilmington, DE 19880	PHONE: 302-999-2240 FAX: 302-999-2718
CHRIS WEBB	HUNTING AVIATION	BICKEN HILL AIRPORT WESTERHAM KENT ENGLAND TN16 3BN	PHONE: 01959 540505 FAX: 01959 570253
Sally Hallmark	OR-WMC Boeing		PHONE: (206) 342-2947 FAX: (206) 717-0460
VICKI BOUSMAN	HOECHST CELANESE CORP.	64 N. OAK AVE #5 PASADENA CA 91107	PHONE: (818) 796-0626 FAX: (818) 796-4942

LIST OF ATTENDEES
INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

Hosted by Douglas Aircraft Company, Long Beach, California

February 7-8, 1995

NAME	ORGANIZATION/ AFFILIATION	ADDRESS	PHONE/FAX
Jim Davis	AccuFleet	363 N. Sam Houston Pkwy #1460 Houston TX 77060	PHONE: 713 999 8800 FAX: 713 999 9066
Laurence DROUET-FLEURIZELLE	AEROSPATIALE Quality Department	316, route de Bayonne 31060 Toulouse Cedex FRANCE	PHONE: 33.61.18.18.70 FAX: 33.61.18.29.34
Bruno CARRIERE	AEROSPATIALE	316 Route de Bayonne 31060 Toulouse Cedex FRANCE	PHONE: 33.61.18.09.06 FAX: 33.61.18.04.95
Shingo Hagihara	SHOWA AIRCRAFT INDUSTRY	8227 44th Ave. W. Suite F Mukilteo. WA 98275	PHONE: 206-290-939 FAX: 206-355-4075
PEGGY QUINN	DER CONSULTANT	14808 W HERITAGE DR SONCITY) WEST AZ 85375-5974	PHONE: 602 546-4737 FAX:
STEVE SHARPE	MT. JEFFERSON WOOLENS	1827 TALBOT RD. SE JEFFERSON, OR 97352	PHONE: (503) 327-2203 FAX: (503) 327-2206
			PHONE: FAX:
			PHONE: FAX:
			PHONE: FAX:
			PHONE: FAX:
			PHONE: FAX:

PRELIMINARY AGENDA

INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

To Be Held At

Douglas Aircraft Company, Long Beach, California

February 7-8, 1995

TUESDAY, FEBRUARY 7, 1995

8:30-9:00 Opening and Introductions - R. Hill (FAA Technical Center)
9:00-10:30 Presentations and Updates by Task Group Leaders:
- #1 Continued Airworthiness - R. Hill (FAA Technical Center)
  - Final Report & Recommendations on Continued Compliance Seat Fire Blocking Layers - R. Hill (FAA Technical Center)
- #2 Production Quality Assurance - P. Cahill (FAA Technical Center)
- #3 Minor Changes to Qualified Materials - R. Johnson (FAA Technical Center)
- #4 Material Systems Renovation & Repair Procedures - T. Marker (FAA Technical Center)

10:30-10:45 Break
10:45-12:30 Separate Task Group Meetings
- #1 Continued Airworthiness - R. Hill
- #2 Production Quality Assurance - P. Cahill
- #3 Minor Changes to Qualified Materials - R. Johnson
- #4 Material Systems Renovation & Repair Procedures - T. Marker

12:30-1:30 Lunch
1:30-2:30 Task Group Discussion/Task Group Leader Reports/Assignments
2:30-3:30 Blanket and Pillow Discussion
3:30-3:45 Break
3:45-5:00 New Topics

WEDNESDAY, FEBRUARY 8, 1995

9:00-10:30 Ongoing Round Robin Testing Updates - R. Johnson (FAA Technical Center)
- 9:00-10:00 Heat Flux Transducer Update & Discussion R. Johnson (FAA Technical Center)
- 10:00-10:15 OSU Standard Material R. Felder (Schneller, Inc.)
- 10:15-10:30 Standard Panel Task Group R. Felder (Schneller, Inc.)

10:30-10:45 Break
11:00-12:00 Discussion on Aircraft Materials Fire Test Handbook Test Methods
12:00-1:00 Lunch
1:00-3:00 Test Method Videos (OSU/Oil Burner-Seats/Oil Burner-Cargo Liners)
3:00-3:30 Pat Cahill's Test Videos
3:30-4:00 General Discussion/Closing

P. Cahill
2/7-8/95

FEBRUARY 7-8, 1995

TASK GROUP LEADER MINUTES

TASK GROUP #2- PRODUCTION QUALITY ASSURANCE (Pat Cahill)

The Quality Assurance Task Group was joined by Mr. Layton Walker of the Los Angeles Aircraft Certification Office. The group felt that AC 21-31 and ISO 9000 would be worthwhile quality control references for inclusion in the Handbook. Both documents provide information and guidance concerning compliance with certification procedures for products and parts.

TASK GROUP #3 - MINOR CHANGES TO QUALIFIED MATERIALS (Richard Johnson)

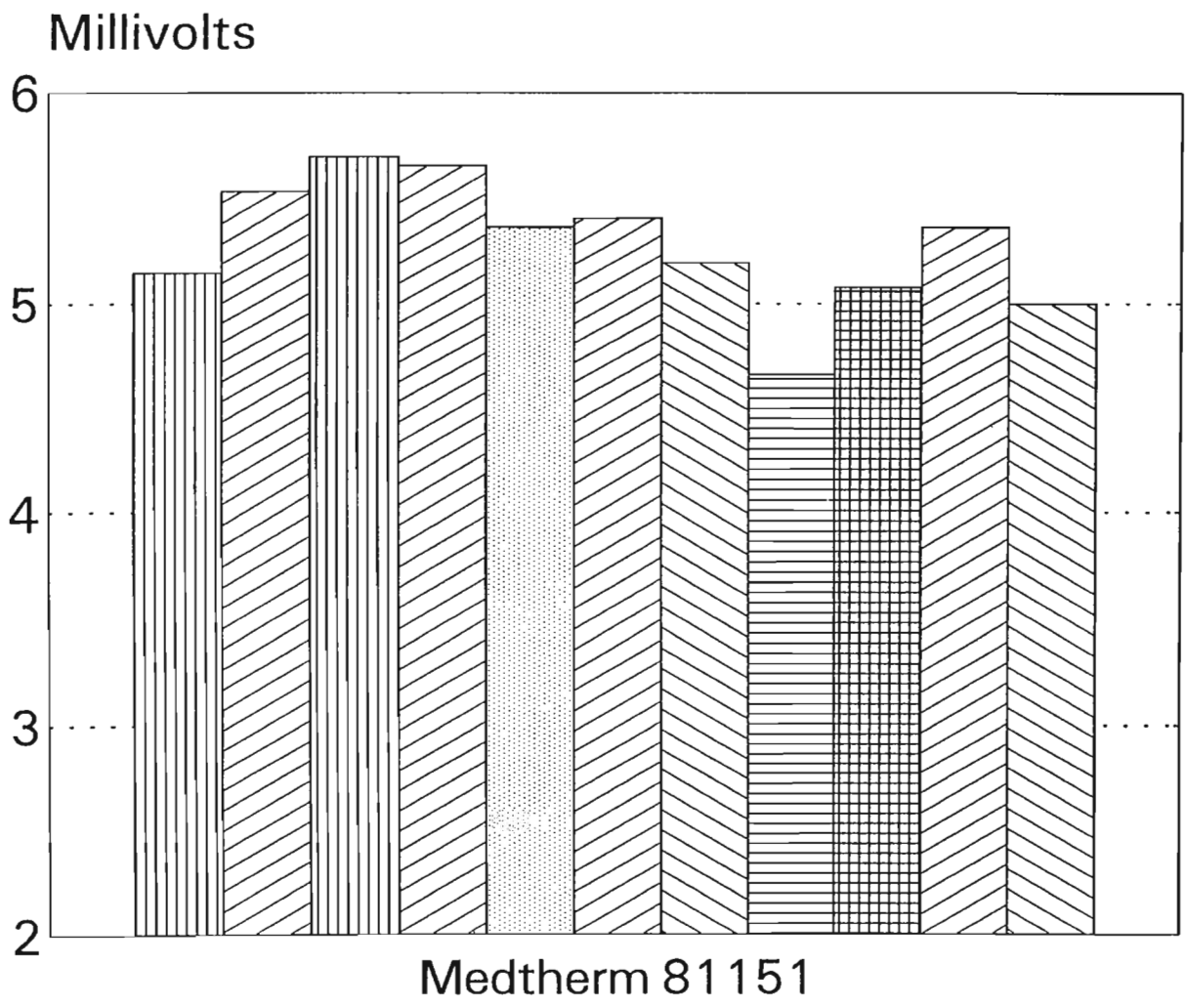
Those in attendance were:

Robert Stacho
Karen Forest
Don Cardis
Reinhard Felder
Beth McGee
Chuck Story
Ingo Weichert
Richard M. Johnson

There was a discussion on present procedures at various ACO regions. Present desired procedures would be more compatible in all regions. A letter of intent was finally drafted with input from all those present and an outline accepted. The letter describes practices used by ACO's regarding retesting materials that were previously qualified and have been changed by color or texture only. An analysis and statistical report was given by Ingo Weichert (Daimler-Benz Aerospace Airbus), and this format was accepted to be expanded for support of reduced testing of qualified materials with color/texture change only. This will be presented to the proper Directorate with the supporting documentation available. The expanded date is being assembled by Reinhard Felder (Schneller).

GARDON GAGE, R/R

Millivolts @ 3.5 Watts

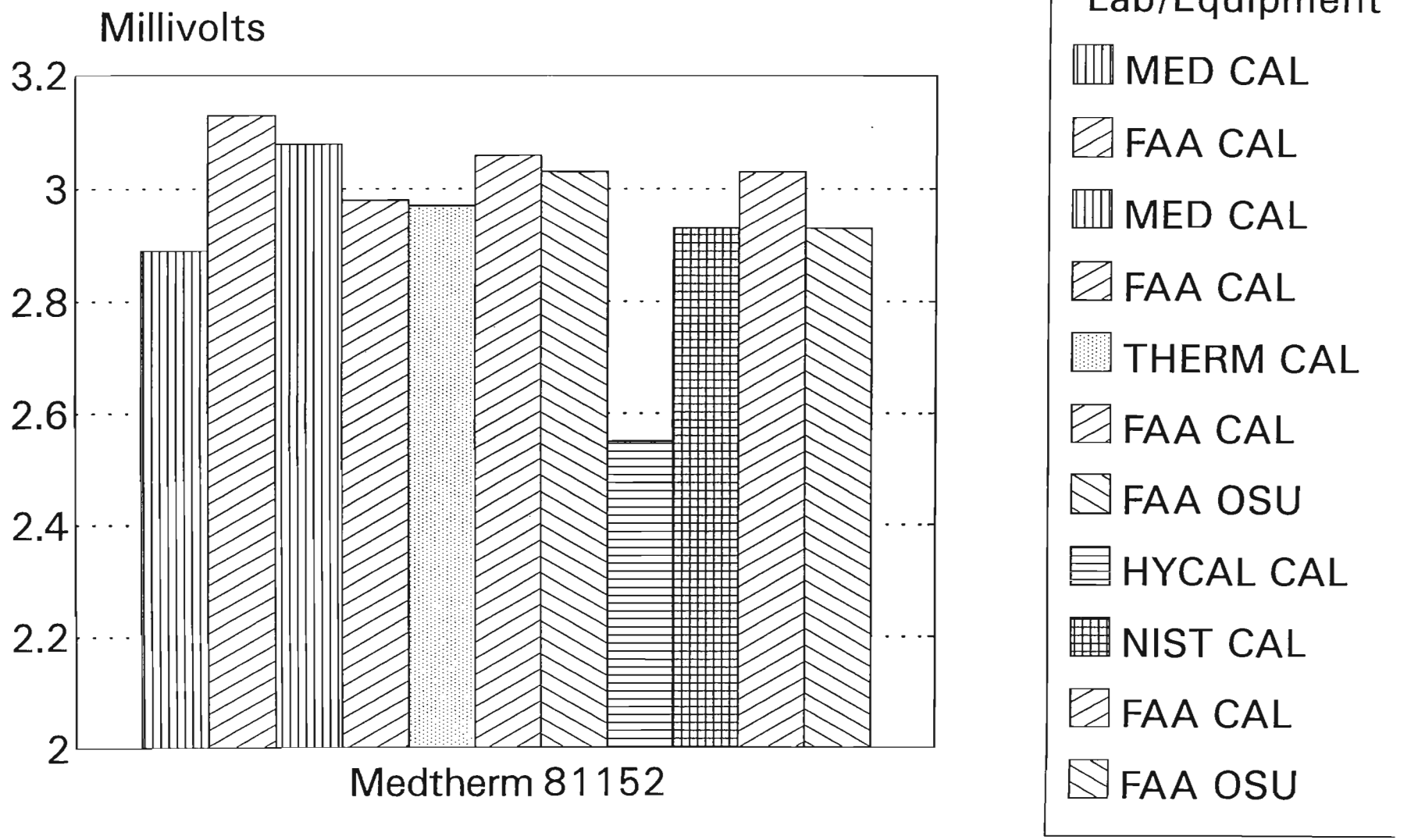


Lab/Equipment

- MED CAL
- FAA CAL
- MED CAL
- FAA CAL
- THERM CAL
- FAA CAL
- FAA OSU
- HYCAL CAL
- NIST CAL
- FAA CAL
- FAA OSU

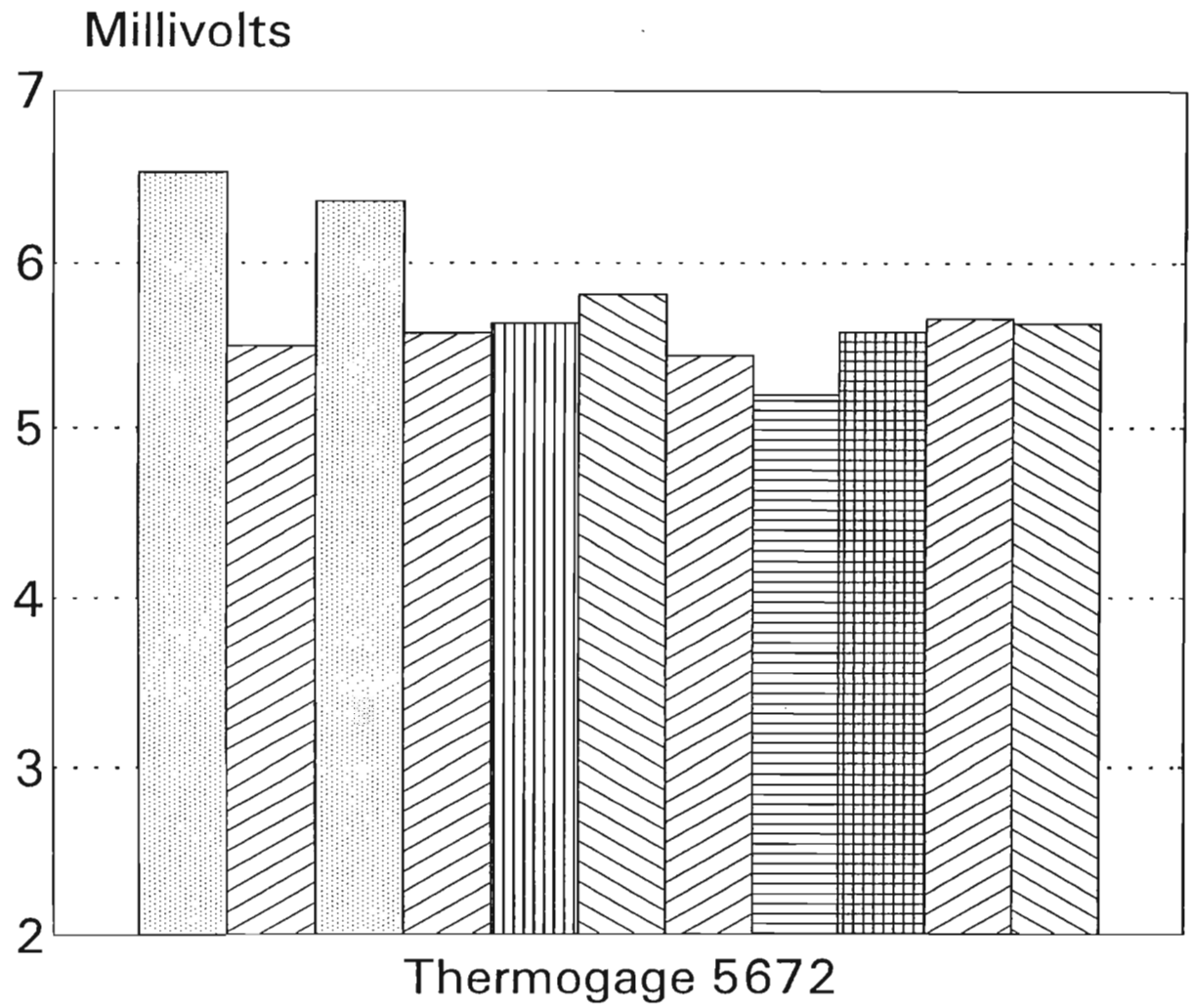
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



GARDON GAGE, R/R

Millivolts @ 3.5 Watts

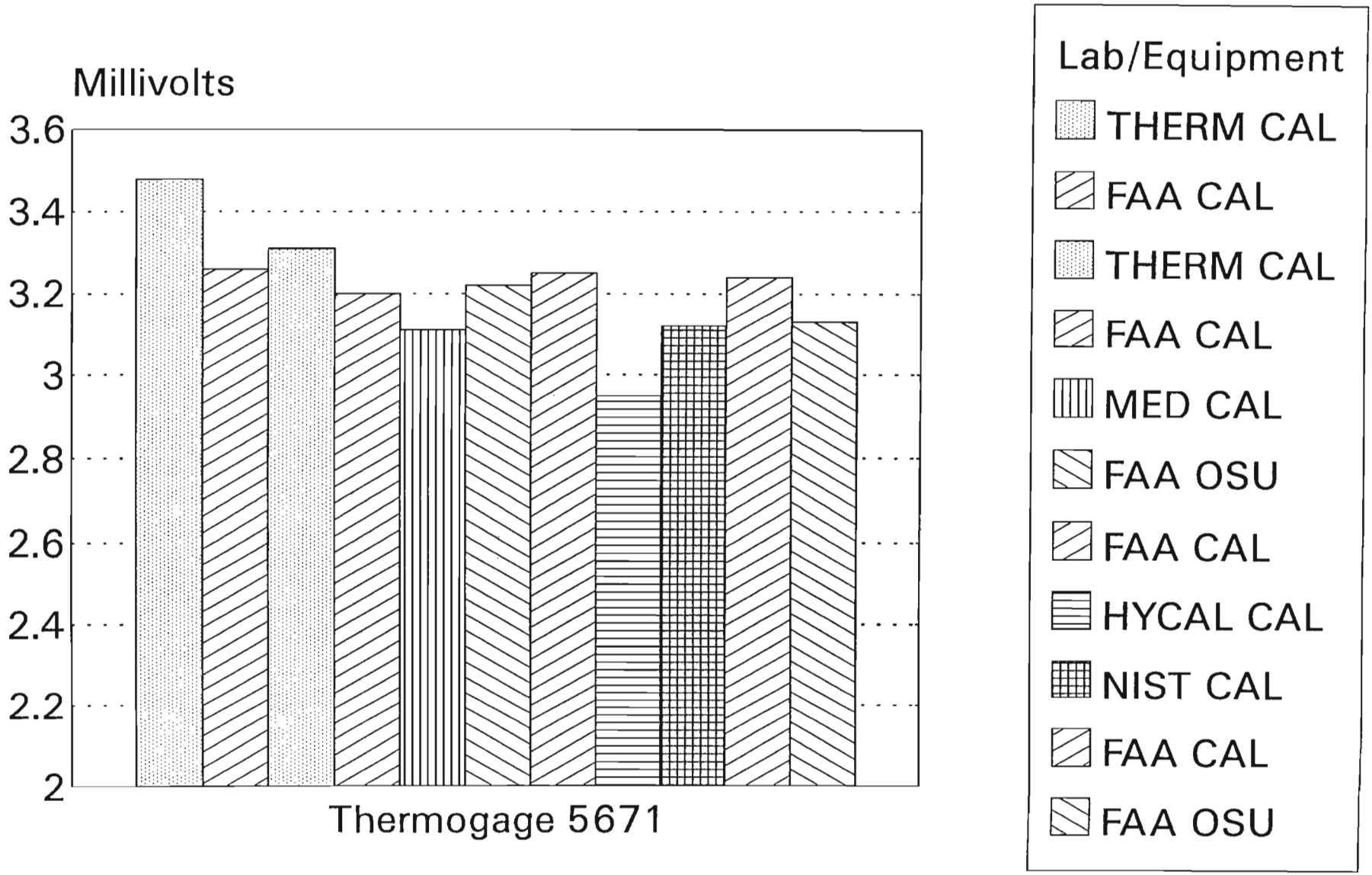


Lab/Equipment

- THERM CAL
- FAA CAL
- THERM CAL
- FAA CAL
- MED CAL
- FAA OSU
- FAA CAL
- HYCAL CAL
- NIST CAL
- FAA CAL
- FAA OSU

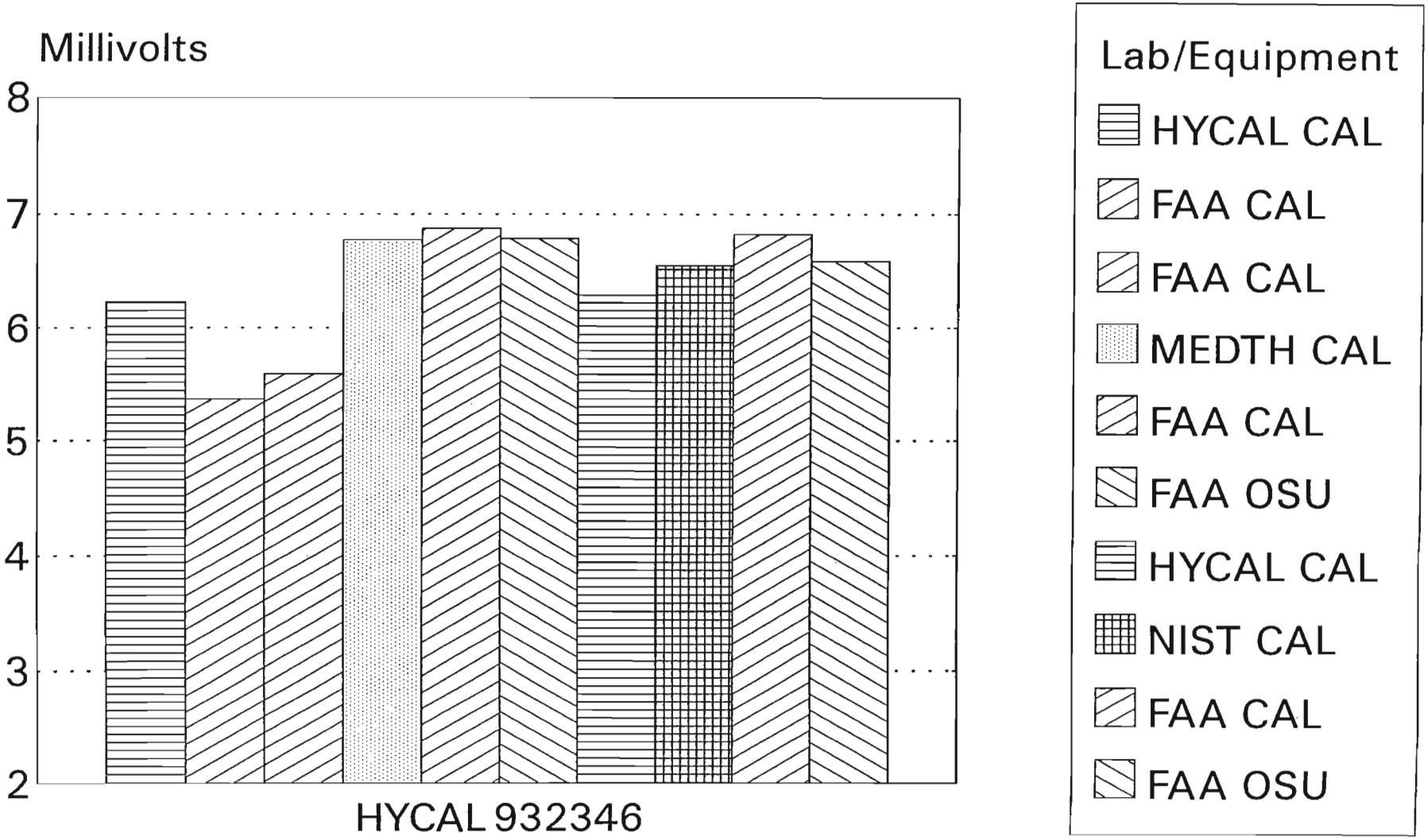
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



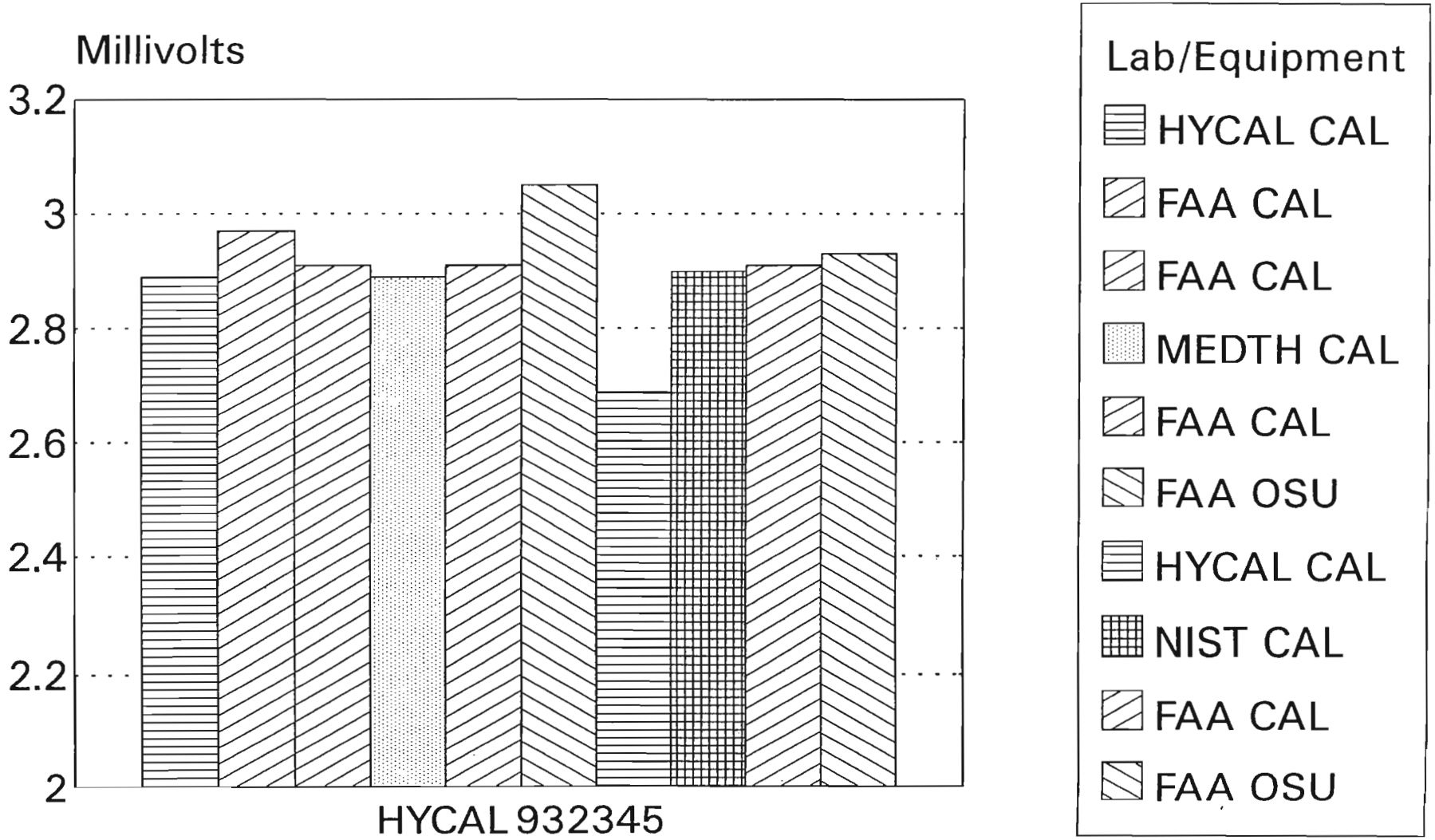
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



GARDON GAGE, R/R

Millivolts @ 3.5 Watts



Subgroup 4, Material Systems Renovation and Repair
Meeting Minutes, Summary

Renovation/Refurbishment

In terms of renovation/refurbishment, I proposed a new method by which qualification tests could be run on an interior panel that has been painted or decorative laminated (fig 1). Most participants seemed receptive to this format, provided some adjustments could be made. To clarify this proposal: if an aircraft interior is type certified to meet 100/100, then it must continue to do so after the refurbishment procedure; if the aircraft interior is type certified to meet 65/65/200, then it must also continue to do so after the refurbishment, no exceptions.

The qualification test would involve the build-up of the actual material "system" using the substrate followed by the dec laminate or paint, whichever the case. This material system would then be required to pass either the 100/100 test or the 65/65/200 tests, depending on the type certification.

If, for any reason, the actual base panel cannot be obtained for these qualification tests, then the proposed qualification procedure would allow for the tests to be run on three different "surrogate" substrates of the same construction as the original (i.e. honeycomb, crush core, thermoplastic etc). The actual numbers would be determined by a simple calculation method. For example, let's take the case of an airline who wishes to install a decorative laminate over their honeycomb sidewall panels in a 100/100 type certified aircraft. The original sidewall panels produced a HR Total of 70, and a HR peak of 75, but are no longer being produced, and the airline has no spare panels. The decorative laminate would then have to be tested over three surrogate honeycomb type panels for qualification. The surrogates used in these tests must be within plus or minus 10 units of the 70/75. The qualification tests might procede as follows:

surrogate panel 1: 65/65, surrogate panel 1 with dec lam: 70/70
surrogate panel 2: 70/70, surrogate panel 2 with dec lam: 80/80
surrogate panel 3: 75/75, surrogate panel 3 with dec lam: 90/90

In this particular example, the worst increase due to the installation of this decorative laminate was on surrogate number 3, which resulted in an increase of 15/15. In order to obtain a final number that takes into account for the synergistic effects of the materials, a safety factor of 5/5 is added, for a grand total of 20/20. This 20/20 would be added to the original 70/75 to produce a final number of 90/95, which is less than 100/100, so it is an acceptable refurbishment prcedure. The qualification procedure would have to be repeated if the decorative is to be used on any other types of interior panels, for example crush cores or thermoplastics.

This refurbishment procedure would be applicable only when the original substrates cannot be obtained, but the original O.S.U. data is available. *This procedure would not be applicable if the original panels are so old that they lack any O.S.U. test data, since there is no possibility of these panels passing the 100/100 test anyway.* In terms of smoke testing, the finished material system would have to pass the 200 D_s over all of the surrogates (if the type certificate is 65/65/200).

Comments/Discussion

The first item discussed surrounded the proposed use of *three* surrogate panels for qualification testing. According to one group member, there are currently only *two* types of crush core panels available: one using glass construction, the other using graphite construction. It will be recommended that any surrogate testing using crush core panels will involve the use of both the glass and graphite panels, and probably an additional glass and graphite panel which uses a different curing process, for example.

The next item that was discussed involved the difficulty in obtaining the original base panel O.S.U. numbers required to proceed with the above mentioned qualification procedure. It seems logical that if

an operator wishes to refurbish his interior and is having difficulty obtaining this data, that he would be able to apply enough pressure on the manufacturer to produce it. To help out, a group member has proposed to develop a data base which would be usable and obtainable by the airlines who are in this predicament. The data base would provide the base panel O.S.U. rate of heat release numbers for a variety of aircraft type (it might be useful to have the data tabulated according to aircraft serial number).

Another item that was discussed with the proposed qualification method was the safety factor. I will be contacting various working group participants to try to obtain some data which reflects how much scatter is typical when decoratives or paints are used. From this, the proposed safety factor (5/5) could be adjusted accordingly. In any event, an operator who backs up his claim with data is in a better position than the operator who is giving his best guess when it comes to certifying a particular refurbishment. For example, some operators active in the working group have displayed data on numerous tests performed on the various interior systems. If these operators feel that the safety factor can be reduced to 3/3 or less during this type of qualification procedure, and have sufficient data to suport this trend, then they will most likely be permitted to do so.

Some operators who participated in the sub-group meetings discussed other problems with the above proposed qualification method. In particular, these operators discussed how their 65/65/200 type certified interiors are already very close to the 65/65 limit. They expressed their concern over not being able to meet the proposed criteria in the event that they wish to refurbish their interior, since some of their aircraft's interior sidewall panels cannot be "stripped" of the original decorative laminate (Boeing manufactured panels cannot be stripped of their decoratives, since they are bonded using a two-part thermoset adhesive; Airbus manufactured panels are strippable from the PSU down, and Douglas panels are completely strippable). In many cases, the operators claim that an additional decorative, piggybacked over the existing one, or painting of these panels is their only option for refurbishing. Either of these two options is likely to raise the numbers above the 65/65 limit, with the operators already hesitant at piggybacking since it adds weight. The only other option the operator has if his interior is showing signs of wear is to replace the panels with new ones, supplied by the airframe manufacturer, which could prove to be a rather costly approach, claim the operators. Additionally, the operators expressed their displeasure that by replacing the worn panels with new ones, the colors don't match up exactly due to the ultra-violet degrading of the surface of the original panels.

One operator proposed that the refurbished interiors could be qualified on a percentage basis (i.e. if the average surface area of all the panels does not exceed 65/65, then some areas could be allowed to be over 65/65, provided they don't exceed 70/70 or 75/75, for example). This would make for a very complicated qualification procedure, however, since the actual surface area of the panels which exceed 65/65 would have to be calculated, etc.

Repair

The discussion and recommendations pertaining to the repair and patching of cargo compartment liners is complete. The subgroup recommended several test criteria for qualifying a cargo liner patch, in addition to the current criteria of burnthrough resistance and patch adhesion. These additional criteria were based on technical information obtained during previous group sessions.

The issues surrounding repair have focused primarily on the use of fillers for making repairs to interior sidewall and ceiling panels, as well as stowage bin doors. Fillers are available in a variety of consistensies, each aimed at performing a specific function. Spray fillers may be used for minor surface imperfections such as scratches, whereas a brush filler may be used for deeper gouges or chips. Extensive damage would be repaired using a spatula or putty type filler. There are currently no regulations governing the use of fillers, and it has become evident that quick action is necessary since many of the fillers that are currently in use are somewhat flammable. Presently, fillers are permitted for use on any non-O.S.U. aircraft interior, to any extent. The fillers are, in actuality, being used in both 100/100 and 65/65/200 type certified interiors because there are no regulations governing them. *It is contradictory to implement numerous cabin flammability standards which govern interior material use, and at the same time permit the widespread use of these more flammable filling materials.*

In order to qualify a filler for use in an aircraft cabin, there are currently two possible solutions. The first solution is actually a two-part test involving a spray and brush filler test and then a separate spatula filler test. In the spray/brush filler test, a 6" by 6" substrate (identical to the type it is to be used on in service) would be coated with a representative thickness of each, and tested in the O.S.U. chamber where it would have to pass either 100/100 or 65/65/200, depending on the type certification of the aircraft. During the spatula filler test, a 6" by 6" layer of the material would be tested in the O.S.U. in a special sample holder. The thickness of the filler would have to reflect what would likely be used in service. This is critical, since testing has shown that the thickness of the filler will dictate the heat release rate produced. The pass/fail criteria would be based on the best available materials, thereby eliminating the less than desirable materials.

The other solution would be to test the fillers as they would actually be in service, or as part of a material *system.* A typical test specimen would likely involve the base substrate, a representative thickness of spatula filler, brush filler, and spray filler, followed by the decorative laminate or paint. The entire system would have to pass either the 100/100 or 65/65/200, depending on the type certification. The only problem with this type of test is that a fairly flammable filler could probably pass the 100/100 test, and maybe even the 65/65/200 if the spray filler or topcoat of paint used over the spatula filler is very flame retardent. The test could be a vehicle to get less than desirable materials into the cabin that may not be used in the same manner that they are tested (e.g. large quantities/surface areas of spatula filler covered by a decorative only).

The results of the filler only tests conducted at the Tech Center in January were discussed. The test methods which utilized various diameter holes did not produce results that would appropriately rank the materials, for various reasons. To begin with, the heat sink effect was too dominant when using a small, centralized hole in a stainless steel plate because the surrounding surface area of steel was too great. This caused a dramatic and steady decrease in the total heat release rate, overriding any contribution made by the burning of the filler. The total (net) heat release rate was actually less than zero during many of the tests. The other problem with a small, centralized hole in a steel plate is that the pilot flame does not impinge on the filler; the filler is thereby exposed to the radiant heat source only. It was evident that the only method of filler testing that would produce results differentiating the various materials (ranking) would be some type of 6" by 6" sample holder which could eliminate the heat sink effect and the pilot flame problem.

Comments/Discussion

One group member expressed concern over adopting the filler *system* test method. He felt that by using this method, a greater amount of certification testing would result because a system test would presumably have to be run for each cabin material that the filler would be intended for use on. Coversely, by adopting the filler only test method where spray/brush and spatula fillers are isolated, these materials could be used universally throughout the cabin once they meet the pass/fail criteria (this is only partially true, since the proposed spray/brush filler tests would still have to be tested over the actual substrate, or representative surrogates, which would involve as much testing as would be required in the filler system approach).

I have discussed the filler issues with representatives from the Aircraft Certification Office (Seattle), and they have suggested a two-tiered approach. The **first step** would involve a questionaire distributed to the group participants on the issue of the filler *system* test. The questionaire would likely have two or three possible methods for running the system test (e.g. substrate/.125" spatula filler/brush filler/etc. or substrate/.250" spatula filler/brush filler/etc.) The respondents would be asked for their choice and some reasoning for it. The **second step** would involve the on-going development of a filler only test, as a group task. The issues would involve the thickness of the spatula filler test, the possibility of various thickness spatula filler tests, what type of spray/brush filler test, could the spray/brush fillers be qualified over aluminum substrate, etc. Anyone interested in being included in the filler questionaire (besides the subgroup participants) should contact me by fax at (609) 485-5580 or phone (609) 485-6469.

SUBGROUP 4
MATERIAL SYSTEMS RENOVATION & REPAIR

MATERIAL SYSTEMS RENOVATION

METHOD OF QUALIFICATION TESTING

USE OF SURROGATE MATERIALS FOR QUALIFICATION

SYNERGISTIC PROBLEMS

MATERIAL SYSTEMS REPAIR

FILLER REPAIRS

DEVELOPMENT OF TEST METHOD

CARGO LINER PATCHING/REPAIR ✓

RENOVATION/REFURBISHMENT

QUALIFICATION PROCESS REPEATED FOR OTHER INTERIOR PANELS

HONEYCOMB
CRUSH CORE
THERMOPLASTIC
ALUMINUM
} SIDEWALL, STOWAGE BIN GALLEY PANEL, ETC.

QUALIFICATION PROCESS APPLICABLE ONLY WHEN:

ORIGINAL SUBSTRATE UNAVAILABLE

ORIGINAL O.S.U. TEST DATA IS AVAILABLE

QUALIFICATION PROCESS NOT *ALLOWED IF:*

ORIGINAL PANELS ARE LACKING O.S.U. TESTING DATA

SMOKE TESTING: D_s< 200 (3 PANELS)

RENOVATION/REFURBISHMENT

{ OR + } = 65/65/200

ANY COMBINATION — ORIGINAL BASE PANEL

IF ORIGINAL BASE PANELS CANNOT BE OBTAINED, THEN:

TRADITIONAL METHOD: TEST OR + 3 SURROGATE PANELS (+/- 10 OF ORIG O.S.U.) NEGOTIABLE

EXAMPLE: ORIGINAL BASE PANEL HRR/HRP = 45/50

TEST PANEL 1 BASELINE = 55/55, TEST PANEL 1 WITH = 60/60
TEST PANEL 2 BASELINE = 50/50, TEST PANEL 2 WITH = 57/57
TEST PANEL 3 BASELINE = 40/40, TEST PANEL 3 WITH = 49/49

WORST CASE (9/9) + FUDGE FACTOR (5/5) = 14/14

ADD 14/14 TO ORIGINAL 45/50 = 59/64 "ACCEPTABLE"

REPAIR

PRIMARY TYPES OF FILLER REPAIRS

MINOR SURFACE IMPERFECTIONS, SCRATCHES

DEEP SCRATCHES, CHIPS

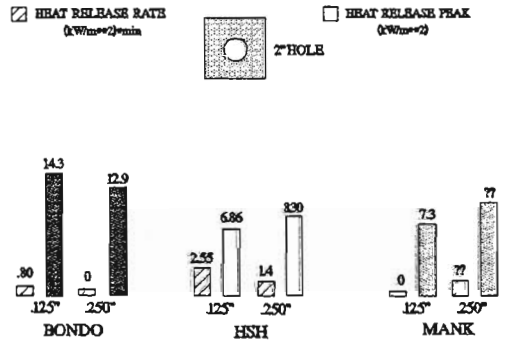
MORE EXTENSIVE DAMAGE, DENTS, CRACKS, HOLES

POSSIBLE TEST METHODS:

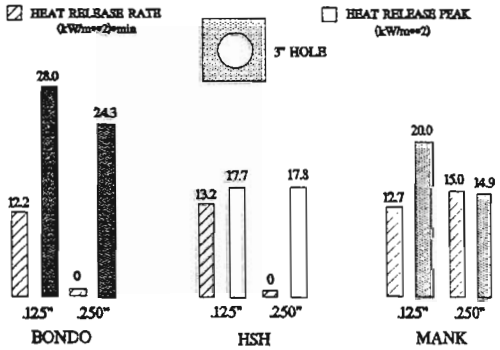
#1 *QUALIFY SPRAY AND BRUSH FILLERS LIKE PAINTS*
+
FILLER ONLY TEST (SPATULA)
SAMPLE HOLDER SIZE? THICKNESS?
OR

#2 *SUBSTRATE/FILLER/LAMINATE/PAINT TEST*
FILLER "HIDDEN" UNDER LAMINATE?

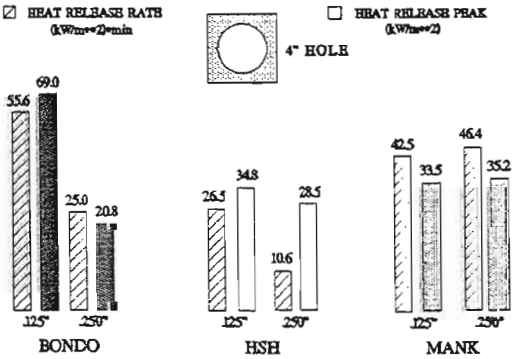
FILLER TESTS IN O.S.U. CHAMBER



FILLER TESTS IN O.S.U. CHAMBER



FILLER TESTS IN O.S.U. CHAMBER



FILLER TESTS IN O.S.U. CHAMBER

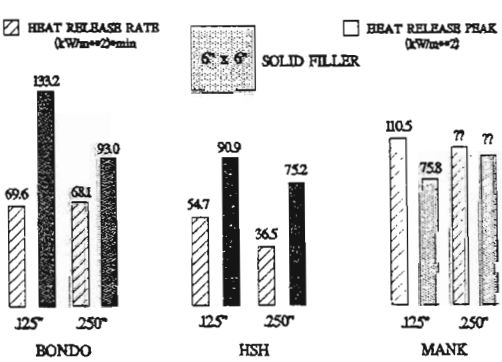


fig. 1

Ktech CORP.

Heat Flux Measurement and Calibration

Ned Keltner
Ktech Corporation

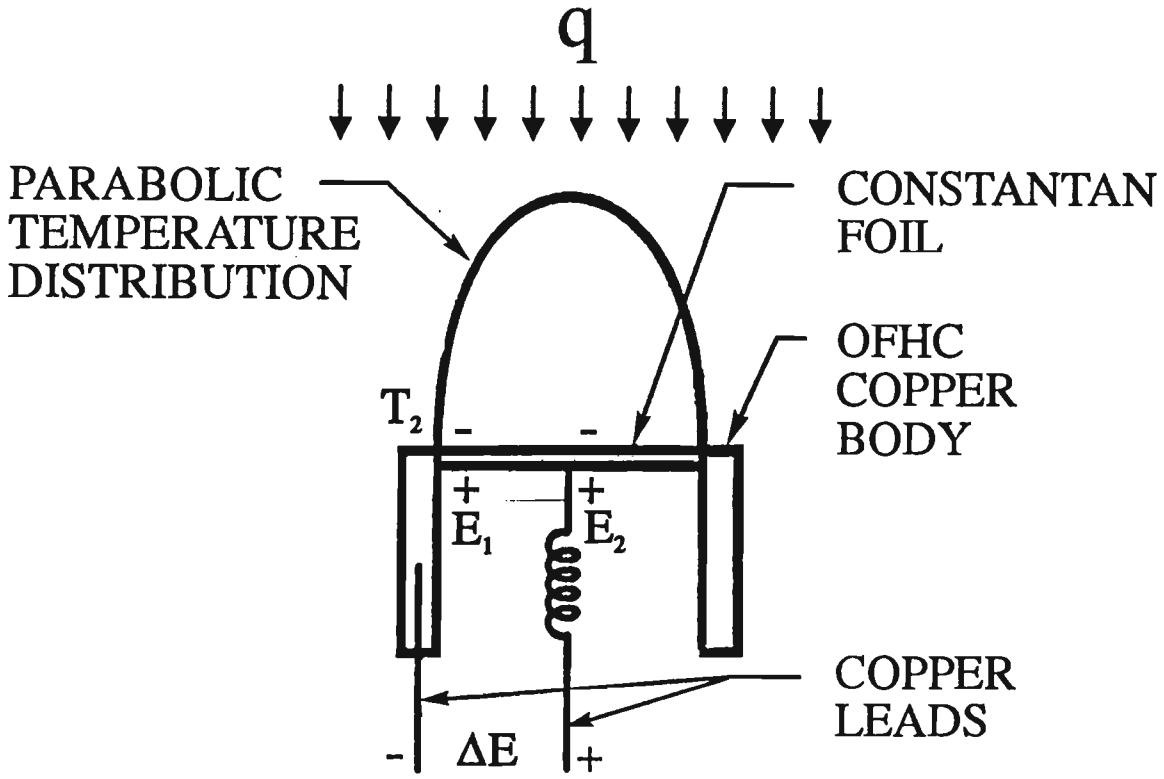
N. Keltner
2/7-8/95

NRK0025.CDR-C

Ktech CORP.

Heat Flux Measurements

Circular Foil Heat Flux Gauge (Gardon Gauge) Designed for Radiant Heat Flux Measurement.



Heat Drain - Either by Water Cooling the Body or with Sufficient Thermal Mass

Problems to Consider:

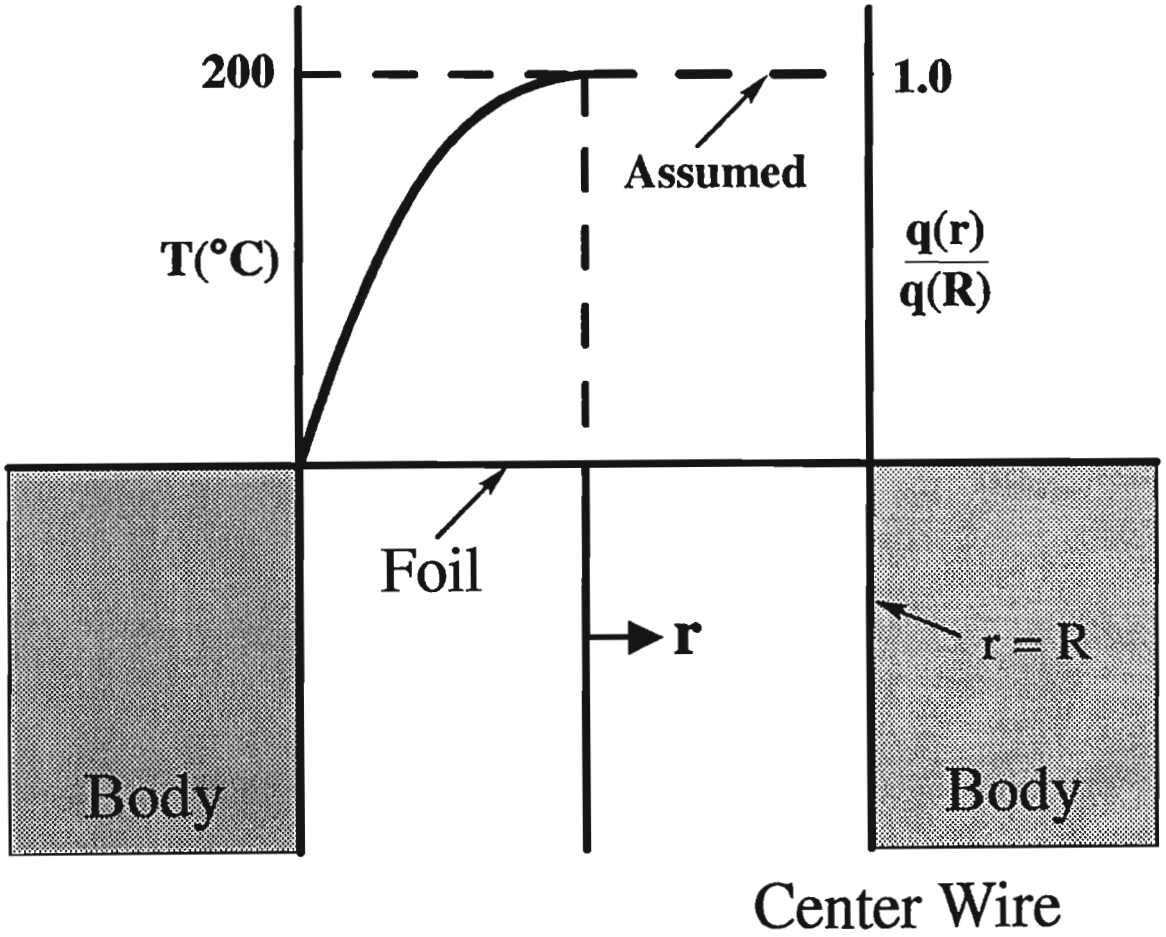
- Absorptivity of the Sensor Coating is not Uniform Over the Radiation Spectrum.
- Condensation and Soot Deposition on these Sensors can Create Additional Problems.
- If the Sensor is Used to Measure Total Heat Flux, a Large Convective Fraction can Result in Changes of the Calibration Constant. (Up to 25%)

Ktech CORP.

Temperature and Heat Flux

Distributions for Gardon Gauges Under Different Heating Conditions

Radiation Only



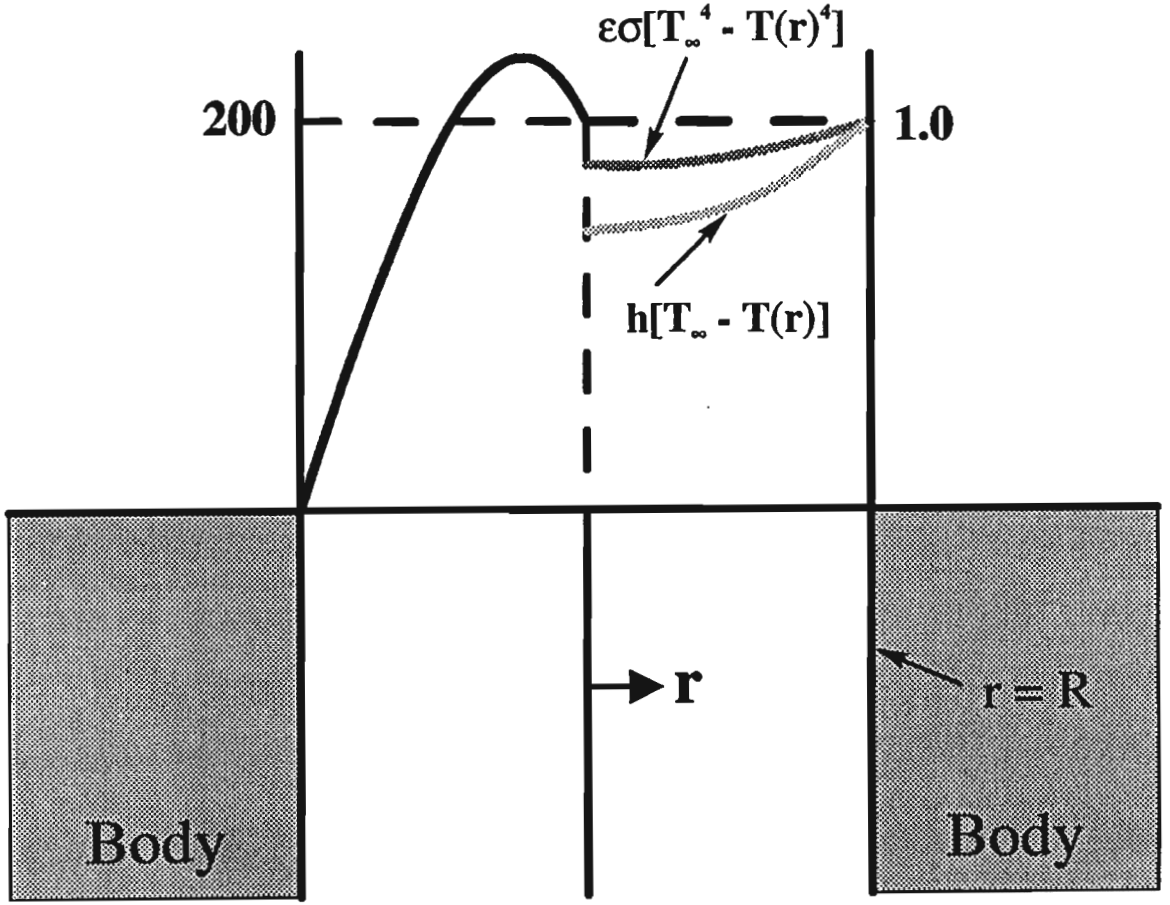
Traditional or ideal gauge analysis ignores center wire, dangerous because it affects both sensitivity and response time.

NRK0020.CDR-C

Temperature and Heat Flux

Distributions for Gardon Gauges Under Different Heating Conditions

Radiation or Stagnation Flow (T_∞ = 1000°)

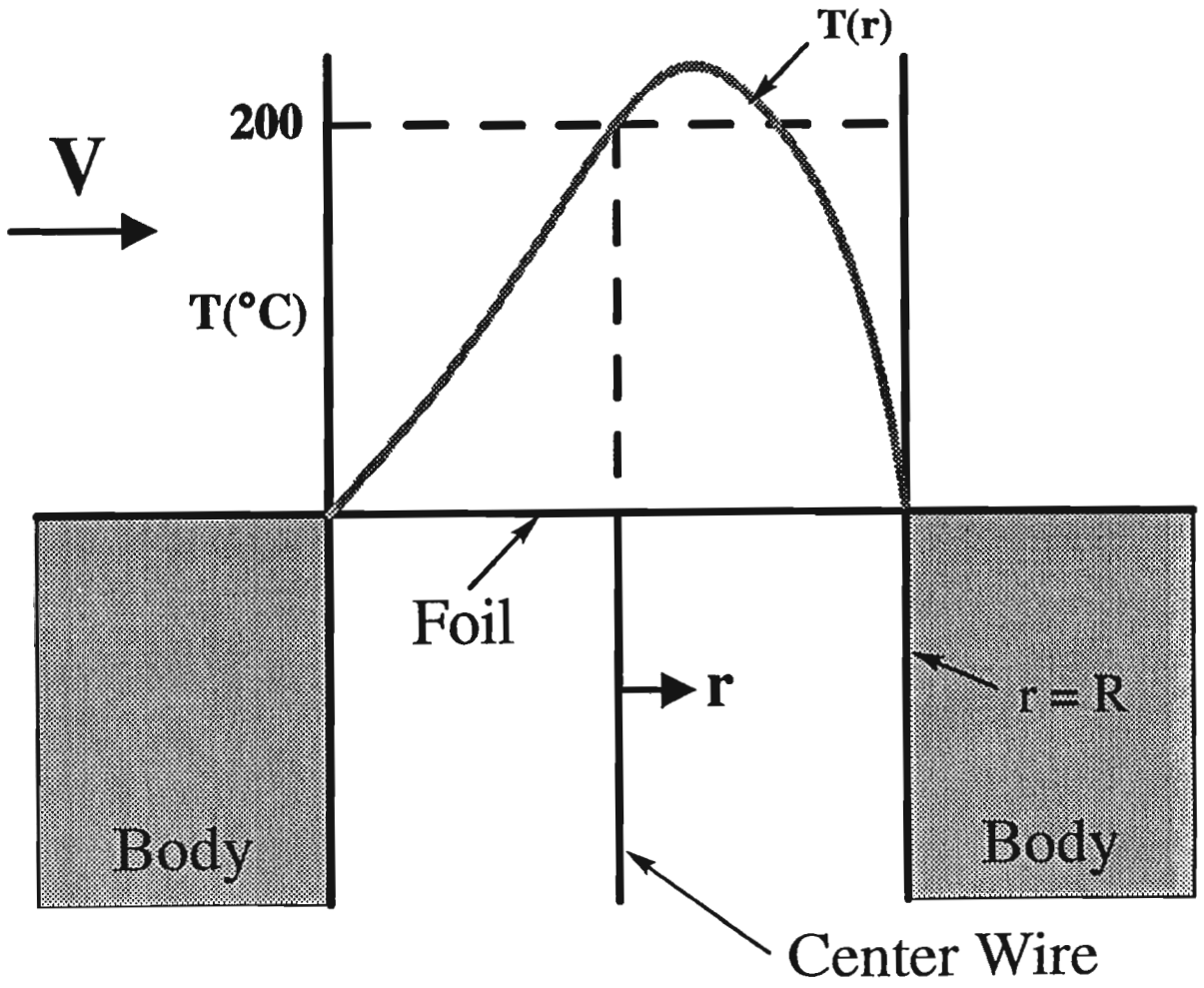


Ktech CORP.

Temperature and Heat Flux

Distributions for Gardon Gauges Under Different Heating Conditions

Shear Flow



Heat flux depends on free stream temperature, velocity, angle of attack, mounting, etc. Because T(r) depends on all of these parameters, it is basically impossible to analyze.

NRK0022.CDR-C

Ktech CORP.

Gardon Gauges

- Accuracy
  - ASTM Standard E511 - ±3%
  - FAA Round Robin - ±15%
- Total Heat Flux Capability
  - Advertised as such
  - Reality - be very careful

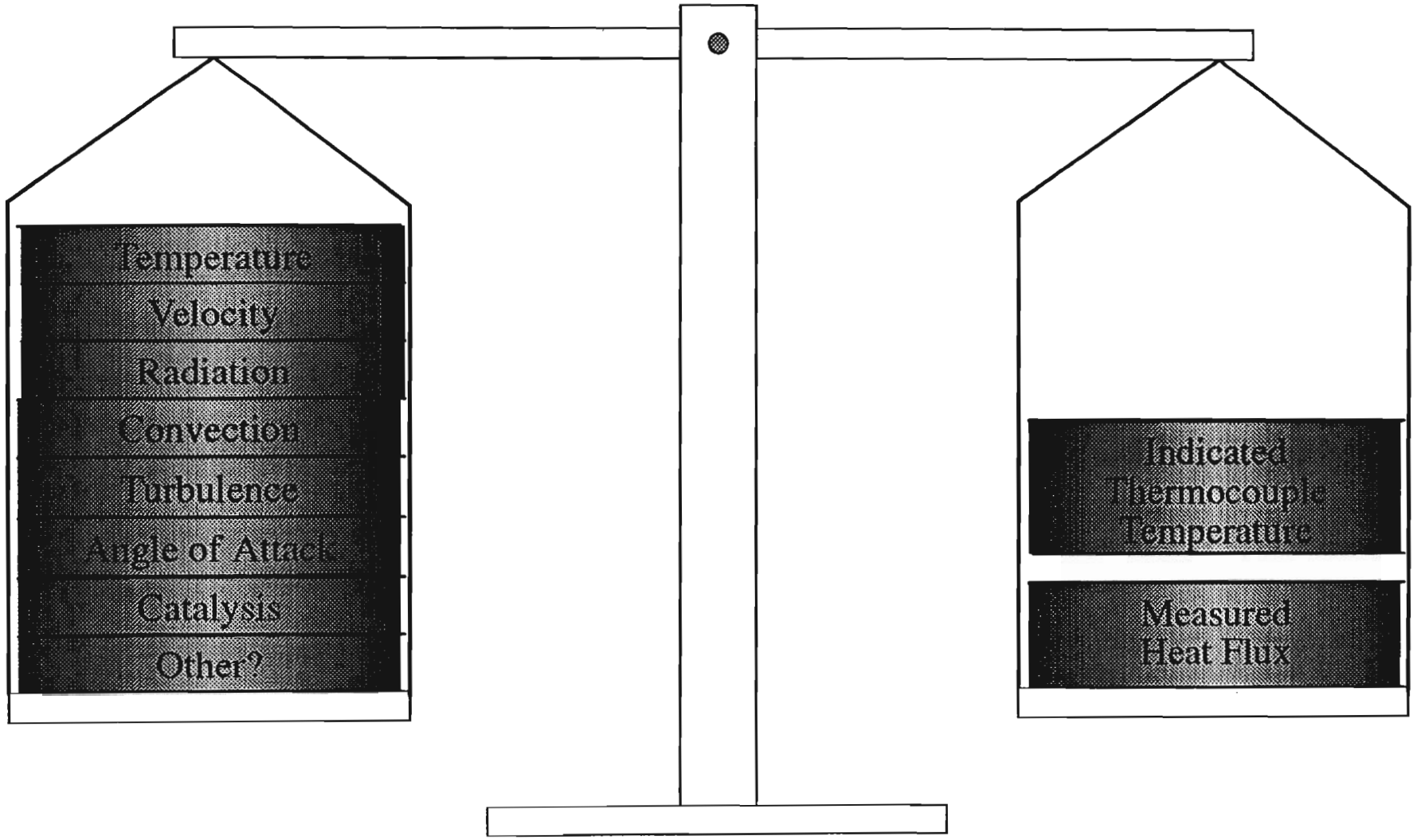
Ktech CORP.

Gardon Gauges

- Different radiative/convective sensitivities proper range selection can minimize effect
- Use in Stagnation Flow - OK w/calibration
- Use in Shear Flow - Difficult to Impossible
- Coatings - Diffuse and Flat and Durable?
- User Concerns - condensation and deposition
- Sensor versus Surface Temperature effects

Ktech CORP.

Simplified Models for Thermal Transducers



NRK0031.CDR-C

Ktech CORP.

Measurement Magic vs Lying with Statistics

- MM can be more effective
- MM is more difficult to find
- Many researchers do not know or will not admit that MM is present in their experiments

R. Felder
2/7-8/95

SCHNELLER, INC.

O.S.U.
ROUND ROBIN
FEBRUARY, 1995

O.S.U. ROUND ROBIN

SCHNELLER, INC.

O.S.U. ROUND ROBIN

STANDARD PANEL

- ALBANY INTERNATIONAL RESEARCH
- BOEING COMMERCIAL AIRPLANE
- DOUGLAS AIRCRACT COMPANY
- F.A.A. TECH CENTER
- G.E. PLASTICS
- SCHNELLER, INC.

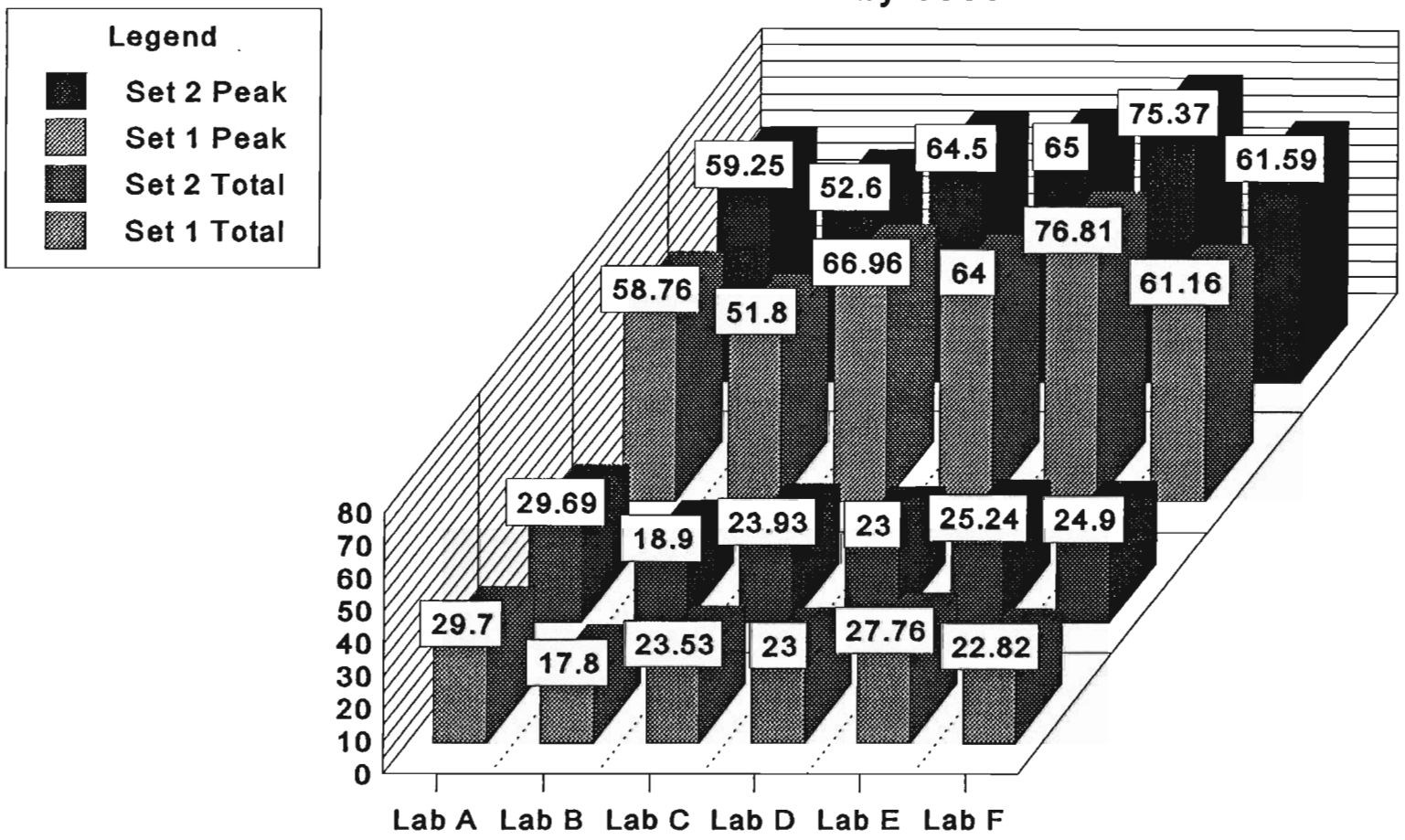
O.S.U. ROUND ROBIN

AIRESCO PANEL
February, 1995

	SET 1		SET 2		COMBINED	
	Ave Total	Ave Peak	Ave Total	Ave Peak	Ave Total	Ave Peak
LAB A:	29.70	58.76	29.69	59.25	29.69	59.00
LAB B:	17.80	51.80	18.90	52.60	18.35	52.20
LAB C:	23.53	66.96	23.93	64.50	23.73	65.73
LAB D:	23.00	64.00	23.00	65.00	23.00	64.50
LAB E:	27.76	76.81	25.24	75.37	26.50	76.09
LAB F:	22.82	61.16	24.90	61.59	23.86	61.38
MEAN:	24.10	63.25	24.28	63.05	24.19	63.15
STD. DEV:	3.82	7.68	3.19	6.87	3.45	7.26

OSU ROUND ROBIN

AIRESCO Panel February 1995

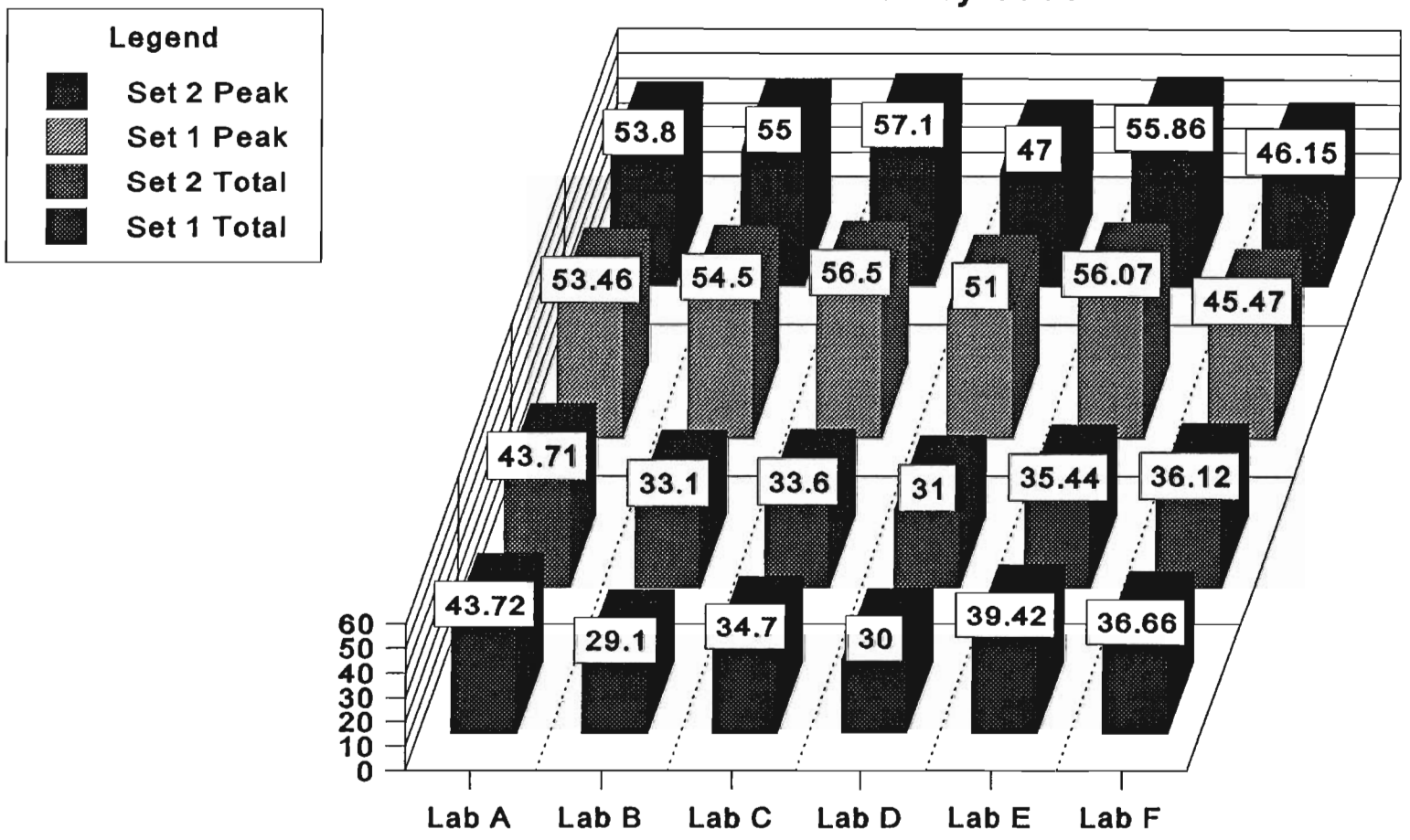


SCHNELLER STANDARD CORE
February, 1995

	SET 1		SET 2		COMBINED	
	Ave Total	Ave Peak	Ave Total	Ave Peak	Ave Total	Ave Peak
LAB A:	43.72	53.46	43.71	53.80	43.71	53.63
LAB B:	29.10	54.50	33.10	55.00	31.10	54.75
LAB C:	34.70	56.50	33.60	57.10	34.15	56.80
LAB D:	30.00	51.00	31.00	47.00	30.50	49.00
LAB E:	39.42	56.07	35.44	55.86	37.43	55.96
LAB F:	36.66	45.47	36.12	46.15	36.39	45.81
MEAN:	35.60	52.83	35.50	52.48	35.55	52.66
STD. DEV:	5.10	3.76	4.03	4.30	4.44	3.95

OSU ROUND ROBIN

Schneller Standard Core February 1995



AIRESCO PANEL
February, 1995

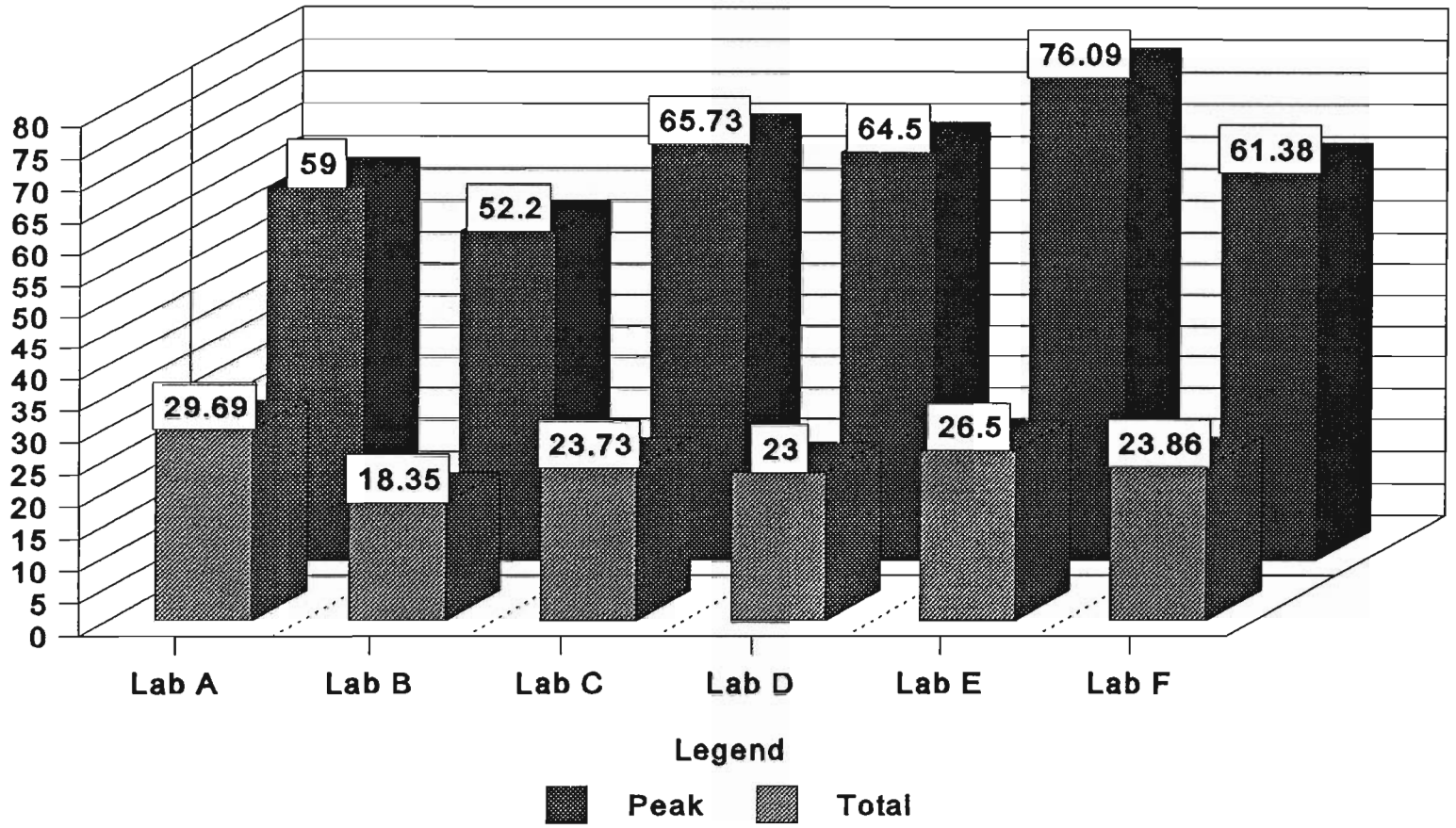
	Set 1 Peak	Set 2 Peak	Set 1 Total	Set 2 Total
LAB A:	58.76	59.25	29.70	29.69
LAB B:	51.80	52.60	17.80	18.90
LAB C:	66.96	64.50	23.53	23.93
LAB D:	64.00	65.00	23.00	23.00
LAB E:	76.81	75.37	27.76	25.24
LAB F:	61.16	61.59	22.82	24.90
MEAN:	63.25	63.05	24.10	24.28
STD. DEV:	7.68	6.87	3.82	3.19

OVERALL

	PEAK	TOTAL
MEAN:	63.15	24.19
STD DEV:	7.00	3.38

OSU ROUND ROBIN

AIRESCO Panel Overall February, 1995



SCHNELLER STANDARD CORE
February, 1995

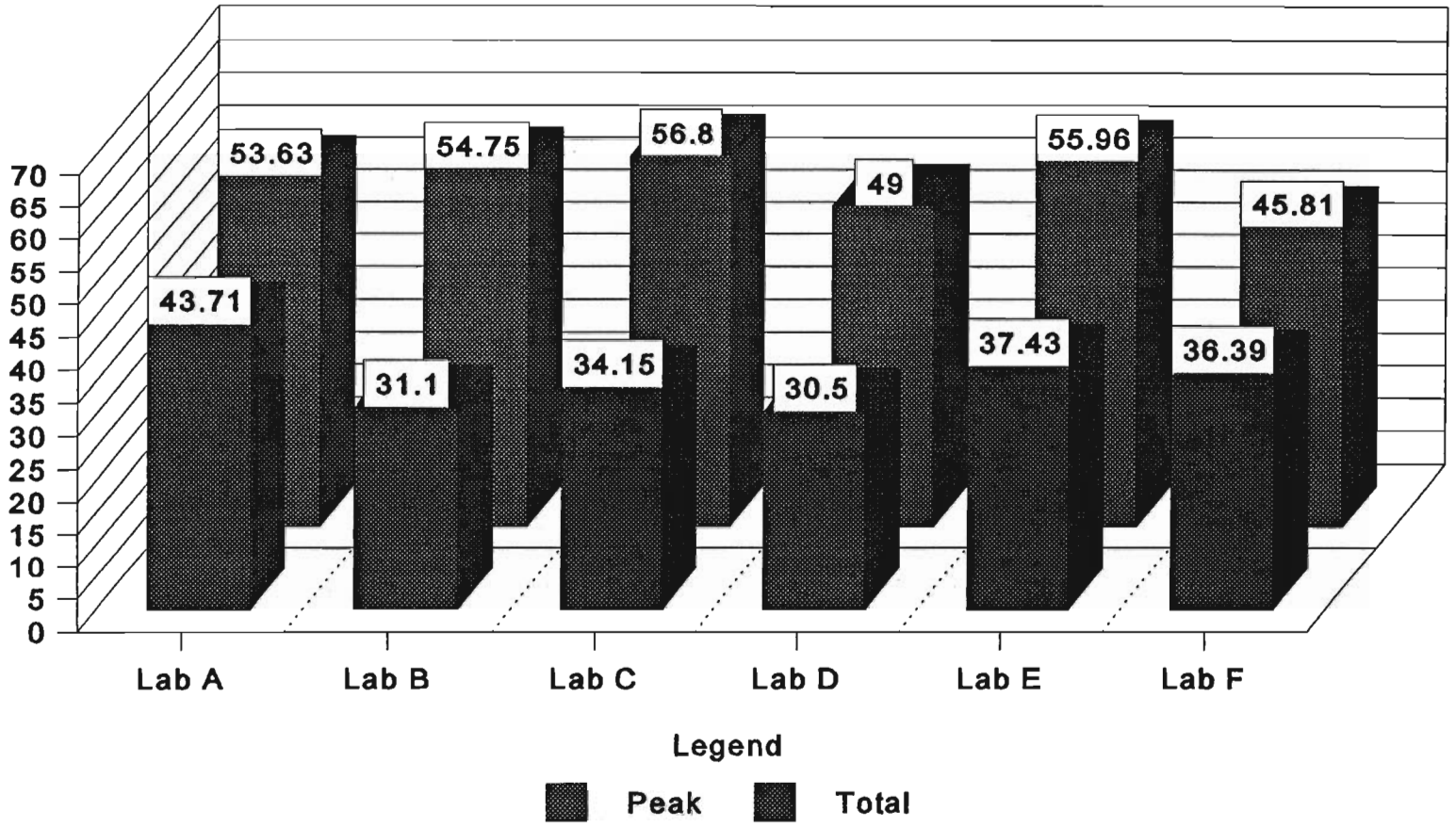
	Set 1 Peak	Set 2 Peak	Set 1 Total	Set 2 Total
LAB A:	53.46	53.80	43.72	43.71
LAB B:	54.50	55.00	29.10	33.10
LAB C:	56.50	57.10	34.70	33.60
LAB D:	51.00	47.00	30.00	31.00
LAB E:	56.07	55.86	39.42	35.44
LAB F:	45.47	46.15	36.66	36.12
MEAN:	52.83	52.48	35.60	35.50
STD. DEV:	3.76	4.30	5.10	4.03

OVERALL

	PEAK	TOTAL
MEAN:	52.66	35.54
STD DEV:	3.88	4.42

OSU ROUND ROBIN

Schneller Standard Core Overall Feb. 95



O.S.U. ROUND ROBIN

"DATA SHEET"
LAB A

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	51.76	26.38
	Run 2	62.65	30.85
	Run 3	61.86	31.87
	Average	58.76	29.70
Set B:	AIRSCO PANEL		
	Run 1	58.84	30.10
	Run 2	57.90	28.01
	Run 3	61.02	30.96
	Average	59.25	29.69
Set C:	SCHNELLER STANDARD CORE		
	Run 1	54.20	45.45
	Run 2	53.91	44.36
	Run 3	52.26	41.34
	Average	53.46	43.72
Set D:	SCHNELLER STANDARD CORE		
	Run 1	55.25	44.47
	Run 2	51.79	42.70
	Run 3	54.38	43.96
	Average	53.80	43.71

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB B

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	54.30	19.70
	Run 2	52.20	21.70
	Run 3	48.80	12.10
	Average	51.80	17.80
Set B:	AIRSCO PANEL		
	Run 1	50.40	12.50
	Run 2	53.70	18.40
	Run 3	53.60	25.90
	Average	52.60	18.90
Set C:	SCHNELLER STANDARD CORE		
	Run 1	49.80	26.90
	Run 2	54.40	28.60
	Run 3	59.30	31.80
	Average	54.50	29.10
Set D:	SCHNELLER STANDARD CORE		
	Run 1	54.40	30.40
	Run 2	55.70	36.80
	Run 3	54.80	32.10
	Average	55.00	33.10

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB C

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	71.40	16.40
	Run 2	64.20	27.10
	Run 3	65.30	27.10
	Average	66.96	23.53
Set B:	AIRSCO PANEL		
	Run 1	65.80	26.10
	Run 2	62.90	24.10
	Run 3	64.80	21.60
	Average	64.50	23.93
Set C:	SCHNELLER STANDARD CORE		
	Run 1	54.10	29.80
	Run 2	58.20	40.20
	Run 3	57.30	34.20
	Average	56.50	34.70
Set D:	SCHNELLER STANDARD CORE		
	Run 1	61.80	39.30
	Run 2	52.60	26.90
	Run 3	56.90	34.70
	Average	57.10	33.60

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB D

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	65.00	24.00
	Run 2	63.00	21.00
	Run 3	65.00	23.00
	Average	64.00	23.00
Set B:	AIRSCO PANEL		
	Run 1	63.00	22.00
	Run 2	63.00	21.00
	Run 3	68.00	26.00
	Average	65.00	23.00
Set C:	SCHNELLER STANDARD CORE		
	Run 1	60.00	34.00
	Run 2	45.00	31.00
	Run 3	47.00	26.00
	Average	51.00	30.00
Set D:	SCHNELLER STANDARD CORE		
	Run 1	43.00	32.00
	Run 2	43.00	24.00
	Run 3	54.00	37.00
	Average	47.00	31.00

O.S.U. ROUND ROBIN

"DATA SHEET"
LAB E

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	74.56	23.13
	Run 2	78.07	26.73
	Run 3	77.02	33.43
	Average	76.81	27.76
Set B:	AIRSCO PANEL		
	Run 1	73.32	24.80
	Run 2	77.64	25.03
	Run 3	75.17	25.10
	Average	75.37	25.24
Set C:	SCHNELLER STANDARD CORE		
	Run 1	50.52	34.05
	Run 2	62.85	42.77
	Run 3	54.84	41.44
	Average	56.07	39.42
Set D:	SCHNELLER STANDARD CORE		
	Run 1	53.61	36.21
	Run 2	63.46	36.54
	Run 3	50.52	33.59
	Average	55.86	35.44

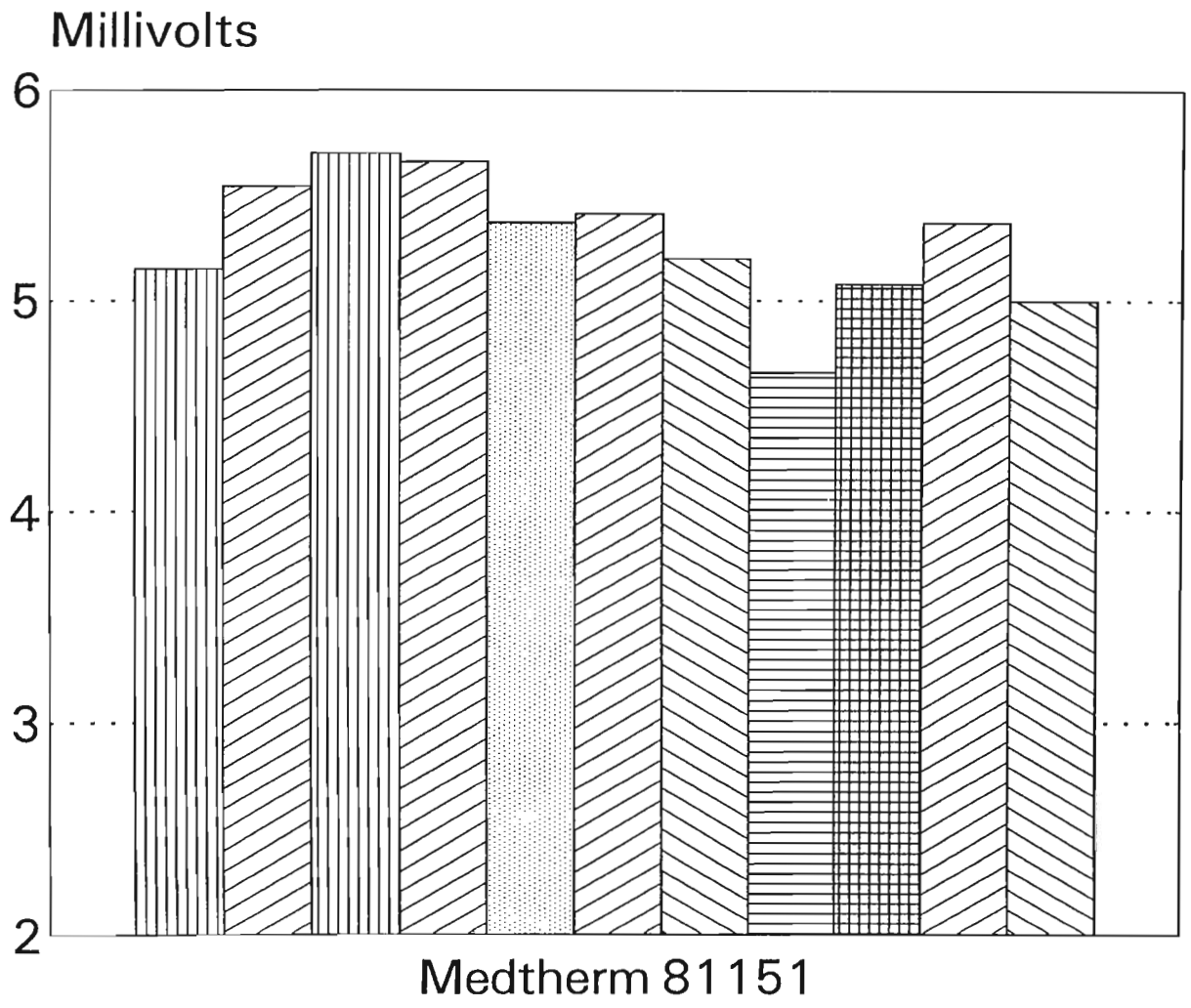
O.S.U. ROUND ROBIN

"DATA SHEET"
LAB F

	Run #	KW/m sq.	KW min/m sq.
Set A:	AIRSCO PANEL		
	Run 1	62.95	24.12
	Run 2	58.75	21.68
	Run 3	60.14	18.23
	Run 4	62.81	27.27
	Average	61.16	22.82
Set B:	AIRSCO PANEL		
	Run 1	61.68	27.21
	Run 2	62.77	25.65
	Run 3	64.70	26.68
	Run 4	57.23	20.06
	Average	61.59	24.90
Set C:	SCHNELLER STANDARD CORE		
	Run 1	43.56	35.90
	Run 2	45.29	33.86
	Run 3	45.34	37.58
	Run 4	47.71	39.29
	Average	45.47	36.66
Set D:	SCHNELLER STANDARD CORE		
	Run 1	46.38	31.53
	Run 2	47.00	37.23
	Run 3	46.64	39.83
	Run 4	44.57	35.91
	Average	46.15	36.12

GARDON GAGE, R/R

Millivolts @ 3.5 Watts



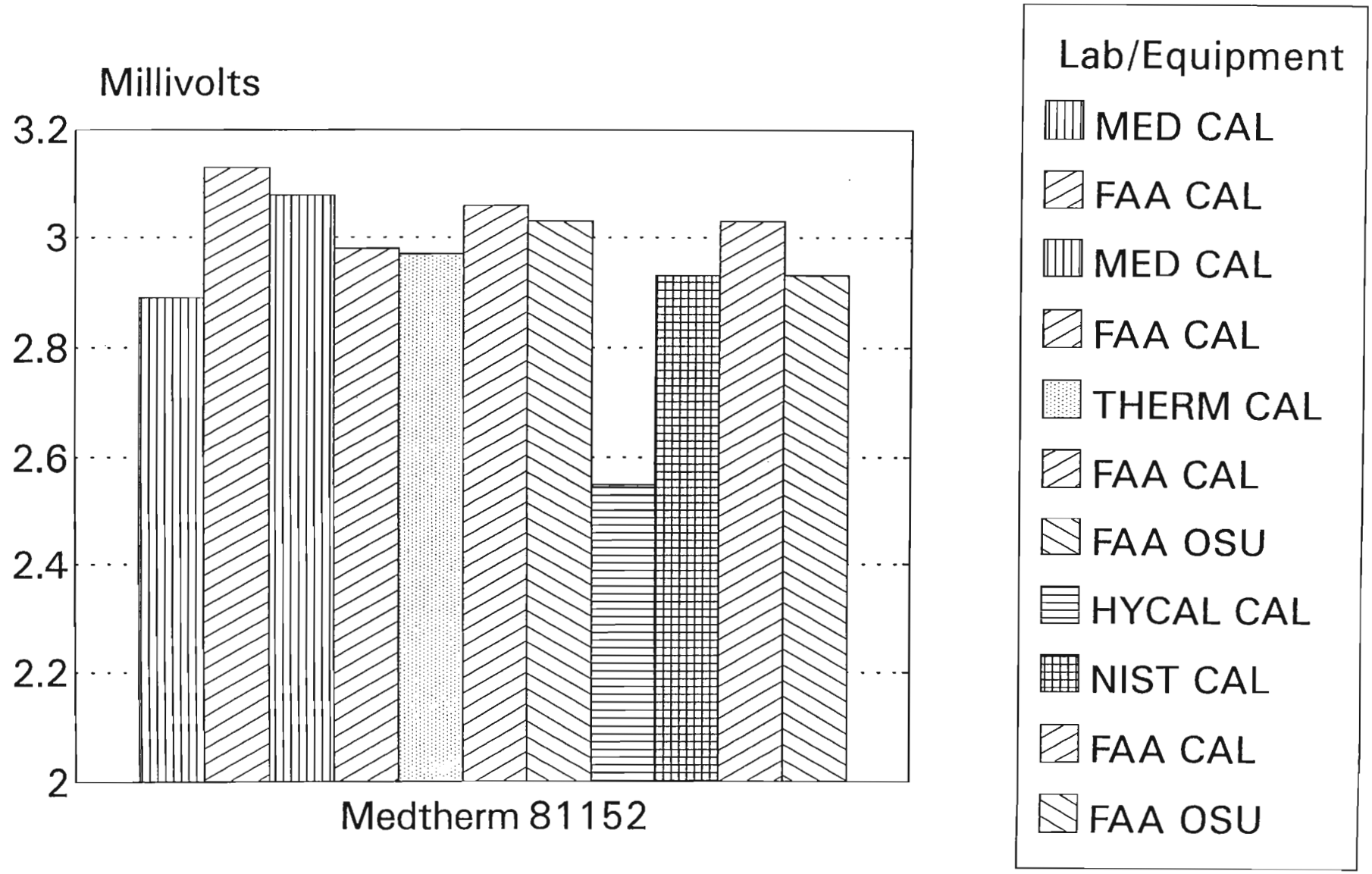
Lab/Equipment

- MED CAL
- FAA CAL
- MED CAL
- FAA CAL
- THERM CAL
- FAA CAL
- FAA OSU
- HYCAL CAL
- NIST CAL
- FAA CAL
- FAA OSU

R. Johnson
2/7-8/95

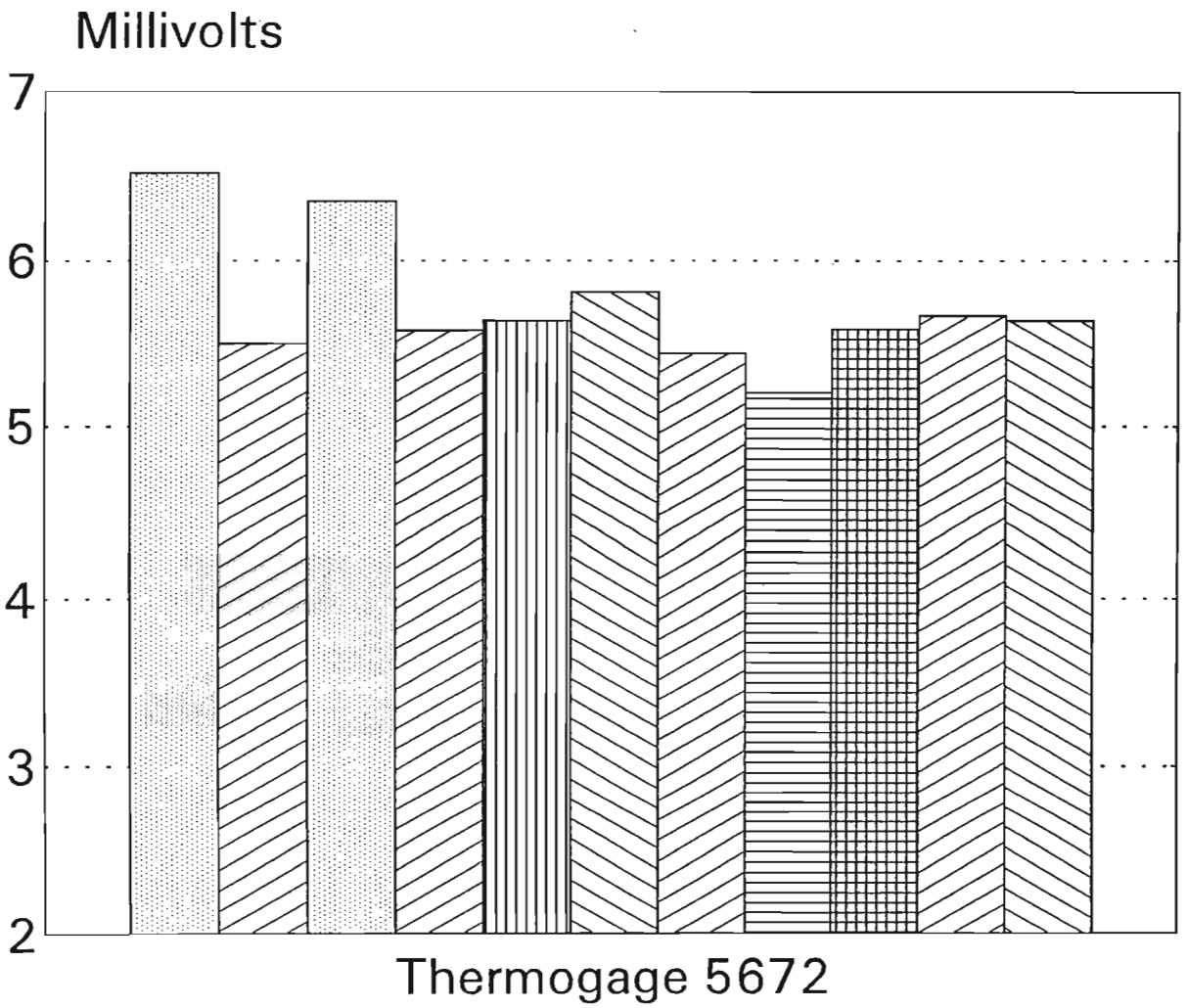
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



GARDON GAGE, R/R

Millivolts @ 3.5 Watts

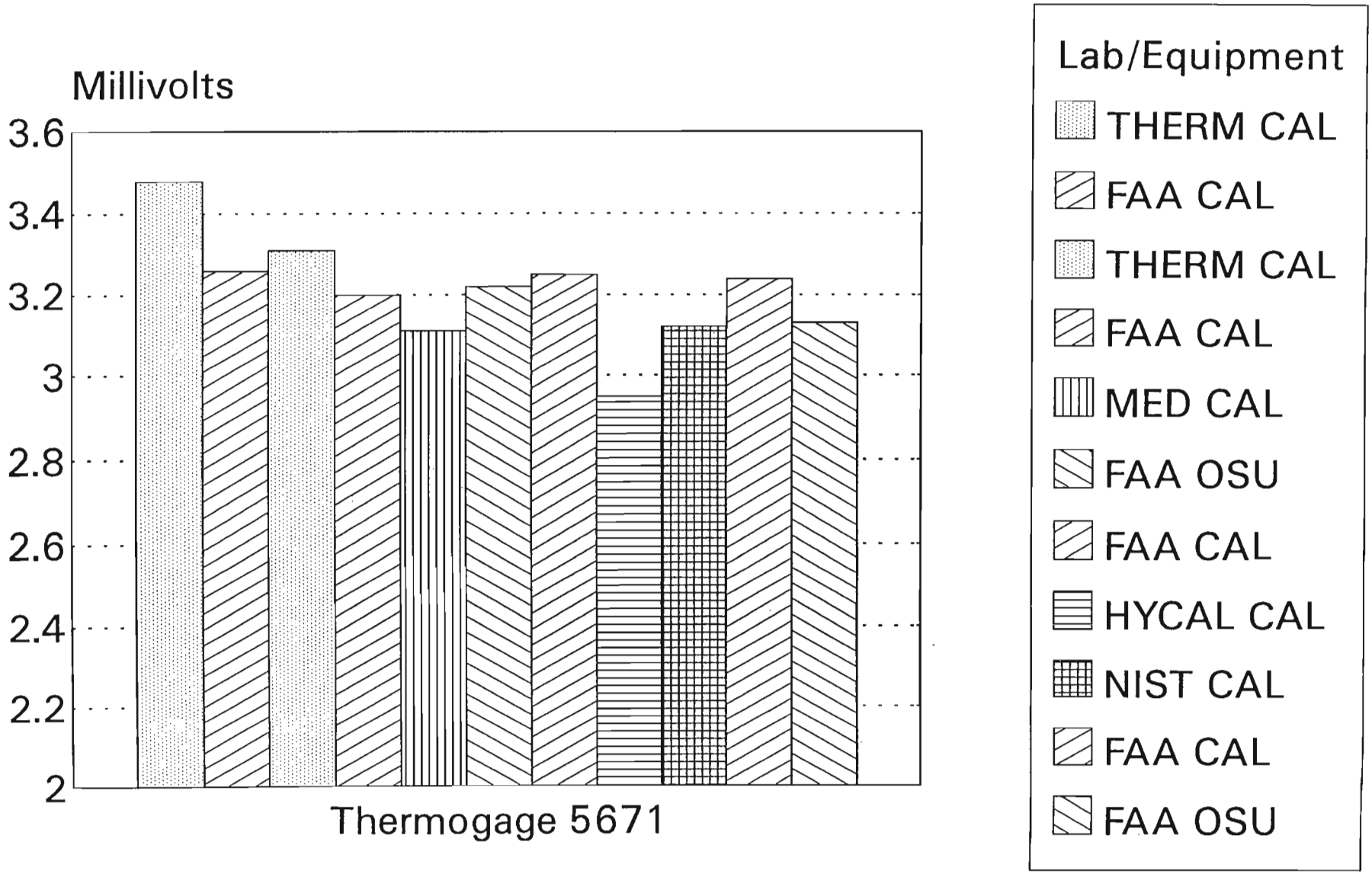


Lab/Equipment

- THERM CAL
- FAA CAL
- THERM CAL
- FAA CAL
- MED CAL
- FAA OSU
- FAA CAL
- HYCAL CAL
- NIST CAL
- FAA CAL
- FAA OSU

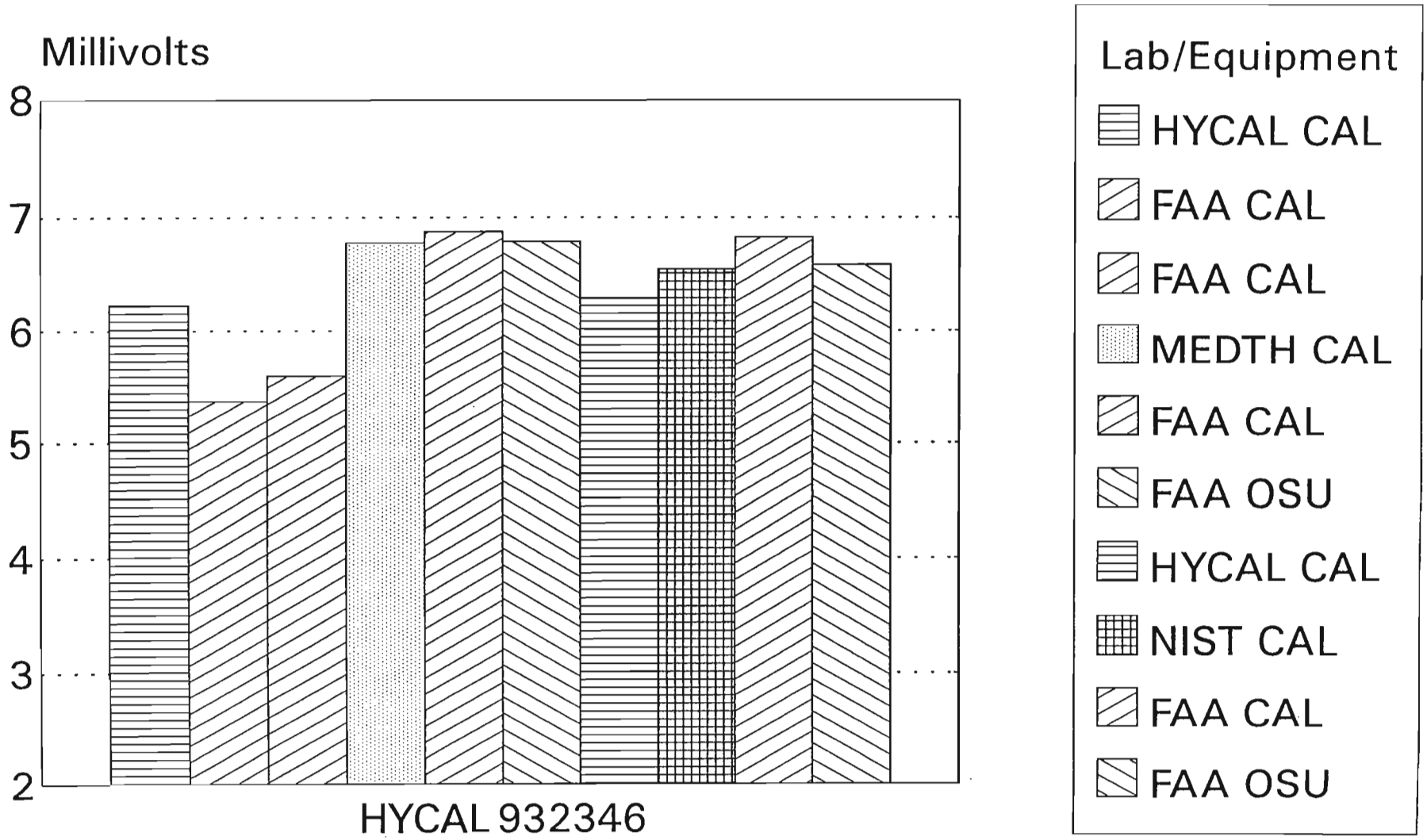
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



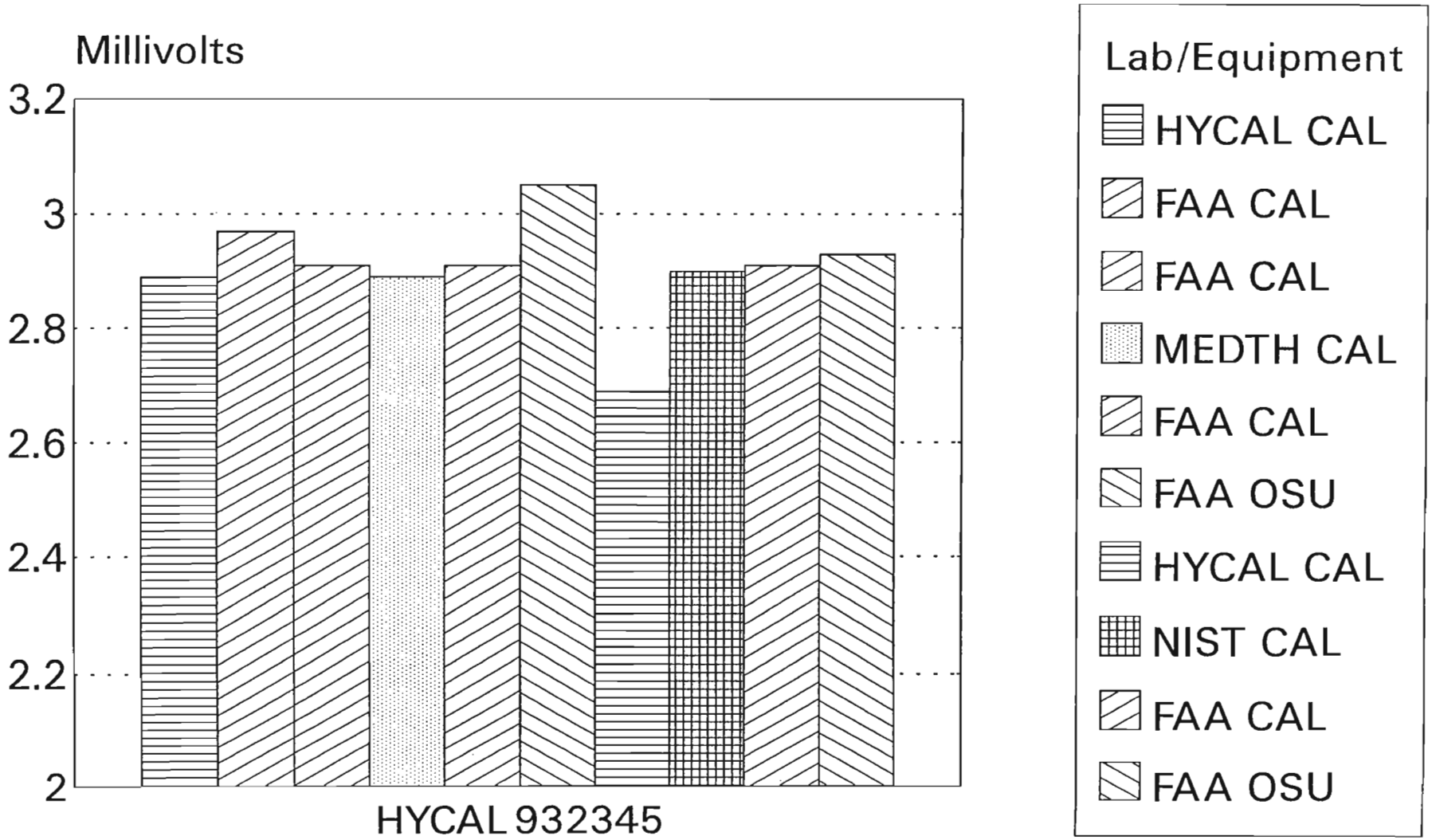
GARDON GAGE, R/R

Millivolts @ 3.5 Watts



GARDON GAGE, R/R

Millivolts @ 3.5 Watts

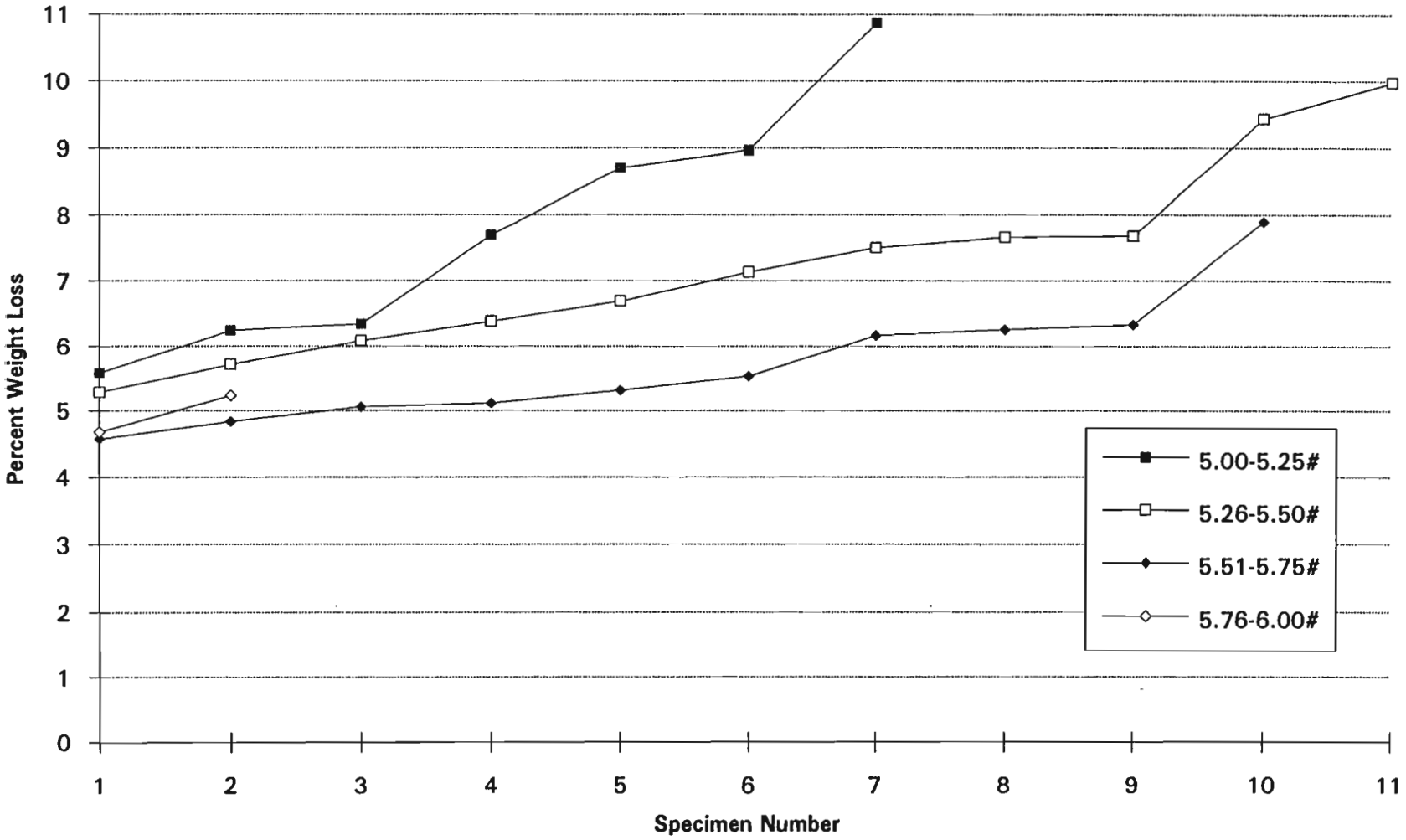


IN-SERVICE SEAT TALLIES

Seat Construction Breakdown by Airport			
ACY			
Total seats examined:	*109*		
PBI blends :	48	44	
Kevlar/Nomex blends :	11	10.1	
FR foams :	9	8.26	
Other :	41	37.6	100
EWR			
Total seats examined:	*37*		
PBI blends :	19	51.4	
Kevlar/Nomex blends :	18	48.6	
FR foams :	0	0	
Other :	0	0	100
SWF			
Total seats examined:	*30*		
PBI blends :	21	70	
Kevlar/Nomex blends :	9	30	
FR foams :	0	0	
Other :	0	0	100
TOTALS			
Total seats examined:	176		
PBI blends :	88	50	
Kevlar/Nomex blends :	38	21.6	
FR foams :	9	5.11	
Other :	41	23.3	100

Seats Examined by Aircraft Type	
Shorts 360	30
ATR 42	16
EMB 120RT	25
Subtotal	71
DC 9/MD 80	83
B727	10
B737	6
A300	6
Subtotal	105
TOTAL	176

Percent Weight Loss by Initial Weight, Standard Shapes



Percent Weight Loss by Initial Weight, Stock Shapes