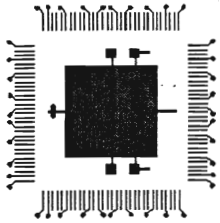


PROCESSES AND PROCESS CONTROL (INTRODUCTION)

PWA ASSEMBLY PROCESSES

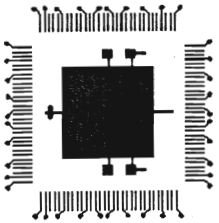
BY

SCOTT DAHNE

WESTINGHOUSE ELECTRIC CORPORATION

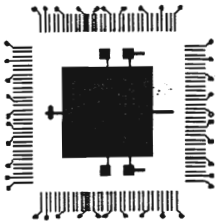
ELECTRONIC SYSTEMS GROUP

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (GOALS)

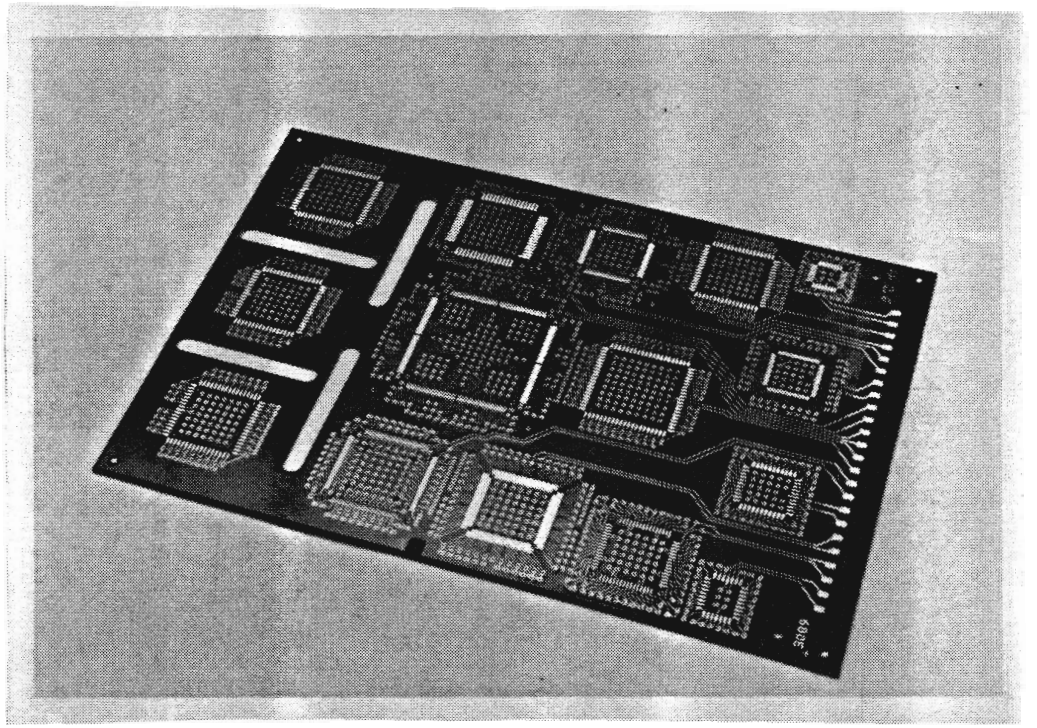
- DEVELOP PROCESS FOR ECONOMICAL AND RELIABLE MANUFACTURING OF VHSIC PWAs
- ACHIEVE 1000 -55 °C TO +125 °C FAILURE FREE THERMAL CYCLES



PROCESSES AND PROCESS CONTROL (THERMAL CYCLES)

- RANGE: -55 °C TO +125 °C
- RAMP RATE: 5 °C PER MINUTE
- DWELL AT TEMPERATURE: 24 MINUTES
- TOTAL CYCLE: 2 HOURS
- MONITORING: EVERY 2 MINUTES, DC
- FAILURE CRITERION: 10 X NOMINAL RESISTANCE

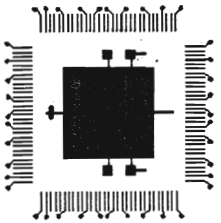
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

WESTINGHOUSE

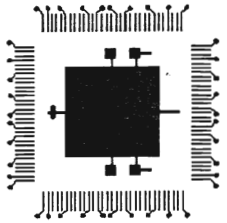
MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (DISCLAIMER)

THE MATERIALS AND EQUIPMENT SPECIFIED IN THE FOLLOWING SLIDES DOES NOT CONSTITUTE AN ENDORSEMENT FOR THOSE PRODUCTS.

THERE ARE MANY ALTERNATIVE PRODUCTS AVAILABLE.

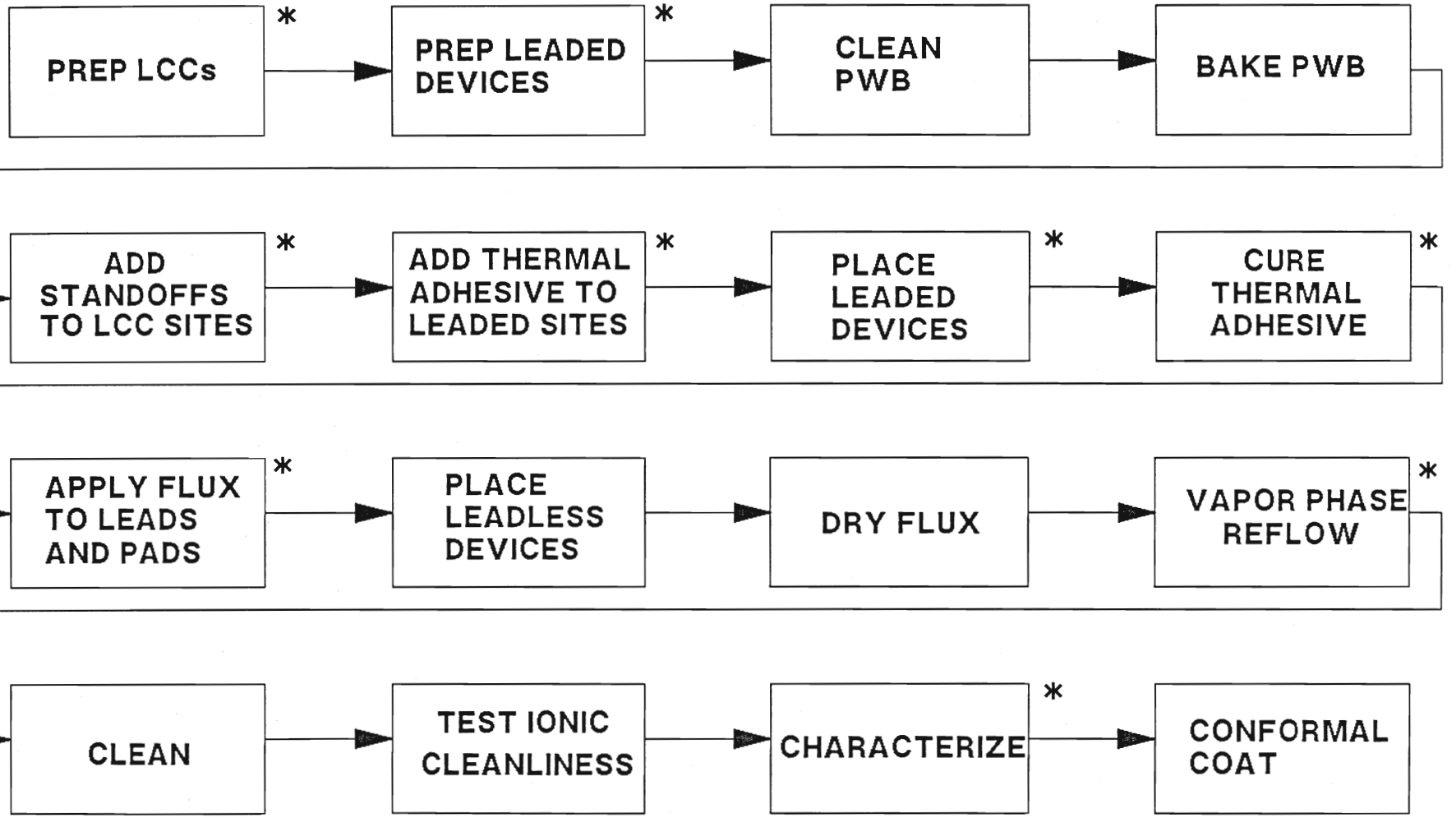


PROCESSES AND PROCESS CONTROL (PROCESS VARIABLES ADDRESSED)

VARIABLE	CONDITION "0"	CONDITION "1"
LEADLESS FILLET	NOMINAL	BULBOUS
LEADED VOLUME	MINIMUM	ADDITIONAL
LEADLESS HEIGHT	4-5 MIL	8-10 MILS
LEAD STRESS	NO STRESS	STRESSED
SOLDER ALLOY	63/37 Sn/Pb	50/50 Sn/Pb
PRETIN ALLOY	63/37 Sn/Pb	50/50 Sn/Pb
SOLDER FORM	PASTE	PREFORMS
PWB SURFACE FINISH	BARE COPPER	NICKEL
PWB MATERIAL	QUATREX/KEVLAR	POLYIMIDE/E-GLASS

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

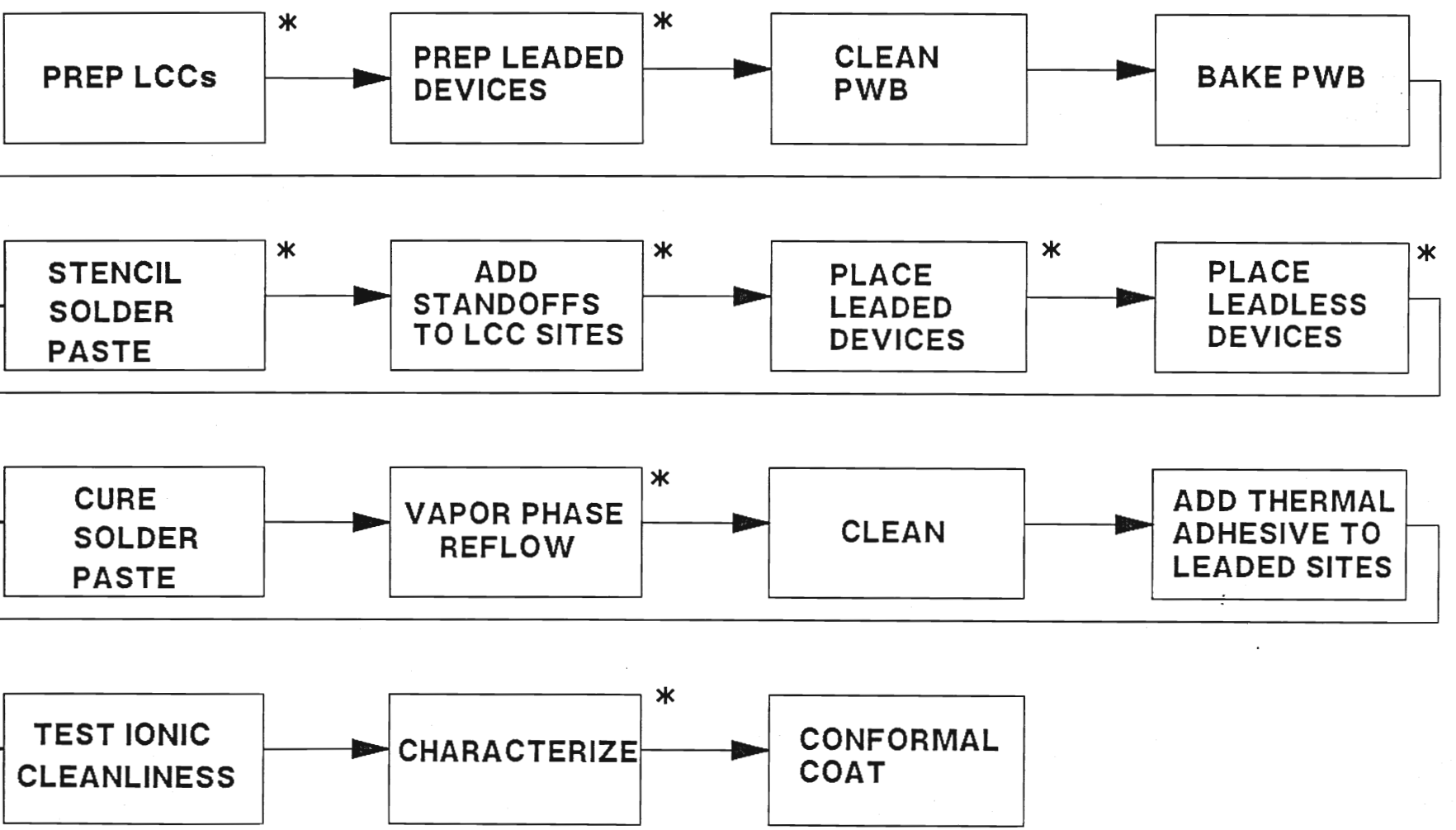
PROCESSES AND PROCESS CONTROL (PROCESS FLOWCHART - PREFORMS)



GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

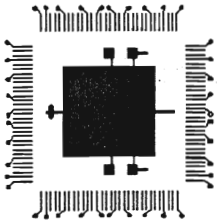
* DESIGNATES ADSP/MT AREA OF CONCENTRATION

PROCESSES AND PROCESS CONTROL (PROCESS FLOWCHART - STENCILS)



GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

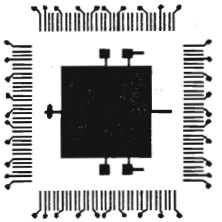
* DESIGNATES ADSP/MT AREA OF CONCENTRATION



PROCESSES AND PROCESS CONTROL (MATERIALS)

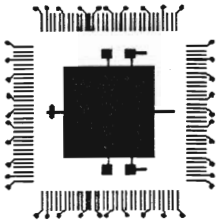
- SOLDER
  - SOLDER INGOTS 63/37 Sn/Pb (ALPHA METALS)
  - PREFORMS 63/37 Sn/Pb (ALPHA METALS)
  - SOLDER PASTE (ALPHA) RMA 390DH3, 90% METALS, 650,000 CPS, -325/+500 MESH
  - SOLDERQUIK PREFORM (RAYCHEM)
- CLEANING SOLVENT
  - DOW PRELETE
  - ALPHA 565
  - DUPONT FREON TMS
- ADHESIVE
  - ABLEFILM 561KTW (THERMAL ADHESIVE)
  - EPO-TEK 115-SMT (THERMAL ADHESIVE)
  - DYMAX 20199 (UV CUREABLE ADHESIVE)
- FLUX
  - ALPHA 611
  - KESTER 185
- VAPOR PHASE FLUID
  - FC5312 (3M)
  - FC5311 (3M)
  - FC70 (3M)
  - FREON TF (DUPONT)
- CONFORMAL COAT
  - HUMISEAL 1B31 (ACRYLIC)
  - CONAP CE-1155 (POLYURETHANE)
  - DOW 3140 (SILICONE)

PROCESSES AND PROCESS CONTROL (EQUIPMENT FLOWCHART)



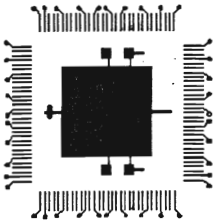
FIXTURES	SOLDER POT	DEGREASER	OVEN (N2 PURGE)
PREP LCCs →	PREP LEADED DEVICES →	CLEAN PWB →	BAKE PWB
EFD DISPENSER		ADEPT ROBOT	OVEN (N2 PURGE)
ADD STANDOFFS TO LCC SITES →	ADD THERMAL ADHESIVE TO LEADED SITES →	PLACE LEADED DEVICES →	CURE THERMAL ADHESIVE
SYRINGE		OVEN (N2 PURGE)	BATCH VP
APPLY FLUX TO LEADS AND PADS →	PLACE LEADLESS DEVICES →	DRY FLUX →	VAPOR PHASE REFLOW
DEGREASER	ICOM 3000	MICROSCOPE	SPRAY BOOTH
CLEAN →	TEST IONIC CLEANLINESS →	CHARACTERIZE →	CONFORMAL COAT

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



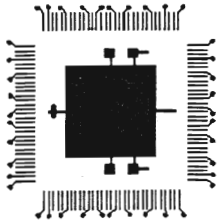
MATERIALS

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



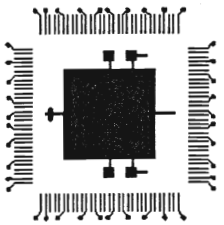
PROCESSES AND PROCESS CONTROL (SOLDER PASTE)

- 63/37 Sn/Pb ALLOY
- RMA FLUX
- FINE MESH SIZE (-200/+325 TO -325/+500 MESH)
- HIGH METALS CONTENT (90% MINIMUM)
- MINIMUM SLUMPING (10% MAXIMUM)
- VISCOSITY OF 650,000 TO 900,000 CPS
- PASTE MUST BE BAKED OUT PRIOR TO REFLOW
- PROPER CONTROL OF UNUSED AND USED PASTE



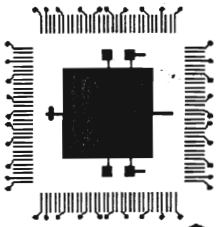
PROCESSES AND PROCESS CONTROL (PREFORMS)

- SPHERICAL PREFORMS
  - 63/37 Sn/Pb ALLOY
  - .021" AND .031" DIAMETER
- FLUXLESS ATTACHMENT TO LCCs WITH SPECIAL FIXTURE
- ALL PARTS PREPARED PRIOR TO ASSEMBLY OF PWB



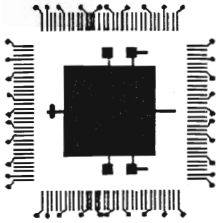
PROCESSES AND PROCESS CONTROL (FLUX)

- RMA FLUX PER MIL-F-14256
- SOLDER PASTE USES SAME FLUX FOR COMPATIBILITY
- USE THERMOGRAVIMETRIC ANALYSIS (TGA) TO OPTIMIZE PROCESS TO PARTICULAR FLUX USED
- MUST BE CORRECTLY DRIED TO MINIMIZE VOLATIZATION
- DO NOT OVER-APPLY



PROCESSES AND PROCESS CONTROL (ADHESIVES)

- THERMAL ADHESIVE
  - ABLEFILM 561KTW
    - 8-12 MILS THICK (DEPENDENT ON LEAD FORMING)
    - CUT TO SIZE FOR EACH PART
  - EPO-TEK 115-SMT
    - APPLIED FROM BACK SIDE OF PWB
    - CAN BE APPLIED BY AUTOMATIC DISPENSING SYSTEM
- LCC STANDOFF ADHESIVE
  - DYMAX 20199
  - UV CUREABLE
  - CAN BE APPLIED BY AUTOMATIC DISPENSING SYSTEM

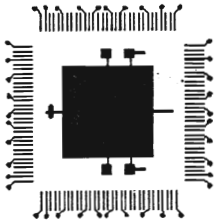


PROCESSES AND PROCESS CONTROL (REFLOW FLUIDS)

- PRIMARY FLUID
  - 3M FC-5312, FC-5311, FC-70
  - 419°F (215°C) BOILING POINT
  - LOWER PFIB AND HF GENERATION
- SECONDARY FLUID
  - DUPONT FREON TF
  - 185°F (85°C) TO 215°F (102°C) BOILING POINT

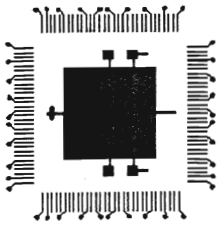
PROCESSES AND PROCESS CONTROL (CLEANING SOLVENTS)

- DOW PRELETE
  - 167°F (75°C) BOILING POINT
- FREON TMS
  - 104°F (40°C) BOILING POINT
- ALPHA 565
  - 165°F (74°C) BOILING POINT
- REPLACE OR DISTILL FLUID WHEN DIRTY



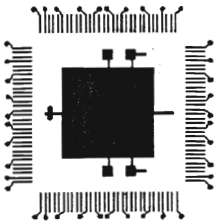
ASSEMBLY PROCESSES

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



COMPONENT PREPARATION

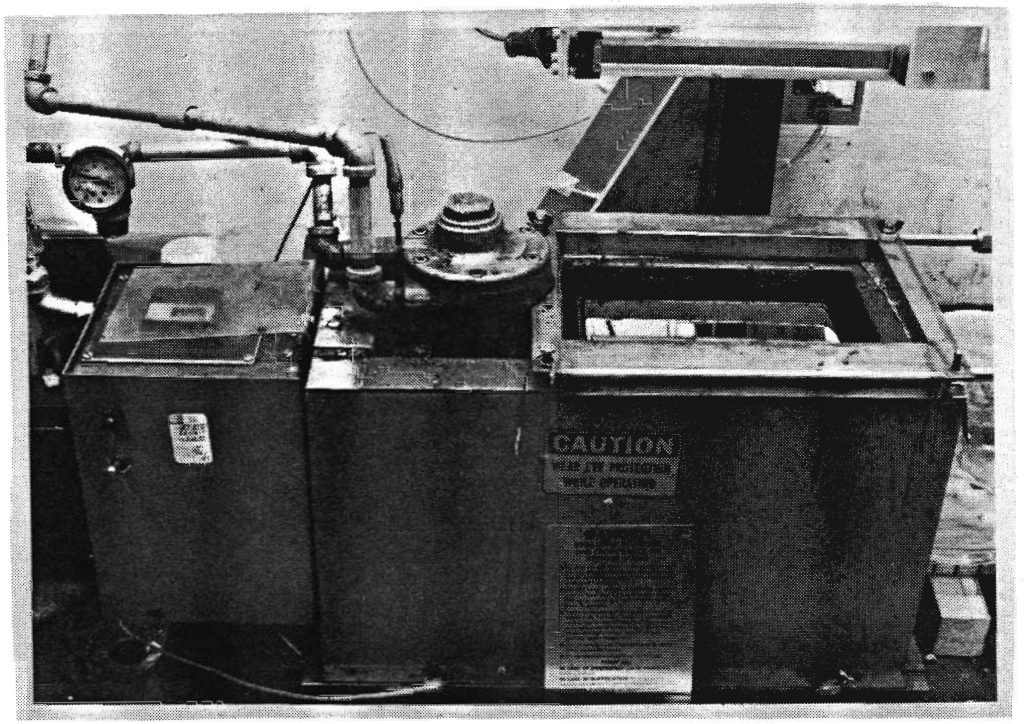
GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



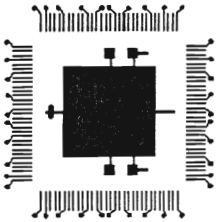
PROCESSES AND PROCESS CONTROL (PRETINNING)

- DYNAMIC (FLOWING) SOLDER POT
  - 500°F +- 5°F TEMPERATURE
- DIP TO WASH AWAY ALL GOLD
- MAINTAIN POT PER WS6536
- INSURE UNIFORM LEAD/CASTELLATION COVERAGE
- NITROGEN BLANKET MAY BE USED
  - ELIMINATES NEED FOR FLUX

PROCESSES AND PROCESS CONTROL



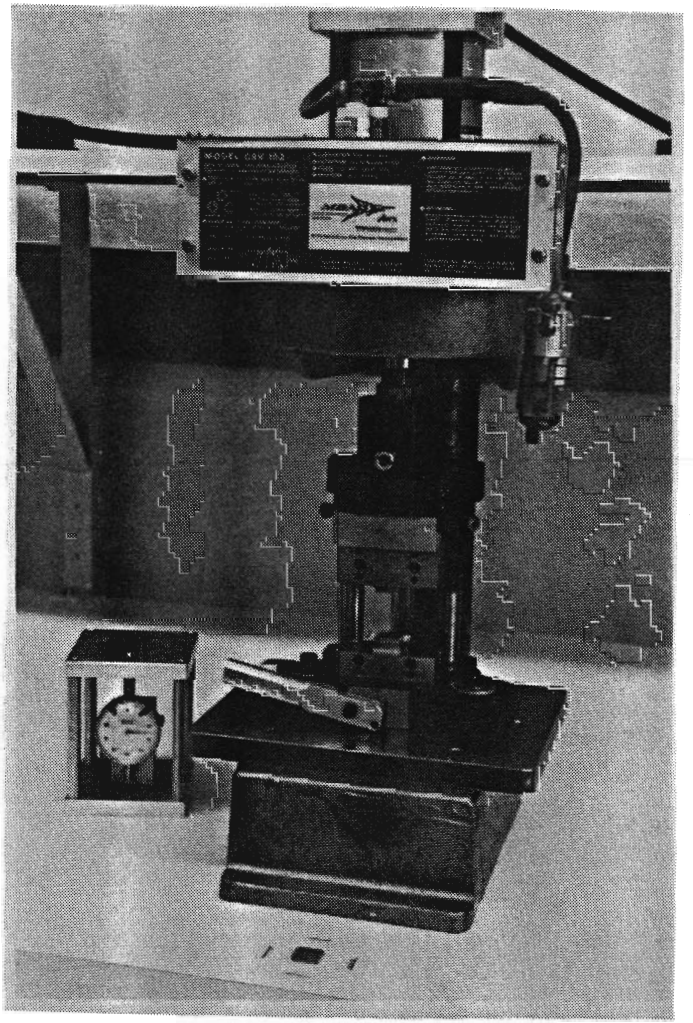
GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (LEAD FORMING)

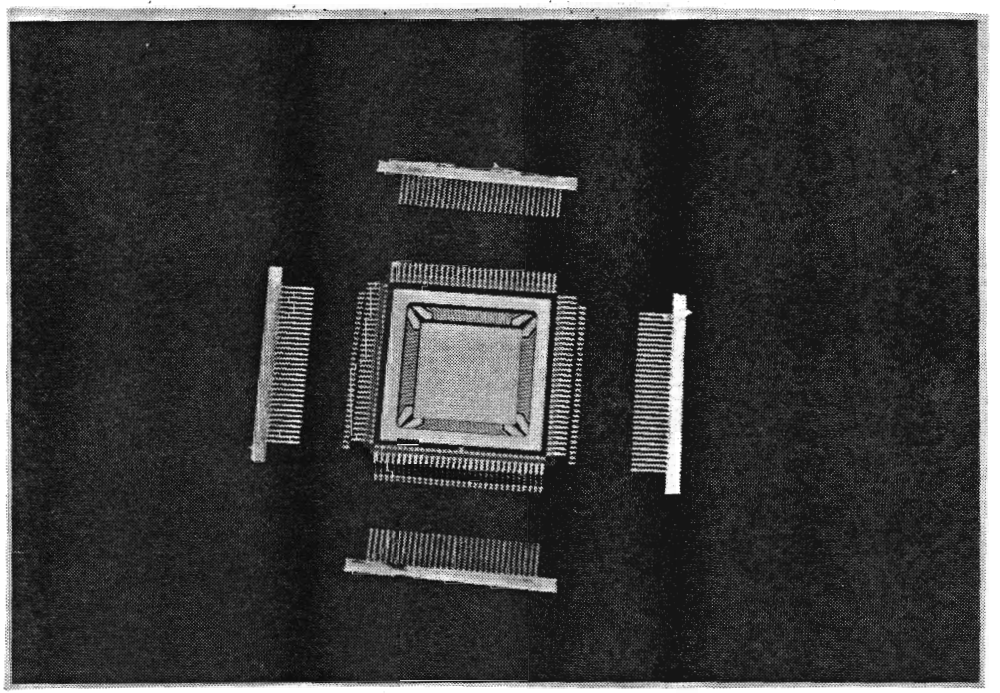
- FORM LEADS 9 +- 2 MILS BELOW PACKAGE
  - DEPENDENT UPON THERMAL ADHESIVE HEIGHT USED
- MAINTAIN +-2 MILS COPLANARITY ACROSS LEADS
- CUT OFF CORNERS OF TIE BARS PRIOR TO FORMING
  - ELIMINATES SKEWING OF LEADS DURING FORMING
- HARD TOOLED DIES ELIMINATE NEED FOR ADJUSTMENTS
- CERTIFY ALL DIES !!!

PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

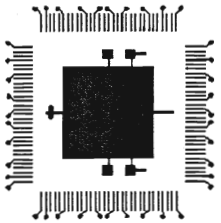
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

WESTINGHOUSE

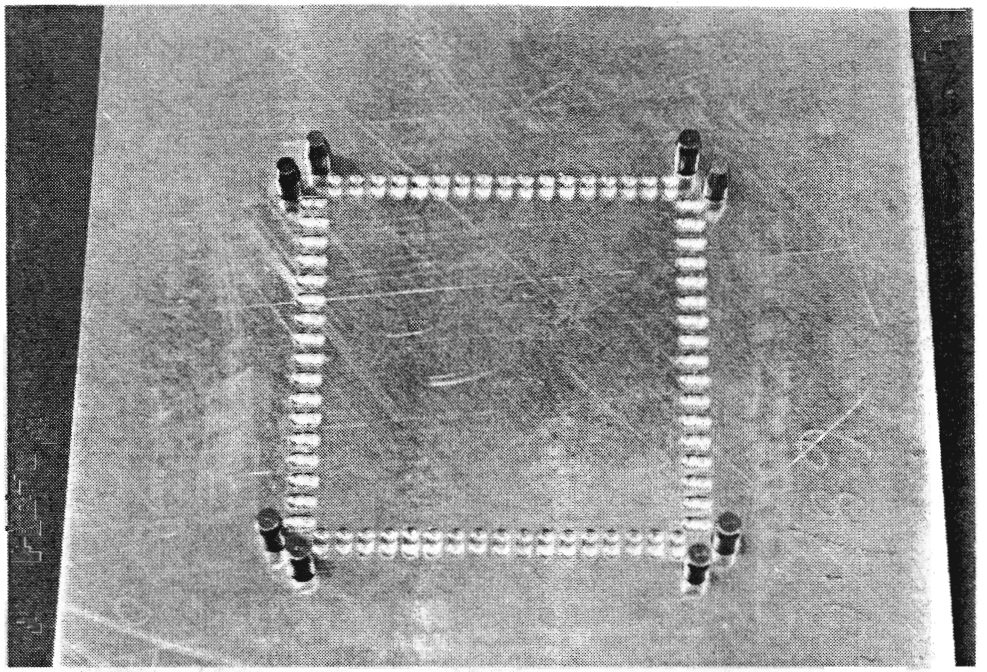
MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (PREFORMS)

- SPHERICAL PREFORMS
  - 63/37 Sn/Pb ALLOY
  - .021" AND .031" DIAMETER
- FLUXLESS ATTACHMENT TO LCCs WITH SPECIAL FIXTURE
- ALL PARTS PREPARED PRIOR TO ASSEMBLY OF PWB

PROCESSES AND PROCESS CONTROL

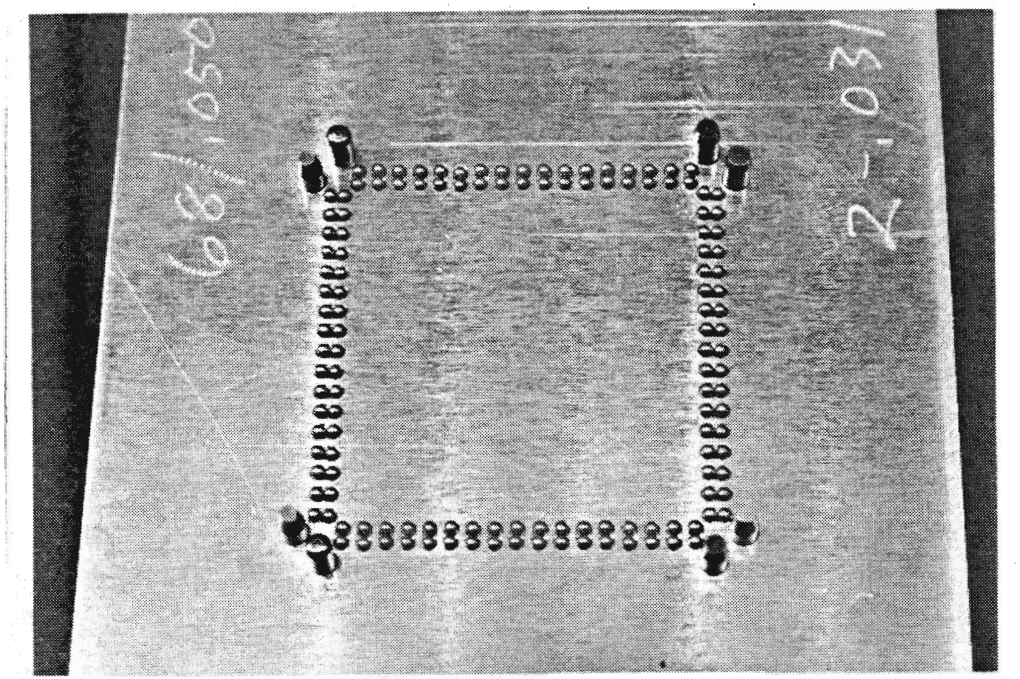


GENERAL ELECTRIC

WESTINGHOUSE

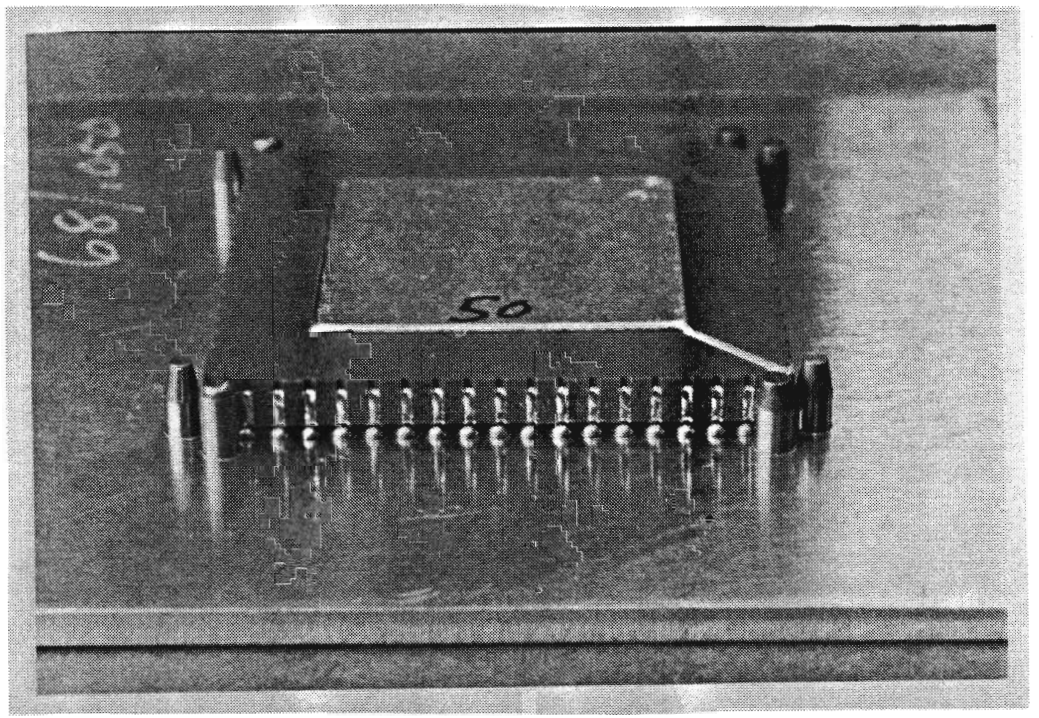
MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

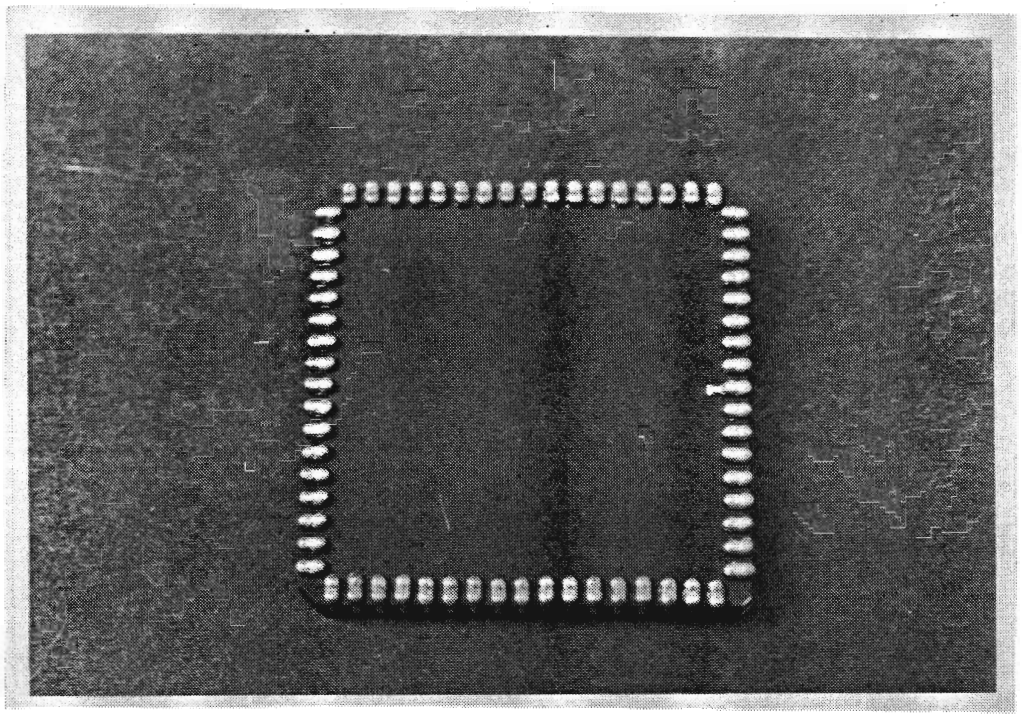


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

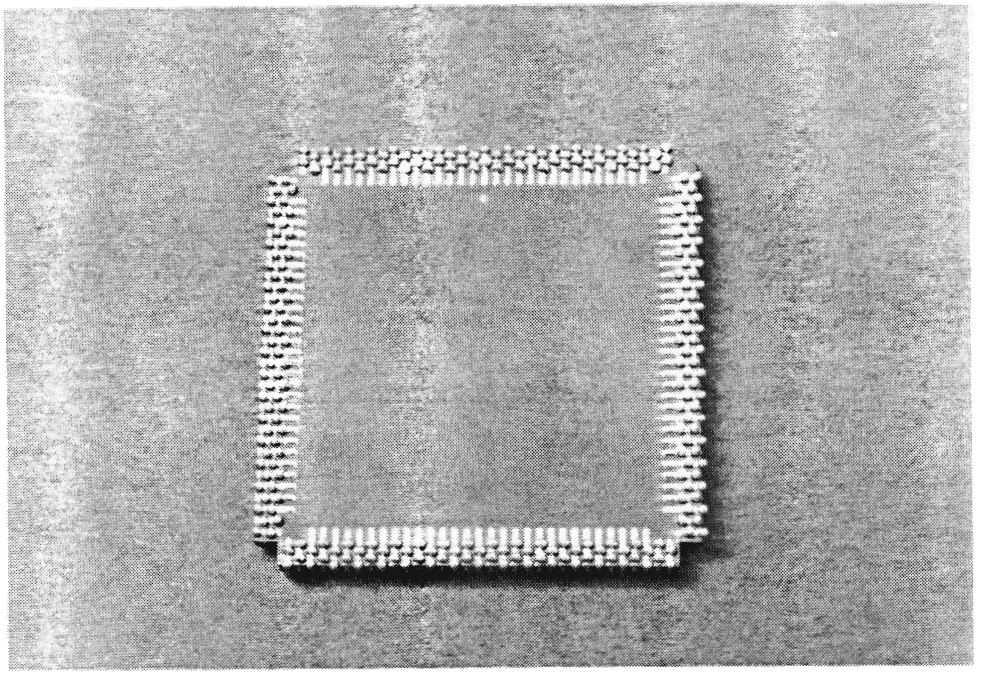


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

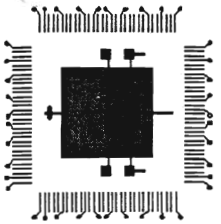
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

WESTINGHOUSE

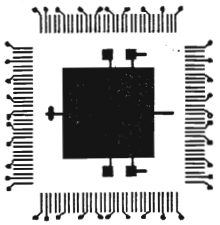
MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (PREFORMS)

ADVANTAGES

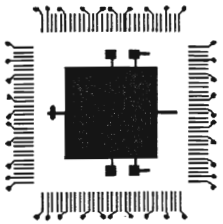
- PRECISE JOINT VOLUMES ARE OBTAINED
- IDENTICAL JOINT TO JOINT GEOMETRY
- THEORETICAL AND ACTUAL VOLUMES CAN BE MATCHED
- JOINTS ARE COSMETICALLY SUPERIOR
- JOINTS TEND TO HAVE LESS VOIDS



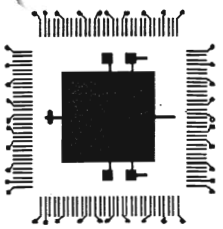
PROCESSES AND PROCESS CONTROL (PREFORMS)

DISADVANTAGES

- PROCESS IS MANUAL IN NATURE AND THUS VERY TIME CONSUMING
- TOOLING IS NOT YET PRODUCTION ORIENTED



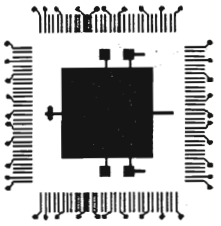
PWB PREPARATION



PROCESSES AND PROCESS CONTROL (THICK SOLDER PLATE)

- TIN RANGE 60-66%
- Sn/Pb THICKNESS 2.5 - 3.5 MILS AS PLATED
  - VERIFY BY CROSS-SECTION OR PROFILOMETER
- VENDOR
  - NORTH AMERICAN PRINTED CIRCUITS

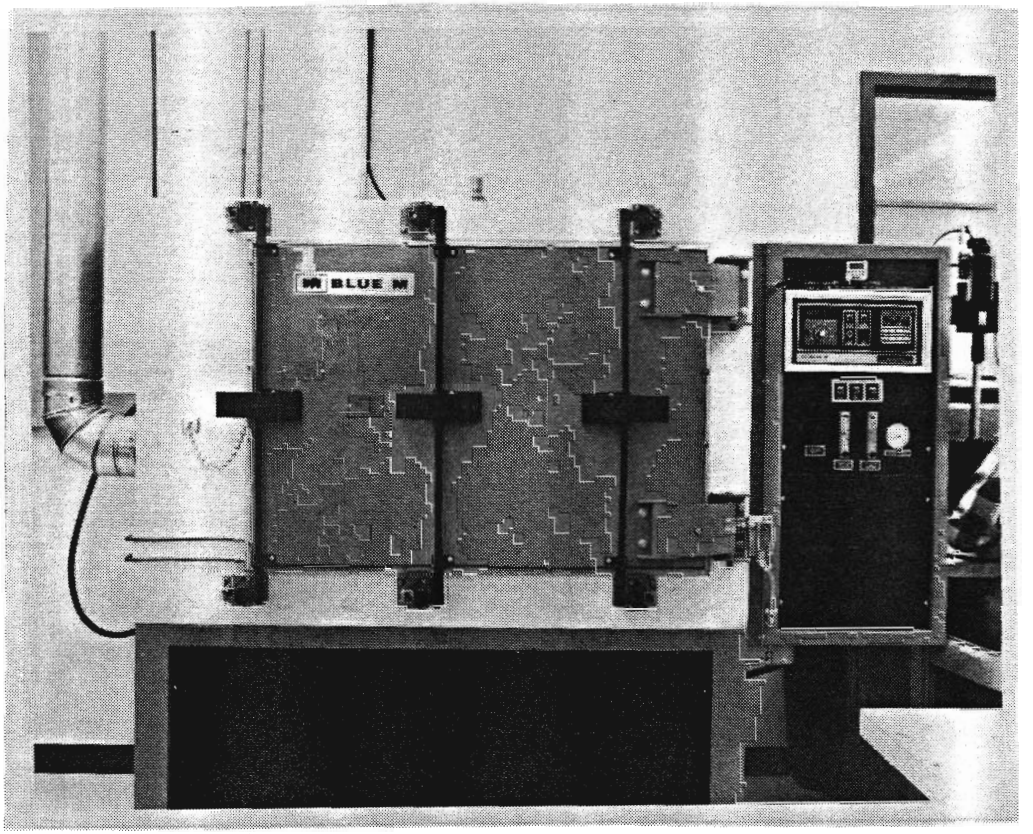
GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (MOISTURE BAKE-OUT)

- MANY PWB MATERIALS ARE HYGROSCOPIC
- BAKE TO REMOVE MOISTURE
- USE THERMOGRAVIMETRIC ANALYSIS (TGA) TO OPTIMIZE BAKE OUT TIME/TEMPERATURE
- NITROGEN PURGED OVEN TO PREVENT OXIDATION OF SURFACES
- STORE IN NITROGEN FOLLOWING THIS OPERATION
  - KEEP IN NITROGEN UNTIL AFTER REFLOW

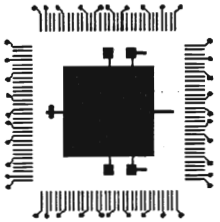
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

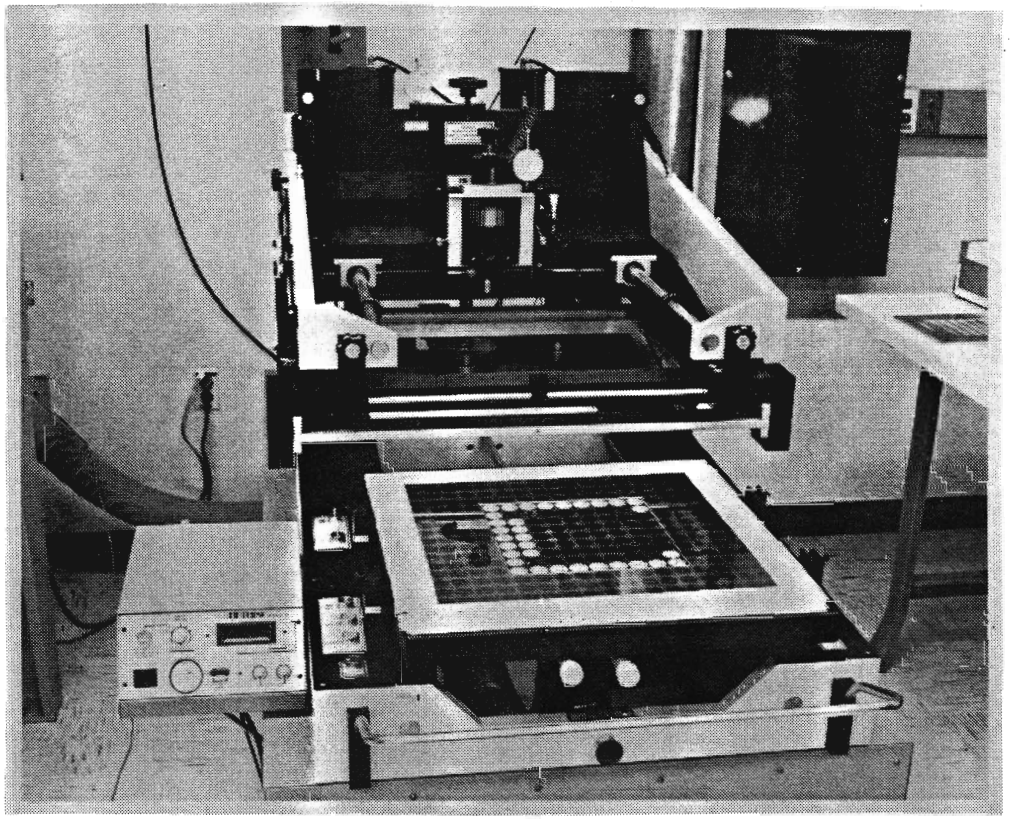


PROCESSES AND PROCESS CONTROL (STENCIL PRINTING)

- TIGHT FABRICATION TOLERANCES ON STENCILS (+-2 MILS)
- ON-CONTACT PRINTING
- BARE PWB OR <2 MILS OF SOLDER MASK
- SQUEEGEE PRESSURE 5-10 POUNDS
- SQUEEGEE SPEED 0.5 -1.5 INCHES/SECOND
- SQUEEGEE DUROMETER 80 - 90 SHORE A
- 8 MIL STENCIL FOR 20-25 MIL PITCH
- 12 MIL STENCIL FOR 40-50 MIL PITCH

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

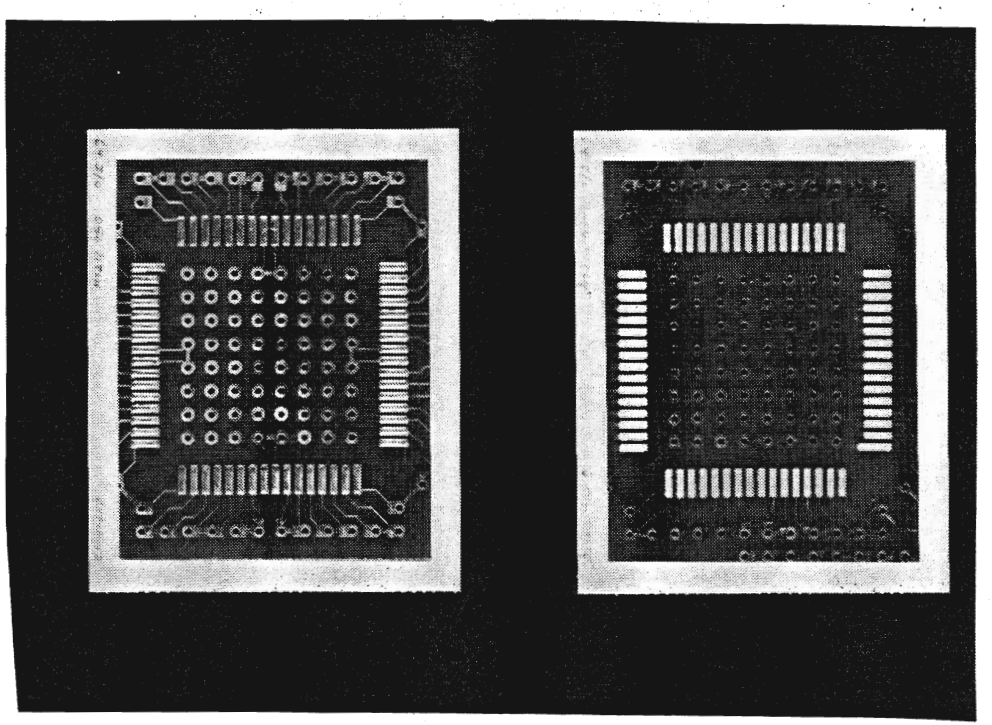


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

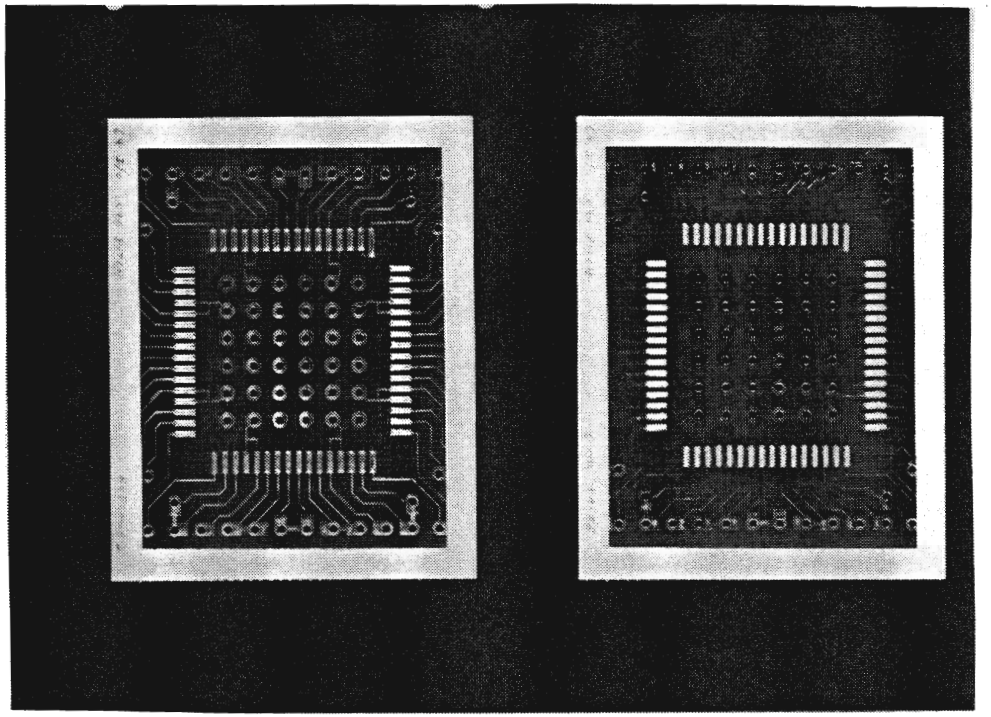


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

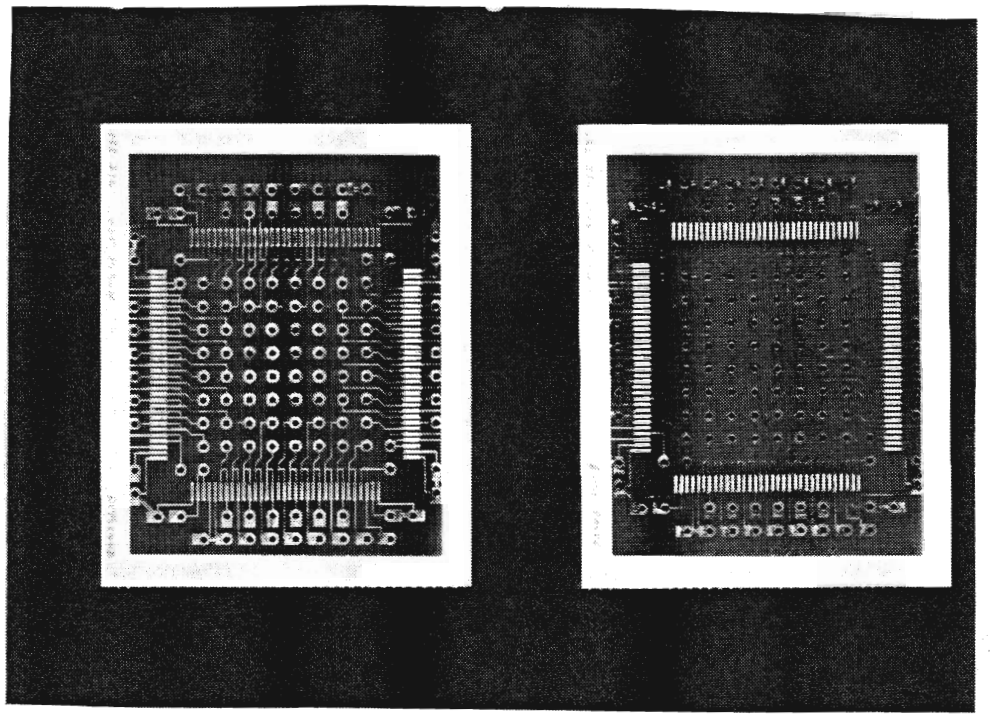


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

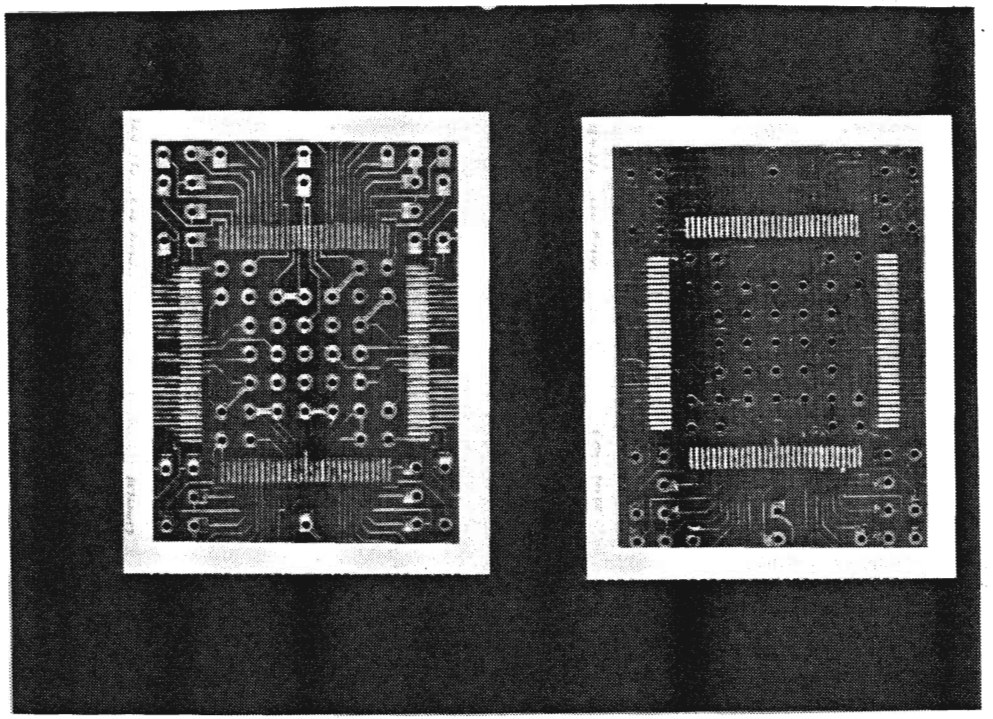


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

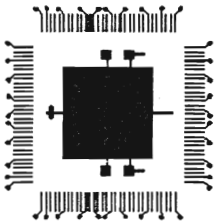
PROCESSES AND PROCESS CONTROL



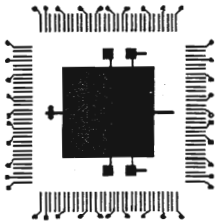
GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA



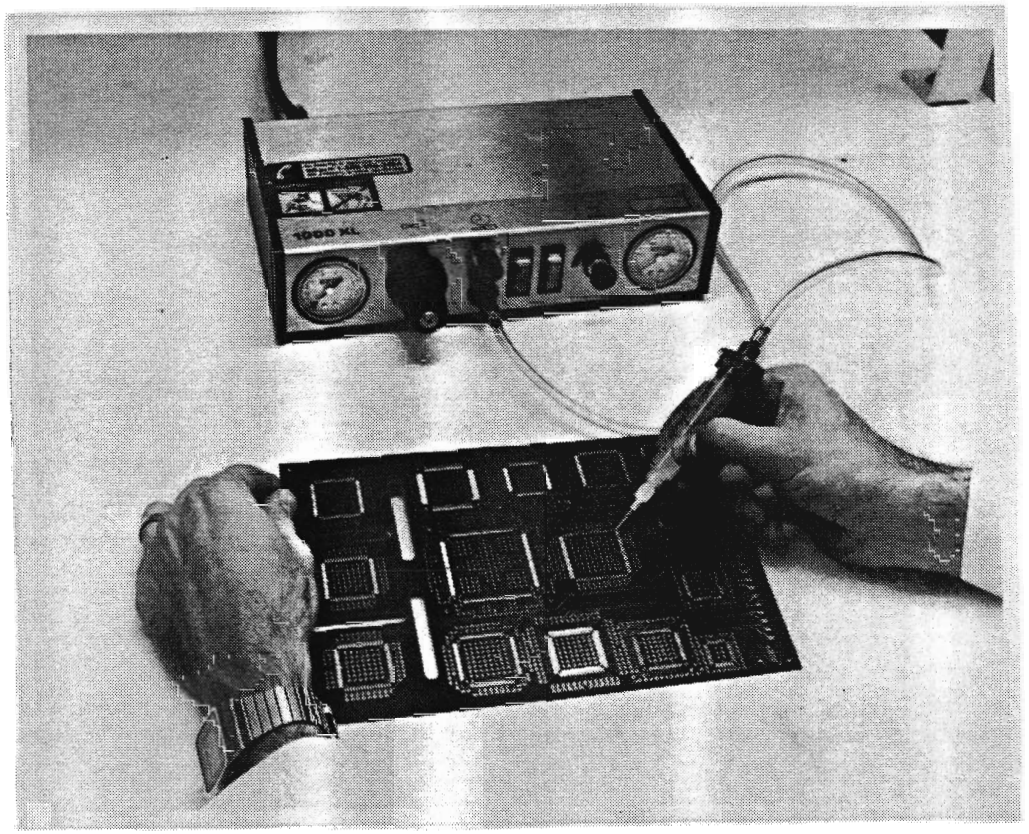
ADHESIVES



PROCESSES AND PROCESS CONTROL (LCC STANDOFF ADHESIVE)

- EFD SEMI-AUTOMATIC DISPENSING SYSTEM
  - 12 PSI
  - 0.2 SECONDS
  - .024" NEEDLE CUT TO 0.5" LENGTH
- ADHESIVE SHOULD BE AT ROOM TEMPERATURE
- FORM DOT ON TIP OF NEEDLE
- HOLD NEEDLE AT 45 DEGREE ANGLE
- ALLOW CAPILLARY ACTION TO TRANSFER DOT TO PWB SURFACE
- CURE FOR 2-3 SECONDS UNDER 300-350nm UV LAMP

PROCESSES AND PROCESS CONTROL

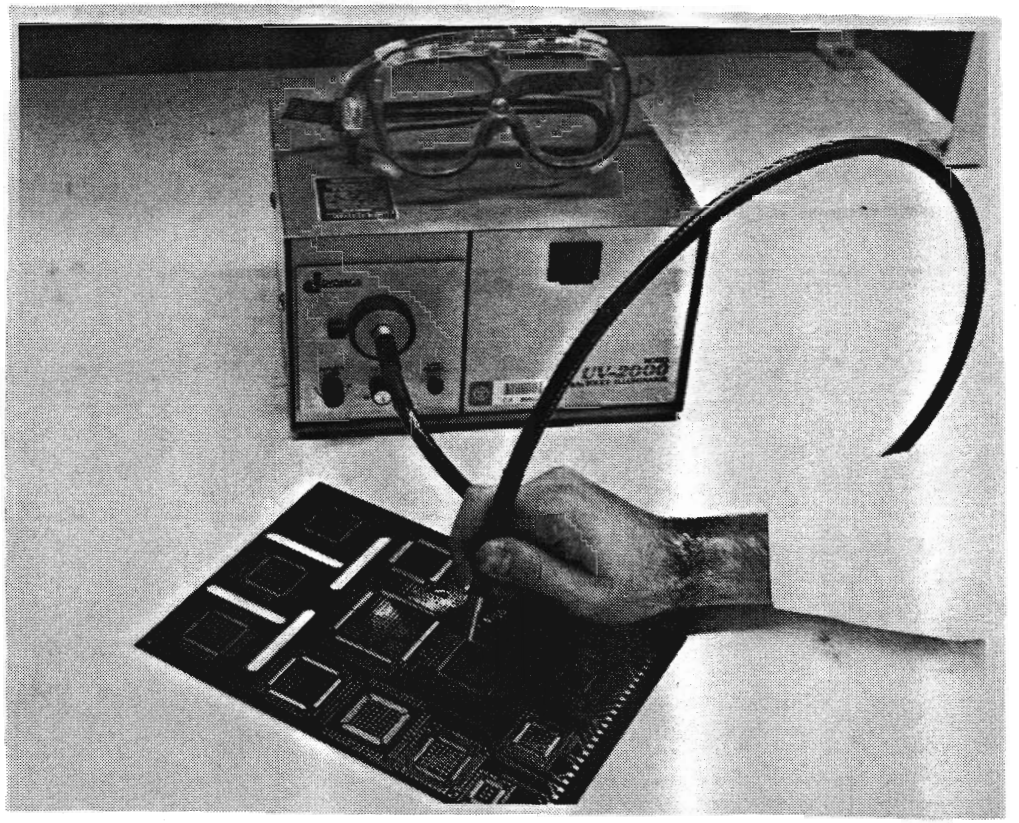


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

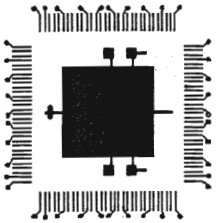
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

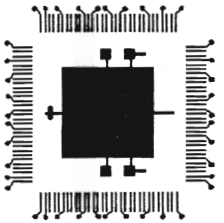
WESTINGHOUSE

MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (THERMAL ADHESIVE)

- CUT TO A SIZE RELATIVE TO AMOUNT OF PRESSURE APPLIED DURING CURE
- CENTER PRECUT PIECE BENEATH EACH PART FOR EVEN FLOW
- FABRIC SIDE AGAINST PWB TO MINIMIZE CREEP DURING CURE

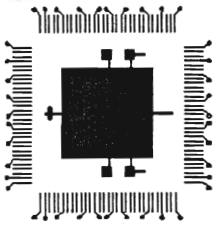


PROCESSES AND PROCESS CONTROL (LEADED THERMAL ADHESIVE)

LEADED DEVICE	SIZE OF UNCURED ADHESIVE
64 I/O 40 MIL	.375" X .375"
64 I/O 50 MIL	.500" X .500"
124 I/O 20 MIL	.375" X .375"
132 I/O 25 MIL	.375" X .375"
256 I/O 20 MIL	.875" X .875"

UNCURED ADHESIVE IS 8-12 MILS THICK

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

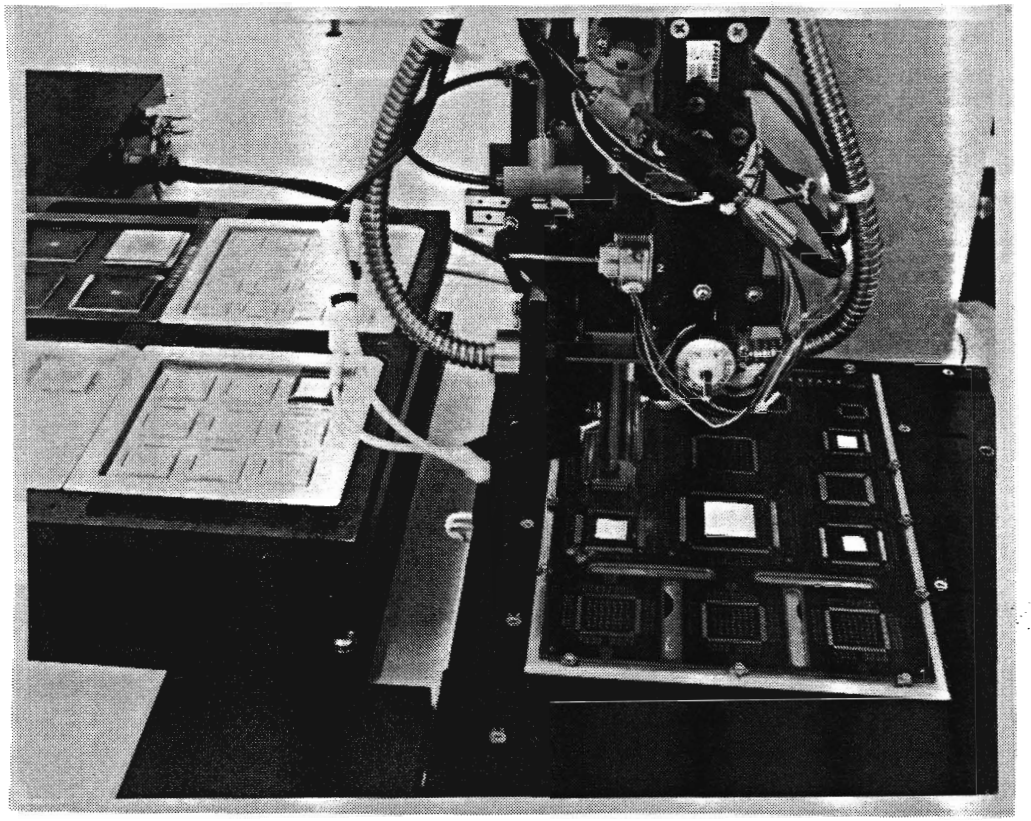


PROCESSES AND PROCESS CONTROL (COMPONENT PLACEMENT)

- LEADED DEVICES
  - UTILIZE ROBOTIC PLACEMENT STATION
  - .001" ACCURACY NEEDED FOR 20 -25 MIL PARTS
  - .002" ACCURACY NEEDED FOR 40-50 MIL PARTS
  - Z-AXIS PRESSURE OF 11 POUNDS TO CONTACT ADHESIVE
  - NO X-Y MOVEMENT AFTER PLACEMENT TO PREVENT MOVEMENT DURING ADHESIVE CURE
- LEADLESS DEVICES
  - PICK AND PLACE OR MANUAL PLACEMENT CAN BE USED
  - 25% OVERHANG WILL SELF ALIGN DURING REFLOW

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL



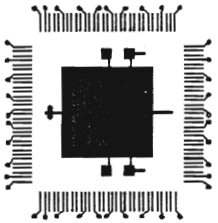
GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL (THERMAL ADHESIVE CURE)

- 150°C FOR 1 HOUR
- MUST ELIMINATE X-Y MOVEMENT
- Z-AXIS PRESSURE ONLY
- NITROGEN ATMOSPHERE TO PREVENT PWB OXIDATION
- COMPLETE CURE INSURES FULL CROSS-LINKING OF POLYMER

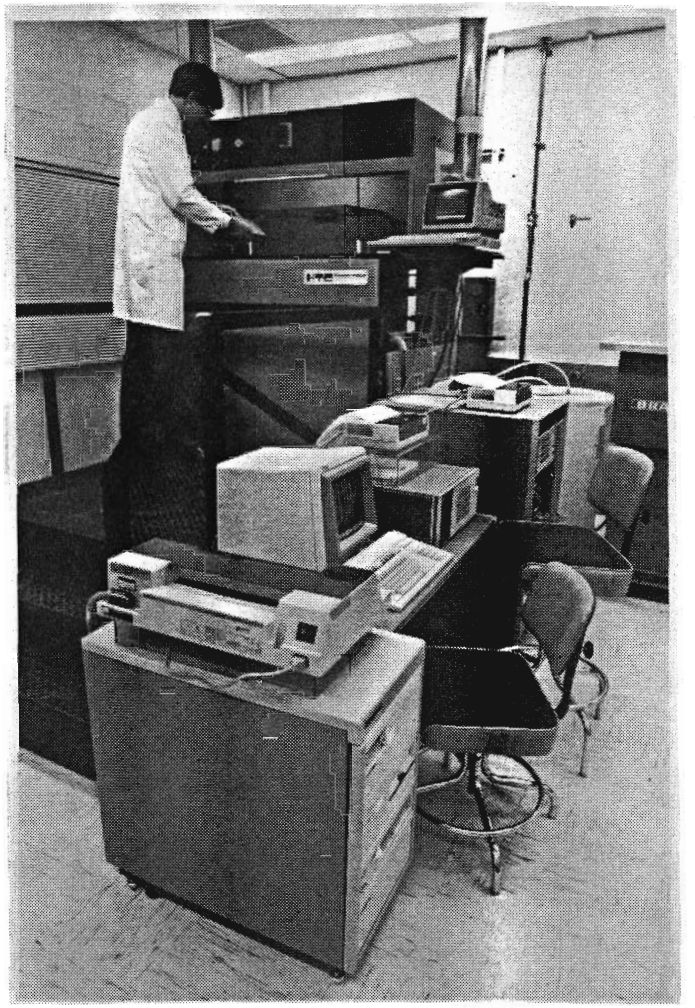


PROCESSES AND PROCESS CONTROL (REFLOW)

- VAPOR PHASE SOLDERING SYSTEM
  - COMPUTER CONTROL SYSTEM
  - CAPABILITY FOR RAPID COOLING
- PROFILE TAILORED TO FLUX OR SOLDER PASTE USED
- FIXTURE PWB TO PREVENT WARPING

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

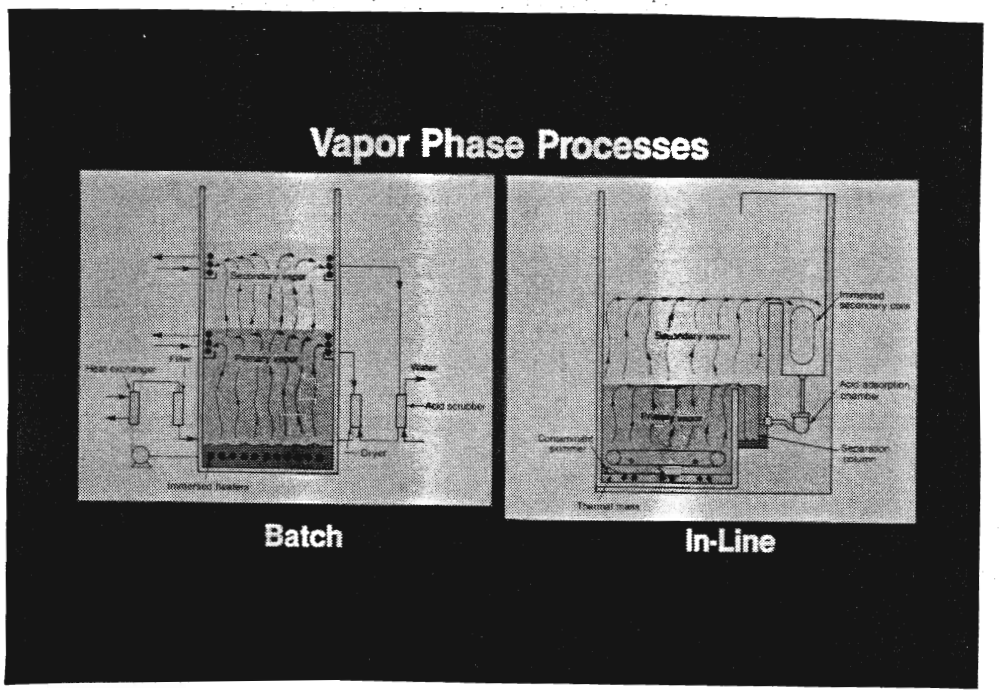


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

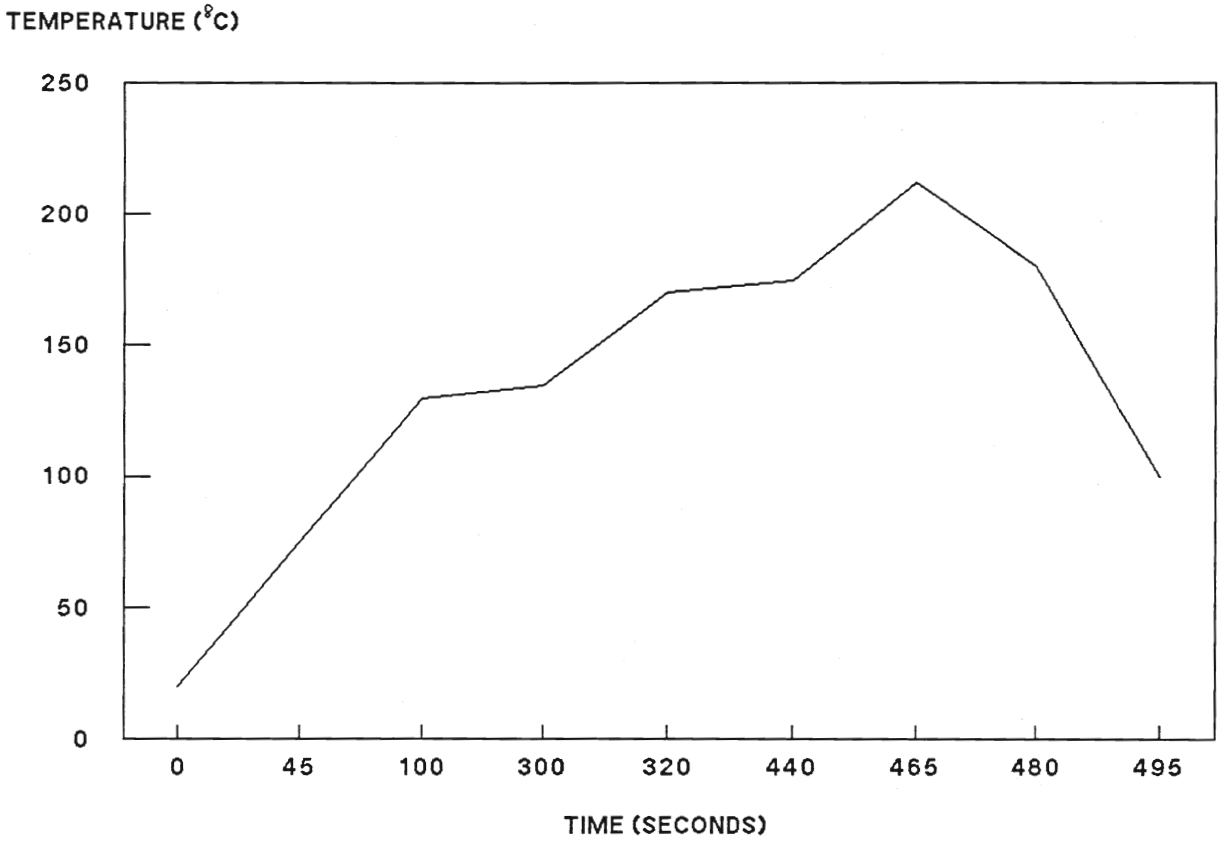
PROCESSES AND PROCESS CONTROL



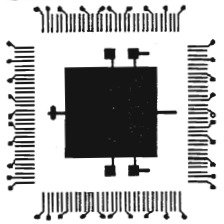
GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL (REFLOW)

TYPICAL VAPOR PHASE REFLOW PROFILE:



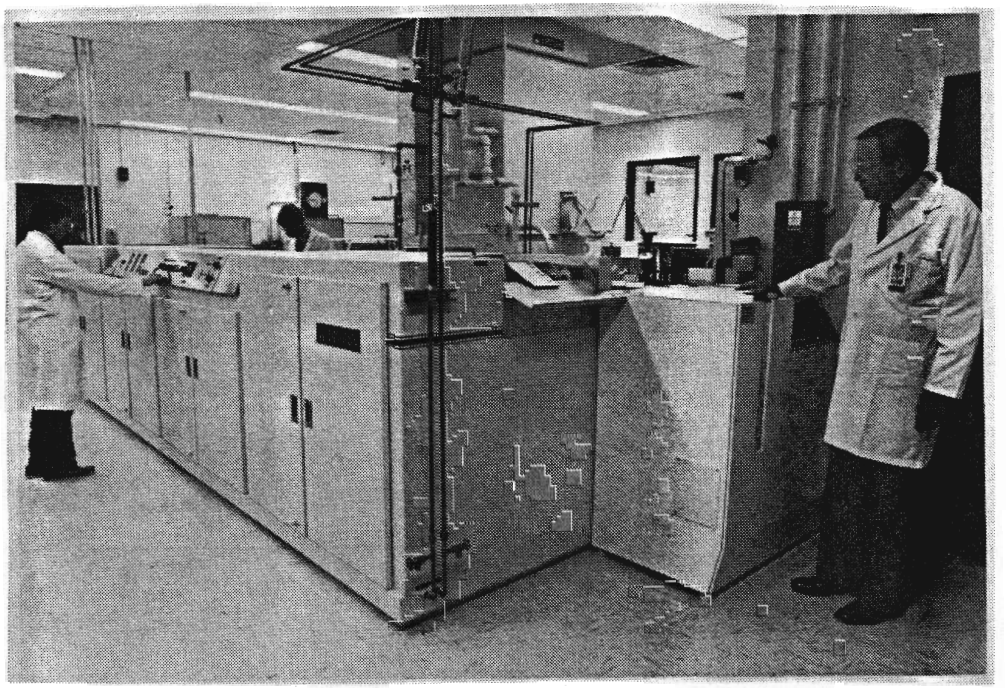
GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (CLEANING)

- IN-LINE SYSTEM
  - CONTROLLED BELT SPEED
  - CONTROLLED SPRAY PRESSURES
- SOLVENT STILL TO REPLENISH SOLVENT WHEN DIRTY
- TOP SPRAYS AT HIGHER PRESSURE TO PREVENT PWBs FROM FLOATING
- CLEAN WITHIN 10 MINUTES OF SOLDERING WHILE FLUX IS STILL WARM

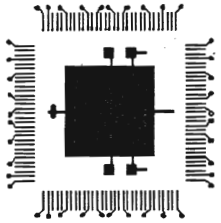
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (CLEANLINESS TESTING)

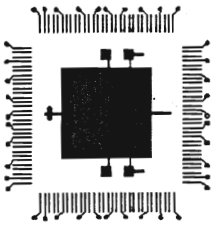
- DO NOT HANDLE PWA BETWEEN CLEANING AND CLEANLINESS TESTING WITHOUT GLOVES OR FINGER COTS
- ICOM 3000 PROVIDES 40 PSI SPRAYS FOR "MORE ACCURATE" TEST RESULTS
- PWAs PASSING OMEGAMETER WILL STILL FAIL ICOM IF DIRTY
- CAN ALSO FUNCTION AS CLEANING OPERATION
- CALIBRATION OF TEST SOLUTION EVERY 4 HOURS
- SET TEST TIME TO 3 MINUTES
- INSURE CORRECT PWA SURFACE AREA IS INPUT TO TESTER

PROCESSES AND PROCESS CONTROL

GENERAL ELECTRIC

WESTINGHOUSE

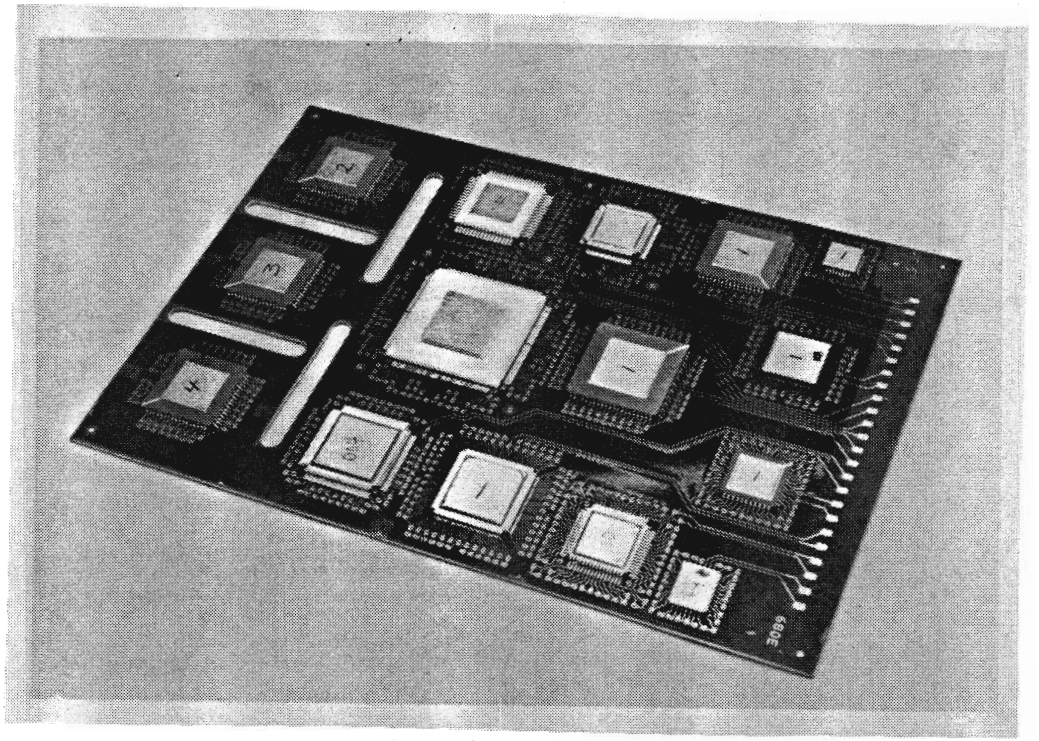
MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (CHARACTERIZATION)

- USED TO COMPARE PROCESS VARIABLES
- MEASURES
  - LCC HEIGHT OFF PWB SURFACE
  - LCC JOINT GEOMETRY
  - LEADED JOINT GEOMETRY
- CHARACTERIZATION SHOULD BE DONE BY SAME INDIVIDUAL OR PEOPLE TRAINED BY SAME INSTRUCTOR

PROCESSES AND PROCESS CONTROL

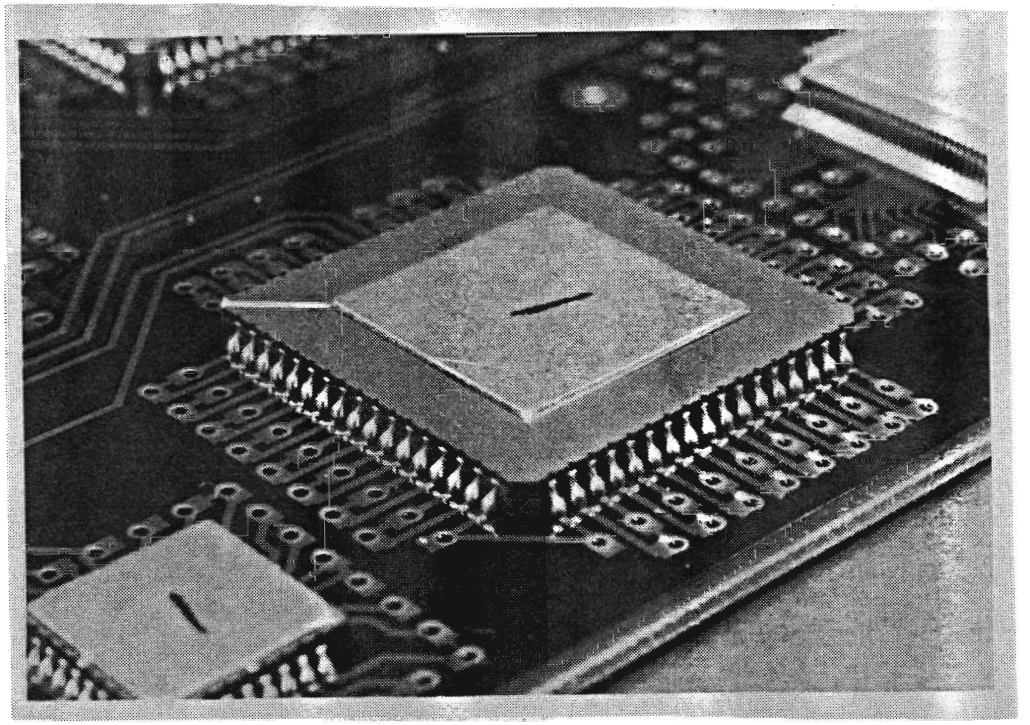


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

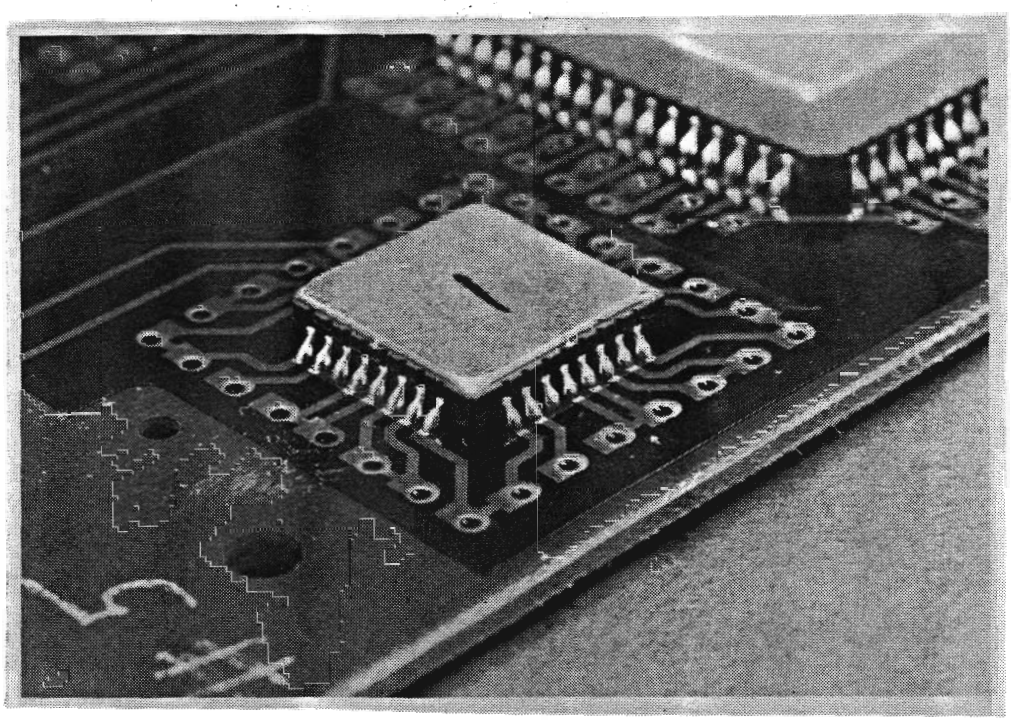


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL



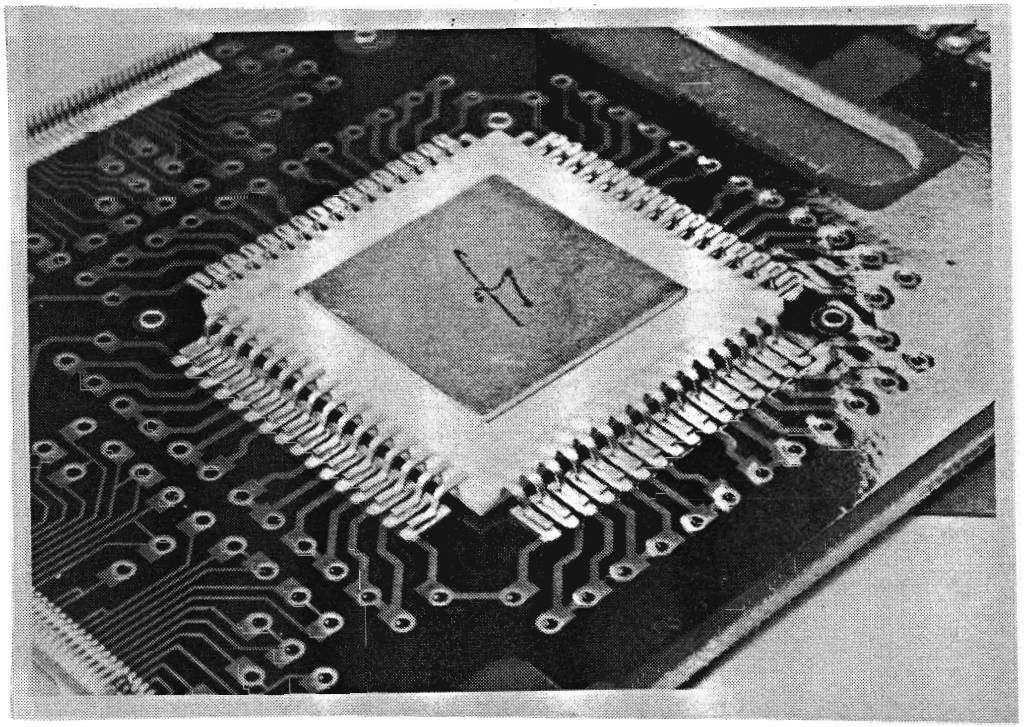
GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

89 NEPCON EAST/SD63

PROCESSES AND PROCESS CONTROL

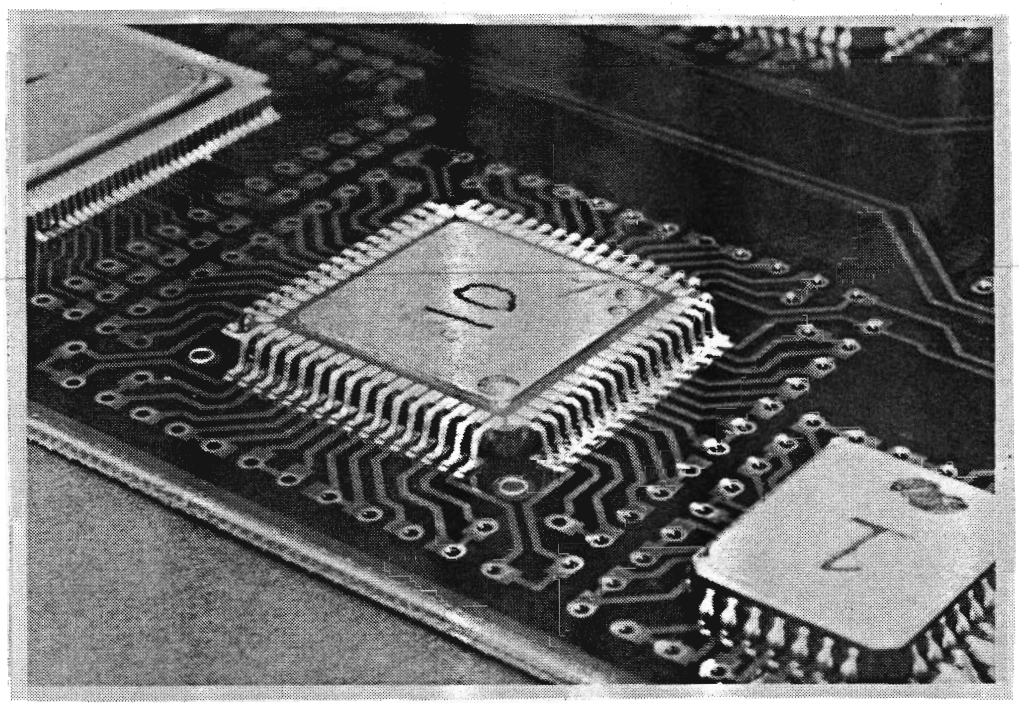


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

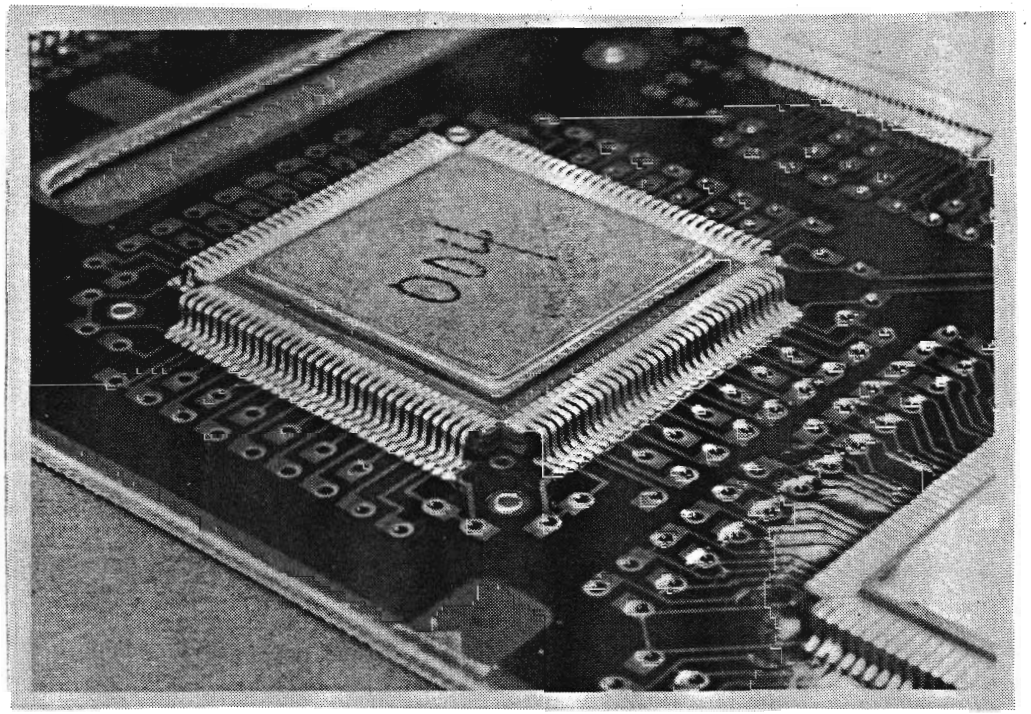


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

PROCESSES AND PROCESS CONTROL

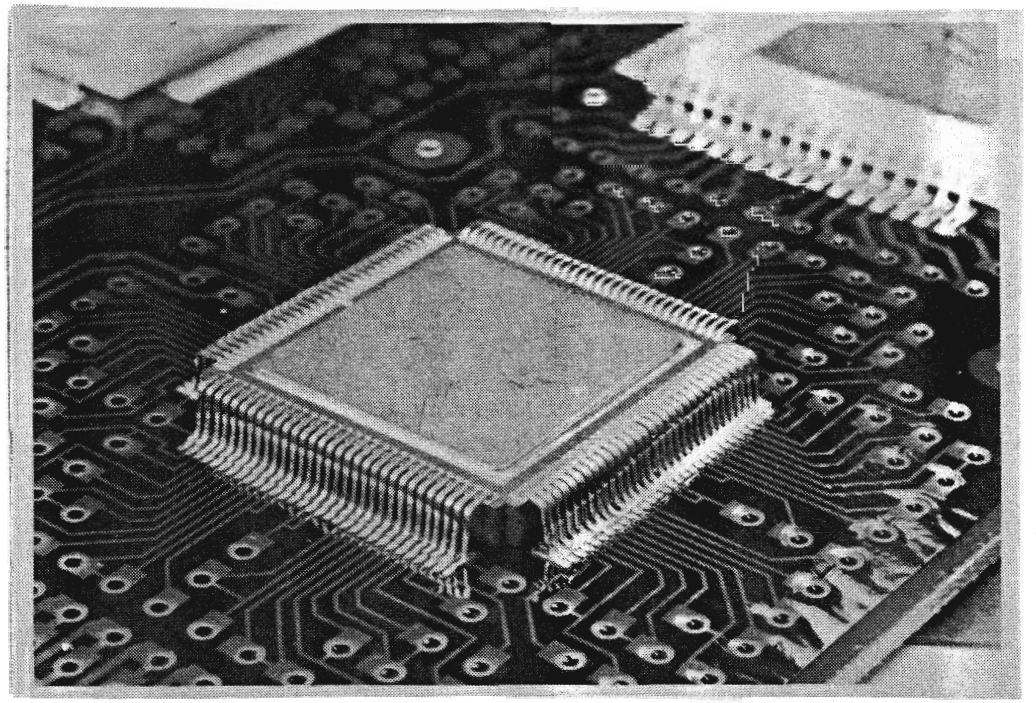


GENERAL ELECTRIC

WESTINGHOUSE

MARTIN MARIETTA

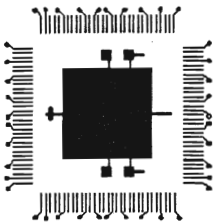
PROCESSES AND PROCESS CONTROL



GENERAL ELECTRIC

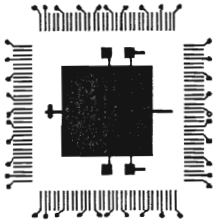
WESTINGHOUSE

MARTIN MARIETTA



PROCESSES AND PROCESS CONTROL (INSPECTION)

- OPTICAL INSPECTION TO APPLICABLE MILITARY REQUIREMENTS
- DETERMINE ELECTRICAL MALFUNCTIONS
- IDENTIFY TYPES AND QUANTITIES OF DEFECTS



PROCESSES AND PROCESS CONTROL (INSPECTION)

TYPICAL DEFECTS

NON-SOLDERED CONNECTION

BRIDGING

COLD SOLDER JOINT

FRACTURED OR DISTURBED JOINT

INSUFFICIENT SOLDER

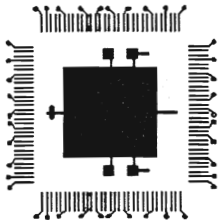
EXCESSIVE SOLDER, LEAD NOT DISCERNIBLE

POOR WETTING

SOLDER SPLATTERING/BALLS

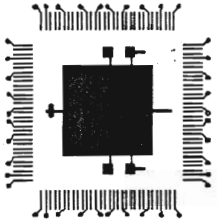
PITS, PINHOLES, VOIDS

- DEWETTING OF SOLDER CONNECTION AREA(S)
- SOLDER NOT SHINY AND SMOOTH
- FLUX RESIDUES, OIL, GREASE ON ASSEMBLY
- CONTAMINANTS IN SOLDER CONNECTION
- EXPOSED COPPER
- LEAD TOO HIGH
- COMPONENT/LEAD MISREGISTRATION
- COMPONENT NOT LEVEL
- OTHER (SPECIFY ON DOCUMENTATION)



PROCESSES AND PROCESS CONTROL (CONFORMAL COAT)

- BAKE 1-4 HOURS @ 250°F +-18°F PRIOR TO COATING
- COAT WITHIN 24 HOURS OF BAKE OR STORE IN NITROGEN
- MASK AREAS TO REMAIN UNCOATED AREAS AFTER BAKING
- SPRAY COATING IN MULTIPLE APPLICATIONS TO ACHIEVE .002" +-.001" THICKNESS
- CURE FOR 1 HOUR AT ROOM TEMPERATURE FOLLOWED BY 60 +- 20 MINUTES @ 150°F +- 12° F



PROCESSES AND PROCESS CONTROL (TEST)

- ENVIRONMENTAL
  - THERMAL CYCLING
  - VIBRATION
- ELECTRICAL

GENERAL ELECTRIC WESTINGHOUSE MARTIN MARIETTA

Text: NEWFILE
Portfolio List: Page 1 of 2

	Topic	File Path	DRW Filename	Print
1:	INTRO SLIDE	C:\FL\NEPCON\	SD01.DRW	yes
2:	GOALS OF PROGRAM	C:\FL\NEPCON\	SD02.DRW	yes
3:	THERMAL CYCLES (BACKUP SLIDE)	C:\FL\NEPCON\	SD03.DRW	yes
4:	PWB PICTURE (BARE BOARD)	C:\FL\NEPCON\	SD04.DRW	yes
5:	MATERIALS/EQUIPMENT DISCLAIMER	C:\FL\NEPCON\	SD05.DRW	yes
6:	VARIABLES CONSIDERED IN PROCESS	C:\FL\NEPCON\	SD06.DRW	yes
7:	PROCESS FLOWCHART - PREFORMS	C:\FL\NEPCON\	SD07.DRW	yes
8:	PROCESS FLOWCHART - STENCILS	C:\FL\NEPCON\	SD08.DRW	yes
9:	MATERIALS	C:\FL\NEPCON\	SD09.DRW	yes
10:	EQUIPMENT FLOWCHART	C:\FL\NEPCON\	SD10.DRW	yes
11:	MATERIALS	C:\FL\NEPCON\	SD11.DRW	yes
12:	SOLDER PASTE	C:\FL\NEPCON\	SD12.DRW	yes
13:	SOLDER PREFORMS	C:\FL\NEPCON\	SD13.DRW	yes
14:	FLUX	C:\FL\NEPCON\	SD14.DRW	yes
15:	ADHESIVES	C:\FL\NEPCON\	SD15.DRW	yes
16:	REFLOW FLUIDS	C:\FL\NEPCON\	SD16.DRW	yes
17:	CLEANING SOLVENTS	C:\FL\NEPCON\	SD17.DRW	yes
18:	ASSEMBLY PROCESSES	C:\FL\NEPCON\	SD18.DRW	yes
19:	COMPONENT PREP	C:\FL\NEPCON\	SD19.DRW	yes
20:	PRETINNING	C:\FL\NEPCON\	SD20.DRW	yes
21:	TINNING POT PICTURE	C:\FL\NEPCON\	SD21.DRW	yes
22:	LEAD FORMING	C:\FL\NEPCON\	SD22.DRW	yes
23:	FORMING DIE PICTURE	C:\FL\NEPCON\	SD23.DRW	yes
24:	FORMED 124 I/O PICTURE	C:\FL\NEPCON\	SD24.DRW	yes
25:	PREFORMS	C:\FL\NEPCON\	SD25.DRW	yes
26:	PROCESS PICTURES	C:\FL\NEPCON\	SD26.DRW	yes
27:	PROCESS PICTURES	C:\FL\NEPCON\	SD27.DRW	yes
28:	PROCESS PICTURES	C:\FL\NEPCON\	SD28.DRW	yes
29:	PROCESS PICTURES	C:\FL\NEPCON\	SD29.DRW	yes
30:	PROCESS PICTURES	C:\FL\NEPCON\	SD30.DRW	yes
31:	ADVANTAGES	C:\FL\NEPCON\	SD31.DRW	yes
32:	DISADVANTAGES	C:\FL\NEPCON\	SD32.DRW	yes
33:	PWB PREP	C:\FL\NEPCON\	SD33.DRW	yes
34:	THICK PLATE	C:\FL\NEPCON\	SD34.DRW	yes
35:	MOISTURE BAKE-OUT	C:\FL\NEPCON\	SD35.DRW	yes
36:	OVEN PICTURE	C:\FL\NEPCON\	SD36.DRW	yes
37:	STENCIL PRINTING	C:\FL\NEPCON\	SD37.DRW	yes
38:	SCREEN PRINTER PICTURE	C:\FL\NEPCON\	SD38.DRW	yes
39:	PROCESS PICTURES	C:\FL\NEPCON\	SD39.DRW	yes
40:	PROCESS PICTURES	C:\FL\NEPCON\	SD40.DRW	yes
41:	PROCESS PICTURES	C:\FL\NEPCON\	SD41.DRW	yes
42:	PROCESS PICTURES	C:\FL\NEPCON\	SD42.DRW	yes
43:	ADHESIVES	C:\FL\NEPCON\	SD43.DRW	yes
44:	LCC STANDOFF ADHESIVE	C:\FL\NEPCON\	SD44.DRW	yes
45:	EFD DISPENSER PICTURE	C:\FL\NEPCON\	SD45.DRW	yes
46:	UV CURING SYSTEM	C:\FL\NEPCON\	SD46.DRW	yes
47:	LEADED THERMAL ADHESIVE	C:\FL\NEPCON\	SD47.DRW	yes
48:	ADHESIVE PREFORM SIZES	C:\FL\NEPCON\	SD48.DRW	yes
49:	COMPONENT PLACEMENT	C:\FL\NEPCON\	SD49.DRW	yes
50:	ADEPT ROBOT PICTURE	C:\FL\NEPCON\	SD50.DRW	yes
51:	ADHESIVE CURE	C:\FL\NEPCON\	SD51.DRW	yes
52:	REFLOW	C:\FL\NEPCON\	SD52.DRW	yes
53:	VAPOR PHASE PICTURE	C:\FL\NEPCON\	SD53.DRW	yes

Text: NEWFILE
Portfolio List: Page 2 of 2

	Topic	File Path	DRW Filename	Print
54:	VAPOR PHASE CROSS SECTION	C:\FL\NEPCON\	SD54.DRW	yes
55:	VAPOR PHASE PROFILE	C:\FL\NEPCON\	SD55.DRW	yes
56:	CLEANING	C:\FL\NEPCON\	SD56.DRW	yes
57:	DETREX PICTURE	C:\FL\NEPCON\	SD57.DRW	yes
58:	CLEANLINESS TESTING	C:\FL\NEPCON\	SD58.DRW	yes
59:	ICOM 3000 PICTURE	C:\FL\NEPCON\	SD59.DRW	yes
60:	CHARACTERIZATION	C:\FL\NEPCON\	SD60.DRW	yes
61:	PWB PICTURE (COMPLETED)	C:\FL\NEPCON\	SD61.DRW	yes
62:	68 I\O .050 PITCH LCC	C:\FL\NEPCON\	SD62.DRW	yes
63:	32 I\O .040 PITCH LCC	C:\FL\NEPCON\	SD63.DRW	yes
64:	64 I\O .050 PITCH LEADED	C:\FL\NEPCON\	SD64.DRW	yes
65:	64 I\O .040 PITCH LEADED	C:\FL\NEPCON\	SD65.DRW	yes
66:	132 I\O .025 PITCH LEADED	C:\FL\NEPCON\	SD66.DRW	yes
67:	124 I\O .020 PITCH LEADED	C:\FL\NEPCON\	SD67.DRW	yes
68:	INSPECTION	C:\FL\NEPCON\	SD68.DRW	no
69:	INSPECTION - DEFECTS	C:\FL\NEPCON\	SD69.DRW	no
70:	CONFORMAL COAT	C:\FL\NEPCON\	SD70.DRW	no
71:	TEST	C:\FL\NEPCON\	SD71.DRW	no
72:				no
73:				no
74:				no
75:				no
76:				no
77:				no
78:				no
79:				yes
80:				yes
81:				yes
82:				yes
83:				yes
84:				yes
85:				yes
86:				yes
87:				yes
88:				yes
89:				yes
90:				yes
91:				yes
92:				yes
93:				yes
94:				yes
95:				yes
96:				yes
97:				yes
98:				yes
99:				yes
100:				yes

falls will be clearly
ective action alterna-
This course reflects
d over the past ten
s te ques and find-
vith t mplementa-
(17) surface mounting
erous new SMT prod-
pant will be provided
nical workbook. This
ed specifically for sur-
d soldering profes-
ent training. The
s a wide variety of
ns which are used
ining program to
oblems and solutions.
end This Course?
ff, technical manage-
or line position and
sing or plans to use
technology, you
course. This course
beneficial to quality
gineers. Also, design
to acquire a higher
ling in the area of
nanufacturing. Those
ing or sales of sur-
ted equipment and
benefit from this

ec
Military
oD 2000)
n Raby, Soldering
tional Inc.

Course
e are accustomed to
lder joints and elec-
purely for cosmet-
netics must be
ur emphasis must
ect, *"Integrity"*. We
doesn't look good.
dustry with the ratio-
r cosmetics and to
rison of, and new
Inspection for

egrity and what

if cosmetics are
g and/or just a

uch indiscriminate
ints within our
iminate touchup is
t that the solder
does not look like
he picture in our
ir pecification.
lly serves to
tion rather than
it can do internal
ge to our circuit
his costs money.

II. Course Content

We will begin with the cosmetic requirements and how/why they originated. We will then progress through new rationale and test data to show the solder joint inside.

What it looks like on the outside when it is good inside and commence a philosophy change in inspection criteria.

The program will be comprised of slides and photographs of the external solder joint, microsections of good, bad, and marginal joints. There will also be presented pull test data and thermal fatigue data and resulting microsections. It is planned that this data will then be presented to the industry in different forms of educational formats in order to upgrade the knowledge of our industry solder experts.

III. Who Should Attend This Course?

This session is most likely to appeal to and be attended by the facility soldering guru; manufacturing/quality engineer, process engineer, inspection supervisor and inspectors, as well as managers of the assembly line.

PAC 9

Advanced Design/Manufacturing Techniques for High Speed Digital Processing

Course Leader: Dr. Gail Love, Technical Director, Martin Marietta Missile Systems

I. Objectives of the Course

This course will cover the latest design and manufacturing techniques that are being employed in the design of high speed digital electronic circuits/assemblies. The material to be presented has been developed under the Manufacturing Technology For Advanced Data/Signal Processing (AS/SP) Program.

This will be the first time that the data generated on the AD/SP Program has been taught to the general public. This course will concentrate on providing the attendees with the fundamental design equation, material selection rationale and processes for implementing high speed digital electronic circuits.

II. Course Content

The course is divided into three topic areas. Design: PWB layout; high speed electrical design; thermal considerations; reliability. Materials: Material selection; material specifications; testing and control. Processing: PWB processes/process control; PWA processes/process control.

Emphasis will be placed on presenting the material in such a way that the interrelationships between these key technical areas are clearly understood.

III. Who Should Attend This Course?

This course should be attended by those individuals who are directly involved with the design, materials, and/or processing of advanced electronic circuits. It is intended that those who attend this course will be able to use the information presented as a teaching aid within their own facilities.

WEDNESDAY June 14, 1989
9:00 a.m.

WORKSHOP 3

Beyond SMT— Fine Pitch Technology (FPT)

Course Leader: Phil Marcoux, President, PPM Associates

I. Objectives of the Course

This course will introduce potential users to the new design and assembly demands of a new breed of high lead count, lower cost IC packages. These packages known under various names such as TAB, PQFP, VSOIC and Tapepak are generally characterized by surface attachable leads whose pitches are 0.025" or less center to center.

II. Course Content

This course includes a description of the package types. Cost performance and size advantages will be reviewed with emphasis on the cost situation that differs significantly from the early SMT period. The course will conclude with a discussion of the design and board assembly requirements and suggestions of how to minimize capital expense and extra assembly problems.

III. Who Should Attend This Course?

Design and manufacturing engineers, managers and purchasing personnel interested in preparing for the next evolution in packaging and assembly technology.

SESSION 19

Emerging MLB SMT Construction Strategies for the 90's

Chairman: William Teat, Engineering Manager, Motorola Inc.

"Process Technology for Fine-Line Controlled Impedance Printed Circuit Boards", Tony Sweet, Psi Star
"Performance Benefits of Resin Systems Beyond FR4", Richard Hein, Norplex/Oak
"Solder Mask Testing for Hi-Rel Printed Circuit Boards", Frank Juskey, Motorola Inc.
"Blind Via—A Useful Tool for High Density SMT Realization", Alan Beekman, Futura Circuits Corporation
"Integramount, an Alternative to Solder Finish", Bob Davenport and Tom Weaver, Printed Wiring Inc.

SESSION 20

VXIbus ATE Systems

Chairman: David Haworth, VXI Program Manager, Tektronix, Inc.

"A VXI
Hollist
San Di
"Multi-
Wolfe,
Instrur
"Solvir
Functic
Ing Ma
"Embe
Baasch
Radix I
"Integr
Using
and Sc
ing Ma
Inc.
"Cost E
The For
Solutio
uct Spe

SESSION

**Case S
Succes**
Chairm
CEO, C

"Triboel
Materia
Materia
Product
"TBA", T
Enginee
"Standa
Includin
tion Tes
Dischar
Adrienn
and Der
Corpora

SESSION

**Proces
Assem**
Chairma
Project
Enginee

"Alterna
Solvent
Dr. Kirk
Ist, Allie
Blakesl
"Flux Se
Negate
Technic
Center,
"Alterna
Do We N
New Ma
Johnson
Researc
"Defluxi
Kawales
Chemic
"Govern
Removin
ing Usin
spheric

NEPCON EAST '89

SESSION PROPOSAL

Nepcon East '89
Bayside Exposition Center
Boston, Massachusetts
June 12 - 15, 1989

Proposed Chairman's Name: Gail F. Love

Company Address: Martin Marietta Corporation
Martin Marietta Missile Systems
P.O. Box 555837
City/State/Zip: Orlando, Florida 32855-5837

Telephone,FAX: (407)356-5706, (407)356-3393

1. Proposed Topic: Advanced Design/Manufacturing Techniques For High Speed Digital Processing

2. Focus Of Proposed Topic:

This one-day professional advancement course will cover the latest design and manufacturing techniques that are being employed in the design of high speed digital electronic circuits/assemblies. The material to be presented has been developed under the Manufacturing Technology For Advanced Data/Signal Processing (AD/SP) Program, Contract F33615-85-C-5065, funded by the Materials Laboratory of Wright-Patterson Air Force Base in Dayton, Ohio.

The primary purpose of this session is to make the data developed during the program available to the technical community in a training type environment so that the attendee's will be able to learn how to implement the technology into their own electronic systems/subsystems.

This will be the first time that the data generated on the AD/SP Program has been taught to the general public. The course will concentrate on providing the attendee's with the fundamental design equations, material selection rationale, and processes for implementing high speed digital electronic circuits.

3. Who Should Attend:

This course should be attended by those individuals who are directly involved with the design, materials, and/or processing of advanced electronic circuits. It is intended that those who attend this course will be able to use the information presented as a teaching aide within their own facilities.

4. Planned Technical Composition:

The course will be divided into three topics:

A) Design
B) Materials
C) Processing

Emphasis will be placed on presenting the material in such a way that the interrelationships between these three key technical areas are clearly understood.

5. Proposed Speakers And Planned Technical Papers:

Subject	Paper	Speaker	Co	Time
Overview		G. Love	MM	15 Min
Design				
	PWB Layout	G. Love	MM	30 Min
	High Speed Electrical Design	R. Canright	MM	2 Hr.
	Thermal Considerations	V. Brzozowski	WEST	30 Min
	Reliability	G. Love	MM	45 Min
Materials				
	Material Selection	V. Brzozowski	WEST	30 Min
	Material Specifications, Testing and Control	W. Pattison	MM	30 Min
Processing				
	PWB Processes/Process Control	J. Chamblin	MM	1 Hr
	PWA Processes/Process Control	S. Dahne	WEST	1 Hr