



# Hughes

Circuits, Inc.



The Experts in  
Printed Circuits

**(760) 744-0300**

**[sales@hughescircuits.com](mailto:sales@hughescircuits.com)**



## Company Background

**Hughes**  
Circuits, Inc.

### **A Performance-oriented Legacy**

#### **Founded in 1999 by Jerry Hughes**

- 47 years in the circuit board business, founding 2 successful prototype PCB companies
- Spearheaded and implemented in-house prototype facilities within Burroughs, NCR and Unisys
- The underlying theme of the company – strong front-end and engineering support
- Keen understanding of time sensitive products and constraints



## Company Background

**Hughes**  
Circuits, Inc.

- Privately Held Corporation
- Circuit Board Layout, Fabrication, and Assembly
- All processes within same facility, in San Diego
- Many years experience in Commercial, Medical and Military markets
- Fully EPA and environmentally compliant
- 160 Employees
- Shifts: 3 Fab, 2 Assembly
- SD Business Journal Top 100.
- 50,000 Sq Ft ITAR Facility

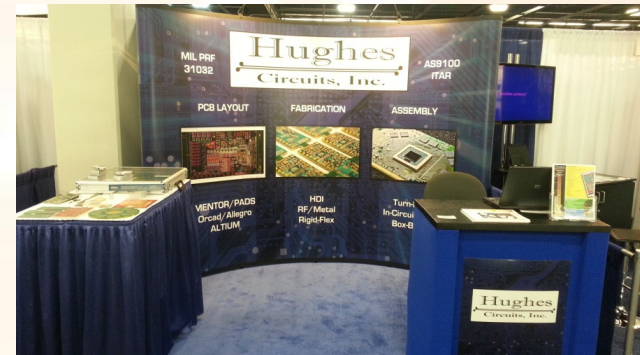




## Company Background

**Hughes**  
Circuits, Inc.

- CAGE 1KXU6
- Active in Trade Shows
- Growing 15%+ Yr/Yr
- Operating at 65% Capacity
- Recent Capital Investments
  - Additional LDI
  - Additional LASER
  - . Additional AOI





# Company Background

**Hughes**  
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## MIL/AERO 65%

**L3 Communications**

**Boeing**

**General Atomics**

**Raytheon**

**Northrop Grumman ( Supplier of the Year)**

**Aethercomm**

## MEDICAL 20%

**Boston Scientific**

**Sparton Medical**

**Medtronic**

**Illumina**

## COMMERCIAL/IND 15%

**Universal Electronics**

**Delta Design**

**Microprobe**

**SRAM**

**PANAVISION**

**These are to name a few of our satisfied customers.**

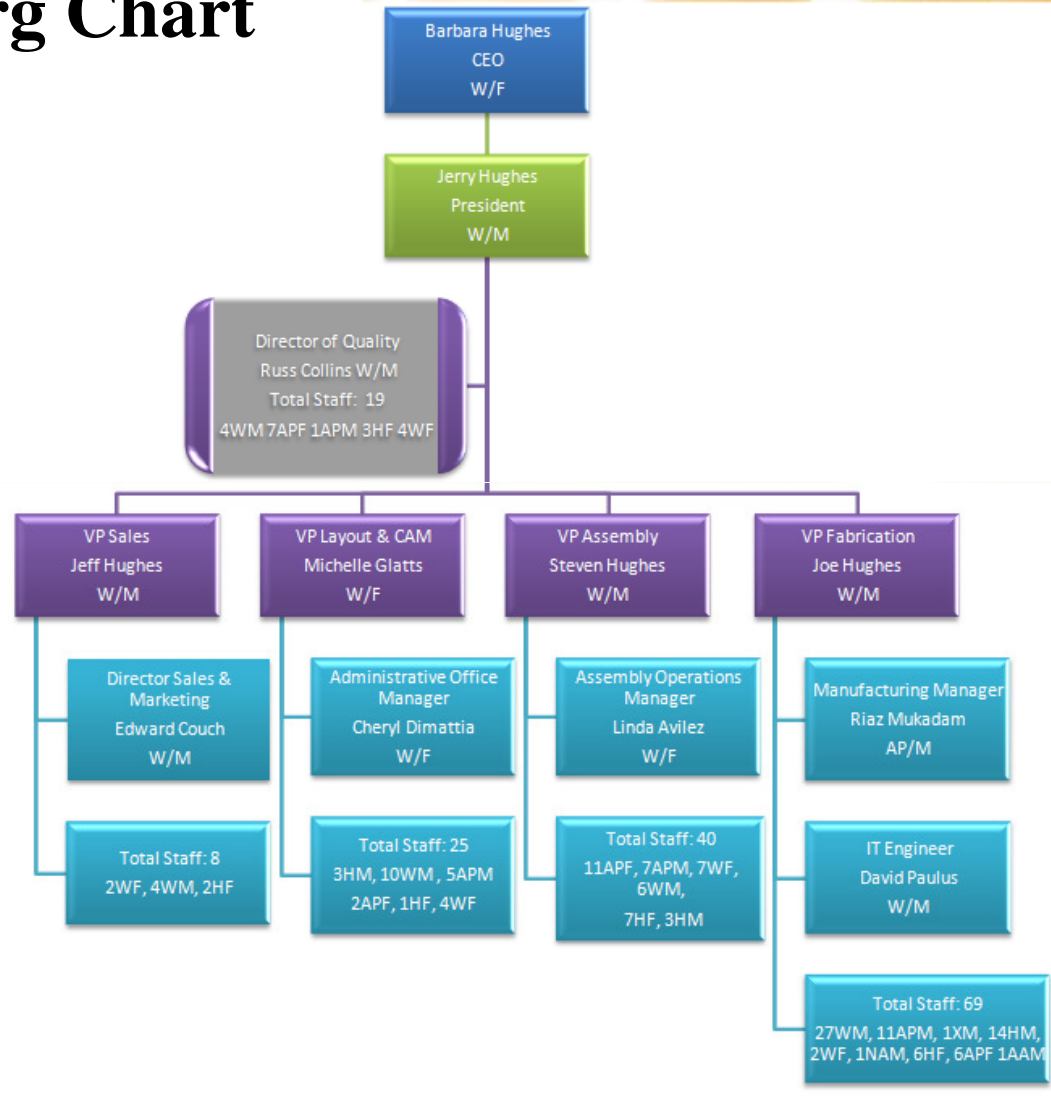
**References available upon request**



# Company Background



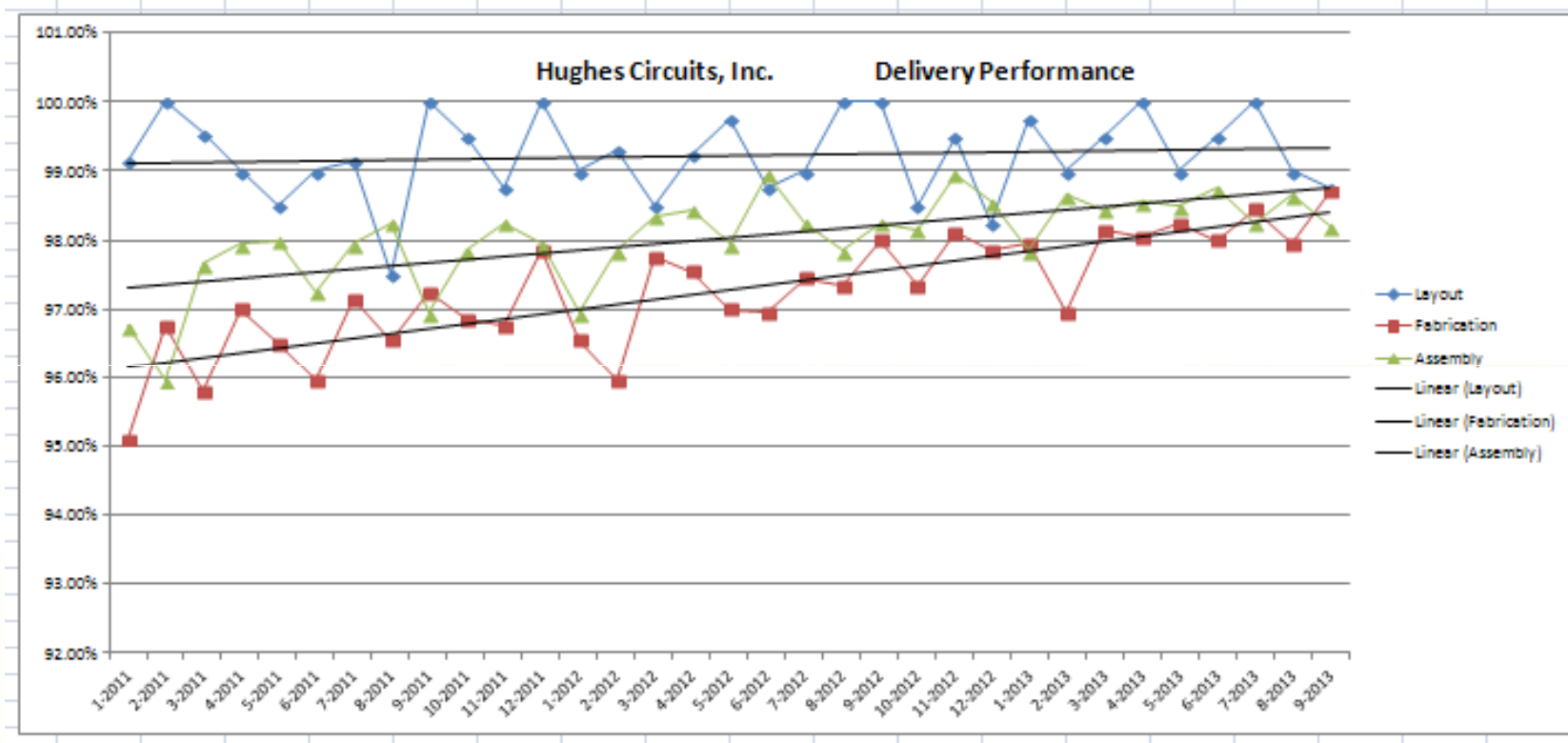
## Org Chart





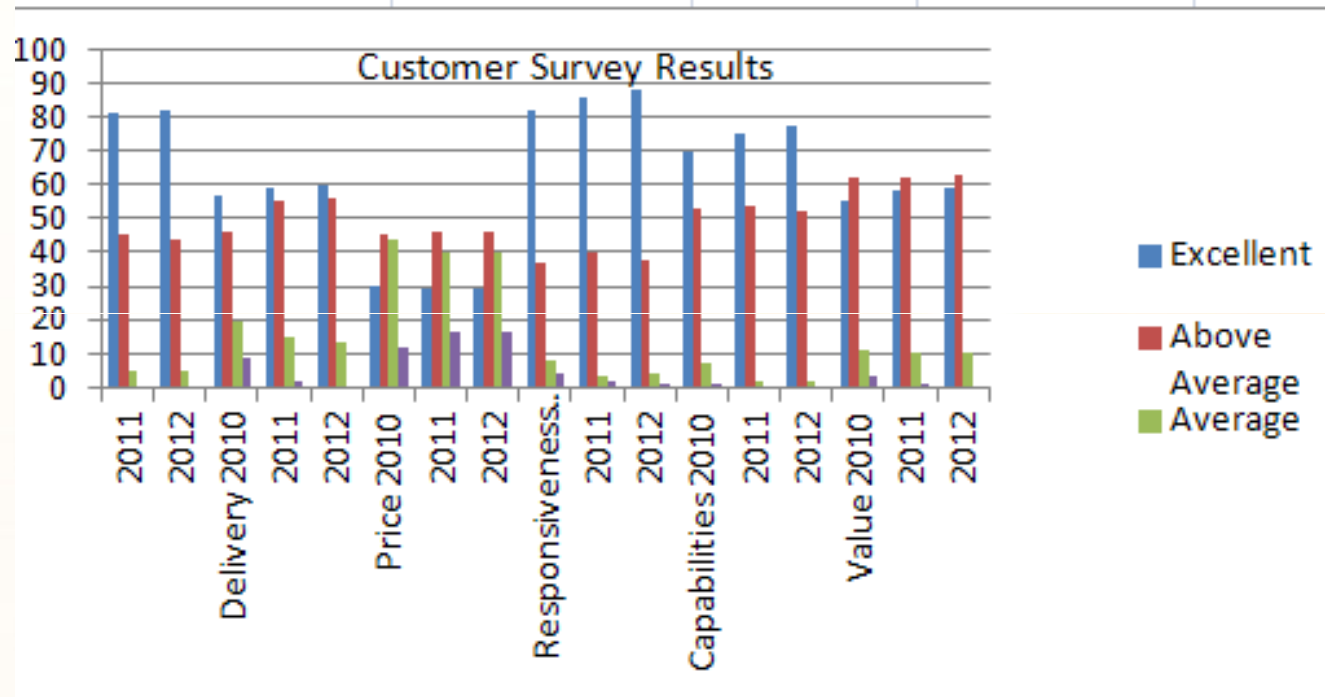
# Company Background

**Hughes**  
Circuits, Inc.





# Company Background







## Company Background

**Hughes**  
Circuits, Inc.

### Industry Accreditations

- ISO 9001:2008, AS9100C Certified
- Mil PRF 31032 & 55110 Certified
- ITAR Registered
- IPC standards 6012B, 6013, 6018, Class 2 and 3(A)
- A member of IPC, SMTA
- Award Winning DLA Certified LAB





**Your Layout Partner**

**Hughes**  
Circuits, Inc.

## **Hughes Teams with your Board Layout Designers**

### **A Performance-oriented Resource Partner:**

- Gives you one source Layout/build
- Controlled outsourcing
- One point of contact for complete process

### **Featuring:**

- Both original board Layout and repackaging
- Experienced, Senior Layout Engineers
- Hundreds of satisfied clients



**Your Layout Partner**

**Hughes**  
Circuits, Inc.

**Providing a broad range of Layouts including:**

- Through-hole conversion
- Ultra high density, BGA-rich boards (25,000+ pins)
- RF and mixed signal boards
- Power supply boards and
- Low-power boards for portable products



**Your Layout Partner**

**Hughes**  
Circuits, Inc.

## **Flexible Circuits**

- Greater freedom of design, increased product reliability and reduced space requirement in packaging
- Designing flexible circuits for new applications can be challenging, we have the expertise.
- We design and build flex, multilayer flex and rigid flex up to 12 layers.



**Your Layout Partner**

**Hughes**  
Circuits, Inc.

## **Talent and Tools**

### **Experience :**

- 7 Full-Time Layout Engineers, average over 20 years of PCB layout experience with wide variety of designs
- All are IPC Certified Interconnect Designers (CID)

### **Tools:**

- Allegro XL, PADS/Exp, Altium, Orcad, DxDesigner
- Valor Genesis, Polar and PCB Libraries



## Your Layout Partner

**Hughes**  
Circuits, Inc.

### **Input and Deliverables**

#### **Input :**

Netlist or Schematic  
Board Outline Drawing  
Bill of Materials (Excel preferred)  
Datasheets for parts  
Critical Component Locations (if applicable)  
Critical Routing Constraints (if applicable)  
Layer Constraints

#### **Deliverables:**

Fabrication drawing (PDF and/or DXF)  
Assembly drawing (PDF and/or DXF)  
PADS, Allegro, Expedition or Altium database  
Gerber files, NC-Drill file, and IPC netlist  
Pick and Place file (component location co-ordinates)  
Check Plots (PDF)  
Valor Design for Manufacturing Analysis (additional charge applies)



# General Manufacturing Capabilities

**Hughes**  
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## Fabrication Materials

- RF Boards
  - Rogers, Taconic, Arlon  
Nelco
- FR4
  - Isola, Nelco, Getek
- Polyimide
  - Isola, Nelco, Arlon
- Flex
  - Dupont, Panasonic
- Metal Backed Fabrication
  - Aluminum, Copper, Brass

## Fabrication Capabilities

- 1-50+ layers
- 10 to 1 Mech Drill aspect ratio
- 1 to 1 laser via
- Reverse Pulse Plating
- 100% Netlist testing
- Controlled Impedance –TDR
- Controlled dielectrics





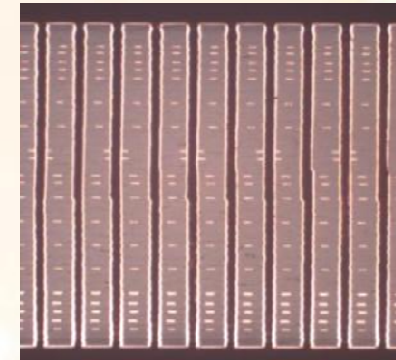
# General Manufacturing Capabilities

**Hughes**  
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## Technologies

- Controlled depth drill, laser blind vias
- Burr free plated edges and half-holes
- Multilevel “Cavity” Boards
- Blind and Buried vias
- via-in-pad, conductive filled holes
- Conductors and spaces down to 2 mils
- Multilayer thickness from .015” to .325”
- Buried Resistance and Capacitance
- Metal Backed Boards, Aluminum, Copper etc.

30 to 1 aspect

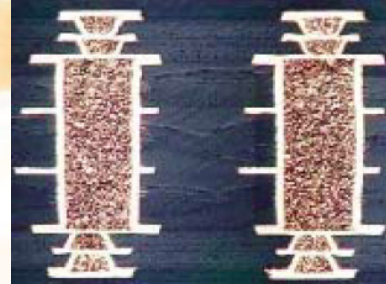




# General Manufacturing Capabilities

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## HDI Blind/ Buried/Stacked Vias



Combination of filled microvias with filled buried via – plated over.

### Blind Via 3<sup>rd</sup> Level

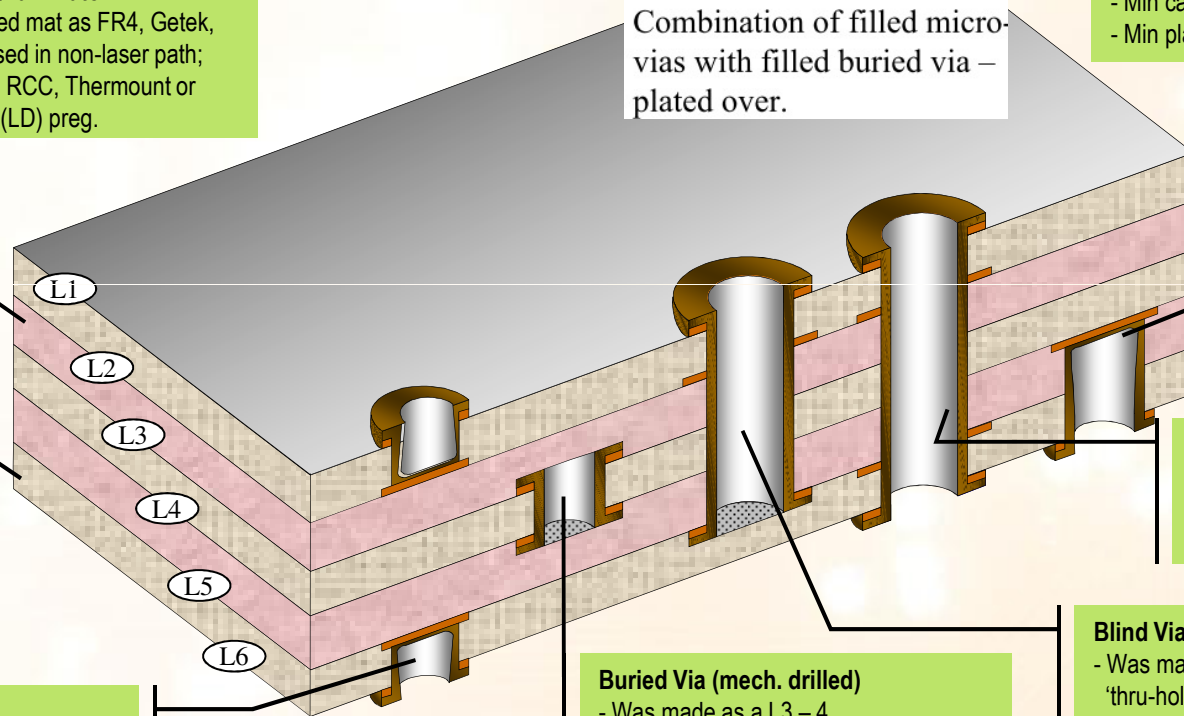
- Laser drilled
- Aspect ratio, drill/thk 1/2:1
- Min drill size .006"
- Min capture pad = drill + .008"
- Min plating .0005"

### Material: Core / laminate

- Glass reinforced mat as FR4, Getek, GIN may be used in non-laser path;
- Otherwise use RCC, Thermount or laser drillable (LD) preg.

### Material: Prepreg

- Laser compatible: RCC, LD Preg and Thermount;
- Optimum thickness .002 to .004"



### Standard Thru Hole

- Aspect ratio, drill/thk: 13:1
- Min pad size: drill + .008
- Min drill size: .008"

### Blind Via (2<sup>nd</sup> Level)

- Laser drilled
- Aspect ratio, drill/thk 1/2:1
- Min drill size .004"
- Min capture pad = drill + .008"
- Min plating .0005"

### Buried Via (mech. drilled)

- Was made as a L3 – 4 'thru-hole' package.
- Min material core thickness .008" (for non-filled technology)
- Min drill size .004"
- Min plating .0005 (IPC-6012A class 2)

### Blind Via (mech. drilled)

- Was made as a L1-5 'thru-hole' package; L6 was then added.



## Board & Plating Finishes

### Board Finishes

- LPI/LDI (liquid photo imageable) solder mask and silk screen
  - TAIYO
- Entek / OSP
- Carbon ink

### Plating Finishes Available

- HASL (hot air level)
- Lead Free HASL\*
- ENIG
- ENIPIG\*
- Hard/Soft gold
- Imm. Silver & Tin
- Rhodium/Palladium\*
- Solder Fusing \* Outside process



# General Manufacturing Capabilities

**Hughes**  
Circuits, Inc.

## Industry Standards

- ISO 9001:2008, AS9100C Certified
- Mil PRF 31032 & 55110 Certified
- Flight Certified NASA
- ITAR Registered
- IPC standards 6012B, 6013, 6018, Class 2 and 3
- A member of IPC, SMTA



## Equipment

**Hughes**  
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### **ENGINEERING**

Pentalogix CAM Master ( Sales )  
Frontline Valor GenFlex ( Production )  
POLAR SI9000 Stackup Simulation

### **TESTING**

Micro Craft Moving probe Testers  
Orbotech Discovery 6000 AOI  
Omega Meter 500 Ionic Contamination Test System  
Micro-Vu Measuring Center  
CMI-9000 XRF  
Zmetrix Impedance Test System



## Equipment

**Hughes**  
Circuits, Inc.

### **PRODUCTION**

Orbotech 9008 LDI Photo Plotter  
Multiline Tooling  
Direct Metallization Line  
Plasma Etch  
OEM Vacuum lamination Press  
Uniline 2000 Drill  
Concept 1 and 4 Drill  
Excellon 129 Vision Drill  
Excellon 300 Routers  
Excellon Co2 & UV laser  
Colight Photo Printers  
Haas 3 Axis CNC Milling Center



## Quality Control

**Hughes**  
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### Standard Quality Control Procedures

- 100% Netlist tested with a moving probe tester
- Cross sectioned to ensure acceptable verification and plating
- Coupons and cross sections available upon request
- All Inspectors are IPC 600 certified



## Assembly & Quality Control

**Hughes**  
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### **In-House Assembly**

- 24 hour quick turn PCB assembly, Turnkey or CFM
- Machine placement at up to 15,000 cph
- Through hole, surface mount , ultra fine pitch .3mm, 01005
- All BGA joints are x-ray inspected
- 100% inspection per IPC 610, J-001
- Conformal Coat
- Flying Probe Test
- Box Build





## Conclusion

**Hughes**  
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**Printed circuit board quality is directly related to  
*Manufacturing Expertise in a Controlled Environment***

### **Hughes Circuits has:**

- Attracted high technology board designs too complex for the average .
- Leveraged the knowledge gained from building complex board designs for the client's benefit.
- Developed processes and systems which reliably produce great boards whether simple or complex.



## Conclusion

**Hughes**  
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***All this translates into a Great Partner for You***

### **You Made the Right Choice with Hughes Circuits**

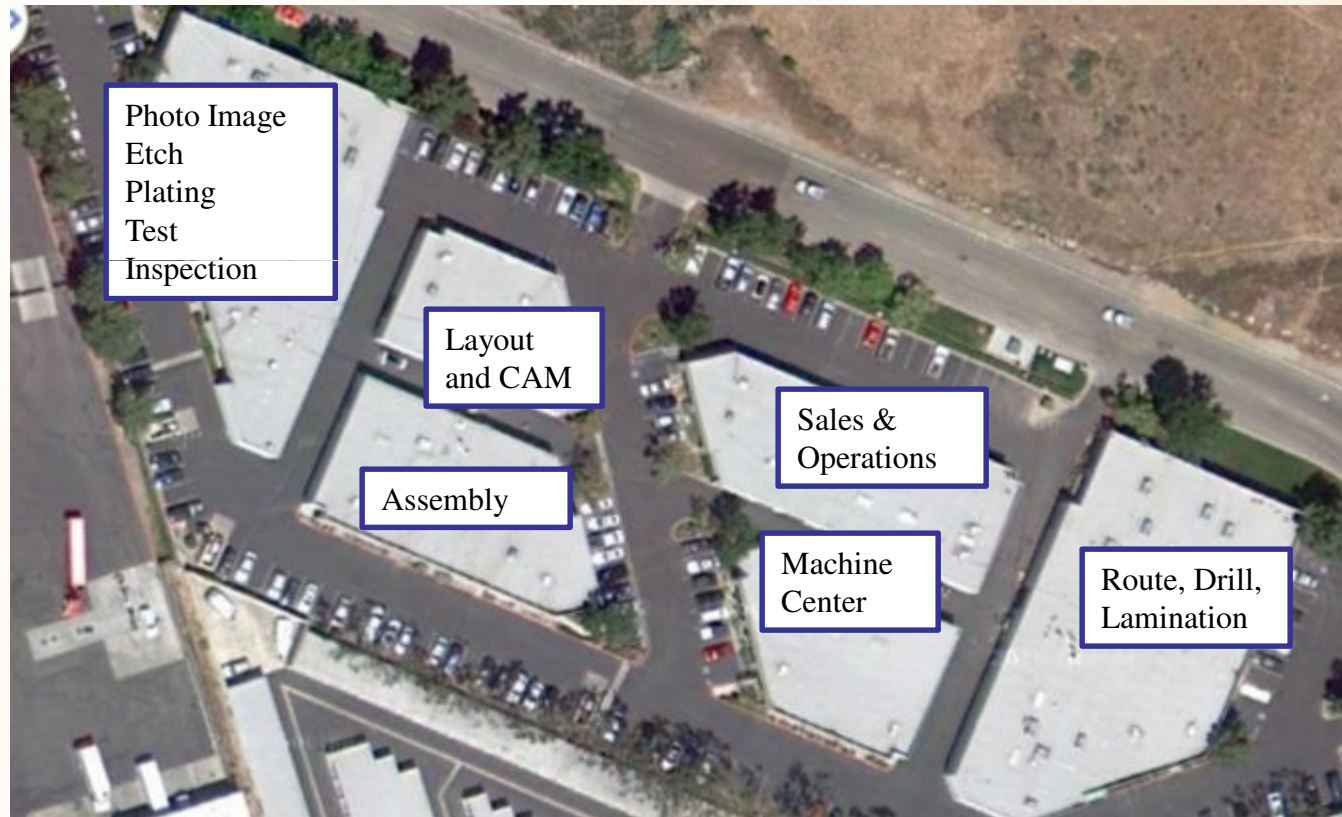
- Big enough to do the job perfectly
- Small enough to have a personal touch
- Always keeping clients informed and updated



# Virtual Tour



## Hughes Circuits Campus





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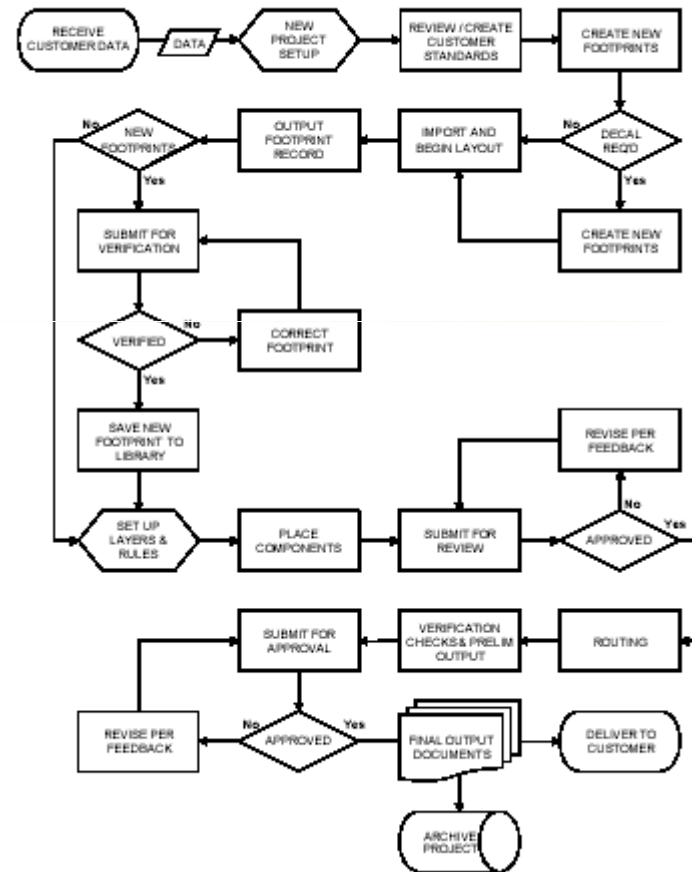
## Hughes Circuits Layout /CAM





## Layout Process

10.1 Layout Process Flowchart





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## IPC CID + Certified Layout





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## Hughes Circuits PCB Layout

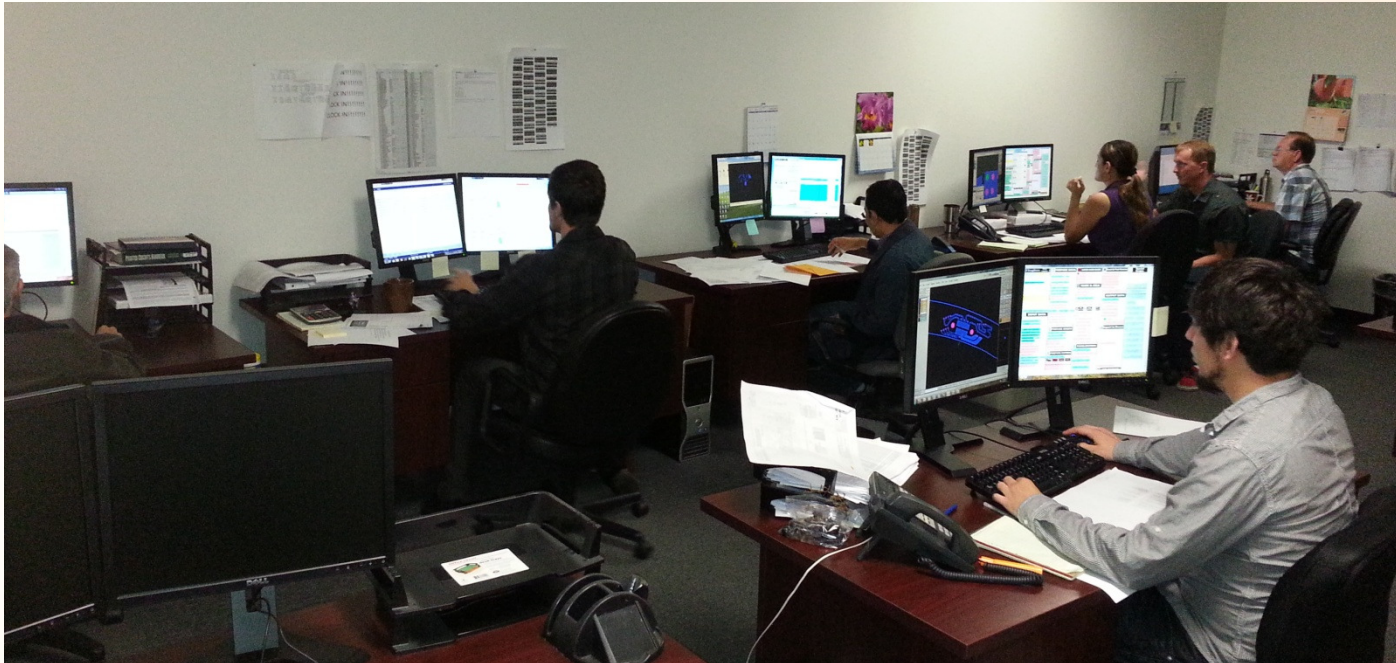




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## Hughes Circuits CAM Engineering







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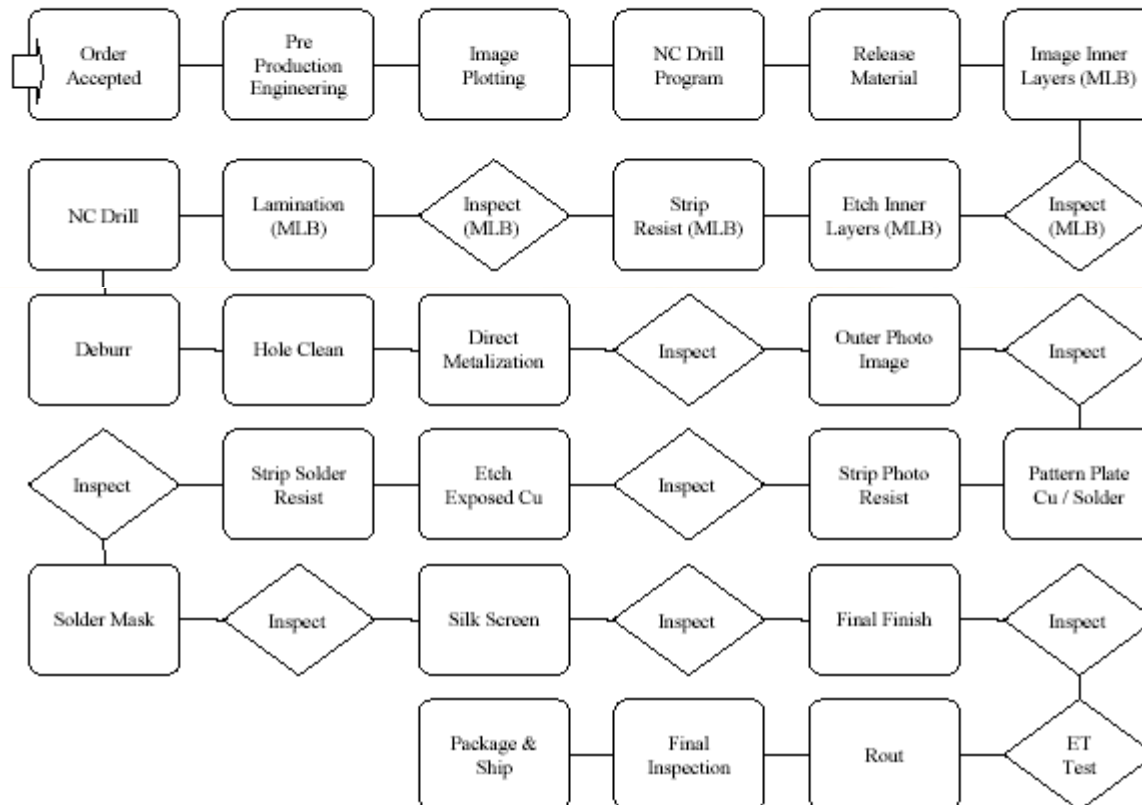
## PCB Fabrication





## Fabrication Process

10.2 Fabrication Process Flowchart





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## Photo Resist





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## Laser Direct Imaging





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## **Cupric Etcher Inner/Flash Etch**





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## Automated Optical Inspection





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## Lamination Presses





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## Drill Machines







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# 129 Intelli Drill with Vision System

# Excellon

## 129 VISION DRILL



### High Speed Spindles for Micro-via Drilling

High Density Interconnection (HDI) technology requires change of micro-vias and blind vias. Smaller holes require higher spindle speeds for improved hole wall quality. The full range, high speed spindle also provides increased torque for large hole diameters.

### Excellon Z Axis Precision (ZAP) Depth Control

Depth control drilling ( $\pm 0.0005$ ") of blind via, counter sink, counter bore, pocket routing and milling rails.



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### Lasers – Excellon Cobra and ESI CO2/UV



- HIGH POWERED DIODE-PUMPED SOLID-STATE UV LASER
- SEALED SUPER-PULSED CO<sub>2</sub> LASER
- HIGH-SPEED SCANNERS/LINEAR MOTORS
- TELECENTRIC LENSES



#### Specifications

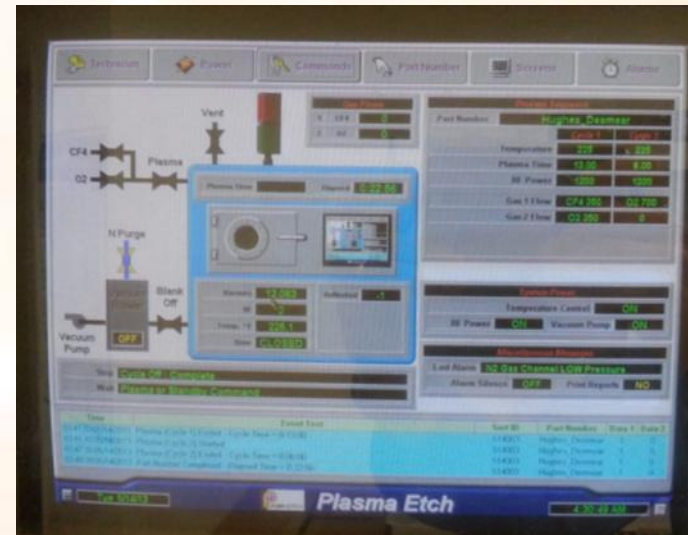
- High power diode-pumped, repetitively q-switched Nd:YAG laser
- Wavelength: 355nm
- Pulse width @ 5kHz: 40 nsec (typical)
- Power: 2W
- Repetition Rate : 5-20 kHz
- Stage Resolution : 1um
- Accuracy : +/- 20um
- Max velocity: 500 mm/sec



# Virtual Tour



## Plasma Clean/Etch





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## **Direct Metallization- Hole Plate**





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## Hole Fill & Planarization

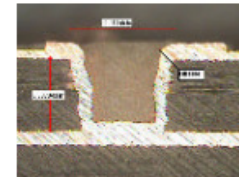
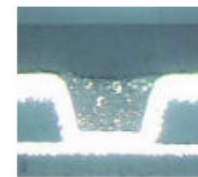
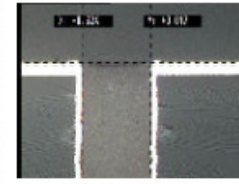
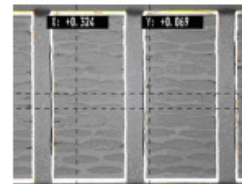


Horizontal Via Hole Filling VHF 300 V with Vacuum

Typical Fill Materials:

- Peters
- Tatsuta
- CB-100
- San-ei
- Taiyo

max. Aspect Ratio 1:40

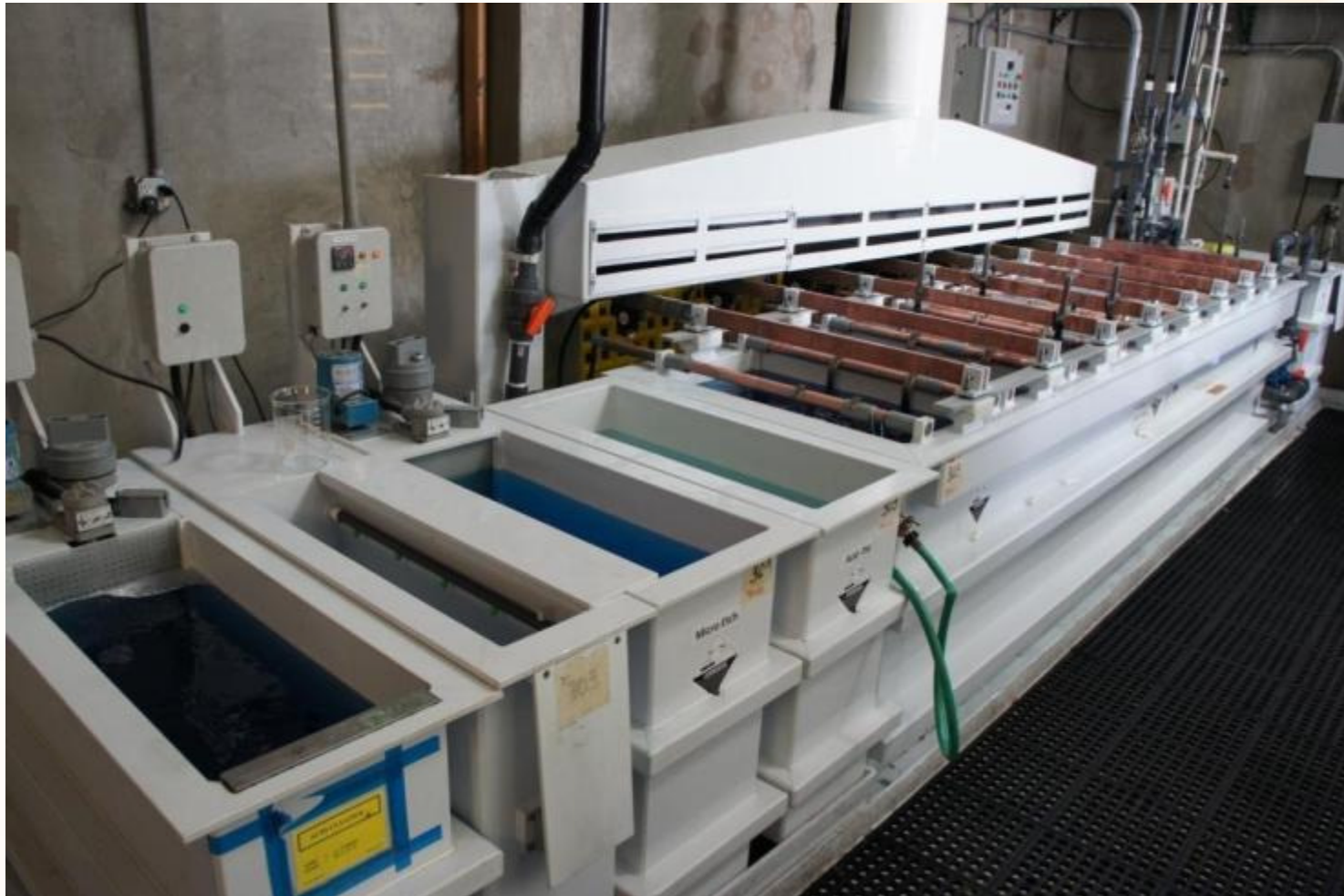




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## Pattern Copper Plate





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## Solder Plate





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## **Ammonia Etcher Outer layers**







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## Strip Solder





# Virtual Tour

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## Soldermask /Silkscreen





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**ENIG- Immersion Gold**





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# HASL





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## Soft / Hard Gold , Imm Tin





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## Electrical Test





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**Route**





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## Haas CNC Machine Center







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**V-Score**





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# Optical Measuring System

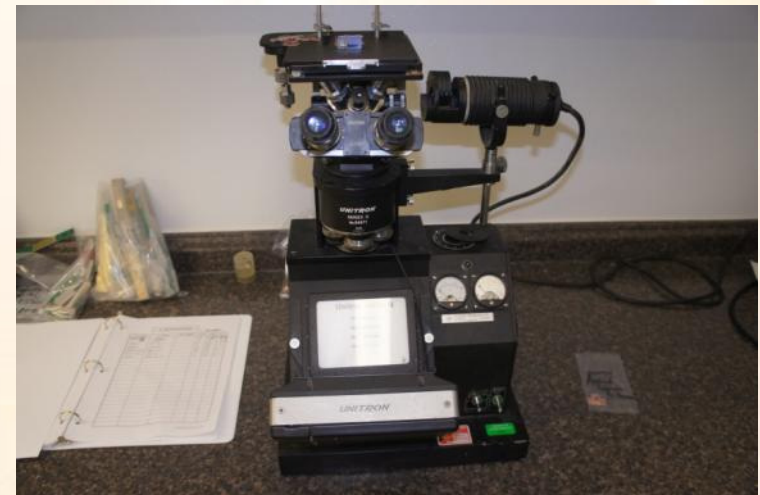




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## Cross-Section Analysis Lab





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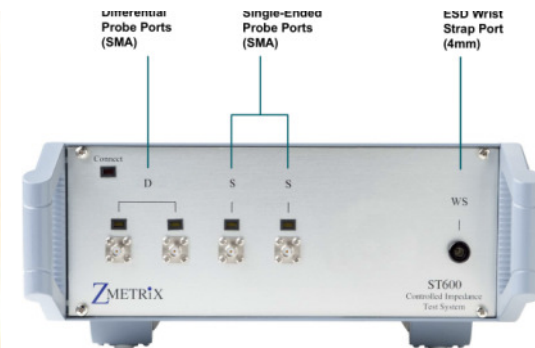
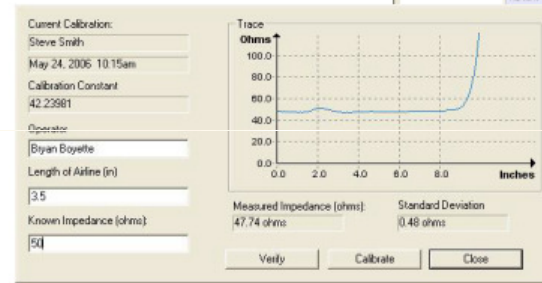
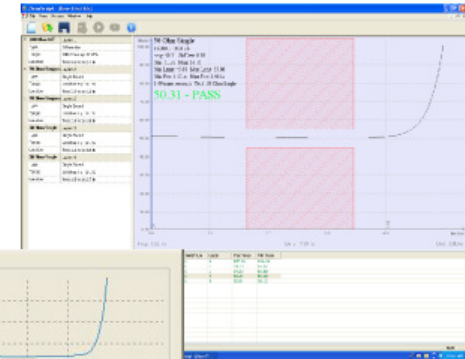


## Impedance TDR & XRF

The Zmetrix ST600 impedance test system comes standard with Windows software that automates the data gathering process through an intuitive user interface. Calibration, verification, data logging, and statistical reporting are all fully supported by the software.



**CMI900 XRF**



**Zmetrix Impedance Test System**



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## Assembly Operation

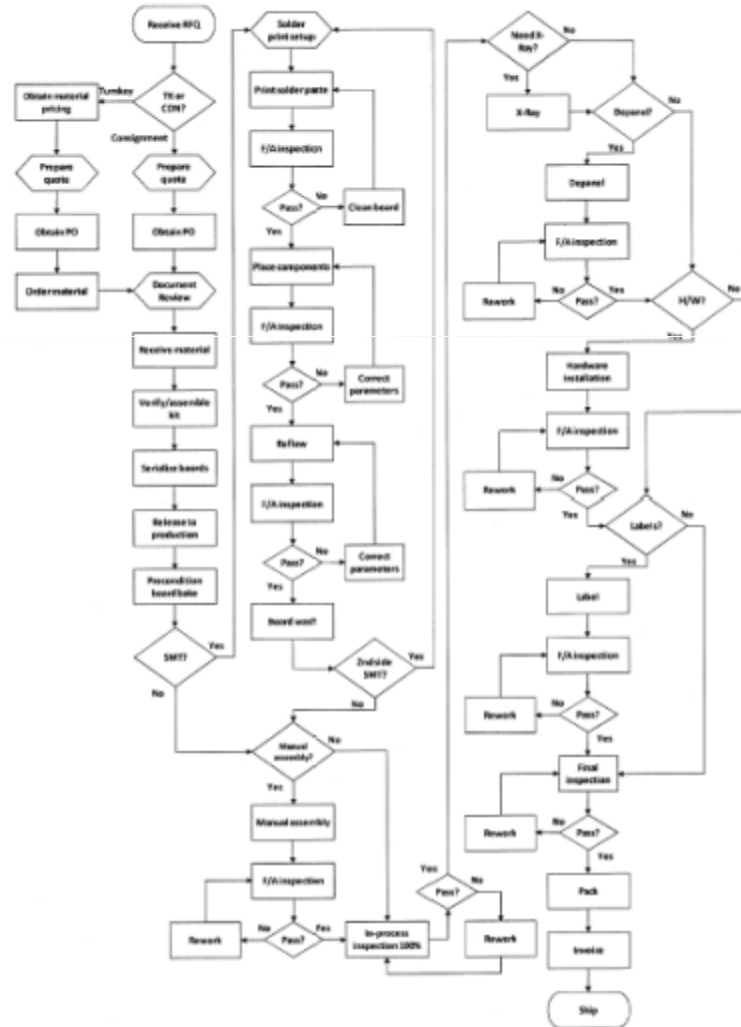




# Virtual Tour

## Assembly Process

10.3 Assembly Process Flowchart





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## SMT Area





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## **Solder Stencil Printer**







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## SMT Pick and Place





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## Reflow Ovens

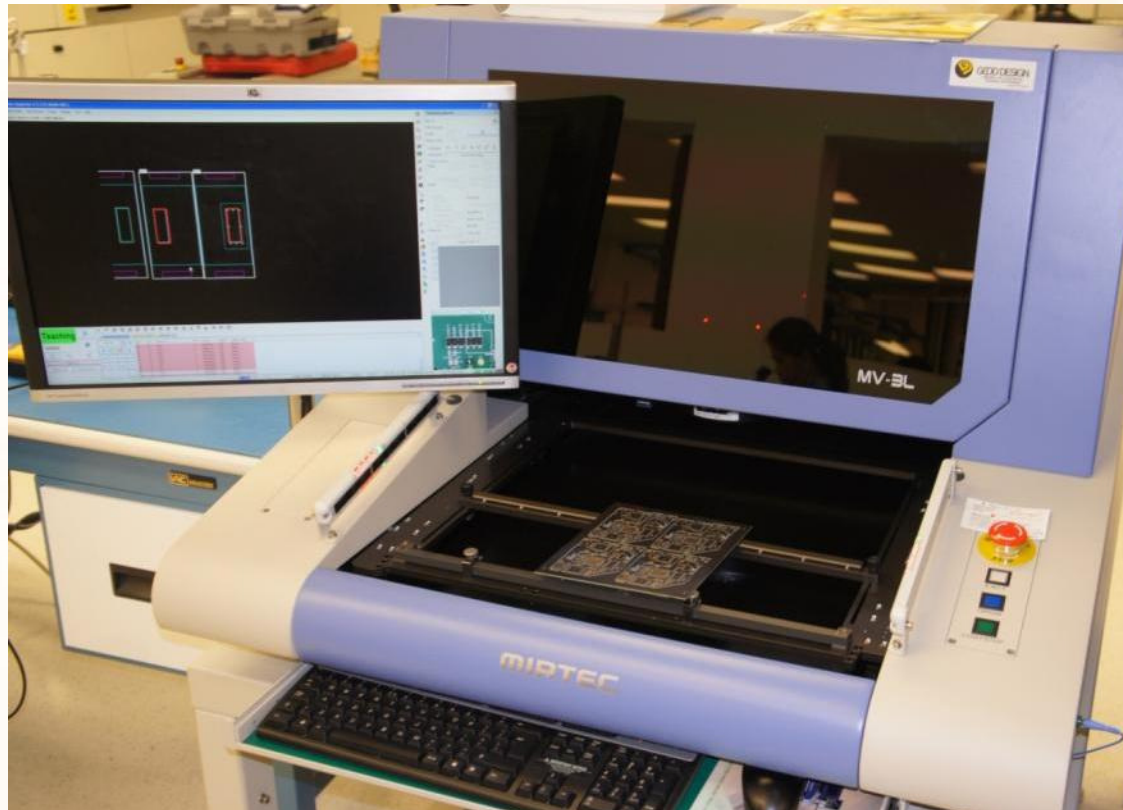




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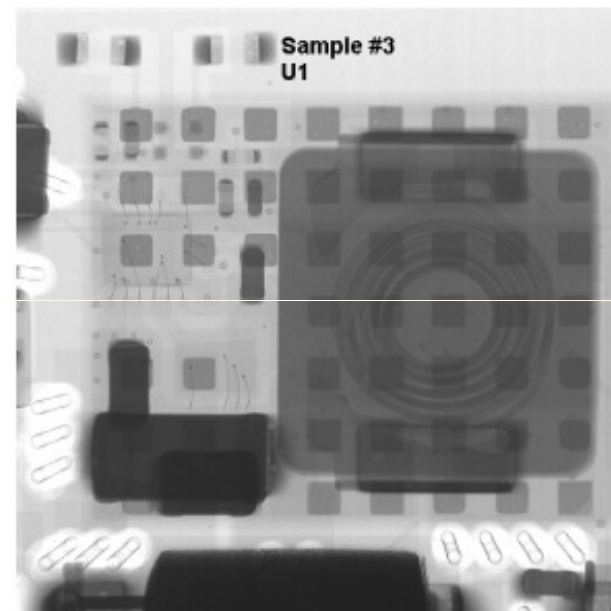
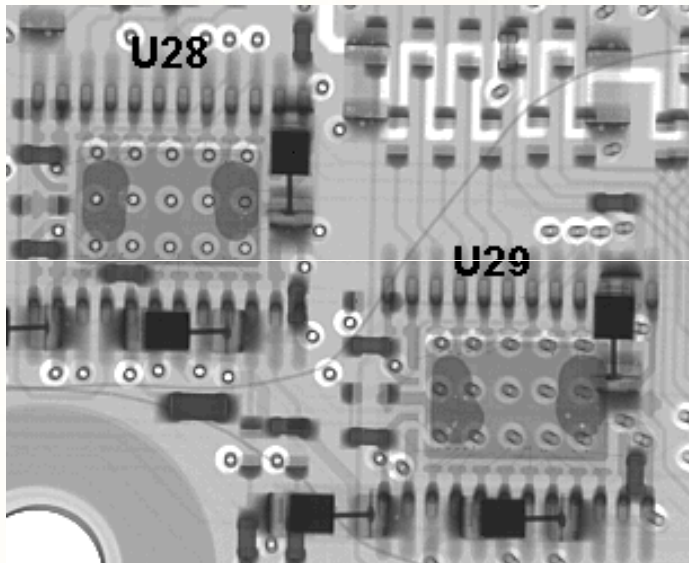
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## Automated Optical Inspection





## Component X-RAY





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## Selective Solder







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## Hot Air Stations





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## D.I. Water Board Wash



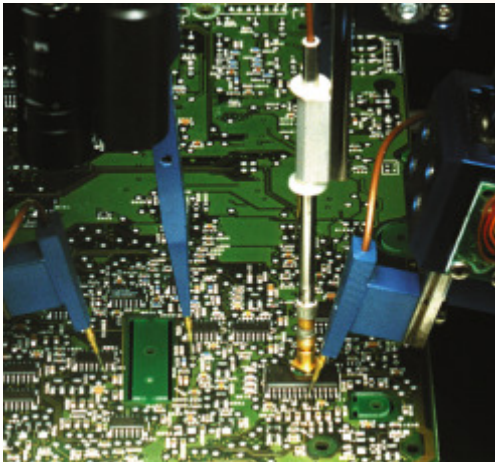
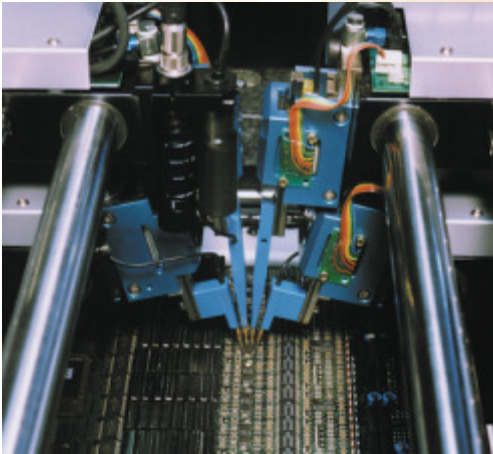




# Virtual Tour

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## Flying Probe In-Circuit Test





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## **Box-Build and Functional Test Area**





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## **Final Inspection**





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## Packaging and Shipment





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**Thank you for visiting Hughes Circuits**