Solutions to Productivity Problems
CARDS
Printed Circuit Design System
Company Background

- Incorporated in 1964

- Wholly-owned subsidiary of General Electric

- Three areas of CAD application: microelectronics; mechanical products; architecture, engineering & construction

- Over 900 installations worldwide

- Approximately 1200 employees throughout the world

- Committed to providing the best possible solution to productivity problems
GE/Calma Partnership

Calma  +  GE

Financial Strength  Technical Resources

=  

Increased Productivity
<table>
<thead>
<tr>
<th>Domestic CARDS Users</th>
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<tbody>
<tr>
<td>Amdahl</td>
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<tr>
<td>Atari</td>
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<td>Burroughs</td>
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<td>Aerojet</td>
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<td>Comten</td>
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<td>Data General</td>
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<td>Delco</td>
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<td>Digital Telephone</td>
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<td>EMI</td>
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<td>Fairchild</td>
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<td>Floating Point</td>
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<td>Fluke Instruments</td>
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<tr>
<td>General Electric</td>
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<tr>
<td>Harris</td>
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<td>Honeywell</td>
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<td>Hughes Aircraft</td>
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<td>Intel</td>
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<td>ITT</td>
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<td>MIT</td>
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<td>Microcomputer System</td>
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<td>Motorola</td>
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<td>NCR</td>
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<tr>
<td>National Exsysco</td>
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<tr>
<td>Precision Art Masters</td>
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<tr>
<td>Rockwell</td>
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<tr>
<td>Sanders</td>
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</tbody>
</table>
International CARDS Users

AEG
Burroughs
Chuo Meiban
Electronic Marcel Dassault
GEC
GTE
General Instruments
ITT
Matsushita
Motorola
Lucas Aerospace

Physisch Laboratorium
Pioneer
Plessey
Nippon Electric
Radiotelevisione
Sanyo
Sony
Societe Du Cuivre Professionnel
Toshiba
Elin-Union A.G.
Telefonia
Potential Savings Using CAD*

* Based on comparison of tasks and hours required to create artwork for an 8 layer, 80 EIC board.
CARDS Features

- Calma Disk Operating System
- Human engineered design station
- Vector Memory Display design station
- Mechanical drafting
- Graphic Programming Language (GPL II)
- Design Analysis Programs
- Electrostatic plotting
Calma Disk Operating System
Provides multitask ability by separating foreground and background operations

CDOS

Foreground Operations
- Design
- Edit
- GPL II
- Foreground Checks

Background Operations
- Design Analysis Programs
- Plots
- NC Drill

BENEFITS: Ensures optimum use of CPU time
Minimizes multistation system degradation
CARDS Design Station

Dual Displays

- Full color graphics screen displays the design
- Alphanumeric screen displays command inputs, error messages, and designer prompts

BENEFIT: Improves interactivity between designer and system
DESIGN

Graphics Screen

- On-screen command menus
- 7 programmable colors
- 4 fill patterns
- 4 line patterns

BENEFITS: Designer does not have to look away from design
Easier to see designs
Improves contrast between layers of data
Reduces eye strain
Signal Highlighting

Using color for easy identification of nets and their features

- Signal 001 and its features highlighted in a contrasting color

**BENEFIT:** Helps the designer locate data
Vector Memory Display Design Station

- Continuous pan & zoom
- Multiple viewports
- Selective erase
- On-screen menus
- Voice control unit

**BENEFIT:** Faster on-line designing
Mechanical Drafting
Automatic Dimensioning

• Baseline Dimensioning

• Linear Dimensioning

• Angle Dimensioning
DESIGN

Mechanical Drafting
Automatic Dimensioning

- Corner Dimensioning
  \[0.030 \times 45^\circ\] Chamfer

- Radial Dimensioning
  \[0.15\] R

- Circle Dimensioning
  \[3.5\] DIA.

- Array Dimensioning
  \[3.5 \times 2 = 7.0\]

BENEFITS: Frees the designer from tedious drafting duties
Delegates detailed, repetitive tasks to the computer
Powerful Commands

- **REDO**

REDO lets the user open a geometry (i.e., ground plane or trace) at any location, then close it at the same or new location by entering the desired change. The change will be merged with the original data.

- **STRETCH**

The all-angle STRETCH command stretches a user-selected side of a trace to a new location.
Powerful Commands

- **NOTCH**

A notch of any size and direction may be added at any location on a line segment.

- **COPY**

COPY lets the user put duplicate patterns anywhere in the format without redefining them.
EDIT

Selective Erase

- 3 DIPS on graphics screen
- Middle DIP identified in bright white
- DIP deleted without repainting the graphics screen

BENEFITS: Saves CPU time
Improves multistation response time
GPL II

Graphic Programming Language

General purpose language designed for:

- Increasing the system's capabilities
- Custom tailoring the CARDS system

BENEFITS: Easy to learn and use
Interacts directly with the database
Performs edits and calculations
FOREGROUND CHECKS

On-line Continuity Checking

Continually checks connections between nets; an error is displayed on the alphanumeric screen when the designer joins nets with different signal names.

BENEFIT: Allows immediate correction of design problems
Calma Disk Operating System

CDOS

Foreground Operations

- Design
- Edit
- GPL II
- Foreground Checks

Background Operations

- Design Analysis Programs
- Plots
- NC Drill

CALMA COMPANY
Design Analysis Programs (DAP)
DAP checks PC boards for design correctness

- Spacing Verification
- Connections-to-Planes Verification
- Minimum/Maximum Pad Intrusion
- Minimum Trace Intrusion
- Background Continuity Checking

BENEFITS: Fully automatic — no designer interaction required
Assures total accuracy
Spacing Verification

Checks critical distances

- PAD TO PAD
- TRACE TO TRACE
- PAD TO TRACE
Connections-to-Planes Verification

Verifies electrical connections to power and ground planes by recognizing power/ground pad connections within an enclosed boundary.
Minimum/Maximum Pad Intrusion

Checks and reports an error, if the overlap between two pads is not design rule correct.
Minimum Trace Intrusion

Checks and reports an error, if a trace is not connected deep enough into a pad or trace.
Background Continuity Checking

Checks engineering schematics against artwork.

Verifies at system level (checks several boards against several schematics).
PLOTS

Electrostatic Plotting

- 10 times faster than pen plots
- 64 fill codes
- 64 line codes
- 200 dot-per-inch resolution
- Multiple copies output

BENEFITS: Improves throughput
           Increases reliability
           Produces scaled plots
Benefits

- Increases designer's productivity
- Decreases design cycle time
- Assures higher manufacturing yields
- Keeps abreast of state-of-the-art CAD/CAM advancements
- Reduces overall costs
Product Support

Calma’s commitment to you

- Customer Education
- Application Support Response Center
- Application Engineer Support
- Hardware Regional Response Centers
- Parts Depots
Customer Education

- Calma U Courses
  - PC Operations
  - PC System Support
  - PC Technical Overview
  - PC Schematic & Artwork Analysis
  - PC Board & Artwork Analysis
  - Graphic Programming Language

- Regional Seminars

- On-Site Training

- Consulting Services
Application Support Services

- Application Support Response Center
  Receives customer phone calls
  Follows status of all reported bugs
  Follows status of enhancement requests
  Receives documentation remarks
  Tracks new systems
  Publishes software problem alert

- Application Engineer Support
  Install software and verify operation
  Answer customer phone calls
  Visit customer sites requiring additional field support
  Evaluate customer sites to increase production and reduce costs
5 Hardware Regional Response Centers

- Receive and track all customer service requests

- Dispatch requests to Customer Engineers within 1 hour

- Contact customer to quote estimated time of C.E.'s arrival at customer's site

- Assign a C.E. as well as a back-up C.E. for each customer
Worldwide Parts Depots

- Tokyo, Japan
- Sunnyvale, CA
- Los Angeles, CA
- Denver, CO
- Phoenix, AZ
- Houston, TX
- Wichita, KS
- Detroit, MI
- Boston, MA
- Woodbridge, NJ
- Charlottesville, VA
- Raleigh, NC
- Chicago, IL
- Minneapolis, MN
- Orlando, FL
- Miami, FL
- London, England