Bendix Kansas City Division is a manufacturing facility. The uses for computer graphics are different than that of our design agency. We are interested in many of the same things as the design agency, but are required to put out formal drawings in a specified drawing system. We worked with Sandia Labs in Albuquerque to have a compatible data base, as well as have the system meet both the design needs and the needs of Bendix. We feel we have been able to do this and have 27 months of production application. As a result, we have reduced the time for throughput, can process changes faster, and have been able to maintain a headcount that would have increased without the graphics system.

A graphics system at Bendix Kansas City has cost approximately $300,000 and has been used on printed wiring boards, hybrid microcircuits and test equipment schematics.
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PROJECTED SAVINGS

NEW DESIGNS 4:1
DESIGN REVISIONS 8:1
OVERALL 5:1

OVER 2½ YEAR PERIOD, 43 MAN-YEARS DESIGN TIME SAVINGS
Computer Aided Design

Computer Graphics Evolution

1969  CAL COMP PLOTTER
1970  GERBER N/C PLOTTER SYSTEM
       PHOTOPLOTTER
       DIGITIZER
1975  APPLICON INTERACTIVE GRAPHICS SYSTEM (2D)
1979 (PLANNED)  SECOND INTERACTIVE GRAPHICS SYSTEM
                ADDED CAPACITY
                3D APPLICATIONS
1980 (BUDGETED)  THIRD INTERACTIVE GRAPHICS SYSTEM
                ADDED CAPACITY
Computer Aided Design

Interactive Graphics

- Used for two dimensional design work
  - Printed wiring boards
  - Hybrid microcircuits
  - Test equipment electrical schematics
- Installed December, 1975
- 27 months productive application
- Commercial, stand alone system - Applison
- Elements
  - Computer
  - 4 Graphics Terminals
  - Teletype Terminal
  - Digitizer - Plotter
  - Mag tape & punch paper tape capability
  - Hardcopy unit
  - Software for both two and three dimensional applications
  - Cost - $300,000
- Capability to interchange data with similar system in use at Sandia Labs, Albuquerque
Computer Aided Design
PWB Savings - IGS vs. Pre IGS

- SCHEMATIC
- COMP. TEMPLATE DRAWINGS: 4 HRS
- DL (ROUGH): 40 HRS
- DL (FORMAT): 16 HRS
- DIGITIZER: 8 HRS
- GERBER PLOT: 5 HRS
- PHOTO-TOOL FAB
- BOARD FAB
- SPIN OFF
  - ENGINEERING DRAWINGS
  - DATA BASE FOR MANUFACTURING
    - N/C MACHINING
    - PROCESS ENGINEERING
    - QUALITY CONTROL

- SCHEMATIC
- COMP. LIBRARY: 0.2 HRS
- SKETCH: 4 HRS
- IGS: 16 HRS
- PROOF PLOT: 5 HRS
- CYBER 174
- GERBER PLOT
- PHOTO-TOOL FAB
- BOARD FAB
Computer Aided Design
HMC Savings-IGS vs. Pre IGS

<table>
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<tr>
<th>Process</th>
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<tr>
<td>Schematic</td>
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<td>DL (Rough Form)</td>
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<td>200UT CDC 6600 Process</td>
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<tr>
<td>CAL COMP PLOT</td>
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<tr>
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SPIN OFF ENGINEERING DWGS.
Computer Aided Design
Interactive Graphics Benefits

- REDUCED THROUGH-PUT TIME
- FASTER PROCESSING OF CHANGES
- ABILITY TO RECALL EXISTING DATA FOR NEW APPLICATIONS
- FORCES COMPLETE DIGITIZATION OF DESIGN-ELIMINATES AMBIGUITIES
- IMPROVES EFFICIENCY OF USE OF GERBER PLOTTING EQUIPMENT
- RELIEVES DESIGNER OF DRUDGE TASKS
- PROVIDES ANALYTICAL AND COMPUTATIONAL ASSISTANCE TO DESIGNER
- MORE ACCURATE DESIGN LAYOUTS