

What to look for from a vision supplier

- Strong Company Finances
- Strong R&D commitment
- Breadth of product range
- Ease of use
- Technology
- Direct support
- Proven applications
- Total Cost of ownership

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All we do is machine vision:
COGNEX designs, develops, manufactures, and markets machine vision systems which emulate human sight in industrial applications.

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Donald J. Shuman, President, CEO, and Chairman; Victoria Hahn, Senior Vice President of Software Engineering; Bill Glavin, Vice President of Research and Development and Chief Technology Officer

1981

- Founded in 1981
- 3 employees
- Privately financed
- \$0 revenues
- \$0 profits
- 0 systems installed
- Just 1 of more than 100 vision companies in the U.S.


2002

- 21st year
- 600+ employees worldwide
- Public company (CGNX on NASDAQ)
- \$120M in 2001
- Strong Balance Sheet
- \$25+ R&D Annually
- 170,000+ systems installed
- Worldwide leader in machine vision!


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Vision System Components

General Purpose PC
Based Vision Systems




General Purpose
Standalone Vision
Systems



G

Application Specific
Systems & Sensors



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Network Ready!

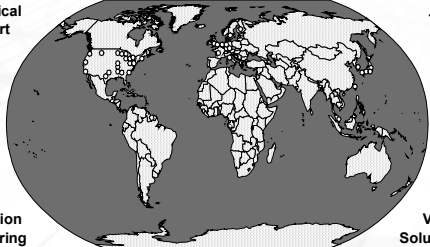



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COGNEX Technology plus Support Over 600 employees in 50+ offices

Technical
Support

Training



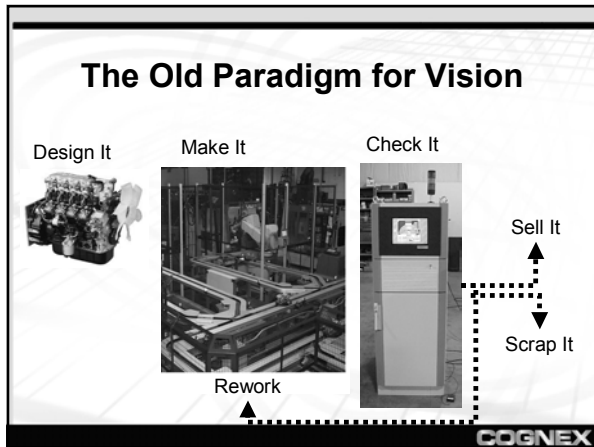
Application
Engineering

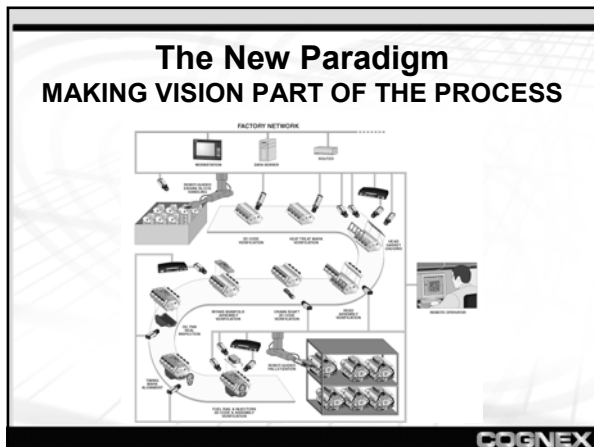
Vision
Solutions

Web Support and training

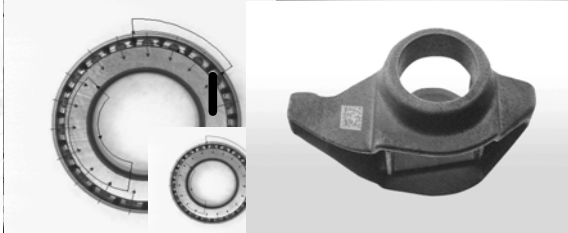
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Where Machine Vision is used



Guidance Inspection Gauging Identification

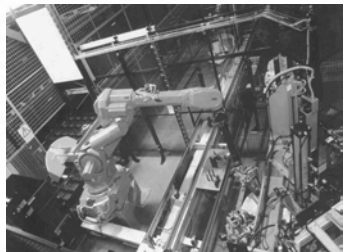
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Guidance: Locate the Part

Front Wheel Assembly

"This is hardly possible with other vision technologies."

Anders Boman
Project Manager
Volvo

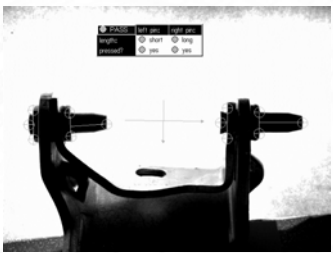


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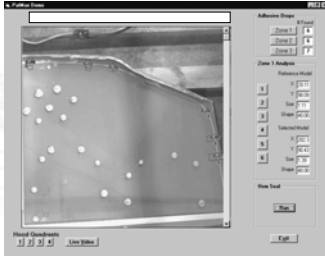
Inspection: Verify Quality and Assembly

Ball joints



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Gauging: Measure the Part



The Cognex equipment installed at DaimlerChrysler-Sterling Stamping over the past several years has performed above expectations.

David Allison
Tool Engineering
DaimlerChrysler-Sterling Stamping

Adhesive on Body Panel

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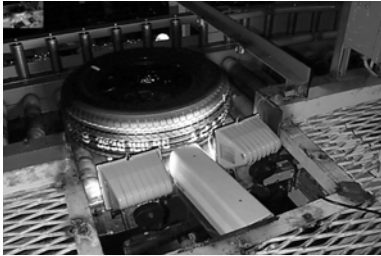
Identification: Identify the part

Tyre Tread

Cognex vision is used for 100% in process inspection to eliminate errors and downtime.

"Since using the Cognex system, however, GM has eliminated the downtime caused by these errors entirely."

Kal Wallner
Systems Engineer
EDS



Sort tires by tread pattern

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Identification: Identify the model

ID Tag Reading



Cognex Vision has been exceptional at identifying the codes providing 100% automated inspection.

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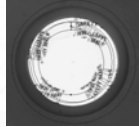
Identification and Inspection



Label Inspection



Cap Print Inspection



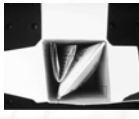
Safety Seal Inspection



Fill Level Inspection



Cap Position and Skew



Box Inspection

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Identification and Inspection

Piston Verification



"[Cognex]Checkpoint has been exceptional at verifying the codes, and is running at 99.998 efficiency."
Rod Sturgis
Project Engineer, Industrial Automation

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PatMax Technology

Helping solve manufacturing problems

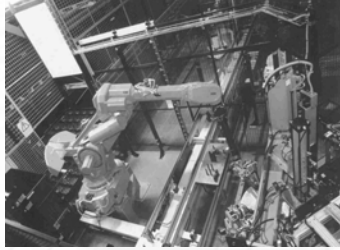
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Guidance: Locate the Part

Front Wheel Assembly

"This is hardly possible with other vision technologies."

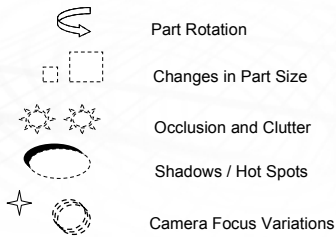
Anders Boman
Project Manager
Volvo



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What hinders Machine Vision?



PatMax technology can deal with all these variations

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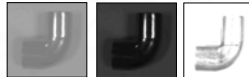
PatMax® Technology Makes Vision Robust and Easy to Use

Works with parts
in any orientation or scale



Tolerant of Lighting Changes

"The Cognex system is not affected by poor lighting which is exactly what we needed." - Ford Motor Company



Handles Occluded views and
Appearance changes



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Evolution of Machine Vision

1977	1987	1997
Binary Vision – Sensitive to process changes – Required operator intervention <i>Obsolete</i>	Normalized Correlation – Robust algorithm – Improved yield – Public domain <i>Obsolete</i>	PatMax® – Highest Accuracy – Highest Yield – Ease of use

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Geometric Pattern Matching

- Represents an object as geometric shapes
- Not tied to limitations of a discrete pixel grid
- Independent of shading & uneven lighting
- Tolerates and measures variations in angle & size
- Improves accuracy by up to 10X over grid matching
- Provides defect data for inspection operations

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Feature Detection

- Defines what geometry PatMax® will match
- Defines boundary points along contours
 - Uses a range of image granularity to “understand” coarse and fine features
 - Specifies position and orientation
 - Edge detection simply marks pixels as edge points

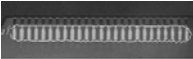




Figure 24 – Feature detection, coarse Figure 25 – Feature detection, fine

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PatMax® Pattern Matching

- Two step approach for speed and accuracy
 - PatQuick® coarse alignment
 - PatMax® high accuracy alignment

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PatQuick®

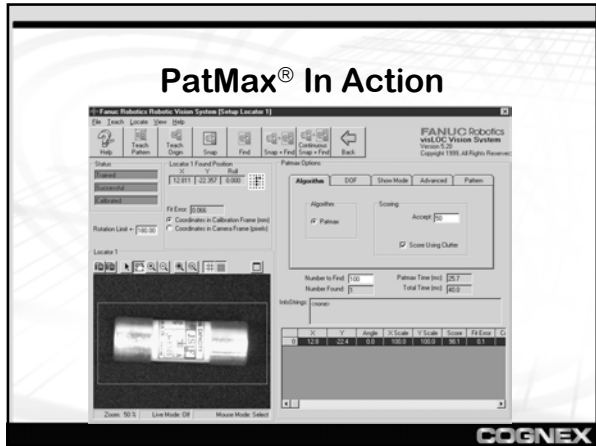
- “Affine Search” includes both rotation and size
 - Locates translated, rotated, scaled & stretched patterns
- Leverages Intel MMX technology for high speed
 - Full frame 0 to 360 degree part location at video rates
- Performs exhaustive search, and returns a “pose”
 - For PatMax®, a “pose” is a location in a 6-dimensional space
 - 6 dimensions: X,Y, Angle, Uniform Size, X Size, Y Size

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PatMax®

- Uses entirely new geometric matching algorithm
 - Matching is separate from exhaustive affine searching
 - Sole purpose is extreme accuracy at high speed
- Results:
 - Location accuracy better than 1/40 pixel
 - Orientation measurement to within 1/50 degree
 - Size measurement with 1/2000 of focal range

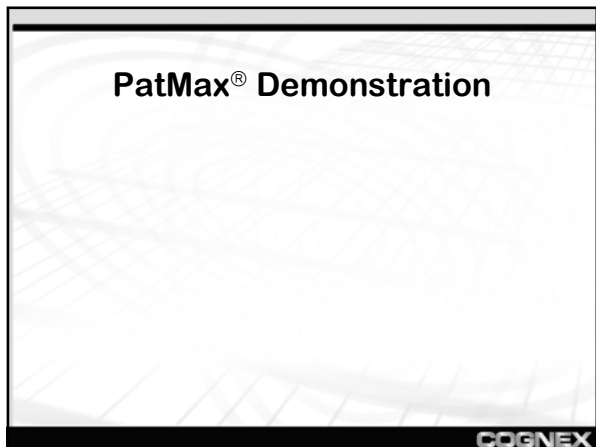
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PatMax[®] vs. Normalized Correlation

	Correlation	PatMax [®]
x,y accuracy	0.25 pixel	up to 0.025 pixel
Theta tolerance	0 -> 10	0 -> 360
Theta accuracy	N/A	0.02 degrees
Scale tolerance	No	Yes
Scale accuracy	N/A	.0005
Non-linear image tolerance	no	yes
Tolerance to occlusion	limited	yes

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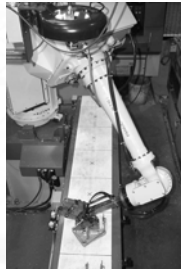
Benefits of PatMax®

Feature	Advantage	Benefit
Robustness	More tolerant to occlusion, lighting changes	Easier training; No special lighting
Rotation, scale tolerance	Part positioning not crucial	Easier training; Less fixturing; Model transportability
Rotation, scale measurement	One-shot alignment	Higher throughput
High accuracy	Greater FOV or greater precision	Better guidance; Higher throughput

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PatMax® Applications

- Ganton Technologies
- No special lighting
- No special fixturing
- Less Robot programming
- Variety of parts can be handled
- Additional camera for inspection



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PatMax® Applications


- Ford
- Depalletising
- Operates in poor lighting
- Consistent gripping
- Also checks bin ID and empty pallet



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PatMax® Applications


- Plumbing joints
- Non linear lighting effects
- Distinguishes between different types




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