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**SECURITIES AND EXCHANGE COMMISSION**  
**Washington, D.C. 20549**

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**FORM 8-K**

**CURRENT REPORT**

**Pursuant to Section 13 or 15(d) of the**  
**Securities Exchange Act of 1934**

Date of report (Date of earliest event reported): August 4, 2004

**BRUSH ENGINEERED MATERIALS INC.**  
(Exact Name of Registrant as Specified in Charter)

Ohio  
(State or Other Jurisdiction  
of Incorporation)

001-15885  
(Commission  
File Number)

34-1919973  
(IRS Employer  
Identification No.)

17876 St. Clair Avenue Cleveland, Ohio  
(Address of Principal Executive Offices)

44110  
(Zip Code)

Registrant's telephone number, including area code: (216) 486-4200

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EX-99.1 Current Investor Update

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## Table of Contents

### Item 9. Regulation FD Disclosure

On August 4, 2004, Brush Engineered Materials Inc., an Ohio corporation (the “Company”), updated the “Current Investor Update,” a slide presentation on its website, a copy of which is attached hereto as Exhibit 99.1. This slide presentation shows the Company’s corporate strategy and the financial results through the second quarter of 2004.

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SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned hereunto duly authorized.

BRUSH ENGINEERED MATERIALS INC.

Date: August 4, 2004

By: /s/ Michael C. Hasychak  
Vice President, Secretary and Treasurer

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INDEX TO EXHIBITS

Exhibit Number	Description of Exhibit
99.1	Current Investor Update



## *Brush Engineered Materials Inc. Profile*

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- Publicly traded since 1956: NYSE-listed since 1972.
- Founded 1931 as Brush Beryllium Company.
  - Building off earlier pioneering technical work at Brush Laboratories
  - Initial scope was development of commercial markets
- With onset of WW II and post war period, significant growth in defense and eventually, aerospace applications
- Mid-70s: major expansion of new commercial markets.
- Today, commercial markets represent 90% + of revenues





# *Brush Engineered Materials Inc.*

## *Profile*

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- A leading manufacturer of high performance engineered materials
- Operations, service centers and major office locations in North America, Europe and Asia
- Serving long-term growth oriented global markets:
  - Telecommunications and computers
  - Automotive electronics
  - Optical media
  - Industrial components
  - Aerospace and defense
  - Appliance



# *Brush Engineered Materials Inc.*

## *“Advancing the World’s Technologies”*

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- BEM Materials are found in a wide range of critical and demanding applications requiring:
  - Strength
  - Reliability
  - Thermal & electrical conductivity
  - Miniaturization
  - Weight reduction
  - Corrosion resistance
  - Reflectivity



# *Brush Engineered Materials Inc.*

## *End Uses*

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Notebook and network computers

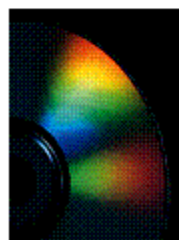
Cellular phones and other wireless communications



Electronic components in cars and trucks



Life enhancing devices



Optical Media



Industrial products



## *Investment Highlights and Strengths*

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- Unique Status as Fully Integrated Provider of Beryllium-Containing Products
  - Global Sales and Distribution Network
  - Sales Based on End User Specifications
  - Strong Value Proposition in Served Markets
  - Broad Metallurgical Capabilities in Precious and Non-precious Metals
  - Global Leader in High Performance Engineered Materials
  - Positive Market Trends
  - Capacity to Support Profitable Market Growth
  - Strategic Customer Relationships
  - Strong and Improving Sales and Margins
  - Significant Technical Capabilities
  - High Barriers to Entry
- 
-

*Brush Engineered Materials Inc.*  
*Organized into Two Separate Reportable Segments*

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**Metal Systems**

Alloy Products

Beryllium Products

Technical Materials, Inc.

**Microelectronics**

Electronic Products

Williams Advanced Materials Inc.



# *Metal Systems Group (2003 Sales: \$239 million)*

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## **Alloy Products**

### **2003 Sales: \$162.3 million**

- Copper and nickel-based alloy materials, most of which incorporate beryllium
- Strip products are used in electronic connectors including PDA's, wireless communications equipment, notebook and network computers and automotive electronics that require high strength, formability and electrical conductivity
- Bulk products are rod, bar, tube and plate products for industrial and aerospace bushings and bearings, oil & gas components and plastic mold materials where strength, corrosion and wear resistance, thermal conductivity and lubricity are critical performance requirements

## **Technical Materials, Inc. (TMI)**

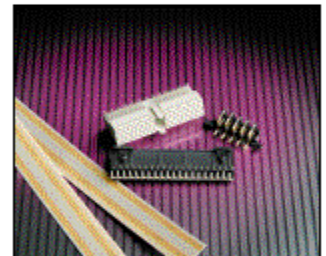
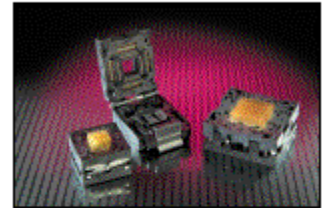
### **2003 Sales: \$41.9 million**

- Engineered material systems, including clad, plated and electron beam welded metals used in demanding connector applications
- Combines precious and non-precious metals in strip form for use in complex electrical components for telecommunications systems, computers and automotive electronics

## **Beryllium Products**

### **2003 Sales: \$35.2 million**

- Pure beryllium and aluminum-beryllium composites for high-performance applications, principally for aerospace and defense applications where stiffness, strength, lightweight, dimensional stability and reflectivity are critical



# *Microelectronics Group (2003 Sales: \$157 million)*

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## **Williams Advanced Materials (WAM)**

### **2003 Sales: \$127.8 million**

Precious metal and specialty alloys for high reliability applications

Products include precious and non-precious metal vapor deposition targets, frame lid assemblies, clad and precious metal preforms, high-temperature braze materials and ultra fine wire

Industries served include optical media, semiconductor, data storage, performance film and wireless



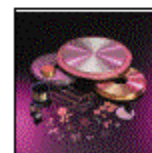
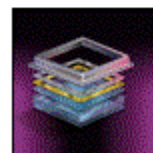
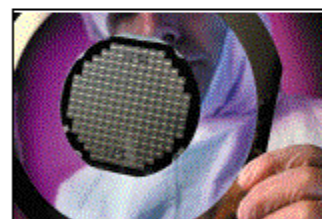
## **Electronic Products**

### **2003 Sales: \$29.5 million**

Products include beryllia ceramic materials, electronic packaging and thick-film circuitry

Products designed to meet exacting performance requirements of target customers

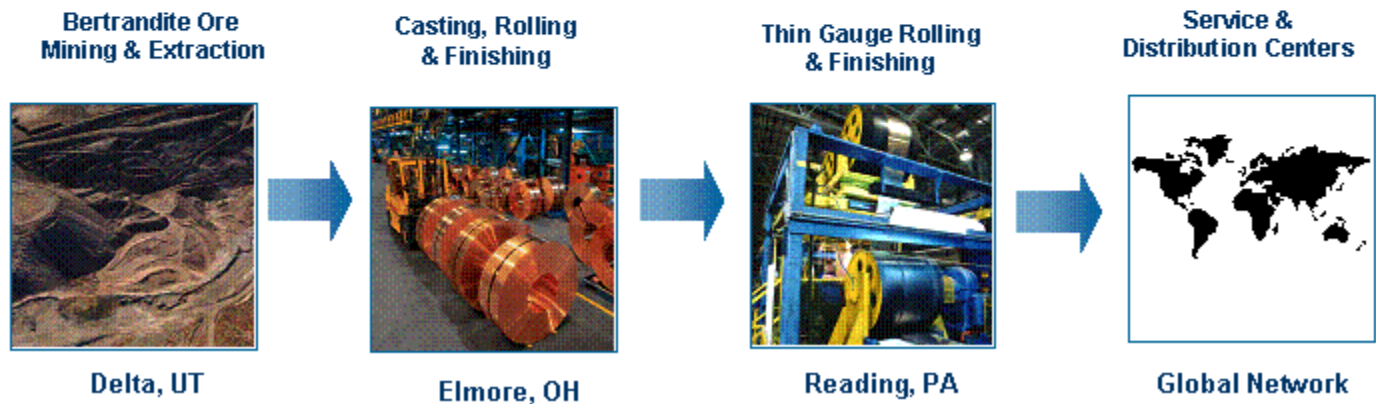
Industries served include wireless telecommunications, medical laser, aerospace, defense and automotive



## *Fully Integrated Beryllium Producer*

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- Beryllium and beryllium alloys are critical to many high performance applications
  - Strong
  - Lightweight
  - Good formability
  - High reliability
  - Thermal and electrical conductivity
  - Corrosion and wear resistant
- Operate the only active bertrandite ore mine in the developed world
  - 7,500 acres in Juab County, Utah
  - Approximately 100 years of proven reserves



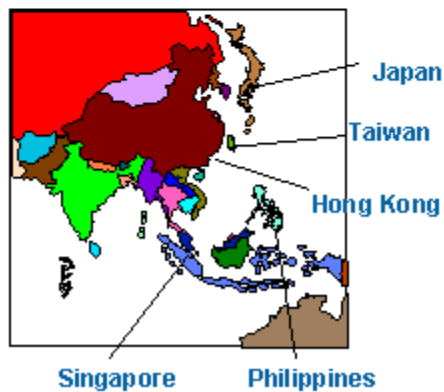


# *Global Sales and Distribution Network*

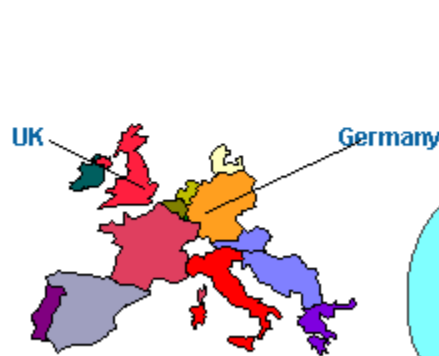
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- Operations in the U.S. and seven foreign countries
- Significant recent expansion to China and Taiwan
- International sales are 33% and growing

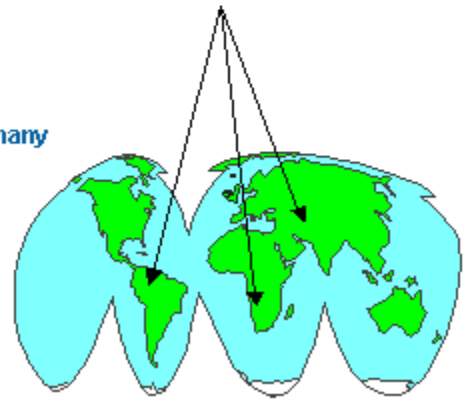
◀ ----- Asia / Pacific ----- ▶

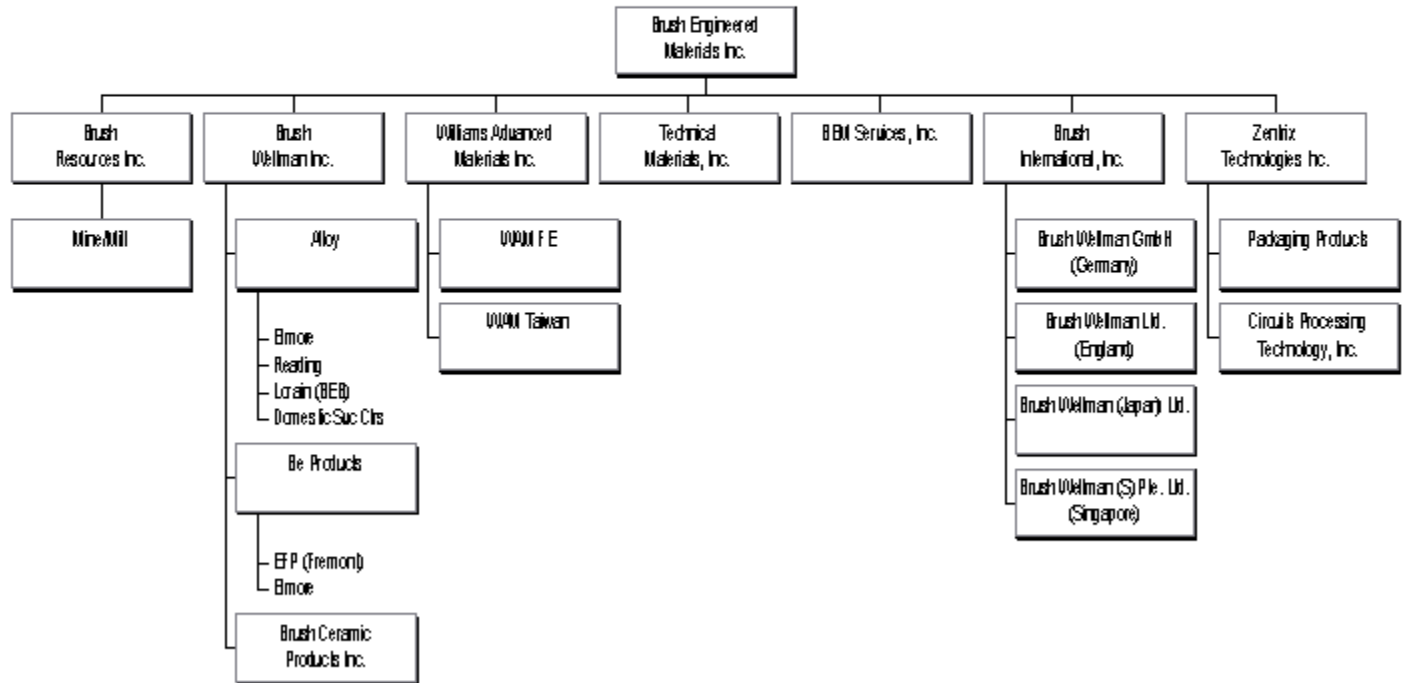


◀ ----- Europe ----- ▶



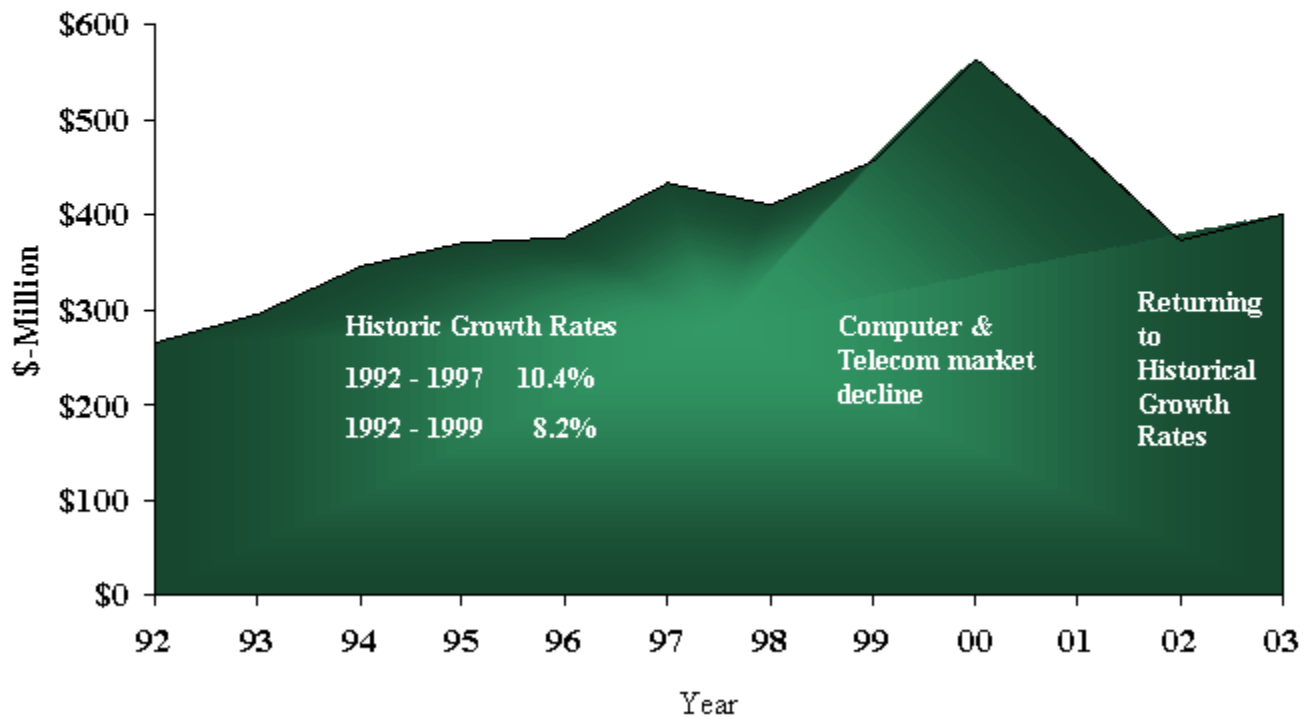
◀ - Exports from USA - ▶





*In 2001, the Computer and Telecom Market Decline Drove Sales  
back to Mid-90's Levels*

*In 2003, Growth Began to Return to Historical Rates*



*The Decline in Telecom/Computer Market Resulted  
in a 50% Drop in the Market Segment's Revenue  
Comparing 2003 to 2000*

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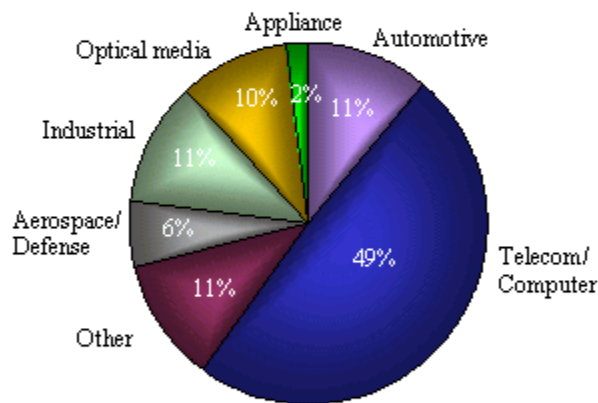
\$ in millions

	<u>2000</u>	<u>2003</u>	<u>Change</u>
Telecom/Computer	\$277	\$139	(138)
Automotive	62	53	(9)
Industrial	62	42	(20)
Optical media	56	53	(3)
Defense/Aerospace	34	37	3
Appliance	19	27	8
All Other	<u>54</u>	<u>50</u>	<u>( 4)</u>
—	\$564	\$401	\$(163) —

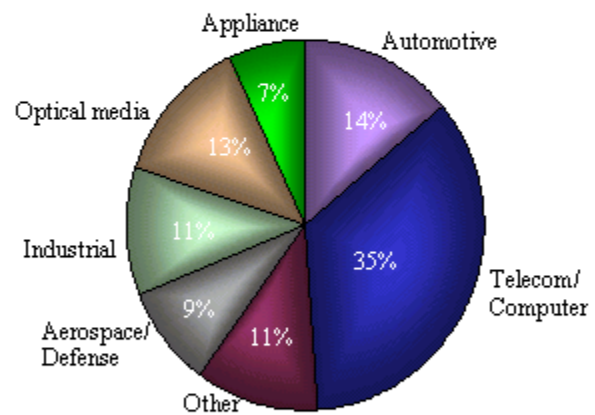
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*The portion of Brush's revenue from the telecom/  
computer market has declined from nearly 50% to  
slightly more than 35%*

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2000  
\$564 Million



2003  
\$401 Million

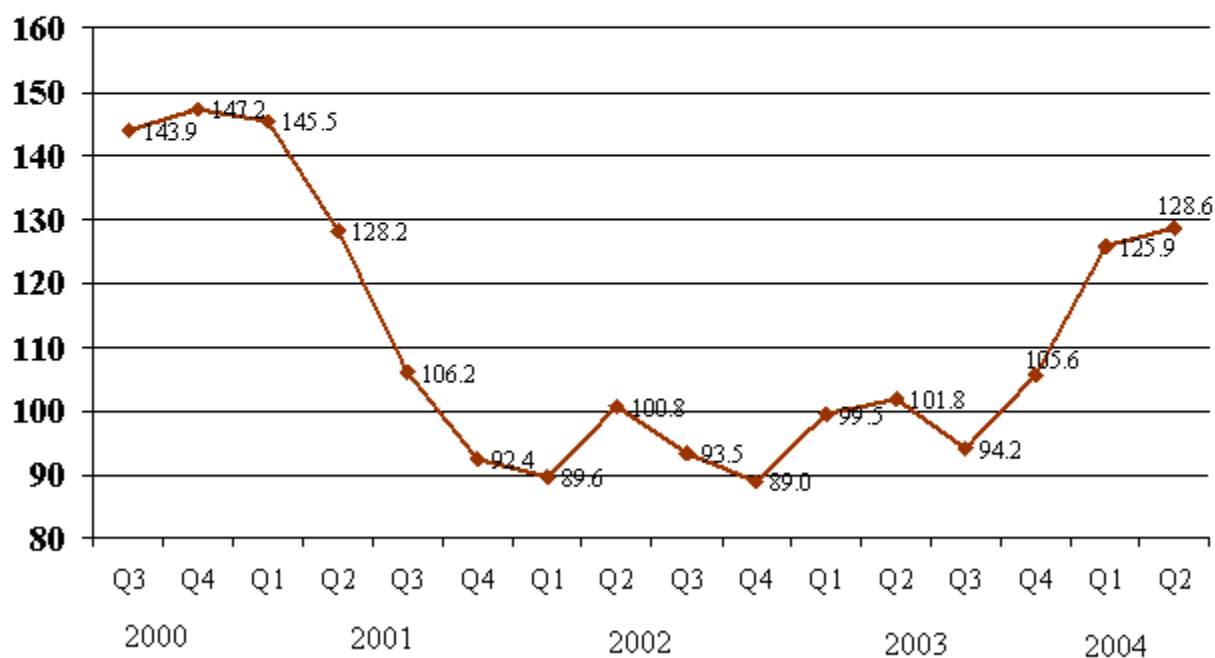
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*Brush experienced a major downturn in Q-2 and Q3 2001, with revenue remaining flat through 2002. 2003 was stronger than 2002 and 2004 to date is stronger than 2003*

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## *Positive Market Trends*

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- Electronic component manufacturers are being driven by end user demands to produce products that are smaller, lighter and faster
- Increased electronic component performance characteristics require materials that have enhanced mechanical, electrical and thermal properties
- Growing opportunity for thin film physical vapor deposition (PVD) products in the DVD, LCD, data storage and semiconductor markets
- Spending and conditions in the telecommunications and computer market are improving

*Brush has generated year-over-year sales growth in six consecutive quarters*

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# *Capacity to Support Profitable Market Growth*

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*Well-positioned to support rapid sales growth without significant incremental cash investment*

- \$140 million invested between 1996 and 2000
  - Operating with significant available excess capacity
  - Significant productivity gains in recent years
  - Capital spending in 2002 and 2003 averaged \$6 million per year
-



## *Our Improvement Programs are Centered Around Five Key Areas*

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- Reducing debt through improved working capital management and limiting capital spending
  - Reducing overhead costs
  - Continued improvement in margins through operational efficiency
    - Lean manufacturing
    - Six Sigma
  - Broaden the base – revenue from new products and applications
  - Improvement in demand from the telecom/computer market
-

# *Financial and Operational Initiatives*

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*Our performance improvement initiatives have been  
focused on five key areas*

- Expanding the revenue base
    - New products
    - New markets
    - New applications
    - New geographies
  - Improving margins through increased operating efficiency
    - Six Sigma and Lean Manufacturing
  - Reducing overhead costs
  - Reducing debt
  - Positioning for global market growth and economic recovery
    - Improve quality, cost, speed and service
-

# *Expand and Diversify Revenue Base*

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*Since 2000, BEM has aggressively worked to broaden its base with initiatives targeted at new products, new end use markets and new high-growth regions*

## ***New Products***

- **Alloy 390** – Telecom & Auto
- **PM Plated Strip** – Telecom & Auto
- **Toughmet** – Bushings & Bearings
- **MoldMax XL** – Plastic Molds
- **Welded Tube** – Oil & Gas
- **Silver DVD Alloy (Silx)** - DVD
- **Visi-Lid** – Telecom & Military

## ***New End Use Markets***

- Alloy
  - Heavy Equipment
  - Oil & Gas Components
  - Plastic Tooling
- WAM
  - Semiconductors
  - Data Storage
  - Magnetic Media
  - Thin Film Transistor/Liquid Crystal Display

## ***New High-Growth Regions***

- Singapore
  - Taiwan
  - Hong Kong
  - Korea
  - China
-

## *Increase Operating Efficiency*

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*Lean Manufacturing and Six Sigma initiatives enabled Brush's Alloy Products business to improve operational efficiency and reduce costs in 2003*

- Reduced manufacturing cycle times 18%
  - Improved manufacturing inventory turns 48%
  - Raised yields 11%
  - Shipped 23% more pounds per manufacturing employee
-

# *Reduce Overhead*

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*Brush has significantly lowered its breakeven point*

## *Overhead Reduction*

(\$ in millions)	<u>2001</u>	<u>2002</u>	<u>2003</u>
Contribution Rate	40.0%	40.3%	42.0%
Total Overhead	\$208	\$171	\$175
Breakeven Sales	\$520	\$428	\$417

Note: Total Overhead = Total fixed costs (manufacturing overhead + SG&A + interest).

Breakeven point in 2004 may be higher due to currency, increased metal prices and product mix shifts.

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## *Reduce Debt*

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*Total debt has fallen 33% from 2000 levels*

<i>(\$ in millions)</i>	<u>2Q04</u>	<u>4Q03</u>	<u>4Q00</u>
Balance Sheet Debt	\$104.1	\$99.1	\$68.7
Key Off-Balance Sheet Leases	\$13.8	\$14.2	\$77.6
Off-Balance Sheet Inventory Financing	<u>\$19.8</u>	<u>\$11.5</u>	<u>\$59.6</u>
Total	\$137.7	\$124.8	\$205.9

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*Improving Margins*  
*Our efforts to improve margins have  
succeeded, despite the fall in revenue*

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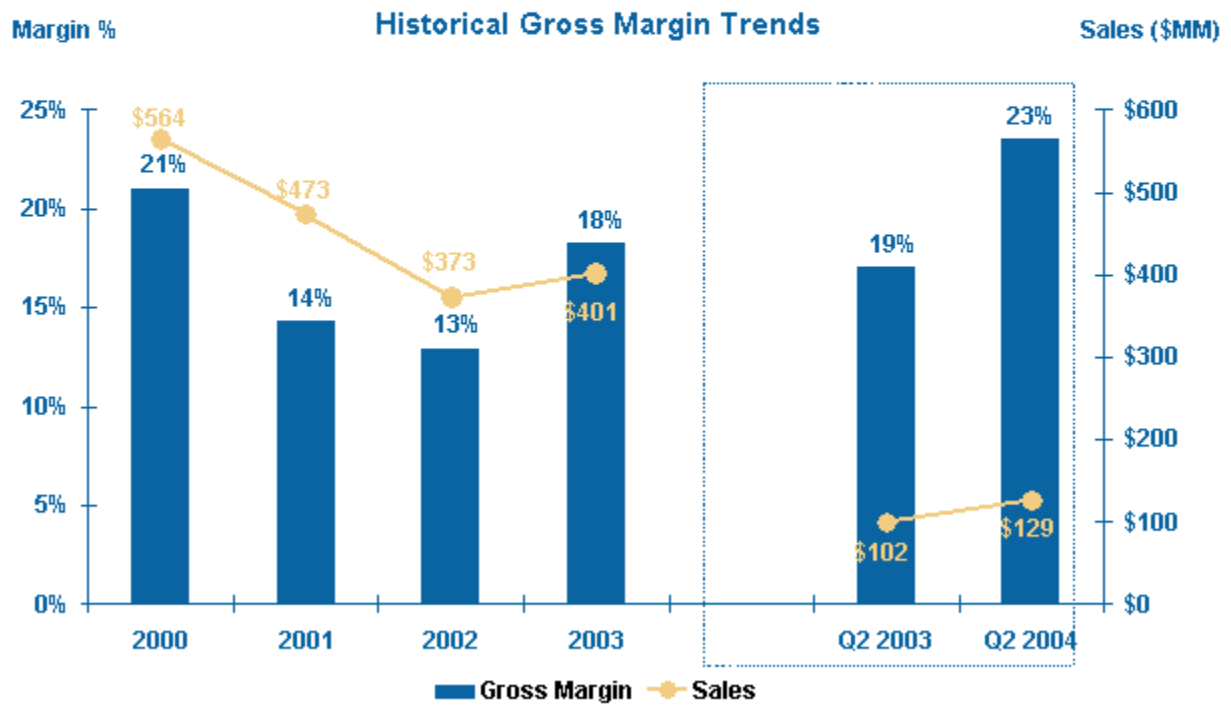
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<u>Year</u>	<u>Gross Margin %</u>
2000	21.0%
2002	12.9%
Thru Q2-2004	23.0%

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# Improve Margins

Margins have improved through cost reduction and productivity improvement initiatives





*Programs to improve profitability had a significant impact in 2003 and to date in 2004*

\$ Millions	2002		2003				2004	
	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4	Q1	Q2
Net Sales	\$93.5	\$89.0	\$99.5	\$101.8	\$94.2	\$105.6	125.9	128.6
Oper. Profit	(3.9)	(10.9)	(2.1)	1.0	(2.4)	(5.8)	6.1	9.1

Q-4 2002 includes the impact of the Electronic Products' restructuring and asset write down charge of \$5.1 million. Excluding this charge operating profit would have been (\$5.8) million.

Q-4 2003 includes the impact of the \$6.0 million refinancing charge. Excluding the charge operating profit would have been \$0.2 million.

## *Investment Highlights and Strengths*

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- Unique Status as Fully Integrated Provider of Beryllium-Containing Products
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  - Global Leader in High Performance Engineered Materials
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  - Strategic Customer Relationships
  - Strong and Improving Sales and Margins
  - Significant Technical Capabilities
  - High Barriers to Entry
- 
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# Segment Sales Review 2003

\$ in millions

	Q1 2003		Q2 2003		Q3 2003		Q4 2003	
	\$	% sales	\$	% sales	\$	% sales	\$	% sales
▪ Metal Systems Group	61	62%	61	60%	54	57%	63	59%
– Alloy	40	40%	42	41%	37	39%	43	41%
– Beryllium Products	12	12%	11	11%	9	10%	10	9%
– TMI	9	9%	8	8%	8	9%	10	9%
▪ Microelectronics Group	38	38%	38	37%	39	41%	42	40%
– WAM	30	30%	30	29%	32	34%	36	34%
– Electronic Products	8	8%	8	8%	7	7%	6	6%
▪ Other	<u>0</u>	<u>0%</u>	<u>3</u>	<u>3%</u>	<u>1</u>	<u>1%</u>	<u>1</u>	<u>1%</u>
TOTAL	99	100%	102	100%	94	100%	106	100%



# Segment Sales Review 2004

\$ in millions

	Q1 2004		Q2 2004	
	\$	% sales	\$	% sales
▪ Metal Systems Group	76.0	60%	77.1	60%
- Alloy	52.5	42%	54.7	43%
- Beryllium Products	9.7	8%	7.8	6%
- TMI	13.8	11%	14.6	11%
▪ Microelectronics Group	49.9	40%	51.5	40%
- WAM	42.1	33%	43.5	34%
- Electronic Products	7.8	6%	8.0	6%
▪ Other	0	0%	0	0%
TOTAL	126	100%	129	100%



# Segment Earnings 2000 - 2004

\$ in millions

	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	Through Q-2 <u>2004</u>
Metal Systems Group	10.2	(20.1)	(37.7)	(16.6)	9.7
Microelectronics Group	8.4	4.6	3.8	12.6	12.1
Other	<u>4.4</u>	<u>1.4</u>	<u>11.0</u>	<u>(5.3)</u>	<u>(6.7)</u>
Total Segment Operating Profit	23.0	(14.1)	(22.9)	(9.3)	15.1



# *Brush Wellman Alloy Vision*

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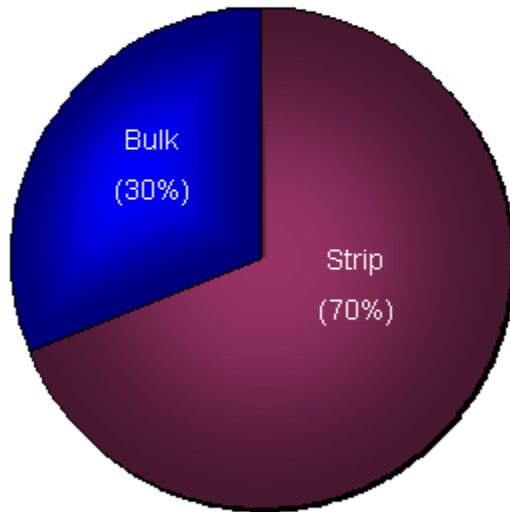
Brush Wellman is a leading supplier of High Performance Copper Alloys worldwide, providing manufacturing excellence in the form of high reliability products and services to satisfy our customers most demanding applications. We provide these services in a culture of local support and global teamwork.

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Engineered Materials

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# *Alloy Products Markets*

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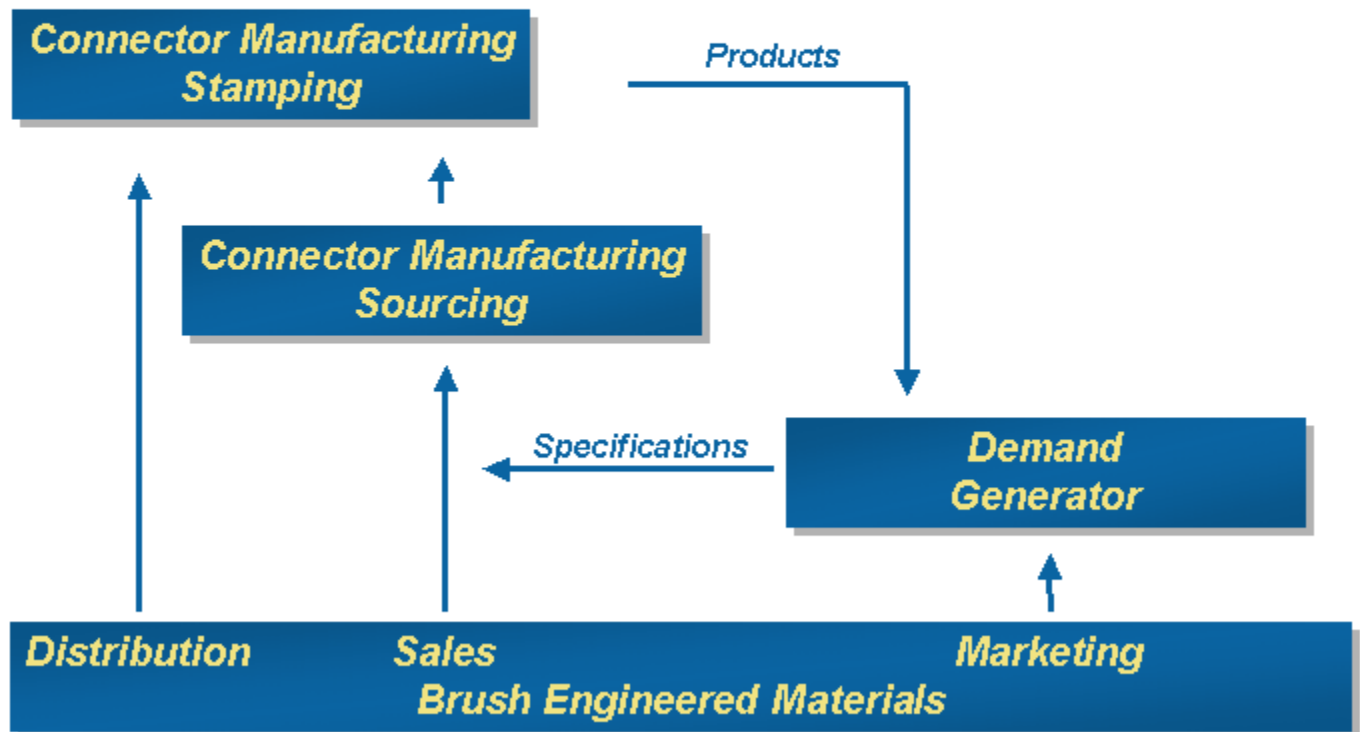


- *Strip Markets (coils)*
  - Telecommunications
  - Computers
  - Automotive Electronics
  - Appliance
- *Bulk Markets (rod, bar, tube, plate)*
  - Plastic molds
  - Undersea cable amplifiers
  - Aerospace landing gear bearings
  - Oil and gas drilling equipment
  - Heavy Equipment - New
  - Bearings - New

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Engineered Materials

## *Sales Based on End User Specifications*

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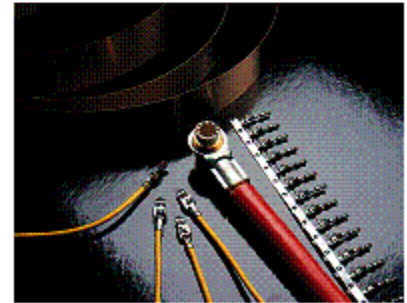
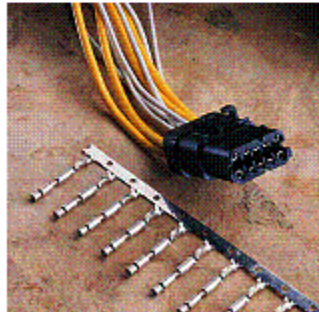
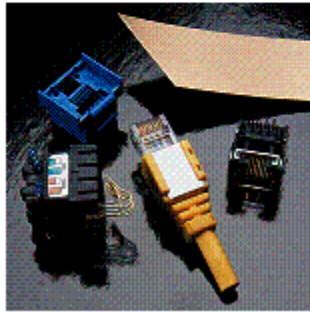
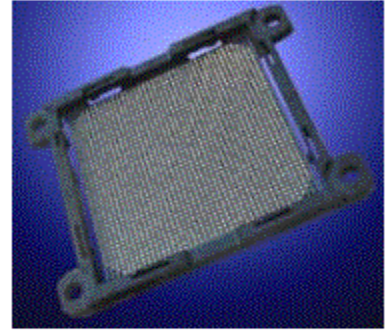


# *Strip Alloy Applications*

*(strength, conductivity, spring characteristics)*

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- Current Carrying Springs and Relays
- Integrated Circuitry Sockets
- Electrical and Electronic Connectors
- Air Bag Sensors
- Pressure Responsive Devices
- Fire Extinguisher Sprinkler Heads



# *Alloy Products*

## *Strip Products - Strategy*

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- **Maintain focus on 4 major end-use markets**
  - Computer      Telecommunications      Automotive      Appliance
- **Defend leadership in traditional alloy strip, rod & wire**
  - Reduce total cost of manufacture to allow penetration of mid-range alloy applications
  - Enhance product properties to provide additional value to customers
- **Introduce new alloys to meet needs of targeted market opportunities.**
  - Brush 60, ToughMet Strip, Alloy 390
- **Focus on new non-connector markets**
  - Deep Offshore Oil and Gas, Bearings, Instrumentation Tubing, Heat Exchanger Tubing
- **Geographic Growth**
  - Expand commercial operations in Asia Pacific

**BRUSHWELLMAN**  
Engineered Materials

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# *Strip Capacity Expansion Elmore and Reading Facilities*

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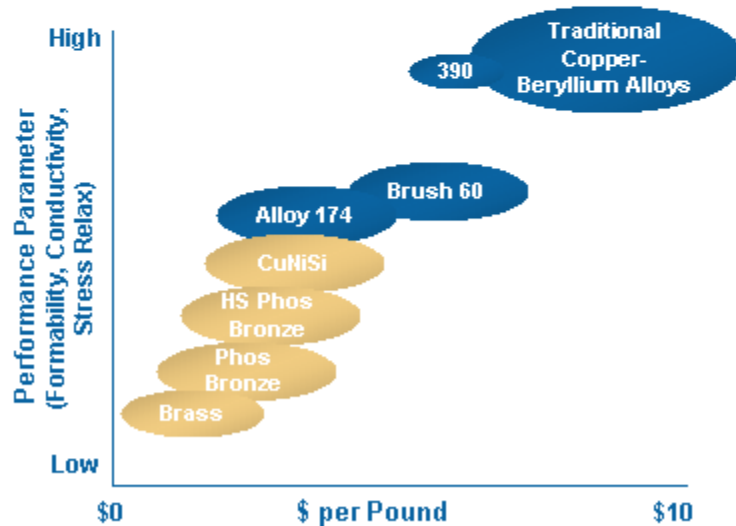


- \$140 Million (1996 - 1998)
- Added casting, hot rolling, annealing and cold rolling capacity at Elmore
- Added light gauge strip and mill hardening capacity at Reading
- 50% to 100% capacity increase depending upon product

# Strong Value Proposition in Served Markets

*Copper-beryllium alloys, while premium priced, provide best-in-class performance*

## Competitive Alloy Comparison



Note: Blue denotes Brush Engineered Materials' alloys; beige represents competitive materials.

## Brush Value Proposition

- Unique, high-performance materials
- Technical design capabilities
- Outstanding service
- Global marketing, sales and distribution

# *Automotive Electronics*

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Definition: power and signal distribution in passenger cars and light trucks - connectors, switches and relays

# *Automotive Applications*

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## Potential New Applications:

- Infotronics/telematics - in car multimedia systems and mobile communication systems, navigational, global positioning, internet based services.
- Powertrain electronics - in vehicle networks, drive-by-wire systems, continuously variable transmission, intelligent braking
- Safety systems - intelligent air bag systems, driver alertness monitoring, adaptive cruise control, frontal collision warning, intelligent highway vehicle systems, automatic emergency notification
- 42 Volt Powernet - increase number of terminals, switches and relays used in a vehicle; shift mix of components size toward miniaturization due to smaller current and increase the number of performance critical systems in a vehicle.

# *Computer*

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Definition: Brush Wellman's high performance alloys are sold to the computer industry in strip and wire forms for connectors, contacts, and shielding. End use applications include servers, workstations, notebook and desk top computers, personal digital assistants (PDAs), and data storage devices.

# *Computer Applications*

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## Examples of specific end-use product applications

- Fingerstock shielding used in servers and data storage.
- Power connectors used in server power supplies manufactured by Sun, HP, Compaq, and Intel.
- Microprocessor socket connectors.
- PDA ID connector and battery contacts.
- VHDM connector system for EMC data storage systems.

## Examples of future target product applications

- Intel and AMD's Pentium 5 microprocessor connectors.
- Power connectors for multi-chip module interfaces as well as backpanel power applications in high end servers.
- High pin count and high density flex circuit interface connectors for high resolution flat panel displays.

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Engineered Materials

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# *Telecommunications*

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Definition: Brush Wellman's high performance alloys are sold to the telecommunications industry in strip and wire forms for connectors, contacts, shielding, switches and relays. End use applications include wireless base stations, cell phones, pagers, telecom switching equipment, transmission equipment and communication networks.

# *Telecommunication Applications*

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## Examples of specific end-use product applications

- Handheld and portable device battery clips, antenna clips, I.O. connectors, board to board connectors, SIM card connectors & display connectors.
- Category 6 modular jacks for connecting data networks.
- Shielding gaskets and clips for EMI protection.
- Coaxial switches for cable company central office switches.
- VHDM connector system used in backpanel connector systems for fast Ethernet and Gigabit Ethernet switches and routers.

## Examples of future target product applications

- Category 7 modular jacks for data networks.
- Low profile board to board connectors for wireless handsets and high speed mezzanine connectors for network switches and routers.

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Engineered Materials

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# *Cellphone Connector Applications*

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**BRUSHWELLMAN**  
Engineered Materials

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# *Rear of Circuit Board*

Antenna Contact  
Brush Wellman Alloy



Battery Contacts  
Brush Wellman Alloy



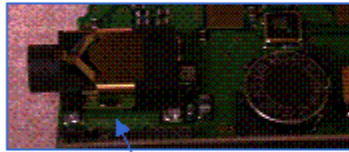
Vibrator Motor Contacts  
Brush Wellman Alloy



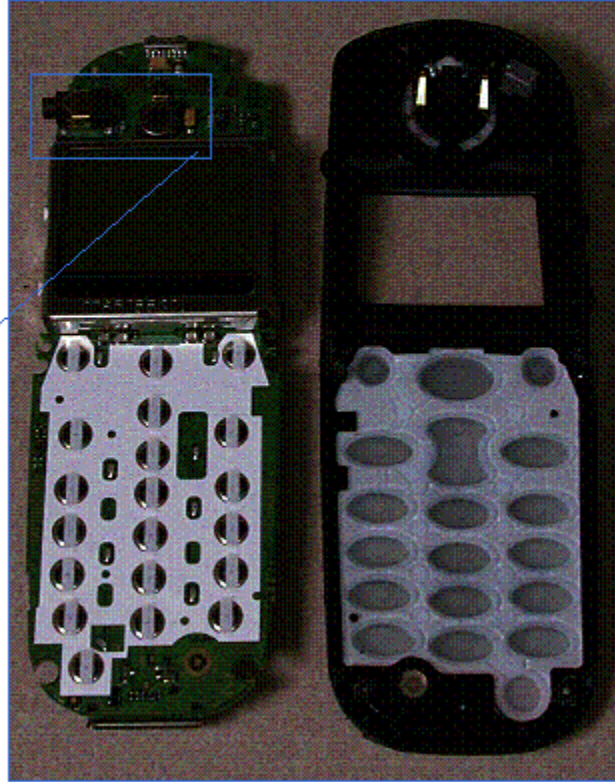
Battery Clips  
Brush Wellman Alloy

## *Front of Circuit Board*

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Hands Free Set  
Connector  
Brush Wellman Alloy  
and other material



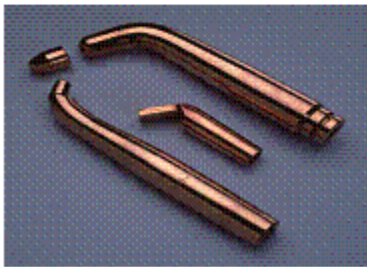
**BRUSHWELLMAN**  
Engineered Materials

# *Bulk Alloy Applications*

*(strength, corrosion resistance, non-galling, conductivity)*

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- Plastic Injection Molds
- Aircraft Landing Gear Bushings
- Undersea Repeater Housings - Telecom
- Oilfield Drill Collars & Anti-Friction Bushings
- Heavy Equipment Bearing and Wear Applications



# *Alloy Products*

## *Bulk Products - Strategy*

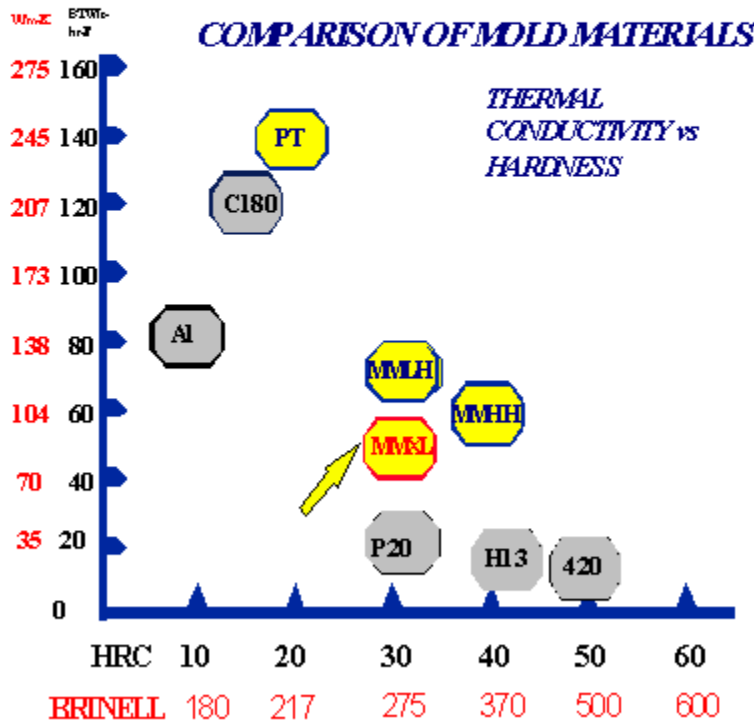
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- **Maintain focus on traditional end-use markets**
  - Oil & Gas      Aerospace      Plastics      Undersea
- **Introduce new alloys or product forms to meet needs of targeted market opportunities.**
  - MoldMax XL
  - ToughMet and improved ToughMet products (CD ToughMet)
  - Alloy 310 RWMA class 3
- **Focus on new non-traditional growth markets**
  - Bearings, Oil & Gas completions, Heavy Equipment & Mining, Pumps, Marine, Heat Exchangers
- **Geographic Growth**
  - Expand commercial operations in Asia Pacific, improve customer awareness and distribution

**BRUSHWELLMAN**  
Engineered Materials

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# Plastics - Moldmax XL



- Similar properties to dominant tooling materials and standard Moldmax
- Conductivity similar to Moldmax (CuBe) of 30%
- No EH&S issues
- Value proposition includes machinability >5X steels adding cost benefits to offset increased material costs

Value proposition - no added cost for faster cycles and lower cost manufacturing



# *Lorain Casting Facility*

## *Spinodal and Equacast™ Technology-Winning!*

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### High performance Copper based engineered materials:

- Strength and hardness found in CuBe products
- Thermal conductivity

### The value proposition differentiates:

- No EH&S issues
- Corrosion resistance
- Superb tribological properties (low friction coefficient, excellent wear resistance - without lube) adding value in Reliability,Uptime, and Less Mtce.
- Machinability and Design Simplicity adding cost benefits to offset increased material costs
- Casting capability including size, shapes, tubes and quality

Developing Applications in the markets we are strong:

**Mold Tooling, Aircraft Parts, Drilling Equipment**

Developing markets/applications where technology is strong:

**Oil Well Completion Equipment, Mining, Heavy Equipment, Hydraulic Systems, Marine Hardware, Engine Bearings.**

Lorain Technology Expanding  
Brush Wellman market and  
application reach

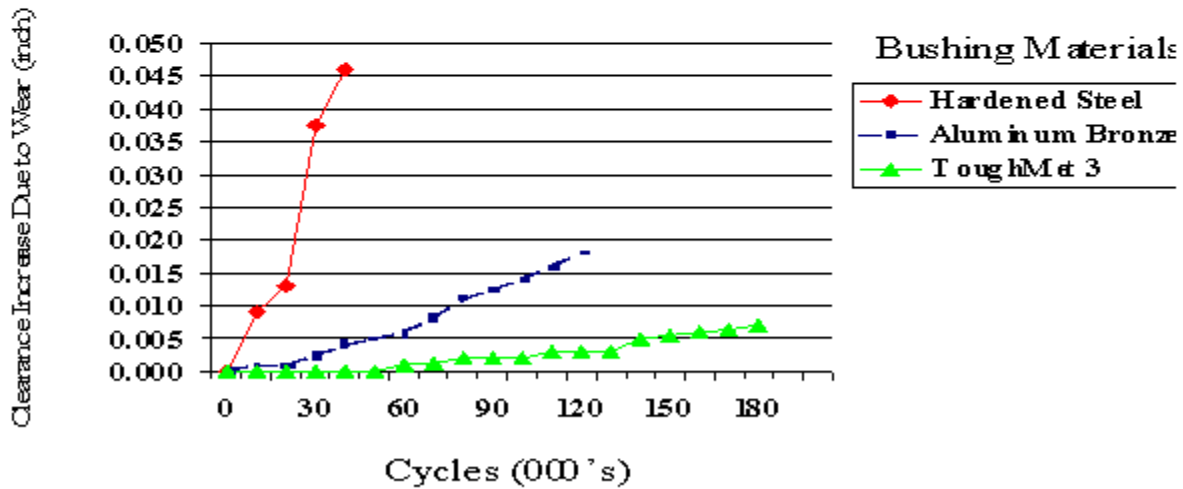
**BRUSHWELLMAN**  
Engineered Materials

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# *ToughMet™ Industrial Components Results:*

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**ToughMet™ Alloy Bushings and Plain Bearings Provide Superior Durability**  
Allowing More Time Between Machine Lubrication and Overhaul Operations.



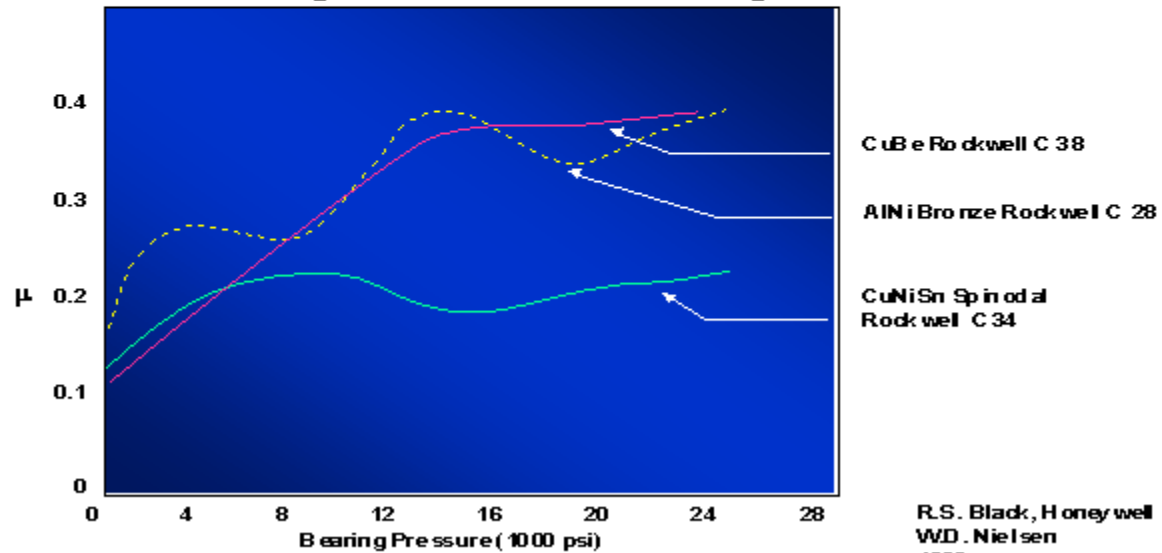
**BRUSHWELLMAN**  
Engineered Materials

# *ToughMet™ Industrial Components Results:*

---

## **ToughMet™ Alloy Bushings Provide Superior Power Efficiency Performance**

in a Comparison of Dynamic Coefficient of Friction  $\mu$  vs  
Bearing Pressure for Three Bearing Materials



R.S. Black, Honeywell  
W.D. Nielsen  
1996

**BRUSHWELLMAN**  
Engineered Materials

# *Brush International Inc.*

## *Global Sales, Marketing, Distribution & Tech Service*

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### **Brush International Inc.**

S. Freeman

#### ◀ ----- Asia / Pacific ----- ▶

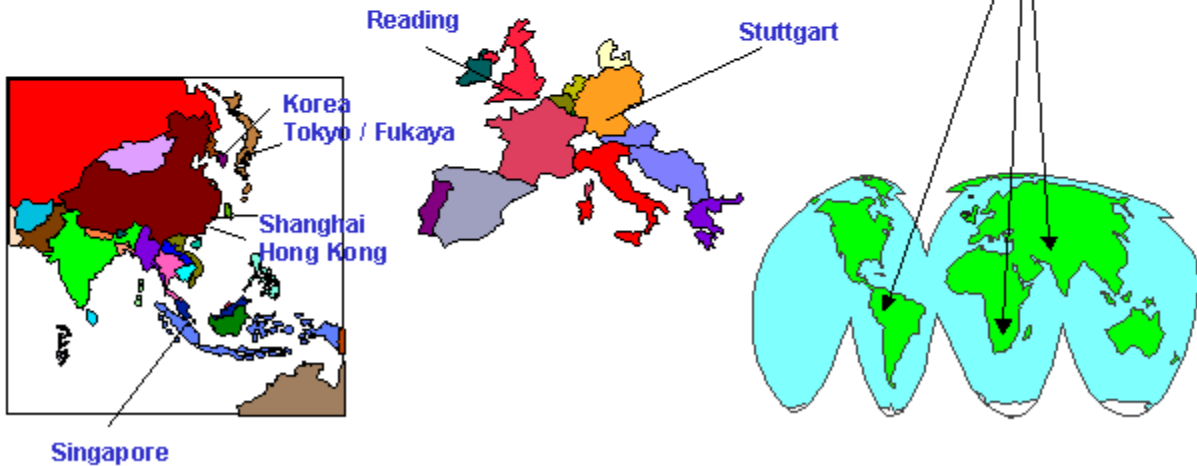
BWS	BWT	BWC	BWJ	BWK
Singapore	Taiwan	China	Japan	Korea
T. Ong	J. Tien	J. Oei	K. Hase	Y.J. Kim

#### ◀ ----- Europe ----- ▶

BWL	BWG	BWG	BWG
U.K.	Germany	Italy	Spain
G. Shapland	K.L. Rausch	A. Danielli	F. Aguirre
	W. Zeder		

#### ◀ - Emerging Markets - ▶

EXPORTS FROM USA



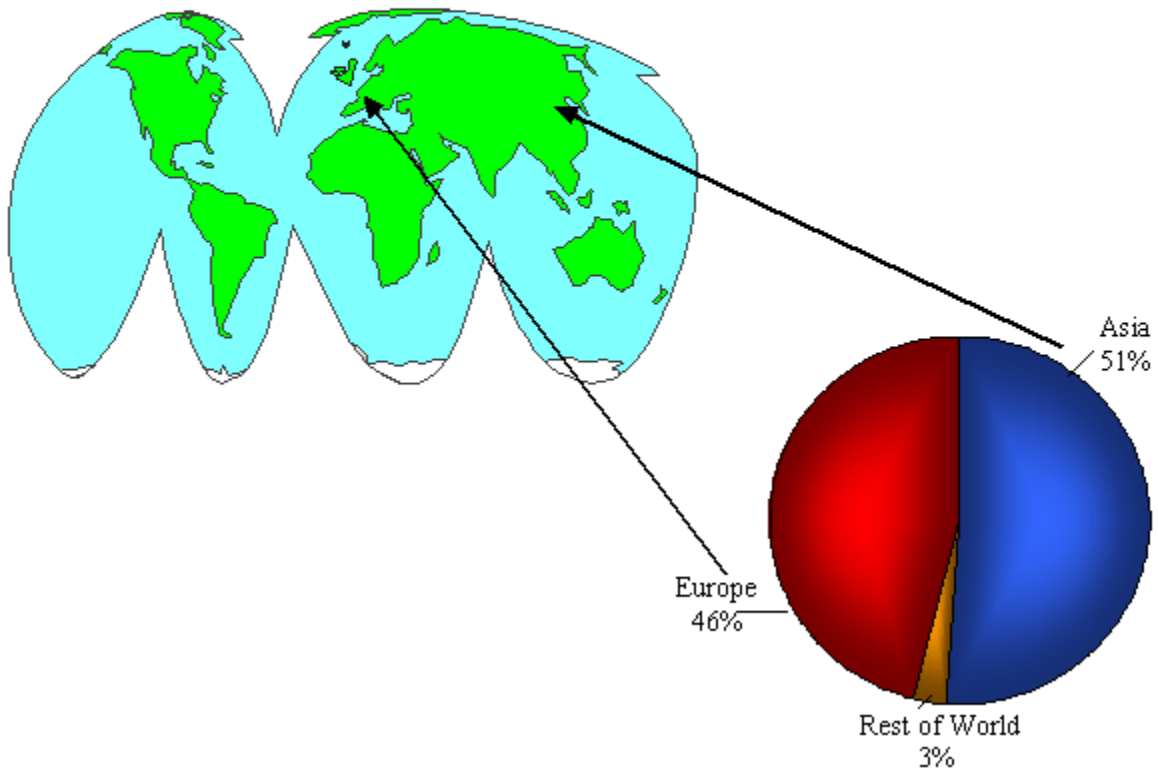
Brush International Service Centers

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# *Brush International, Inc.*

## *Alloy Sales by Region 2003*

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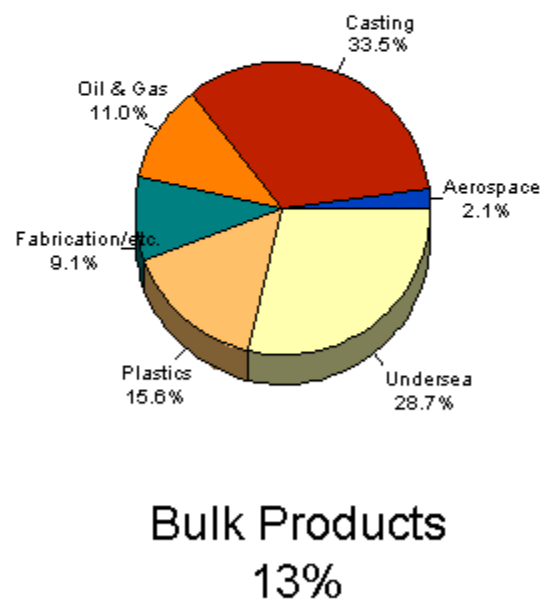
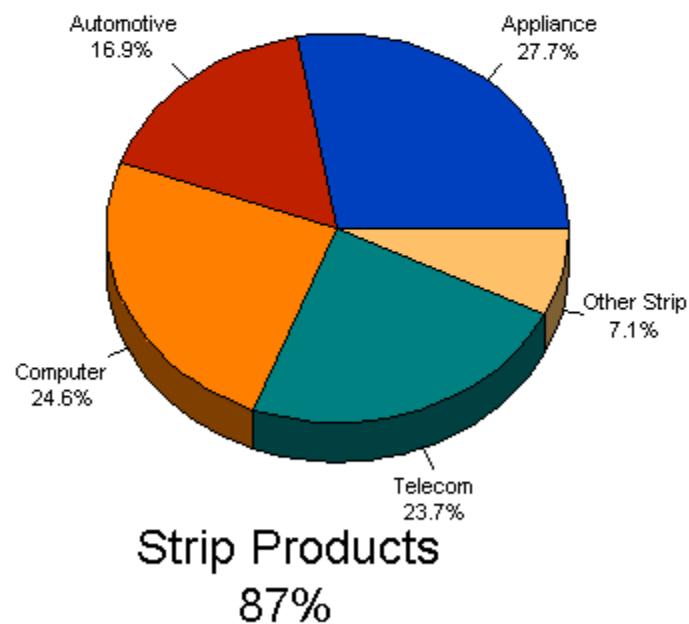


# *Brush International, Inc.*

## *2003 Historical Sales by Market Segment*

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# *Brush Wellman Beryllium Products*

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## Products

Beryllium Metal - One of the lightest metals known

- Family of vacuum hot and hot/cold isostatically pressed powder-derived metals

AlBeMet™

- Family of lightweight alloy composites
- Extruded, rolled sheet and hot isostatically pressed powder-derived metals

# *Brush Wellman*

## *Beryllium Products*

---

### Products - Cont.

- E-Materials
- Family of low expansion, lightweight electronic packaging materials
  - Composites of beryllium metal and beryllium oxide

### Beryllium Oxide/

- Chemicals
- Ceramic-grade beryllium oxide powder
  - Specialty beryllium-containing chemicals



# *Brush Wellman Beryllium Products*

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## Facilities

Elmore, Ohio

Fremont, California

# *Key Product Attributes*

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- Be/AlBeMet™
  - Light Weight (Density)
  - High Stiffness (Elastic Modulus)
  - High Thermal Conductance/Capacity
  - Low Thermal Expansion
- Be
  - Transparent to X-Rays
  - Neutron Reflector

# *Brush Wellman Beryllium Products*

---

## Primary Competition... Alternative Materials

Organic Composites (e.g. Carbon epoxy)

Metal Matrix Composites (e.g. Al - silicon carbide)

Pyrolytic graphite

Titanium

Aluminum (high strength grades)

# *Major Defense/Aerospace Applications for Brush Wellman Beryllium Products*

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## Optics

Optical substrate and support structure for visual and infrared target acquisition systems (fighter aircraft, helicopters, tanks), surveillance systems and astronomical telescopes.

## Satellites

Structures and sensors for defense and commercial telecommunications satellites.

## Electronics

Electronic packaging for defense avionics, radar and electronic countermeasures systems for helicopters and fighter aircraft. Applications include circuit boards, covers and packages.

# *Major Commercial Applications for Brush Wellman Beryllium Products*

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## X-ray Windows

Radiographic tube components for ① medical diagnostic equipment (x-ray, mammography, CAT-scan), and ② industrial x-ray equipment

## Optical Scanners

Mirrors for laser scanners used in reprographic and other high-performance laser applications.

## Motion control

Structural components for high-precision semiconductor processing and industrial robotic equipment

# *TMI - From a Customer Perspective*

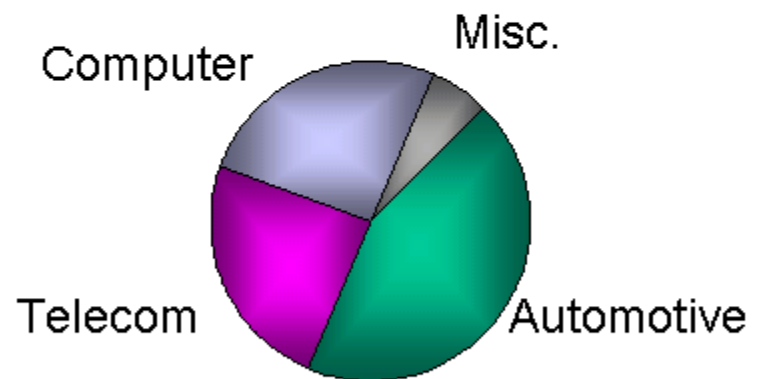


- 
- |      |  |
|------|--|
| WHAT | TMI provides our customers the ability to demand varied performance (electrical, thermal, or mechanical) from a metal surface area or section.   |
| WHO  | We provide this “service” to the telecommunication, automotive, computer, semiconductor and other industries.  |
| HOW  | By offering various forms of strip metal products: clad metals, plated metals, electron beam welded, solder plated, reflowed or printed-on, milled and/or skived metal strip or various combinations of the above. |
-

# *Our Major Markets*



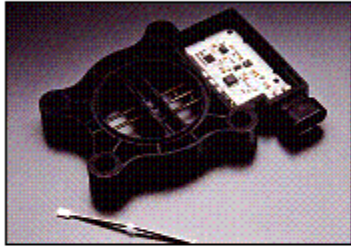
- Automotive
- Telecommunications
- Computer
- Jewelry
- Semiconductor
- Appliances
- Medical
- Aircraft





# *Our Major Applications*

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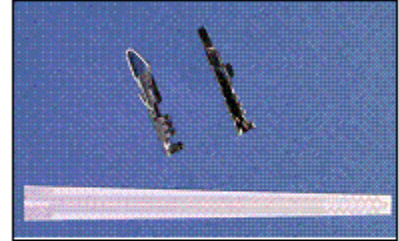


Leadframe

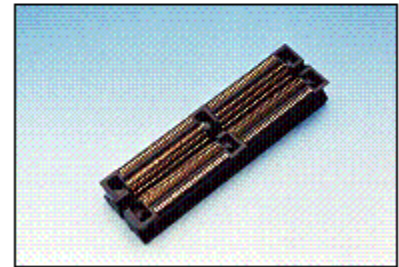


Air Bag Sensor

- Capacitors
- Coins and Tokens
- Connectors
- Contact Probes
- Fuses
- Leadframes
- Micro Motor
- Microwave
- Potentiometers
- Relays
- Sensors
- Solder Clips
- Switches



Connectors





# *Electroplating*

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- Precious and non-precious metals
  - Overall and selective stripe capabilities
  - Combination with current TMI technologies
-

# *Stripe Plating Application*

## *Cellular Phone Battery Contact*



### **Base Material**

- Base Material: BeCu
- Overall Ni plating
- Selective Au (one side)
- Selective SnPb (both sides)

# *Competitive Advantage*

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- Quality
    - QS 9000 / ISO 9002
    - State-of-the-art equipment
    - Vision Systems / PLC Systems for consistent quality
  - Design Support
    - Technical knowledge
    - Engineering expertise
  - Overall Capabilities
    - Slitting and leveling
    - Inlay / Electron-Beam Welding / Solder / Milling / Skiving / Plating
    - Any combination of the above processes
    - Large coil handling capability
-

# Strategic Concept

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- Total capability under one roof
  - Make it easy for our customers to get what they need to satisfy their customers' requirements
  - Make our customers competitive with reliable products
  - Solve problems for our customers with engineered strip metal solutions
  - Explore and develop new markets and geographic regions for manufacturing (*China*).
-

# *Growth in Electroplating*

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- Precious and non-precious metals
  - Overall and selective stripe plating capabilities
  - Combination with other TMI technologies
  - Proprietary closed contact plating technology
  - Building additional lines to further increase capacity
-

# Summary



- From 1992-2000 TMI sales more than quadrupled.
- 2001 through 2003 proved to be extremely difficult years due to major served markets being severely depressed; however, TMI remained profitable all three years.
- We have added major new technical capabilities using state of the art equipment in precious metal electroplating to better serve worldwide customer demand (*both technical & capacity*).
- We are ISO and QS registered.
- Additional Plating technology and capacity have been added to better service market demands.
- We are making further inroads into new markets (*energy*) and other markets (*consumer, medical, appliance, construction*), and new products for current markets in order to broaden our served market base and will have a much different served market profile by 2005/2006.

*Our focus is on materials, circuitry, subassemblies and packaging for the wireless & fiber-optic telecom market, specifically the signal amplifiers...*

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- Signal amplifiers transmit signals through air (wireless) or optical fiber media by boosting signal strength while maintaining integrity. Thermal management and reliability properties are of paramount importance.
- Signal amplifiers are critical active components located in base stations for wireless (cellular) and in regenerator stations along fiber-optic (Internet) links.

*Electronic Products*

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# *Our Overall Strategy*

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- Vertically integrate materials to subsystem assembly, providing customized solutions
- Meet the Customer's needs
  - Materials or subassemblies
- Fast Flexible Manufacturing Systems
  - Responsive to market needs

*Electronic Products*

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# *Business Groups*

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- Packaging
  - Electronic Packaging Products
- Circuitry
  - Circuits Processing Technology
- Materials
  - Brush Ceramic Products

*Electronic Products*

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# *Electronic Packaging Products*

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- Located in Newburyport, MA
- Products
  - RF Power Packages for base stations in cellular phone & wireless data networks, for cellular handsets, for military radar applications and for digital TV
  - Automotive Components for ignition systems in cars and trucks
  - Power Circuit Assemblies for DC motor controls

*Electronic Products*

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# *Circuits Processing Technology (CPT)*

---

- Located in Oceanside, CA
- Products
  - High Frequency Military and Aerospace Circuitry used in military radar and missile guidance
  - High Frequency Wireless circuitry for satellite communications
  - Fiber Optic Package components for amplifiers in fiber optic networks

*Electronic Products*

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# *Brush Ceramic Products*

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- Located in Tucson, AZ
- Products
  - RF Power Package Components for cellular base stations, high definition television, and cable TV
  - Fiber Optic Package components for amplifiers in fiber optic networks
  - Gas Laser Components for medical and research applications
  - Automotive components for ignition systems

*Electronic Products*

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# *Williams Advanced Materials Overview*

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- Williams is a supplier of high-purity, specialty metals serving the wireless, photonics, data storage, high temperature joining, traditional microelectronics and performance film markets.
- Established 1918. Subsidiary of Brush Engineered Materials
- Business Groups
  - Packaging Material Products - Solder preforms, bonding wire, FLA's, clad material and refining. These materials are used in photonic, wireless, traditional semiconductor and hybrid microelectronic packaging applications.
  - Specialty Alloy Products - Braze materials and structural alloys. These materials are used in electron tube, photonic and aerospace applications.
  - PVD (Physical Vapor Deposition) products - Precious metal and non-precious metal sputtering and evaporation materials, refining and related services. These materials are used in wireless, photonic, thin film heads, optical media, hybrid microelectronic and performance film applications.



# *WAM Headquarters*

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- Buffalo, NY USA - Manufacturing Facility
  - 100,000 sq. ft. overall, 6,500 sq. ft. of cleanroom, state-of-the-art machining/ milling/rolling/stamping/ cladding centers, hydrostatic wire extrusion, high purity refining/recycling, metals casting, automated plating, full analytical capabilities, product Research & Development



# *Far East Operations*

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- Singapore - WAM Far East Pte. Ltd.
  - 5,000 sq. ft., 2,500 sq. ft. of cleanroom, automated assembly operations, hydrostatic wire process, product development. PVD bonding operation.



# *Far East Operations*

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- Subic Bay, Philippines
  - Combo-Lid®, low-cost lids and preform - assembly, inspection and packaging





# *Far East Operations*

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- Taiwan
  - Target bonding services.
  - Low cost production capabilities.



# *Specialty Alloys Operations*

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- Wheatfield, NY USA- Williams Specialty Alloys
  - 30,000 sq. ft. with volume vacuum casting, rolling, annealing, powder atomizing and machining. 10 acres for expansion



# *WAM Thin Film Products Operations*

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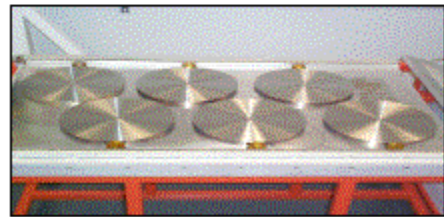
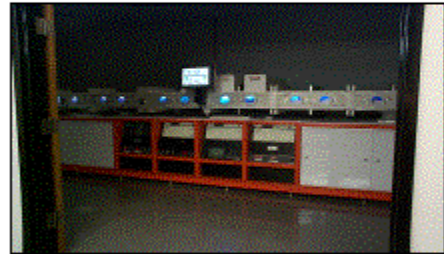
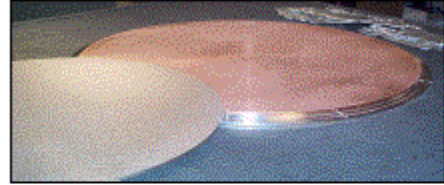


- Brewster, NY USA – WAM TFP
  - 35,000 sq. ft. with vacuum melting, hot-pressing, milling, Hot & cold rolling automated machining and target bonding capabilities.
  - Acreage to more than double our facility as needed.

# *Target Bonding Centers*

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- Buffalo, NY
- Brewster, NY
- Santa Clara, CA
- Limerick, Ireland
- Singapore
- Taiwan



# *Williams Advanced Materials*

## *Service and Support*

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➤ **Regional Offices (Sales and Applications Engineering support)**

Santa Clara, CA	Manila, Philippines
London, England	Buffalo, NY
Singapore	Boston, MA
Guadalajara, Mexico	Dallas, TX
Brewster, NY	Tucson, AZ
Taipei, Taiwan	

➤ **Worldwide Representatives**

Florida	France	Israel
Korea	India	China
Japan	Italy	Germany



# *Williams Advanced Materials Packaging Material Products*

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Hybrid Microelectronic Device

› **Markets**

Wireless, Photonics and Hybrid/  
Traditional Microelectronic Devices

› **Typical End-uses**

Cell phones, LEDs, fiber-optic  
networks, PC's, military  
electronics, avionics, medical  
electronics, appliances



Solder preforms and clad materials

› **Combo-Lids® - Frame/lid assembly**

Hermetic sealing

› **Clad Materials**

Thermal management

› **Bonding Wire**

Electronic interconnect

› **Solder Preforms**

Component attachment

› **Refining**

Scrap recovery



# *Williams Advanced Materials Specialty Alloy Products*

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Electron Tube

## › **Markets**

Electron Tube, Photonics, Aerospace,  
microelectronic packaging

## › **Typical End-uses**

Cellular base stations, lasers, x-ray  
machines, industrial microwaves



WAMBRAZE™ Materials

## › **Braze materials**

Powder, ribbon and preform

## › **Structural Alloys**

Monel

Cupronickel

Nickel Tungsten



# *Williams Advanced Materials*

## *Physical Vapor Deposition(PVD) Products*

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**Markets**

Cellular Phone (wireless)



**Products**

Sputtering Targets

### › **Markets**

Wireless microelectronics, Optical media, Photonics, thin film heads, glass, decorative, wear resistance, performance film

### › **Typical End-uses**

Wireless and fiber optic components, Recordable CDs, DVDs, Architectural glass, Hard Disks, faucets, automotive glass

### › **Precious Metal Sputtering Targets and Evaporation Materials**

### › **Precious Metal Refining Services**

### › **Non-precious Metal Sputtering Targets and Evaporation Materials**





# *Williams Strategic Leverage*

## *Ensuring Distinctive Abilities Translate to Maximum Returns*

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- Over 80 years of metal management and fabrication experience
  - Ability to efficiently manage precious metals critical to customers
- One-stop Shopping
  - Comprehensive product offering
  - Allows customer to reduce supplier base
- Industry leading lead times
  - Reduces Total Cost to Customer - Inventory turns
  - Alleviates planning “headaches”
- Fully Integrated Operations
  - In house fabrication, refining and analysis
  - Reduced cycle times and single point of contact for metal needs
- Service
  - WAM provides a unique, coordinated response to customers
  - We help our customers do their jobs - sales, engineering, accounting, etc.
  - We also prepare our customers for the future



## *Beryllium Health and Safety*

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*Brush has continued to make progress on issues related to beryllium health and safety*

- Improved worker protection programs in place
  - Rates of sensitization down among new workers
  - CBD litigation claims have declined to 13 cases
  - Strong focus on regulations related to beryllium exposure
-

# *Litigation*

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Caseload has dropped dramatically in recent years

	<u>Total Cases Pending</u>	<u>Total Plaintiffs (including spouses)</u>
12/31/02	33	70
12/31/03	15	33
03/31/04	14	34
07/02/04	13	32

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