Laser and Waterjet Technology

Website: http://www.iit.edu/~ipro323s06
Advisor: Dr. Keith McKee

Presenters: Ali Gowani, Ben Ingvoldstad, Trevor Waller
Team Members: (left to right) Hyung Choe, Ben Ingvoldstad, Trevor Waller, Hassaan Nasir, Ali Gowani, Sangmin An, Jimmy Lie, Dr. Keith McKee
Presentation Outline

- Introduction
- IPRO Objectives
- Laser Overview
- Waterjet Overview
- Technology Comparison
- Market Trends
- Conclusions & Recommendations
Objectives

- Gather information regarding the detailed specifications of how lasers and waterjets work.
- Examine the applications that lasers and waterjets can have in a variety of manufacturing processes.
- Compare which machinery is better suited for a particular task.
- Determine the feasibility of introducing these machines to a mainstream industrial market.
Lasers: An Overview
Laser Technology Overview

- What is a laser?
  - Excited Electrons Creating Light
  - YAG vs. CO₂

- Laser Properties
  - Monochromatic
  - Highly Directional
  - High Power in a Small Area
Laser Technology Overview

- **Laser Uses**
  - Cut very hard materials
  - Alternative to metal stamping
  - Rapid prototyping
Waterjets: An Overview
Waterjet Demonstration
Waterjet Technology Overview

- **Major Components**
  - Pump
  - Plumbing
  - Cutting Head

- **Types**
  - Abrasive
  - Non-Abrasive
Waterjet Technology Overview

- Pure Waterjet Attributes
  - Very thin stream (0.004 to 0.01 in. Diameter)
  - Able to cut soft, light materials
  - Extremely low cutting forces

- Abrasive Waterjet Attributes
  - Thin stream (0.02 to 0.05 in. Diameter)
  - Thin and thick material cutting (up to 10 in.)
  - Low cutting forces
Waterjet Technology Overview

- Why Use Waterjets?
  - Very Powerful
  - “Cold” Cut Process
  - Minimal wear on machine

- Who Uses Waterjets?
  - Food Industry
  - Aerospace Industry
  - Smaller Custom Shops
  - Automotive
Laser and Waterjets: A Comparison

Laser

Water Jet
Laser and Waterjet Comparison

Laser advantages
- Narrow cutting tolerance (.020 inches)
- Low maintenance
- Faster cutting rates

Laser disadvantages
- Equipment cost
- Material limitations
- Small Heat Affected Zone

Waterjet advantages
- Cuts all materials
- No Heat Affected Zone
- No part distortion

Waterjet disadvantages
- Equipment cost
- Pump maintenance (every 1,000 hours)
- Noise (80 dB or more)
- Slow cutting rates
- Water must be highly purified
Market Trends
Market Trends

- Misconceptions
  - Lasers and waterjets are brand new technologies
  - These machines are high maintenance
  - Not cost effective to operate

- Truths
  - Lasers and waterjets are well established and reliable
  - Low maintenance and simple operation
  - Initial purchase saves future production costs
Market Trends

Industry Growth

- Lasers
  - $1.5 billion sales per year
  - 22% growth between 2003–2004
  - 3–4% growth expected this year

- Waterjets
  - Fastest growing in machine tool market
  - 9.1% steady growth rate between 1997–2004
  - Expected increase in sales
Conclusions and Further Study
Conclusions

- Both technologies provide alternatives to traditional cutting methods
- Cost effective investment
- Both machines are reliable for general applications
Recommendations

- Large companies consider long term investment in these machines
- Small companies develop rapid prototyping for limited production
- Future IPROs can select industries that would benefit and propose machine alternatives
Questions?

For more information check out
http://www.iit.edu/~ipro323s06