# THE BUSINESS CASE

# FOR ROBOTS

MOTOMAN

a YASKAWA company

# The Business Case for Robots

- American industry is fighting to survive in a hyper-competitive global market
- Following WWII, the U.S. was the leading industrial country in the world
  - Out-produce any country… sell all we produced
- Third-world countries began to show their might with quality products produced at lower costs
- Low-cost imports began eating away at earnings and profits of U.S. companies
- To survive in the global marketplace companies must focus on:
  - Total supply chain costs
  - Product quality
  - Productivity
  - Time to market

**ALL THE THINGS THAT MAKE ROBOTS ATTRACTIVE!**

# The Business Case for Robots


Is China really the answer?

LABOR is only one piece of total supply chain costs.

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**If you could get your labor costs in line with Chinese manufacturing sector wages, why would you even consider moving your operations to China?**

**Remember…**
**You still have to ship your products back to sell them and that adds to your logistics costs.**

# The Business Case for Robots

**OFFSHORE MANUFACTURING RISKS AND OBSTACLES:**

- Higher transportation costs
- More transportation problems
- Longer delivery times
- Quality problems
- International concerns – terrorism
- Loss of real-time control of manufacturing
- Loss of ability to make quick product or process changes
- Loss of closeness to your market and your end-customers

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**How about if you could employ a highly skilled laborer for $0.30 per hour with no benefits or legacy costs?**

**A laborer that can work 24 hours per day,
7 days a week, 52 weeks a year,
Without the need for breaks!**

**THIS IS THE BUSINESS CASE FOR ROBOTS!**

# The Business Case for Robots

- So, how do we compete with offshore low labor costs?
  There is a very powerful message that follows.

- National average cost per KWH for industrial usage: 5 cents per hour
  (source: U.S. Department of Energy)

**AVERAGE ROBOT POWER CONSUMPTIONS:**

| Robot Size | Payload Capacity | Power Consumption |
|---|---|---|
| Small | 5 - 10 kg | 1 KVA |
| Medium | 100 kg | 5 KVA |
| Large | 500 kg | 10 KVA |

Source: Robot manufacturers' specification sheets

- Many of the robots sold in the U.S. are of medium size
  (auto industry is the biggest user)
  - 5 KVA average power consumption
  - Power factor of 85% to convert KVA to KW results is approximately 6 KW as the average power consumption for a medium size robot

**At 5 cents per KWH and 6 KW usage,
the average cost per hour to operate
a medium size robot is about 30 cents!**

# The Business Case for Robots

- Many robot applications are for material handling of some sort
  - According to RIA, some 45% of robots purchased in North American in 2006 were for material handling applications
- To handle material, a robot must be equipped with some type of gripper device to be comparable to a hand on a human worker
- Grippers are typically pneumatic and require very little air consumption
- The national average cost for compressed air is around $0.02 per hour for 1 CFM. (source: U.S. Department of Energy)
- A 2” bore x 2” stroke gripper cylinder cycling four times per minute uses about 25 cubic inches of compressed air per minute or 0.014 CFM
- At 2 cents per hour per CFM, that is less than a penny per hour

**The cost of compressed air to operate a robot’s gripper is essentially negligible**

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At an average cost of $0.30 per hour for a medium-size robot, what do we have?

- For a one shift day, the average cost is **$2.40**
- For a two shift day, the average cost is **$4.80**
- For a three shift day, the average cost is **$7.20**
- Total average cost per year for one shift, five days for 52 weeks is **$624**
- Total average cost per year for two shifts, five days for 52 weeks is **$1,248**
- Total average cost per year for three shifts, five days for 52 weeks is **$1,872**

# The Business Case for Robots

## How does this compare to human workers?

- According to an article that appeared last year in Forbes magazine titled, “Buy a Robot and Save America” ….
  - The average wage for a U.S. warehouse or distribution worker is around $15 per hour plus benefits
  - The average wage for this same worker in China is about $3 per hour
  - The average wage for a skilled UAW U.S. auto worker is somewhere between $25 and $30 per hour, plus the staggering costs of health care coverage and retirement benefits
- Even if the cost of 30 cents per hour for robot labor were to double, it is still 1/5 the cost per hour of a Chinese laborer!
- It’s more like 1/50 as costly as a skilled UAW U.S. auto worker!

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**COST OF MAINTENANCE FOR MANUAL WORKERS:**

- Lunch and breaks = lost production time
- Vacations = no production
- Lost time due to injuries = no production
- Employee turnover: training and retraining
- Protective clothing and safety devices
- Locker rooms and supplies: lunch rooms and supplies
- Parking lot
- Insurance
- Pensions
- Worker’s compensation
- Inconsistent, unpredictable production

# The Business Case for Robots

**ROBOT MAINTENANCE COSTS:**

- Beyond the initial cost and small operating cost, there are some additional maintenance costs (example: typical application of two shift per day material handling robot)
- For the first 3-4 years, $500 per year in preventive maintenance (mainly lubrication)
- After the 4th year, $5,000 in preventive maintenance, mainly in replacement of wear items (I.e., internal wire harnesses)
- For the next 3-4 years, $500 per year in preventive maintenance (mainly lubrication)
- After 8-10 years (30,00 hours usage), refurbishment may be required at a cost of 50% of the asset value of the robot, depending on the duty cycle and environment of the robot

**The costs for human maintenance are substantial and many times more than the maintenance cost for robots!**

# The Business Case for Robots

**There is the initial purchase and installation cost of a robot that can usually be amortized in a few years. After that, the cash flow is impressive!**

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**Example**

**ROBOT PROJECT PAYBACK ANALYSIS**

| Year | Robot System Cost* | Manual Labor Costs** | Yearly Cash Flow | Cumulative |
|---|---|---|---|---|
| 1 | $200,000 | $100,000 | -$100,000 | -$100,000 |
| 2 | $500 | $102,000 | $101,500 | $1,500 |
| 3 | $500 | $104,040 | $103,540 | $105,040 |
| 4 | $500 | $106,121 | $105,621 | $210,661 |
| 5 | $5,000 | $108,243 | $103,243 | $313,904 |
| 6 | $500 | $110,408 | $109,908 | $423,812 |
| 7 | $500 | $112,616 | $112,116 | $535,928 |
| 8 | $500 | $114,869 | $114,369 | $650,297 |
| 9 | $500 | $117,166 | $116,666 | $766,963 |
| 10 | $30,000 | $119,509 | $89,509 | $856,472 |

*includes training and installation costs

**$50,000/yr/man/2 shifts including benefits and 2% annual inflation

# The Business Case for Robots

## EXAMPLE: PARTIAL LABOR ATTENDING ROBOT SYSTEM

**So, let's say you still need 25% labor to attend the robot system:**

| Year | Robot System Cost* | Manual Labor Costs** | Yearly Cash Flow | Cumulative |
|---|---|---|---|---|
| 1 | $200,000 | $75,000 | -$125,000 | -$125,000 |
| 2 | $500 | $76,500 | $76,000 | -$49,000 |
| 3 | $500 | $78,030 | $77,530 | $28,530 |
| 4 | $500 | $79,591 | $79,091 | $107,621 |
| 5 | $5,000 | $81,182 | $76,182 | $183,803 |
| 6 | $500 | $82,802 | $82,306 | $256,109 |
| 7 | $500 | $84,462 | $83,962 | $350,071 |
| 8 | $500 | $86,151 | $85,651 | $435,723 |
| 9 | $500 | $87,874 | $87,374 | $523,097 |
| 10 | $30,000 | $89,632 | $59,632 | $582,729 |

*includes training and installation costs

**$37,500/yr/man/2 shifts including benefits and 2% annual inflation

# The Business Case for Robots

**Now, let's see what happens with a 25% productivity gain:**

| Year | Robot System Cost* | Manual Labor Costs** | Yearly Cash Flow | Cumulative |
|---|---|---|---|---|
| 1 | $200,000 | $125,000 | -$75,000 | -$75,000 |
| 2 | $500 | $127,500 | $127,000 | $52,000 |
| 3 | $500 | $130,050 | $129,550 | $181,550 |
| 4 | $500 | $132,651 | $132,151 | $313,701 |
| 5 | $5,000 | $135,304 | $130,304 | $444,005 |
| 6 | $500 | $138,010 | $137,510 | $581,515 |
| 7 | $500 | $140,770 | $140,270 | $721,785 |
| 8 | $500 | $143,586 | $143,086 | $864,871 |
| 9 | $500 | $146,457 | $145,957 | $1,010,828 |
| 10 | $30,000 | $149,387 | $119,387 | $1,130,215 |

*includes training and installation costs

**$50,000/yr/man/2 shifts including benefits and 2% annual inflation;
25% more labor required for same output as robot

- If we look at spreading the total cost of the system working on a two shift per day, five days per week basis, over a 15 year life of the robot, we arrive at a cost of $2.40 per hour.

**$150,000/(80 hr X 52 wk X 15 yr) = $150,000/62,400 hr = $2.40/hr**

- When power and maintenance costs over the same period are added in, the total amortized cost for the robot system is $3.44 per hour.

**POWER: $0.30/hr X 62,400 hr = $18,720**

**MAINTENANCE: $500 X 12 yr + $5,000 + $30,000 = $46,000**

**$150,000 + $18,720 + $46,000 = $214,720/62,400 hr = $3.44/hr**

- This is very competitive with the current average labor cost in China, without all the drawbacks!

## DIRECT LABOR SAVINGS are many times used as the only justification for a robotics project, because they are EASY to quantify

There are many other benefits that are harder to quantify that are left out of the justification analysis.

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**HARDER TO QUANTIFY BENEFITS INCLUDE:**

- Increase in productivity
  Examples: arc welding and machine load/unload
- Improved quality
  Examples: arc and spot welding
- Material Savings
  Example: Paint and sealants
- Reduced scrap and rework
  Example: Investment casting
- Improved manufacturing flexibility (shorter product runs, product life)
- Reduced work-in-process inventory (combined operations)
- Floor space savings
  Example: overhead mount and arc welding
- Better utilization of capital equipment
  Example: machine tool load/unload
- Lower piece part cost (competitive advantage)
- More efficient production planning and scheduling (predictability)
- Better department efficiency
- Removal of personnel from hazardous or fatiguing tasks and their redeployment to other value-added jobs

**Since all of these items have VALUE that is difficult to quantify, it is better to make an educated guess of their value rather than leave them out of the justification analysis.**

**This will give you a MORE REALISTIC picture of the project benefits.**

# The Business Case for Robots

**Justification should be a STRATEGIC decision made by informed management that balances the short-term goal of SURVIVAL with the longer-term goal of GROWTH, to posture a company to have a competitive advantage.**

**It should not be relegated to an accounting function without the foresight of long-term strategy.**

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**US FDI (Foreign Direct Investment) in the Manufacturing Sector – China**

| Manufacturing Industry Group | Annual Growth Rate (2000-04) | Total Value (2004) |
|---|---|---|
| Transportation equipment | 31% | $1.83 billion |
| Chemicals | 11% | $1.64 billion |
| Computers and electronic products | 25% | $1.34 billion |
| Food | 21% | $593 million |
| Electrical equipment, appliances, and components | 2% | $493 million |
| Machinery | 20% | $455 million |
| Primary and fabricated materials | 2% | $149 million |
| Total | 2% | $8.22 billion |

Source: US Government Accountability Office Report to Congressional Committees on China Trade, December 2005

**FOOD FOR THOUGHT:**

Had that $8.22 billion been spent for robots, at let's say an average system cost of $150,000 each to install, U.S. industry could have employed over 54,000 robots at from 30 to 60 cents per hour to enhance its competitive position in the global marketplace!

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## IN CONCLUSION:

China may seem very attractive in the short term as a way for U.S. industry to reduce manufacturing labor costs.

However, China is not going to remain that way forever. Workers will eventually demand and get better wages.

Unless U.S. industry begins to consider other alternatives like robots to remain competitive, we could end up without a manufacturing base in this country.

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## THE END

## OR…..

…the beginning of a renewed effort to reclaim American manufacturing as the **NATIONAL TREASURE** that it once was!

It's up to you.
Make the best decision for your survival and continuing growth!