

# Production Challenges in a Competitive Environment of Wire Manufacturing

Tom Moran  
Mexico City, Mexico  
September 25, 2007



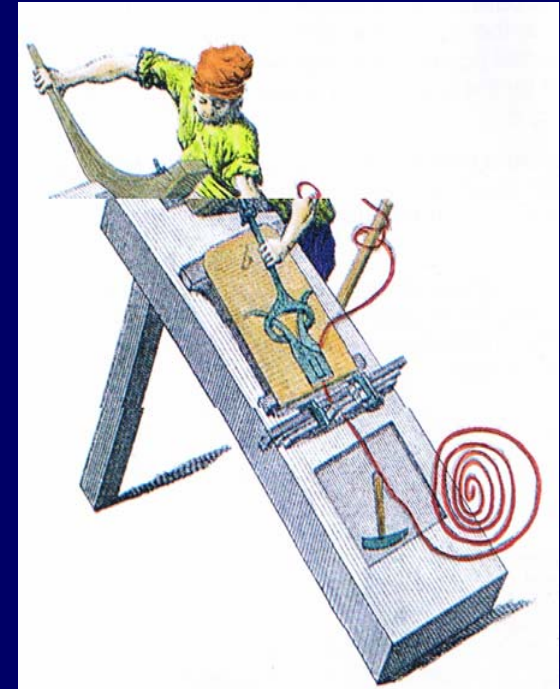
# History 1973-2007

## ■ Manpower

- Management
  - Multiple layers/Flat
  - Research and Development
- Operations
  - One person per machine/One person per multiple machines

## ■ Machine Speeds

- Stripper (800-1000 fpm)
- Continuous (>6000 fpm)



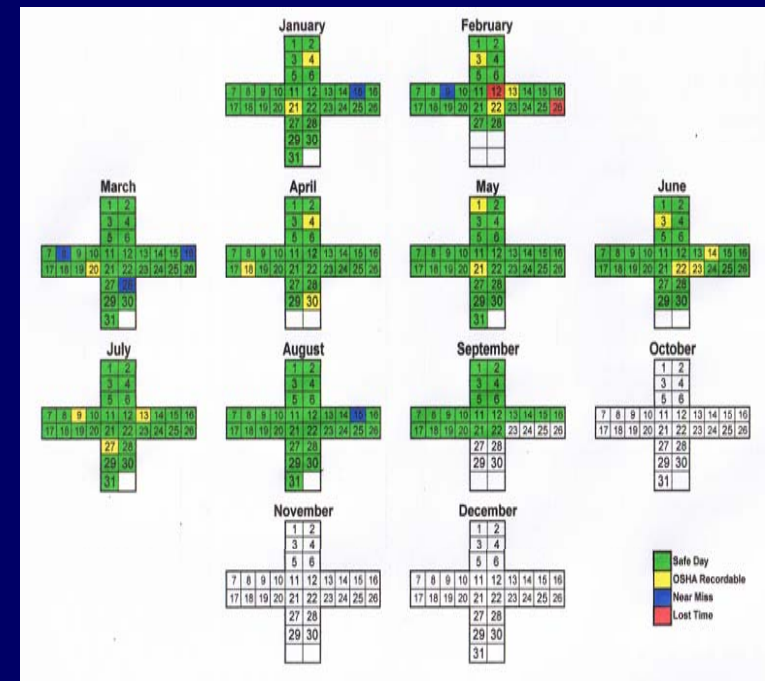
# The New Operations Plan for Global Market

- Safer
- Better (Quality)
- Faster (Cheaper)



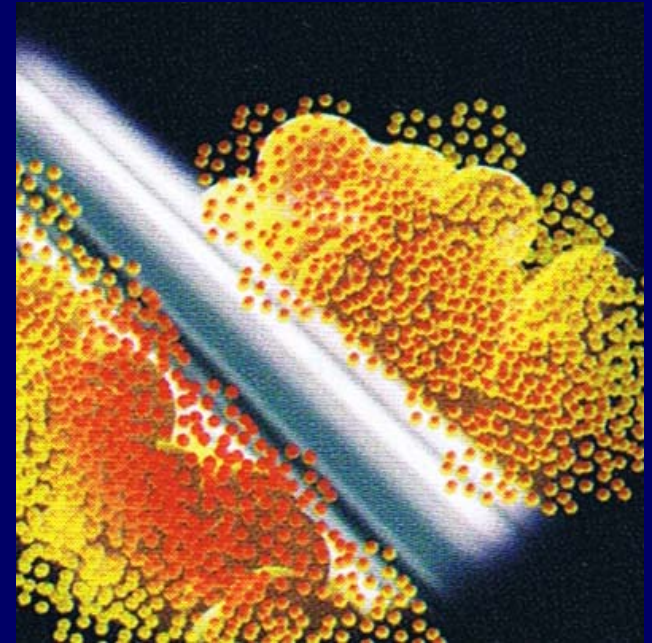
# Safety Programs

- Training
- Employee retention
- Machine Guarding
  - Reduce accidents/lost time/employees away from job
  - Reduce insurance premiums



# Better (Quality)

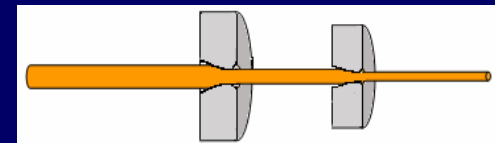
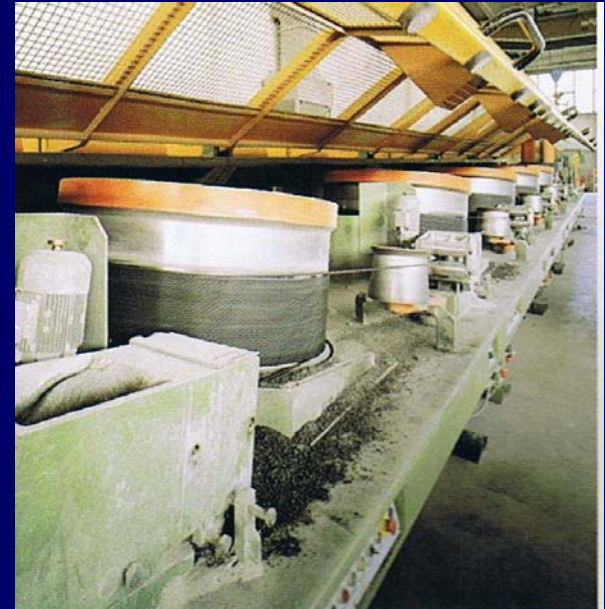
- Higher Surface Expectations
  - Raw material sourcing
- Reduced use of chemical cleaners
- Reduced use of filler metals (copper, nickel)





# Faster (Cheaper)

- Machines
  - How fast can we go?
- Materials
  - Quality levels
- Manpower
  - Experience
- Methods
  - Best practices



# Faster (Cheaper)

## ■ Cost Controls (Burden Expense)

- Indirect Labor
  - Salaried Wages, Material Handling, Janitors, Inspection, Union Officials
- Operating Supplies
  - Oils and Lubricants, PPE, Cleaning Supplies, Shipping Supplies, Office Supplies
- Tools
  - Wire Cutters, Wrenches, Micrometers, Internal Grinders
- Utilities
  - Electric Power, Gas, Water

# Factors in Wire Drawing At Higher Speeds (Faster)

- **Machines**
- **Wire Rod Quality:**
  - Metallurgical quality: Tensile strength and % ROA
  - Surface quality
- **Die Design and Quality:** Design, scratches, cracks, etc.
- **Lubrication:** Type, presence
  - Cleanliness
  - Life
- **Total Reduction:** True strain
- **Drafting Practice:** % of reduction per die
- **Drawing Speed:** ft/min



# Machines

## ■ Designed for higher speed

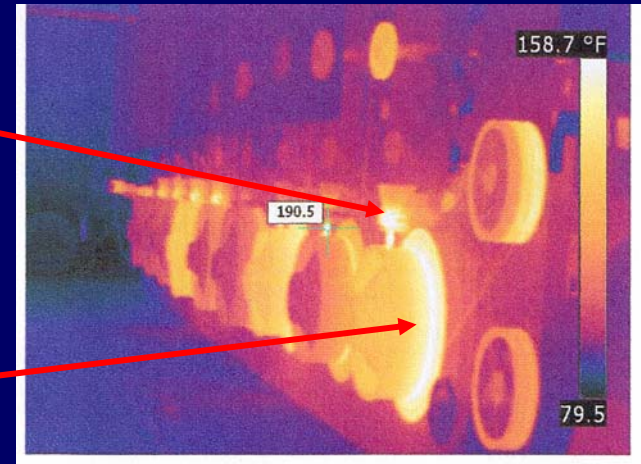
- Block cooling
- Die Holder cooling (Rotating)
- Pressure die holders
- Robust
- Motor cooling



# Machines

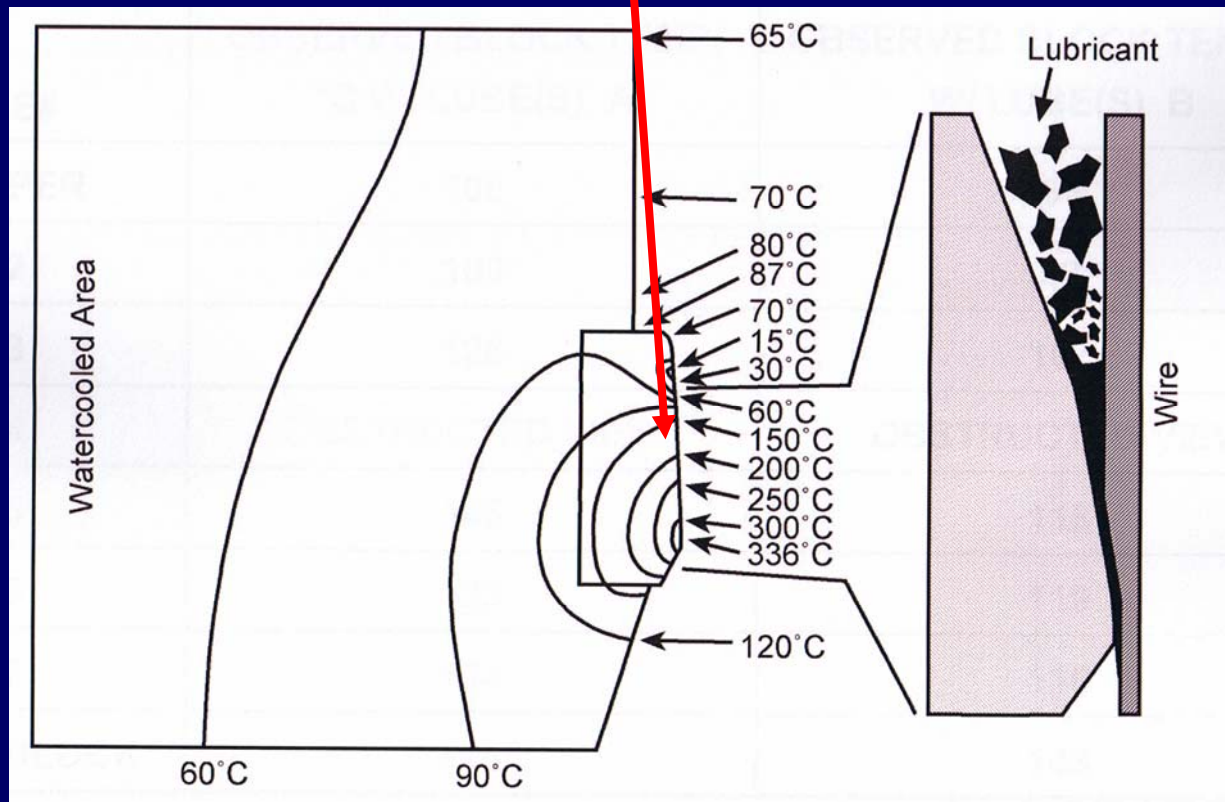
Die Box Temperature

Block Temperature

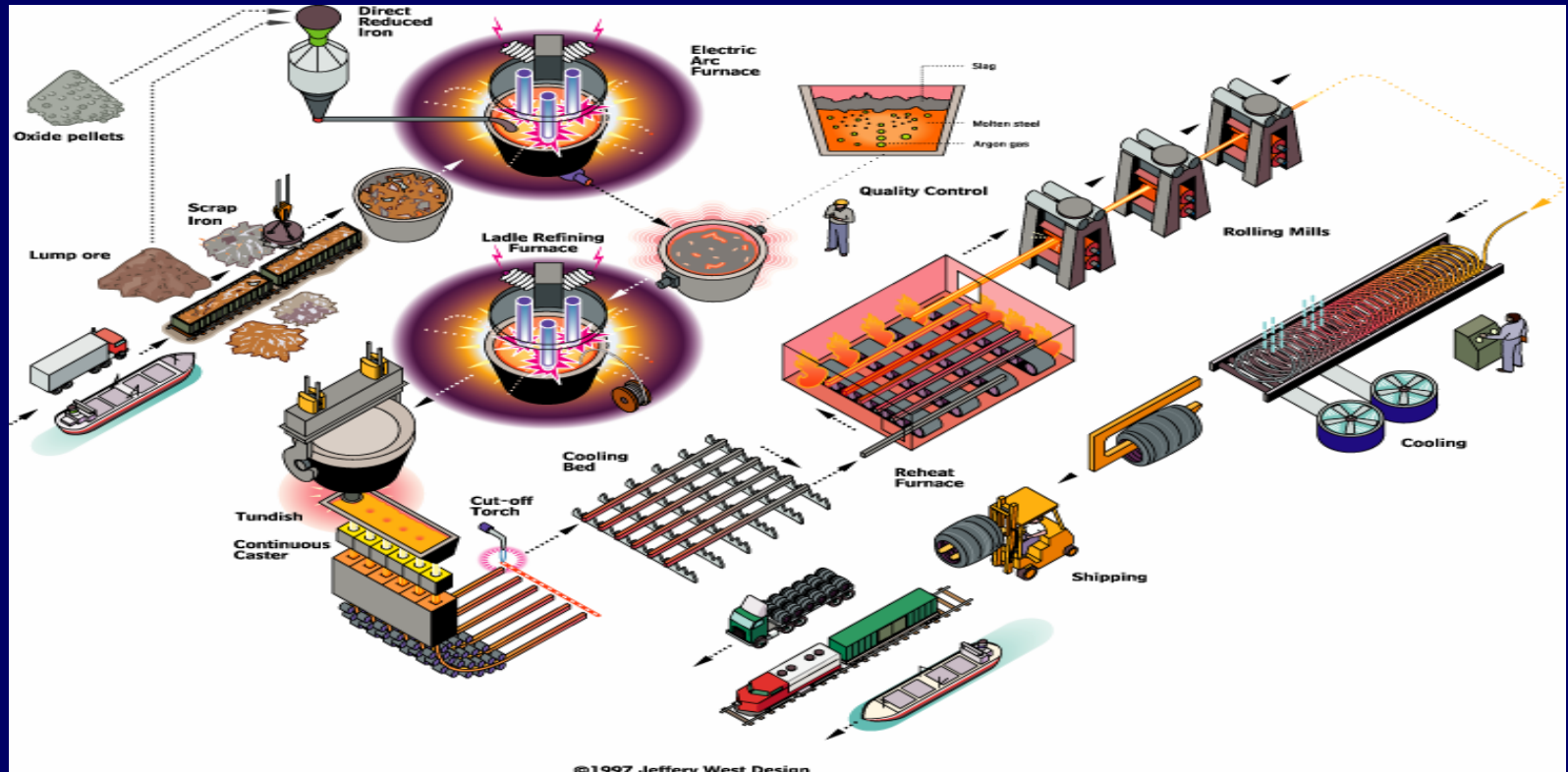


# Machines

## Die Temperatures



# Material Sourcing





# Scrap - Rod Prices

- EAF's (Mini-Mills) use high amounts of scrap to make up their charge
- Scrap prices greatly influence the rod market and pricing
- China and other countries have participated heavily in the scrap market, including the Central and North American market

## AMM Scrap Iron & Steel Prices

Prices based on information received by AMM as of 11 a.m. Eastern time.  
Prices are subject to the disclaimer appearing on the "AMM North American Scrap Prices" page.  
Estimated domestic consumer buying prices in US\$/gross ton, delivered mill price.

### CONSUMER BUYING PRICES

	Aluminum	Cast Iron	Chromium	Chromium	Steel	Stainless steel	Ni-Cr	Phos	Aluminum	Aluminum	Aluminum
NO. 1 HEAVY MELT	180	180	208	180	208	180	220	220	185	110-112	185
No. 1 heavy mill	170	180	208	170	208	170	210	210	180	107-108	175
No. 1 bundles	260	260	270	260	245	245	250	250	250	250	250
No. 2 bundles	160	160	160	160	160	160	170	170	170	170	170
No. 1 building	235	245	260	275	250	250	250	250	250	250	250
No. 1 factory bundles	247	235	230	230	230	230	240	250	250	130-134	240
Shredded auto scrap	247	235	230	230	230	230	240	250	250	130-134	240
MACHINE SHOP TURNINGS	70	94	150	90	150	90	140	135	115	90-92	125
Shavings turnings	70	94	150	90	150	90	140	135	115	90-92	125
Cold iron turnings	70	94	150	90	150	90	140	135	115	90-92	125
Mixed turnings, turnings	70	94	150	90	150	90	140	135	115	90-92	125
CUT STRUCTURAL PLATE											
2" MAX.		220	325				240		300		
Cut structural plate, 2" max.	230	230	240	230	225	220	230	230	230	125-127	220
Cut structural plate, 2" max.	230	230	240	230	225	220	230	230	230	125-127	220
Flamingo steel, 2" max.	170	180	180	170	180	180	180	180	180	180	180
CUPOLA CAST	210	125	200	185	180	210	210	230	195		
Cold iron cast	230	230	230	230	230	230	230	230	230	230	230
Unalloyed motor blocks	180	180	230	230	230	230	230	230	230	230	230
Unalloyed motor cast	180	180	230	230	230	230	230	230	230	230	230
Drop broken machinery cast	210	260	295	235	220			247	250	150	
NO. 1 100 HEAVY MELT	210	295	345	185				230	230	140	220
Roll scraps, 2" max.	125	270	375	380				230	230	140	220
Roll scraps, 2" max.	125	270	375	380				230	230	140	220
Steel car wheels	225	230	280	290	290	290	290	290	290	290	290
Other black material (OTM)	180	190	210	210	210	210	210	210	210	210	210
CLEAN USED DENSED CANS											
Aluminum price											
Aluminum price											
Aluminum price											

### STAINLESS STEEL SCRAP

	Aluminum	Cast Iron	Chromium	Chromium	Steel	Stainless steel	Ni-Cr	Phos	Aluminum	Aluminum	Aluminum
DEALERS BUYING PRICES (cwt)											
18-8 bundles, solid, clips	83-84	83-84	84-85	84-85	84-85	84-85	84-85	84-85	84-85	84-85	84-85
18-8 turnings	79-80	79-80	80-81	80-81	80-81	80-81	80-81	80-81	80-81	80-81	80-81
18-8 new clips	53-54	53-54	54-55	54-55	54-55	54-55	54-55	54-55	54-55	54-55	54-55
18-8 bundles, solid, clips			2,425-2,450	2,425-2,450	2,425-2,450	2,425-2,450	2,425-2,450	2,425-2,450	2,425-2,450	2,425-2,450	2,425-2,450
18-8 turnings			2,325-2,350	2,325-2,350	2,325-2,350	2,325-2,350	2,325-2,350	2,325-2,350	2,325-2,350	2,325-2,350	2,325-2,350
430 bundles, solid			240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250
430 turnings			240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250
430 bundles, solid			240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250
430 turnings			240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250	240-250
Aluminum price											
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### EXPORT YARD BUYING PRICES

Estimated prices in export yards. Scrap in process will pay for items delivered to the yard, in US\$/gross ton.

	Aluminum	Cast Iron	Chromium	Chromium	Steel	Stainless steel	Ni-Cr	Phos	Aluminum	Aluminum	Aluminum
NO. 1 HEAVY MELT	180	180	208	180	208	180	220	220	185	110-112	185
No. 1 heavy mill	170	180	208	170	208	170	210	210	180	107-108	175
No. 1 bundles	260	260	270	260	245	245	250	250	250	250	250
No. 2 bundles	160	160	160	160	160	160	170	170	170	170	170
No. 1 building	235	245	260	275	250	250	250	250	250	250	250
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CUPOLA CAST	210	125	200	185	180	210	210	230	195		
Cold iron cast	230	230	230	230	230	230	230	230	230	230	230
Unalloyed motor blocks	180	180	230	230	230	230	230	230	230	230	230
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Drop broken machinery cast	210	260	295	235	220			247	250	150	
NO. 1 100 HEAVY MELT	210	295	345	185				230	230	140	220
Roll scraps, 2" max.	125	270	375	380				230	230	140	220
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Other black material (OTM)	180	190	210	210	210	210	210	210	210	210	210
CLEAN USED DENSED CANS											
Aluminum price											
Aluminum price											
Aluminum price											

### AMM WEEKLY SHREDDED SCRAP PRICE COMPOSITE



### AMM WEEKLY SCRAP COMPOSITES

Averages calculated each Friday, based on data effective from the previous Friday - Thursday Prices are in US\$/gross ton.

	Aluminum	Cast Iron	Chromium	Chromium	Steel	Stainless steel	Ni-Cr	Phos	Aluminum	Aluminum	Aluminum
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Aluminum price											
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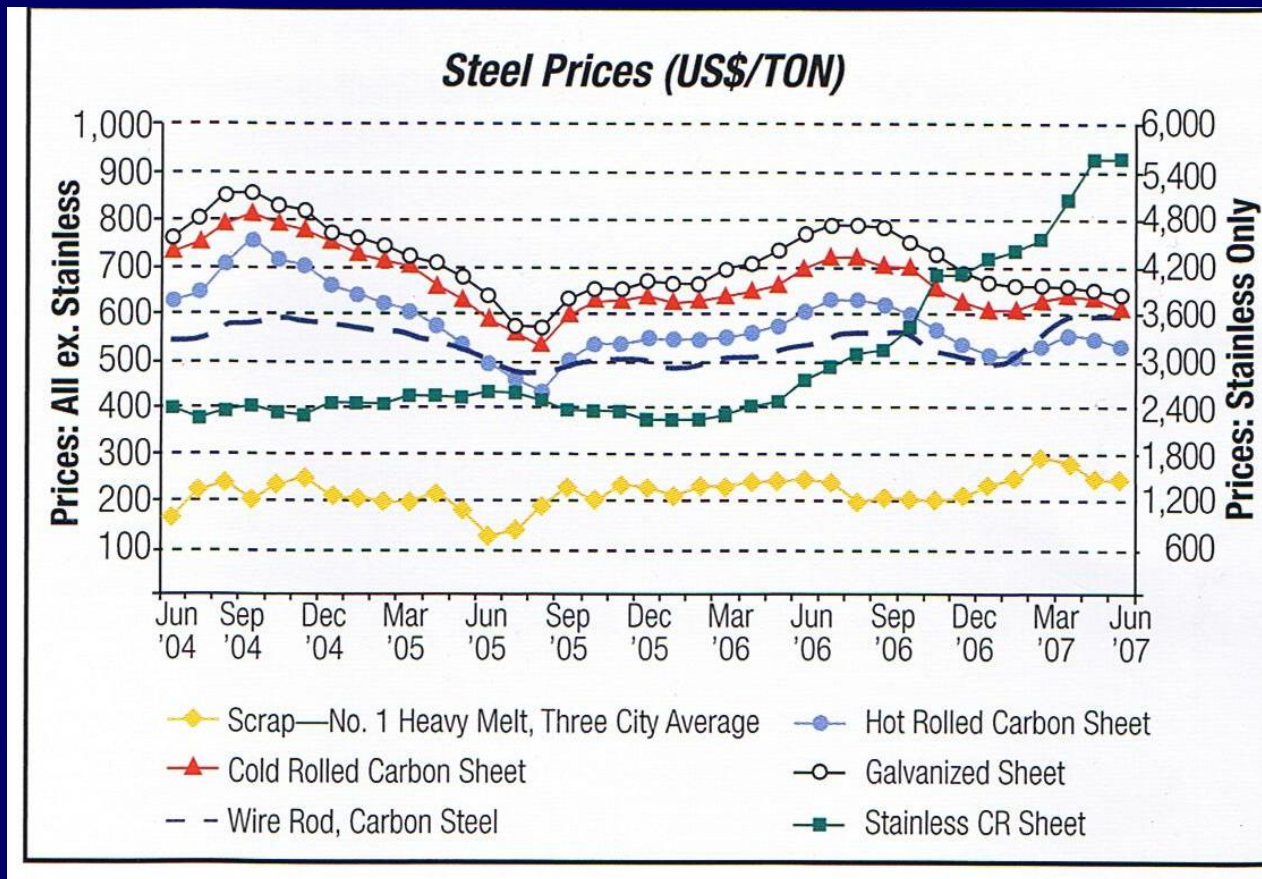
### STAINLESS COM

Averages calculated each Friday, based on data effective from the previous Friday - Thursday Prices are in US\$/gross ton.

18-8 turnings	430 turnings, oxide	430 turnings	408 turnings, oxide	409 turnings
<b>ADDITIONAL GRADES</b>				
Electric furnace, 3" max.				
Cut structural plate, 4" max.				
Stove plate				
No. 1 industrial heavy mill				
Rail oxide, 16" max.				
Reversing rolls				
Steel oxide				
Heavy forge bar oxide				
Stove plate				
Punching & plate, 12" max.				

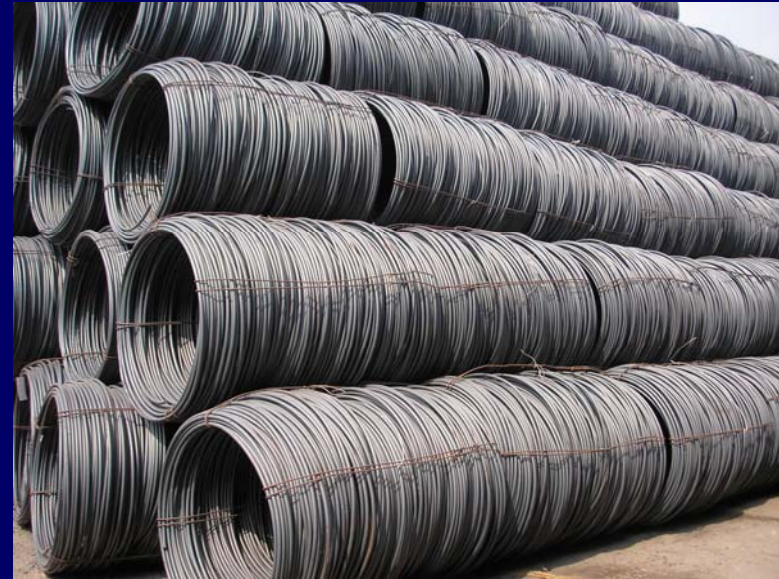


# Wire Rod Pricing

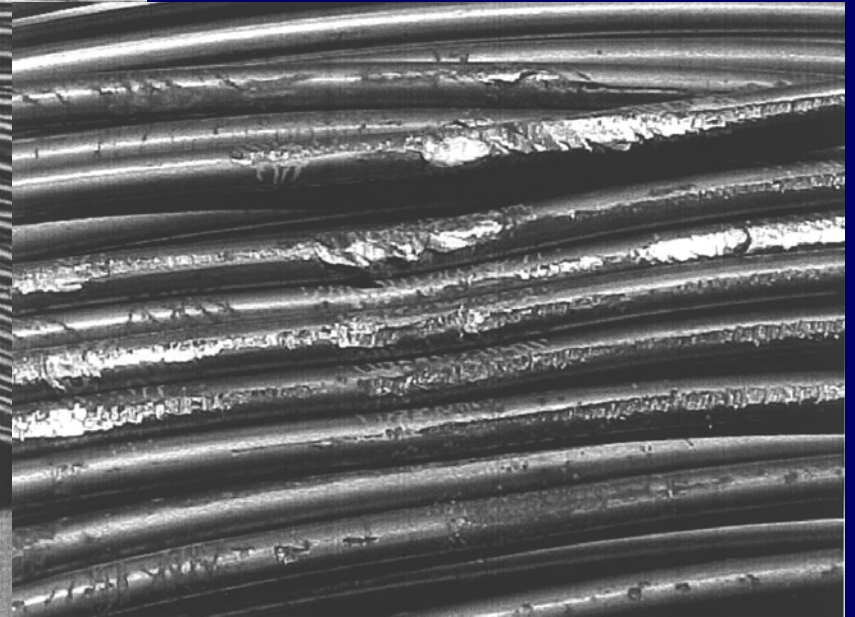
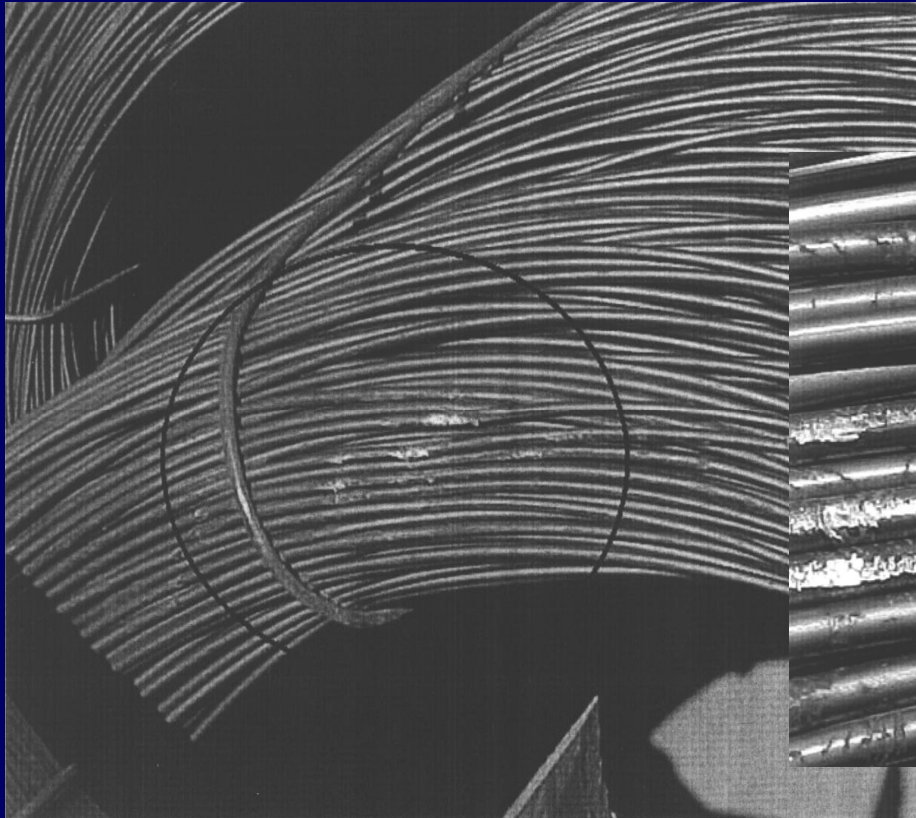


# Wire Rod

- Identifying sources for raw material
- EAF (Electric Arc) vs. BOF (Basic Oxygen)
- Chemistry
- Quality levels



# Material Quality



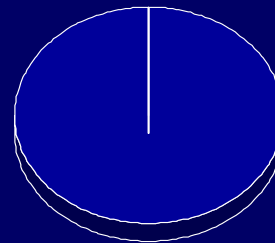


# Material Quality

**Fact: Rod Mills produce  
An oval shape rod.**

**IRM capability  
currently  
Is + or – 0.006”  
99.9 % of the  
time.**

**Fact: Rods  
vary in diameter  
from front end to  
middle to back end  
of the coil.**

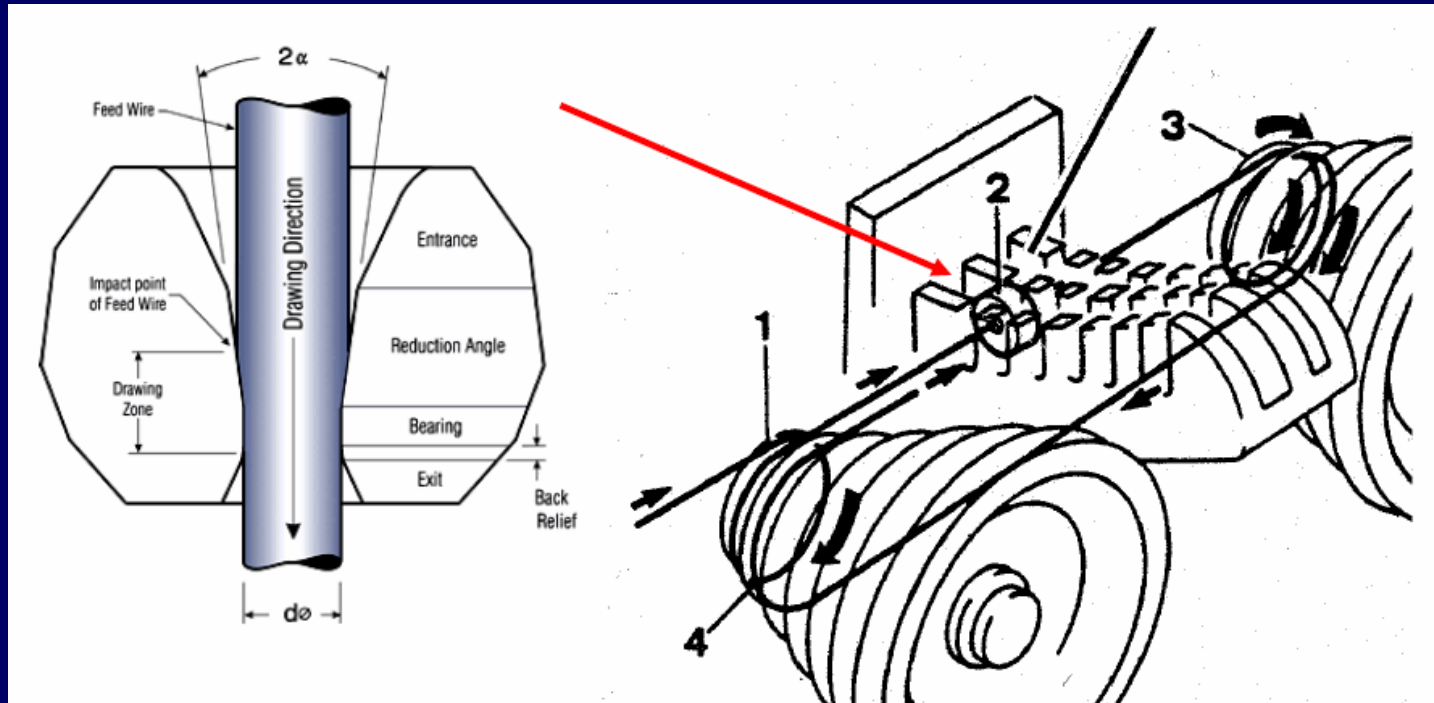


Example average  
FE – 0.215”  
Middle section – 0.216”  
BE – 0.219”

Higher quality wire rod significantly contributes to success at **faster** speeds

# Die Design

## ■ Die Quality – Profile and Drawing Process





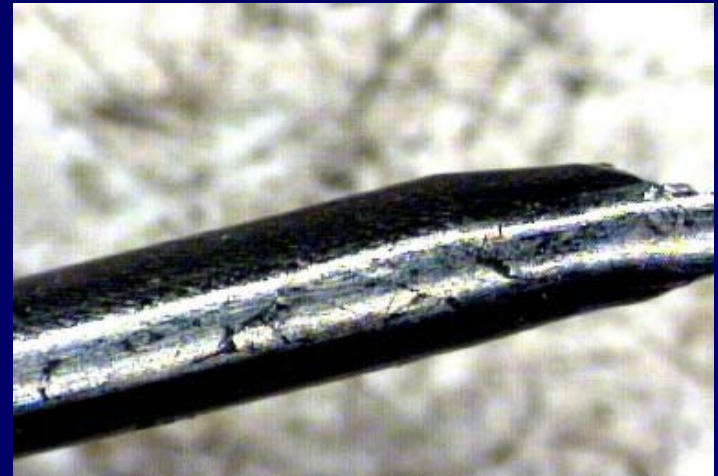
# Wire Drawing

## ■ Effects of Poor Die Practice:

- If the die geometry, reduction per die, and lubrication are not optimized, one may cause center-burst (arrowhead cracks in the center of wire) or crow-feet (surface cracks)



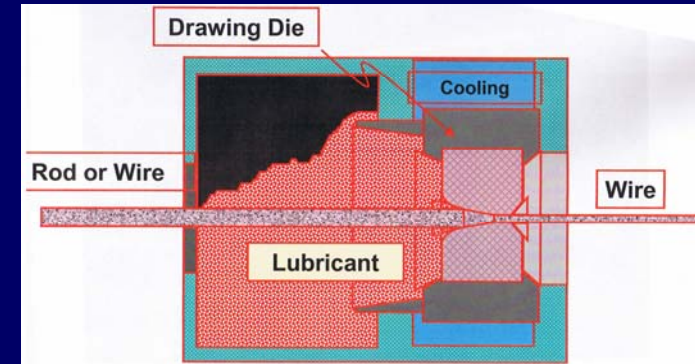
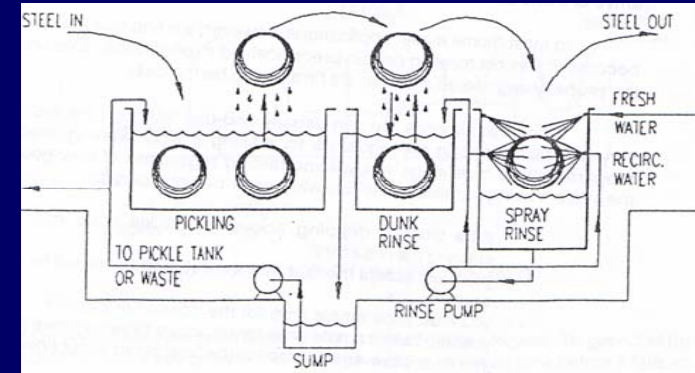
Center-burst



Crow-feet

# Lubrication

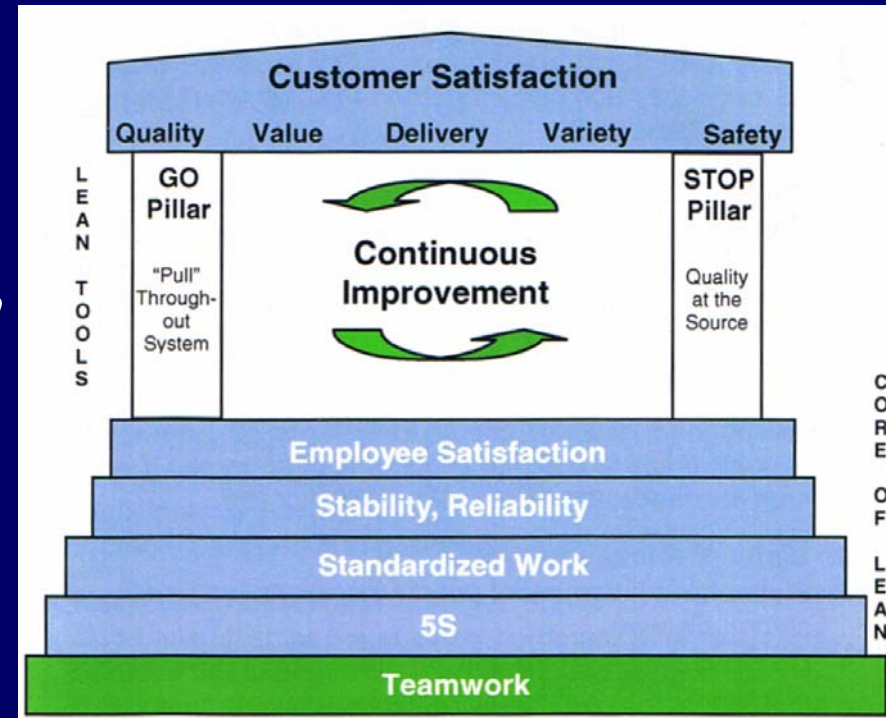
- Properly cleaned rod
  - Mechanical
  - Chemical
- Higher quality lubricants
  - Calcium
  - Sodium
- Lubricant applicators



# Lean Initiatives

Lean Manufacturing  
is.....

*"The process of identifying and eliminating waste within our operations including manufacturing, engineering, and administration."*

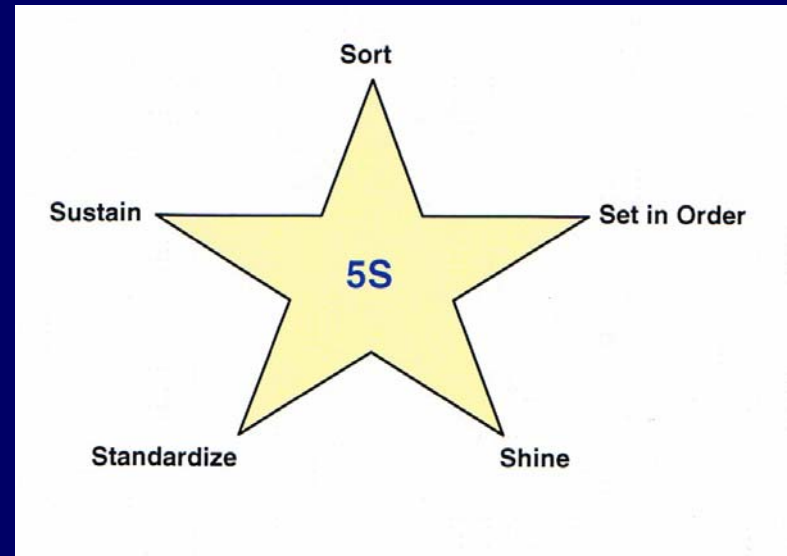


# Lean Initiatives

## 5S

The First Building Block of Lean

A system of visual management that promotes workplace organization aimed at improving safety, eliminating waste, and building employee pride.





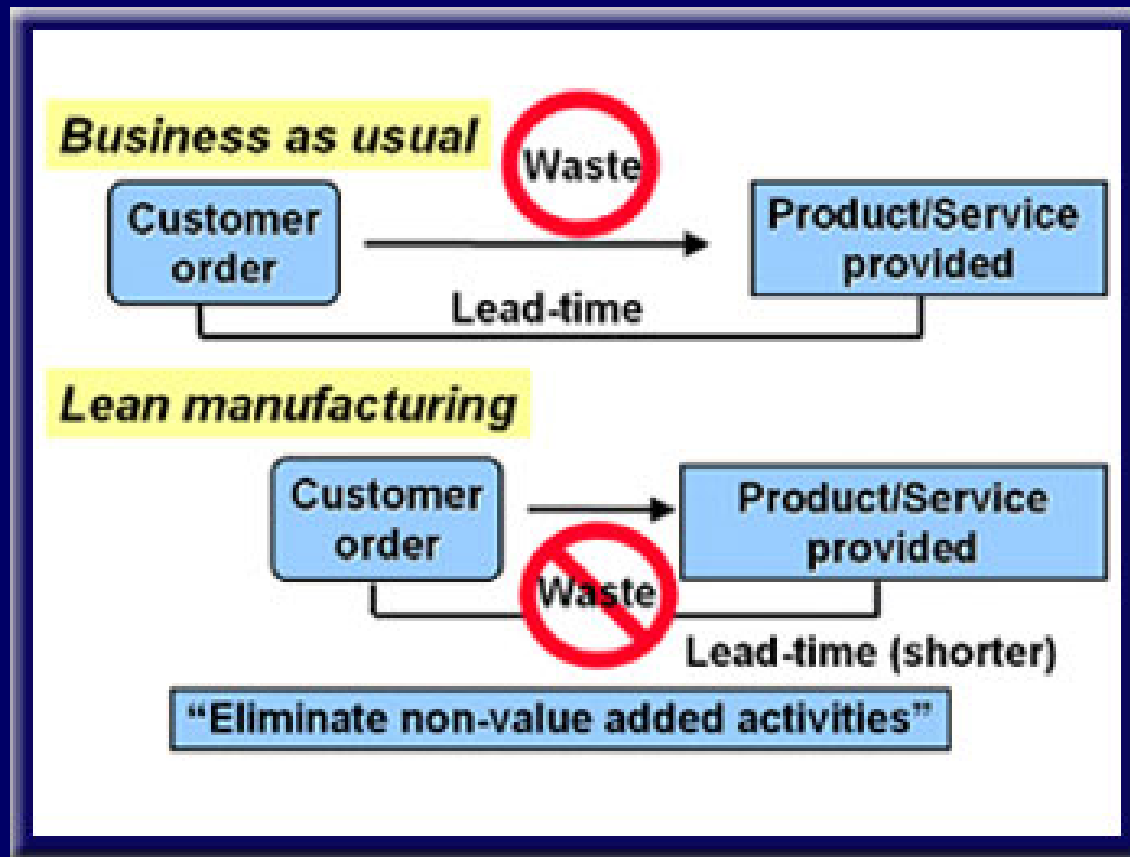
# Lean Initiatives

## ■ How 5S Benefits Manufacturing

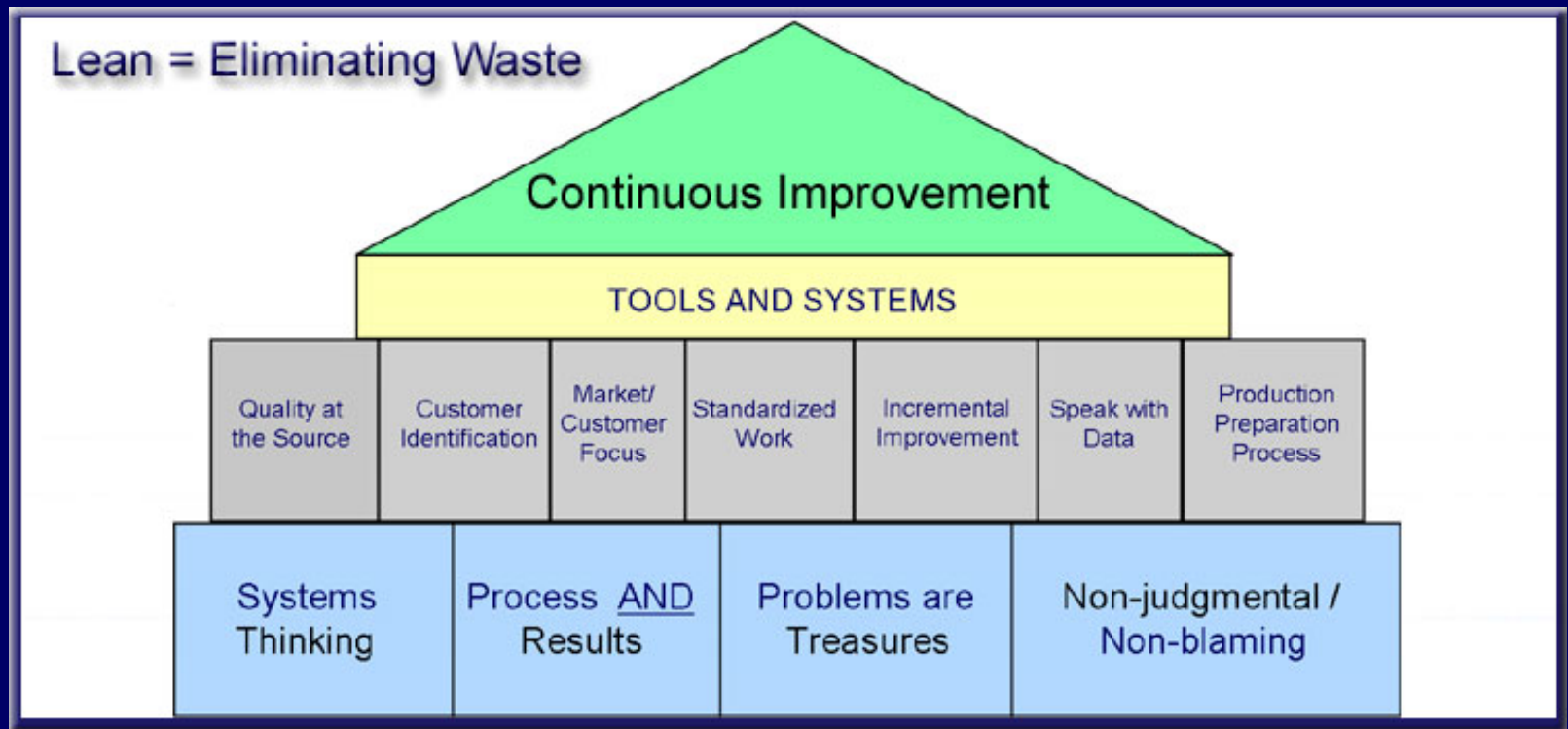
- Eliminate defects
- Higher Quality
- Reduces Scrap
- Lowers Costs
- Increases Service Levels
- Improves Safety Awareness
- Reduces Machine Downtime
- Fewer Customer Complaints Promotes Intense Customer Loyalty



# Lean Initiatives

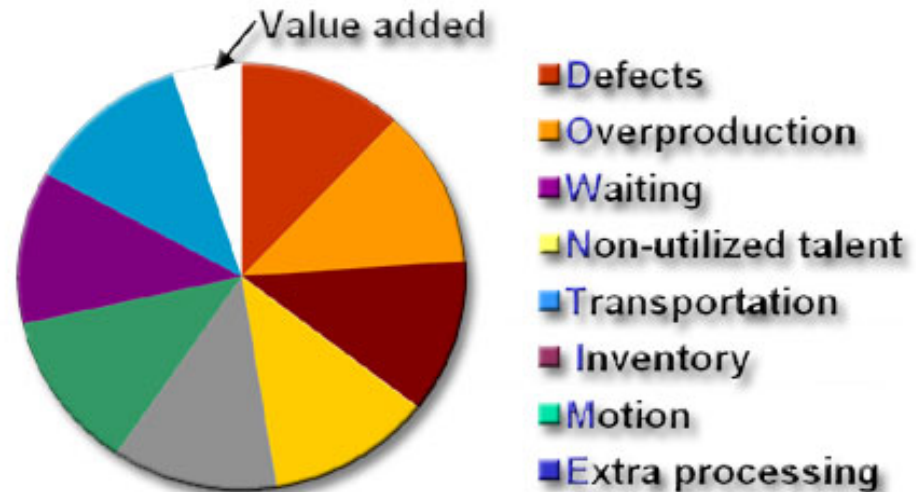


# Lean Initiatives



# Lean Initiatives

Lean = Eliminating Waste



# Lean Initiatives

- Defects – Rework or repair
- Over-production – Producing more than is needed before it is needed
- Waiting – Any non-work time waiting for material, supplies, or tooling
- Non-Utilized Talent – Failure to utilize experience of workforce
- Transportation – Wasted effort to transport materials, supplies, or finished goods into or out of storage, or between processes
- Inventory – Maintaining excess inventory of raw materials, work-in-process, and finished goods
- Motion – Any wasted motion to pick up parts or tooling. Also wasted walking
- Extra-processing – Doing more work than necessary

# Lean Initiatives

## 6 Big Losses

Downtime  
loss

Equipment failure / breakdowns

Set-up / adjustments

Speed loss

Minor stopping / idling

Reduced speed

Quality loss

Quality defects and rework

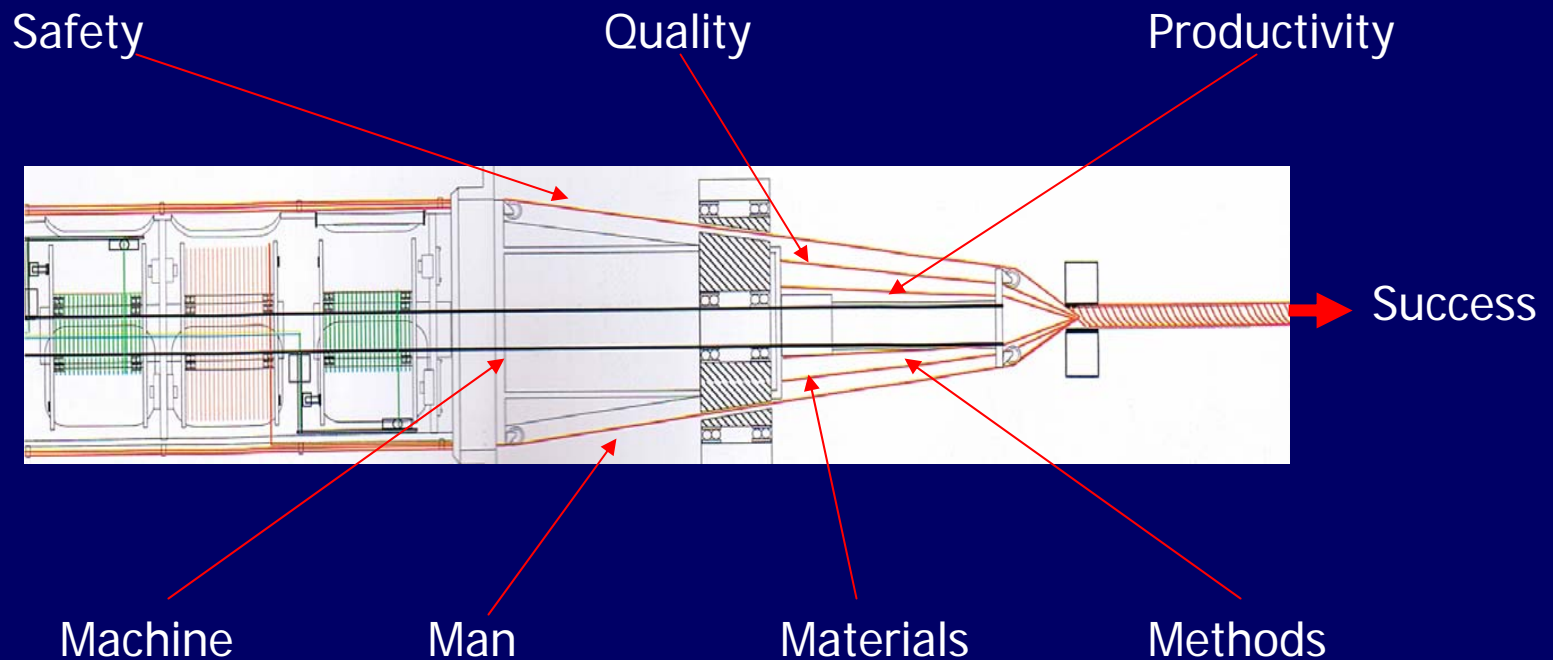
Start-up scrap and reduced yield



# Lean Initiatives

- The challenge for today's wire manufactures is great. Many companies are struggling to regain a competitive edge in manufacturing.
- Lean manufacturing offers many organizations a proven methodology to help reduce waste in their operations.
- However, unless you are committed to making such a significant change, Lean manufacturing may cause more headaches than you wish to handle.

# Contributors to Success



# Thank You!

# Questions?

# Thomas E. Moran

## Plant Manager

### National Standard Co.

- Tom Moran, a member of the WAI International since 1991, has over 30 years of experience in the wire and cable industry. Before joining National Standard Co. earlier this year, he was employed by Taubensee Steel & Wire, focusing on process and product improvement. He began his career with Sivaco New York in 1974 and held positions in Operations Management for 12 of his 21 years with that company. His technical and field experience encompass all areas of wire manufacturing and end use, and include a working knowledge of low and high-carbon, cold heading and annealed processing. Moran has a BS in Business Administration from Columbia College, and received certification from Villanova University for Lean Six-Sigma.
- Moran is currently serving his second term on the WAI Board of Directors, and has been on the Executive Committee since 2003. Prior to the recent committee restructuring, he served on the Technical Council since 1998, and chaired the group in 2005. He was a member of both the Ferrous and Suppliers Management Committees, as well as the Membership and Website Advisory Committees. He helped organize both the Wire Expo 2002 and Interwire 2003 events. Moran is a member and past president of the WAI's Midwest Chapter, as well as a frequent moderator for WAI technical programs.