



# Modern Continuous Improvement Methods to Improve Seaport Velocity and Productivity

**Nicholas Loyd**

University of Alabama in Huntsville  
256.824.3025

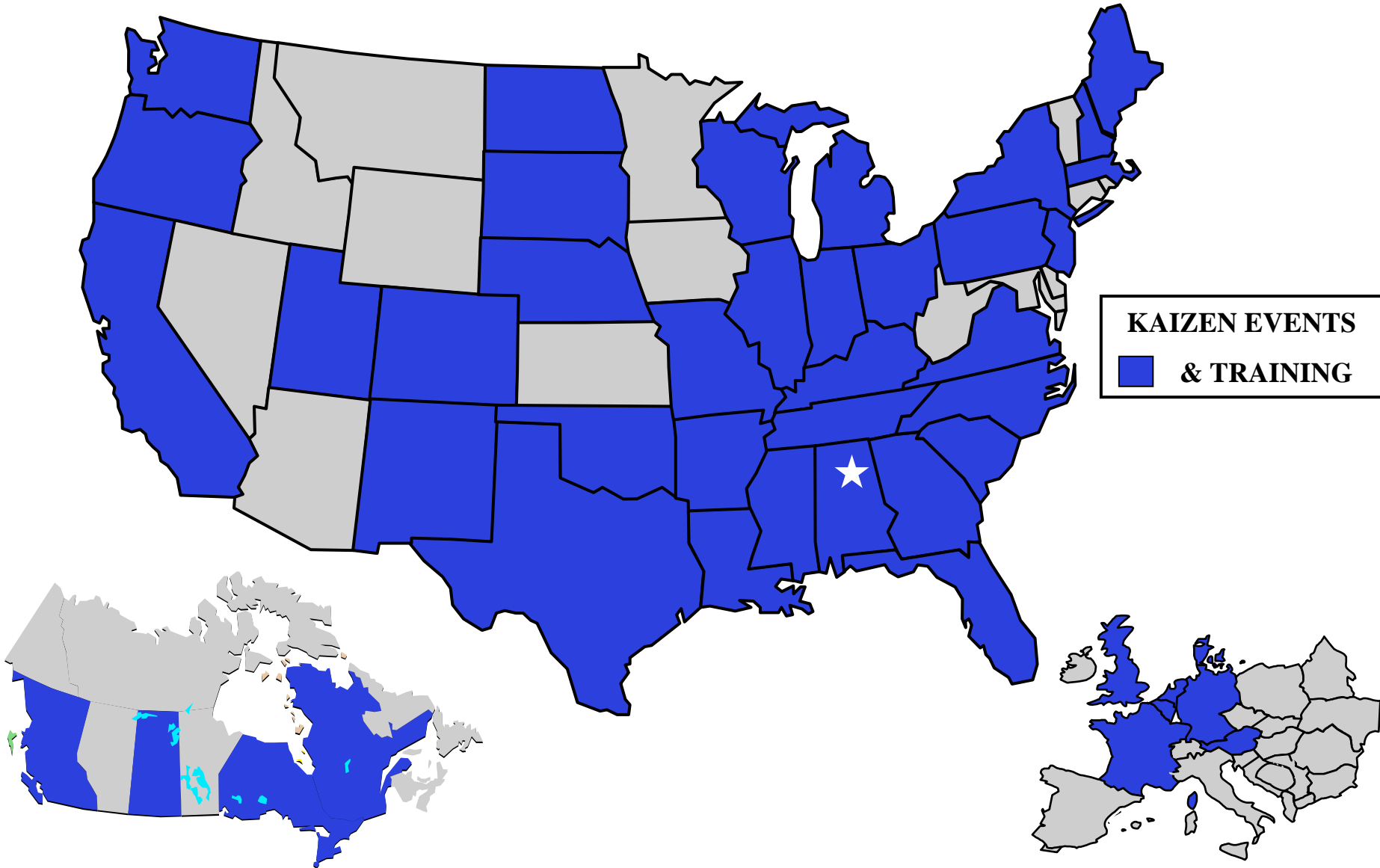
[Nicholas.Loyd@uah.edu](mailto:Nicholas.Loyd@uah.edu)

**Jeff Siniard**

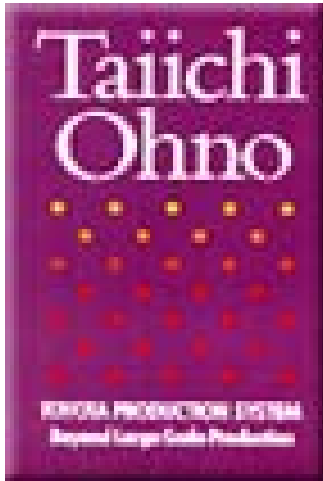
University of Alabama in Huntsville  
256.824.6202

[Jeff.Siniard@uah.edu](mailto:Jeff.Siniard@uah.edu)

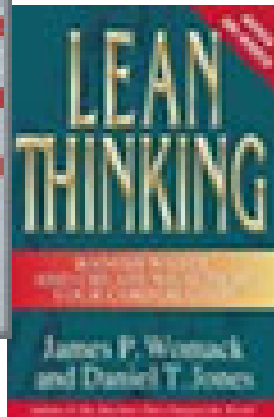
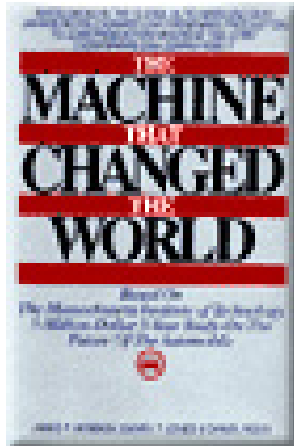




# Where Did “Lean” Come From?



## The Toyota Production System by Taiichi Ohno



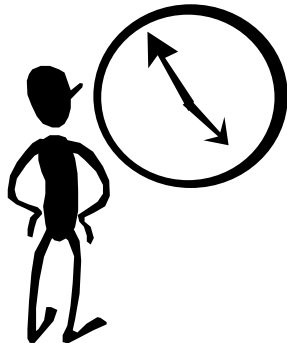
## The Machine That Changed the World and Lean Thinking

by Jim Womack and Dan Jones

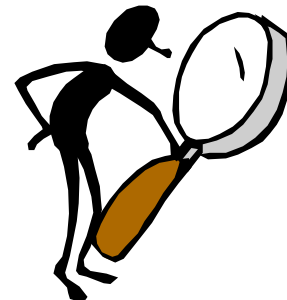
# Lean Enterprise Objective

*All we try to do is “reduce the timeline from the moment a customer places an order to the point the customer receives what they want (and the company collects cash) by removing non-value-added activities (or waste)”– Taiichi Ohno, *The Toyota Production System**

## SATISFY THE CUSTOMER BY...



**COMPRESS TIME**



**IMPROVE QUALITY**



**REDUCE COST**

# The Case for Port Improvement:

The need for efficient travel and transfer of goods between overseas ships and domestic trucks, trains, and barges has accelerated due to:

- Increase in world population
- Nations increasingly becoming more industrialized
- Heavier reliance on world trade

## The Data:

- Foreign trade accounts for 22% of the U.S. Gross Domestic Product
- 95% of this trade is moved by ships (*USDOT*)

## Trends:

- North American port volumes have increased by an average of 7% per year since 1990
- It is estimated that most major ports are already operating near capacity, and some reports are predicting port volumes to double by 2020

*(Transportation Journal)*

**To increase port capacity without significant investment in new resources, we must:**

■ **Flow material through at a faster rate**

- Unload more efficiently when it arrives
- Manage material more efficiently while we store it
- Load more efficiently when it departs



# Why Lean at Ports?

**Past:** Price set by provider

$$\text{Operating Cost} + \text{Profit} = \text{Price}$$



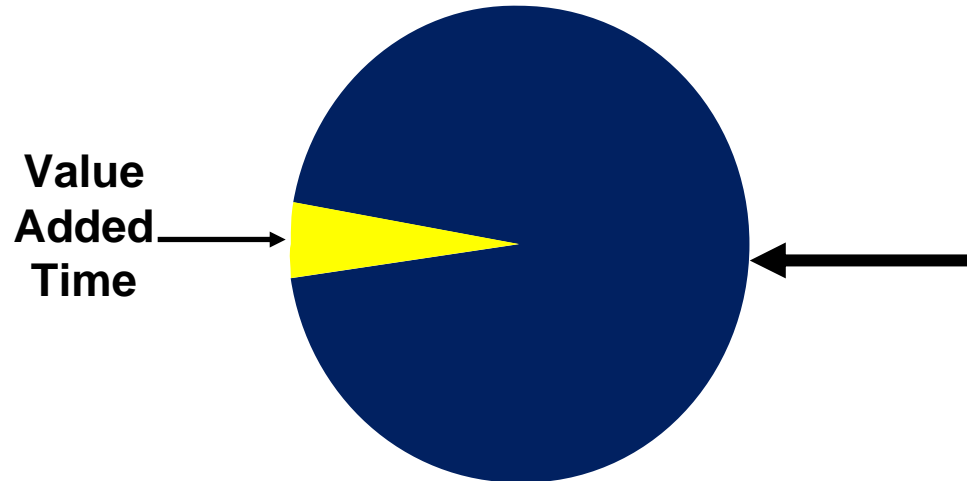
**Today:** Price set by market

$$\text{Price} - \text{Operating Cost} = \text{Profit}$$

**The key to truly reducing operating cost is to simplify processes by eliminating non-value-added steps (waste)!**

Every process has wastes...the key lies in seeing it

## Total Lead Time



### VALUE ADDING ACTIVITY

Absolute minimum activities which must be done to produce customer requirements:

*Things that customers pay for*

### NON-VALUE ADDING ACTIVITY

Any resources like labor, space, materials spent in the manufacturing process that customer has no requirements for:

*Things that customers do not pay for*

Typically 95% of Total Lead Time is Non-Value Added!

# 8 Deadly Wastes

- **D**efects
- **O**verproduction
- **W**aiting
- **N**ot Utilizing People's KSAs
- **T**ransportation
- **I**nventory
- **M**otion
- **E**xcess Processing



# Waste of Defects



# Waste of Defects



# Waste of Overproduction



# Waste of Overproduction

The screenshot shows an Outlook interface with a left-hand navigation pane and a main inbox view. The navigation pane shows the following folders and counts:

- Mail <<
- Favorite Folders >>
- Inbox
- Unread Mail
- Sent Items
- Mail Folders >>
- All Mail Items ▾
- Personal Folders
- Deleted Items (928)
- Drafts
- Inbox (698)**
- Junk E-mail
- Outbox
- quarantine
- Read Later (221)
- Remove Later (9984)
- RSS Feeds
- Sent Items

The main inbox view shows a list of emails with the following columns: From and Subject. The list contains 12 visible entries, all of which are highlighted in blue, indicating they are unread. The first entry is from Scott Brote... with subject Presentati...

From	Subject
Scott Brote...	Presentati...
Teri Martin	Update on...
Nicholas Lo...	RE: Need y...
Koch, Craig	RE: Need y...
Tipton, Steve	RE: Survey...
Karen Hanc...	acct listing...
Midori Mal...	Updated A...
Teri Martin	FW: Payroll...
Teri Martin	2009 Travel...
Smith, Rick	RE: Lean Im...
Tipton, Steve	RE: Lean at...
Tipton, Steve	RE: Lean at...
Tipton, Steve	RE: Lean at...

# Waste of Waiting





# Waste of Waiting



# Waste of Waiting



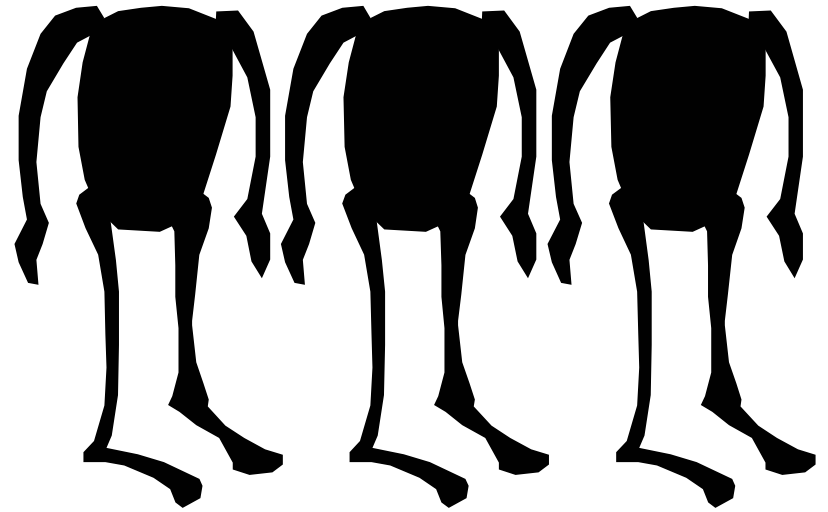
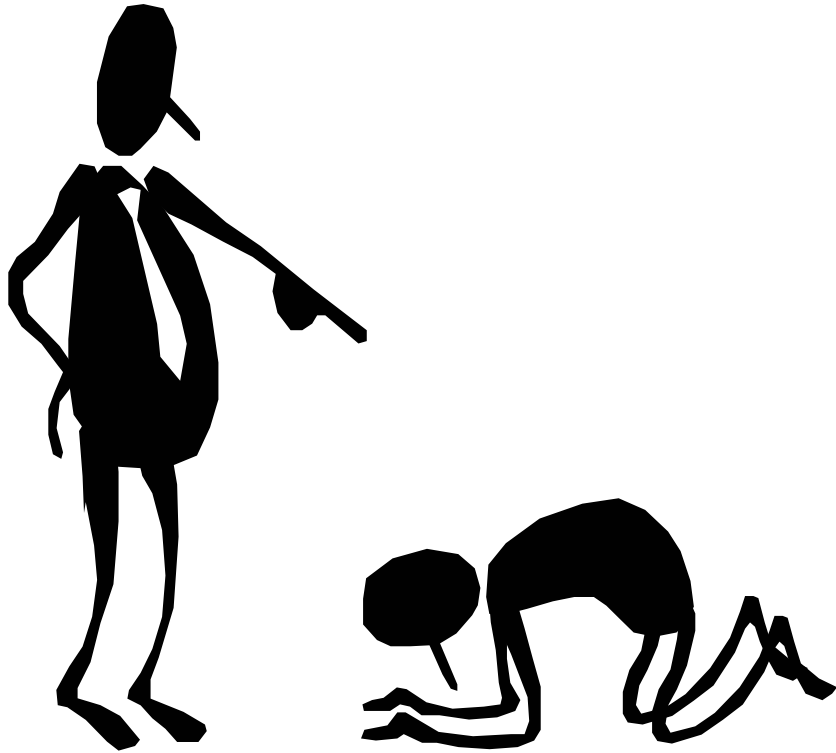
# Waste of Waiting



# Waste of Waiting



# Waste of Not Using People's KSAs



# Waste of Transportation



# Waste of Transportation



# Waste of Transportation





# Waste of Inventory



# Waste of Inventory



# Waste of Inventory



# Waste of Inventory



# Waste of Inventory



# Waste of Motion



# Waste of Motion



# Waste of Motion





# Waste of Motion





# Waste of Excess Processing



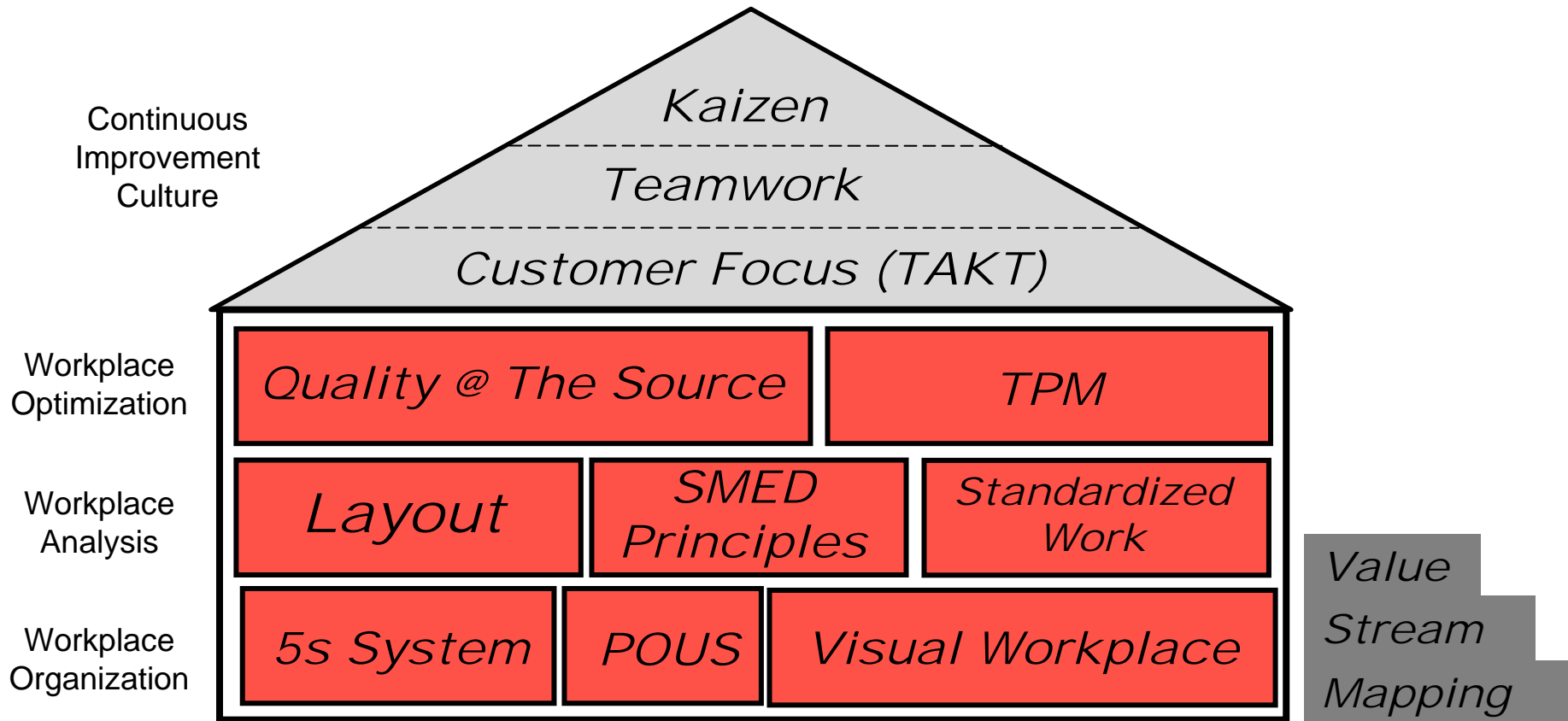
# Waste of Excess Processing



# Waste of Excess Processing



# UAH Lean Enterprise for Port Operations



# Workplace Organization Tools

## ■ **5S**– (**S**ort, **S**et-in-Order, **S**hine, **S**tandardize, **S**ustain)

- A safe, clean, neat, arrangement of the workplace provides a specific location for everything, and eliminates anything not required

## ■ **Point-of-Use-Storage (POUS)**

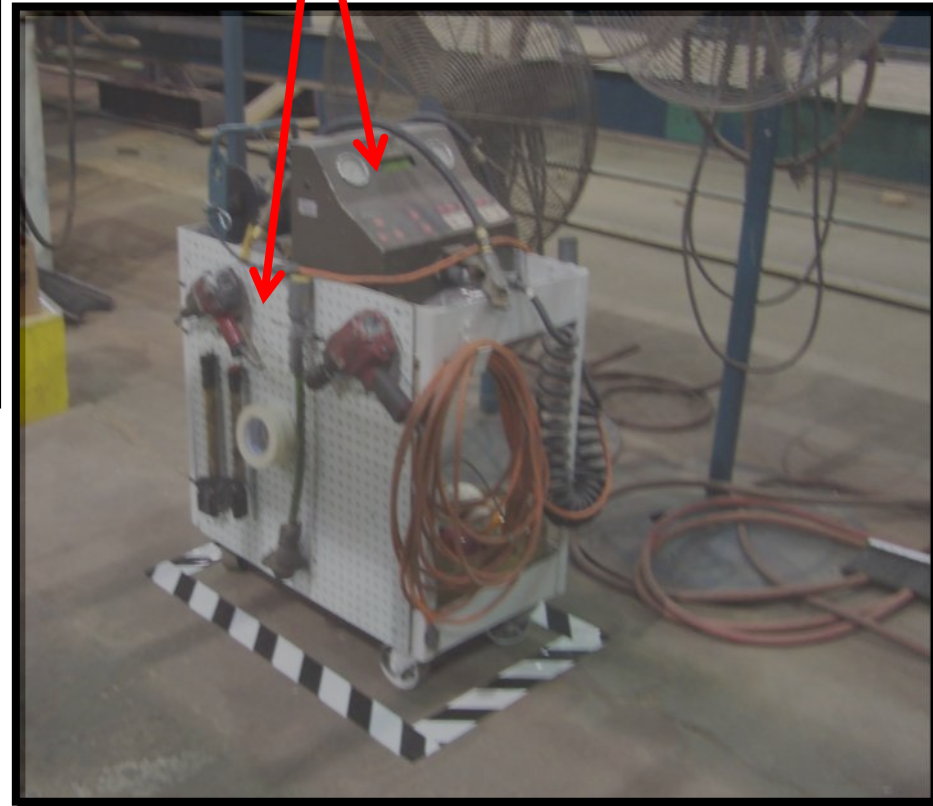
- Locate items necessary to perform job activities *where they are used* (Tools, materials, supplies, equipment, and information)

## ■ **Visual Workplace**

- Simple, self-explanatory signals that give immediate and accurate understanding of a situation or condition

# Tools and Equipment at the Point of Use

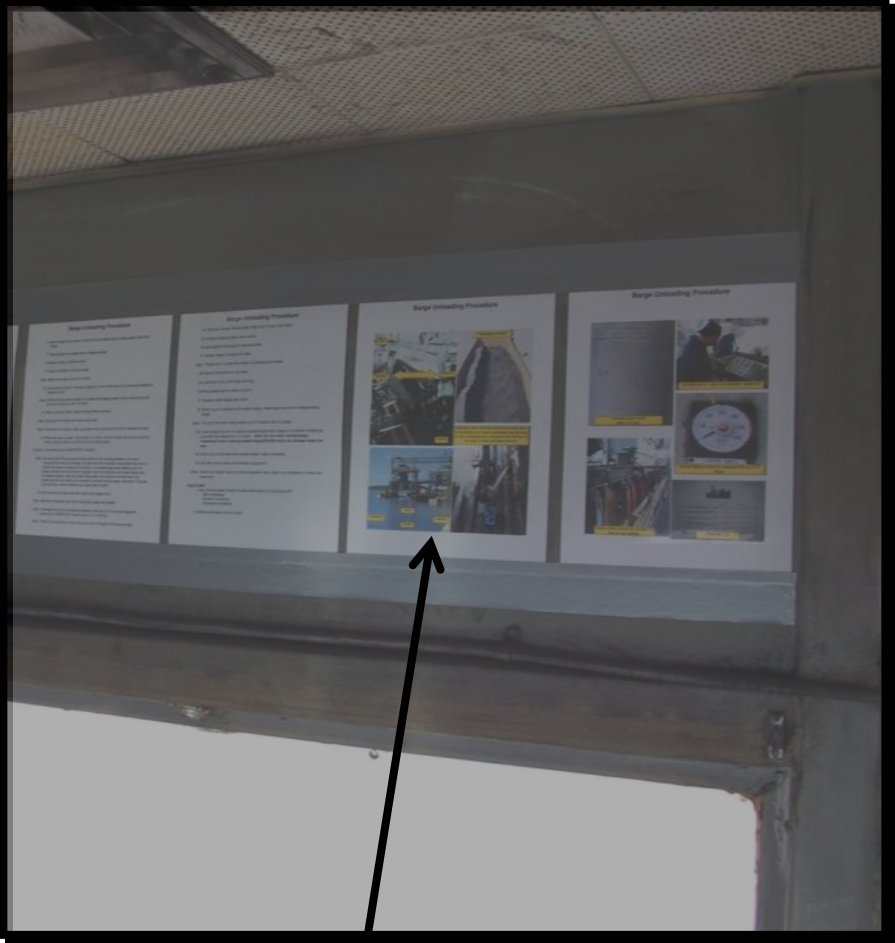
Tools and equipment located exactly where needed





# Materials and Supplies at the Point of Use





Work Instructions

Ship unloading status



AVERAGE TONS  
PER DAY LAST SHIP  
37 892  
GOAL 35000

# Visual Identification



Equipment  
Identification

Product  
Identification



# Visuals: Outlining and Labeling



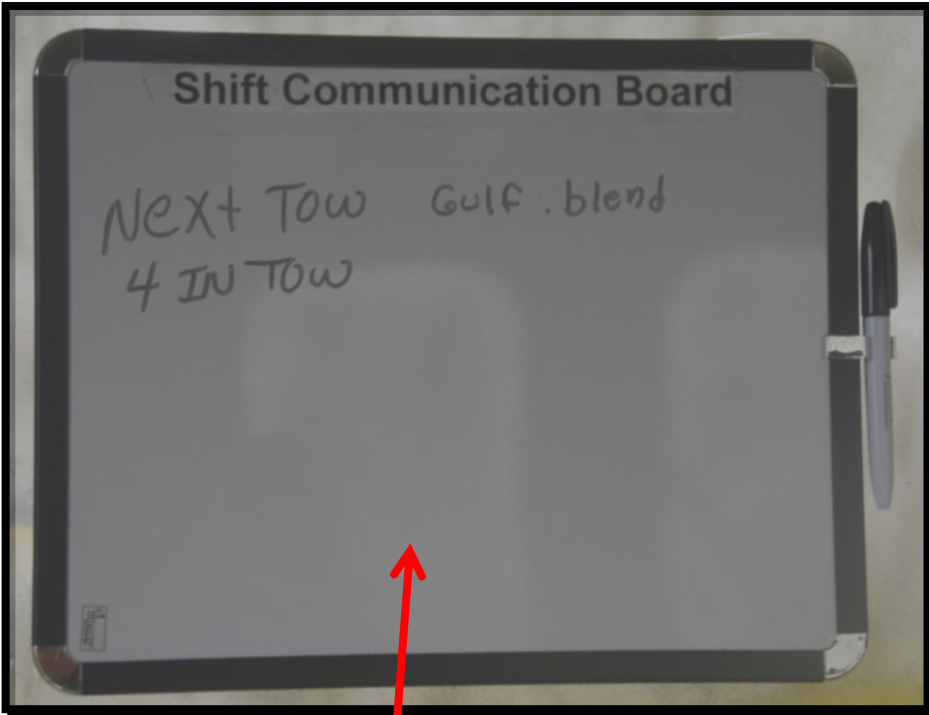
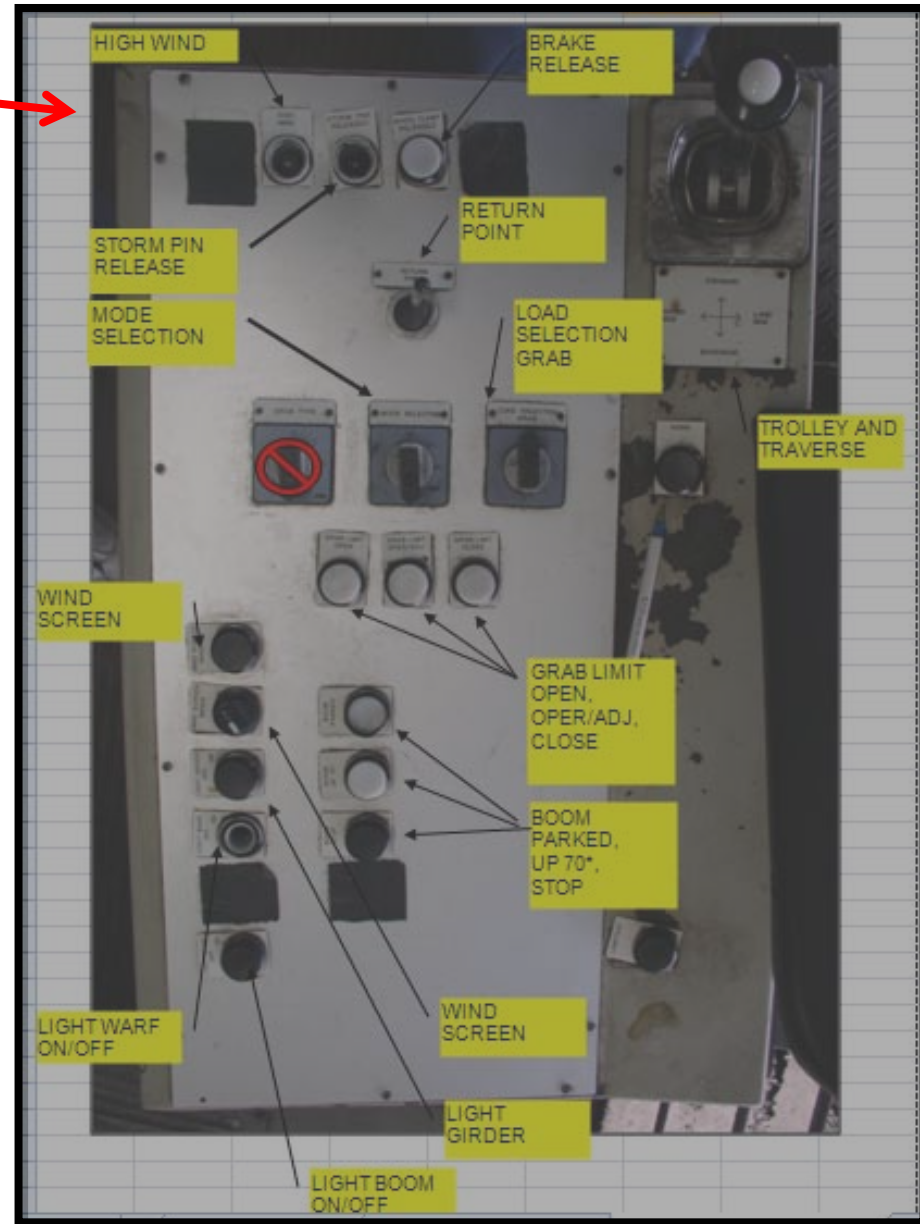
Painted parking locations to ensure adequate space for loading



Outlined location with labeling

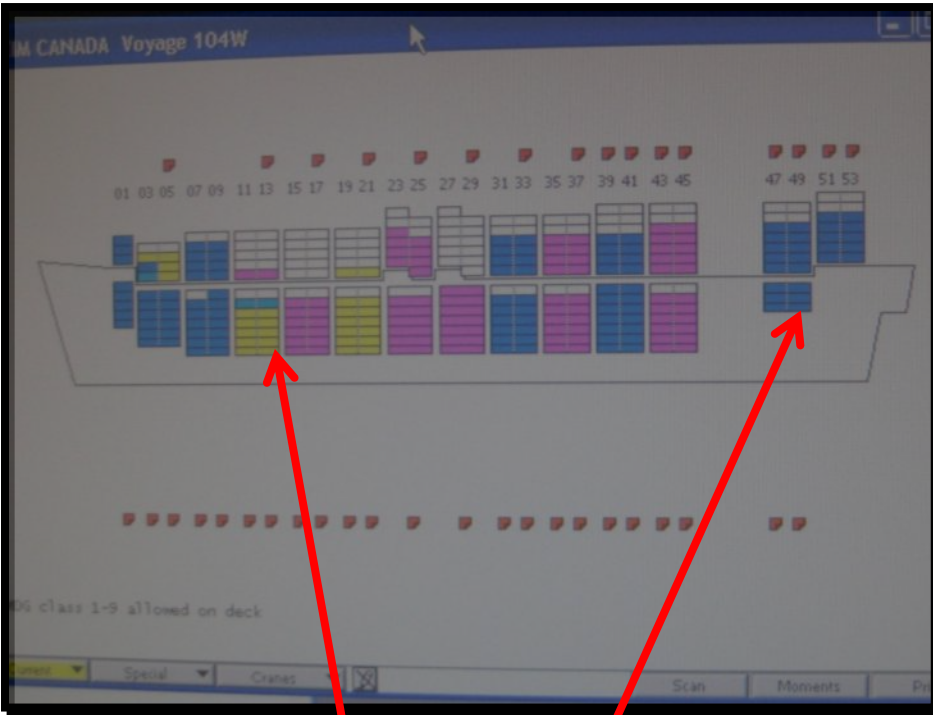
# Visual Communication

Visual aids for crane controls



Visual communication board

# Visual Workplace



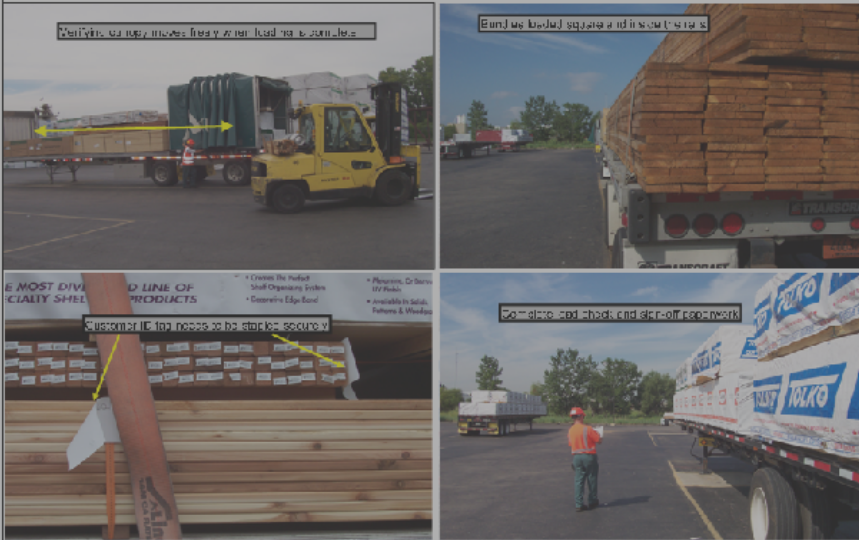
Color-coding cargo by destination

Clearly marked yard locations



## Truck Loading Procedures

8. When loading is complete do a load check verifying: correct product was loaded, load is tight and can be transported safely, loaded in proper order to minimize customer movement. **Note:** on Roll tight trailers roll canopy from front to back ensuring there are no obstructions interfering with canopy movement



9. Sign paperwork, turn it in to office, and pick up next assignment

		Raise Bridge	Lower Bridge
1			
2			
3			
4	1 Turn Control Key to an Parition		1 Using Marine radiotele draw bridge in clearing for rail traffic (wait 15 seconds for response)
5	2 Switch Emergency stop to run parition		2 Turn Control Key to an Parition
6	3 Switch Railway signal to tap		3 Switch Emergency stop to run parition
7	4 Switch Machine brake to release		4 Switch machine brake to release
8	5 Switch Span Lacker to Pull parition (allow 15 seconds for lacker to release)		5 Switch Span Lacker to Pull parition (allow 15 seconds for lacker to release)
9	6 Switch span operate to raise		6 Switch span operate to lower parition
10	7 Press horn button for 5 seconds		7 Press horn button for 5 seconds
11	8 Press run button and release		8 Press run button and release
12	9 Bridge raises, stops automatically and orange light signals bridge is fully raised		9 Bridge lowers, stops automatically and white light signals bridge is fully lowered
13	10 Once bridge is raised switch Span operate and span lacker to neutral parition		10 Switch span lacker in the drive parition (allow 15 seconds for lacker to engage)
14	11 Switch machine brake to set		11 Switch railway signal to clear (should get green light on top of bridge tower)
15	12 Switch Emergency stop to tap parition		12 Switch Span operate and span lacker to neutral parition
16	13 Switch control key to off		13 Switch machine brake to set
17			14 Switch Emergency stop to tap parition
			15 Switch control key to off

# Workplace Organization

**Before**



**After**





# Workplace Organization

**Before**



**After**



# Workplace Organization

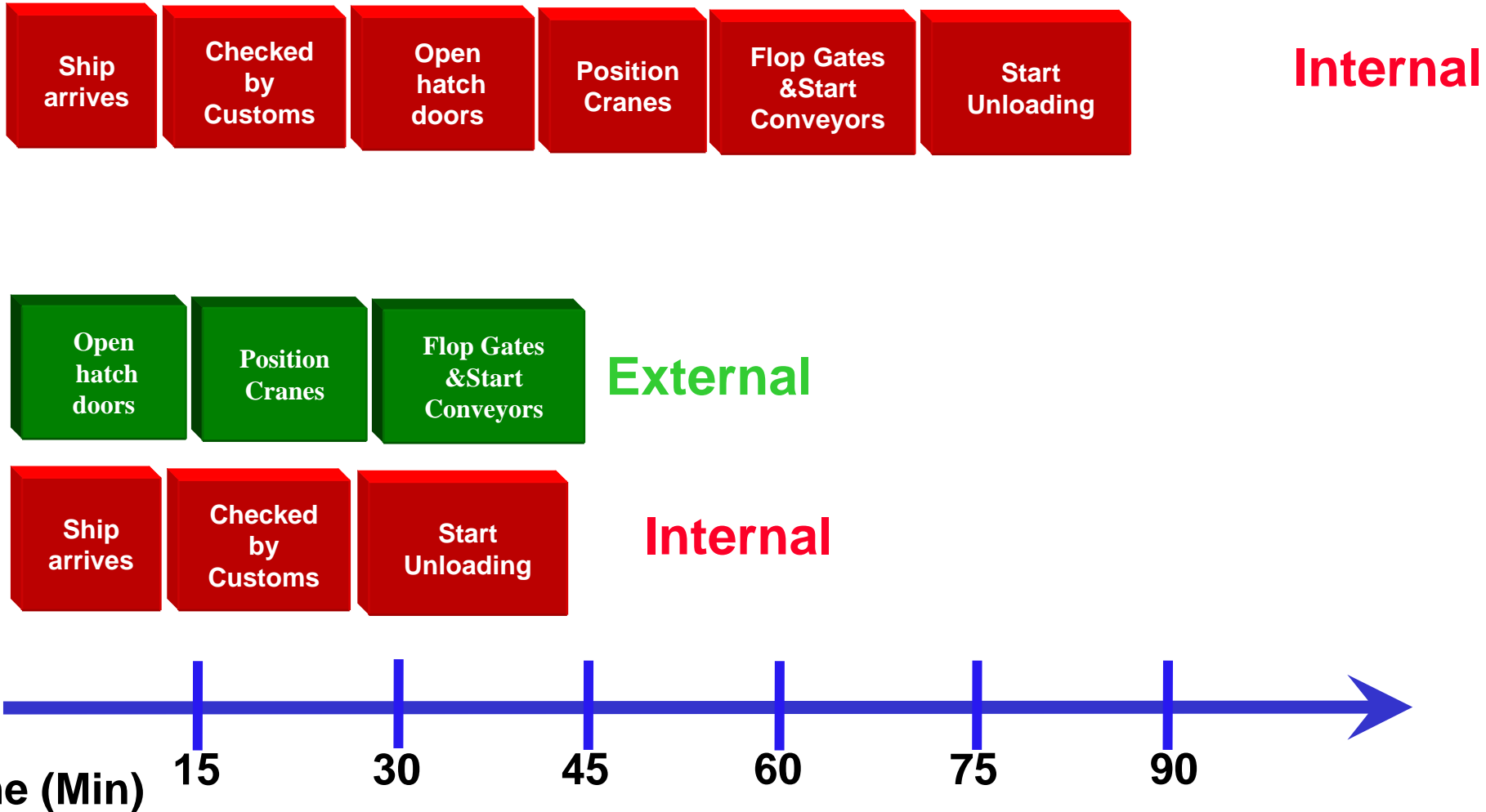
**Before**



**After**



# SMED Principles: Internal vs. External Steps



## Truck Loading SOP

7. Visually inspect load for: items outside the rails of the trailer and square up as needed, blocking is in correct position and adequate to support the load, no loose items or wrappers, all units are tagged properly.

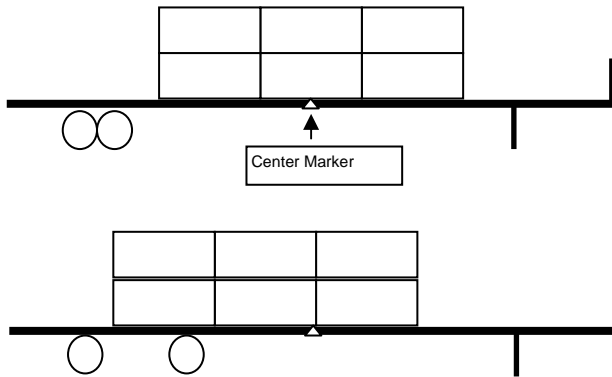


# Standardized Work

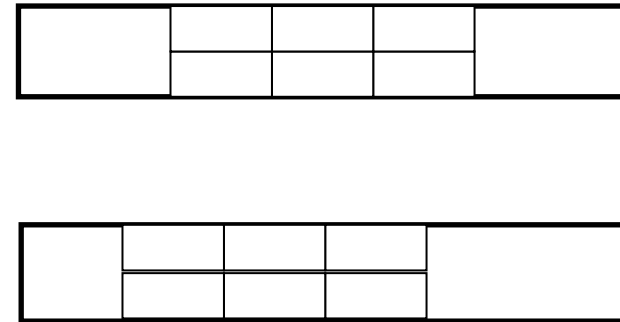
## Load Profiles

### 12 - 4x8 Bundle Profiles

Side View

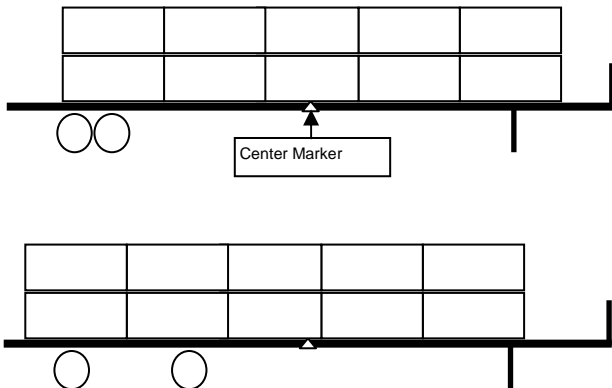


Top View

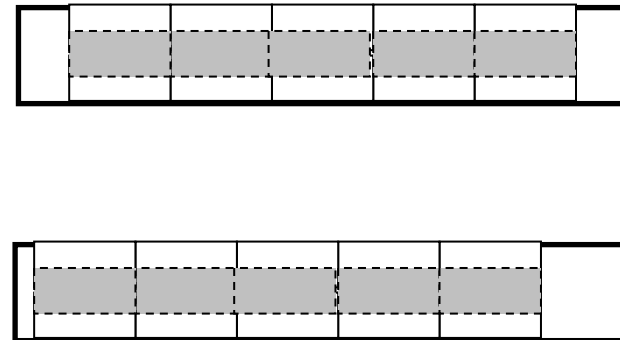


### 15 - 4x8 Bundle Profiles

Side View



Top View



## Barge Loading SOP

8 Call loaders to send coal



9 Load coal until the bottom of the pile builds up to the weld line on the wall of the barge (Note: Keep coal out of the corners of the bow)

10 Once the first pile is the correct height move the barge north keeping the pile consistent height (Note: Monitor barge list and correct as needed by positioning chute in shore/out shore)



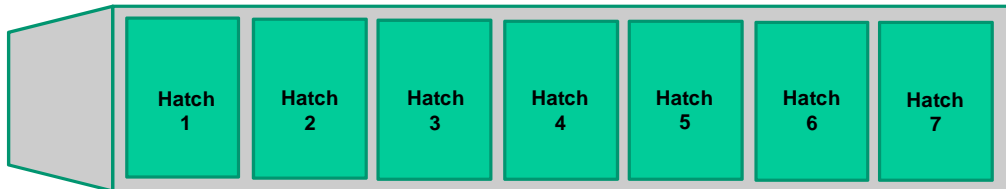
## ■ Training to improve quality

### Visual training procedures

### Mentoring Checklists

## Unloading Schedule

(Standard 7 Hatch Vessel)



**F Crane**

**H Crane**

**Start** Hatch 2 dig 1/2 of hatch  
 Hatch 1 dig 1/2 of hatch  
 Hatch 3 dig 1/2 of hatch  
 Hatch 2 finish hatch  
 Hatch 4 finish hatch  
 Hatch 1 finish hatch  
 Hatch 3 finish hatch

Hatch 4 dig 1/2 of hatch  
 Hatch 6 dig 1/2 of hatch  
 Hatch 5 dig 1/2 of hatch  
 Hatch 7 dig 1/2 of hatch  
 Hatch 6 finish hatch  
 Hatch 7 finish hatch  
 Hatch 5 finish hatch

### TRAINMAN CUB REPORT

PLEASE PRINT LEGIBLY

NAME and JOB # \_\_\_\_\_

CUB'S PAYROLL # \_\_\_\_\_

FOREMAN/TRAINMEN \_\_\_\_\_

ACTUAL TIME SPENT  
(PERFORMING SWITCHING DUTIES) \_\_\_\_\_

WORE SUITABLE CLOTHING, FOOTWEAR, P.P.E'S Yes \_\_\_\_\_ No \_\_\_\_\_

MOUNT/DISMOUNT LOCOMOTIVE/EQUIPMENT PROPERLY.  
 Yes \_\_\_\_\_ No \_\_\_\_\_

FOLLOWS PROPER RADIO PROCEDURES. Yes \_\_\_\_\_ No \_\_\_\_\_

DURING JOB BRIEFING WERE QUESTIONS ASKED? IF SO WHAT.  
 \_\_\_\_\_  
 \_\_\_\_\_

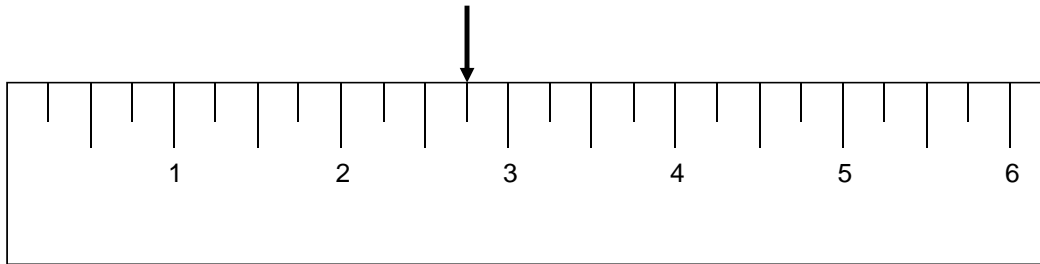
ASK'S FOR 3-STEP PROTECTION BEFORE GOING UNDER OR FOULING  
 STANDING EQUIPMENT WITH LOCOMOTIVE ATTACHED.  
 Yes \_\_\_\_\_ No \_\_\_\_\_

FOLLOWS SAFETY RULES Yes \_\_\_\_\_ No \_\_\_\_\_

PROPERLY POSITIONED HIM/HERSELF FOR TASK BEING  
 PERFORMED.

## ■ Hiring practices

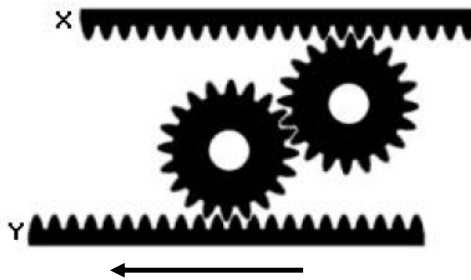
3.



What is the measurement at the arrow?

- a.  $2 \frac{1}{2}$
- b.  $2 \frac{5}{8}$
- c.  $2 \frac{3}{4}$
- d.  $2 \frac{11}{16}$

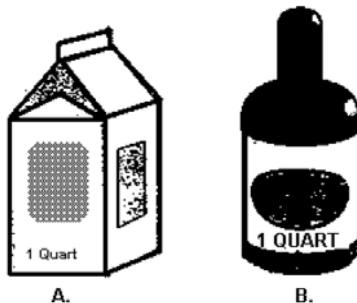
4.



If bar Y moves left at a constant speed, how does bar X move?

- a. Faster than Y
- b. Same speed as Y
- c. Slower than Y

5.



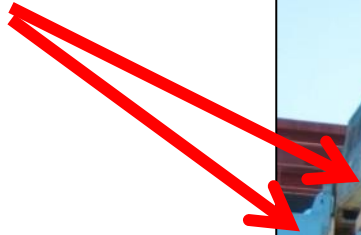
Which container holds more

- a. Container A
- b. Container B
- c. Equal



## ■ Improving process quality– (mistake-proofing)

Guides to simplify  
pick-up of containers



## ■ Improving process quality– (mistake-proofing)

Required fields are in **BOLD**

**Invoice details**

**Name**

Company

**Address**

**City**

**State or County**

**Postal or Zip Code**

**Country**

**Phone**

Fax

**E-mail**

- TPM is a company wide equipment maintenance program that permanently improves the overall effectiveness of equipment with the active involvement of all employees
- Goal is to eliminate/minimize downtime due to breakdown maintenance and to maintain machines at peak performance.

## Typical conditions:

- There is often a run-to-failure mentality
- Breakdowns occur regularly
- Temporary repairs are the norm
- Minor stoppages occur frequently
- Processing speed decreases
- No one is accountable for tracking these losses
- Operator training may not be adequate



# What's the Impact?

- An estimated \$200 billion spent each year on wasteful maintenance-related activities.
- Average equipment efficiency < 50%



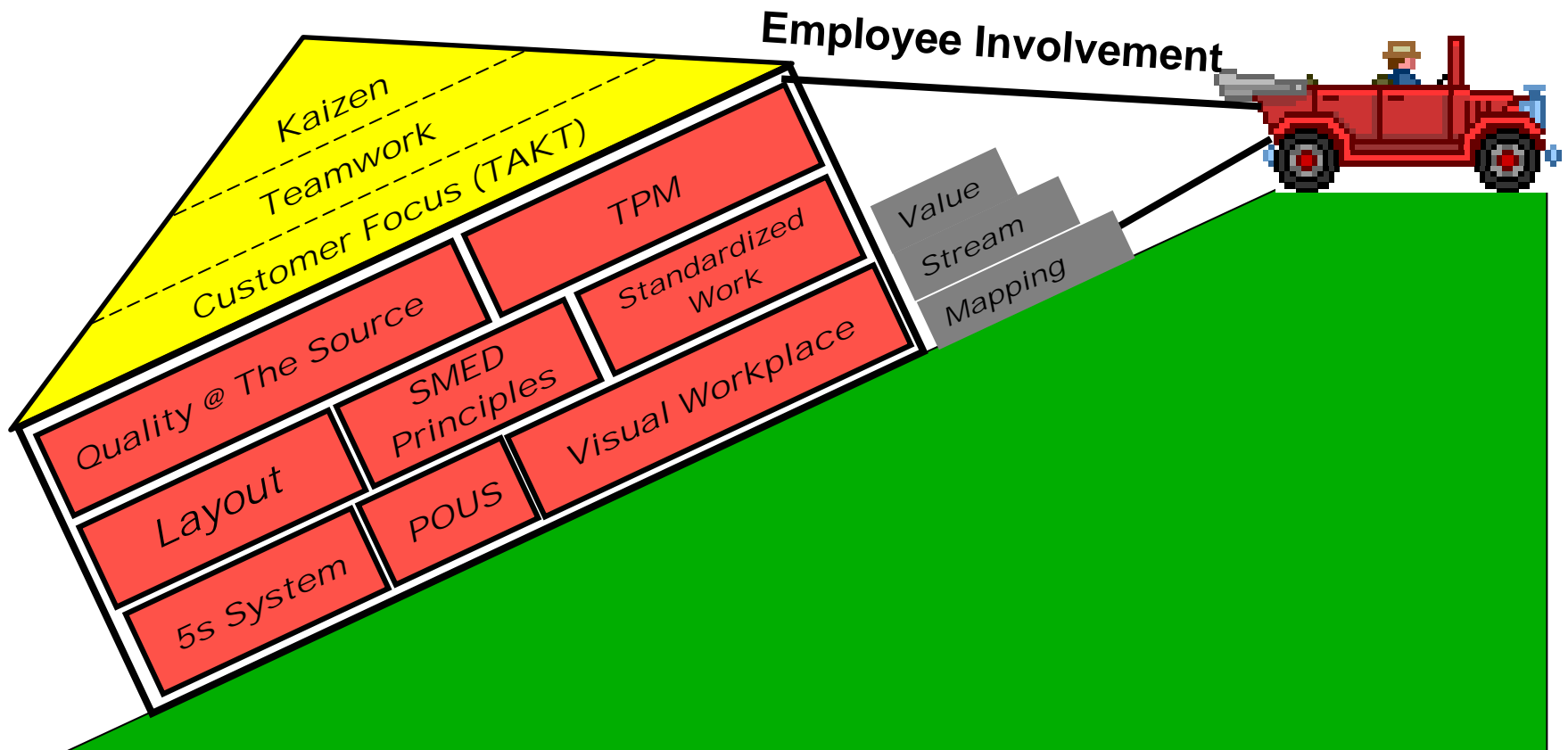








**Kaizen is the vehicle of implementation for Lean tools**



## ■ Kaizen is the process of:

- Identifying & eliminating waste
- as quickly as possible
- at the lowest possible cost

## ■ Kaizen requires:

- Continuous, gradual, persistent improvement
- by all employees and management



## ■ Kaizen utilizes:

- Cross functional team
- Focused scope
- Aggressive goal



**T - Together**



**E - Everyone**



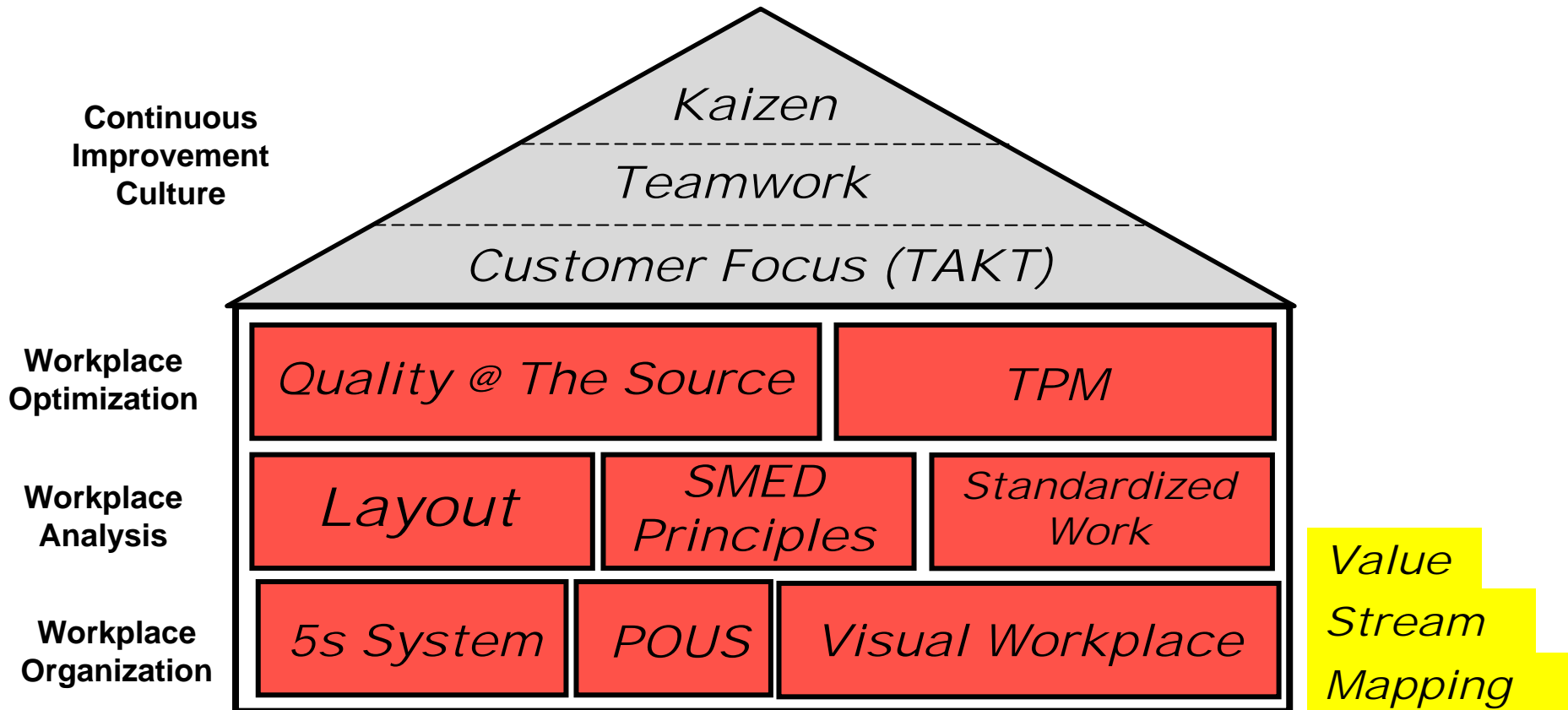
**A - Achieves**



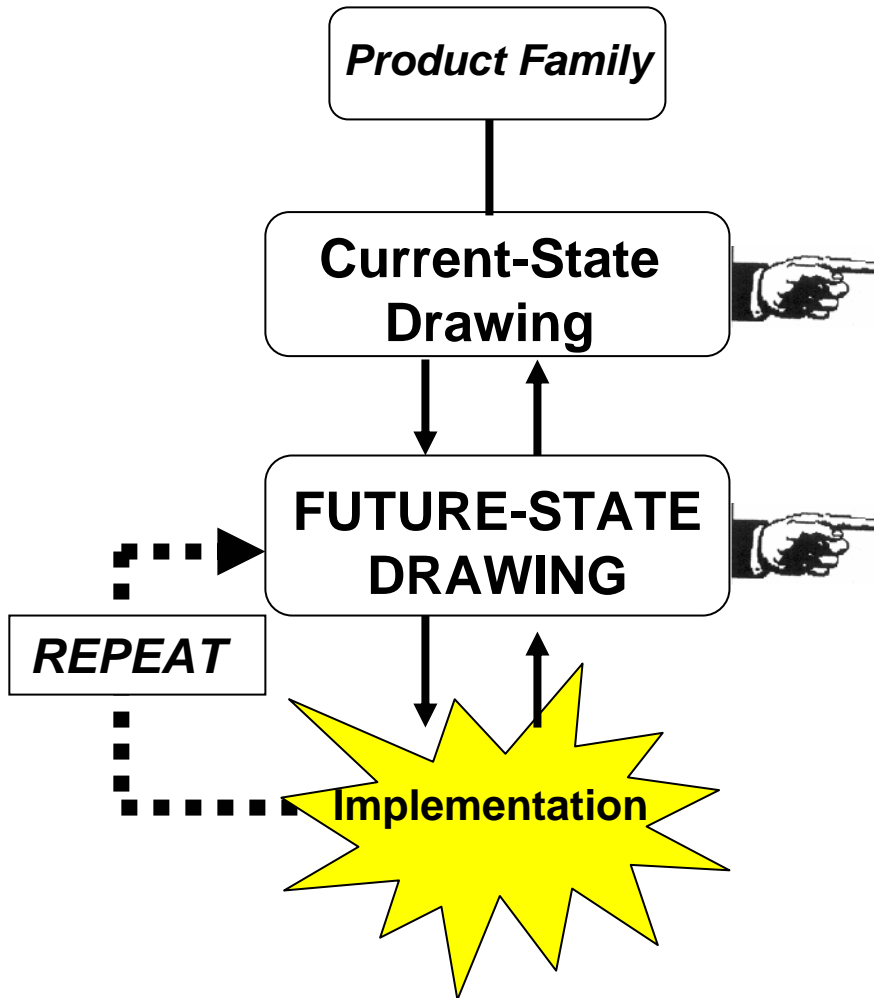
**M - More**



# UAH Lean Enterprise for Port Operations

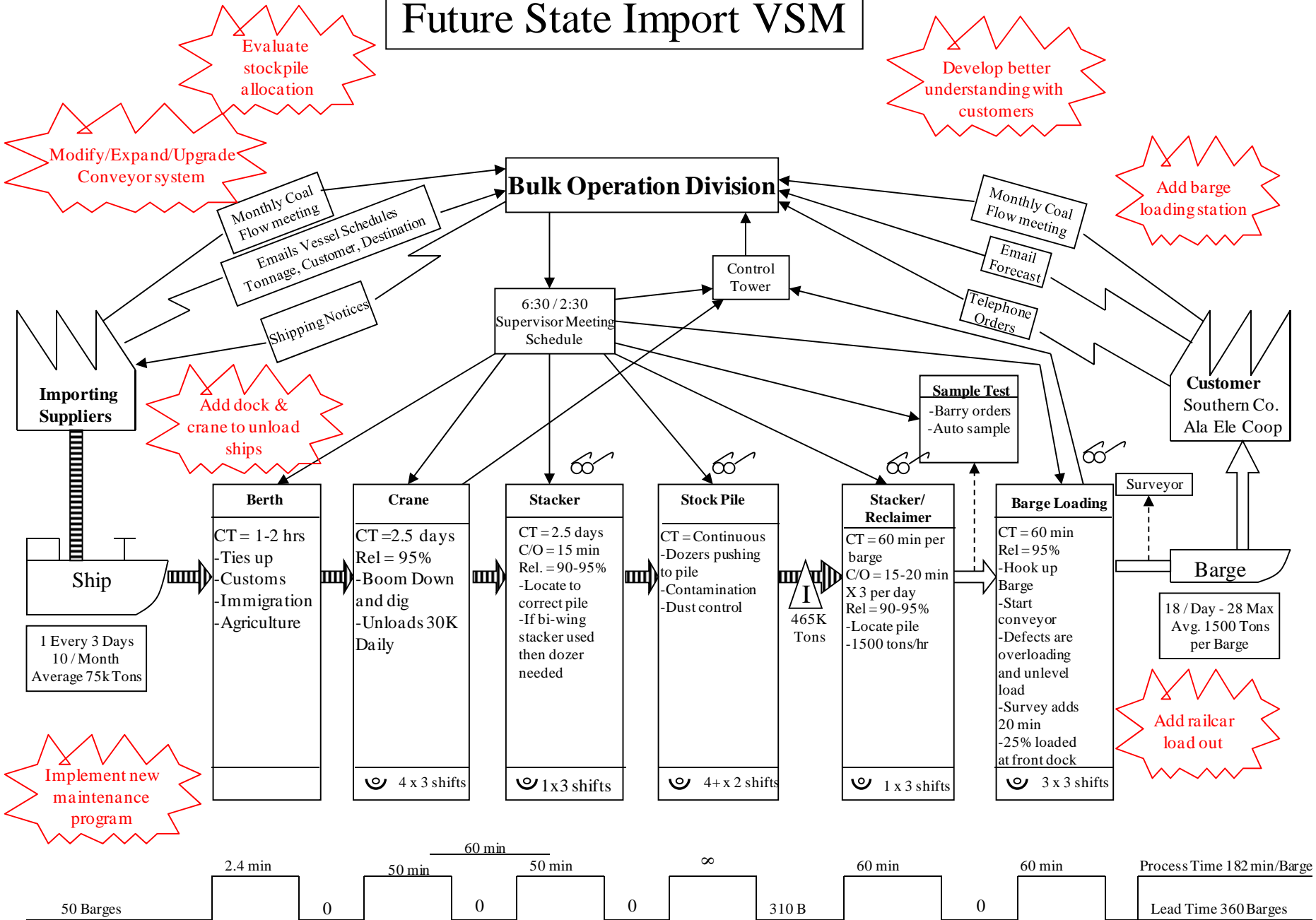


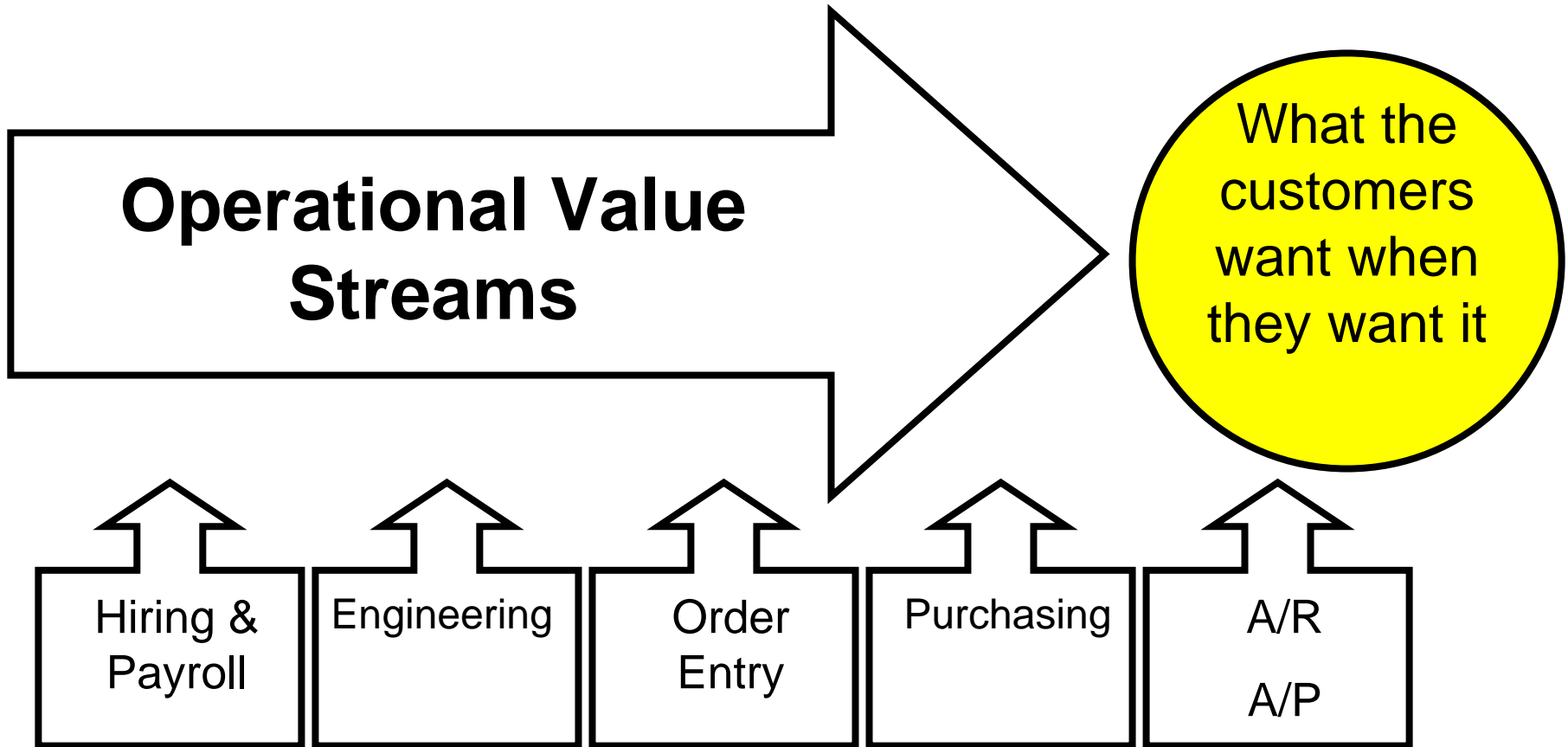
# Value Stream Mapping



- **Determining the product families**
- **Understanding how the shop floor currently operates. (Foundation for future state.)**
- **Designing a lean flow & how to get there.**
- **Do IT!**

# Future State Import VSM





Support Processes - These processes only create value for internal customers, but are currently necessary to run the business

# Keys to Success

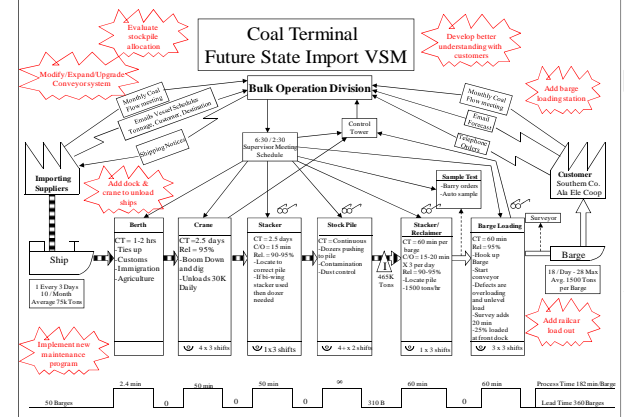
- Integrate Lean Enterprise into strategic planning
- Invest in Lean training at all levels of the organization
- Establish corporate Lean Steering Committee to champion efforts
- Establish appropriate performance metrics
- Practice Value Stream Management

## Executive Management Involvement

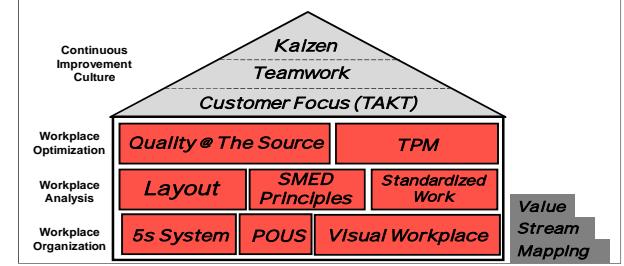
- Integrate Lean Enterprise into strategic planning
- Invest in Lean Enterprise training at all levels of the organization
- Establish Lean Steering Committee
- Choose a pilot area and get started!



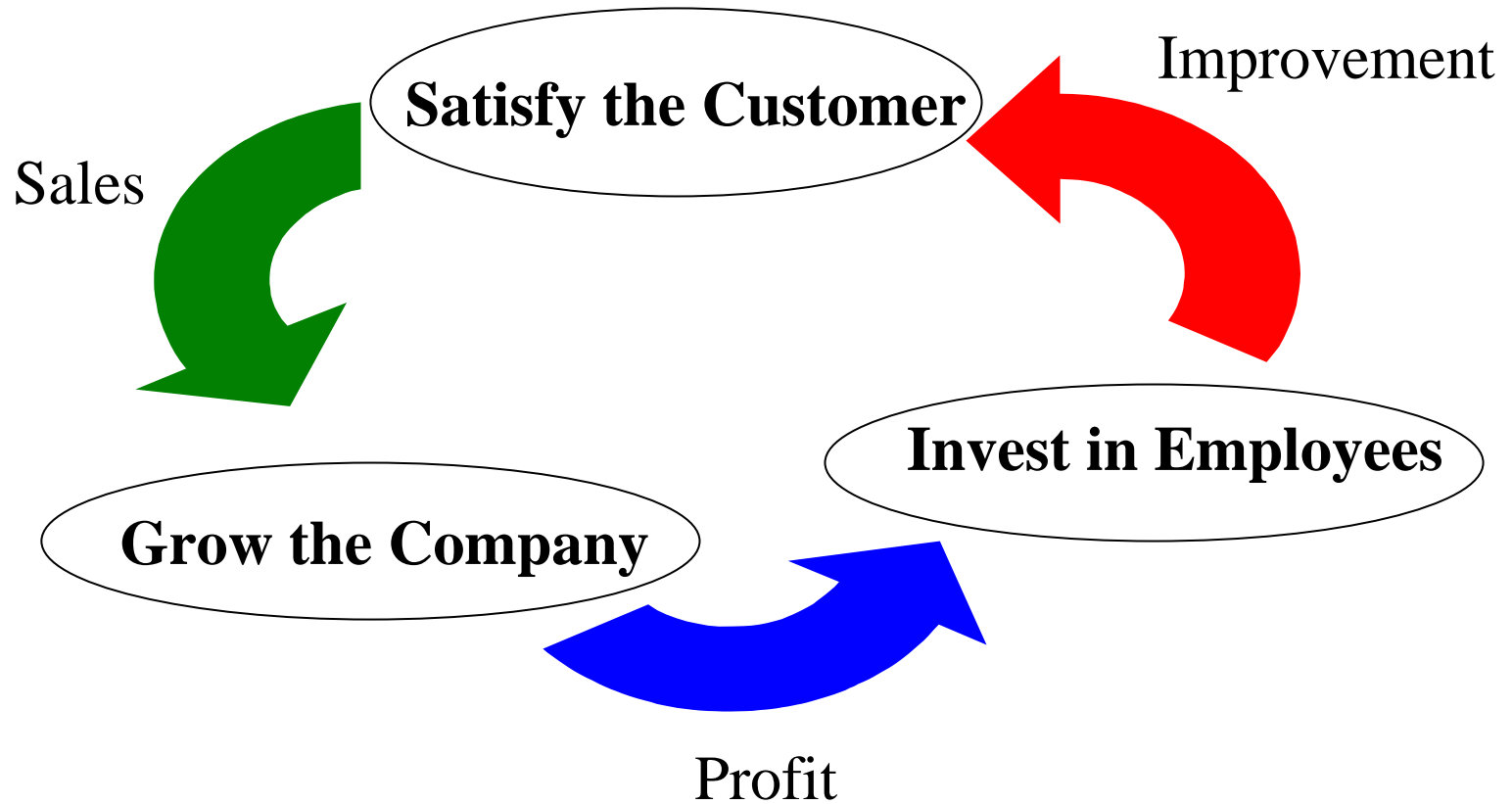
## Value Stream Management



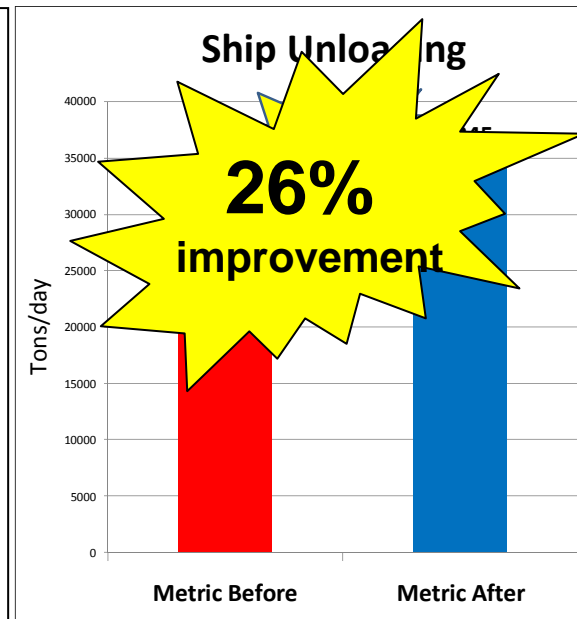
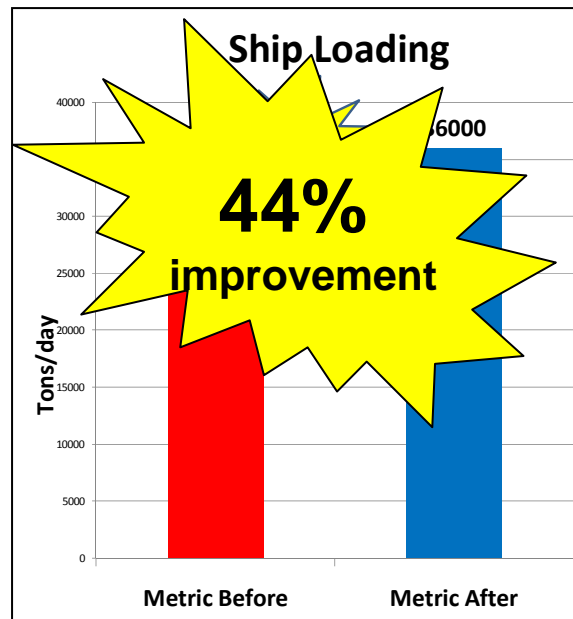
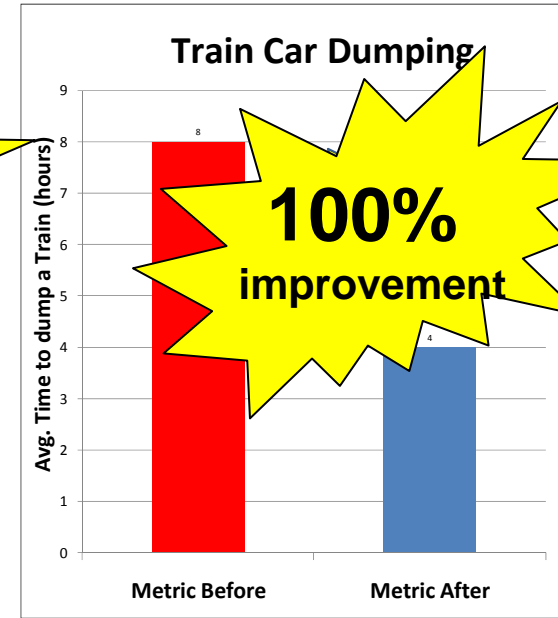
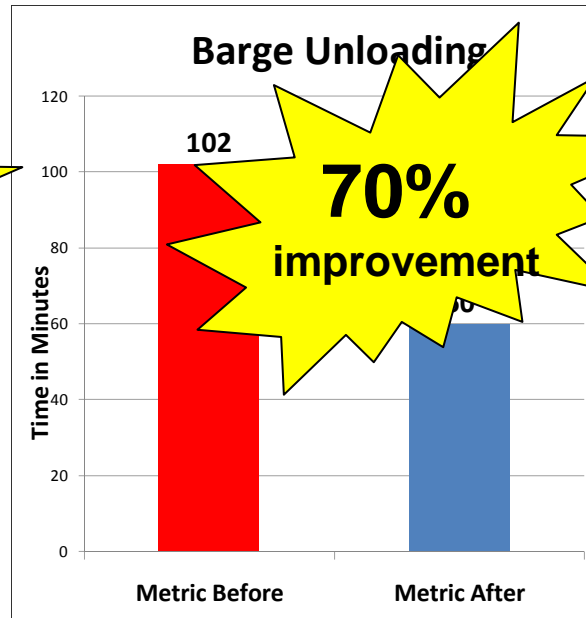
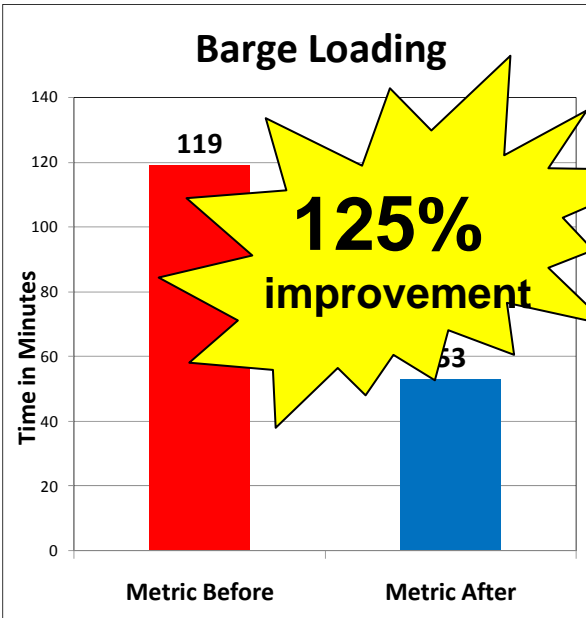
## UAH Lean Enterprise Model for Seaport Operations







# Benefits of Lean at Ports



- Flexibility
- Documented Procedures
- Involved Workforce
- Visual Management