QA 101 - Lean Thinking Applied

Jim Caldwell

Improving Processes. Instilling Expertise.

DYNO
Dyno Nobel

SANDVIK

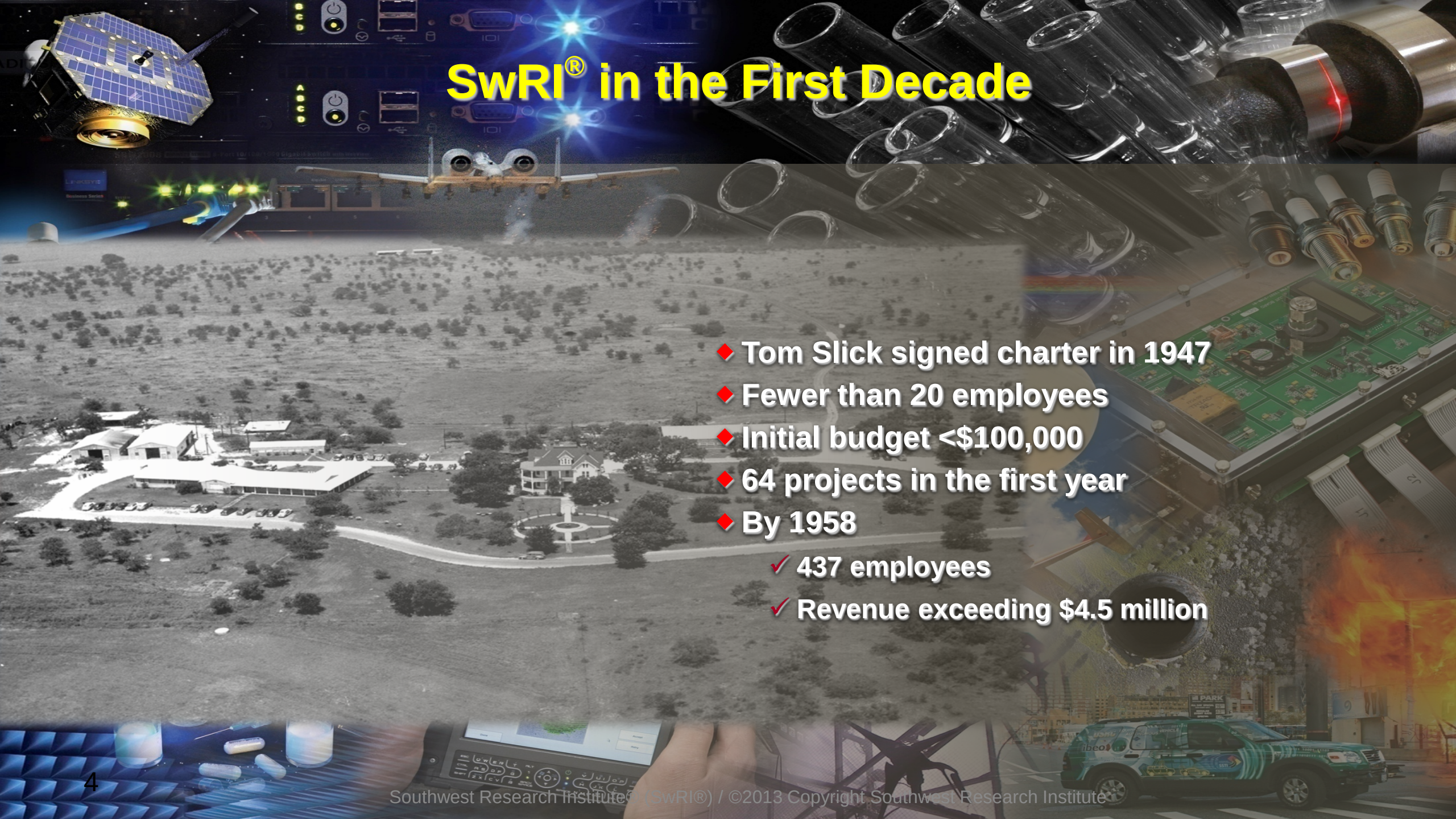
Southwest Research Institute® (SwRI®)

SwRI® Mission and Purpose

Benefiting government, industry and the public through innovative science and technology

- Founded in 1947 by Thomas Baker Slick Jr.
- Charter
  - ✓ Nonprofit organization
  - ✓ Independent & unbiased
  - ✓ Betterment of mankind through science and technology
  - ✓ Development & transfer of technology

SwRI® in the First Decade



- Tom Slick signed charter in 1947
- Fewer than 20 employees
- Initial budget <$100,000
- 64 projects in the first year
- By 1958
  - ✓ 437 employees
  - ✓ Revenue exceeding $4.5 million

SwRI® Today

- Over 3,000 employees
- Revenue in 2012 exceeded $584 million
- Over 1,200 acres / 4.86 km² facility in San Antonio, Texas
- 2.2 million ft² / 204,400 m² of laboratories & offices
- Over 1,000 patents
- 37 *R&D 100* awards

SwRI® Technical Divisions

- Aerospace Electronics, Systems Engineering, and Training
- Applied Physics
- Applied Power
- Automation and Data Systems
- Chemistry and Chemical Engineering
- Engine, Emissions and Vehicle Research
- Fuels and Lubricant Research
- Geosciences and Engineering
- Mechanical Engineering
- Signal Exploitation and Geolocation
- Space Science and Engineering

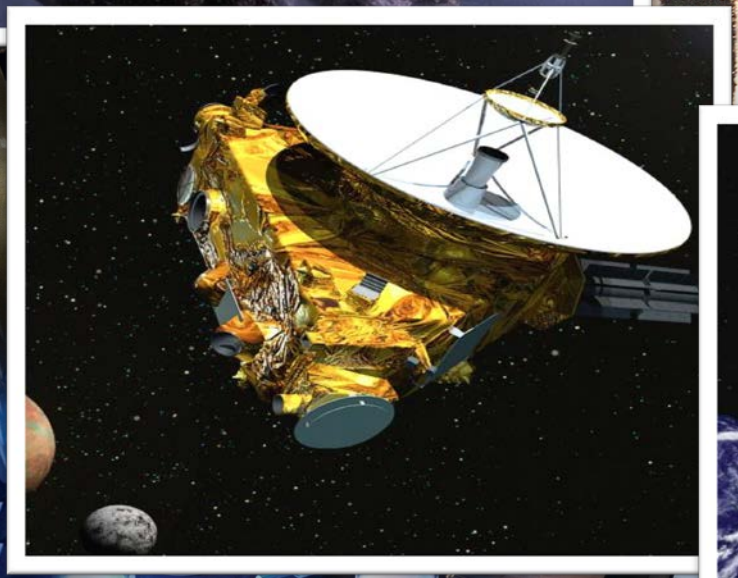
We are here to discuss lean
Lean is not Rocket Science

Space Misssions

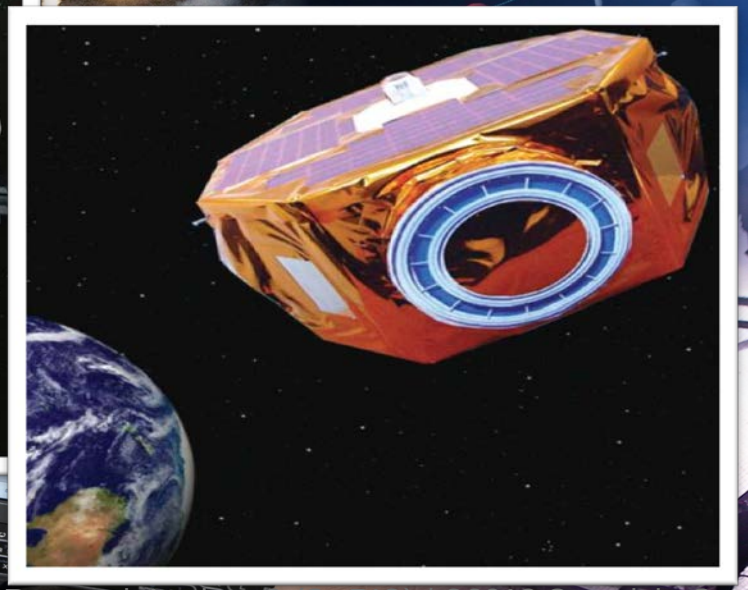
Deep Impact

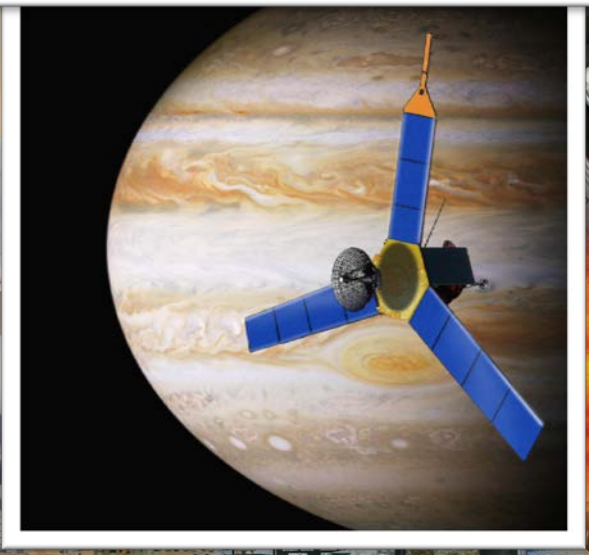
Cassini-Huygens

Magnetospheric Multiscale (MMS)



New Horizons





Juno


• SUSTAINABILITY •
• PROFITABILITY •
• PRODUCTIVITY •
BREAK ROCK
Mechanical & Chemical Crushing
MOVE ROCK
Load & Haul
SIZE ROCK
Screening
• PLANNING AND METRICS •
• SAFETY CULTURE •

Course Agenda

- What is Lean Six Sigma (LSS)
- Why Lean Six Sigma as an Improvement Strategy
- What is Value and Value Creation
- What is Non-Value Added and the Eight Wastes
- Measuring the Process
- Applying to Quarrying – A Rock Factory
- Conclusions / Take-Aways
- Questions and Answers

QUARRY ACADEMY

The New Normal – Every Company Is Driven by Quality, Cost, and Delivery

- Quality is now a “given” in the marketplace
- Customers demand shorter lead times
- Customer loyalty and retention is critical
- Downward price pressure – lower costs
- Lower invested capital – get more output with less

Lean Six Sigma optimizes capacity, reduces process lead time performance and eliminates variability in all processes

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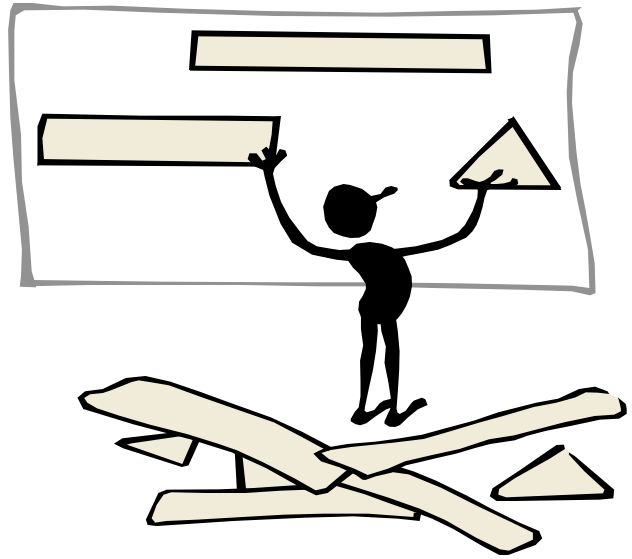
To Embrace the New Normal Means Embracing Change

- How we approach challenges
- How we solve problems
- How we involve others
- How we communicate
- How we think



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Why Change Our Thinking

Einstein said:

“We can’t solve problems by using the same kind of thinking we used to when we created them.”

We need to challenge and break our paradigms!

QUARRY ACADEMY

“I think there is a world market for maybe five computers.”

Thomas J. Watson,
Chairman of IBM, 1943

“Computers in the future may weigh no more than 1.5 tons.”

Popular Mechanics,

Forecasting the relentless march of science, 1949

QUARRY ACADEMY

“I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won’t last out the year.”

Prentice Hall

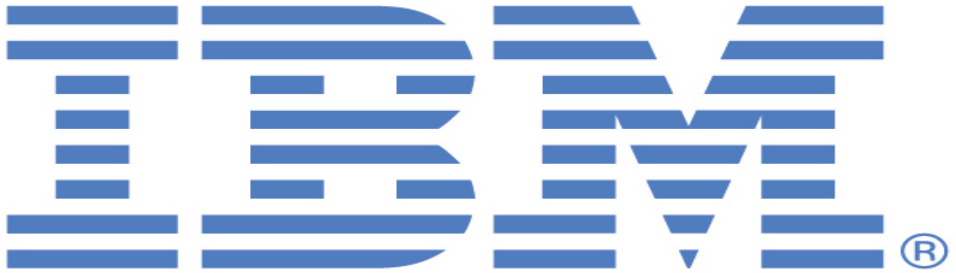
Editor Business Books, 1957

“But what ... is it good for?”

Engineer,

Advanced Computing Systems Division of IBM,

Commenting on the microchip, 1968



QUARRY ACADEMY

“There is no reason for any individual to have a computer in their home.”

Ken Olson, President, Chairman, and founder of Digital Equipment Corporation, at the Convention of the World Future Society in Boston 1977

QUARRY ACADEMY

“640K ought to be enough for anybody.”

Bill Gates,

Microsoft Chairman, 1981

Microsoft®

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What is Six Sigma?

- A **statistical measure** for determining process capability *(Six Sigma equates to **3.4 defects per million opportunities**)*
- A **proven set of tools** and tactics for reducing variation
- A successful **business strategy** *(in use by GE, Motorola, Texas Instruments and Allied Signal)*
- A comprehensive philosophy about **operational excellence**
- A **complementary discipline** to existing tools

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What is Six Sigma?

Process Capability

σ	Yield	DPMO
2	69.2%	308,537
3	93.3%	66,807
4	99.4%	6,210
5	99.97%	233
6	99.9996%	3.4

Defects Per Million Opportunities

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Is a 99% quality level good enough?

- **The "goodness level" of 99% equates to:**
  - ✓**20,000 lost articles of mail *per hour***
  - ✓**Unsafe drinking water almost 15 minutes *each day***
  - ✓**5,000 incorrect surgical operations *per week***
  - ✓**2 short or long landings at major airports *each day***
  - ✓**200,000 wrong drug prescriptions *each year***

We are all customers of these processes.
Do you feel comfortable with 99% now?

QUARRY ACADEMY

Defining Lean

Lean is relentlessly pursuing:

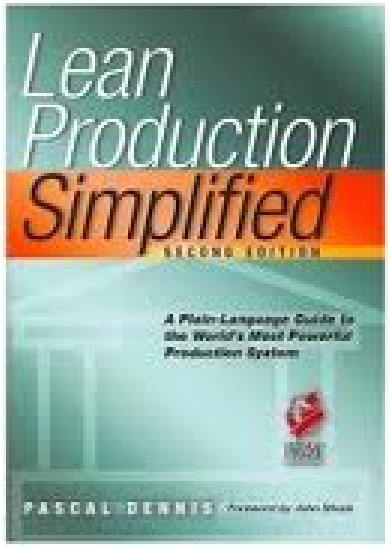
"A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection."

—The MEP Lean Network

QUARRY ACADEMY

Defining Lean Simplified

- Understanding Value from a **Customers Perspective**
- **Systematic** Approach
- Identification and **Elimination of Waste**
- **Continuous** Improvement
- **Flowing Product** based on **Customer Demand**
- Pursuit of **Perfection**



Cost – Quality – Delivery

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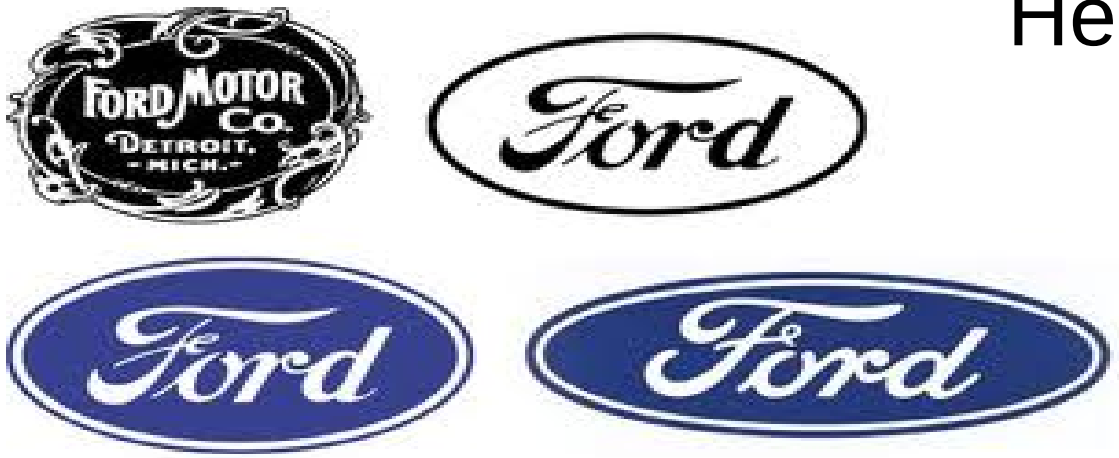
Foundation of Lean

“One of the most noteworthy accomplishments in keeping the price of Ford products low is the gradual shortening of the production cycle. The longer an article is in the process of manufacture and the more it is moved about, the greater is its ultimate cost.”

Henry Ford, 1926



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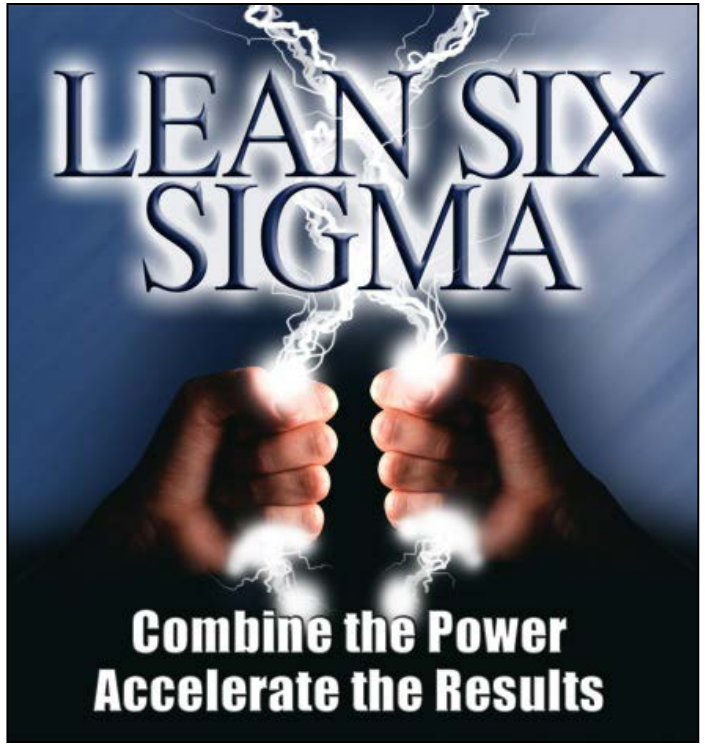
What is Lean Six Sigma

- **Lean and Six Sigma combined are a powerful combination of improvement strategies and tools to achieve excellence across the enterprise.**

- **Lean Six Sigma is a process improvement methodology that has proven successful in a variety of industries.**



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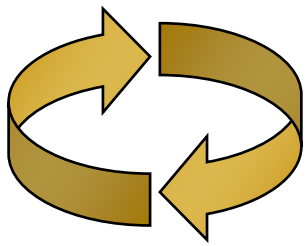
Lean Six Sigma Is the Integration of Two Powerful Business Improvement Approaches...

Lean

Speed + Low Cost

- **Goal – Reduce waste and increase process speed**
- **Focus – Use VSM to identify & eliminate waste (non value add activities and causes of delay)**
- **Method – Kaizen events**

Lean Speed Enables Six Sigma Quality (Faster Cycles of Learning)



Six Sigma

Culture + Quality

- **Goal – Improve performance on Customer CTQs**
- **Focus – Use DMAIC with TQM tools to eliminate variation**
- **Method – Management engagement, 1% dedicated as Champions and Black**

Six Sigma Quality Enables Lean Speed (Fewer Defects Means Less Time Spent on Rework)

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Why Lean Six Sigma?

Overall Yield vs. Sigma

(Distribution Shifted ±1.5σ)

# of Steps	±3σ	±4σ	±5σ	±6σ
1	93.32%	99.379%	99	99.99966%
7	61.63	95.733	99.839	99.9976
10	50.08	96	99.768	99.9966
20	25	88.29	99.536	99.9932
40	6.29	77.94	99.074	99.9864

Lean Six Sigma Drives Quality, Speed and Cost Simultaneously

Lean **Reduces Non-Valued Add Steps**

Six Sigma Improves Quality of Value Add Steps

Source: *Six Sigma Research Institute*, Motorola University, Motorola, Inc.

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Assessing Types of Activities

- **Value Added – Steps essential to deliver product or service according to customer requirements**
  - ✓ **Transforms the item or service toward completion**
  - ✓ **Customer cares (what the customer is willing to pay for)**

- **Non-Value Added – Steps that generate a negative return on the investment of resources and usually can be eliminated without impairing a process**

- **Non-Value Added But Necessary – Steps that would otherwise be non-value add, but are required for regulatory, safety, or other reasons**

In general, assume a step is Non-Value Added unless a strong case can be made to show that it is Value Added

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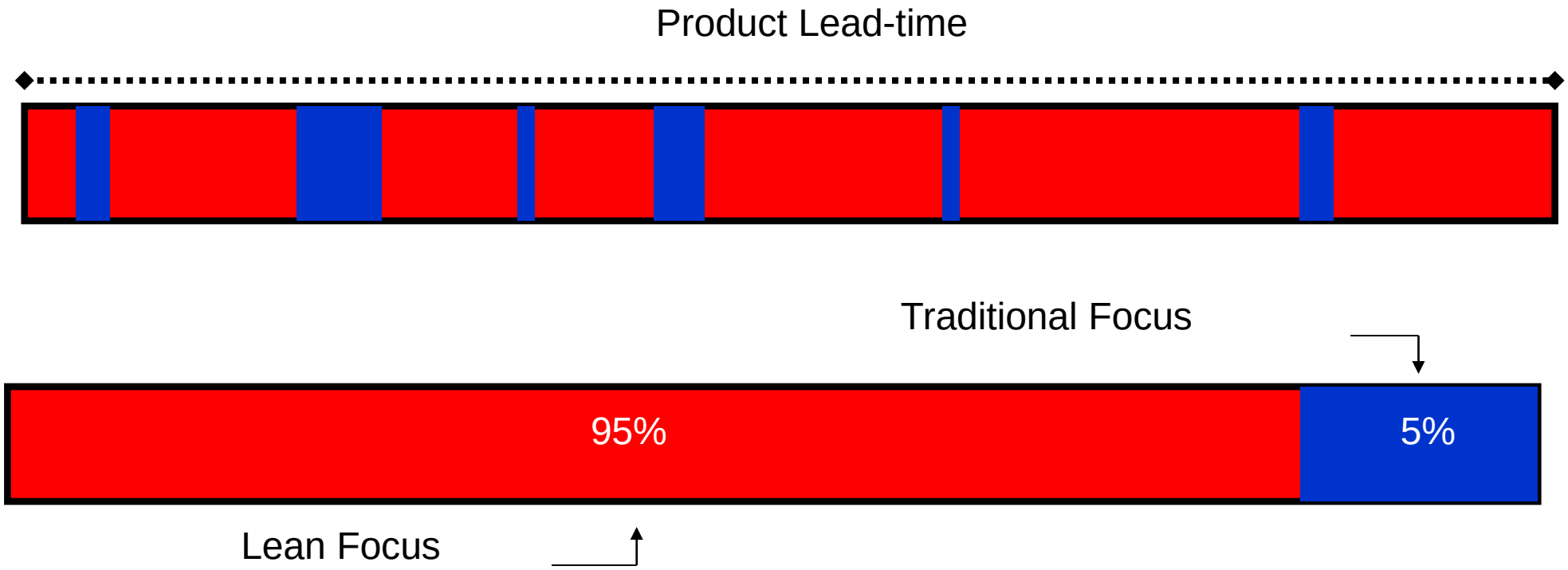
Value Added vs. Non-Value Added in Typical Processes



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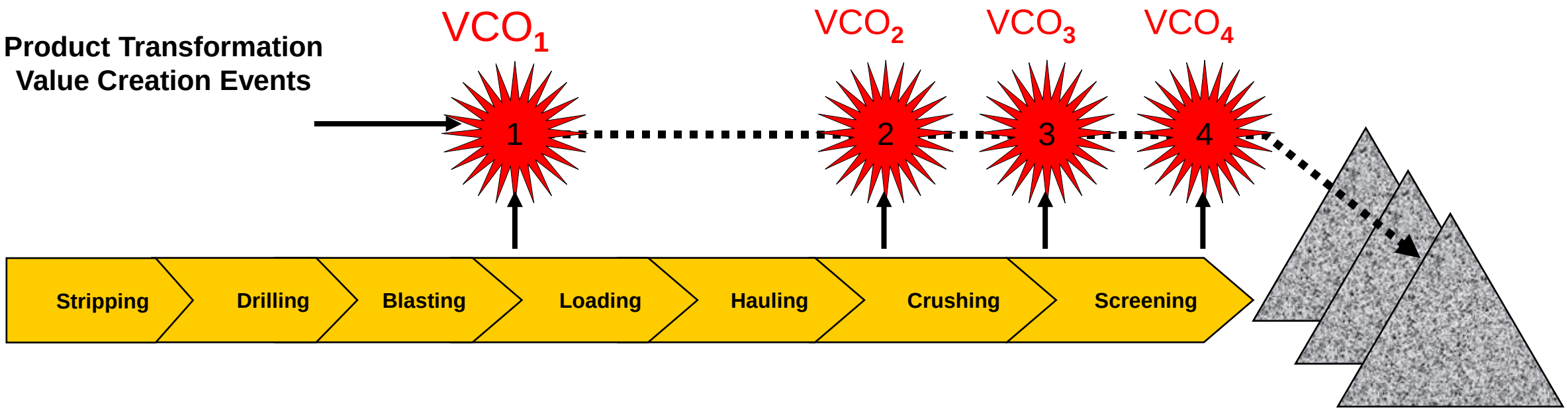
Value Creation Opportunities for Quarry Operations

VCO = Value Creation Opportunity



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