Presenter: Rob Watson

Non-degreed Engineer

POSITIONS SINCE 1974

US Coast Guard – Petty Officer
- Seaman – Search and Rescue
- Patrol/Rescue Boat Operator
- Federal Boarding Officer

Marine Rescue Lieutenant
Battalion Chief
Rescue EMCA – Ambulance
Police Officer, Reserve
Professional Firefighter
College Instructor - Fire Service Technology
Professional Research Assistant – High Energy Physics
Small Business Owner – 2D CAD and 3D Lofting
Machinist/Fabricator
Manufacturing Technician
Manufacturing Engineer
- Safety Coordinator

Sr. Manufacturing Engineer
Project Manager – Factory Construction
Marketing Director
Lead Design Manager – Sales

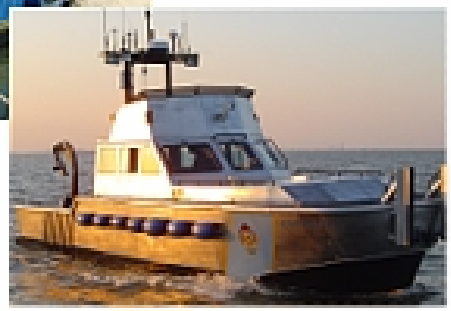
There are many different types of engineers in the world. Many engineering disciplines and skilled crafts people Support other engineers. Civil Engineers design the land base around structures and must understand many other professional interests involving motion, soils, stability, strengths of materials, water and waste water, etc.,.

Project Manager, Construction
Manufacturing Factory and Engineering Office

Naval Architecture
Marine Engineering

ORIGINAL CAD DESIGN
followed by
COLOR IMAGING
MARKETING VIDEO
DOCUMENTATION
SEA TRIALS

Enforcer
Ketchikan, AK



Churchill
Cordova, AK

Naval Architecture
Marine Engineering

Engineers still need other engineers to bring their designs to fruition.

Mechanical Engineering
- Structural Engineering
- Gears and Shafts
- Tensional Loading
- Torsion Loading
- Seals and Gaskets
- Paint and Adhesives
- Electrolysis
- Hydrodynamic Flow
- Hydrodynamic Thrust
- Current Eddy Reduction
- Screws, Nuts, and Bolts
- Lubricant Flow and Pumps

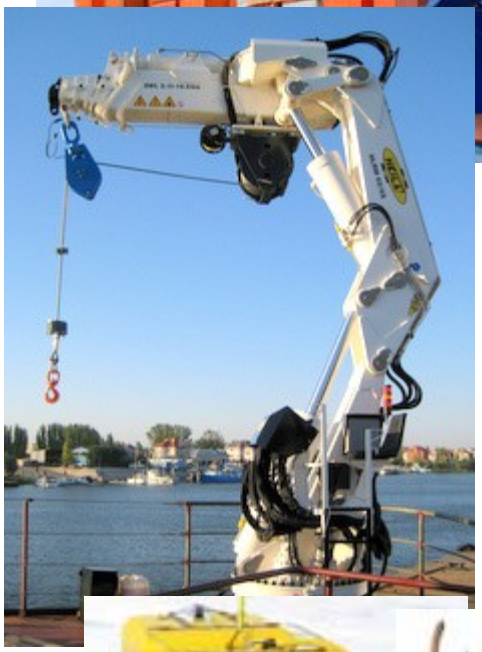
Manufacturing Engineering
- Machining
- Welding
- Tooling
- Assembly
- Wiring
- Material Handling

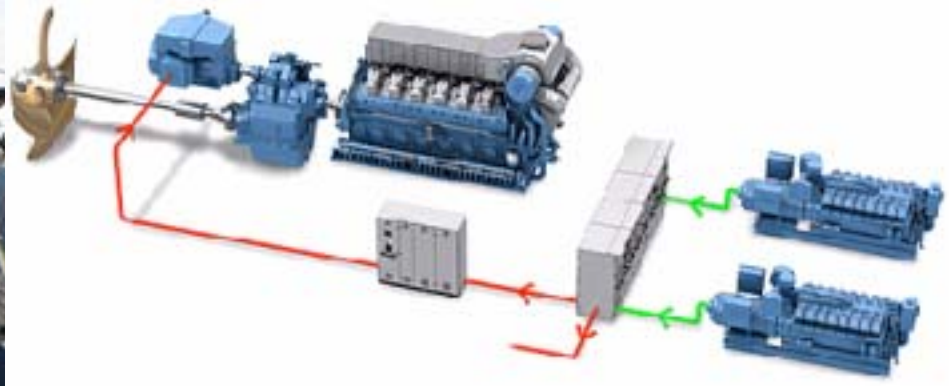
Manufacturing engineering

Once a product is designed the Manufacturing engineer takes over and determines the best way to build many of the items for profit. Manufacturing engineers also understand other disciplines and skills in industry.

Web image from: CR Watson

Manufacturing engineering





Web image from: CR Watson

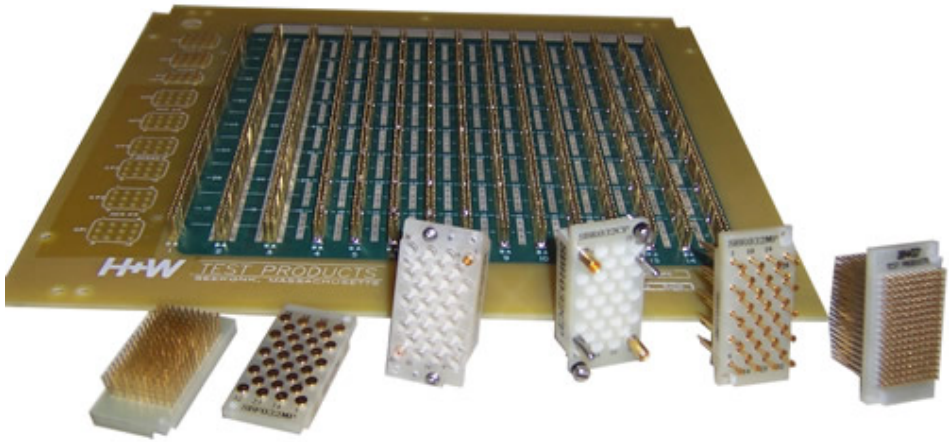
Manufacturing engineering

12,300 per week required

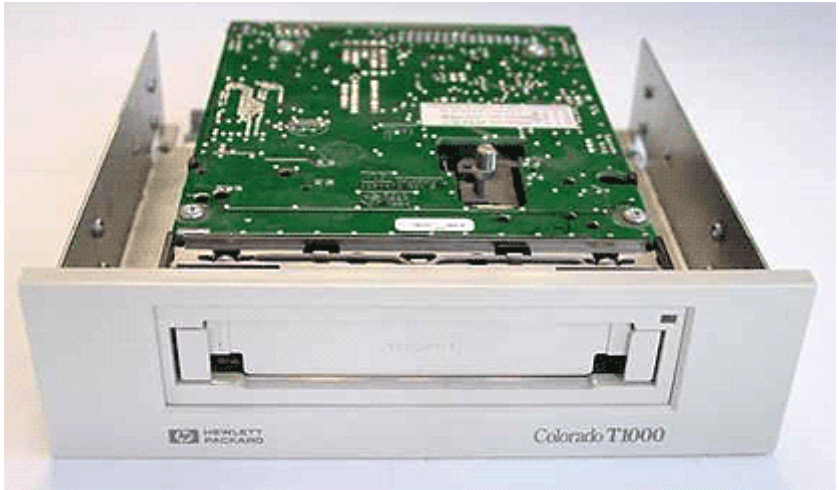
Projects I worked on

Manufacturing engineering

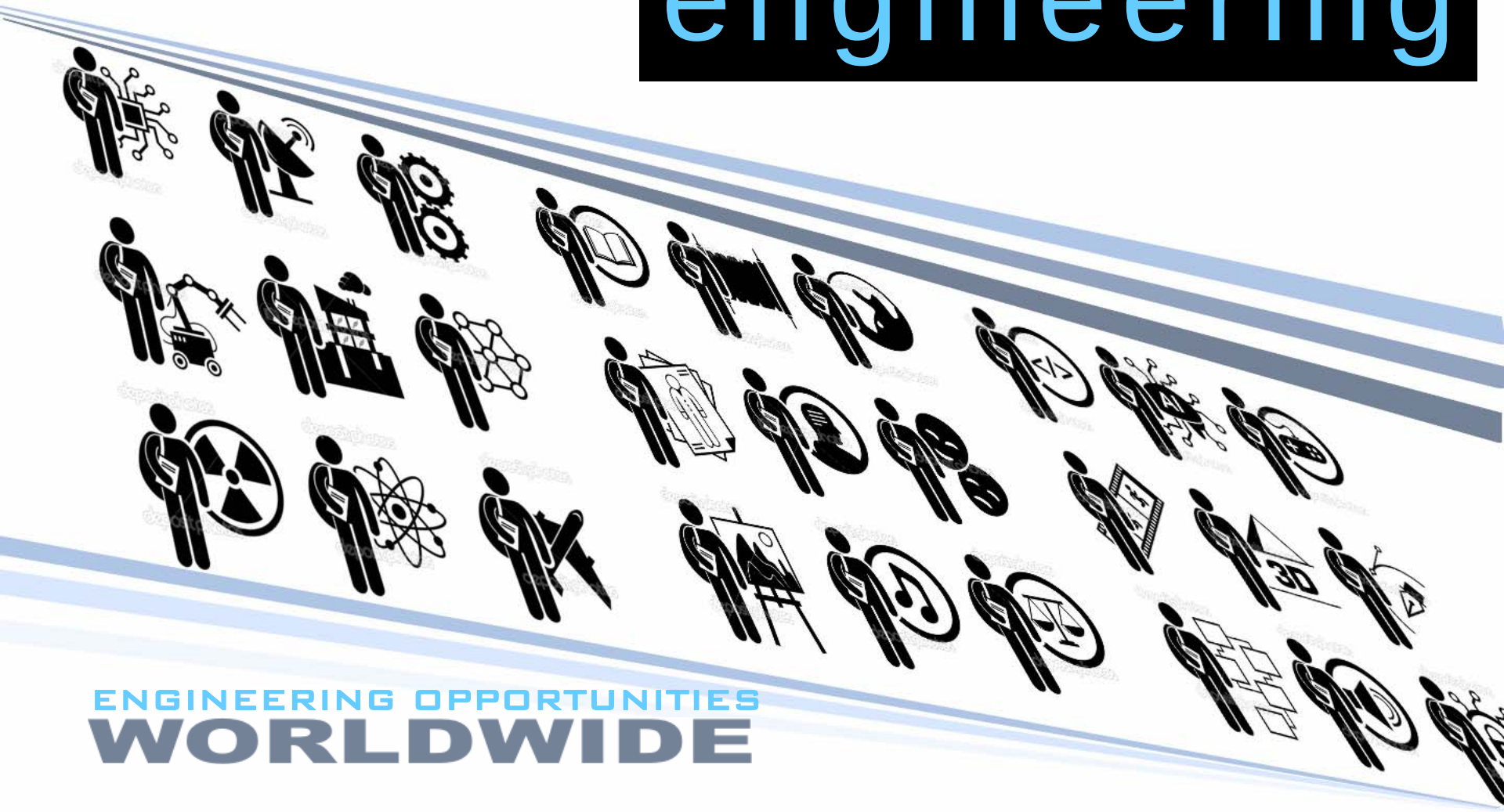
Some Engineering projects I worked on was to build tools and fixture to help physically challenged workers stand alongside able bodied workers and work at the same rate. See Centre Industries in Wichita Kansas.



Manufacturing engineering



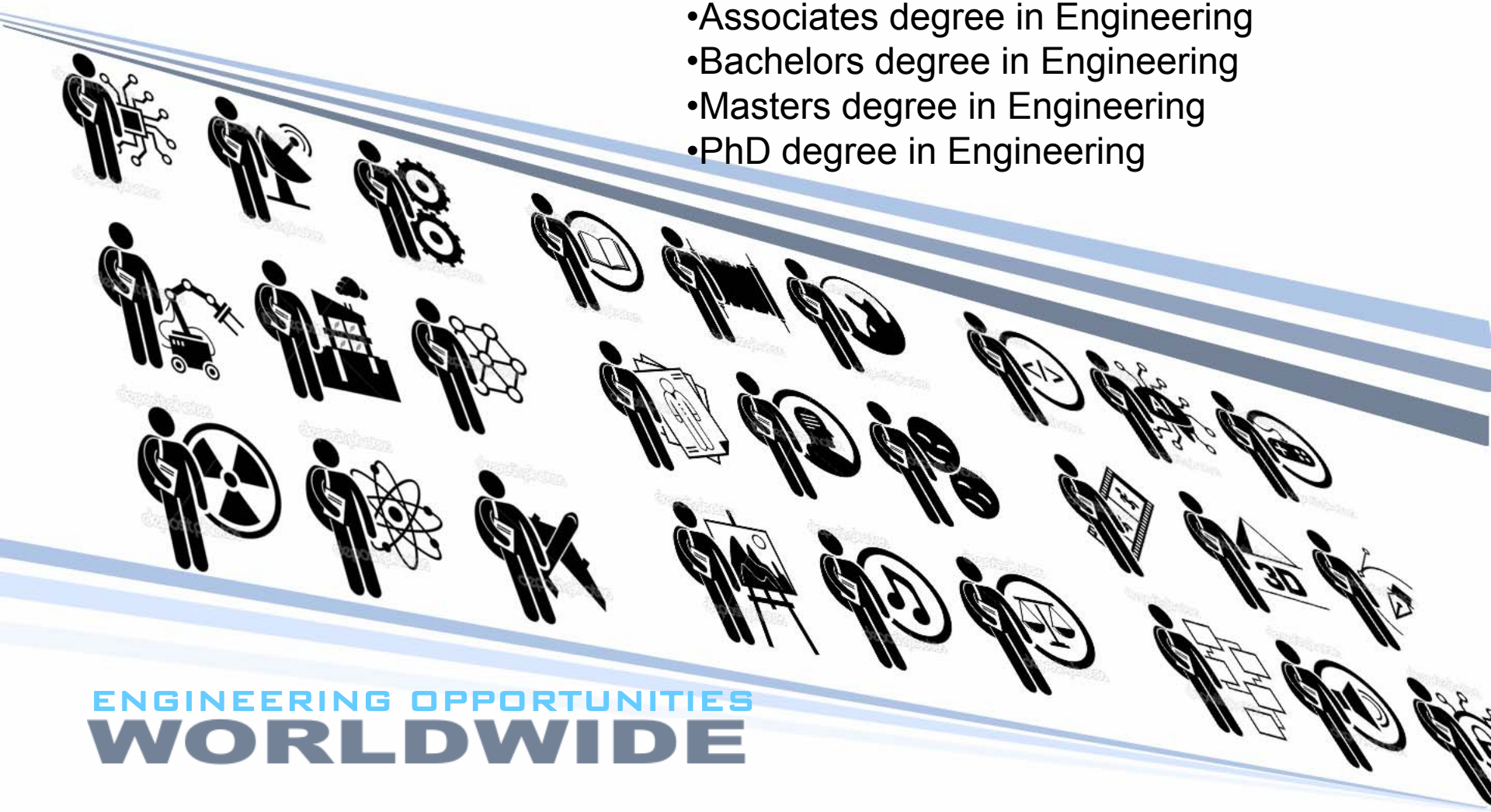
Manufacturing engineering



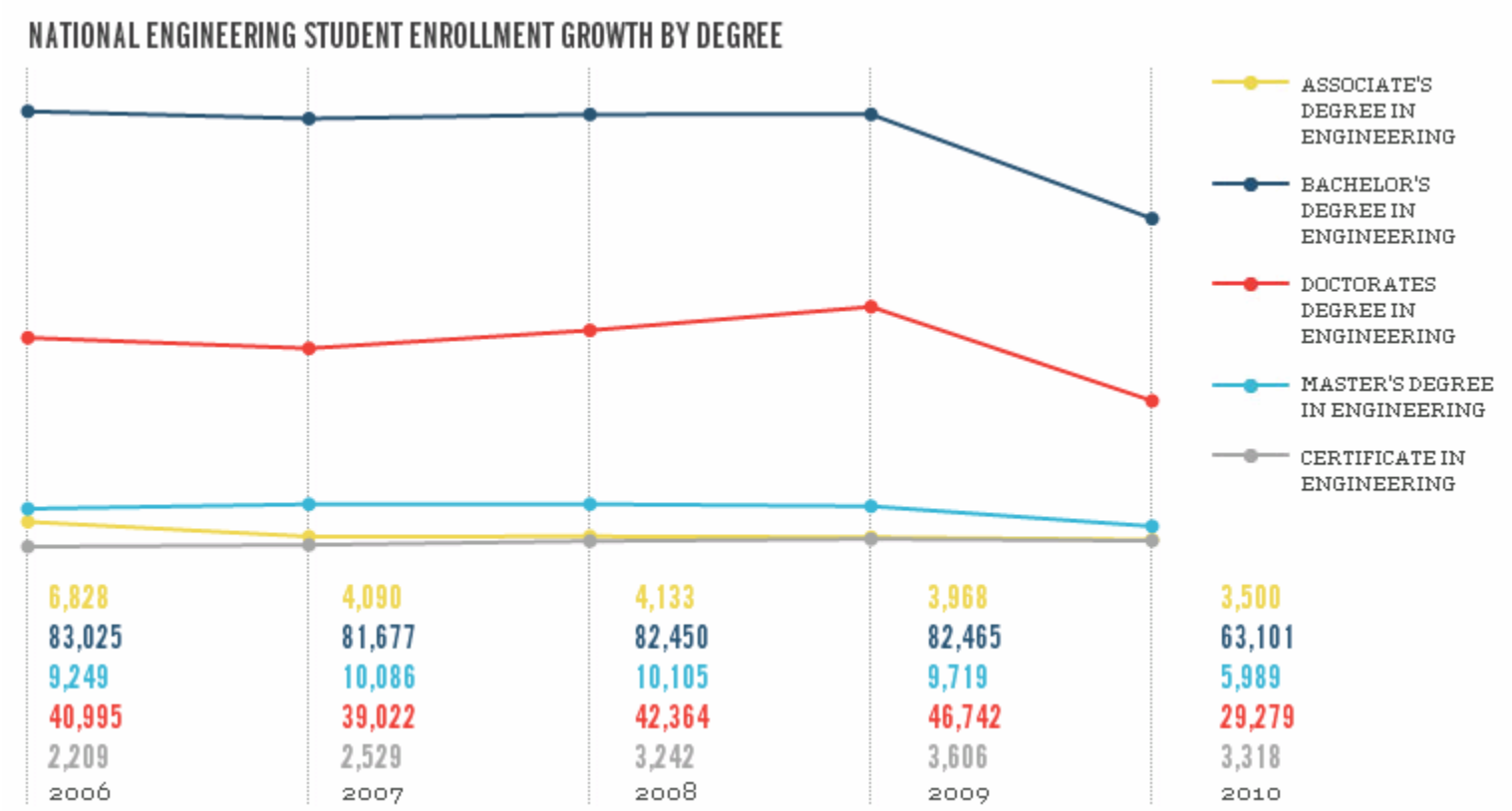
ENGINEERING OPPORTUNITIES
WORLDWIDE

•Fifteen Million Engineers (Estimated) Worldwide
•According to Education News there are 1,074 accredited engineering schools in the USA. Engineering training is available to achieve:

- •Engineering Certificates
- •Associates degree in Engineering
- •Bachelors degree in Engineering
- •Masters degree in Engineering
- •PhD degree in Engineering



ENGINEERING OPPORTUNITIES WORLDWIDE



ENGINEERING OPPORTUNITIES

WORLDWIDE

Manufacturing Engineering

What is it? How does it work?

A discipline of engineering dealing with different manufacturing practices. Can include research, design and development of systems, processes, machines, tools and equipment needed to turn base materials into a new or updated product in the ***most economic, efficient, and effective way possible***.

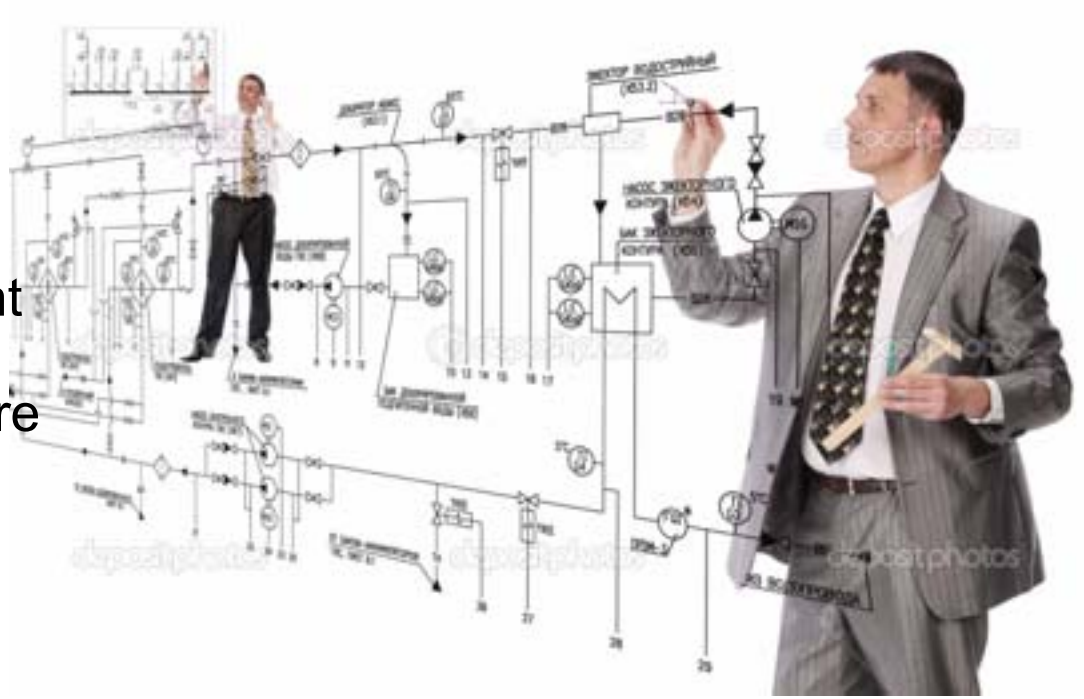
Finding an established degree program for a Manufacturing Engineer is rare since Manufacturing Engineers typically come from standard engineering disciplines.

The ***Industrial Engineering Degree*** is the most common degree that is directly related to being a Manufacturing Engineer

Manufacturing Engineering

Visit www.sme.org

Organizations such as the Society of Manufacturing Engineers seek to represent the body of Manufacturing Engineers for now and future generations



VISION - Enhance progress, prosperity and strong communities through manufacturing.
MISSION - Inspire, prepare and support our stakeholders in the advancement of manufacturing.
PURPOSE - Advance manufacturing and attract future generations.

Manufacturing Engineering

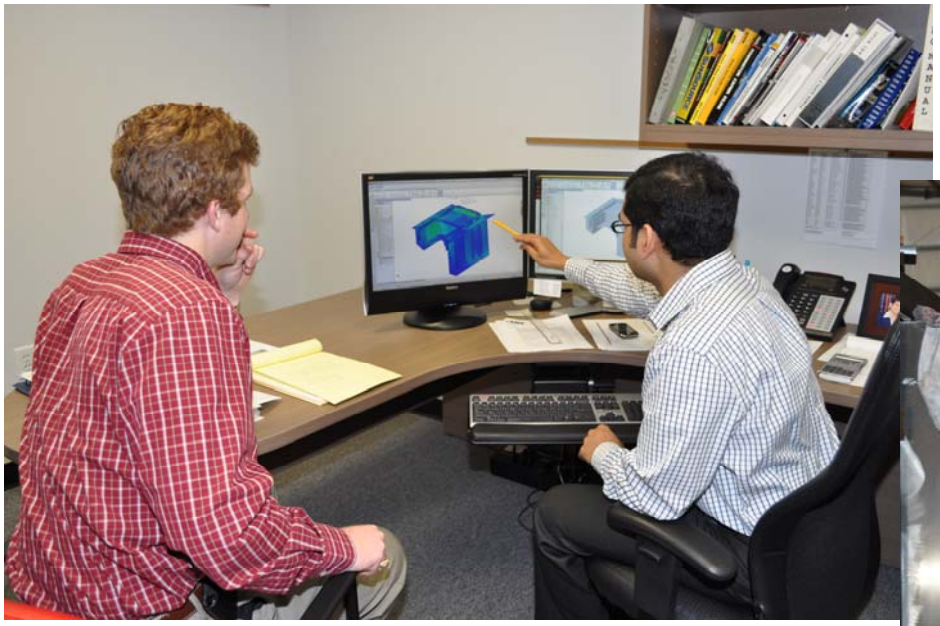
- FORMULAS
- SOFTWARE
- PROCESSES
- SPECIFIC DISCIPLINES

Web image from: CR Watson

Manufacturing Engineering

Sometimes a Manufacturing Engineer is brought in after the product line has started in order to

- streamline the process,
- remove bottlenecks,
- increase the quality of produced parts, or
- create a value added process that was not part of the original plan



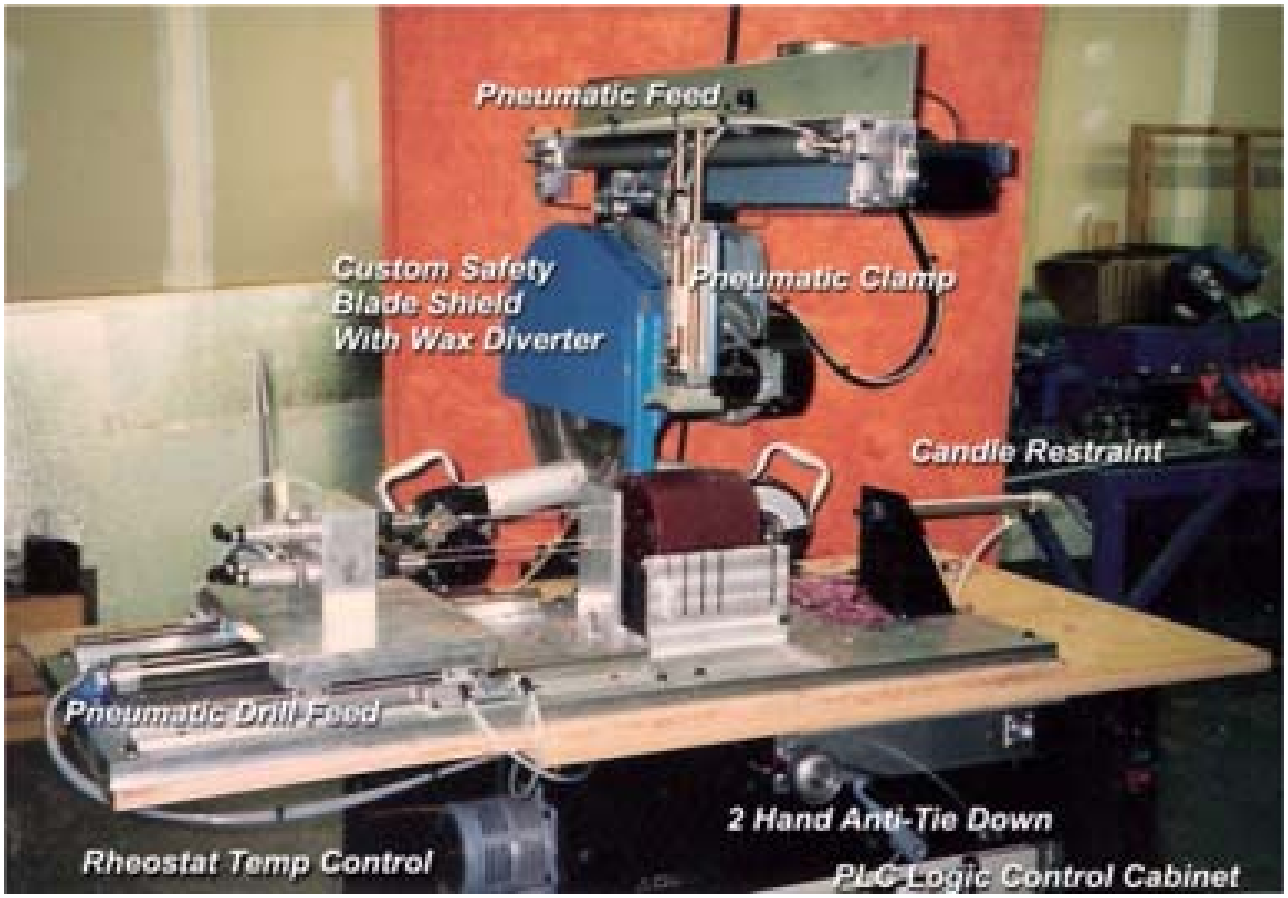
Web images from: CR Watson

Manufacturing Engineering

Worlds FIRST Web Server – CERN Visitors Center

Manufacturing Engineering

The types of machines created by the Manufacturing Engineer can be a simple case of automating a carpenters radial arm saw to automatically cut and drill a candle, to…



Candle 3-Hole Drill and Sizing Machine

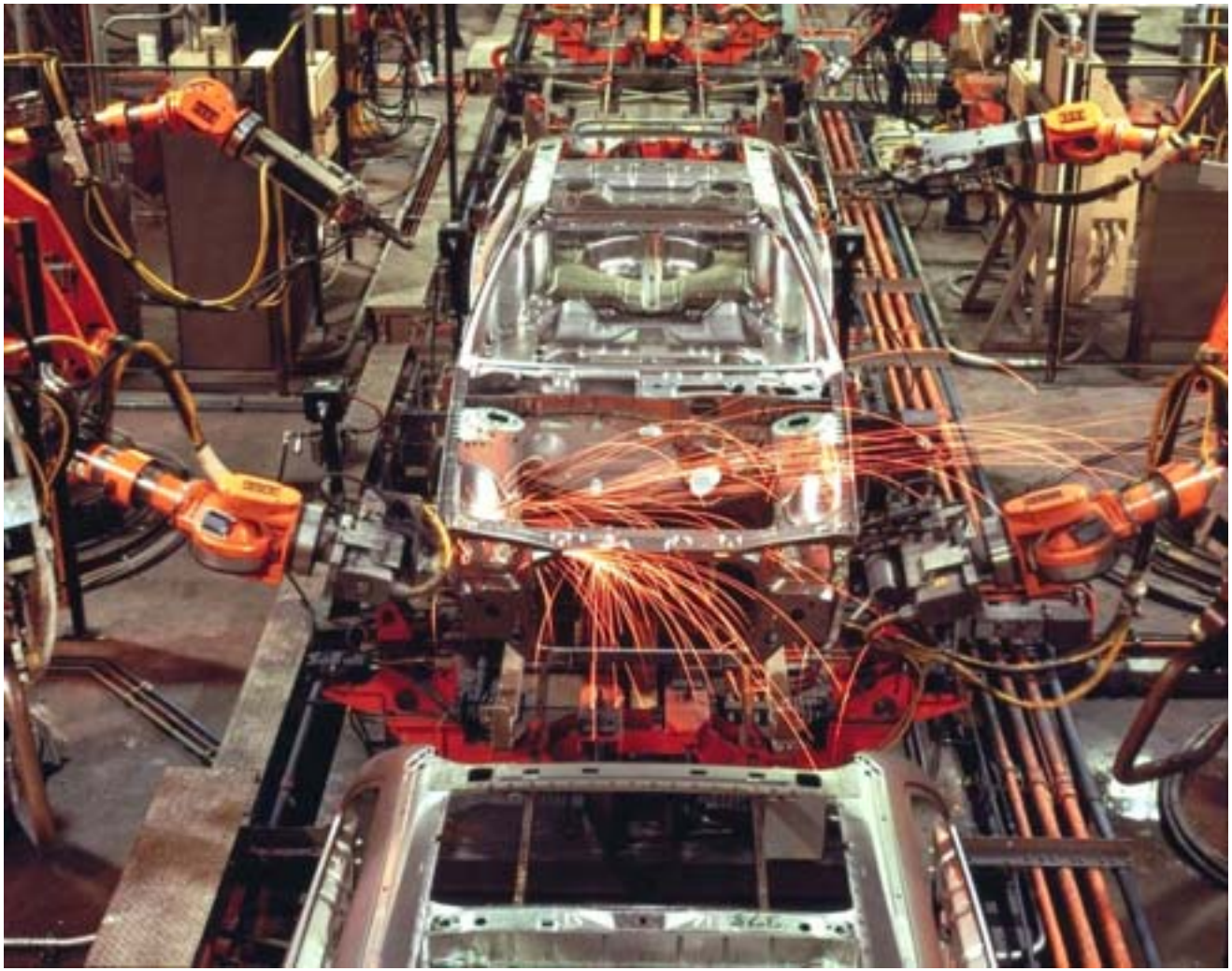
Manufacturing Engineering

Robot - For a stage play the word robot was coined by artist Josef Čapek, the brother of famed Czechoslovakian author Karel Čapek. Roboti' derives from the Old Church Slavanic 'rabota', meaning 'servitude', which in turn comes from 'rabu', meaning 'slave.

The first movie robot I recall was named Robbie. (Maybe because my grandmother nicknamed me Robbie as well) But my most familiar was the B9, Class M-3 General Utility Non-Theorizing Environmental Control Robot in the television series "Lost in Space".

Manufacturing Engineering

Robotic production lines with little human interaction to run the day to day processes.



Auto Production Line - Robotics

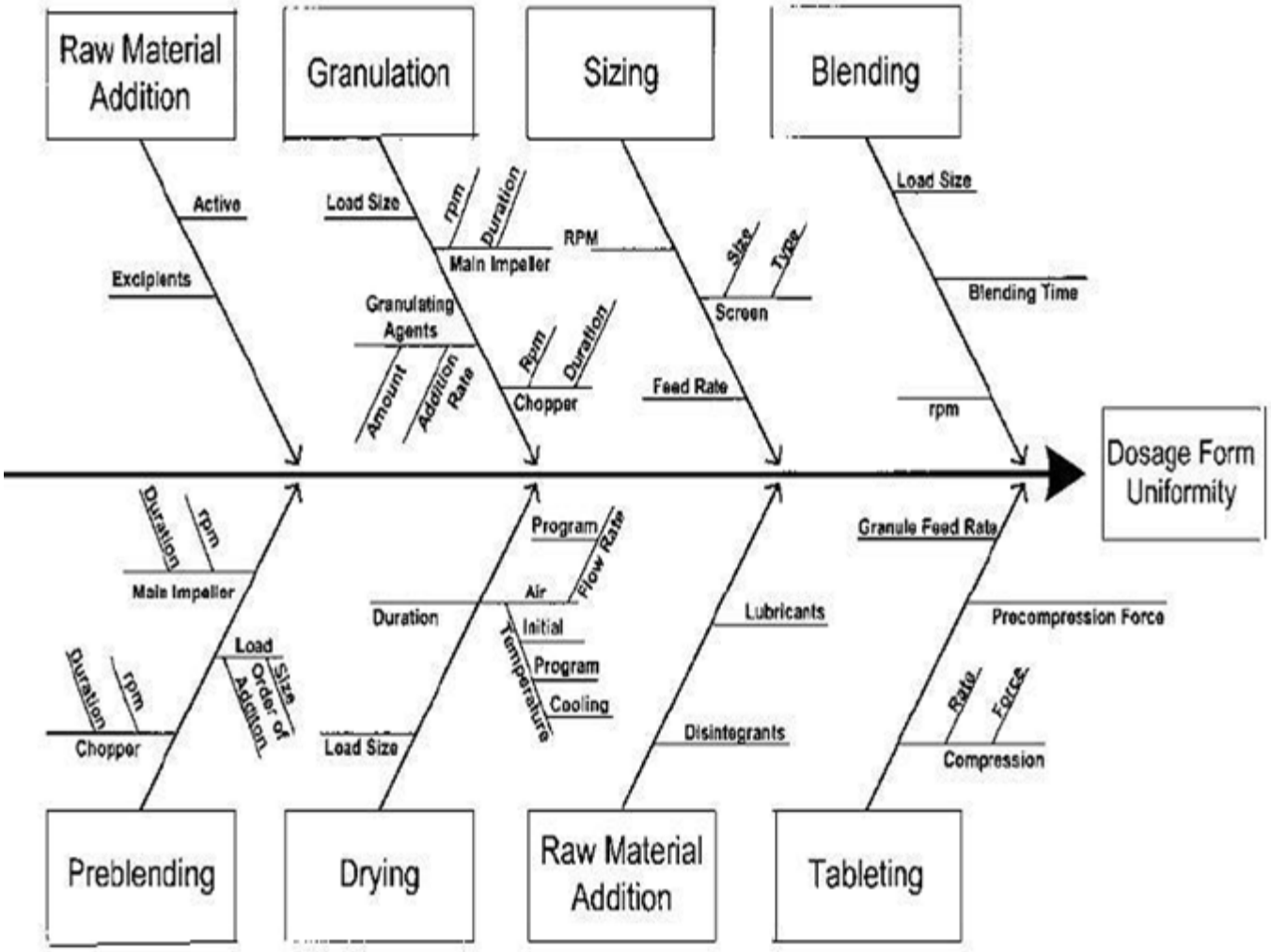
Manufacturing engineering

However, robots are not the center of attention in manufacturing engineering. They are simply a tool. A means to an end. The true focus of Manufacturing Engineering EFFICIENCY AND PROFITABILITY

What about SAFETY? If a manufacturing process is efficient and profitable, it is also safe, productive, quick and easy to change, simple to repair, unimposing to modify, and everything else but…, attractive.

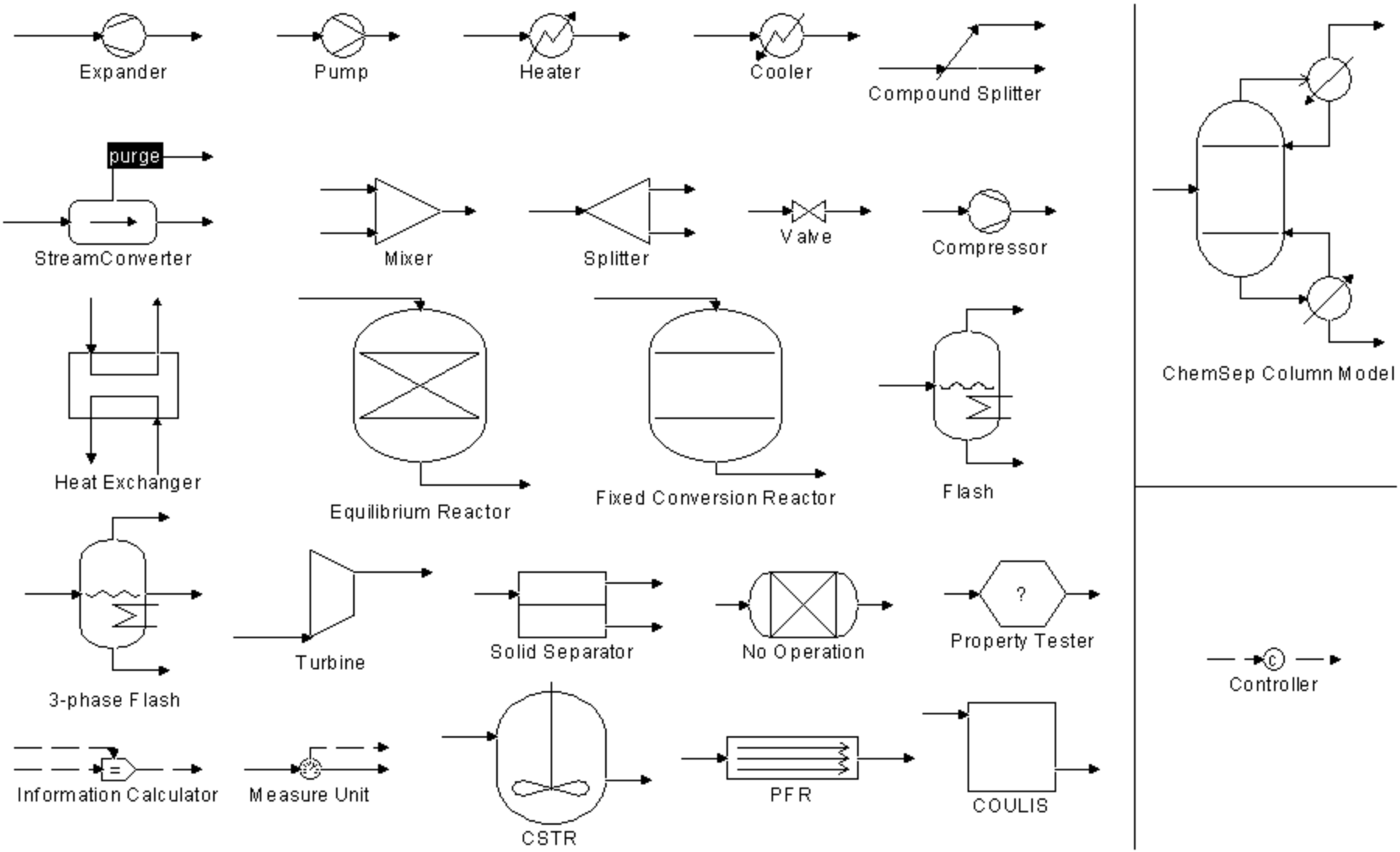
Manufacturing engineering

Sketch Of A Process Schematic To Understand What Is Involved To Arrive At The Desired End Result For A Medicinal Drug



Manufacturing engineering

Schematic Symbols are Common To Design A Manufacturing Flow Process



Manufacturing engineering

This field also deals with the integration of different **facilities and systems** for producing quality products (with optimal expenditure) by applying the principles of physics and the results of manufacturing systems studies, such as the following:

Mass production
Computer integrated manufacturing
Computer-aided technologies in manufacturing
Just in time manufacturing
Lean manufacturing
Flexible manufacturing
Mass customization
Agile manufacturing
Rapid manufacturing
Prefabrication
Ownership
Push / Pull Systems
Modular Cell Manufacturing
Lean 6 Sigma

Manufacturing engineering

6σ

Lean 6 Sigma - The term *Six Sigma* originated by **Motorola** in 1986. It is based on statistical modeling of the manufacturing processes.

The goal is 99.99966% of the total products manufactured from a line are expected to be free of defects. (3.4MM) Motorola's goal of "six sigma" became a buzz-word for management and engineering practices used to achieve it.

Many company's now expect a Manufacturing Engineering applicant to be a "Master Black Belt" in 6 Sigma with an Engineering Degree from a leading university with extensive experience.

Manufacturing engineering

In Manufacturing Engineering We Like Everybody To Be Exactly Alike.

We Use D M A I C - pronounced as "duh-may-ick“ To Make Sure

The DMAIC project methodology has five phases:

Define **the system,**
Measure **key aspects and collect relevant data.**
Analyze **to investigate and verify cause-and-effect relationships**
Improve **based upon data analysis**
Control **the process**

Manufacturing engineering

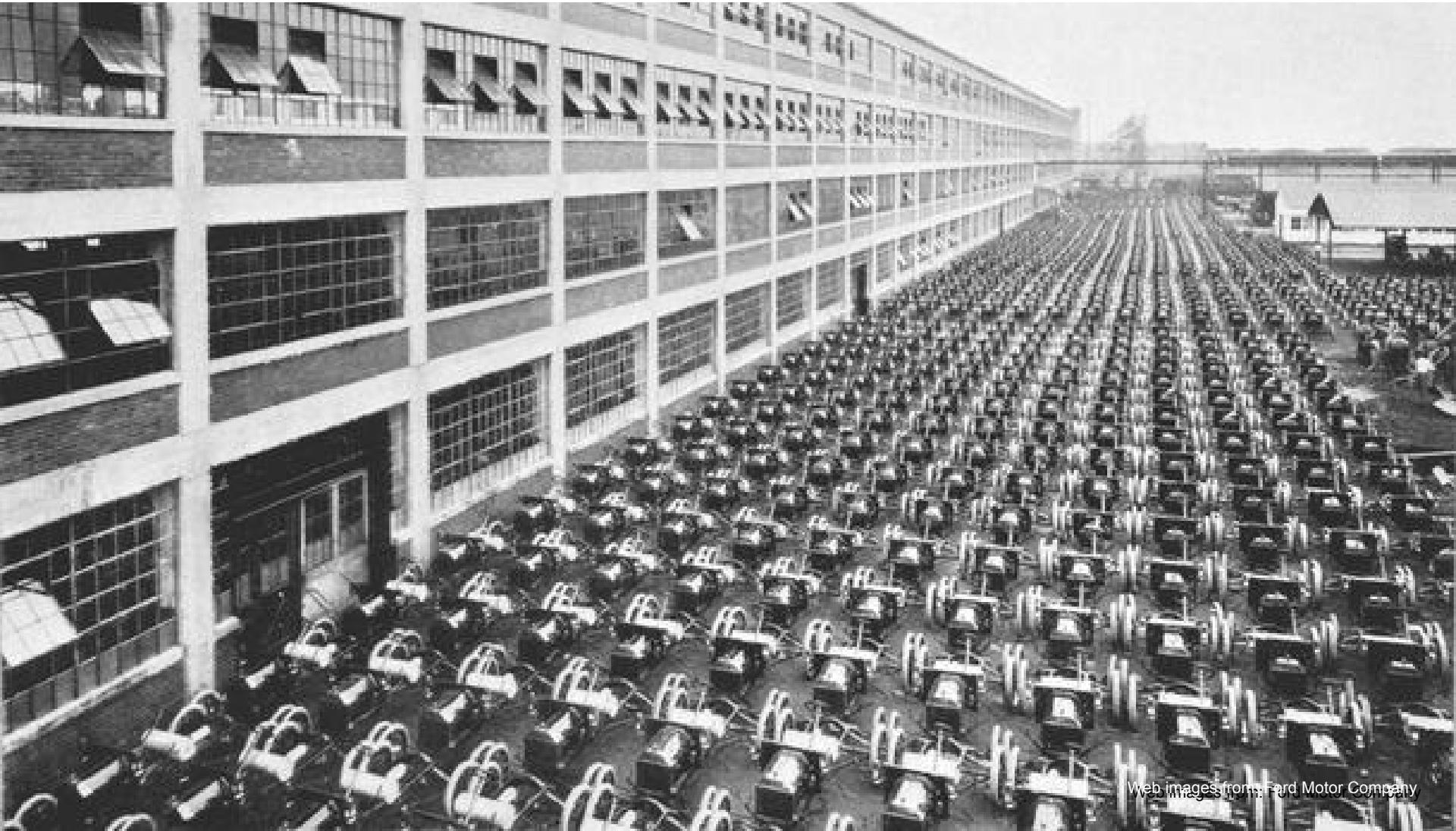
In Mass Manufacturing, Making All Products Exactly Alike Is GOOD!
It Is The Individual Which Stands Out That Gets Rejected


ANY
QUESTIONS
?

The Ford Motor Company

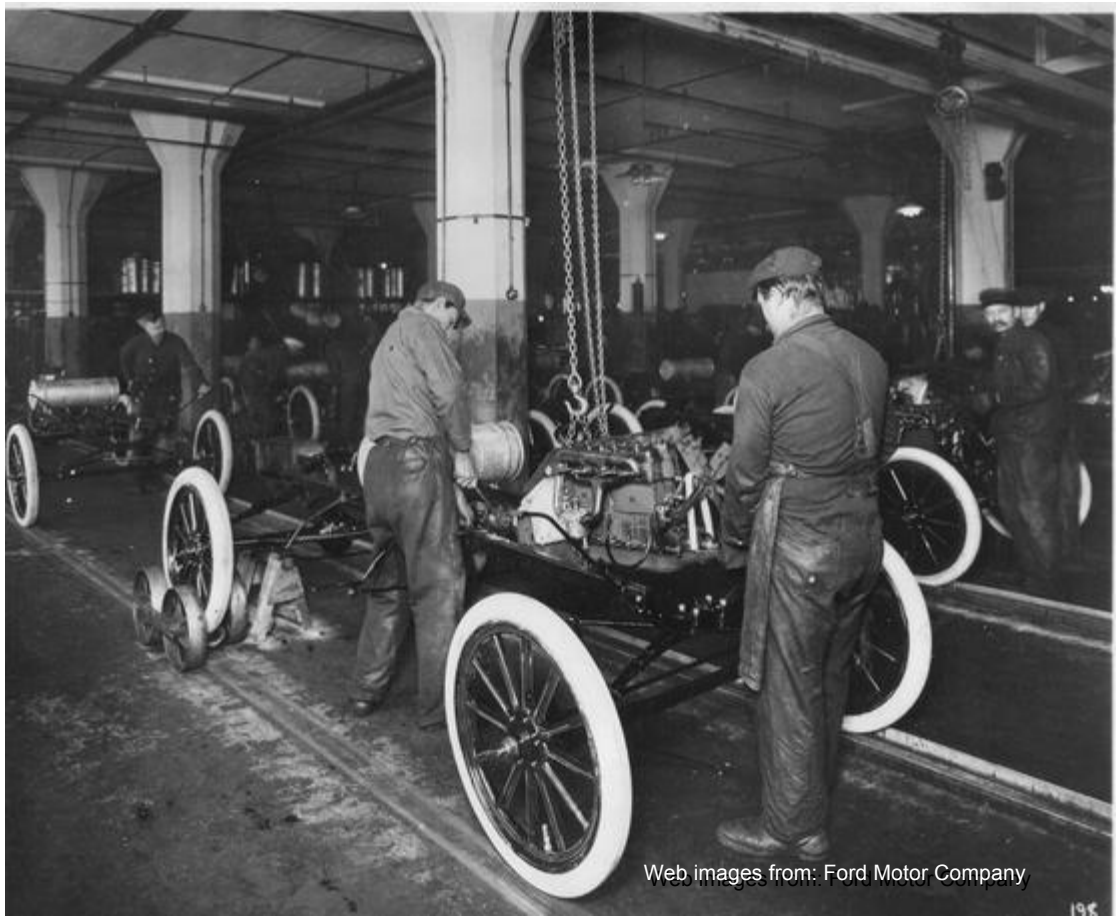
One of America's Best Success Stories Continues On Today

1000 Model T Chassis' Produced in 24 hours Shows The Power Of The Production Line Method



The Ford Motor Company

One of America's Best Success Stories Continues On Today



FORD TO OWN SHIPS, MAKE TIRES, EXTEND $5 A DAY SCHEDULE

Garden for Every Workman With Big Lot, Is Plan for Rouge Plant; Oakwood May Be Business

In 1914 Ford decided to use the free enterprise system in the form of pay and benefits to retain workers. Ford increased the base salary to $5/day, added an incentive program allowing workers to purchase an automobile for near cost, and brought unheard of services to the Hyde Park Plant.

The Ford Motor Company

One of America's Best Success Stories Continues On Today

Web image from: http://america.aljazeera.com/

100 years later Ford is the most profitable auto manufacturer in America. The production line started by Henry Ford changed how things were made the world over.

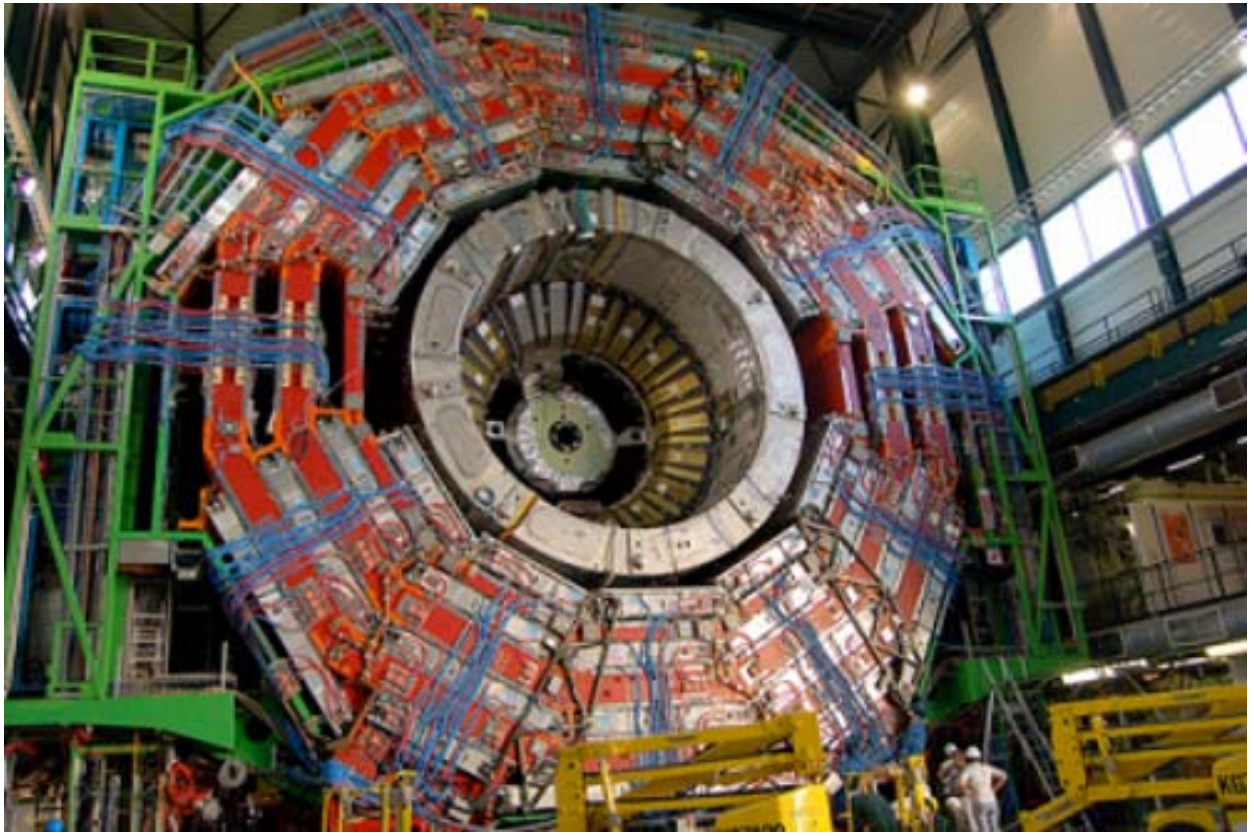
But, the production line is not the only component of manufacturing engineering…

Manufacturing engineering

The need for Manufacturing Engineers is driven by the desire to produce a lot of products. The value of the products is not important to the ME. Products can range from candles you burn at home…

Manufacturing engineering

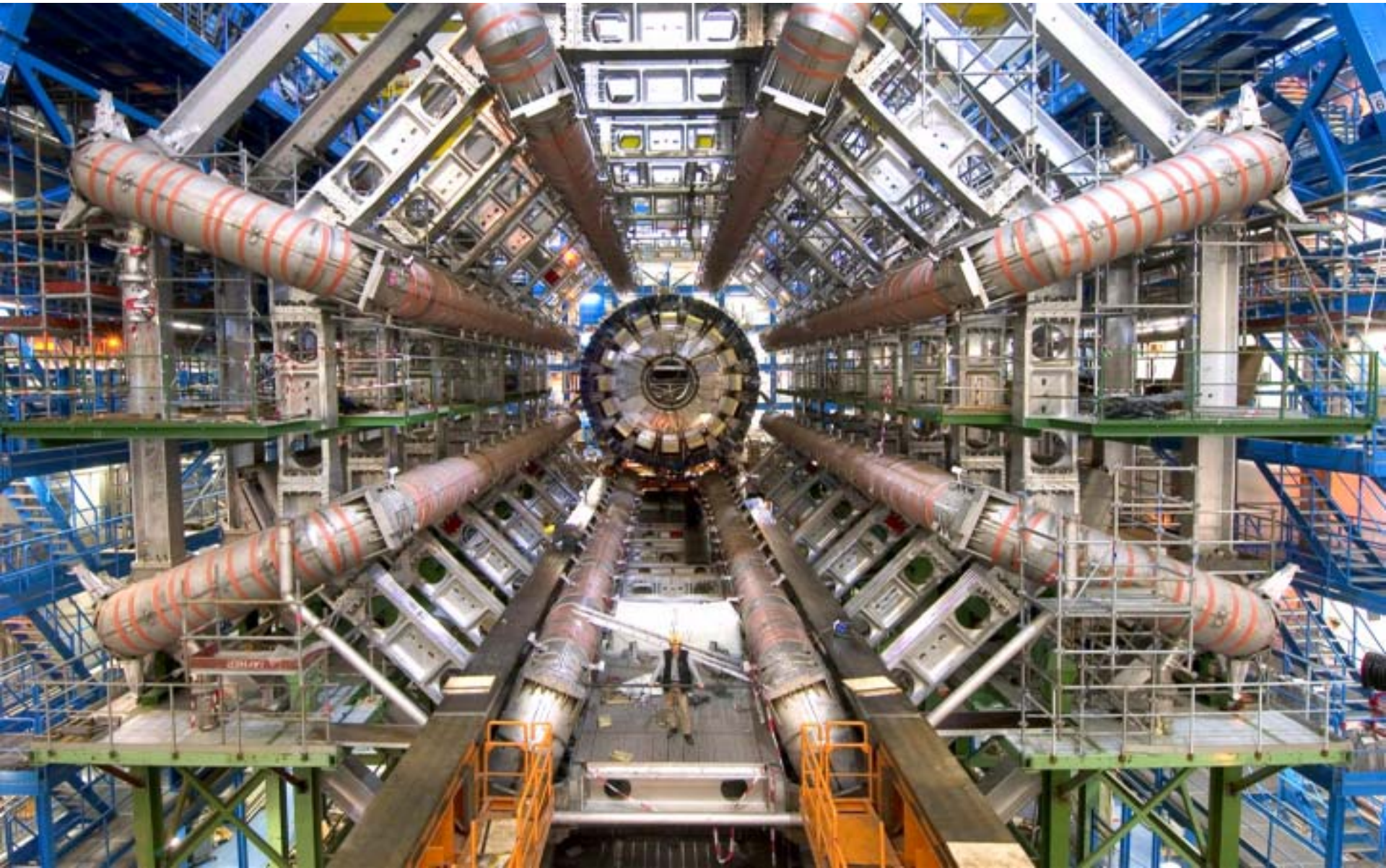
To what would be the largest scientific project in the history of mankind.



Superconducting Super Collider would have been 40TeV (trillion electron volts per particle) vs the current 20TeV per of CERN (*Conseil Européen pour la Recherche Nucléaire*) (shown above)

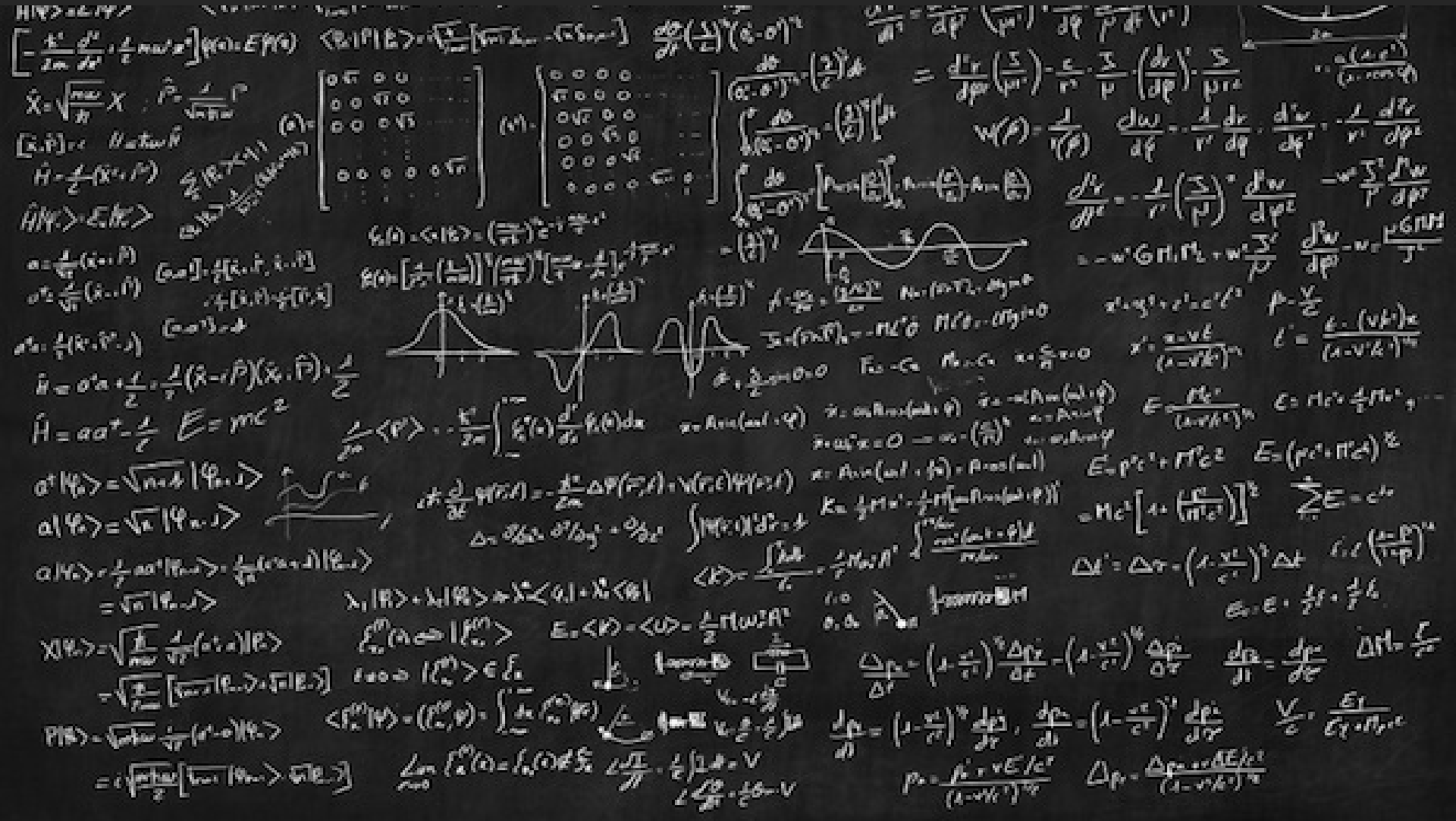
The *Tevatron* at Fermilab ceased operations in October of 2011. The *Relativistic Heavy Ion Collider* (RHIC) is run by Brookhaven National Laboratory (BNL) in New York.

Manufacturing engineering



Manufacturing engineering

Basic and Advanced Mathematics Play A Critical Role In Manufacturing Engineering



Manufacturing engineering

C2 f_x =IF(A2="Prod1",IF(B2<0.05,"Pass","Fail"), IF(A2="Prod2",IF(OR(B2>=0.9,B2<=1.1), "Pass","Fail"),IF(OR(B2>=1.9,B2<=2.1), "Pass","Fail")))

	A	B		
1	**Prod**	**X**	F	
2	Prod1	0.03	Pass	x<.05
3	Prod1	0.01	Pass	x<.05
4	Prod1	0.10	Fail	x<.05
5	Prod2	1.00	Pass	.90<x<1.1
6	Prod2	0.94	Pass	.90<x<1.1
7	Prod3	1.98	Pass	1.9<x<2.1
8	Prod3	2.00	Pass	1.9<x<2.1
9	Prod3	1.97	Pass	1.9<x<2.1

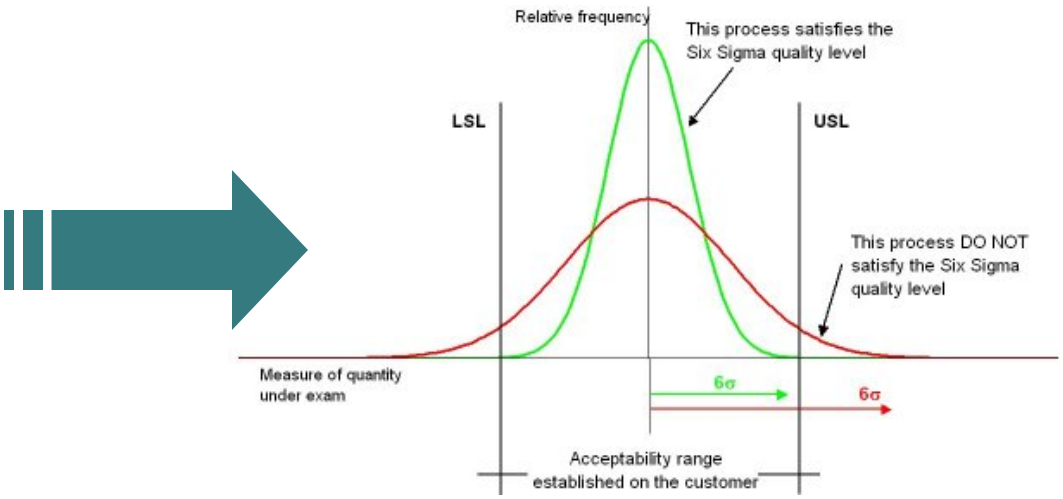
You need to understand typical software packages to use when developing more extended programs needed for manufacturing engineering.

Manufacturing engineering

C2 fx =IF(A2="Prod1",IF(B2<0.05,"Pass","Fail"), IF(A2="Prod2",IF(OR(B2>=0.9,B2<=1.1), "Pass","Fail"),IF(OR(B2>=1.9,B2<=2.1), "Pass","Fail")))

	A	B		
1	Prod	X	F	
2	Prod1	0.03	Pass	x<.05
3	Prod1	0.01	Pass	x<.05
4	Prod1	0.10	Fail	x<.05
5	Prod2	1.00	Pass	.90<x<1.1
6	Prod2	0.94	Pass	.90<x<1.1
7	Prod3	1.98	Pass	1.9<x<2.1
8	Prod3	2.00	Pass	1.9<x<2.1
9	Prod3	1.97	Pass	1.9<x<2.1

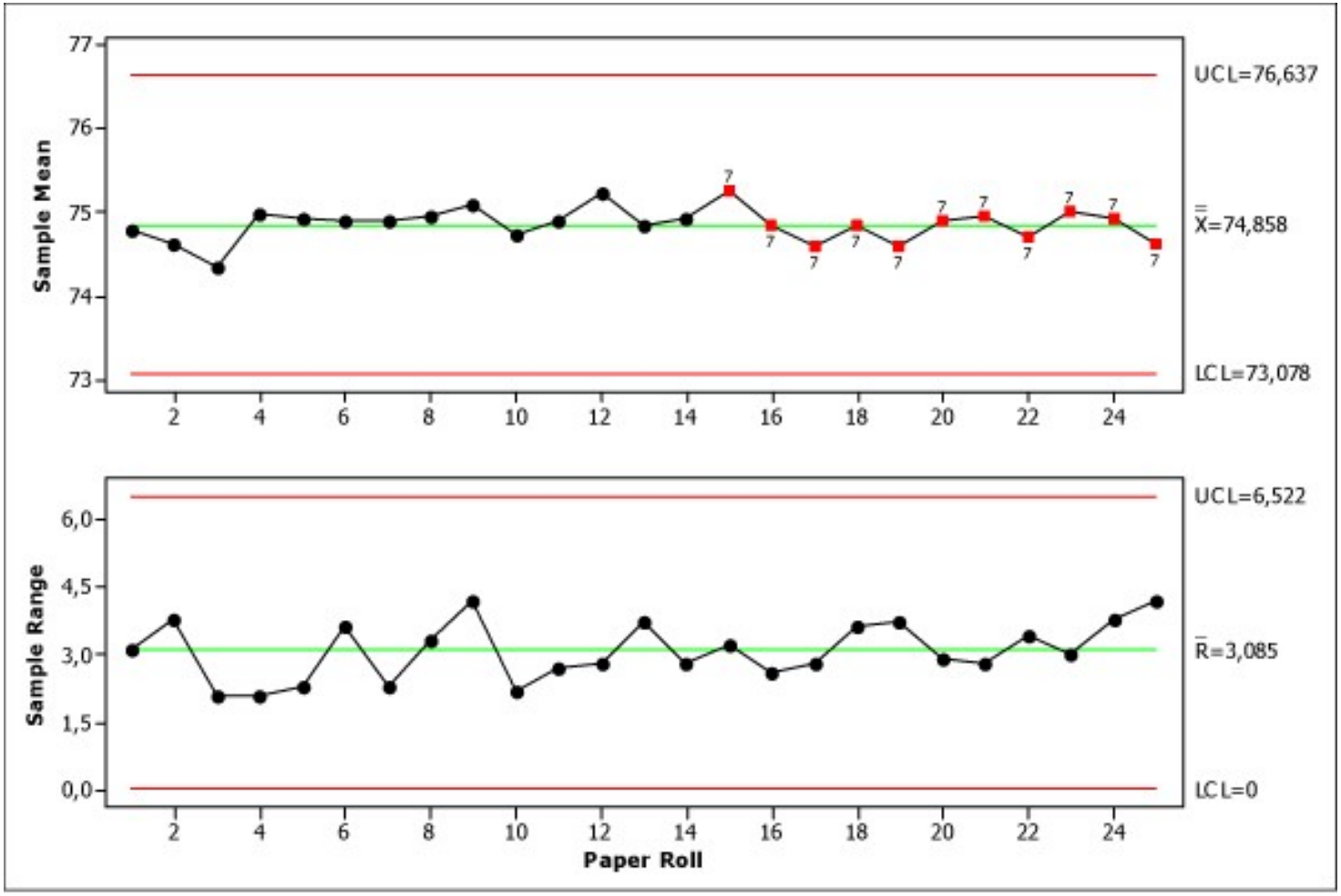
Spreadsheets Collect Data



Produce Analytical Data
Graphs To View The Data

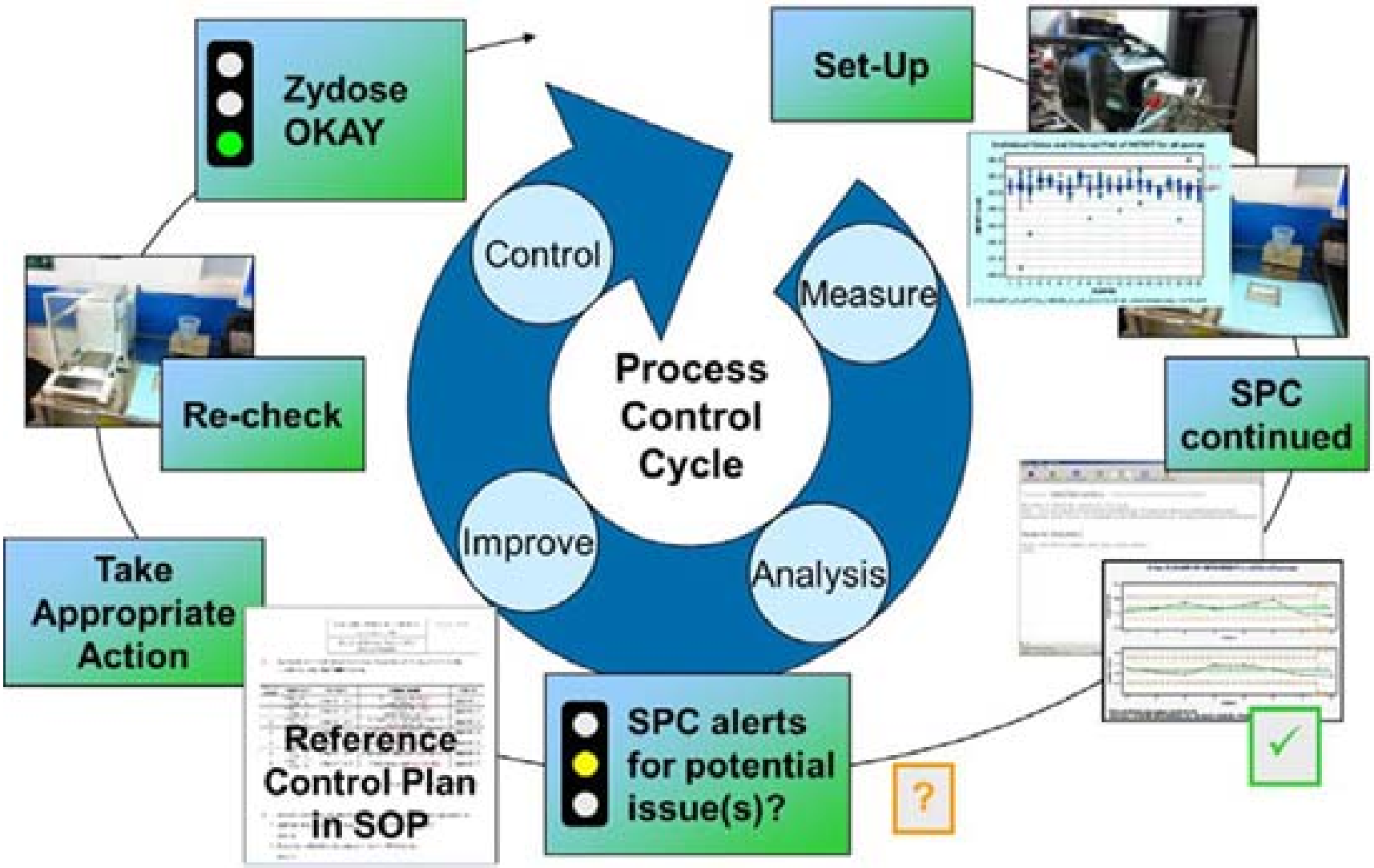
A Bell Curve Fits Between The Lower Statistical Limit and the Upper Statistical Limit

Manufacturing engineering



Statistical Process Controls – How much the process varies tells us a lot of information about what to expect in the product.

Manufacturing engineering

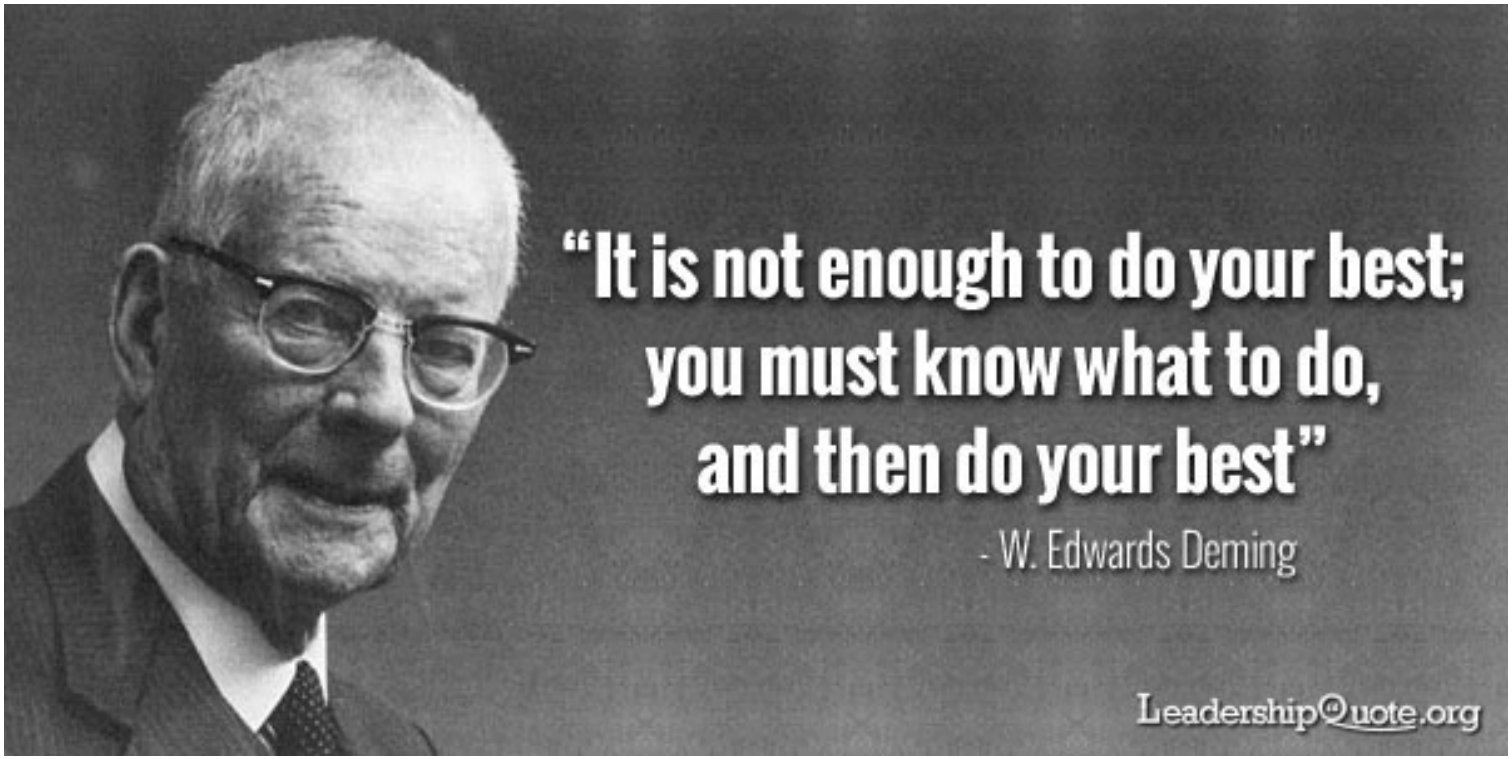


Manufacturing engineering

Dr. W. Edwards Deming's approach to Total Quality (TQM) opened many doors in the USA and Japan showing new ways to build things for profit. His management led process actively involves every employee in satisfying customer needs (internal and external) by continuously improving all aspects of work activity through structured control, improvement, and planning methods. It requires a transformation of the roles and empowering employees to continuously improve their work processes. It is often up to the Manufacturing Engineer to design and implement these process for the employees to follow.

Manufacturing engineering

Dr. W. Edwards Deming's might be called by many as the father of modern manufacturing methodology.



Credits

- Charles R. Watson – www.marineimaging.com
- Wikipedia – www.wikipedia.org –