Takt Time
Module 8.1

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These materials were developed as part of MIT's ESD.60 course on "Lean/Six Sigma Systems." In some cases, the materials were produced by the lead instructor, Joel Cutcher-Gershenfeld, and in some cases by student teams working with LFM alumni/ae. Where the materials were developed by student teams, additional inputs from the faculty and from the technical instructor, Chris Musso, are reflected in some of the text or in an appendix

Overview

- Learning Objectives
  - Clearly define the concept of Takt time
  - Show the relationship between cycle and Takt time
  - Illustrate difficulties with meeting Takt time
  - Describe real-world side-effects of controlling an operation via Takt time
- Session Design
  - ***Part I:*** *A Short History*
  - ***Part II:*** *Takt Time: Defined*
  - ***Part III:*** *Examples and Applications of the Concept*
  - ***Part IV:*** *Common Disconnects and Measure of Level of Implementation*
  - ***Part V:*** *Summary and Questions*

Short History

Takt: **German word for "baton"**

Refers to beat, timing, and regulation of speed

1930's: Germany, Japan collaborated within the Axis Powers

After WWII, Japan uses concept to organize its Just In Time system

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Takt Time: Defined

GENERAL DEFINITION: *Takt Time* is the desired time that it takes to make one unit of production output.**

***CUSTOMER DRIVEN: Available Operating Time / Customer Demand**

e.g.-- 8 hours of Daily Operating Time / 4 units of daily demand =
Takt Time of 2 Hours

***OPERATION DRIVEN: Available Operating Time / "Forecasted" Demand**

e.g.– 8 hours of Daily Operating Time / 5.7 units of forecasted demand =
Takt Time of 1.4 Hours

Nominally this is an initial design variable that dictates the architecture of the entire manufacturing operation

***Takt Time* differs from *Cycle Time*, which is the actual time it takes to make one unit of production output.**

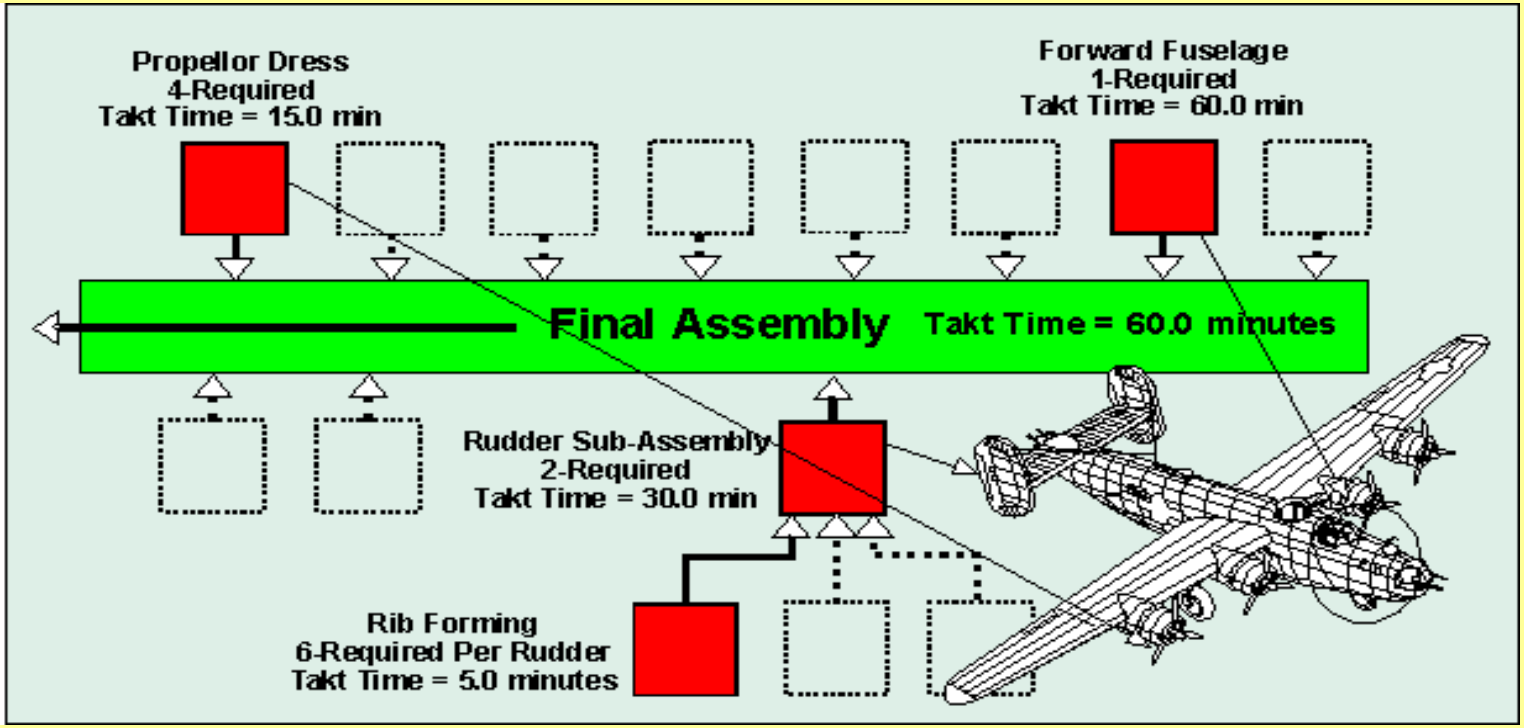
Real World Example: WWII B-24's

~1940: Charles Sorensen builds plant to output "a bomber an hour"

Stabilized operation by preventing inventory buildups, consequential stops and starts

A balance to the assembly process that ensures that all pieces arrive when they are needed

RESULT: Syncopated system with all pieces working in concert and a balance a balanced assembly line



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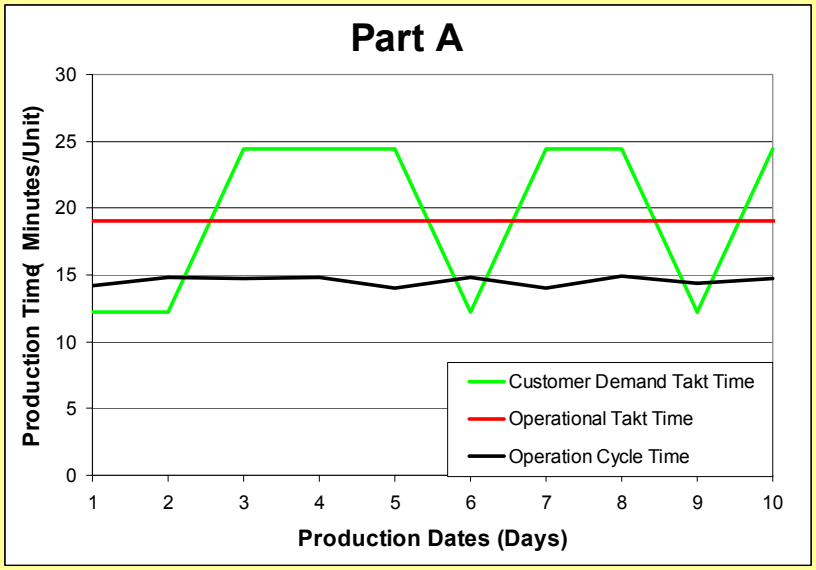
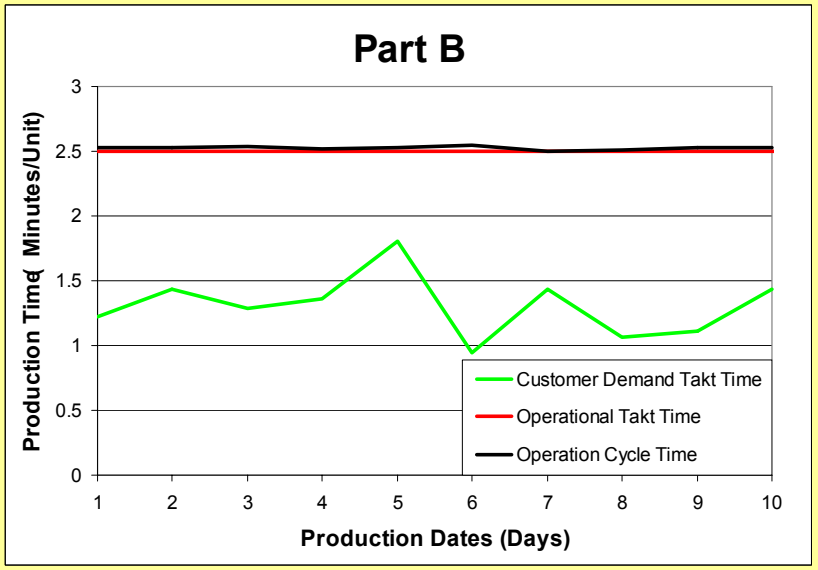
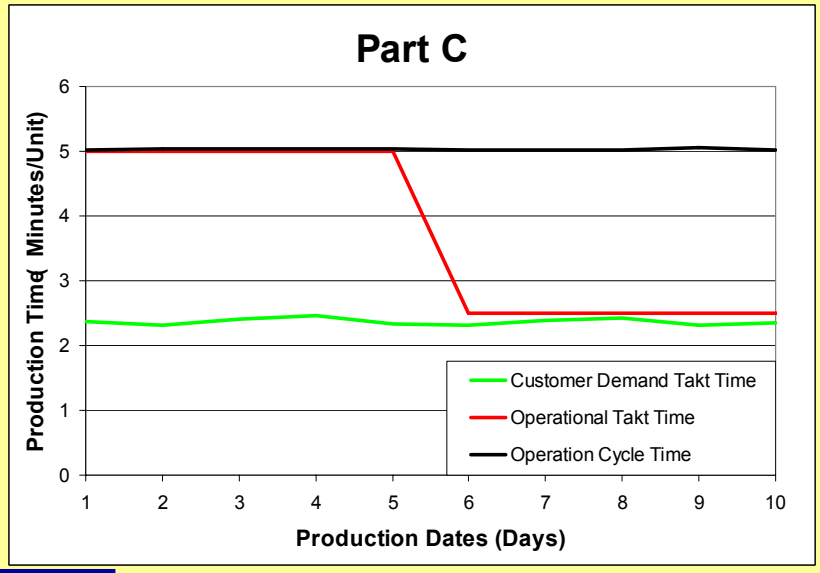
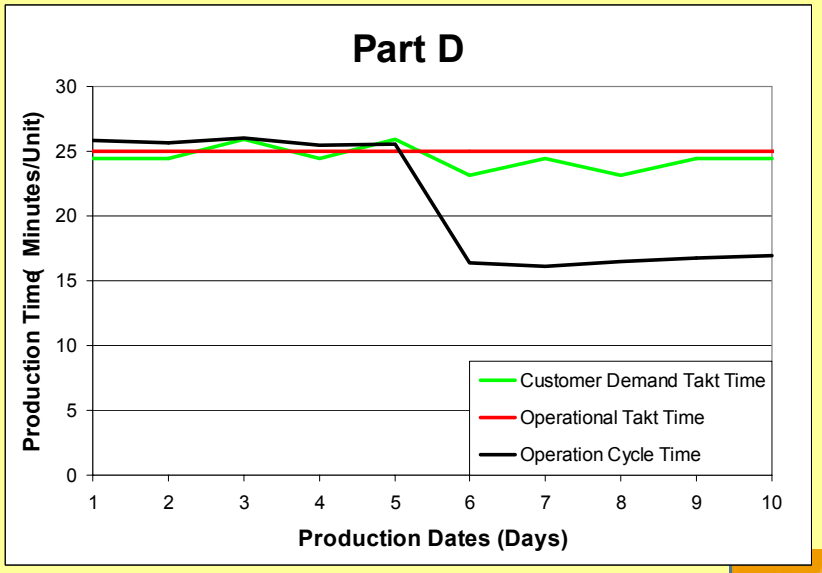
Automobile Supplier Data









What are the major issues with the production of these parts?

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Takt Time Disconnects

- **Technical Factors**
  - Need to be able to properly set the takt time for each operation
  - Once the operational takt time is set it can be very difficult to change (example: speeding up or slowing down an assembly line)
  - Hard to control customer demand fluctuations (order stability)
  - Difficult to ensure processes remain in control
- **Social Factors**
  - Workforce can be resistive to being told what speed to work at
  - A company controlled by finance may throw the system out of whack by forcing products to be made in order to meet/exceed a quarter point
  - Lack of trust in management's commitment to employees (Why should we work to improve a process if management will just lay us off?)

There are numerous reasons plants have trouble implementing takt time

Measures of Takt Time Implementation

- How well do the operational takt times meet the customer demand?
- Are the takt times and cycle times synchronized?
- What percentage of operations are controlled by takt time?
- Is there a system in place to handle fluctuations in customer demand? (Overtime, temporary workers, etc.)
- Does the plant conform to the takt time and not deviate from following it?

It is necessary to evaluate the implementation of a takt time driven operation

Summary and Questions

- Takt time is the rhythm or heartbeat at which an organization should operate
- A truly Lean operation will synchronize takt and cycle times as well as make sure that operational takt times meet customer demand
- Taken alone takt time can lead to disconnects and issues, but within a Lean mind frame it is a powerful tool
- Questions???

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Appendix: Instructor's Comments and Class Discussion for 8.1

- Takt time is at the heart of a value stream map
- Operations on the critical path work to the takt time, regulated by the constraint in the process
  - Feeder operations need not work to the takt time, but as waste is eliminated, interdependency increases and the takt time becomes more relevant

Bibliography

http://www.strategosinc.com/takt_time.htm

http://www.isixsigma.com/dictionary/Takt_Time-455.htm

Pascal, Dennis. "Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System". Productivity Press: New York, 2002.

Appendix: Instructor's Guide

Slide	*Time*	*Topic*	*Additional Talking Points*
1-2	2-3 min	Introduction, overview and learning objectives	• Identify overall themes • Clearly defining takt times is easier said than done
3-4	3-5 min	Short History and Definition	• Concept is not originally Japanese • Customer driven takt time is the accepted academic definition and operational driven takt time is often the design variable in real world applications
5-6	7-10 min	Examples/Exercises/Activities	• Use the B-24 example to highlight how takt time can be used to balance material flow (example: 4 propellers need to be completed per hour in order to balance with the flow of one aircraft per hour) • Part A: Fluctuating orders & disconnect between cycle time and takt time (over capacity) • Part B: Disconnect with customer orders (under capacity) • Part C: Operational takt time arbitrarily changed, but cycle time is physically constrained and can't adapt • Part D: End of a quarter, product pushed out the door
7	5-7 min	Disconnects	• Relate disconnects to the part data from the previous slide • Specifically address the trust in management issue by highlighting how good Lean organizations react to the issue (example: job security via kaizen teams as in NUMMI Plant)
8	2-3 min	Measurables	• Examples of questions an organization should ask itself to determine it's commitment to takt time
9	1-2 min	Concluding comments	• Takt time is part of the entire Lean mindset and is most powerful when used in conjunction with other tools • Takt time is a design variable that stays relatively constant once it is set, it is rarely changed