ADM Unit 2 | Mission Brief 2.3

Smart Conveyor Throughput Optimization

Increase conveyor-line throughput while maintaining safe spacing and routing accuracy.

Customer	Department	Difficulty	Time
Falcon Manufacturing	Production Engineering	Advanced	2 class periods

Production Goal: Increase verified line throughput by at least 20%.

Background

Falcon Manufacturing must raise output without purchasing a second line. The conveyors, robot, and routing cylinders are not synchronized, producing idle time in some zones and part bunching in others. Teams will optimize the coordinated process.

Learning Objectives

- Measure system throughput and spacing
- Analyze interactions between robot and conveyor timing
- Use data to optimize a multi-device process
- Balance speed, accuracy, and reliability

Equipment

- VEX CTE Workcell
- Conveyors
- Sensors
- Pneumatics
- 6-Axis Arm if used
- Thirty parts
- Stopwatch
- Spreadsheet

Student Instructions

1. Run a ten-part baseline trial and record total time, part spacing, and failures.
2. Measure the time required by each major station.
3. Identify the bottleneck station and explain your evidence.
4. Propose at least three software changes.
5. Test one change at a time with ten parts.
6. Choose final conveyor speeds and release logic.
7. Run a thirty-part final trial.
8. Calculate throughput in parts per minute and percent improvement.

Engineering Requirements

- Increase throughput by at least 20%
- Maintain zero collisions and correct routing
- Keep at least the approved minimum spacing between parts
- Complete thirty final parts without manual intervention

Constraints & Safety

- Do not move hardware
- Conveyor speed may not exceed approved classroom limits
- Safety-stop code must remain active
- Final settings must be documented

Deliverables

- Baseline and final code
- Station-time study
- Throughput and spacing data
- Before/after graph
- Bottleneck explanation
- Reflection

Reflection Questions

1. Which station controlled maximum throughput?
2. Why did increasing one conveyor not always improve the full line?
3. How did reliability influence your final setting?
4. What buffer would help the system?

Engineering Support

Engineering Tip
Optimize the bottleneck first; speeding a non-bottleneck station may only create waiting or jams.

Common Mistake
Changing conveyor speed, robot speed, and waits simultaneously makes it impossible to identify the useful change.

Stretch Goal
Develop an adaptive release interval that changes based on downstream sensor status.

Career Connection
Industrial engineers use line-balancing and bottleneck analysis to improve complete production systems.

Before You Submit

- Notebook evidence included
- Requirements checked
- Testing documented
- Reflection completed