

Design a Stable Pallet Pattern

Create and program a pallet pattern that stores aerospace components efficiently and remains stable during handling.

Customer Falcon Launch Systems	Department Outbound Logistics	Difficulty Intermediate	Time 1-2 class periods
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Production Goal: Palletize eight components with high stability and repeatability.

Background

Falcon Launch Systems ships compact sensor housings in reusable pallets. The existing arrangement leaves unused space and occasionally shifts during transportation. Your team must design a new pattern and program the robot to build it repeatably.

Learning Objectives

- Plan an efficient pallet layout
- Translate a layout into robot coordinates
- Use loops or variables to reduce repeated code
- Evaluate repeatability and stack stability

Equipment

- VEX CTE Workcell
- 6-Axis Arm
- 8-12 cubes
- Pallet area
- Ruler
- Engineering notebook
- Python project

Student Instructions

- 1 Measure the available pallet area and the dimensions of one cube.
- 2 Sketch three possible arrangements for eight cubes. Label coordinates or spacing.
- 3 Create a decision matrix using capacity, stability, robot access, and coding simplicity.
- 4 Choose one pattern and plan the pickup/drop sequence.
- 5 Program the first layer and test clearance between placements.
- 6 Use variables or loops where repeated spacing occurs.
- 7 Run the complete program five times without manually repositioning cubes.
- 8 Test stability by gently moving the pallet or performing the approved classroom transport test.
- 9 Revise spacing or placement order if the stack shifts.

Engineering Requirements

- Place at least eight cubes
- Placement error must remain within ± 5 mm
- No cubes may fall during the approved stability test
- Complete the sequence in under five minutes

- Return the robot to Home

Constraints & Safety

- Use only the supplied pallet footprint
- No manual adjustment after the cycle begins
- Robot must approach each placement from a safe clearance height
- Only approved cubes may be stacked

Deliverables

- Three labeled pallet concepts
- Decision matrix
- Final Python program
- Five-run reliability log
- Photo of completed pallet
- Reflection

Reflection Questions

- 1 Why was your selected pattern more stable?
- 2 How did placement order affect robot access?
- 3 Which coordinates could be generated from variables?
- 4 How would fragile parts change your pattern?

Engineering Support

Engineering Tip

A staggered or interlocking pattern can improve stability without adding packaging.

Common Mistake

Placing parts too close together can make the magnet or robot wrist contact previously placed parts.

Stretch Goal

Increase capacity to twelve cubes while keeping the same pallet footprint.

Career Connection

Automation engineers develop palletizing routines for aerospace, medical, food, and logistics facilities.

Before You Submit

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