

# **PART XI — FACTORY DESIGN, AUTOMATION, WORKFORCE, AND ROI**

## **THE FACTORY FOOTPRINT**

- Facility size: 280 ft × 165 ft = 46,200 sqft
- Layout: 2 parallel production lines (A & B)
- Stations per line: 14 (7 robotic + 7 human/hybrid)

### **ROBOTIC STATIONS (7 PER LINE)**

- 1) CNC Chassis & Subfloor Framing (Hypertherm plasma cutter + Lincoln robotic welder)
- 2) Automated Wall Panel Fabrication (FrameCAD F150i — ~1 panel every 8 minutes)
- 3) Robotic Wall Erection & Roof Truss Setting
- 4) Robotic Spray Foam Insulation (Graco Reactor E-30 + AI thickness scanner)
- 5) Robotic Drywall Installation (Hilti Jaibot + overhead gantry)
- 6) Robotic Spray Texture & Paint
- 7) Automated Exterior Siding & Window Frame

### **HUMAN / HYBRID STATIONS (7 PER LINE)**

- 8) Plumbing & HVAC Rough-In
- 9) Electrical Rough-In & Panel
- 10) Flooring & Tile
- 11) Kitchen & Bath Fixtures
- 12) QC & Punch List
- 13) CNC Cabinet Install (hybrid)
- 14) Final Wrap & Load Prep

## **TOTAL WORKFORCE MODEL**

- Total team: 91 people
- Robotic Techs & Operators: 16
- Plumbing & HVAC Crew: 10
- Electrical Crew: 10
- Finishing & Flooring: 8
- QC & Inspection: 6
- Factory Supervision & Management: 18
- Material Handling & Logistics: 10
- Maintenance & Support: 13
- Labor comparison baseline: ~180 fully manual (automation model reduces by 89 roles)

## **ROBOTIC EQUIPMENT CAPEX (TOTAL: \$7,150,000)**

- FrameCAD F150i Wall Line: \$1,200,000
- Module Transfer Conveyor System: \$1,800,000
- CNC Cabinet Line: \$900,000
- Automated Exterior Panel System: \$650,000
- Hilti Jaibot Drywall Robot ×2: \$500,000
- Servo Joist Gantry: \$450,000
- Automated Texture/Paint System: \$350,000
- Graco Spray Insulation Robot: \$280,000
- AI Vision QC System: \$300,000

- Robotic Welding Arms x2: \$320,000
- Laser/BIM Verification: \$220,000
- CNC Plasma Cutter: \$180,000

## **ROI SUMMARY**

- Replaces ~47 production workers: "H \$3.38M annual labor savings
- Equipment payback: ~2.1 years
- 10-year net savings: ~\$26.7M
- Defect/rework rate improvement: ~65% reduction
- Production speed improvement vs. all-human: ~40% faster per module
- Factory + equipment total investment: ~\$12.65M
- Full facility payback estimate: ~3.8 years

## **EXECUTIVE TAKEAWAY**

This factory model combines robotic repeatability with skilled human finishing and control checkpoints. The design aims to increase throughput, reduce defects, improve labor efficiency, and generate bankable payback performance under a phased automation strategy.