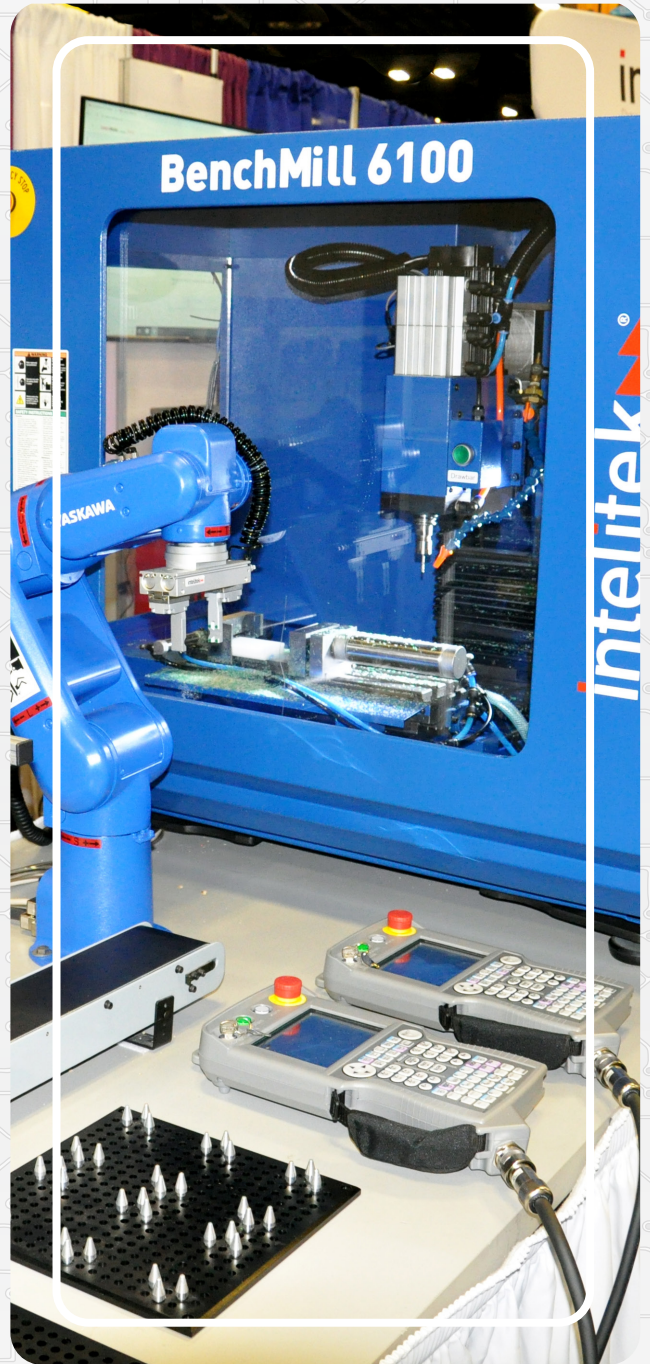# Flexible Manufacturing Systems (FMS)

Bridging the Gap Between STEM, CTE, and Industry

Integrated manufacturing is the cornerstone of modern manufacturing processes. Intelitek FMS education solutions combine machining, robotics, materials handling, assembly, and quality control, with automation and control software to introduce students to real manufacturing scenarios like those in industry. Students learn how to design and operate an FMS system bringing them to a level they are job ready. The FMS is combined with skill and task based curriculum to prepare students for the complex systems they will see in industry.

ALIGNED WITH

Education for Advanced Manufacturing

As new generations of manufacturing are rolled out, new careers are available in industry. There is a major shortage of skilled operators, installers and maintenance technicians worldwide. This solution addresses that.

Bridging the Gap

Intelitek's Flexible Manufacturing System (FMS) training solutions are designed to teach proficiency in relevant skills and introduce technical and engineering classrooms to the industrial automation and industry applications needed in modern manufacturing plants.

Augmenting specific skill training like industrial skills, automation, mechatronics, machining and robotics, the training integrates automation and system integration as industry certifications.

What is FMS?

- A multi-faceted training solution incorporating a variety of skills and tool sets to qualify students for industry
  - Fundamentals of manufacturing
  - Machining
  - Robotics & materials handling
  - Machine vision & quality control
  - Storage and materials handling
  - Mfg. integration with mobility systems and integrated manufacturing software

- An integrated program including curriculum that encompasses design, hands-on experience, project-based learning, and theory to deliver job ready graduates for industry

- A flexible solution with mix and match training modules, skillsets, and hardware to create a comprehensive manufacturing program

Flexible Manufacturing Systems

Real Industrial Hardware
- Built with Intelitek and industrial vendor hardware
- Full size, real industrial equipment from end-to-end
- Manufacturing cell produces real products

Complete Training Solution
- Intelitek provide hardware bundles, curriculum and software required for classroom
- Aligned with CTE manufacturing standards, the program includes robotics, machining, automation, mechatronics, informatics and industrial engineering learning

Flexible Design Project Based Learning
- Classroom projects challenge students to design, build and operate the manufacturing cell
- Basic configuration can be adjusted, augmented and re-designed as needed

Pathway to Jobs and Learning
- Advanced manufacturing capstone prepares students for jobs in industry or advanced education in mechanical, electrical, or industrial engineering disciplines

Flexible Manufacturing Systems (FMS)

Modern manufacturing processes comprise of several key components integrated to operate automatically and in unison. Intelitek FMS platforms are built around a production machine, robotic arms, part storage, materials handling and assembly, quality control elements, and automation and control operating software.

Students learn to design products and operate and FMS system. Intelitek curriculum for each skill as well as curriculum teaching integration, operation and maintenance of the FMS are included.

Real Production Process

The FMS manufactures real products that students can design and take home. The system can produce a variety of complex multi-part components in materials like aluminum, brass, plastic, wood, composite, and wax.

FMS Components

1 MACHINING

Education optimized industrial CNC routing, milling, lathes and plasma cutting machines are used to learn operation and advanced programming for manufacturing. Machining options include milling, turning, routing, laser engraving, etc.

2 INDUSTRIAL ROBOTICS

Safe industrial robotic arms enable students to learn robotic operation, robotic programming and advanced system integration. The robot can be mounted on a linear slidebase for mobility and larger work area.

3 AUTOMATION AND SENSORS

Adding industrial components to automate, control and manage the manufacturing process like vision sensors, motion and touch sensors, Programmable Logic Controllers (PLCs), and more, expand the scope of the students system understanding

4 INTEGRATION ACCESSORIES

Mobility accessories and automation controllers are integrated in the manufacturing cells to enhance the functionality. By adding conveyors, slide-bases, storage, feeders, safety lights, safety lock out / tag out switches, machine vision inspection and assembly stations, the FMS cell can be expanded and automated using PLCs and ERP s/w

5 SYSTEM CONTROL SOFTWARE

The system can be managed using RoboCell and CNCMotion, by a PLC, or using the advanced OpenMES for FMS application. Using the software, students will also learn to program the system and to control and monitor the flow of the workcell. Integrating the machine, robot, accessories and sensors just like a real factory floor environment.

6 SIMULATION

Using Robocell, CNCMOtion, and OpenMES, the system can create a virtual simulation of the system to setup, configure and evaluate potential changes.

7 CURRICULUM

Self-paced and instructor led training modules delivered online are integrated with the hardware and applications and aligned to industry standards and competencies. Intelitek courseware has been developed based on industry input over more than 35 years.

8 CERTIFICATIONS

Graduates of programs can obtain industry certifications that are testaments to their job readiness and recognized by employers worldwide.
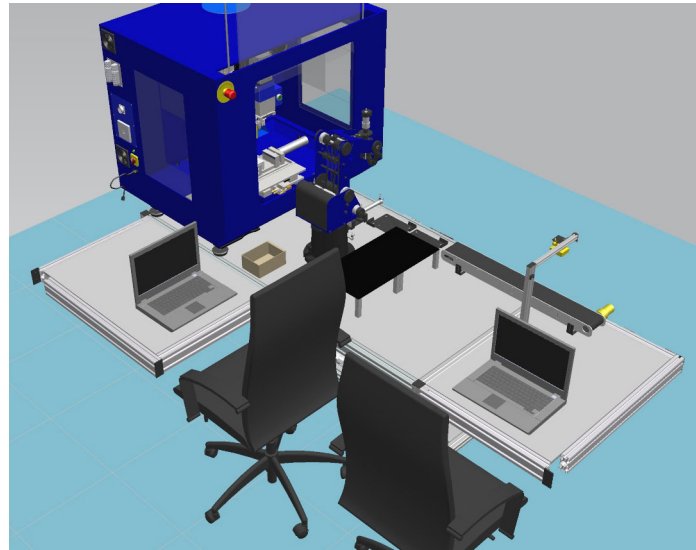
FMS Education

The objective of this integrated capstone education solution is to give students an experience that parallels the environments they will see in industry. The FMS solution teaches overall production over and above specific skills. Students will practice design, engineering, manufacturing, logistics, warehousing and distribution, supply chain, and Integration. In parallel they will develop career readiness, job skills, leadership, teamwork, planning skills, and safety awareness.

Flexible Manufacturing System Level I

Includes basic robotics and CNC milling expanded with materials handling, and other accessories. This configuration is designed to support the level 1 curriculum and includes all required accessories for robotics and CNC milling.

Components:

- ScorBot ER-4U or Yaskawa Motoman robotic arm
- BenchMill 6100 CNC Milling Machine
- Parts feeder, conveyor, storage and other optional accessories
- Safety and control components
- Optional: Vision sensors
- RoboCell and CNCMotion

Simulation, design, optimization and programming software is integrated into the training program

Flexible Manufacturing System Level II

This mid-range flexible manufacturing configuration combines subtractive manufacturing, robotics and materials handling simulating a fully functional manufacturing cell. Built around a robot arm and milling machine, this solution combines with various mobility options for an advanced PBL learning solution.
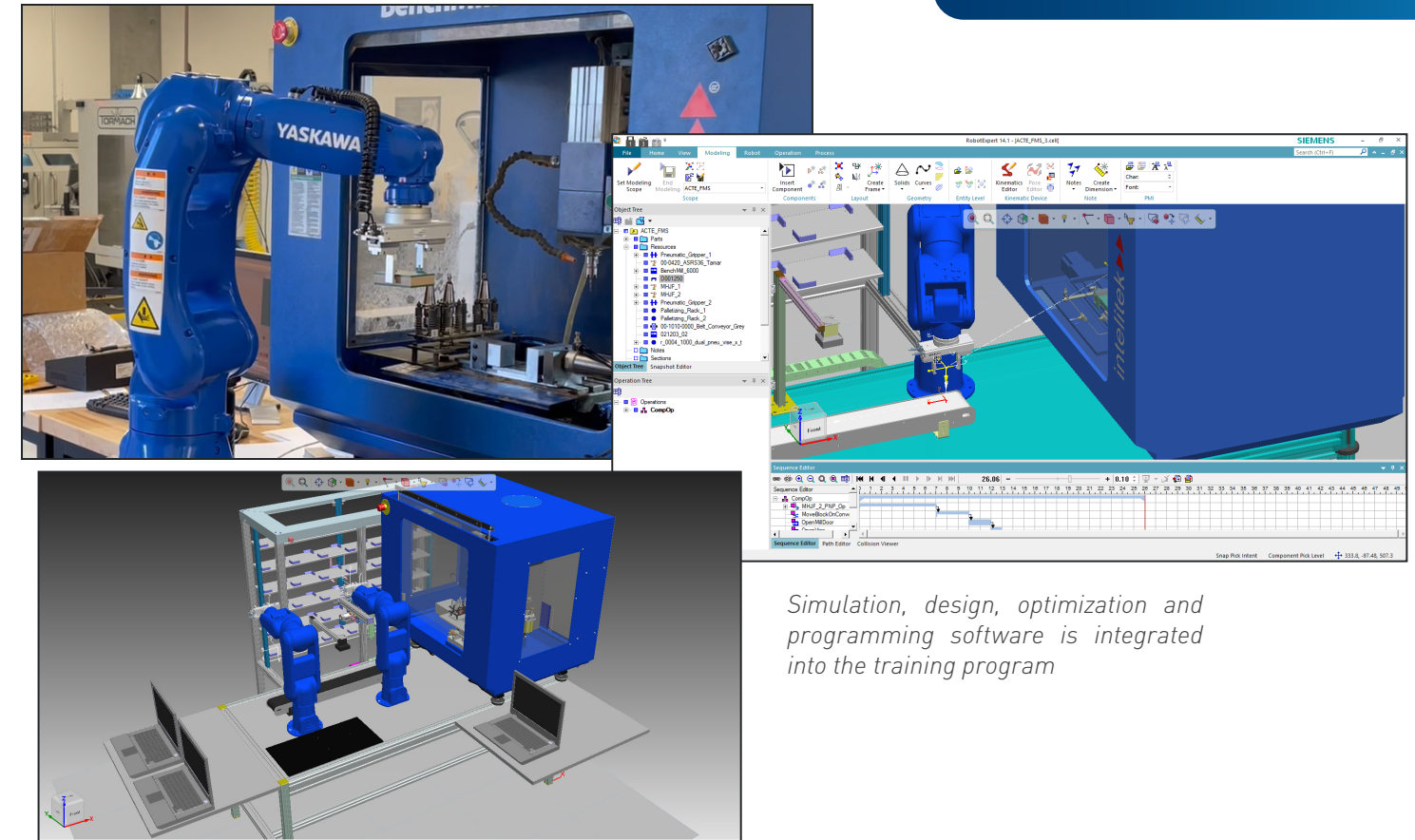
Components:

- ScorBot ER-4U on a linear slide base or Yaskawa Motoman robotic arm
- BenchMill 6100 CNC Milling Machine
- Parts feeder, conveyor, storage and other optional accessories
- PLC and HMI (Allen Bradley or Siemens)
- Safety and control components
- Automatic Tool Changer
- Optional: Vision sensors

Flexible Manufacturing System Level III

This advanced flexible manufacturing cell setup takes the program to a more advanced level using OpenMES to configure and control the FMS. The system can accommodate more peripherals, advanced sensors, storage options, and manage multiple different production cycles. The use of OpenMES adds the process design and operation layer with the advanced capabilities of the MES software.

Components:

- ScorBot ER-4U or Yaskawa Motoman Robotic Arm
- BenchMill 6100 CNC Machine
- Automatic Tool Changer
- Parts feeder, conveyor, storage and other optional accessories
- Optional add ons include:
  - ❯ BenchTurn or ProTurn Lathe
  - ❯ Linear Slide Base
  - ❯ Pneumatic Feeder
  - ❯ ASRS
  - ❯ Laser Engraver
- OpenMES for FMS

FMS Manufacturing Curriculum

Intelitek training courses include introductory and advanced courseware for manufacturing that provide students with an overall understanding of the technology in an industrial environment, as well as comprehensive FMS specific courseware. Courses include:

- CNC Milling
- CNC Routing
- CNC Turning
- Fundamentals to Advanced Robotics
- Robotics and Materials Handling
- Machine Vision and Quality Control
- PLC programming
- Manufacturing for Industry 4.0
- Flexible Manufacturing Systems (FMS)

Custom FMS Designs

There is a wide variety of additional machines, robots and peripheral add ons and accessories that can be used to build manufacturing cells for projects in the classroom. The integration of additional accessories can adapt the FMS into a more bespoke solution aligned with your education program and local industry needs. Contact Intelitek or your local partner to start a discussion on enhancing the FMS proposal.

Learning Topics

En Es 25 hrs

The Flexible Manufacturing System (FMS) course introduces students to the industrial workcell where automation and industrial applications are built by combining machining technology with robotics and materials handling. Students develop and edit programs, operate robots, accurately mill parts, and synchronize mill and robot operation.

Students design solutions for industrial FMS applications with emphasis on real industrial concerns, such as optimized programming and accurate machine tending.

- CNC Machining
- RoboCell Simulation and Control Software
- Designing an FMS Workcell
- Expanding the Workcell
- Writing a Program
- Programming Mill Operations
- Conditional Programming
- Storing Finished Parts
- Multiple Part Programming
- Lathe Operations
- Multiple Part Lathe Operations
- Program Integration
- Designing a Final Project
- Running the Final Project)

Intelitek FMS is a flexible solution for educating and training students in the principles and technologies of advanced manufacturing

FMS is not a demo system. Using industrial equipment, conveyors, tools, materials and software, the system manufactures real products and a school using the FMS environment develops their own unique outcome. The system supports multiple product production processes and the breadth of the outcome is in the hands of students ingenuity.

Project Based Learning (PBL)

Project based learning, also called Learning by Doing, is used extensively in this program where students learn by designing, creating and building a product or process. Through project based learning, students learn to implement the theory, operate the equipment and validate the results of the topics they have been studying in class. This is real work experience and on-the-job hours that will help them integrate into the workplace after completing their training.

Projects enable students to work in groups in an immersive instructional experience with the common goal of developing solutions to relevant scenarios. Students develop communication, time-management and leadership skills while also learning core engineering principles

Project Examples Available for FMS Workcells:

Intelitek offers sample projects used in classrooms and SkillsUSA events in the past for teachers to use in the classroom.

- Four-Cavity Mold
- Brass Cannon
- Planetary Gearbox
- CO2 Car
- Chess Set
- Golf Putter
- Precision Measuring Device
- Yo-Yo

Sustainability

By collaborating with industrial vendors Intelitek is able to maintain an updated educational environment. Intelitek also offer professional development and ongoing training and support to help introduce new staff members to the system as the school's program grows and matures.

Technology Partners

YASKAWA

COGNEX

Allen-Bradley
by ROCKWELL AUTOMATION

SIEMENS

NIMS

intelitek ►► ®

- 18 Tsienneto Road. Derry, NH 03038 USA
- +1-603-413-2600
- info@intelitek.com
- www.intelitek.com