Revised September 2013

Vincennes University

Indiana Center for Applied Technology (ICAT) - Haas Technical Education Center (HTEC)

CNC Machinist Now

An Accelerated Training Program for Veterans and Civilians

Goals:

1. To provide high quality training on state-of-the-art equipment to help bridge the Advanced Manufacturing "skills gap".
2. To provide well-rounded entry level skilled CNC Machinists to an industry that is in desperate need.
3. To provide opportunities for students to earn industry recognized *NIMS credentials.
4. To prepare Veterans and Civilian adult learners for gainful employment as CNC Machinists.
5. To prepare students for life-long learning in a CNC machining career.

*NIMS is the acronym for the National Institute for Metalworking Skills

Description:

The Vincennes University CNC Machinist Now program is designed to prepare Veterans and civilian adult learners to become well-rounded entry level CNC machinists with upward mobility potential. The curriculum is a combination of machining theory and extensive hands-on training. The duration of the training is 16 weeks or 600 hours. College credit is not awarded for this program, rather it is designed as an accelerated program of study around industry recognized credentials based on skills needed for a career in CNC machining and manufacturing.

Eligibility:

This program is designed for Veteran and Civilian adult learners, recent high school graduates are referred to Vincennes University's two year Precision Machining Technology program. Entrance requirements include a high school diploma or a GED.

Credentials:

Required NIMS Industry Recognized Credentials:

(Earning these credentials IS required for successful completion of course.)

1. NIMS Measurement, Materials & Safety
2. NIMS Job Planning, Benchwork & Layout
3. NIMS CNC Mill Operator
4. NIMS CNC Lathe Operator
5. NIMS Milling: Programming, Setup and Operations Level 1
6. NIMS Turning: Programming, Setup and Operations Level 1

Optional Industry Recognized Credentials:

Earning these credentials IS NOT required for successful completion of course, but if time and circumstances allow, may be attempted in order to tailor the training to the needs of their employer, or future employer.)

1. NIMS Manual Drilling Level 1
2. NIMS Manual Milling Level 1
3. NIMS Surface Grinding Level 1
4. NIMS Manual Turning: Chucking Level 1
5. NIMS Milling: Programming, Setup and Operations Level 2
6. NIMS Turning: Programming, Setup and Operations Level 2
7. Mastercam Mill Design and Toolpaths

Certificate:

Upon successful completion of the program, the trainee will be awarded with a Vincennes University Certificate of Completion for the CNC Machinist Now training program.

Facility:
VU will provide all of the training at the Haas Technical Education Center (HTEC) CNC Training Center which is located in Vincennes in the Indiana Center for Applied Technology (ICAT) on the main campus at Vincennes University. The HTEC lab contains 15 full size Haas CNC machines along with 12 Haas control simulators, and 15 seats of Mastercam CAD/CAM software and miscellaneous manual machines. In addition to the CNC machines and manual machines, the center has a variety of precision measuring tools to train students in the use and care of metrology equipment.

Partners:
The Vincennes University HTEC CNC Training Center is dedicated to providing the highest quality training available for Haas CNC machines and related technologies. The center leverages the support of its many manufacturing partners to provide training on the latest technology available. The list of partners includes: Haas Automation, Renishaw, Clodfelter Engineering, Sandvik, Mastercam, Quality Mill Supply, Immerse2Learn, SGS Tools, Techniks, Wallover, RegoFix, Lista, Fifth-Axis, and others.

Tuition and Fees:
The cost of the program is $8000. This includes all tuition, lab fees, textbooks, materials, hardware, software, training and testing.

Off-Campus Housing:
Special Vincennes University apartment rates are available for the program. Students may choose to participate in the Vincennes University meal plan.

Weekly Schedule:

	Monday	Tuesday	Wednesday	Thursday	Friday	Total hrs/w
CNC Programming/Study lab	12:30-4pm	12:30-4pm	12:30-4pm	12:30-4pm	8:30-12:00n	17.5
Lecture/CNC Machining Lab	4:30-9:00pm	4:30-9:00pm	4:30-9:00pm	4:30-9:00pm	12:30-5:00pm	22.5
						40.0

Total Training Hours
40 hrs per week for 16 weeks = 640 hours, minus 4 holidays (32 hrs.) = 608 hours (592 minimum)

Implementation:
The CNC Machinist Now program began September 3, 2013 and will run three times per year: 2014: January 6, May 5, and September 2. Class size will be limited to 10-12 students per class.

Recruitment:
Students will be recruited through Save Our Veterans, Operation: Job Ready Veterans and other Veterans organizations, WorkOne in Indiana, and its counterpart one-stop employment centers in other states, and through industry partners, along with multimedia contact. Ideally, companies will be involved in the candidate selection process from the beginning.

Placement:
Vincennes University will use its own resources along with Save Our Veterans, Operation: Job Ready Veterans, WorkOne in Indiana, its counterparts in other states, Veterans organizations, and industry partners, to help trainees to gain full time employment as CNC Machinists. Ideally, companies will be involved in the candidate selection process up front, and then provide full time employment at the conclusion of the training. In some cases, the employer may wish to hire the individual to work full-time before the training, or part-time during the training if it works logistically and financially.

Textbook:
Precision Machining Technology
Peter J. Hoffman, Eric S. Hopewell, Brian Janes, Kent M. Sharp, Jr.
Delmar – Cengage Learning 2012 ISBN-13: 978-1-4354-4767-7

COURSE OUTLINE:

Basic Machine Shop Practices

Introduction to machining, careers, and workplace skills, as well as safety, measurement systems, machining related math, semi-precision and precision measurement, quality assurance and control, process planning, metal composition and classification, heat treatment of metals, maintenance, lubrication and cutting fluids.
Exploration of the basics of hand tools, job planning and part layout, the use of a metal saw, pedestal grinder, and drill press. Understanding of drawings, basic symbols and notation, and how to interpret basic GD&T feature control frames. Introduction to the lathe, milling and surface grinding machine, their setup, tooling and operations. Students will develop process plans, and use workholding fixtures and tools to machine parts. Safety, turning tools, rotating tools, tool holders, speeds and feeds for a variety of operations and critical thinking and problem solving are emphasized. Hands-on experience and practical applications are included.

SECTION 1 - (10 clock hours total)

Introduction to Machining

Unit 1 – Introduction to Machining - (3 hrs)
Introduction
Machining defined
History of machining
The role of machining in society
Major machine tools

Unit 2 – Careers in Machining - (2 hrs)
Introduction
Modern machining careers

Unit 3 – Workplace Skills - (5 hrs)
Introduction
Personal skills
Technical skills
Training opportunities / methods
Job seeking

SECTION 2 - (50 clock hours total)
Measurement, Materials and Safety
Unit 1 – Introduction to Safety - (5 hrs)
Introduction
General safety guidelines
General Clothing for a Machining environment
Personal protective equipment (PPE)
Housekeeping
Guards and barriers
Handling and lifting
Compressed air safety
Lockout/tagout
Hazardous materials
Fire safety
Safety documentation

Unit 2 - Measurement Systems and Machine Tool Math Overview - (5 hrs)
Introduction
Measurement systems of the of the machining world
Machining mathematic concepts and operations

Unit 3- Semi-Precision Measurement - (10 hrs)
Introduction
What is a semi-precision measurement?
Rules
Calipers
Adjustable squares
Angular measurement
Fixed gages

Unit 4- Precision Measurement - (10 hrs)
Introduction
What is precision measurement?
Care of precision tools
Straight edges
Precision fixed gages
Surface plates
Solid squares
Gage blocks
Vernier measuring tools
Micrometers
Dial and digital measuring tools
Precision transfer or helper-type measuring tools
Measuring tools
Dial and digital indicators
Sine tools
Surface finish measurement
Optical comparators
Toolmaker's microscope
Coordinate measuring machine

Unit 5- Quality Assurance, Process Planning, and Quality Control - (5 hrs)
Introduction
Quality assurance
The process plan
Quality control

Unit 6- Metal composition and classification - (5 hrs)
Introduction
Ferrous metals nonferrous metals

Unit 7- Heat Treatment if Metals - (5 hrs)
Introduction
Hardening
Tempering
Annealing
Normalizing
Heat treatment of nonferrous metals
Heat-treating safety
Hardness scales and testing

Unit 8- Maintenance, Lubrication, and Cutting fluid overview - (5 hrs)
Maintenance
Cutting fluids

SECTION 3 - (30 clock hours total)

Job Planning, Benchwork, and Layout

Unit 1- Understanding Drawings - (10 hrs)

Importance of engineering drawings
Components of engineering drawings
Basic symbols and notation
Tolerance
Classes of fit
Geometric dimensioning and tolerance (GD&T)

Unit 2- Layout - (4 hrs)

Introduction
Layout fluid (layout dye)
Semi-precision layout
Precision layout
Basic layout construction and math
Layout procedure guidelines

Unit 3- Hand tools - (4 hrs)

Introduction
Screwdrivers
Pliers
Hammers
Wrenches
Bench vise
Clamps
Hacksaws
Files
Deburring
Abrasives

Unit 4- Saws and Cutoff Machines - (4hrs)

Introduction
Power hacksaws
Band sawing machines
Saw blade characteristics and applications
Band saw blade welding
Band saw blade mounting/removal
Blade speed
The abrasive cutoff saw
Metal cutting circular (cold) saws

Unit 5- Offhand Grinding - (3 hrs)

Introduction
Grinder uses
Abrasive belt and disc uses
Grinding wheels
Pedestal grinder setup
Grinding procedures

Unit 6- Drilling, Threading, Tapping, and Reaming - (5 hrs)

Introduction
Benchwork holemaking operations
Threading and tapping

SECTION 4 - (20 clock hours total)

Drill Press

Unit 1- Introduction to the Drill Press - (2 hrs)

Introduction
Upright drill press
Radial arm drill press

Unit 2- Tools, Toolholding, and Workholding for the Drill Press - (8 hrs)

Introduction
Types of cutting tool materials
Drill bits
Reamers
Countersinks and counterbores
Toolholding
Workholding

Unit 3- Drill Press Operations - (10 hrs)

Introduction
General drill press safety
Speed and feed
Locating holes on a drill press
Center drilling and spot drilling
Reaming
Counterboring and spotfacing
Chamfering and countersinking
Tapping

SECTION 5 - (25 clock hours total)

Manual Turning

Turning

Unit 1- Introduction to the Lathe - (2 hrs)

Introduction
Headstock
Lathe Bed
Carriage
Tailstock
Lathe size

Unit 2- Workholding and Toolholding Devices for the lathe - (5 hrs)

Introduction
Workholding
Holding cutting tools

Unit 3- Machining Operations on the Lathe - (10 hrs)

Introduction
Depth of cut, speed, feed, and time calculation
General lathe safety
Facing and turning operations
Filing and polishing
Center and spot drilling
Holemaking on the lathe
Thread cutting with taps and dies
Form cutting
Grooving and cutoff

Knurling

Unit 4- Manual Lathe Threading - (5 hrs)
Introduction
Screw thread terminology
Class of fit
Determining thread data
Producing threads on a lathe
Lathe setup
Lathe threading operation
Thread measurement
Other thread forms

Unit 5- Taper Turning - (3 hrs)
Introduction
Typical taper specifications
Taper dimensions and calculations
Taper Turning Methods

SECTION 6 - (25 clock hours total)
Manual Milling
Milling
Unit 1- Introduction to the Vertical Milling Machine - (2 hrs)
Introduction
Base and column
Knee
Turret
Ram
Head
Operation features

Unit 2- Tools, Toolholding, and Workholding for the Vertical Milling Machine - (10 hrs)
Introduction
Cutter shanks and arbors
Cutting tool materials
Proper cutting tool storage
Endmills
Flat surface milling cutters
Specialty milling cutters
Toolholding
Workholding

Unit 3- Vertical Milling Machine Operations - (10 hrs)
Introduction
General milling machine safety
Tramming the vertical milling machine head
Aligning workholding devices
Speeds and feeds for milling operations
Milling basics
Squaring a block
Angular milling
Milling steps, slots and keys
Milling radii

Unit 4- Indexing and Rotary Table Operations - (3 hours)
Introduction
Parts of the rotary table
Rotary table setup
Rotary table operations
The indexing head
Indexing head operations

SECTION 7 - (25 clock hours total)
Grinding
Unit 1- Introduction to Precision Grinding Machines - (2 hrs)
Introduction
Surface grinders
Cylindrical grinders
Tool and cutter grinders
The jig grinder

Unit 2- Grinding Wheels for Precision Grinding - (8 hrs)
Introduction
Wheel shapes
Grinding wheel specifications
Superabrasives

Unit 3- Surface Grinding Operations - (15 hrs)
Introduction
General surface grinder safety
Mounting the grinding wheel
Workholding devices
Angle plates, V-blocks, and collet blocks
Wheel dressing
Dressing aluminum oxide and silicon carbide wheels
Dressing diamond and CBN wheels
Grinding parallel surfaces
Grinding perpendicular surfaces
Grinding angles
Side grinding
Performing side grinding
Grinding cylindrical work
Grinding problems

CNC Program, Setup & Operation

CNC turning and milling setup, programming and operation. Students develop process plans, plot points, set tool and work offsets using manual tools and probes, write, load, and edit basic programs. Use turning tools and rotating cutting tools, tool holders, speeds and feeds, and run part programs in the inch and metric coordinate positioning system. Accurate part inspection is emphasized, along with critical thinking and problem solving. Repetitive hands-on experience and practical applications are included. Students advance to programming parts with Mastercam and setting up and running their programs on the CNC machines.

SECTION 8 - (415 clock hours total)
Computer Numerical Control

Unit 1- CNC Basics - (35 hrs)
Introduction
The CNC machine control unit

CNC motion control
Coordinate systems
Positioning systems
Codes
Conversational-type programming
Parts of a CNC program

Unit 2- Introduction to CNC Turning - (15 hrs)
Introduction
Types of turning machines
Tool mounting adapters
Workholding
Process planning

Unit 3- CNC Turning: Programming - (100 hrs)
Introduction
Coordinate positioning for turning
Types of motion for turning
Non axis motion commands
Machining operations
Canned cycles

Unit 4- CNC Turning: Setup and Operation - (50 hrs)
Machine control panel
Workholding setup
Machine and work coordinate systems
Work offset setting
Cutting tools for turning
Program entry for turning
Turning machine operation

Unit 5- Introduction to CNC Milling - (15 hrs)
Introduction
Types of CNC milling machines
Toolholding
Process planning

Unit 6- CNC Milling: Programming - (100 hrs)
Introduction
Coordinate positioning for CNC milling
Speeds and federates for milling
Machining operations
Sequence numbers
Types of motion for milling
Machining operations
Cutter radius compensation

Unit 7- CNC Milling: Setup and Operation - (50 hrs)
Machine control panel
Workholding setup
Machine and work coordinate systems
Power up and homing
Work offset setting
Cutting tools
Program entry

Machine operation

Unit 8- Computer Aided Design and Computer Aided Machining - (50 hrs)
Introduction
CAD software use
CAM software use

Transitioning service members from their military careers to civilian careers.

Charlie McBride – Veterans Employment Program Director, Indiana Dept. of Workforce Dev.
November 2012

As members of our military return home from duty and resume life as a civilian they face many challenges. One of those challenges is an economy and job market that is struggling. Another is a job market that has dramatically changed from what existed prior to joining the military. This means a prime opportunity to engage these returning service members in a focused training effort that will provide the skills needed to enter a career field. In addition there should be a clear path for future advancement through additional education and expanding job responsibilities that will encourage the veteran to see the career choice as a long-term growth opportunity. Many members of the military have experience in many career areas yet can't qualify for matched civilian careers because the certifications and requirements that are not compatible or transferrable to civilian occupations. While I have no knowledge of training programs designed and offered only to veterans'. A good case can be made for such a program some of the points are listed below:

- Veterans are generally more prepared for a structured training program because of their past training and military structure.
- They are used to learning difficult technical material at a fast pace
- They usually bring several years of experience as would an adult learner with years of work experience.
- They are very focused and goal or mission oriented.
- Many a have strong math and technical backgrounds because of the military's use of advanced equipment.
- They are disciplined and methodical in their approach to tasks.
- They have been exposed to many cultures and environments so they tend to be more open to new concepts and ideas.
- Veterans most likely would benefit from a program designed for them since they have had some unique experiences and could get frustrated in a class environment with students straight out of high school. Like adult learners they can find younger students concerns petty and unrealistic.
- Former military are job ready in that they understand the demands of the job market. They only lack the specific training needed to be marketable.
- Returning veterans' have many benefits available to them for training and education both in short and long term educational programs. The critical issue is matching them to a program that will provide a sustainable and enjoyable career.
- These benefits also include tax and pay subsidies for the veteran and employer with OJT and the early phase of employment.

CNC Machinist Now 8.5 x 11 Flyer.

CNC Machinist NOW

An Accelerated Training Program for Veterans and Civilians

Vincennes University Haas Technical Education Center (HTEC) CNC Training

- **16 Week VA & INTraining Approved CNC Training Program**
- **3 Annual Starting Dates in January - May - September**
- **600 Hours of Training on CNC and Manual Machines**
- **Earn Industry Recognized NIMS Machining Credentials**
- **Learn Skills that are in High Demand for Good Paying Jobs!**
- **State-of-the-Art Training Facility and CNC Machines**

For more information call the Vincennes University HTEC CNC Training Center at 812-888-4159 or email Doug Bowman at dbowman@vinu.edu

CNC Machinist Now 11 x 17 Poster.

Vincennes University HTEC CNC Training Lab.