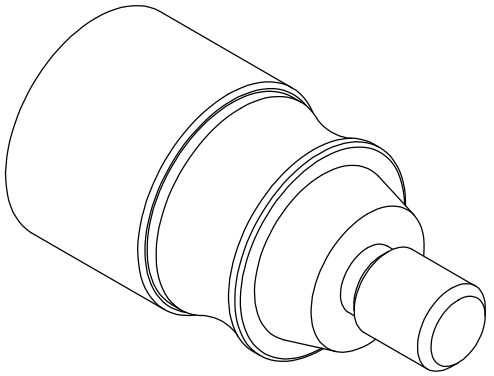
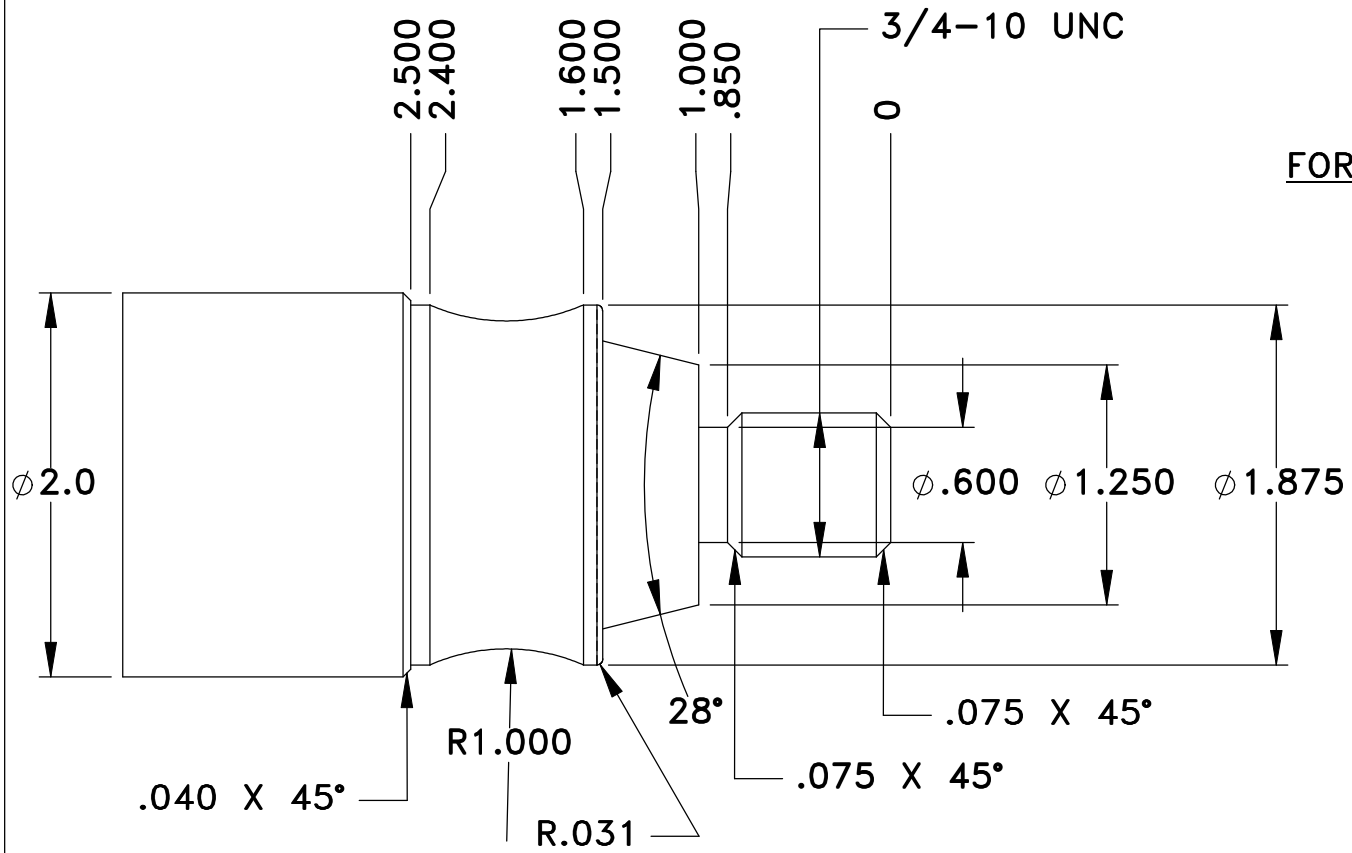
SkillsUSA
2011 Contest Projects

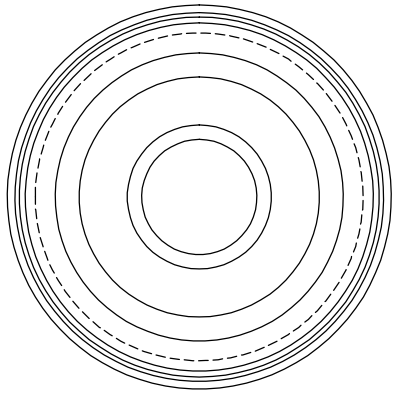
CNC Turning

Click the “Print this Section” button above to automatically print the specifications for this contest. Make sure your printer is turned on before pressing the button.



NOT TO SCALE
FOR REFERANCE ONLY





DIMS IN INCHES BREAK EDGES 0.015
LATHE FINISH 63 uINCH MILL FINISH 125 uINCH
90° CSINK TAPPED HOLES 0.016R OVER MAJOR ⌀
TOLERANCES– UNLESS OTHERWISE SPECIFIED
X/X ±0.06 X.X ±0.06 X.XX ±0.02 X.XXX ±0.005
ANGLES ±1° X.XXX DIAMETERS ◎ 0.005 TIR
X.XXXDIA & SURFACES // & ⊥ 0.001 INCH/INCH

MATERIAL	FINISH
Aluminum	NONE

Skills USA

HAAS AUTOMATION, INC.

CNC Turning Competition

APPROVALS	DATE
DRAWN Daniel Scott	05–06–11
CHECKED Micah Babcock	05–13–11
ENGINEER Doug Bowman	04–20–11

SIZE	SCALE	DWG	REV
A	1:1	2011–1	

CNC MILLING TECHNOLOGY

Buses will begin loading for Metropolitan Community College, Lobby 1500, Tuesday, 8:15 a.m. All buses will leave at 8:30 a.m.(Contestants and Advisors Only)
Orientation: Tuesday, 9 a.m.–11:30 a.m., Metropolitan Community College - Business and Technology Campus, 1775 Universal Ave. Kansas City, MO 64120
Instructors' Tutorial: Tuesday, 9 a.m.–11:30 a.m., Metropolitan Community College - Business and Technology Campus, 1775 Universal Ave. Kansas City, MO 64120
Lunch: Tuesday, 11:30 p.m.–12:30 p.m., Metropolitan Community College - Business and Technology Campus, 1775 Universal Ave. Kansas City, MO 64120
Meeting: Tuesday, 12:30 p.m. - 2:30 p.m., Metropolitan Community College - Business and Technology Campus, 1775 Universal Ave. Kansas City, MO 64120
Contest: Wednesday, 8 a.m. - Noon, Contest Area, Bartle Hall
Debriefing: immediately following competition, Contest Area, Bartle Hall

CNC MILLING

PURPOSE
To evaluate each contestant's preparation for employment in Computer Numeric Control Milling and to recognize outstanding students for excellence and professionalism in the CNC milling field.

First, refer to General Regulations, Page 9.

CLOTHING REQUIREMENT
Official SkillsUSA khaki work shirt and pants, black or brown leather work shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.)

These regulations refer to clothing items that are pictured and described at: www.skillsusastore.org. If you have questions about clothing or other logo items, call 800-401-1560 or 703-956-3723.

Note: **Contestants must wear their official contest clothing to the contest orientation meeting.**

ELIGIBILITY
Open to active SkillsUSA members enrolled in programs with precision machining, automated manufacturing or CNC as the occupational objective.

EQUIPMENT AND MATERIALS:
1. Supplied by the technical committee:
   a. Haas Programable Controllers
2. Supplied by the contestant:
   a. Nonprogrammable calculator
   b. Pencils and paper
   c. Machinery's Handbook (optional)
   d. All competitors must create a one-page résumé using a word processor and submit the résumé electronically at: www.skillsusa.net/newresume. Check the Web site for further instructions.

***Note*: Your contest may also require a hard copy of your résumé as part of the actual contest. Check the Contest Guidelines and/or the updates page on the SkillsUSA Web site: www.skillsusa.org/compete/updates.shtml**

SCOPE OF THE CONTEST

Knowledge Performance
The contest will include a written test evaluating a contestant's knowledge of Computer Numeric Control machining in such areas as: basic machining skills, CNC programming, setting up a CNC machine, performing mathematical calculations related to CNC, communication and inspection.

Skill Performance
The contest will assess the ability to write the CNC program for a part drawing and materials, determine tool offsets, setting up the machine and producing a part.

Contest Guidelines
1. Each contestant will be given a dimensional drawing and materials to produce a part on a CNC mill.
2. Programming
   a. Write and verify CNC program without the use of CAM software (competitor has the opportunity to correct any program errors on the machine)
   b. Display complete knowledge of DIN/ISO programming (G and M codes)
   c. Apply the correct use of cutter compensation (G41/G42)
   d. Adjust speeds and feeds as needed
3. Perform mathematical calculations
   a. Calculate CNC speeds and feeds
   b. Calculate programming coordinates from the drawing
   c. Calculate radius tangent points
4. Measuring
   a. Measure test part to the nearest 0.001"
5. Communication
   a. Read and interpret technical blueprints
   b. Understand all symbols on technical blueprints, such as geometric

tolerances, surface-finish symbols, corner-break symbols, etc.

6. Dimensions

   This is an objective scoring. Scores will only be granted if dimension is in compliance with the print. The score for each dimension will either be full points or zero points.

7. The CNC will be available for orientation before the competition with technicians on hand to help competitors and their advisors familiarize themselves with the equipment.

Standards and Competencies

CNCM 1.0 — Apply basic machining skills per industry standards as set forth by the SkillsUSA technical committee

1.1 Demonstrate the basic math skills essential to CNC machining
1.2 Identify and use measuring tools that are basic to CNC machining
1.3 Interpret and apply information from prints and drawings
1.4 Measure part to nearest +/- .001"
1.5 Demonstrate safe working practices on machines
1.6 Use various precision measuring tools (i.e., micrometers, calipers, radius gages)
1.7 Use correct filling techniques and appropriate terminology
1.8 Define and calculate speed and feed rates (SFPM, CCS, IPM, IPR)
1.9 Demonstrate knowledge of cutting tools, clamping devices and materials
1.10 Perform mathematical calculations that enable the solving of complex trigonometric, geometric and algebraic problems applicable to CNC machining processes

CNCM 2.0 — Demonstrate knowledge of CNC programming per industry standards as set forth by the SkillsUSA technical committee

2.1 Manually write and verify the CNC program without the use of CAM software according to print specifications, dimensions and tolerances (competitor has the opportunity to edit any program errors on the machine)
2.2 Display complete knowledge of DIN/ISO Programming (G and M codes)
2.3 Apply the correct use of cutter compensation (G41/G42)
2.4 Demonstrate knowledge of incremental and absolute positioning
2.5 Demonstrate knowledge of coordinate system
2.6 Determine proper machining sequences from work piece drawing
2.7 Adjust speeds and feed as needed

CNCM 3.0 — Perform mathematical calculations as needed for calculating speeds, feeds, program coordinates, angles, radii and tangent points

3.1 Calculate CNC speeds and feeds

3.2 Calculate programming coordinates from the drawing
3.3 Calculate angles, radii and tangent points

CNCM 4.0 — Communicate and demonstrate an understanding of all symbols on a blueprint

4.1 Read and interpret technical blueprints
4.2 Understand all symbols on technical blueprints, such as geometric tolerances, surface-finish symbols, corner-break symbols, etc.

CNCM 5.0 — Inspect work per industry standards as set forth by the SkillsUSA technical committee

5.1 Inspect for conformity to print (shape and features of part to drawing)
5.2 Inspect for broken edges
5.3 Inspect for damage to part (clamp marks, scratches)

Committee Identified Academic Skills

The technical committee has identified that the following academic skills are embedded in this contest.

Math Skills

- Use fractions to solve practical problems
- Simplify numerical expressions
- Measure angles
- Apply transformations (rotate or turn, reflect or flip, translate or slide and dilate or scale) to geometric figures
- Apply Pythagorean Theorem
- Solve problems using proportions, formulas, and functions
- Solve problems using trigonometry
- Solve problems using Cartesian Coordinate System

Science Skills

- Use knowledge of speed, velocity and acceleration

Language Arts Skills

None Identified

Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic standards.

Math Standards

- Numbers and operations
- Algebra
- Geometry
- Measurement
- Problem solving
- Reasoning and proof
- Communication
- Connections
- Representation

Source: NCTM Principles and Standards for School Mathematics. To view high school standards, visit: standards.nctm.org/document/chapter7/index.htm. Select "Standards" from menu.

Science Standards

- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

Language Arts Standards

- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics)
- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate

effectively with a variety of audiences and for different purposes

- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes
- Students conduct research on issues and interests by generating ideas and questions and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information)

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.ncte.org/standards.

CNC TURNING TECHNOLOGY

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Debriefing: immediately following competition, Contest Area, Bartle Hall

CNC TURNING

PURPOSE
To evaluate each contestant's preparation for employment in Computer Numeric Control Turning and to recognize outstanding students for excellence and professionalism in the CNC turning field.

First, refer to General Regulations, Page 9.

CLOTHING REQUIREMENT
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EQUIPMENT AND MATERIALS:
1. Supplied by the technical committee:
   a. Haas Programable Controller

2. Supplied by the contestant:
   a. Nonprogrammable calculator
   b. Pencils and paper
   c. Machinery's Handbook (optional)
   d. All competitors must create a one-page résumé using a word processor and submit the résumé electronically at: www.skillsusa.net/newresume. Check the Web site for further instructions.

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Skill Performance
The contest will assess the ability to write the CNC program for a part drawing and materials, determine tool offsets, setting up the machine and producing a part.

Contest Guidelines
1. Each contestant will be given a dimensional drawing and materials to produce a part on a CNC lathe.
2. Programming
   a. Write and verify CNC program without the use of CAM software (competitor has the opportunity to correct any program errors on the machine)
   b. Display complete knowledge of DIN/ISO programming (G and M codes)
   c. Apply the correct use of cutter compensation (G41/G42)
   d. Adjust speeds and feeds as needed

3. Perform mathematical calculations
   a. Calculate CNC speeds and feeds
   b. Calculate programming coordinates from the drawing
   c. Calculate radius tangent points
4. Measuring
   a. Measure test part to the nearest 0.0001"
5. Communication
   a. Read and interpret technical blueprints

b. Understand all symbols on technical blueprints, such as geometric tolerances, surface-finish symbols, corner-break symbols, etc.

6. Dimensions
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7. The CNC lathes will be available for orientation the day of competition with technicians on hand to help competitors and their advisors familiarize themselves with the equipment.

Standards and Competencies

CNCT 1.0 — Apply basic machining skills per industry standards as set forth by the SkillsUSA technical committee

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1.7 Use correct filling techniques and appropriate terminology
1.8 Define and calculate speed and feed rates (SFPM, CCS, IPM, IPR)
1.9 Demonstrate knowledge of cutting tools, clamping devices and materials
1.10 Perform mathematical calculations that enable the solving of complex trigonometric, geometric and algebraic problems applicable to CNC machining processes

CNCT 2.0 — Demonstrate knowledge of CNC programming per industry standards as set forth by the SkillsUSA technical committee

2.1 Manually write and verify the CNC program without the use of CAM software according to print specifications, dimensions and tolerances (competitor has the opportunity to edit any program errors on the machine)
2.2 Display complete knowledge of DIN/ISO Programming (G and M codes)
2.3 Apply the correct use of cutter compensation (G41/G41)
2.4 Demonstrate knowledge of incremental and absolute positioning
2.5 Demonstrate knowledge of coordinate system
2.6 Determine proper machining sequences from workpiece drawing
2.7 Adjust speeds and feed as needed

CNCT 3.0 — Perform mathematical calculations as needed for calculating speeds, feeds, program coordinates, angles, radii and tangent points

3.1 Calculate CNC speeds and feeds

3.2 Calculate programming coordinates from the drawing
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5.1 Inspect for conformity to print (shape and features of part to drawing)
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Committee Identified Academic Skills

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Science Skills

- Use knowledge of speed, velocity and acceleration

Language Arts Skills

None Identified

Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic standards.

Math Standards

- Numbers and operations
- Algebra
- Geometry
- Measurement
- Problem solving
- Reasoning and proof
- Communication
- Connections
- Representation

Source: NCTM Principles and Standards for School Mathematics. To view high school standards, visit: standards.nctm.org/document/chapter7/index.htm. Select "Standards" from menu.

Science Standards

- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

Language Arts Standards

- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written and visual language to accomplish their own purposes

(e.g., for learning, enjoyment, persuasion and the exchange of information)

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.ncte.org/standards.

Haas Automation, Inc.

Skills USA
CNC Turning 2011

CNC Turning Part Score Sheet **Contestant Number** _____

		Points Poss.	Points Earned
1.	Face front of part	20 pts	_____
2.	.075 x 45 Deg (2)	20 pts	_____
3.	.750" Diameter	20 pts	_____
4.	.600" Diameter	20 pts	_____
5.	28 Deg Taper	20 pts	_____
6.	1.875" Diameter	20 pts	_____
7.	¾ - 10 Thread	20 pts	_____
8.	.040" x 45 deg chamfer	20 pts	_____
9.	1.000" Radius	20 pts	_____
10.	.850" Z Dim	20 pts	_____
11.	1.000" Z dim	20 pts	_____
12.	1.500" Z dim	20 pts	_____
13.	1.600" Z dim	20 pts	_____
14.	2.400" Z dim	20 pts	_____
15.	2.500" Z dim	20 pts	_____
16.	Spindle on	20 pts	_____
17.	Rotation correct	20 pts	_____
18.	Speeds, feeds and DOC	20 pts	_____
19.	Following instructions	20 pts	_____
20.	Tool Changes	20 pts	_____

Total Points Available: 400 points **Total Points Earned:** _____

Scored by: _____

Run on lathe by: _____

Headquarters: 2800 Sturgis Road, Oxnard, California 93030
Telephone: 805-278-1800 • **Fax:** 805-278-2255 • www.HaasCNC.com