



**Northern Illinois  
University**

**EB Manufacturing Lab  
Use, Assistance and Guidance**

**Hours M-F 8:00 – 4:30**



# Shop Use / Training and Other Resources

# Why Training?



In the past safety and training has been handled in a more casual way relying on the instincts and judgement of individuals.

- Students wanting to use the Machine Shop will be required to complete orientation / training.
- We have been fortunate to not have had any major incidents. The number of students needing to use the equipment has made a more formal process necessary.
- Students who have been trained on the shop equipment are able to work on their own projects with guidance and supervision and when needed can request assistance.
- This will help us provide a safe environment for all members of CEET and comply with safety and training requirements.

# Machine Shop Use and Training




-Anyone wanting to work in the shop is required to attend instruction sessions on the shop and individual equipment. Training is usually Thursday afternoon and Friday morning.

-Once you have been checked out on a piece of equipment you can reserve a time slot to use the shop with supervision and guidance, 8-4:30 M-F.

**-Use our O365 Bookings app to request training, shop use and services.**

<https://outlook.office365.com/owa/calendar/CEETEBMachin eShop@mail.niu.edu/bookings/>





Northern Illinois University

CEET EB 269 Machine Shop –  
 Appointments for orientation are available up to 4 days in advance and 10 days in advance for inquiries – Read and follow all confirmation email instructions.

☎ 🌐 📍

- Select service
- Work Request Inquiry / Review...  
1 hour
i
  - Maker Space Inquiry / Request...  
1 hour
i
  - Special Request Inquiry - This ...  
1 hour
i
  - Design Review - Is an opportu...  
1 hour
i
  - 1 - General Shop \*\*Orientation...  
1 hour
i
  - General Shop Use -Prerequisit...  
1 hour
i
  - 2 - Manual Lathe \*\*Orientation...  
1 hour
i

Thursday PM		Shop Instruction	
1 Hour 2-3 Students - Name, z id & team /class / research			
	Section A	Section B	
1pm-2pm	General Safety/ Saws, Drill Press	OMAX Waterjet	
2pm-3pm	Mill	Special Request (Arrange with Staff)	
3pm-4pm	Lathe	General Safety/ Saws, Drill Press	
Friday AM			
8am-9am	Welding Instruction	General Safety/ Saws, Drill Press	
9am-10am	Welding Practice	Special Request (Arrange with Staff)	
10am-11am	Welding Practice	Special Request (Arrange with Staff)	
11am-12pm	Welding Practice	General Safety/ Saws, Drill Press	

# General Safety Guide

-These are the **general** rules for working in the shop and are covered in the general training / orientation, along with saws and drill press.

Equipment is expensive but **safety** is our main concern.

Anyone working in the manufacturing lab will have supervision and guidance.

## NIU CEET MANUFACTURING LABORATORY GENERAL SAFETY GUIDE



THESE POLICIES ARE FOR THE SAFETY AND WELL BEING OF EVERYONE WORKING IN THE LABORATORY.  
GENERAL LABORATORY RULES:

- ANYONE WHO WANTS TO USE THE LAB MUST READ AND FOLLOW THESE RULES**
- IT IS UNSAFE TO OPERATE A MACHINE WITHOUT INSTRUCTION. NO EQUIPMENT MAY BE OPERATED WITHOUT EXPRESS PERMISSION OF THE LAB TECHNICIAN OR INSTRUCTOR.**
- THERE MUST BE AT LEAST TWO PEOPLE IN THE LAB AT ALL TIMES WHILE STUDENTS ARE OPERATING EQUIPMENT.**
- SAFETY GLASSES SHOULD BE WORN AT ALL TIMES.
- NO FOOD OR DRINK ALLOWED IN THE LAB
- NO SHORTS, OPEN TOE SHOES ALLOWED IN THE LAB
- REMOVE FINGER RINGS, WATCHES, NECKLACES, GLOVES BEFORE OPERATING EQUIPMENT
- WEARING AN "IPOD" OR ANY OTHER DEVICES THAT INTERFERE WITH HEARING IS NOT ALLOWED
- NO ONE IS ALLOWED TO USE CELL PHONES WHILE OPERATING EQUIPMENT
- DO NOT DISTURB ANY ONE WHO IS OPERATING ANY EQUIPMENT.
- DON'T MAKE SUDDEN LOUD NOISES THAT COULD STARTLE OTHERS WHO ARE CONCENTRATING ON THEIR WORK
- DO NOT LEAVE MACHINERY RUNNING UNATTENDED. GUARDS ON MACHINERY MUST BE IN PLACE DURING OPERATION
- NEVER LEAN ON A MACHINE. STAND AWAY WHEN IT IS RUNNING
- LAB EQUIPMENT MUST REMAIN IN THE LAB UNLESS PERMISSION IS GIVEN TO USE IT ELSEWHERE
- DO NOT MOVE THE EQUIPMENT FROM ONE PLACE TO ANOTHER UNLESS YOU HAVE PERMISSION FROM THE LAB TECHNICIAN.
- ALWAYS KEEP THE LAB NEAT AND CLEAN. KEEP AISLES CLEAR AND MAINTAIN UNOBSTRUCTED ACCESS TO ALL EXITS, FIRE EXTINGUISHERS, ELECTRICAL PANELS, EMERGENCY SHOWERS AND EYEWASHES.
- NEVER CLEAN, OIL OR ADJUST ANY MACHINE WHILE IT IS IN OPERATION
- STUDENTS MUST BE FAMILIAR WITH ALL SAFETY DEVICES, INTERLOCKS, AND EMERGENCY STOP DEVICES PRIOR TO OPERATING ANY EQUIPMENT.
- EXERCISE CARE WHEN WORKING WITH HYDRAULICALLY OR PNEUMATICALLY- DRIVEN EQUIPMENT. SUDDEN OR UNEXPECTED MOTION CAN CAUSE SERIOUS INJURY
- WHEN USING COMPRESSED AIR, USE ONLY APPROVED NOZZLES, AND NEVER DIRECT THE AIR TOWARDS ANY PERSON.
- FLAMMABLE LIQUIDS AND MATERIALS MUST BE KEPT AWAY FROM WORK AREA. ALL PRESSURIZED CONTAINERS MUST BE SECURED WITH WELDED LINK CHAINS AND LABELED. ALL CHEMICALS MUST BE CLEARLY LABELED WITH SUBSTANCE NAME, CONCENTRATION, DATE
- REPORT ANY DAMAGED OR MISSING EQUIPMENT OR TOOLING TO SHOP PERSONNEL.
- IF YOU HAVE ANY PROBLEM WITH THE EQUIPMENT, REPORT IT TO THE LAB TECHNICIAN. DO NOT TRY TO REPAIR ANY EQUIPMENT ON YOUR OWN
- REPORT ALL INJURIES AND UNSAFE PRACTICES TO THE LAB TECHNICIAN OR THE INSTRUCTOR RESPONSIBLE FOR THE LAB, IMMEDIATELY.
- DO NOT RUN ANY EXPERIMENTS OR PROGRAMS IN THE LAB WITHOUT AUTHORIZATION

For assistance with this form, contact the manufacturing laboratory office, EB278  
815-753-5078

# Quick Start Guides



## NIU CEET MANUFACTURING LABORATORY MACHINERY OPERATION GUIDE



### HORIZONTAL BANDSAW

#### START UP PROCEDURE

1. Have a machinist unlock the primary switch at the back and turn on.
2. Pull out the emergency stop.
3. Turn on work light.
4. Mark length on part
5. Raise the band; make sure the feed hold is on.

#### OPERATION PROCEDURE

1. Adjust feed rate and ensure band lowers at a slow rate.
2. Adjust the clamp and load your stock material. If your stock material sticks out of the back of the machine, then you may want to use the Stock Support table found behind the band saw.
3. Clamp the stock down. Adjust blade guide width
4. Turn the saw on and make sure the coolant is flowing.
5. Release the feed hold on the saw and slowly raise the feed to when the saw is moving downwards.
6. Have the saw slowly engage the material. Once it is engaged slowly raise the feed to where the saw is cutting efficiently.
7. Once the material had been cut off, the saw will turn off. Then raise the saw up and unclamp your left over stock.

#### CLEANING AND SHUT DOWN PROCEDURES

1. Leave the saw in the down position.
2. Put any tools away in a proper location.
3. Brush away chips and clean any coolant up.
4. Push in the emergency stop and turn off the light.
5. Turn off main power switch and lock up the Band saw.
6. Have machinist inspect saw before leaving.

For assistance with this form, contact the manufacturing laboratory office, EB278  
815-753-5078

\* Each piece of equipment has a Quick start guide available that can be used for reference while training and anytime after.

\* If at **any point** you are unsure of something or need advice feel free to ask one of the shop attendants for assistance.

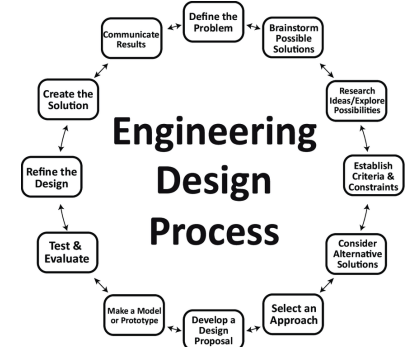


# Work Requests

# When you need assistance... "WorkRequests"



- Sometimes the work you need is outside of your abilities or experience. **Work Requests** can be submitted for help from the Machine Shop staff.
- Remember every shop has limits, try to work within the resources available. i.e., machine capacity, power, depths of cut, complexity, skill of staff, hours of availability.
- Use an **Engineering Design Process** to develop solutions.



## ABET Definition of Engineering Design

Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.



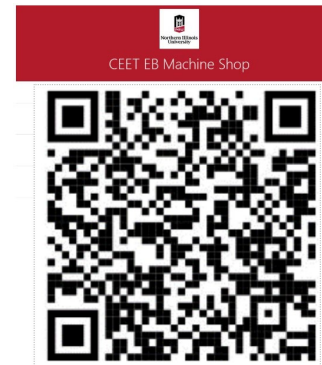
# Machine Shop Assistance



**-Use our O365 Bookings app for:**

- **Work Request Inquiries**
- **Design Review**
- **Maker Space / 3D Print Inquiries**
- **Special Request Inquiries**

<https://outlook.office365.com/owa/calendar/CEETEBMachineShop@mail.niu.edu/bookings/>



Northern Illinois University

CEET EB 269 Machine Shop –  
Appointments for orientation are  
available up to 4 days in advance  
and 10 days in advance for  
inquiries - Read and follow all  
confirmation email instructions.

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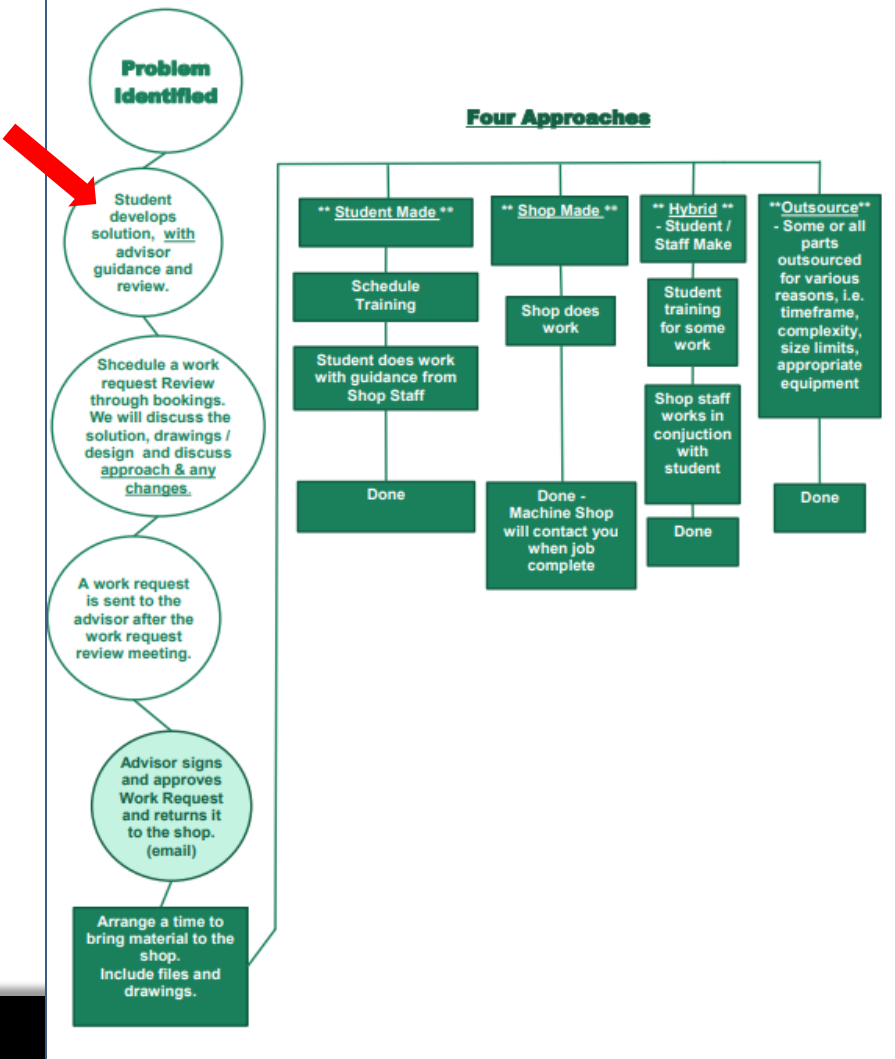
Select service

Work Request Inquiry / Review... 1 hour	i
Maker Space Inquiry / Request... 1 hour	i
Special Request Inquiry - This ... 1 hour	i
Design Review - Is an opportu... 1 hour	i
1 - General Shop **Orientation... 1 hour	i
General Shop Use -Prerequisit... 1 hour	i
2 - Manual Lathe **Orientation...	i

# Work Request Flow Chart



## Work Request Flow Chart



\*When needing assistance from the machine shop follow the flow chart.

(Work request forms will be given to your advisor after consulting with your advisor and the machine shop staff)

\*This Flow Chart can be used as a guide for planning your approach and determining how something will ultimately get done.

\*Sometimes request will need to be completed by a third party due to size, complexity, timeline or specialized equipment.

\*Materials are generally the responsibility of the student.

# Work Request



## Instructions for Work Request / Assistance - EB Machine Shop

You can use the link below to set up a work request inquiry and then **you** can schedule a Teams meeting to discuss what you would like to do. This will help us determine if and how we can assist you.

<https://outlook.office365.com/owa/calendar/CEETEBMachineShop@mail.niu.edu/bookings/>

Once we have the initial work request inquiry meeting and we determine that we can assist with what you need, we will send (e-mail) a work request form to the faculty member.

1. Discuss your request with your advisor or instructor **BEFORE** scheduling a work request / design review.
2. Once we have had a chance to meet and discuss the request the advisor will be sent a work request form. Be sure to include good phone numbers and emails so we can contact you with questions.
3. Be sure to give a good description of what you would like done, and attach any drawings. Depending on the request we may need copies of the files in the shop (DXF / SLDPRT/ STL etc.).
4. Once we receive the work request, we will fit it into our schedule as soon as we can. We will contact you when it is done or if there are questions.

## Things to consider **BEFORE** scheduling a Work Request / design review:

We have a lot of experience. Ask, we like questions.

How soon do you need it? ASK.

What machines are available and most appropriate? ASK about size and capabilities.

Material and supplies. What are they and where are they coming from? ASK for suggestions.

Do you want to or able to do some or all some the work yourself? With guidance?

Software versions and file compatibility. We don't have every kind and version of software.

Transport, handling and logistics. Is the item or part heavy or large?

Skill and expertise of the Machine shop staff. We're good but we don't know everything...

Our machines, measuring equipment and minds still use the English system of measurement...

Tolerance. XXX preferred, check your settings there **is** a difference between .38 and .375

A .500 shaft will not fit into a .500 hole. Check your tolerances.

Rapid prototyping parts is not free. Supplies cost money check your file...again.

What is most important: fast, accurate or cheap? Pick 2...

Are your drawings complete? Could you make the part from your print?

## College of Engineering & Engineering Technology, Dean's Office, EB 321 Technician Work Request

Please print legibly, missing information will slow down approval process

Name: A. Student Date: 10/10/XX

If student, name of faculty member approving this request: DR. ADVISOR

\* Phone # (815) 667 5309 Email: Z12345@STUDENTS.NIU.EDU

Project Name: BRACKET

Cost Center (if you had to pay for this service, where would the funds come from? This must be provided for approval of request): \_\_\_\_\_

Area of Work (check one)

Research

Equipment Repair

Instructional - list course: 185

Student project-not tied to a course: \_\_\_\_\_

Other: \_\_\_\_\_

Location (if applicable): \_\_\_\_\_ NIU Inventory Tag# \_\_\_\_\_

Detailed description of work. Please attach drawings or flash drive if needed.

*Please make 1 BRACKET FROM SUPPLIED MATERIAL. Drawings attached.*

*BRACKET.PDF*

*.DXF*

*.SLDPRT*

DR. ADVISOR

Faculty signature approving request

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES			
ANGLES	.X	.XX	.XXX
±.5°	±.02	±.01	±.005

# Work request / Makerspace inquiry – equipment, capacities, files



- **3D printers (require .STL files)**

- **FDM** (PLA material is typical, PETG and flex possible)- **standard parameters; 20% infill, .3 mm layer**

- \*Prusa mk3 FDM - 210mm x 210mm x 250 mm (8.3"x8.3"x 9.8")
  - Crealty cr10s – 11.8" x 11.8" x 15.74" (11.8 x 11.8 x 15.74)

- **SLA** (.STL files) SLA printer with various Formlabs materials

- \*Formlabs Form 2 SLA - 145mm x 145mm x 175 mm (5.7"x5.7"x 6.8")

- **CO2 Laser cutter/ engraving (.DXF files)**

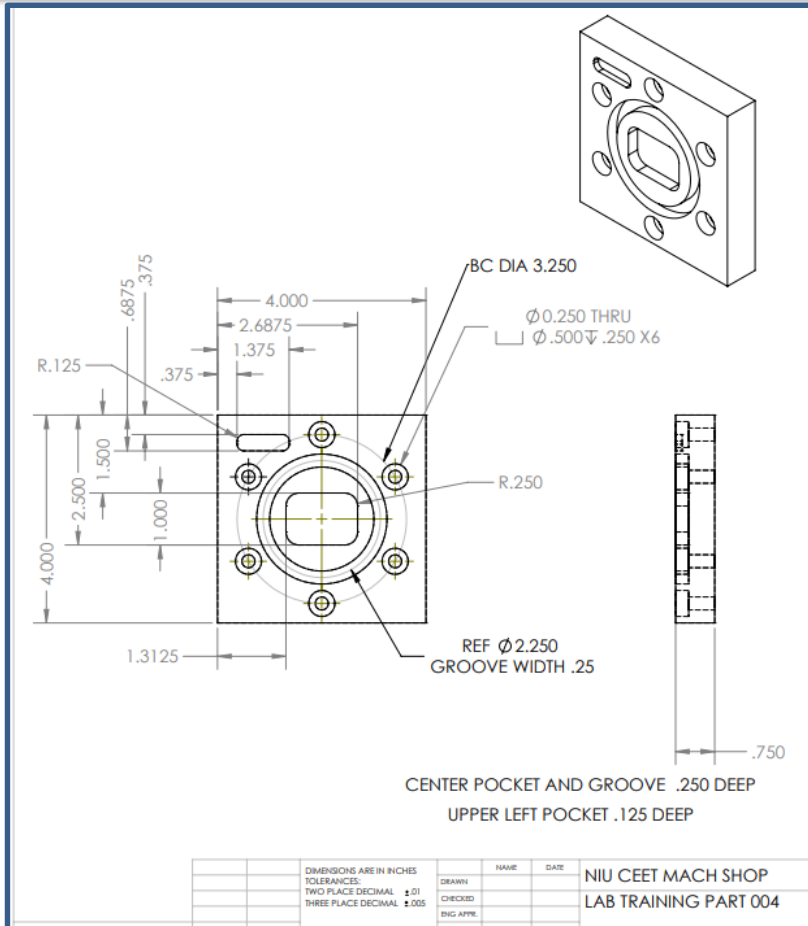
- \*Universal laser 100w CO2 - 18x32 table approx. up to ¼ inch cutting / engraving (mat board, acrylic, etc.)

- \*Epilog laser 50w CO2 - 12x24 table approx. up to ¼ inch cutting / engraving (mat board, acrylic, etc.)

- **CNC, Vertical Mills, Lathe, OMAX waterjet (.dxf,.PDF, .sdlprt, .STEP - for CNC model import)**

- \* mill, lathe, waterjet, sheet metal, CNC mill and lathe, bending

# Drawings / Files



Do not email drawings unless asked...

We need to be able to open them and make sure the versions are compatible.

Drawings should be complete and include; material, quantity, and any special instructions.

Decimal inch units are preferred set your units and tolerance to ips (.XXX)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES			
ANGLES	.X	.XX	.XXX
$\pm .5^\circ$	$\pm .02$	$\pm .01$	$\pm .005$

Discuss file types needed with the shop.  
i.e. pdf / .dxf / .sldprt / printout 1:1 / .stl

Different processes require different files.  
(laser, waterjet, CNC milling, Welding, fabrication/bending, rapid prototyping.)

# Other Resources



- Senior Design Studio- EB 354 (24/7)
- Team Bench- tool box and secure cabinet
- Tinker Space- (24/7) drill press, sander and drill, dremel, jigsaw, etc.
- Maker Space- 3d printers, CO2 laser for thin woods and some plastics, hand tools and small bench tools and assistance
- Manufacturing lab (8-4:30)- welding / fab, mill, lathe, waterjet, sheet metal, CNC mill and lathe, CO2 laser, 3d printer, material handling, training, supervision, guidance and assistance
  
- Private shop-i.e. Walt Ltd- local contract machining / fabricating, project sponsor...
- **Xometry, Vention, Protolabs** 3d print, **e-machineshop** – online job shops

# The next step and Frequently asked Questions...



**Q- I have had the meeting, what is the next step?**

**A- Once we have the initial work request etc. inquiry meeting, and we have determined that we can assist with what you need we will send (e-mail) a work request form to the faculty member.**

**Q- How soon will I get my parts, what is the turnaround time?**

**A- Turnaround largely depends on complexity, scheduling and if we run into problems. Sometimes it's less than a day other times it could be weeks or months.**

**Q- Do you have any scrap?**

**A- We have some limited scrap, but shouldn't you be specifying you materials more carefully????**

**Q - Do you supply materials, fasteners etc?**

**A – Not generally, we have a limited supply of common fasteners but we can help you decide what you may need and where you can get it. 3D prints that require small amounts of on hand material will generally be provided.**

**For certain projects and large amounts of material we ask that you provide material.**

**Q- Can I use the water jet, saw, mill etc. etc.?**

**A- Yes you can... after you have been trained and we have helped you decide the most appropriate machine / process.**

**Q- Can I work alone / after hours / this weekend?**

**A- Nope, not in the shop sorry. You will have to schedule your time around available resources.**

**Your "group" space and the EB354 "tinker space" are also available for students in Senior Design.**





# Design Considerations and Guidance



# Design for your resources

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The college has a well-equipped general machine shop with milling, drilling, turning and fabrication capabilities. The shop has a mix of manual tool room type equipment such as Bridgeport knee mill, tool room lathes as well as CNC - Haas tool room mill, Proto Trak mill (3 axis) and tool room lathe (2 axis) as well as various other machine shop support equipment. (band saw, drill press, cutoff saw, hand tools)

In addition to normal machining capabilities, we have fabrication equipment such as Mig and Tig welding up to about 1/4-inch, sheet metal shears, benders, a 50 w 12x24 co2 laser used to cut acrylic and various other nonmetals.

The shop also is also equipped with an Omax-2 axis waterjet machine that can cut most materials economically up to .5 inch and occasionally up to 3 inch depending on materials.

We do not charge for our services but for planning purposes you should expect a shop to charge around \$ 150.00 / hr. Also, be aware that our machine capabilities outpace our staffing and we do not have expert machinists able to routinely make high precision or production / job shop parts.

We do have a lab manager and two lab mechanic technicians that can help you decide on manufacturing approaches, materials and will guide you in safe machine operation.

# Plan ahead...



The machine shop /manufacturing lab is tasked with supporting many areas of the college...

Instructional lab support – parts, fixtures, repair etc.

Research project and lab support – many varied projects and requests

Training and guidance for manufacturing lab equipment - student projects, research projects, instructional, team and club projects, events, engraving, truck and trailer training, etc. etc.

## Some examples

MEE 320 – walker project

MEE 390 – Experimental methods, many different projects

MEE 331 – Manufacturing processes

MEE/ELE/ISYE/Tech – Senior Design multi disciplinary

ISYE 350 – Manufacturing Processes

Tech 260- Metal Fabrication Processes

Tech 362 – CNC

Tech 262- Machine Production Processes

Tech 420- Computer Integrated Manufacturing

## In addition

Team/ club support- Baja, Formula, Super M, Aero, Snowmobile, Robotics, Mars Rover, etc...

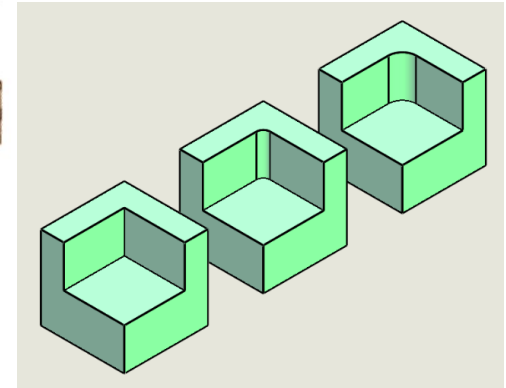
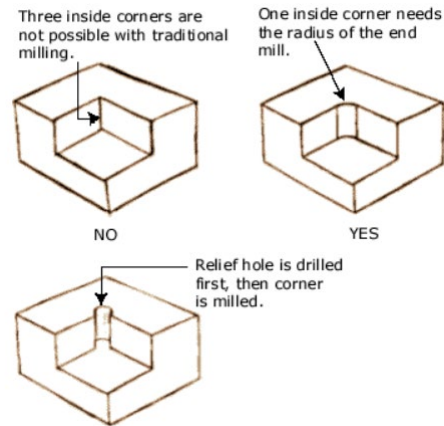
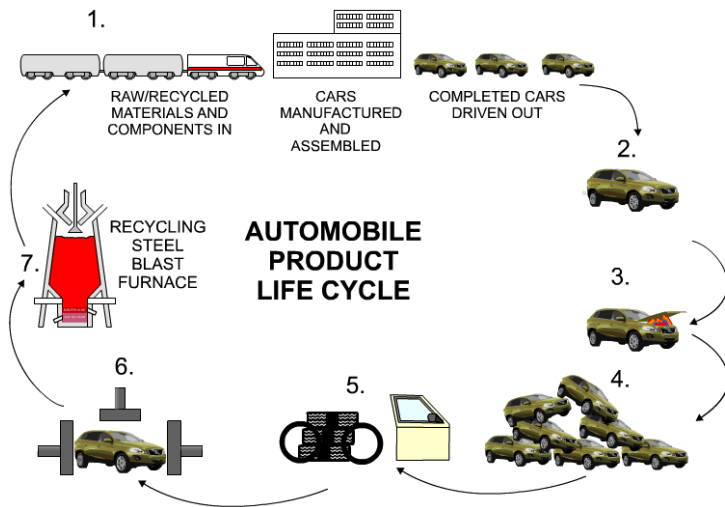
# Design for (X)



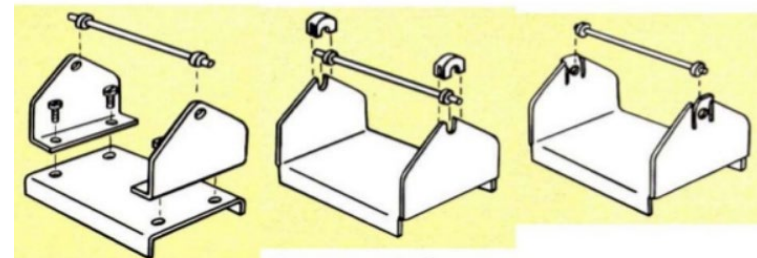
**DFM** – Manufacturing – can it be made?

**DFA** - Assembly – how will it come together?

**DFX** - Lifecycle – how is it disposed / recycled what happens at the end of the semester?

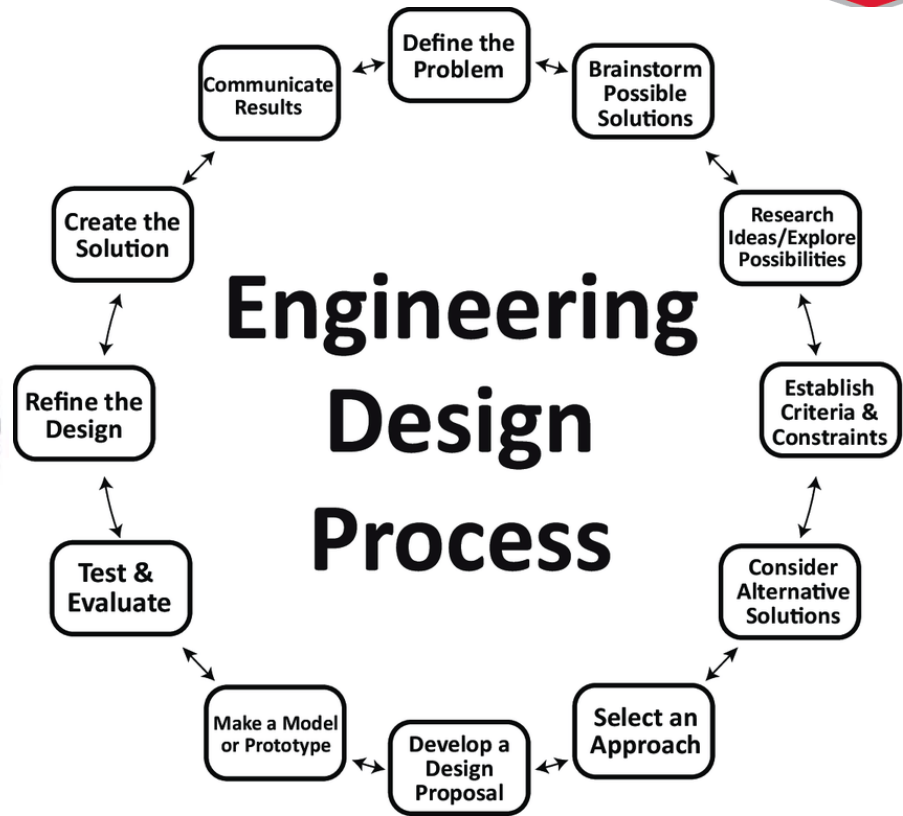
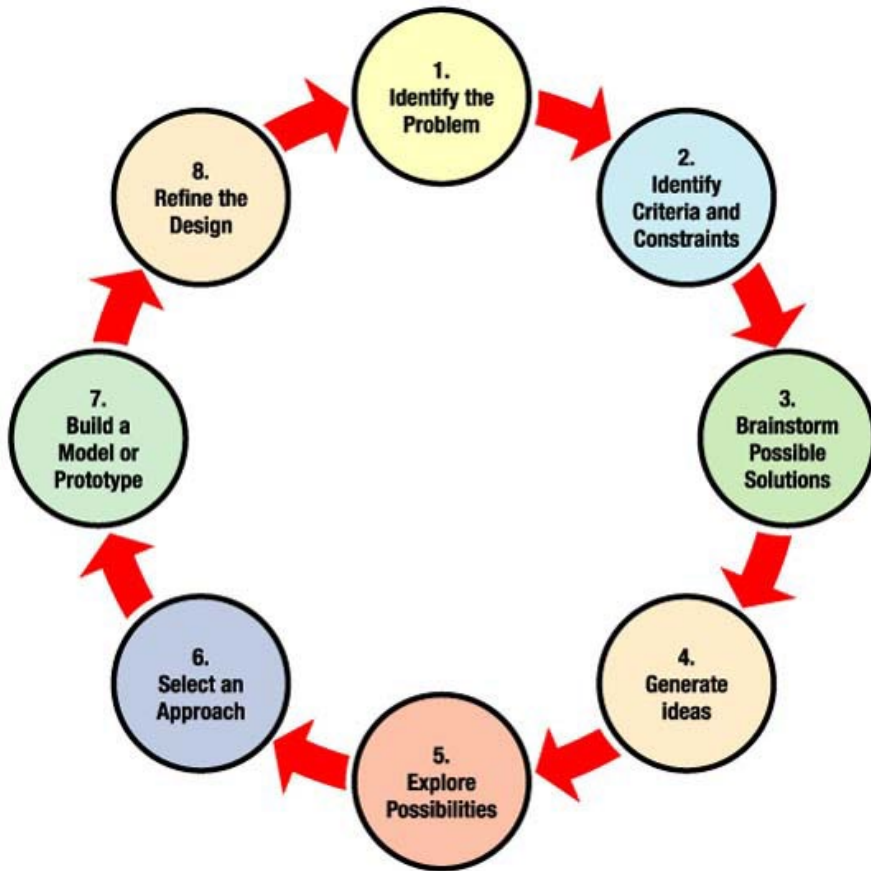


Three solutions to the same design issue.



Comments?  
Which do you prefer?  
Why?

# Engineering Design Process examples



# Team / Project contact info



A project contact card (3x5) **should** be posted on the workbench / work area to identify who to contact if there is a problem or assistance is needed.

<b><u>Team #:</u></b>	<b><u>Project Name:</u></b>
<b><u>TA:</u></b>	
<b><u>Faculty Advisor:</u></b>	
<b><u>Members:</u></b>	

**QUESTIONS,  
COMMENTS, DISCUSSION?  
LAB TOUR**



ANY  
QUESTIONS  
?

# EB Machine Shop Equipment

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES

ANGLES	.X	.XX	.XXX
±.5°	±.02	±.01	±.005



Machine	Make	Model	Serial No.	NIU Inventory #	Date	Status	Size	HP	RPM
Spot Welder	Miller	LMSW-52T	LHO24598		1995	Good			
Tube Notcher Cutting	Baileigh	M800	37898726	311008	2007	Good	1"X3"	1	1430/1720
Tube Bender	Mittler Bros	#2500 180 Degree		281602	2005	Good	3/4"X2"		
MIG Welder	Miller	millermatic 251	LH121023B	285726	2007	Works Well			
TIG Welder	Lincoln	Precision TIG 225	U1130303606	317773	2015	Works Well			
Iron Worker	Baileigh	SW-553	71135	286078	2008	Good			
Pnumatic Hand Tap	Flexarm			297195		Good			400
Drill Press	Arbora Maskiner	A 3008	334786	215600	1996	Good			1420/1720
Lathe	Promax	LG 1767	98295	243847	1999	Good	16"X67"		75-1350
CNC Mill	Bridgeport	V2XT		211505	1993	Needs Updating	36"X12"	3	60-4200
Mill	Bridgeport			267207	1995	Good	36"X12"	2	60-3000
Lathe	Hardinge	HLV-H		215987	1996	Good			
Lathe	Sharp	GGT 1118H	0810 255	290848	2004	Good			
Industrial Press Hyd	Carolina	CBP 1200	1181 NM	164268		Good	50 ton		
CNC Mill	ProtoTrak	TRAK DPMSX5	NICG63437	298275	2011	Works Well		5	
Pedistal Grinder	Baldor	500	PO 105	256057		Good		half	3600
Sander	Wilton	4202	33525	237695		Good		third	1725
Vertical Bandsaw	DoAll	2013-V	500-971638	229802	1996	Good	20"		55/5200
Horizontal Bandsaw	DoAll	C-9165	529-99803	243997	1996	Good	16"	2	1425
Surface Grinder	Harig	618 Automatic		215512		Good		2.5	
Sand Blaster	Frinco	48 BP	51190-9	243999		Good			
Coldsaw	Baileigh	CS-350 SA	5033431	285861	2008	Good	14" 4.33" rd.	3	1730
Bead Roller	RMD	BR-36	37898011	311007	2011	Good		0.5	1725
Powered Roller	Baileigh	PR-403	46104	290774	2007	Near New			
CNC Lathe	Haas	TL1	3096931	317782	2013	Near New			
CNC Mill	Haas	TM1	1107193	317781	2013	Near New	30"X12"	7.5	
Powered Brake	Baileigh	BB-4816M	A1126805	307396	2008	Good			
Powered Shear	HM	JBS 1250/3.0	1998/630118	249447	1995	Good			
Water Jet	OMAX	555	J511583	306216		Good			
Tube Notcher Sanding	RMD	900	37391719	290775	2008	Good	3/4" 1 5/8"	5	3450
Mill	Bridgeport	HJ	3211011	321740	2014	Near New	36"X12"	2	60-4200
Lathe	Sharp	1118H	GCT1410390	321789	2014	Near New			
Holepunch	Rotex	ROTEX 18	L1055			Good	18		
Belt Sander	Delta	31-340	K9015	180194		Good		third	1720
Belt Sander	Wilton	4002	CHO40244			Good		third	1725
Hand Roller	Tennsmith	SR48	9910	297295		Good	16 ga.		
Hand Shear	Di-Acro	SHEAR NO.4	Jan-86			Good	16 ga.		
Hand Brake	Berkroy	B90	3883			Good	16 ga. mild		
Hand Brake	National	46-4812	856-799			Good	12 ga mild		
Hand Bender	Eureka	TRIS		318770	2015	Near New			
Weld Vent	Great Lakes Air	DFP-800-1	21441	297176		Good		0-Jan	



Notes:

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Notes:

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