

Grainger Engineering Student Design Campus (ESDC)

Where Engineering comes ALIVE!

ESDC Safety Policy and Procedures (Required for ESDC Buildings Access)

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ESDC and Safety Policy

The Engineering Student Design Campus (ESDC) strives to provide a safe environment for multi-disciplinary student teams to build and prepare engineering projects for prestigious national and international collegiate competitions. Because this fabrication work is intrinsically dangerous, safety must continually be a vigilant priority for every student. The present safety rules and policies in this document are to be followed by all who use ESDC.

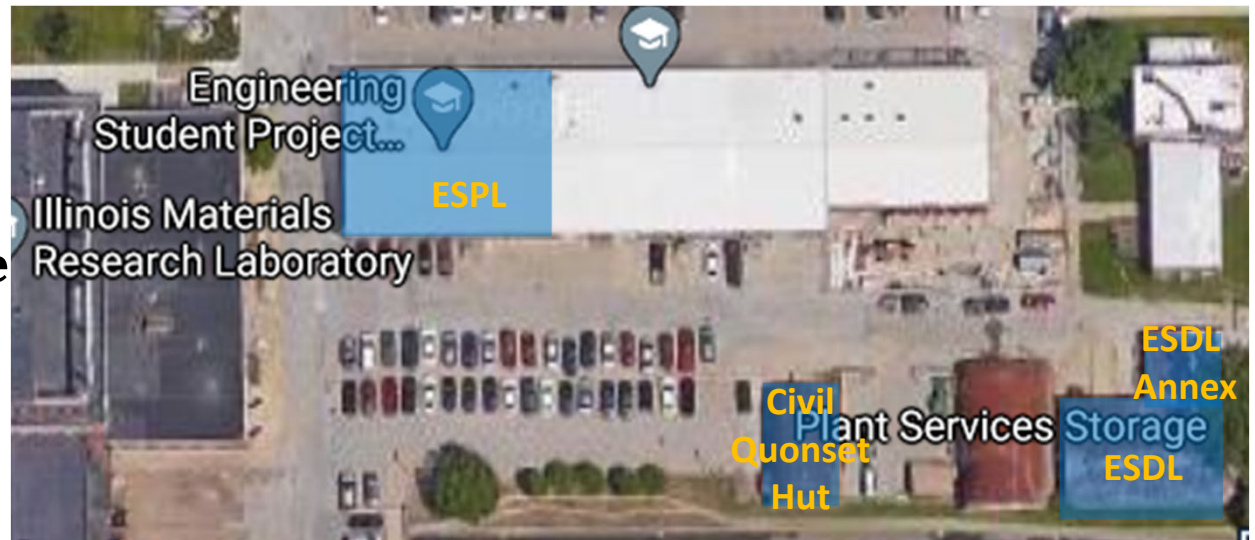
- Mark Pinson is responsible for direct supervision and oversight of ESDC including all safety and training programs as the ESDC supervisor.**
- Ed Chainani is the Grainger Engineering Safety Director and Jose Corral is the Safety Engineer for the entire college and provide guidance on ESDC safety requirements and improvements, including revisions to the present document.**
- Jason Merret is the Chair of Engineering Design Council, which oversees funding and space allocation to teams in ESDC.**

ESDC Spaces

ESDC consists of the following spaces illustrated below:

- **Engineering Student Projects Lab (ESPL-1203 W Western Ave in Urbana)**
- **Engineering Senior Design Lab (ESDL)**
- **Engineering Senior Design Lab Annex (ESDL Annex)**
- **Civil Quonset Hut (HUT)**

**Safety training is required
before accessing any of these
ESDC buildings!**



Our Values:

Respect Others

- Treat everyone with courtesy, politeness, and kindness.
- Celebrate diversity – listen and consider other perspectives.
- Give others the empathy and understanding you would want.

Respect Yourself

- Keep your word.
- Know your limits with both time and energy.
- Take appropriate safety measures.

Respect Our Home

- Always leave ESDC in better condition than you found it.
- Don't take what's not yours – ask if you need help.
- Make ESDC a place you can be proud of.

Purpose of ESDC

- To enable engineering RSO teams to be competitive in *national* and/or *international* engineering *competitions*.
- To pioneer a *multi-disciplinary* learning environment that enhances understanding of engineering *theory with practice*.
- To provide instruction for students in basic shop *safety*, *machining* *welding hands-on training*, and *team management* skills.

RSO admittance to ESDC

- For a group to have access to ESDC it must be:
 1. An RSO (Register Student Organizations) in good standing
 2. Be competitive in a national or international competition related to engineering,
 3. Multi-disciplinary: the majority of team members should come from at least three departments in the College of Engineering.
 4. Granted access to ESDC by the Engineering Design Council.
- Admittance to ESDC is a privilege NOT a right. It can be revoked.

I-Card access/door access to ESDC requires following steps:

1. DRS Training: <https://www.drs.illinois.edu> Take

a) *Laboratory Safety Training, Part 1 and Part 2 (valid 3 years) and*

b) *Fire Extinguisher Training (valid for 1 year), and*

c) *Electrical Safety: Fundamentals (valid indefinitely)*

Email the certificate pdfs to your team's safety officer so they can mark this on your team roster.

2. Read the present document and take PrairieLearn "ESDC Door Access" Test:

https://www.prairielearn.org/pl/course_instance/129223

(must obtain 100% correct) This test covers everything in the present document and includes uploading PDF certificates of the above DRS training

Special training

1. Students **must** take special safety training courses **and** pass the safety training tests in order to:

- Access or use the Machine shop or any of the CNCs Access or use welding equipment
- Work with or near lithium-ion batteries or DC power

Contact the ESCD Supervisor (Mark Pinson) for training details

COVID

- Do not come to ESDC if you are sick with COVID or anything else!
- Follow posted room occupancy limits
- Follow guidelines given here as guidance is continually changing:
<https://covid19.illinois.edu/> and more specifically for students here
<https://covid19.illinois.edu/on-campus/on-campus-students/>



Why are knowing safety rules important?

- *You* make the *choices* that affect *your health* and well-being
- Your *co-workers* and staff personnel *rely on you* to keep them safe.
- You need to be *empowered* to *confront* others if they are not acting safely. It is your *responsibility* to talk to someone who may be doing something unsafe. If they don't listen to you, notify the safety officer of your team and theirs, and let the ESDC Supervisor know what happened. You both will get into trouble if you don't.
- Any serious safety lapses and/or accidents would be a *tragedy* and would likely result in ESDC Complex buildings/facilities *closure*.

Nine main safety rules:

1. *Clean* work area – and keep it that way.
2. *Safety glasses* to be worn in all work areas at all times.
3. *Hearing protection* used near loud equipment or activities.
4. *Respiratory* (inhalation) *protection* used for chemicals and fine debris.
5. *Appropriate dress* (closed toed shoes, no loose clothing, no jewelry, no loose hair, no shorts (pants only)) in all work areas:
6. Use only *tools* and equipment you are *trained* on, in a safe manner. Ask the ESDC Supervisor for training if there is any doubt.
7. Use the *buddy system* when using *power tools or chemicals*.
8. *Hazardous chemicals* should be used only in appropriate locations and only stored inside the yellow chemical storage lockers

Why being “Clean” is so important?

- The most common work injuries occur because of messy work areas.
- Teams must **maintain a 32” wide aisle** from the entrance to the back of every work room and in front of all fire-extinguishers and circuit boxes.
- **No cardboard boxes on floors** (put on shelves or under tables).
- **Workbenches** must have **1/3rd of the work surface clear before leaving**.



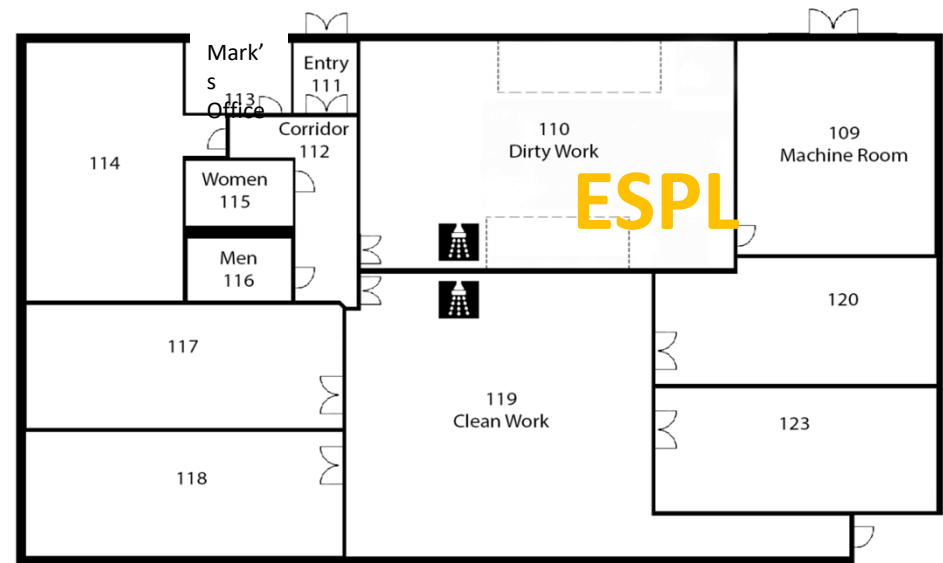
Team Work Space and Meeting Area– ESPL room 114

- Half of the computer lab is a *communal space, the other half is team assembly space*.
- Only scheduled design related work and meetings are done in the computer lab area, so:
 - No team may have more than eight hours scheduled in any given day, max, in the computer lab.
 - No food
 - No sleeping.
 - No fabrication work of any kind in (sanding, gluing, etc) the computer lab space.
 - No team items except in designated cabinets.
 - *Items left on the conference table over-night will be disposed of.*
- Log off computers when you are done. If you are running a longer simulation, *leave a note*.



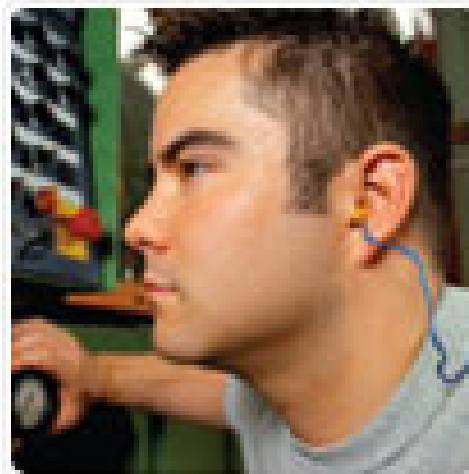
Safety glasses

- Must be worn at all times in all of the areas, except
- NOT ESPL 111, 112, 113, 115, or 116



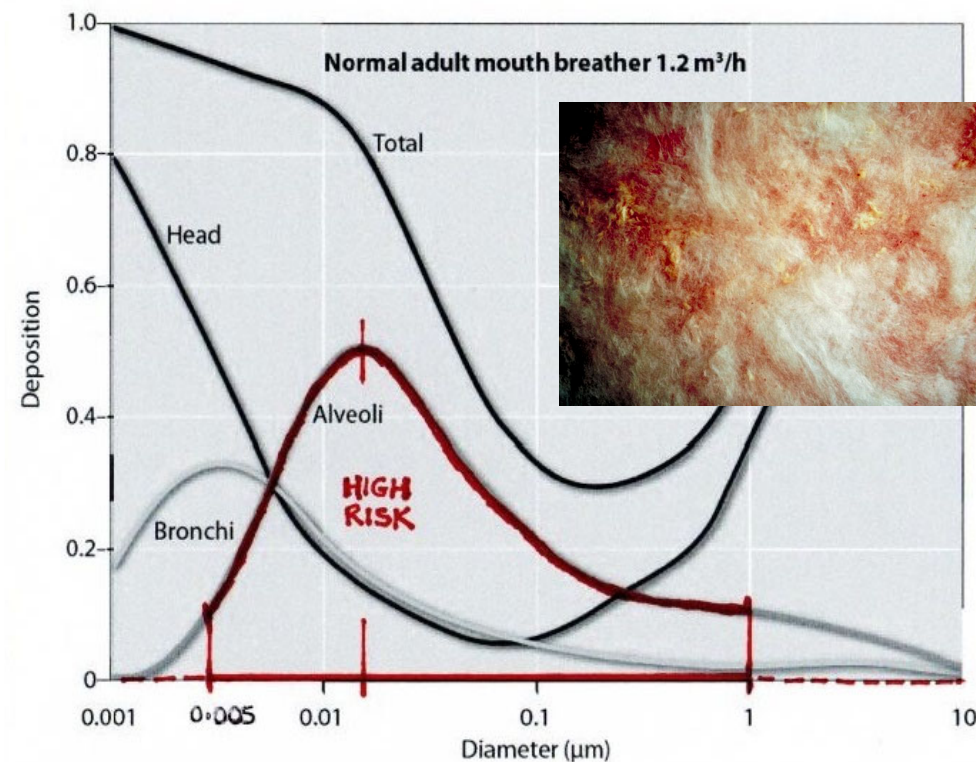
Hearing protection

- Required when noise exposure exceeds 85 decibels. If you suspect an activity in excess of 85 dB, you can request a noise survey from Safety and Compliance.
- Use hearing protection anytime noise level is loud enough to prevent a *normal conversation* at a normal distance without shouting.



Sanding & cutting fiberglass and carbon fiber

- Sanding can release fiber and resin particles that get in your eyes or become lodged in your lungs or skin pores and will not come out.
- Health concerns:
 - Lung *inflammation* and *difficulty breathing*
 - *Rash* and itchy or irritated skin
 - Severe eye irritation and *corneal abrasion* when you rub your eyes



Source: W.G. Kreyling, adapted from International Commission on Radiological Protection.

Sanding & cutting rules for composites

- Check Material Safety Data Sheet (MSDS). Will any toxic materials be produced? Only *paint*, *epoxy*, and/or *bondo* can be sanded at ESDC without further training (see ESDC Supervisor).
- For sanding, use a *vacuum*, a *sink with running water* or the *paint booth* with the exhaust on.
- The “ESPL Composites ShopVac” should be used whenever cutting composite materials or cleaning up sanding debris. Seek guidance from the Supervisor before emptying or opening this ShopVac.
- Required PPE (Personal Protective Equipment)
 1. Respirator (aka mask with filtration)
 2. Goggles
 3. Nitrile gloves
 4. Long shirt tucked into gloves
- Composite work *must* be done with a “buddy”
- All people nearby must wear a respirator and goggles



Buddy system for composite sanding/cutting

- Buddy should help verify PPE is used correctly (goggles, respirator, gloves, appropriate dress, etc.)
- Buddy can immediately collect any particles with a vacuum (*if dust isn't collected, then someone else will be exposed*)
- One person works, the other should watch for health warnings:
 - Rapid breathing
 - Headache or dizziness
 - Confusion or visual misperception
 - Sense of euphoria or apparent drunkenness
- If you notice any health warnings, stop working on composite and move to area with fresh air!

Respirator usage & storage

- Respirators (w cartridges) and a sharpie pen are stored in zip-lock bags on the shelves above the drinking fountain.
- Each circle on a cartridges represent 1 hour of use
 - Darken circles for time used when finished
 - Use $\frac{1}{4}$ hour increments for filling in circles
- When done, wipe off the mask using an alcohol wipe and return the sealed zip-lock to the shelf.
- If all the circles are filled in, place the entire zip-lock bag in the “expired” container on the shelf.



Respirator requirements to use

- It takes work to breathe through filters – if you have any *physical impediment* (e.g. sickness or cough) you cannot use a respirator.
- You must be *clean shaven* to use a respirator (no *beard* or *mustache*)
- Know how to do a *negative pressure “fit-check”* as shown in the video (<https://www.youtube.com/watch?v=nFTtfA73Oa4>)
- Only to be used for sanding *epoxy*, *paint*, or *bondo*. For other use with chemicals or if required by MSDS, see ESDC Supervisor for certification & training.
- Chemical cartridges for respirators are available, but they should be over-protection as there should not be chemicals used inside ESDC that require the use of a chemical cartridges. Curing of special epoxies needing chemical cartridge respirators should be done outside ESDC.

Appropriate dress

- Closed toed shoes in work areas where you need safety glasses.
- No jewelry, loose clothing, or loose hair is permitted around power tools and in work areas.
- If you are giving a tour, then jewelry and clothing restrictions can be waived, but no work should be done while tour is nearby.
- Long pants are required, no shorts are allowed.



Power tool safety

1. *Dull* tools become very *dangerous* tools- do not use them
2. Use the *right tool* for the job – “novel” uses for tools are often the causes of injuries.
3. *Secure work-part* – major cause of injuries with power tools is something coming free.
4. Make sure you use the correct *PPE* (personal protection equipment)
 - safety-glasses, face-shield, ear-plugs, respirator, etc.
5. Keep others at a *safe distance*
6. Personal tools are not allowed unless written ESDC Supervisor is given.

Power tool best practices:

- Always push power tools *away from you* – don't pull it toward yourself
- Always keep a tool *safety guard* between you and the cutting edge
- *Never force* a tool – turn it off if it becomes jammed.
- *Think* about possible Hazards when using the tool:
 - Eyes contaminated with debris, skin contact with a cutting surface, puncture wound potential, entanglement hazards, flying hazards, heavy object collision, etc.
- *Secure work* with vice or clamps freeing both hands for safer tool use.

Glove usage

- Sometimes a good idea, sometimes bad
 - Use rubber gloves when using any chemical that has an MSDS that requires their use (i.e. anything stored in the yellow flammables cabinets, paint, and epoxy)
 - Use leather gloves when welding or operating a torch.
 - Because rotary tools can catch a glove and pull the hand into the tool, **don't** wear gloves with rotary tools – they are **not** allowed in the machine shop.



Tool storage

- Do not use tools with which you do not feel *comfortable*.
- Do not *borrow* tools without *asking*
- All tools should be *labeled* as to which team they belong:
 - Orange – FSAE
 - Blue – IFE
 - Green – Baja
 - Yellow – Supermileage
 - Red – i-Robotics
 - White – Solar Car
 - Silver – Rube Goldberg
 - Pink – ESDC general use
- Unlabeled tools that are left out will be collected, and after 1 week be colored pink

Grinder & belt sander safety

- Keep *hands away* from the abrasive surfaces – pinched fingers can get *severely damaged* very quickly!
- Keep part surface *normal* to grinder surface so part doesn't get pulled between the grinder guard.
- Keep part *against work rest*

Contact the ESDC Supervisor if either guard or work rest are not positioned correctly

Tongue Guard

1/4 in.

1/8 in.

Work Rest



Buddy system

- You need to have another person **with ESDC access** working with you, **not involved in another activity**, when doing **any potential dangerous activity**, such as using:
 - Any **power tool** – electric or air-powered, in the machine shop or work rooms
 - Any **chemicals** – epoxying, dispensing gasoline, spray painting, etc.
 - A **respirator** – sanding epoxy, paint, and/or bondo, or composite cutting
- In the event of an accident the other person needs to be able to:
 - Phone 911 for assistance
 - Assist you to a safe area, the safety shower, and/or provide you with initial first aid
 - Be trained in the activity and with the tool you are using to shut it down safely
- “Vicinity” – defined as **hearing distance** and **in line of sight** of the person using the power tool, chemicals, or respirator. Assume within ~10 feet.

Chemical labeling & storage:

- All chemicals need a NFPA diamond label, and if **any number is higher than “1”** it must only be stored in the **yellow cabinets** in ESPL room 110 (not in team areas). **No chemicals should be stored or used in any other ESDC building.**
- Examples:
 - Gasoline, acetone, & ethanol: 1 – 3 – 0
 - Latex paint: 1 – 0 – 0
 - Motor oil: 0 – 1 – 0
 - Epoxy hardener & fiberglass resin: 3 – 1 – 1
 - Engine cleaner: 2 – 2 – 0
 - Brake fluid: 1 – 2 – 0
- Before a chemical is brought inside ESPL, you **must provide MSDS and have permission** from the team captain and ESDC Supervisor, and it must be **clearly labeled**.
- Used oil is disposed of in the barrel in ESPL room 119



Chemical labeling & storage:

- ESPL is currently the only building in ESDC equipped to store or use chemicals as outlined in the previous slide. So, **no chemicals should be stored or used in any other ESDC building.**
- None of the ESDC buildings are set up to store or utilize dangerous chemicals, defined as anything with an NFPA rating in the “health hazard” or “instability” categories of greater than 1 or a “fire hazard” greater than 3, **so these are not allowed in ESPL and ESDC.**



Chemical spills & hazards

- Review the following Chemical Spills - DRS Library!
<https://www.drs.illinois.edu/Page/AccidentResponse/ChemicalSpill>
- In the event of a spill, notify nearby students, get the chemical spill kit (in hallway near bathrooms), and cover the spill with the absorbent material. When absorbed, sweep it up and dispose.
- If spill become life threatening (e.g. large, dangerous, etc.) then evacuate the building, call 911, and then call the ESDC Supervisor.
- *Paint* ONLY inside *paint booth* in ESPL room 110 or outside.
- *Epoxy curing and mixing* is done only in well ventilated areas (i.e ESPL room 119 or 110). If the MSDS requires fumes to go outside, then cure either *inside the paint booth*, or if vacuum infusing, with the vacuum exhaust tube going outside under the garage door.
- No welding near a fuel source or trash can.
- No food in ESDC as the environment is not conducive



Safety responsibilities required by each team:

- Each team must have a Safety Officer; whose main responsibilities include:
 1. Managing and updating their online team roster page supplied by the ESDC Supervisor
 2. Collecting electronic DRS certificates from team members and adding this information to the roster.
 3. Attending the team safety walk-throughs by the ESDC Supervisor and/or other University Safety representatives, and maintaining their team's fire extinguishers, including documentation.
 4. Discuss with your members safety close-calls, near misses, and ways to improve safety. These are to be shared with everyone during the scheduled safety officer meetings at ESDC.
- Keep work areas clean, floors uncluttered, and paths to fire-extinguishers and electrical boxes clear.
- Keep worktables clean with at least 30% of the surface area “clear” or open.

Paint booth use

- The paint booth exhaust fan should be kept running whenever paint is still “wet” to the touch, epoxy has not yet “set,” or the sanding of parts is taking place.
- Be considerate of others and label your work with your phone number and when you’ll be back to get your part. Clean up any mess, and don’t use this area to store parts.

Electrical hazards

- Never carry a tool by its cord – cords can pull out of their connectors.
- Tools with exposed wires or frayed connections should never be used.
- Do not use electric tools in wet or damp environment, or near explosive chemicals or fire hazards.
- Never daisy-chain electrical cords



Daisy-chained multi-plug outlets

Electrical hazards

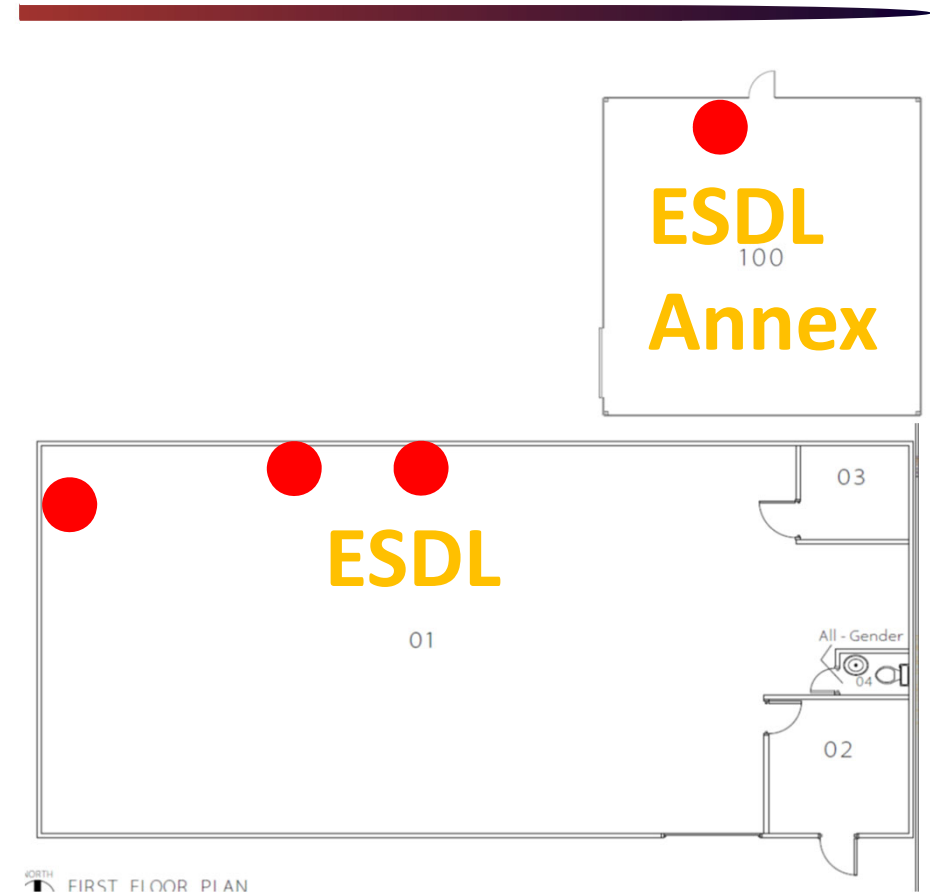
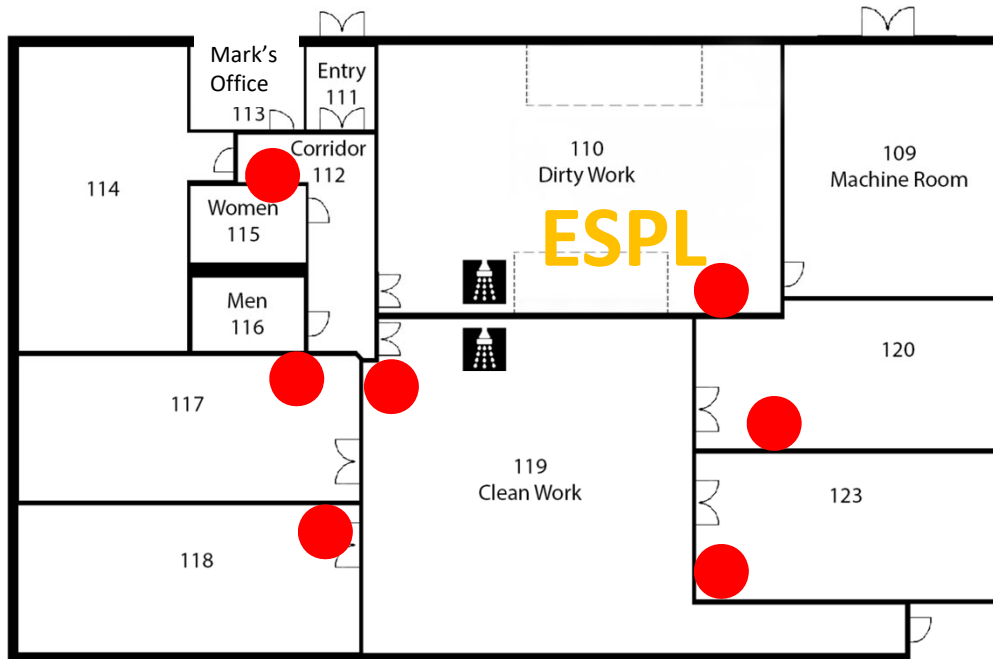
- **For electrical boxes that potentially can supply >0.1 amps at >60 volts DC:**
 - Special safety training is required (see special training slide)
 - Safety glasses and cut resistant gloves, blown checked for pinholes, must be used around boxes.
 - The Buddy System, along with 2 fire extinguishers, are required whenever charging or discharging.
 - Whenever batteries are at full charge, no flammables are within 10 feet, and at least two people should be monitoring the box temperature with fire extinguishers at hand.

Engine testing – internal combustion

1. No engine operation in the buildings
2. Engines should be rolled outside, door closed, and then with extinguishers and safety watchers, run their engines.
3. Must have working *fire extinguisher present* (within 20 feet).
4. Must have at least *2 people* present (do not start an engine by yourself).
5. Never leave a running engine *unattended*.

Fire extinguishers

*Forklift-One extinguisher mounted on the forklift upright frame



NORTH
FIRST FLOOR PLAN

CIVIL Quonset Hut

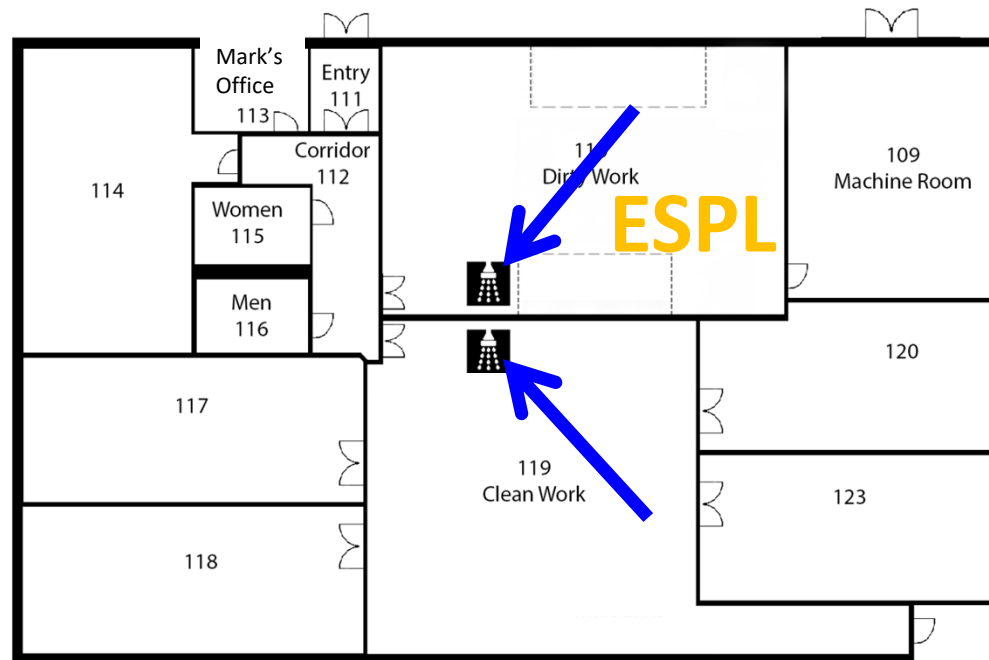
Bruce Flachsbart © 2020 University of Illinois at Urbana-Champaign

Reserved

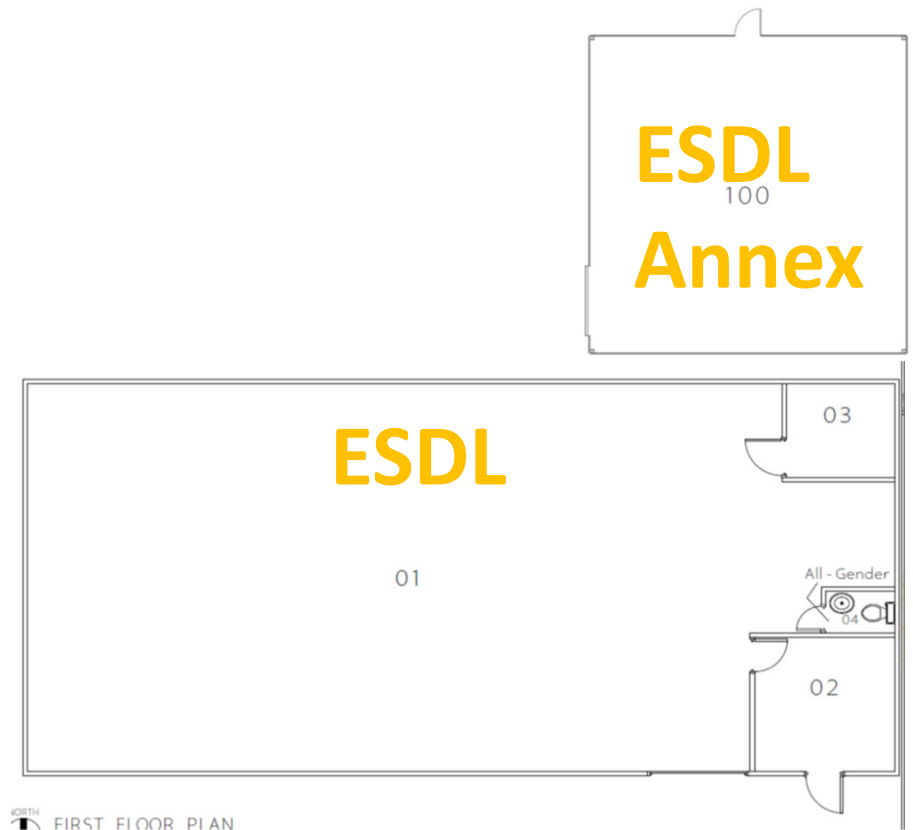
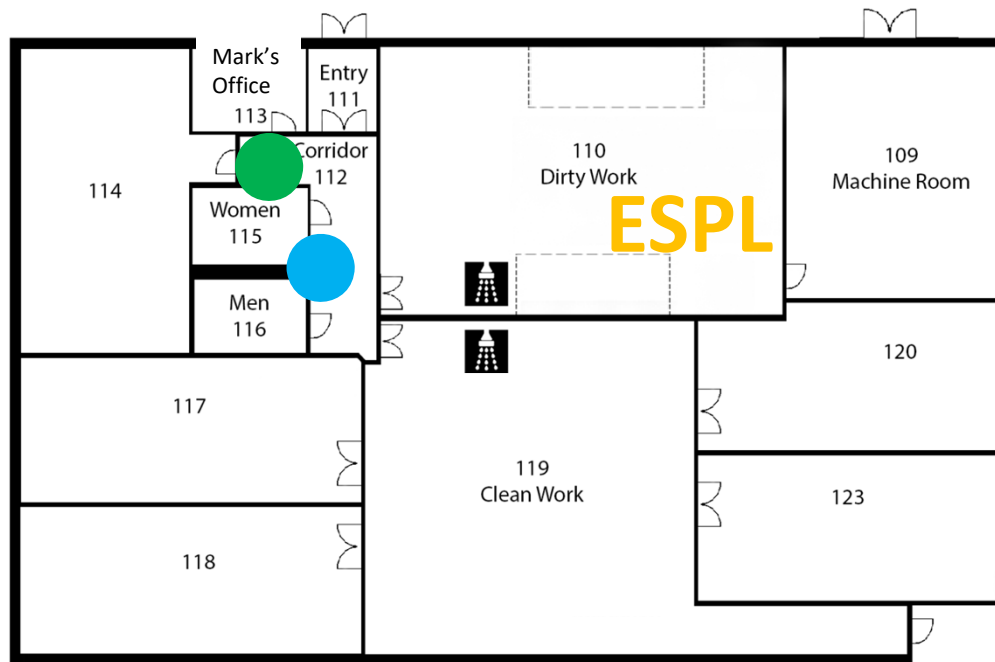
slide 36

I ILLINOIS

Eye wash stations



First aid / absorbent cleaner

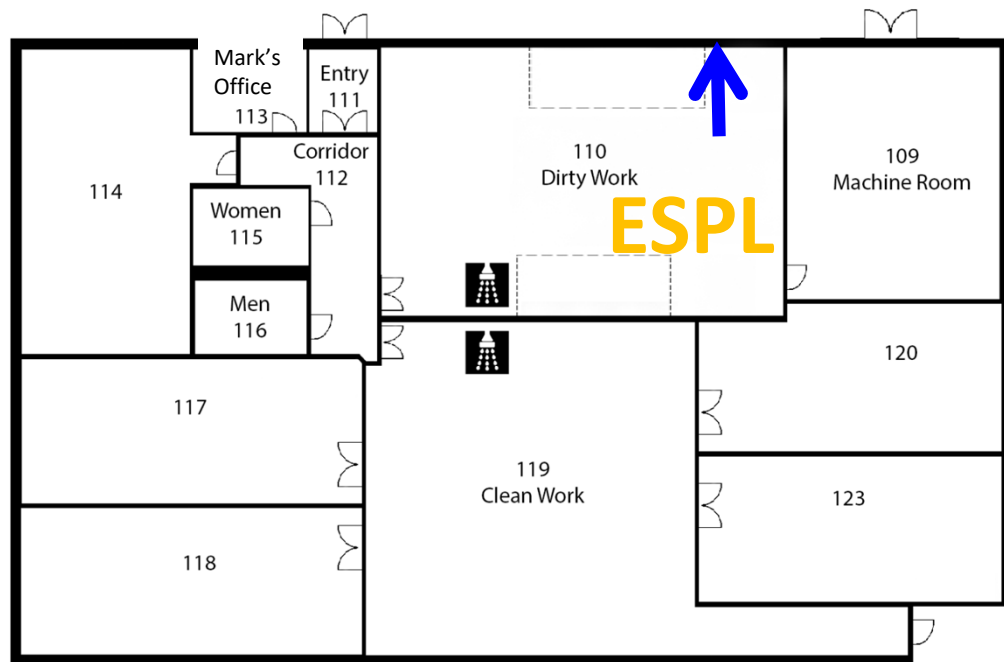


CIVIL Quonset Hut

Parking lot lighting

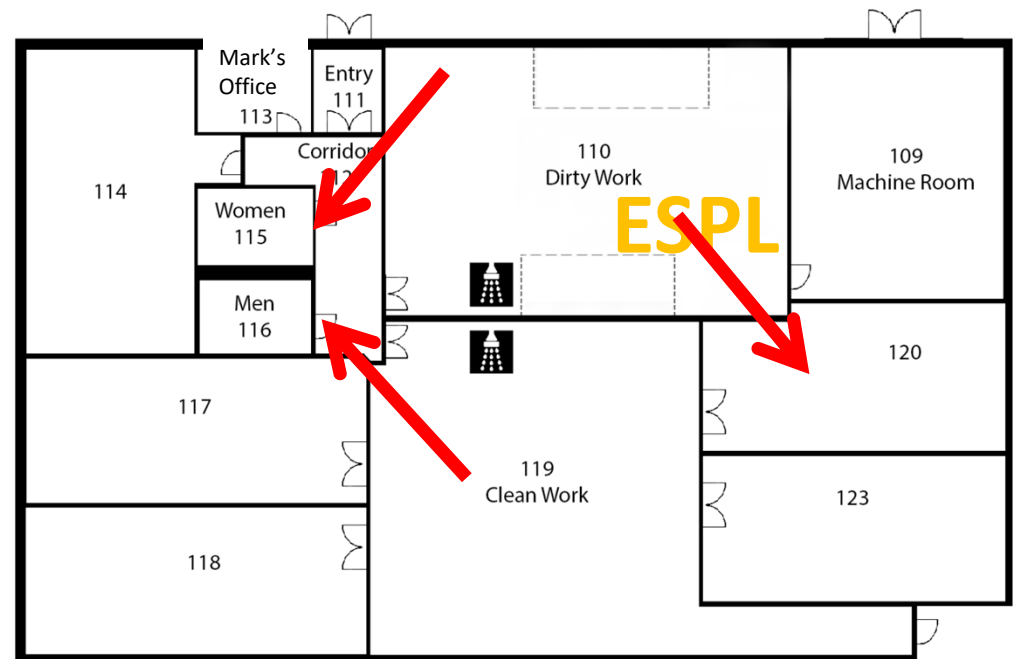
The parking lot is a *high crime area* – be aware of your surroundings and keep the garage doors *locked*.

ESPL lights have been installed outside the garage door; switch located at blue arrow Use at night but DO NOT LEAVE ON



Storm refuge

- In case of a tornado or damaging storm, please move to an ESPL interior room such as one of the bathrooms or room 120



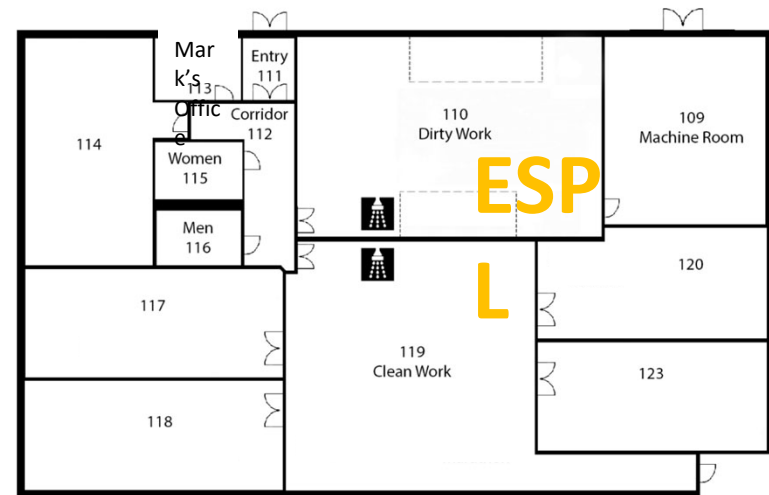
Evacuation area(s)

- If the fire alarm sounds, move quickly and carefully to the evacuation assembly area – located on the grassy area next to MRL (just to the West)

Evacuation
Assembly Area



- If the weather is bad, or the vicinity unsafe, then move to the secondary assembly area: on the front porch of MRL further to the west.



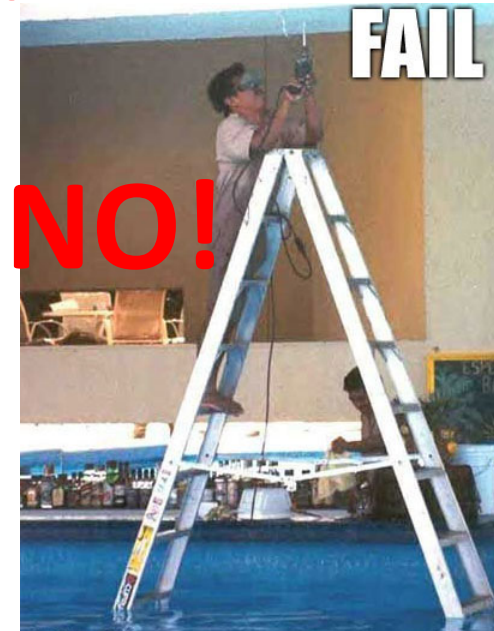
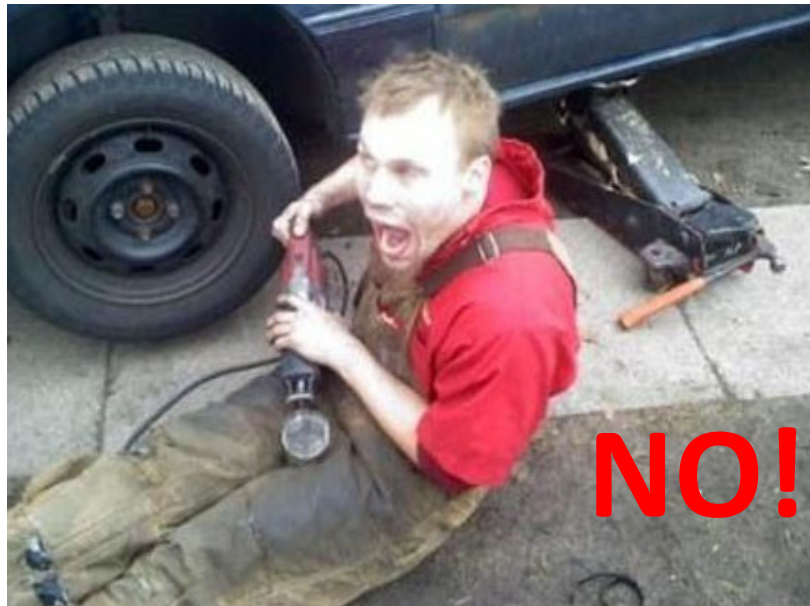
Threat action

- If you observe an individual carrying a weapon and/or acting in a hostile, belligerent manner you should:
 - Evacuate the area and call 911
 - If you can't leave safely, then secure yourself wherever you can.
- If Illini-Alert system notifies you of an active threat in your vicinity:
 - Do NOT leave the building.
 - Close and lock all doors. Stay AWAY from entrance doors.
 - Best to relocate to team rooms or the computer room – door closed.
 - Feel free to barricade the door and prepare yourself as you wish.
 - Do NOT leave until you receive an “all-clear” alert on the illini-alert system (you can sign up at <http://emergency.illinois.edu/>)

Your responsibilities

The causes of most accidents:

- I didn't see - *Make sure the work environment is safe*
- I didn't know - *Make sure you get the training you need*
- I didn't think - *Don't rush things and get enough sleep*



What to do if ...?

Spill:

- Water
 - Use mop to clean spill – *don't leave it to evaporate*
- Oil / Petroleum Fluid / Fuel
 - Pour absorbent from chemical spill cart on it and let it absorb for a few minutes
 - Sweep and discard used powder in trash.
- Chemical from chemical cabinet
 - Use absorbent material to contain and follow MSDS instructions,
 - Contact ESDC Supervisor and dispose of according to DRS procedures.

What to do if ...?

Accident or Fire

- If someone is injured, *get others to assist*.
- Help the person to a safe area, safety shower, and/or provide initial first aid (kit located near entrance).
- Use fire extinguishers to contain small fires - evacuate building if needed
- Have someone immediately call 911 to tell them briefly (& stay on the line):
 - *What happened*: the nature and severity of the injury, fire, or chemical spill
 - *Your location*: 1203 West Western in Urbana or just south of the Advanced Computation Building at 1011 West Springfield in Urbana
- Any injury requiring more than a band aid MUST be reported to the ESDC Supervisor and safety officer (don't wait until the next day – call Mark 217-714-9985)

What to do if ... ?

Tool / Machine Breaks

- Email ESDC Supervisor: mpinson@illinois.edu. Describe what is wrong. If you believe you can fix it yourself, talk with the ESDC Supervisor before attempting.
- Place a “Tool is Down” note on the tool, and your name and email, so someone can contact you if they have questions.
- Do not try to operate a machine if a “Tool is Down” note is attached.
- Your team could be charged to replace or fix a broken tool if negligence was determined to be the cause (but not for tool normal “wear and tear.”)

Handling of infractions

- First Offense
 - Verbal warning and team Leaders will be notified
- Second Offense
 - Access to ESDC removed. An acceptable essay must be written to the team leaders and ESDC Supervisor explaining why the safety infraction happened, why the rule is important, and why it won't happen again, and they must retake and pass pertinent safety assessments before reinstatement is considered by ESDC Supervisor.
- Third Offense
 - Access to ESDC will be removed, possibly indefinitely. The Engineering Design Council can review each of the three safety infractions, talk with the student directly, and make a recommendation to the ESDC Supervisor.

Expectations of students

Clean work area:

- Don't leave tools out or supplies on floor – keep walkways clean & clear
- Keep clear a 32" aisle from workroom door to back of room at all times

Friendly and respectful attitude:

- Be considerate of others wanting to use machines
- Learn people's names from other groups – be willing to help out.

Safety conscious: don't do anything FOOLISH

- If you see someone doing something they shouldn't – TALK WITH THEM.
- Do not work when tired, take a break if you need it – get enough sleep.

Take the PrairieLearn tests

- Go to the PrairieLearn

website: https://www.prairielearn.org/pl/course_instance/129223

- Take ESDC Door Access assessment by yourself

Remember...



- Preparation is 90% of success!

Acknowledgement of training:

“I understand that the use of power tools, lathes, mills, bandsaws, welding equipment, grinders, and other shop tools are potentially hazardous activities, and I understand that by being at ESDC these activities may be going on around me. I understand that I should NOT use any shop tools unless I have been sufficiently trained and am medically able to safely handle and use such tools. I agree that I take responsibility to ensure that the training I have received has sufficiently prepared me with the knowledge to use the equipment appropriately, and if not, I will seek help and clarification before using such tools. I understand that serious injury and even loss of life can result when power tools are used improperly.”

Acknowledgement of safety responsibilities:

“I agree to wear all appropriate personal protective equipment. I agree that my safety also depends upon me ensuring that others around me are following all policies and procedures. I agree to take responsibility for not only ensuring my own safe work environment but to help ensure the work environment around me is also safe. I will not let anyone without authorized door access enter ESDC or restricted spaces therein, such as the machine shop. In all, I have read, understand, and agree to abide by the present ESDC Safety Policy and Procedures and the associated ESDC and campus training programs. ”

Acknowledgement of inherent risks:

“I understand and acknowledge that my participation in activities at ESDC involves inherent risks such as, but are not limited to: risk of property damage, bodily injury, and possibly death. I understand and assume the risks that arise out of my use of the equipment or facilities at ESDC, the activities that occur in and around ESDC, the acts of others, or the unavailability of emergency care. I understand the risks I am voluntarily subjecting myself to.”

Acknowledgement of consent:

“I hereby consent to any publicity, including the use of my name and likeness, in connection with ESDC or participation in any activity that utilized or was aided by the ESDC facility. I consent to the collection by ESDC of personal information including: my name, phone number, major, year in college, and gender, and the publication of team demographics that may include team member’s major, year in college, and gender.”

Acknowledgement of Covid risks:

“I acknowledge the contagious nature of the Covid-19 virus and ESDC has put in place preventative measures to reduce the spread of this virus, but ESDC can not guarantee that I will not become infected with the Covid-19 virus. I understand that the risk of becoming exposed to and/or infected by this virus may result from the actions, omissions, or negligence of myself and others. I voluntarily seek access to ESDC and acknowledge that I am increasing my risk of exposure to the Covid-19 virus. I acknowledge that I must comply with all set procedures to reduce its spread while attending ESDC.”

Final message:

*Keep ESDC the place where
engineering comes alive*