FRC 2135 - Presentation Invasion

Team Safety Manual

Sept. 10, 2021

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1. Introduction

1.1. Team 2135 Safety Mission

The Team 2135 Safety Mission is to educate all team members and visitors on the correct safety procedures so we can operate in a safe, secure, and friendly environment to eliminate the risk of danger or injury. The mission is also to share our safety practices with others while learning from them to achieve "best practices."

1.2. Commitment to Safety

Safety is the number one concern for all team members, mentors, families and visitors. We take pride in maintaining an excellent safety record.

Our safety education and monitoring is an ongoing process. We begin the season with a safety course given to all new and returning members of the team. This includes a general overview of safety rules and procedures as well as safety training on each tool and machine in the shop.

Mentors and veteran members constantly monitor the activity in the shop and surrounding areas to ensure all safety procedures are being followed and to provide immediate, one-on-one training if needed.

To help us maintain a high standard of safety, we would value any suggestions you may have.

2. Personal Safety

This section describes the preparedness and expectations to ensure personal safety during all activities including those: within the shop area, in the Jenvey house, at demos, and at competitions.

2.1. Arrive Prepared

Each team member must be personally ready for robotics, whether at the Jenvey house or at team events.

- Safe and protective clothing at all times/EVERYWHERE - ensures no one gets cut by sharp parts, tools, or machines
    - Wear long, durable pants that cover the whole leg - strongly recommend jeans
        - No yoga pants or leggings - these are too thin to protect
        - No holes, rips or tears in pants
    - Shirts must not be sleeveless or leave the midriff uncovered
        - A short sleeve T-shirt is strongly recommended and will cover exposed skin sufficiently
    - No loose items or clothing at any time
        - Wearing ties, loose clothing, jewelry, hanging key chains, etc. are a danger for getting caught in equipment and should be removed before all activities

- Maintain hair safety at all times/EVERYWHERE
    - Hair must be tied up such that it cannot obstruct your visibility nor get caught in any machinery or hand tools
        - Tie back all hair such that it is fully above the shoulders and away from the face - including when leaning forward
        - Hair in a ponytail that is not fully above the shoulders, requires a bun or similar to keep it back

- Foot protection at all times/EVERYWHERE
    - Closed-toe and durable shoes are required
        - To protect against foot injuries, shoes must completely cover the entire foot: closed-toes and heels
        - Flip-flops, sandals, mules, lightweight slippers, etc. are not acceptable

- Eye protection is required in shop areas and around ANY robot
    - Eye protection is required at all times within the machine shop and storage room
    - Eye protection is required around any robot even when disabled
        - Wear only ANSI-approved safety glasses or goggles
        - Over-the-frame safety glasses are available for those who where glasses

    - Goggles are available for those who wear larger eyeglass frames
    - Some work may require using a full face shield when chips or debris are excessive and thrown

- Hearing protection (when needed)
    - Wear hearing protection for extended exposure to noise at 85 decibels or above - and most power tools are louder than that.
        - Use hearing protection if working on the mill, router, lathe, bandsaw, miter saw and jigsaw
        - Also use hearing protection when working within 10 feet of these tools while they are in operation
    - Hearing protection is available on the shelf in the storage room
        - Blue and orange over-the-ear headphone-style - ensure that safety glasses do not break the seal
        - Pink/yellow/green in-ear plugs
        - When properly worn they provide similar protection
        - For additional hearing protection both can be used at the same time
    - Additional info on hearing protection
        - Each exposure does some damage
        - Damage is cumulative over an individual's lifetime
        - Even a one time encounter can result in loss of hearing
        - Earmuffs and earplugs work when worn properly

- Hand Safety (when needed)
    - Gloves are required when in contact with heat, electrical, chemical or mechanical hazards
        - Never wear gloves with cracks and holes
        - Always make sure that they have good fit, flexibility, and grip before using them
        - Handling sheet metal is a mechanical hazard and requires gloves
        - Working around the machine tools that contain sharp edges or chips is a mechanical hazard
    - Always use proper tool guards and clamps when using machine tools
        - Do not disable or remove any tool guards
    - Always wash hands after working in the shop
        - Metal shavings and machine oil contain bacteria that can be harmful
        - Remove chips or filings before they can be embedded in the skin

- Breathing safety (as needed)
    - Always wear a dust mask when the material being cut produces visible dust and particles
        - Typical uses are around the router, table saw, jigsaw, dremel, etc.
        - Whenever there is debris that emanates from the material, wear a mask

- No cellphones during team activities (always EVERYWHERE)
    - Cellphones are forbidden during team activities
        - When a cellphone call or text is required, always step outside of the Jenvey House and away from any tools/team activities to handle it - this should reserved exclusively for parent communications - do not disturb any teammates
        - There will be a few exceptions for very specific activities related to taking photos/video of team activities, or when a photo/video of the work is used for documentation or analysis of a problem

- No headphones (always EVERYWHERE)
    - Personal headphones are forbidden during team activities
        - Robotics is a team activity that requires awareness of the work, nearby teammates and the environment that precludes wearing personal headphones of any kind

- No medications (legal or otherwise)
    - No medications shall be taken/administered during team activities unless stated on a medical form and communicated to a mentor beforehand

2.2. Be Vigilant, Observant, and Aware

Each team member should be constantly aware and on task

- Look for broken tools
- Look for broken protective gear
- Watch for unsafe conditions
- Report unsafe conditions
- Maintain a safe workspace around robots/work areas
- Clean up and put away tools/parts
- NEVER touch eyes while working in shop
- No running or horseplay
- Do not throw anything under any circumstances

2.3. COVID19 Safety

All team members and mentors are expected to follow the latest school requirements for COVID-19 safety and compliance to the county health guidelines at all times.

3. Jenvey House Safety

The intent of this section is to describe safety expectations at the Jenvey house.

3.1. General Information

- Drop off/pick up is ONLY at the school, not in front of the Jenvey house, and only during scheduled meeting times
- Students must not arrive at the Jenvey House before the scheduled starting time
- Students are only allowed to be in the Jenvey House if there is a mentor or adult present
- Students must always be picked up within 10 minutes of the scheduled end time
- Students are not allowed to wait in front of the school beyond this 10 minute window (unless the school is open)
- Students must sign in/out at each Robotics meeting
- First Aid information/location
    - The First Aid Kit is located in the bookcase in the Mechanical Design room (kitchen area)
    - The nearest AED (Automated External Defibrillator) can be found on the back porch of the Basil (Advancement House) house - this is through the back door of the Jenvey House and the back fence gate
- Fire extinguisher locations
    - Under the sink in the kitchen
    - In the electrical room - east wall
    - In the storage room - west wall
    - In the main shop (garage) - east wall near door leading to the storage room

3.2. Transit Between School and Jenvey House

- Use ONLY the crosswalk to cross the street to the Jenvey House
- Look BOTH ways beforehand and then continue to monitor while crossing the street
- NEVER be on a cellphone or distracted when crossing the street
- NEVER wear headphones when crossing the street
- ALWAYS make eye contact with the driver when a vehicle is present before crossing
- When crossing after dark, use a flashlight or cellphone light and wear visible clothing to highlight your presence
- If crossing with a cart, tools, or a robot in any configuration, if it appears that a vehicle is not going to stop--ABANDON THEM AND RUN TO SAFETY

3.3.

3.4. Run, Hide, Defend

- Given the openness and small size of the Jenvey House and shop, when there is any indication of a threat that might require a Run, Hide, or Defend decision, IMMEDIATELY close any doors, windows, blinds, that may be open in your immediate room.
- AT THE SAME TIME, send someone to the Lead Mentor/Coach to make them aware of the situation IMMEDIATELY.
- The Lead Mentor/Coach will continue to secure the house while evaluating the following situation along the following guidelines

3.4.1. RUN

- In the case that an intruder is far away, or labelled as “Code Blue” we will be following the run protocol as follows:
  - The PA Speaker will announce the intruder’s location.
  - Listen for possible shots fired
  - Follow the mentors’ protocol:
    - Based on their decision, each member of the team should follow through, whether that be relocating to Starbucks, Presentation, or another destination. It is important to listen to one person and follow their directions or else it will be extremely hard to keep everyone safe and calm.
  - If the intruder is on the backside of campus, run to Starbucks by going down Jenvey Ave toward Cherry Ave first
    - If you start running, do not stop
    - When you reach Starbucks/Foxworthy Plaza, notify the shop employees of the situation.

3.4.2. HIDE

- If the intruder is on the front of the campus or in the neighborhood, lockdown the house as quickly as possible, within 3 minutes:
  - Close and lock all the doors and close all the blinds, including the storage room, electrical room, front room, and back room - with priority on the garage door
  - Depending on where you are, barricade the doors and windows in your proximity using benches and tables
  - Turn off the lights
  - Stay quiet and calm, and remain in your hiding spot until the “all clear” signal is given
  - Places to Hide:
    - Storage room, interior back hallway, bathroom in the back, offices, garage (make sure it is closed)

3.4.3. DEFEND

- Grab any objects that would deter the intruder:
  - Metal or wood pieces
  - Hammers and mallets and water bottles
  - Saws
  - Red bins (bolts, nuts)
- Attack the intruder, be loud, and try to disorient them

4. Tool Safety

The intent of this section is to describe the expectations for safely using hand and machine tools within the shop area, Jenvey house (think electronics assembly), at demos, and at competitions.

4.1. Hand Tools

- Always use the proper tool for the job (don't hammer on screwdrivers, etc.)
- Check tool condition before using--electrical cords, blades, housing intact, no loose parts. Never use defective, dull or broken tools.
    - Any defective tool found should be removed from the shop and shown to a mentor so the tools can be replaced or repaired.
- Job procedure
    - Start with a clean workspace
    - Secure the work
    - Periodically clean away chips, saw dust or debris
    - Clean up at end of job
    - Put away clamps and tools
- Securing the work
    - In a vise or using proper clamps: C-clamps or compression clamps
    - On a hard surface such as a bench--not in the palm of a hand.
    - Use scrap wood under the work when there is potential for cut-through
    - Once clamped, do a pull-test to check if secure
- When using any tools that are sharp or abrasive
    - Ensure the blade is sharp
    - Monitor the blade during the cut in case the material fills the teeth
    - Direct all cutting strokes away from hand and body parts
    - Be aware of anyone in the cutting path or moving near it
    - Always close/cover blades when not in use
    - Cover the tip or edges with shields when carrying
    - Keep saws and knives pointed down when not in use
    - Ensure that clamps/vice do not interfere with a cut
    - Have a balanced standing position on both feet when drilling, sawing, etc.
    - Sawing jobs should be secured such the blades is pointed down during the cut
    - Filing jobs should be directed downward and preferably over a trash can
    - Deburring jobs should be directed downward and preferably over a trash can
- When using tools that are hot
    - Plugin/turn on only while the tool is actively in use
    - Ensure tools are unplugged when not in use
    - Allow several minutes for cooling after use

    - Put away only after completely cooled
    - Not that fumes can be given off when hot tools are used--a small fan or face mask should be used to protect from breathing in fumes:
        - Bending polycarbonate or ABS
        - Soldering electrical connections
        - Welding

4.2. Machine Tools

- Notify a mentor before working with a machine tool
- Never operate a machine tool unless all the safety guards are in place
- Keep hands and foreign objects away from the moving parts of the machine when in use
- Keep loose objects away from machines to prevent them from getting entangled in the machine
- CNC Mill
    - Know and use the E-STOP button whenever unsure of safe operation
    - Always work with the doors closed
    - Always clamp/vice materials securely-have a mentor check tightness
    - Always tighten bits into collets securely-have a mentor check tightness
    - Keep hands and arms outside of the enclosure when running
    - Beware of aluminum flash during cutting which can be razor sharp
    - Use nitrile gloves to protect hands from shavings/coolant
    - Don’t touch cutting edges of end mills, drill bits, etc.
    - Never drop end mills, drill bits, etc.
    - Never use damaged tools
- CNC Router
    - Know and use the E-STOP button whenever unsure of safe operation
    - Always hold down materials flat and securely-have a mentor check tightness
    - Always tighten collets securely-have a mentor check tightness
    - Keep hands and arms away from the spindle when running
    - Beware of aluminum flash during cutting which can be razor sharp
    - Don’t touch cutting edges of end mills, drill bits, etc.
    - Never drop end mills, drill bits, etc.
    - Never use damaged tools
    - Some cuts may require using a wooden hold-down tool to prevent debris from jamming the bit--this should be done only when absolutely needed
- Lathe
    - Know and use the E-STOP button/pedal whenever unsure of safe operation
    - Always collet materials securely-have a mentor check tightness
    - Always tighten tools securely-have a mentor check tightness
    - Keep ALL hands, arms, materials away from the head when running
    - Beware of aluminum flash during cutting which can be razor sharp

    - Never drop cutting tools
    - Never use damaged tools
    - ALWAYS be aware of the chuck key and ensure it is always in one of TWO places: placed safely in its storage bin OR in a hand - NEVER leave the chuck key in the head without it being used with one hand on it (to tighten/loosen)
- Miter Saw
    - [Needs to be filled in--maybe Nandita can provide a bullet list here.]
- Table Saw
    - The table saw is NOT approved for use by students due to the condition of its guards
- Drill press
    - Always clamp the workpiece securely to the table before cutting
    - Ensure the drill bit is tight in the collet
    - Set the table at the proper height
    - Check for drill-thru to make sure it does not hit the table

4.3. Electrical Cord Safety

- Inspect equipment cords and extension cords routinely to make sure they are in good condition
    - The plug must be securely attached with no bare wires or loose contacts
    - There should be no kinks, bare wire, or knicks in the insulation
- DO NOT overload electrical fixtures and receptacles
- DO NOT plug a power strip into another power strip
- Extension cords
    - DO NOT have an extension cord plugged into another extension cord
    - DO NOT have an extension cord plugged into a power strip
    - DO NOT have a multi-device receptacle plugged into a power strip or extension cord
- No trip hazards

4.4. Tool Certification

The intent of this section is to describe certification requirements and expectations for team members.

- Within the Shop
    - One must have finished all sections of tool certifications to fully work in the shop.
    - One must be tool certified by a qualified team member who has been tool certified with the proper seminar and training.
    - When dealing with machines, one must get proper training from mentors or captains.
    - Quizzes like the Handbook Quiz, Tool Certification Quiz and the Safety Quiz are counted in terms of completing ones tool certification process.
- During Competition
    - Anyone who has not completed tool certification may not be part of the pit crew during competitions
        - All parts of tool certification must be completed (including the quizzes)

5. Robot Safety

The intent of this section is to describe the additional safety requirements when working around the robot in any location.

5.1. General

- Make sure the robot is disabled when it is being worked on.
- Make sure everyone is clear before reactivating the robot.
- Communicate to those nearby when the robot is enabled or disabled.
    - Turned off - may have stored energy like springs or bungees
    - Disabled - it may have stored energy or could be enabled
    - Enabled - the robot can move at any time
    - When operating on blocks - ensure all wheels are clear of floor and blocks
    - When driving/operating - always ensure a minimum clear space around the robot.

5.2. Lifting the Robot

- Wearing gloves is recommended.
- Have a minimum of three people equally spaced around the robot to assist lifting it off a cart or from the floor
- Make sure the robot is properly secured when working underneath it.
- Lift by pushing with your legs and keep your back straight so you do not lift with your back.
- Do not twist your body; use your feet if you need to turn.
- Keep the cart under control at all times, especially when removing or placing the robot.

5.3. Transporting the Robot

- **The rules about Jenvey House Safety also apply for robot transportation**
- When transporting the robot, have a minimum of 3 people, one to push the cart, one to guide from the front, and one to watch surroundings.
- Make sure that the robot is secure on the cart with one person placing a hand on the robot while transporting it.
- Walk quickly, while ensuring the robot remains safely balanced, and get to the other sidewalk as fast as possible.
- Make sure nothing is dangling off the cart or is loose and could fall off the cart.
- Create a clear walkway before moving the robot in that direction and let others know the robot will be moving
- When turning onto the sidewalk ramps make sure the cart wheels are approaching the curb/transition ramp at a right angle to minimize cart instability. The cart should go up the ramp with both front and then back wheels at the same time.
    - When crossing the street, ensure everyone looks both ways

    - Ensure there are 2 other people (not transporting the robot) who are on the street looking out for cars. If it is at night, ensure they have flashlights pointed down the street, and they should wear reflective clothing.
    - When crossing the street with the robot while it is dark, make sure that everyone is visible to drivers by using a flashlight.
- If crossing the street with the robot and a car does not stop, ABANDON the robot IMMEDIATELY and get out of the way.
    - It is always the priority that every person take the necessary steps to evade any dangerous situation--even at the cost of the robot, cart, or tools.
- Be hyper aware of the surroundings and follow ***ALL*** of these procedures.

5.4. Stored Energy

- After matches, always release all stored energy and open the main circuit breaker on the robot.
    - Electrical energy: disconnect the power source and always de-energize the robot before working on it - unplug the battery and turn off the main circuit breaker
    - Pneumatic Energy: release the compressed air and open the main vent valve and verify that all pressure gauges on the robot indicate zero pressure
    - Potential Energy Sources: lower all raised robot arms or devices that could drop down to a lower position on the robot
    - Move mechanisms to the position where any elastic devices such as springs or surgical tubing are under minimum tension

5.5. Battery Safety

- Inspect battery condition
    - Periodically inspect batteries for any signs of damage, cracks, leaking electrolytes, or bent terminals.
    - Beware of battery acid. Report any possible colorless liquids that can burn eyes, skin, and clothing to a mentor or safety captain.
    - ANY battery that is visually damaged in ANY way is dangerous and unusable. DO NOT TAKE A CHANCE BY USING A DROPPED/DAMAGED BATTERY.

- How to handle
    - Always hold and carry a battery by its body--NEVER by the cables or connector
    - Always pull on the SB50 battery cable connectors to disconnect--NEVER by the cables
    - Any extra pulling or movement on the cables can loosen them or break their crimp connections which could cause a failure during a match
        - Moderately tug on the cables to verify that battery terminal connections do not slide/spin/ or move
        - Moderately tug on the connect/cable junction to ensure the connectors are secure and the crimps are still holding

    - Never drop a battery!
        - WHENEVER A BATTERY IS DROPPED - there could be a crack that is not visible to the naked eye that may leak electrolytes.
        - Dropped batteries are likely to have internal damage that prevents them from fully charging/discharging
        - If it happens, the battery will be pulled from competition rotation and will no longer be useful to the team
- How to charge
    - Keep the battery-charging area clean and orderly.
    - Place your battery charger in an area where cooling air can freely circulate since the chargers can fail without proper ventilation.
    - NEVER short out the battery terminals. If any metals contact with the terminals simultaneously, it will create a short circuit, a spark, and a high current situation. This will cause high heat and can damage the battery.
    - Use the Battery Beak to measure charge state and battery health
- Handling spills
    - BATTERIES CONTAIN ACID!!! - there is a corrosive, colorless liquid that will burn your eyes, skin, and clothing.
    - Immediately flush any contacted skin with a large quantity of water.
    - Seek medical treatment.
    - Necessary Safety Materials
        - A box of sodium bicarbonate (baking soda) to neutralize any exposed acid.
        - A pair of acid resistant rubber or plastic leak-proof gloves to wear when handling a leaking battery.
        - A suitable non-metallic leak-proof container in which to place the defective battery.

6. Pit Station Safety

The intent of this section is to describe the safety requirements when working in the team pit at competitions.

6.1. General

- Safety glasses/goggles must be worn at all times in the pit
- Cover all electronics before cutting or drilling to prevent electrical shorts.
- Never use unprotected hands to clean up.
    - Use a brush and a vacuum to remove any scraps or dirt.
    - Clean oily surfaces with a cloth or rag.
- Keep the work area neat and orderly.

6.2. Setup and construction

- No team station structures, signs, banners, or displays can be higher than 10 feet above the floor.
- No team structures to support people or items for storage above the work area in the pit station.
- Design and set up the pit safely and properly use ladders – do not climb on items not meant for the task, such as tables and chairs.
- No daisy chaining in electrical cords i.e., connected multiple battery charging cords to one extension cord which is then connected to another extension cord

6.3. During Competition

- Follow all safety behaviors - even when things are heated in the middle of competition.
- Always use the planned, safe lifting procedure of the robot, including cart removal after the lift.
- Never work on the robot on an unstable surface.
- Make sure that the robot is properly secured before working underneath it.
- After each match, release all stored energy and open the main circuit breaker on the robot.
- After leaving the pit, ensure everything is safely tucked away and all the electrical cords (i.e. battery charger cords) are unplugged.

6.4. Pit Station Age Requirement

- Children twelve and under must have a person eighteen or older with them at all times.
- Make sure children are given the child safety glasses available.
- Child strollers and baby carriages are not allowed in the pit.

7. Travel Safety

The section describes the expectations for students attending an away event with the team.

- Permission slip is required
- Medical form is required
- Students cell phone numbers/room numbers are registered with the mentors
- Everyone on the trip is on the team Slack channel for the event WITH notifications ON
- Buddy system is in force at all times
    - Always have at least one person with you while at the venue or when outside of your room at the hotel
- Keep hotel rooms locked
- NEVER open hotel door for strangers
- NEVER leave your hotel room after bed check
- NEVER enter the hotel room of ANYONE that is not with our team
- NEVER leave the venue without a mentor or approval
- Leaving the event early is not allowed--even with parents

8. Safety Captain Position

This position is reserved for competitions. Every team member should already be following the team's safety rules. The Safety Captain's role is to help ensure team and pit safety, and to communicate the team's safety program to the judges and other teams.

8.1. Help Ensure Team Safety

- Make sure to pack the items listed in the Appendix A packing list for competitions.
- Be familiar with where things are located in the first aid kit and always keep a first aid kit nearby in case of an emergency.
- Always know where a mentor is located in case of emergencies or unknown circumstances.
- Always know the venue escape plan in case of emergencies, and communicate it to the team at the start of the event.
    - Set up an emergency meeting point in case of emergency at competitions.

8.2. Help Ensure Pit Safety

- Ensure that the space in and around the Pit Station is clean and safe from hazards.
- Make sure tools are properly stored, along with tidy storage of personal belongings and other equipment and in a location where someone else might locate if needed.
- Make sure that all electronics are unplugged or in safety mode when not in use.
- Make sure batteries and battery chargers are property taken care of.

8.3. Communicate Our Safety Program

- Go out to other teams and share what our team does for safety.
    - Pass out any safety-related items we have to handout that year.
- Explain our team's safety program to the judges and UL Safety Advisors (wearing the green shirts)
- Be open-minded and learn about other teams' safety culture.
    - Consider incorporating any good practices into our safety program.

Appendix - Competition Safety Pack List

- First aid kit (includes baking soda and burn gel)
- Materials Safety Data Sheet logs (i.e. tool certs sheet)
- Copy of Team Safety Handbook
- Extra safety goggles
- Hair ties
- Gloves