Safety Training Reference Materials

For Staff & Researchers working with the NASA Valkyrie (R5) Robot

Definitions

- **Robot gantry**: the gantry and hoist system used to elevate the robot from the ground, used as a safety mechanism in case the robot falls.
- **Electric Hoist**: the electric chain hoist (CM Lodestar) used to physically raise and lower the robot.
- **Manual Hoist**: the rope and pulley hoist used to physically raise and lower the robot.
- **Static safety line**: the fixed length shackle lanyard, used when storing Valkyrie to remove the load from the hoist.
- **Adjustable safety line**: the adjustable length yellow shackle lanyard, used when Valkyrie is powered on.
- **Robot medical lift**: the hydraulic lift used to elevate the robot from the ground, used to move the robot as needed.
- **Juice Box**: The gray box that contains the power sources. It also holds a network attached storage(NAS) device for storing log files as well as a wireless router.
- **Robot power cord**: the power cord from the "juice box" (power supply) to the robot.
- **Robot operation area**: designated area for the robot to move within and perform tasks.
- **Robot storage area**: designated area where the robot is stored when not operational, with the static safety line engaged.
- **Off, hanging**: the robot is not powered and is hanging either from the gantry or the lift, with no points of contact with the ground.
- **Off, stowed**: the robot is not powered and is hanging either from the gantry (with the static safety line engaged) or the medical lift, in the designated storage space.
- **On, logic power**: Logic power is on and robot motor power is off (chest is green, see "Ring LED Legend" document).
- **On, motor power**: the robot is powered and the robot operation light is flashing; (chest is blue or purple, see "Ring LED Legend" document).
- **Task apparatus**: a fabricated structure that contains elements of terrain or manipulation tasks to be used by the robot.
- **Valkyrie Test Plan**: A form that must be filled out before any code that will or potentially will cause the robot to move is executed. Level 2 Safety Trained personnel can verbally approve tests at their discretion.
- **Robot Operator**: the individual starting up and monitoring robot status during operation (not to be confused with someone merely running code on the robot), must be Level 2 Trained or a Valkyrie On-Site Lead.
- **Operator Computer**: workstation used to start up, shutdown, and monitor the robot, where the robot operator sits.
- **Workstation**: computer desk set up around the perimeter of the robot operation area.

Training Levels

- Level 1

  Permitted To:

  - Observe the robot while it is powered on and moving
  - Operate the hoist for the robot
  - Assist in monitoring the robot and deploying the emergency stop button if their is unexpected robot behavior
  - Execute code on the robot that causes it to physically move with direct supervision and approval of a Valkyrie On-Site Lead
  - Assist a Valkyrie On-Site Lead in removing a limb of the robot when it is powered off

  Not Permitted To:

  - Operate the robot
  - Power the robot on and off or access the "juice box"
  - Be located within the robot operation area when the robot's motors are powered (blue LED ring)
  - Store or deploy the robot without direct supervision of a Valkyrie On-Site Lead and/or someone with Level 2 Safety Training
  - Augment the gantry, hoist, and lift systems for the robot
  - Physically work directly on the robot (augmenting or repairing hardware, removing/driving screws, soldering, etc.) when it is powered off or otherwise

- Level 2

  Permitted To:

  - Everything that a Level 1 is permitted
  - Operate the robot, with a Valkyrie On-Site lead in the nearby vicinity
  - Store or deploy the robot
  - Be located within the robot operation area when the robot's motors are powered (blue LED ring)
  - Swap out the forearm mass sims with the actual forearms (hands)

  Not Permitted To:

  - Power the robot on and off or access the "juice box" (ensures an On-Site Lead is around)
  - Augment the gantry, hoist, and lift systems for the robot
  - Physically work directly on the robot (augmenting or repairing hardware, removing/driving screws, soldering, etc.) when it is powered off or otherwise; unless it is swapping out the forearm mass sims with the actual forearms.

- Valkyrie On-Site Lead

  Members of this group can authorize or restrict what can and cannot be done with the robot and whenever the robot is to be run, at least one Valkyrie On-Site Lead must be present. Additionally, they are able to administer Level 1 Training (see Level 1 Safety Training documentation), and a majority vote must approve a level 2 training (currently an informal apprenticeship).

  As of January 2018, On-Site Leads are: Jordan Allspaw (UMass Lowell) and Murphy Wonsick (Northeastern)