

Valkyrie General Operating Rules

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A note on these rules: These rules and operating procedures exist solely for your protection and the protection of the hardware, not for any legal risk management.

We have taken care to remove rules that we feel researchers who receive a Valkyrie cannot reasonably follow while carrying out their research. Therefore, if you feel that any of these rules is particularly onerous and prevents effective use of the system, please contact Kris Verdeyen at NASA, and we will work with you to amend it or otherwise find a solution.

Human Safety Rules

Note: Motor power is on and the robot may move at any time when the NASA meatball on the chest glows blue.

1. E-stop must be manned whenever motor power is on.
2. Whenever motor power is on, a second person must be within hearing range.
3. Any person within the robot's active work space must have sufficient unobstructed space behind them and around them to get to safety. Do not get between the robot and an obstruction!
4. Any person in the robot's active workspace must be aware that unexpected motion is always a possibility and they should position themselves to minimize exposure to such motion.
5. Any person within the robot's active workspace must keep their hands away from all pinch points.
6. No unnecessary conversation with the E-Stop operator
7. Only one person may be in the robot's workspace at a time when the estop is enabled, and only for a specific purpose. *For example: someone tuning the robot controller may need to manually move the robot in order to determine gain values. Assuming all rules above are followed, and there is only one person in the workspace at a time, this is allowed.*

Ground Rules – General Robot Operations

1. Valkyrie Console Operators must be trained by a trained operator.
2. All operations require the robot to be suspended from a winch.
3. There are a minimum of three roles that need be filled whenever the robot is running.
 - a. Console operator – this person is in charge of operations, calls the shots, and decides what happens and when.

- b. Estop operator – the estop operator is responsible first for the safety of people in or around the robot’s workspace, second for the integrity of the robot.
 - c. Winch operator – this winch operator’s primary responsibility is to maintain an appropriate level of slack in the winch, and to reel in the slack (and lift the robot) if the estop is pressed, or if the robot faults.
4. These roles can be combined, and performed by two people..

E-Stop Operator Rules

- 1. Verify all ground rules in place.
- 2. Always have line of sight of the robot
- 3. Keep people away from all pinch points on the robot and between the robot and stand, and between robot and the application area
- 4. Request information on expected motion of the robot.
- 5. E-stop the robot in the event of the following conditions:
 - a. Someone yells Kill or Stop
 - b. Unintentional contact is imminent
- 6. No unnecessary conversation
- 7. No cell phone calls

Robot Servicing Rules and guidelines

It is occasionally necessary to remove the outer shells in order to service the robot or effect some change or inspection. In this case:

- 1. Logic and motor power shall be removed before removing any limb shells. (NASA meatball color shall be white)
- 2. All power shall be removed before removing any body or head shells. (NASA meatball shall be off)
- 3. Logic power may be re-enabled with shells off, but care should be taken to avoid robot self-contact.
- 4. Shells shall be reinstalled as soon as feasible.
- 5. When removing shells, take steps to prevent fasteners or other foreign objects from falling into the robot. Techniques to accomplish this include taping, the use of magnets, screens, and other methods.
- 6. Should a foreign object fall into the robot or go missing, the robot shall not run until it is retrieved.