

Test Plans for Engineering Requirement Metrics

1. Minimize Time to Move Between Port and Starboard

- a. *Transfer time (s)*
 - i. Conduct a time study with multiple users, averaging the transfer time to move between port and starboard

2. Access Jib Lines

- a. *User Reach Distance (in)*
 - i. Measure the maximum distance from the seat to the jib lines. Position the seat in the furthest location from the lines and measure the distance.

3. Complies with ISAF/IFDS Regulations

- a. *Purely Mechanical Solution (binary)*
 - i. No test required; verify that BOM contains no electronic components
- b. *Distance Between Existing Bench and Seat (200 mm)*
 - i. Measure top of boat bench to maximum boat seat height
- c. *Does the Design Require Boat Modification (binary)*
 - i. No test required; verify that the device has not modified the boat in any way (drilling into the boat, cutting the boat, etc)
- d. *Is the design fixture permanently installed (binary)*
 - i. Test by installing the device and then uninstalling the device

4. Lightweight

- a. *Weight (lbs)*
 - i. Weigh the device on the scale in the KGCOE Machine Shop (note: if the device is too large we will sum the weight of the individual components)

5. Device Secure in Boat

- a. *Secure Fit in Sonar (binary)*
 - i. Details TBD - potentially install in Sonar and apply force in order to shift the device from the secured position. Amount of force and location TBD.

6. Minimize Pinch Points

- a. *Number of Pinch Points (count)*
 - i. Activity hazard analysis - ergonomic analysis on safety of device for user (specifically the potential for the user to become injured from moving components)

7. Able to See Surroundings

- a. *Unobstructed Field of View (%)*

- i. Detailed testing TBD - potentially ask a range of users to sit in the device and estimate the percentage of their view that is unobstructed. (note: This is a subjective test and needs to be brainstormed further to see if another test is more suitable, or if the metric for the function needs to be changed)

8. Safe In Emergency

a. Boat Release Time (s)

- i. Conduct a time study, and average the time from initiating e-release mechanism to actual release of device, over multiple trials. Specific number of trials TBD

9. Secure Limbs that the User Can't Control Themselves

a. Secure someone in boat and test for potential injuries

- i. Test different heel angles (exact angles TBD) and see if the user's limbs remain secure in the device.

10. Minimize Entry Time

a. Time to get out of Seat (s)

- i. Conduct a time study with multiple users, averaging the time it takes for users to correctly position and secure themselves in the seat

11. Minimize Exit Time

a. Time to get into Seat (s)

- i. Conduct a time study with multiple users, averaging the time it takes for users to correctly release themselves from the seat

12. Maximize Weight Capacity

a. Weight Capacity (lbs)

- i. Calculate the weight capacity for the design using stress analysis
- ii. Validate the calculations by placing target weight on the seat
- iii. The device passes the test if it is able to hold the weight for 10 minutes

13. Corrosion Resistance

a. Components chosen for corrosion resistance (binary)

- i. Specific corrosion testing- TBD

14. Easy to Install

a. Time to Install (s)

- i. Conduct a time study with multiple users, averaging the time it takes for two individuals to properly install the device in the Sonar.
- ii. These individuals will not have any knowledge of the device, in order to represent the volunteers at Pier's Park who may have no existing knowledge of the device

b. Number of Installation Steps (count)

- i. Count the number of steps in the completed installation manual.

- ii. Note: The assumption is a device with a fewer number of steps will be easier for the user to install in the sailboat

15. Maximize Range of Movement

- a. *Degree of Rotation (deg.)*
 - i. Position the device at the center of the sailboat (equidistant from port and starboard) and measure the maximum angle of rotation from initial seat centerline (facing forward).

16. Minimize Chance of Boom/Head Collision

- a. *Vertical Distance between boom and seat (in)*
 - i. Measure distance between minimum boom height and maximum seat height

17. Machining Minimizes the use of Specialized Equipment

- a. *Percentage of Custom Parts in Design (%)*
 - i. Count number of parts that require specialized parts to manufacture

18. Design has Minimal Manufacturing Time of Components

- a. *Percentage of Custom Parts in Design (%)*
 - i. Count number of parts that require modification/manufacturing before assembly

19. Easy to Remove Device From Boat

- a. *Time to Remove (min)*
 - i. Conduct a time study with multiple users, averaging the time it takes for two individuals to properly uninstall the device in the Sonar.
 - ii. These individuals will not have any knowledge of the device, in order to represent the volunteers at Pier's Park who may have no existing knowledge of the device.
- b. *Steps to Uninstall Device*
 - i. Count the number of steps in the completed installation manual (the manual will contain steps to properly install and uninstall the device)
 - ii. Note: The assumption is a device with a fewer number of steps will be easier for the user to uninstall from the sailboat

20. Can Accommodate Multiple Body Types

- a. *Percent of Users Who Find Seat Comfortable*
 - i. Survey a minimum of 30 people and ask to rate relative comfort

21. Design to Sonar Dimensions and Tolerances

- a. *Secure fit in Sonar (binary)*
 - i. See ER #5