TEST: Endurance, Maneuverability and Collision avoidance

Engineer: [Name removed for privacy]

Prerequisites:

Lift and propulsion batteries fully charged.

Equipment:

TN-TUF hovercraft, controller, stopwatch, laptop with processing to monitor systems.

Personnel:

Pilot to safely maneuver craft and technician to monitor system response.

Objective:

The primary goal of this test is to validate the collision avoidance system which will avoid all but the most deliberate collisions. Secondary objectives will be to verify stable operation at various speeds and user input, also to test the runtime of the craft while it is operating.

Safety:

Prior to any operation of the craft E-stop functionality will be verified All operations should be performed in a large open space with no personnel able to be hit by the craft.

Procedure:

We will systematically approach objects of increasingly smaller size from various speeds and angles. The collision avoidance system should minimize any severe impacts and completely avoid minor collisions.

- ☐ Verify Battery voltage is at %100.
- ☐ IF AT ANY TIME DURING TESTING BATTERY DROPS BELOW %15 DISCONTINUE TESTING AND CHARGE BATTERY. Resume testing procedures once battery is full and note previous runtime.
- ☐ Test E-stop circuit, ensure that all main power is removed and control power remains on.
- ☐ Perform 20 ft. acceleration test, log time and calculate acceleration and speed.
    - Repeat this test minimum of 3 times, retain all test data and repeat until clear average is obtained.
- ☐ Test stopping distance and time after 3 s full throttle acceleration.
- ☐ Initiate zero turn and measure time for full rotation.
- ☐ Initial round of testing will utilize a 3ft by 3ft solid flat surface.
- ☐ Perform head-on collision avoidance testing as follows
    - No throttle approaching at ~ 1 ft/s
    - Half throttle approaching at ~1 ft/s

- Full throttle approaching at ~1 ft/s
- IF previous results favorable increment speed by .5 ft/s until failure
- Record highest velocity where collision will be avoided

☐ Hovercraft must completely avoid zero and half throttle approaches and attempt to stop during full throttle approach.

☐ Perform oblique collision testing as follows noting response with best outcome

- 60 degree approach ~ 1 ft/s
  - Turn to avoid
  - Stop to avoid
- 45 degree approach ~ 1 ft/s
  - Turn to avoid
  - Stop to avoid
- 15 degree approach ~1 ft/s
  - Turn to avoid
  - Stop to avoid
- IF previous results favorable increment speed by .5 ft/s until failure
- Record highest velocity where collision will be avoided

☐ Note favorable response and utilize this behavior for future testing.

☐ Hovercraft must appropriately maneuver to avoid initial collision.

☐ Perform multiple obstacle collision avoidance testing

- Repeat testing with previous oblique collisions that utilized turning behavior
- Secondary obstacle will be placed directly in front of craft 3 ft from new trajectory after avoiding collision
- Hovercraft must successfully avoid initial collision and demonstrate proper response to mitigate secondary Collison.

☐ Once all tests are successful reduce surface area of obstacle to 2ft by 2ft and repeat.

☐ Once all tests with 2ft by 2ft flat surface are complete repeat with 2ft diameter cylinder 2 ft high

☐ Final testing will be with 1ft by 1ft flat surface and 1ft diameter cylinder 1 ft high.

☐ Once all testing is complete note battery voltage and runtime.

☐ Compute average runtime for hovercraft on full charge

☐ Compute performance characteristics (top speed, acceleration, deceleration)