

Approved May 5, 2011

Site of Research:

Johns Hopkins Medical Institutions
International Center for Spinal Cord Injury
Kennedy Krieger Institute

Patient I.D. Plate

RESEARCH PARTICIPANT INFORMED CONSENT AND PRIVACY AUTHORIZATION FORM

Protocol Title: Virtual Sailing Simulator in Individuals with Spinal Cord Injury.

Application No.: NA_00044093

Principal Investigator: Albert Recio, MD

1. What you should know about this study:

- You are being asked to join a research study.
- This consent form explains the research study and your part in the study.
- Please read it carefully and take as much time as you need.
- Please ask questions at any time about anything you do not understand.
- You are a volunteer. If you join the study, you can change your mind later. You can decide not to take part or you can quit at any time. There will be no penalty or loss of benefits if you decide to quit the study.
- During the study, we will tell you if we learn any new information that might affect whether you wish to continue to be in the study.
- Ask your study doctor or the study team to explain any words or information in this informed consent that you do not understand.

2. Why is this research being done?

The research is being done to look at the benefits of a recreational and therapeutic program for people with spinal cord injury using the VSail-Access sailing simulator.

The VSail-Access is the first sailing simulator available for people with disabilities. The VSail-Access simulator is a variation on the VSail where the cockpit is fitted with a seat. The VSail simulator is a generic sailboat cockpit powered by a pneumatic ram and custom designed software. The sailor sails the simulator around virtual courses displayed on a computer screen in the same way as a real sailboat on water. Electronic sensors provide real time feedback to match the movements of the virtual sailboat displayed on the screen with those of the simulator. Sailors can select wind strength and conditions to suit their ability.

Adults with spinal cord injury may take part in this study.

How many people will be in this study?

Approximately 20 participants will take part in this study.

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3. What will happen if you join this study?

STUDY INTERVENTION

If you qualify to participate in this study, you will be doing 60 minutes of Virtual Sailing training, 1 time a week for 12 weeks

Virtual Sailing training:

You will be transferred to the VSail cockpit and secured. Following the trainer's instruction, you will sail the simulator around virtual courses displayed on a computer screen, using a joystick to control the rudder angle and a mainsheet to control the set of the sail. You will do this for 1 hour.

We will stop the training for the following reasons:

- you feel very tired.
- you show signs of Autonomic Dysreflexia (pilo-erection (goose bumps), sudden and profuse sweating above injury level, facial flushing, intense head/neck tingling, headache, irritability, crying).
- you show signs of symptomatic orthostatic hypotension (dizziness, light headedness, palpitations, sudden vision loss, profuse sweating).

The session will resume when the symptoms resolve.

You will continue your already prescribed rehabilitation regimen as per your clinical plan.

STUDY PROCEDURES:

Initial Visit:

The following procedures will be done during the Initial Visit:

- Check your vital signs (blood pressure, heart rate, and body temperature).
- Check how well your lungs take in and release air (Pulmonary Function Tests or PFTs).
- A neurological exam, called the ASIA, to determine the extent of motor and sensory impairment that you are experiencing as a result of your spinal cord injury.
- You will also be asked a series of questions to determine how well you are able to use your arms and hands (SCI QL-23 test, VR-36).
- Two different assessments of how you are able to use your trunk will be performed (Functional Reach Test, Level of Trunk Activation Test).
- An assessment of the strength in your hands will be performed (Grasp/Pinch test).
- You will also be asked a series of questions to determine your ability to sail.
- Review any medicines you are taking, and any medical issues you might have.

This visit will last up to 2 hours.

Virtual Sailing training Visits:

For the next 12 weeks, you will need to come to the ICSCI once (1) per week during which you will participate in Virtual Sailing training.

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If during the Virtual Sailing training session you have one or more of the following: feel very tired, pilo-erection, facial flushing, intense head/neck tingling, headache, dizziness, light headedness, palpitations, sudden vision loss, profuse sweating, then we will:

- Stop the training.
- Check your heart rate.
- Check your blood pressure.
- Review your level of fatigue on a scale from 0 to 20.

If symptoms resolve satisfactorily, the session will resume.

These visits will last up to 1 ¼ hour.

You will continue your standard rehabilitation without any changes. Your routine medical care will not be interrupted.

You will keep a diary. You will write in any doctor visits or treatments you receive that are not routine. You will also write in any changes in your medication. The clinical trial coordinator will review your diary every week. This will take about ¼ hour.

After the 6th Virtual Sailing training visit, we will schedule the 6 Weeks Visit before your 7th Virtual Sailing training visit.

After the 12th Virtual Sailing training visit, we will schedule the 12 Weeks Visit.

6 Weeks Visit:

The following procedures will be done during the 6 Weeks Visit:

- Check your vital signs (blood pressure, heart rate, and body temperature).
- Check how well your lungs take in and release air (Pulmonary Function Tests or PFTs).
- A neurological exam, called the ASIA, to determine the extent of motor and sensory impairment that you are experiencing as a result of your spinal cord injury.
- You will also be asked a series of questions to determine how well you are able to use your arms and hands (SCI QL-23 test, VR-36).
- Two different assessments of how you are able to use your trunk will be performed (Functional Reach Test, Level of Trunk Activation Test).
- An assessment of the strength in your hands will be performed (Grasp/Pinch test).

This visit will last up to 2 hours.

12 Weeks Visit:

The following procedures will be done during the 12 Weeks Visit:

- Check your vital signs (blood pressure, heart rate, and body temperature).
- Check how well your lungs take in and release air (Pulmonary Function Tests or PFTs).
- A neurological exam, called the ASIA, to determine the extent of motor and sensory impairment that you are experiencing as a result of your spinal cord injury.
- You will also be asked a series of questions to determine how well you are able to use your arms and hands (SCI QL-23 test, VR-36).
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- Two different assessments of how you are able to use your trunk will be performed (Functional Reach Test, Level of Trunk Activation Test).
- An assessment of the strength in your hands will be performed (Grasp/Pinch test).
- You will also be asked a series of questions to determine your ability to sail.

This visit will last up to 2 hours.

Follow-up Visits:

The following procedures will be done at the 6 Month and 12 Month visits:

- You will be asked a series of questions to determine your ability to sail.

If you are not able to come at the ICSCI for these visits, we can ask you the questions over the phone instead.

This visit will last about 10 minutes.

How long will you be in the study?

You will be in this study for 1 year with a total of 17 visits: one Initial visit, 12 weeks of Virtual Sailing, a visit at 6-weeks and one at 12-week, and finally a visit at 6-months and one at 12-months.

Future contact:

We would like your permission to contact you about other studies that you may be eligible for in the future.

Please initial your choice below:

_____ **Yes**, you may contact me in the future about other studies.

_____ **No**, I do not want you to contact me about other studies.

4. What are the risks or discomforts of the study?

Intervention Risks:

Virtual Sailing training:

There is a minimal risk of pressure sores, and skin break down. To further **minimize the risk**, the way you are sitting in the VSail will be assessed and necessary precautions will be taken and proper protection equipment (gloves) will be used.

There is a minimal risk of falls during transfers in/out of the VSail. To **minimize the risk**, you will be transferred using standard transfer procedures that are in use clinically at the ICSCI.

There is a minimal risk of fatigue, autonomic dysreflexia, or orthostatic hypotension. **To minimize the risk**, you will be checked during VSail training by a study team member (Cardio-Vascular Monitoring).

Assessment Risks:

Vital Signs: There are no known risks associated with this measurement.

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Pulmonary Function Test (PFTs): The risk is minimal for most people. Since the test involves some forced breathing and rapid breathing, you may have some temporary shortness of breath or light-headedness. You breathe through a tight-fitting mouthpiece, and you'll have nose clips. To **minimize the risk**, one of the study team member trained in the procedure will perform the test.

ASIA Exam: There is a risk of discomfort at the site of the pin prick during the ASIA Exam. To **minimize the risk**, one of the study team member trained in the procedure will perform the ASIA exam.

Spinal Cord Injury Quality of Life Questionnaire (SCI QL-23): Aside from the risk associated with disclosing personnel or protected health information outside the research study, there are no known risks associated with this measurement.

Veterans RAND 36-Item Health Survey (VR-36): Aside from the risk associated with disclosing personnel or protected health information outside the research study, there are no known risks associated with this measurement.

Functional Reach (FR) test: Patients may feel anxiety related to loss of balance. To **minimize the risk**, one of the study team member trained in the procedure will perform the test and will position themselves in the direction of the lean so you do not fall.

Level of Trunk Activation: Patients may feel anxiety related to loss of balance. To **minimize the risk**, one of the study team member trained in the procedure will perform the test.

Grasp/Pinch Testing: There are no known risks associated with this measurement.

Sailing Ability Questionnaire: Aside from the risk associated with disclosing personnel or protected health information outside the research study, there are no known risks associated with this measurement.

Cardio-Vascular Monitoring: This is a vital signs measurement. There are no known risks associated with this measurement.

Sailing Score: There are no known risks associated with this measurement.

Weekly Diary: Aside from the risk associated with disclosing personnel or protected health information outside the research study, there are no known risks associated with this measurement.

Follow-up Questionnaire: Aside from the risk associated with disclosing personnel or protected health information outside the research study, there are no known risks associated with this measurement.

Other Risks:

Time Commitment: The time commitment for the treatment over the 12 weeks may be inconvenient. To **minimize the risk**: 1] You should contact the study coordinator if having problems scheduling the visits; 2] If we feel that you can not commit the time and effort, you will be excluded from the study; 3] The visits may cause moderate social, school and work disruption. The start of the study will be scheduled to lessen the disruption; 4] the follow-up questionnaire can be done over the phone.

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Loss of Confidentiality:

There is a risk that information about you may become known to people outside of this study.

5. Are there benefits to being in the study?

There is no known benefit to you for participating in this study, although it is possible that you might benefit from learning how to sail. This study may benefit others in the future by helping understand how a Virtual Sailing recreational and therapeutic program might contribute to an improved quality of life for people with spinal cord injuries.

6. What are your options if you do not want to be in the study?

If you decide not to join this study, other options are available. You do not have to join this study to get treatment. If you do not join, your care at the Kennedy Krieger Institute will not be affected.

7. Will it cost you anything to be in this study?

There will be no charge to you for your participation in this study. You will be responsible for the cost of travel to and from the Institute (Valet parking is available at no cost to you), as well as any food/meals purchased throughout the day while engaged in study procedures.

8. Will you be paid if you join this study?

No.

9. Can you leave the study early?

- You can agree to be in the study now and change your mind later.
- If you wish to stop, please tell us right away.
- Leaving this study early will not stop you from getting regular medical care.
- If you leave the study early, Kennedy Krieger Institute and Johns Hopkins may use or give out your health information that it already has if the information is needed for this study or any follow-up activities.

10. Why might we take you out of the study early?

You may be taken out of the study if:

- Staying in the study would be harmful.
- You need treatment not allowed in the study.
- You fail to follow instructions.
- You miss more than 3 training sessions.
- The study is cancelled.
- There may be other reasons to take you out of the study that we do not know at this time.

11. How will your privacy be protected?

Johns Hopkins and Kennedy Krieger Institute have rules to protect information about you. Federal and state laws also protect your privacy. This part of the consent form tells you what information about you may be collected in this study and who might see or use it.

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Generally, only people on the research team will know that you are in the research study and will see your information. However, there are a few exceptions that are listed later in this section of the consent form.

The people working on the study will collect information about you. This includes things learned from the procedures described in this consent form. They may collect other information including your name, address, date of birth, and other details.

The research team will need to see your information. Sometimes other people at Johns Hopkins may see or give out your information. These include people who review the research studies, their staff, lawyers, or other Johns Hopkins staff.

People outside of Johns Hopkins may need to see your information for this study. Examples include government groups (such as the Food and Drug Administration), safety monitors, other hospitals in the study and companies that sponsor the study.

We cannot do this study without your permission to use and give out your information. You do not have to give us this permission. If you do not, then you may not join this study.

We will use and disclose your information only as described in this form and in our Notice of Privacy Practices; however, people outside Hopkins who receive your information may not be covered by this promise. We try to make sure that everyone who needs to see your information keeps it confidential – but we cannot guarantee this.

The use and disclosure of your information has no time limit. You can cancel your permission to use and disclose your information at any time by calling the Johns Hopkins Privacy Officer at 410-735-6509 or by sending a letter to:

Johns Hopkins Privacy Officer
5801 Smith Avenue
McAuley Hall, Suite 310
Baltimore, MD 21209
Fax: 410 735-6521

Please be sure to include the name of the principal investigator, the study number and your contact information.

If you do cancel your permission to use and disclose your information, your part in this study will end and no further information about you will be collected. Your cancellation would not affect information already collected in this study.

12. What other things should you know about this research study?**a. What is the Institutional Review Board (IRB) and how does it protect you?**

The Johns Hopkins Medicine IRB is made up of:

- Doctors
- Nurses
- Ethicists
- Non-scientists
- and people from the local community.

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The IRB reviews human research studies. It protects the rights and welfare of the people taking part in those studies. You may contact the IRB if you have questions about your rights as a participant or if you think you have not been treated fairly. The IRB office number is 410-955-3008. You may also call this number for other questions, concerns or complaints about the research.

b. What do you do if you have questions about the study?

Call the principal investigator, Dr. Albert Recio at 443-923-9227. You may also contact the study coordinator, Shannon Inches at 443-923-9235. If you cannot reach the principal investigator or wish to talk to someone else, call the IRB office at 410-955-3008.

c. What should you do if you are injured or ill as a result of being in this study?

Call the principal investigator of this study, Dr. Albert Recio at 443-923-9227, if you think you are injured or ill because of this study.

d. What happens to Data, Tissue, Blood and Specimens that are collected in the study?

Scientists at Johns Hopkins work to find the causes and cures of disease. The data, tissue, blood and specimens collected from you during this study are important to both this study and to future research.

If you join this study:

- You will not own the data, or the tissue, blood, or other specimens given by you to the investigators for this research.
- Both Johns Hopkins and any sponsor of this research may study your data and the tissue, blood or other specimens collected from you.
- If data, tissue, blood, or other specimens are in a form that identifies you, Johns Hopkins may use them for future research only with your consent or IRB approval.
- You will not own any product or idea created by the researchers working on this study.
- You will not receive any financial benefit from the creation, use or sale of such a product or idea.

e. What are the Organizations that are part of Johns Hopkins?

Johns Hopkins includes the following:

- The Johns Hopkins University
- The Johns Hopkins Hospital
- Johns Hopkins Bayview Medical Center
- Howard County General Hospital
- Johns Hopkins Community Physicians.

If The Johns Hopkins University School of Medicine IRB reviews a Kennedy Krieger Institute (KKI) study "Johns Hopkins" also includes KKI.



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13. What does your signature on this consent form mean?

Your signature on this form means that:

- you understand the information given to you in this form
- you accept the provisions in the form
- you agree to join the study
- You will not give up any legal rights by signing this consent form.

WE WILL GIVE YOU A COPY OF THIS SIGNED AND DATED CONSENT FORM

Signature of Participant

Date

Signature of Person Obtaining Consent

Date

NOTE: A COPY OF THE SIGNED, DATED CONSENT FORM MUST BE KEPT BY THE PRINCIPAL INVESTIGATOR; A COPY MUST BE GIVEN TO THE PARTICIPANT; AND, IF APPROPRIATE A COPY OF THE CONSENT FORM MUST BE PLACED IN THE PARTICIPANT'S MEDICAL RECORD.

Week #1: Introduction to sailing.

Objectives:

1. Determine the appropriate method for getting and setting up the participant into the boat
2. Participant will be able to identify parts of the boat.
3. How to steer the sailboat

Review parts of the boat

1. **Bow** – forward/ front of the boat
2. **Stern** - back of the boat
3. **Port** - Left side of the boat; towards the bow
4. **Starboard** - Right side of the boat
5. **Rudder** -vertical metal or wooden plate attached to the stern; the movement steers the boat
6. **Keel** - centerline, backbone at bottom of the boat; stabilizes the boat
7. **Sheet** - Line that controls a sail or movement of the boom
8. **Helm** - joystick ,tiller, wheel
9. **Hull** - body of the boat
10. **Mast**- Pole made from wood, aluminum or carbon fiber from which a sail is set.
11. **Boom** - Horizontal spar/pole which extends from bottom of the mast (adjusting the boom towards the wind s how the sailboat is able to harness wind power in order to move forward or backward)

Set up Variables

- a. Under RAMS, ensure **Enable Heel Ram** is unchecked. ¹
- b. Under VIEW.
 - i. Uncheck **True Wind Direction Gauge**.

- ii. Uncheck **Speed and Apparent Wind Gauge.** ²
- iii. Check **Snail Trail** ³
- c. Under WAVES/Tides check - **Hit Hotkey 2 (makes wind 10 knots)**
- d. Under BOAT, check **Liberty Motor Sailor.** ⁴
- e. Under BUOYS, check **Upwind/Downwind.**
- f. Under LOCATION, check **Black Rock, Australia.**

Demonstration: Review Steering

1. Go over the Screen
 - a. Point out the bird's eye view
 - b. Point out location of the boat relative to the lighthouse and buoy
 - c. Arrows on the water
2. Allow participant to practice steering the sailboat
 - a. Have participant (using joystick) steer the boat around the yellow circle)

Chalk Talk: Parts of the boat (hand out)

Point Tip: Reminder to re-center the joystick and stopping the turn

Explain speed and force necessary to turn boat.

Week # 2: Steering

Steering is useful for two reasons. First, it allows the participant to go where they want to go. It is also useful in changing the angle of the sail to the wind without having to trim. While this second concept may at present seem unnecessary, it is nevertheless important that the participant understand this concept as it will make later concepts easier to understand.

Steering will require the use of one hand. If one hand is being favored over the other, try having the participant steer with the bad hand sometimes. However, the participant can get by without using one hand.

Objectives:

1. Review terminology and managing the joystick
2. Introduce and Explain the Bernouli's principle and its relevance to sailing
3. Outline **Points of Sail**
4. Allow participant to demonstrate knowledge

Explain concepts:

Bernouli's Principle:

1. Sailing boat derives its power from the wind flowing across the curved surface of sails.
 2. This is very similar to how an airplane wing produces lift to keep the plane in the air.
 3. A sail, like an airplane wing works at its best at one small angle to the wind
 4. Air move faster along the outer curve than the inner curve. Because of this there is more air pressure on the inner curve
 5. This result in **lift force** being created and acting on a sail between 2 curves.
 6. Lift Force pushes sail forward and sideways, thus pushing the boat along.
- The leading edge of the sail must point to the wind for this to work.

Chalk Talk: Hand out #2

Steering: Refers to the course of boat relative to the wind.

Terminology: Wind ward

Leeward

Steering: a. allows sailor to go where he wants.

b. Useful in changing angle of the sail to the wind without having to trim.

Explain Points of sail: There are 5-6 points of sail (describes all possible angle between the boat and the wind).

1. **No go zone:** the sailboat cannot run directly into the wind. Need to keep boat at least 45 degrees away from the wind (i.e., 45 degrees each side)
2. **Close hauled: (beating)** sailboat sail as close as possible to the direction the wind is coming from. The closet to the wind we can efficiently sail. (**1 o'clock and 11 o'clock**)
3. **Close reach:** sailboat sails closer to the wind than a beam reach, but not as close as a close haul. (**2 o'clock or 10 o'clock**)
4. **Beam reach:** the sailboat sails a right angle to wind. (**3 o'clock or 9 o'clock**)
5. **Broad reach:** the sailboat sails farther downwind than when on a beam reach, but not as far down as run. (**2 O'clock or 4 o'clock**)
6. **Run:** the sailboat sails straight down wind. (**6 o' clock**)

Chalk Talk:

- a. Review point of sail via **Hand out #3**
- b. Explain why you cannot go dead into the wind:
 - 1. *Two parallel straight lines of equal length on either side of the sail*
 - 2. *No speed difference between air on either side*
 - 3. *No pressure difference.*
 - 4. *No lift force.*
 - 5. *No movement*
- c. Explain what it means to “come up”
 - a. Let’s consider the boat sailing into a circle. As it does it passes through each point of sail. Turning to the **Windward Side** (direction the wind is blowing) is called “**coming up**”.
 - b. *As you come up – trim your sails
- d. Explain what it means to “falloff”
 - a. Turning to the **Leeward Side** (direction opposite to where the wind is blowing) is called “falling **off**”.
 - b. * As you fall off - ease out of your sail
- e. Explain the method “if the sail is luffing, fall off until it stops luffing.”

Set Variables:

- g. Under RAMS, ensure **Enable Heel Ram** is unchecked. ⁵
 - h. Under VIEW.
 - i. Uncheck **True Wind Direction Gauge**.
 - ii. Uncheck **Speed and Apparent Wind Gauge**. ⁶
 - iii. Check **Snail Trail** ⁷
 - i. Hit Hotkey 2 (makes wind 10 knots)
-

- j. Under BOAT, check **Liberty Motor Sailor.** ⁸
- k. Under BUOYS, check **Upwind/Downwind.**
- l. Under LOCATION, check **Black Rock, Australia.**

Demonstration:

1. Have the participant hold the joystick and release sheet entirely. You do not want them worrying about the sheet. Instructor will trim the sheet.
2. Have the participant steer the boat in the direction of the wind arrows.
3. Have the participant steer the sailboat across the arrows.
4. Have the participant turn the sailboat firmly through the wind (left or right until they switch over (TACK)).
5. Have the participant turn the sailboat so that the stern of the boat goes through the wind (GYBE).
6. Have the participant steer towards the lighthouse.
7. Have the participant steer the boat in a circle around the buoy.

Steering to the sails:

- (Trim the sail to a beam reach). Have the participant steer the boat until the sails are trimmed correctly.
- (Trim sails to a close reach). Have participant steer the boat until the sails are trimmed correctly.
- Continue through all points of sail.
- Ease the sail gradually all the way out. – Have participant gradually turn downwind until they are dead downwind.
- Have the participant turn the sailboat and sail the circle in the opposite direction.

Set Variables: *Add rocks.*

Under Location, check **Watch the rocks.**

- Have the participant steer around rocks and buoys and have them tack and gybe at least once.

Week # 3: Sail Trim

*Now that the participant knows they can steer a boat, the next step is to make the boat go which is **sail trim**. Sail trim is the most direct way of adjusting the angle of the sail to the wind.*

The introduction of sail trim will require the participant to use both arms and hands, so if the purpose of the therapy is to strengthen the arm or hand, this is a good lesson. This may quickly become tiresome, so use caution.

Objectives:

1. Introduce the participant to basic sail trim
2. Determine whether participant can steer and trim simultaneously.
3. Outline points of sail and approximate sail trim for each.

Terminology:

1. **Trim:** To pull the sails in.
2. **Ease:** to let out the sails.
3. **Luff:** The flapping of the whole sail.
4. **Knots:** 1 nautical mile per hour (1 1/6 land mile per hour)
5. **True Wind:** Wind that blows across the water. (i.e., the wind we feel when we are not moving).
6. **Apparent Wind:** wind that is generated by our movement in combination with the true wind. It is the true wind altered in speed and direction as a result of the forward motion of the boat. When the boat moves it creates its own wind, which combines with the true wind forms the apparent wind.

7. **Tails:** air force across sails; need even sail flow on either side for optimal performance. (green- starboard side; red- port side)

Chalk Talk: There are 2 types of force that drives the boat.

1. When you are sailing close hauled, air flows along the surface of the sails and **lift** drives the boat.
2. When you sail downwind, the sails are stalled. There is no air along the surface of the sails and the boat is powered by the wind driving into the sails and **pushing** the boat.
3. On reaches (close, broad) the boat is powered by a combination of lift and pushing. The closer the reach the more lifting, the broader the reach the more pushing.
4. Of the 2 types of force the lift is more powerful. Whenever possible we want to get air flowing along the leeward side of the sails.
5. Easing sails out until they luff a bit and trimming them in just until the luffing stops works on any reach.

How to trim the sails?

- Ease until they start flapping or as you go away from the wind.
- Pull in as you go closer to the wind.
- Use telltales.

Wind Indicators in the VSAIL program

- Arrows in the water
- True Wind Direction Gauge

- Apparent Wind.

Set Variables:

- a. Under VIEW
 - i. Check **True Wind Direction Gauge**.
 - ii. Check **Speed and Apparent Wind Gauge**.
 - iii. Check **Snail Trail**.
- b. Under BOAT, check **Liberty Motor Sailor**.
- c. Under LOCATION
 - i. Uncheck **Watch the Rocks!**
 - ii. Check **Black Rock, Australia**.
- d. Under BUOYS, check **None**.

Chalk Talk cont'd

- when you close haul you trim sail in tight
- When beam reach set trim about halfway.
- When running, ease them out all the way.

Explain Apparent Wind using.

- Hand out # 4
- True/ Apparent Wind Gauge on V- Sail
- (The apparent wind is always farther ahead than true wind direction, except on a dead run.)

Example 1:

1. Boat sails on close reach at 5 knots
2. True wind is 10 knots
3. Boat moving forward produces 5 knots of wind

4. We combine boat speed and direction with true wind speed and direction.
5. The combined effects of true wind and boat motion forward produces (Apparent Wind.)
6. Apparent wind is what we feel on the boat. Apparent wind is stronger than true wind.

Example 2: What if we head down on a run?

- As we turn away from the wind the boat slows down.
- Why? Because the apparent wind drops, and the sails become less efficient.

Demonstration:

- Participant to practice sail trim.
- Participant to Identify / Explain True and Apparent Wind on Gauge on V-Sail.

Activity:

- 1 Have participant point out wind direction and explain how they know.
2. Have participant trim main sheet so that they can see how hard they need to pull. Explain to them that pulling the mainsheet is also called **trimming** the mainsheet.
3. Have sailor steer, while instructor trims to the course.
4. Have participant sail on beam reach:
 - a. **over trim the sail and ask them to fall off. If this is difficult, ease the sails and explain that easing the sail makes it easier to turn downwind.**

- b. **Ease the sails and ask sailor to come up. If this is difficult, trim in the sail and explain that trimming in the sails makes it easier to come up.**
- 5. Have the participant trim the sails while the instructor steers.
 - a. Have the participant trim the sails according to the telltales.
(To do this, make tiny variations in direction that don't cause the sails to flap, but that cause the telltales to flap.)
 - b. Steer on each point of sail for a while and have them trim accordingly.
- 6. Have the sailor control the joystick and have them sail around while trimming and steering. The sailor should tack, gybe, fall off, and come up at least once.

Add Variables

- a. Under LOCATION, check **Sydney Harbour, Australia.**
 - b. Under BUOYS, check **Up/Down Wind.**
 - c. Under BOAT, check **Liberty.** ⁹
- 7. Have participant sail around the buoys.

Week # 4: Basic Sailing Maneuvers

Now that the participant knows how to trim the sails to a course and steer, it is time to introduce the basic sailing maneuvers sailors use all the time on the water (tacking, gybing, docking/stopping, and starting again if stopped dead into the wind).

Objectives:

- 1 Introduce participant to:
 - Tack
 - Gybe
2. Patient should be able to stop boat next to a mark. **Docking**
3. Start moving again after stopping in the wind.

Terminology:

1. **Tack:** Tacking is the basic sailing maneuver which refers to turning the bow of the boat through the wind, so that the wind changes from one side of the boat to the other side.
2. **Gybe:** Opposite of tack. Refers to turning the stern of the boat through the wind so that the wind changes from one side of the boat to the other.

Chalk Talk: Hand out # 5& 6

1. **Why Tack?:** Because you cannot steer directly into the wind, so it is necessary to go on a diagonal.
2. **Why would you need to stop?:** to dock or to get something out of the water
3. **How do you get moving again:**
 - a. Allow the wind to push the boat backward.
 - b. turn the rudder to move the stern to the left or right until the boat is on a broad reach.
 - c. turn the rudder hard the other way and trim the sails to begin moving forward.

If the wind is blowing directly in our direction, then we will enter “no go zone”. Therefore, we have to change direction or boat will lose speed and eventually stop.

Set Variables:

- a. Under VIEW
 - i. Check **True Wind Direction Gauge**.
 - ii. Check **Speed and Apparent Wind Gauge**.
 - iii. Check **Snail Trail**.
 - iv. Under MAPS
 1. Check **Follow Boat**
- b. Under BOAT, check **Liberty**.
- c. Under LOCATION
 - i. Uncheck **Watch the Rocks!**
 - ii. Check **Black Rock, Australia**.

- d. Under BUOYS, check **Upwind/Downwind**.

Activity/ Exercises:

1. Tacking and Gybing

- a. Have participant start on a beam reach.
- b. Have participant turn to a close reach.
- c. Have participant tack 10 times. ***After each tack, pause the program, and show the participant the snail trail so that they can see whether or not they made a good 90-degree tack.***
- d. Have the participant fall off to a broad reach.
- e. Have the participant gybe 10 times. ***After each gybe, pause the program and show the sailor whether or not they made a good 90-degree gybe.***
 - i. Instruct the participant that while gybing, they should pull the sail in until it switches sides, and then ease the sail back out. This is for safety on the water.

2. Stopping and Starting Again

- a. Have the participant sail back to the buoys if they aren't there already. ***If they are completely lost, under CONTROL, click Reset, or just hit Hotkey R.***
- b. Have the participant sail along on a beam reach.
- c. Have the participant turn the boat dead into the wind until the boat stops. ***Instruct the participant that they must turn the joystick firmly.***
- d. The participant should now be stopped dead.
- e. **To start again**, tell the participant to let the boat start to move backward by easing the sail out completely. [***sails are luffing into the wind***]

- f. Once the boat is moving backward, have the participant push the rudder hard one way. [**wind will push the boat backwards; turn the stern of boat in one direction, which will cause bow to go in the other direction**]
 - g. Once the boat is on a broad reach, have the participant turn the rudder hard the other way and trim the sail to establish forward motion. [**once bow is turned away from wind, trim the sails to move forward and turn the joystick so the bow moves further away from the wind.**]
 - h. Have the participant do this 5 times.
3. **Stopping next to a mark**
- a. Have the participant sail on a close reach towards a spot just downwind of a mark.
 - b. Right before they pass the mark, have the participant turn hard upwind to stop the boat.
 - c. Once they have stopped, have them start again by the method explained above.
 - d. Have the participant do the same maneuver starting on a close reach (downwind of the mark)
 - e. Have the participant do the same maneuver starting on a broad reach (upwind of the mark)

Set Variables

Under BUOYS, check **Triangular**.

4. Turning around marks

- a. If the participant isn't near the buoys, ***under CONTROLS, click Reset.***
 - b. Have the participant make their way downwind and round the leeward mark, leaving the buoy to starboard.
 - c. Have the participant sail upwind on a close reach towards the wing mark, and round the mark, leaving it to starboard.
 - i. Explain to them that the best way to do this is to tack after passing the mark.
 - d. Have the participant sail upwind to the upwind mark and leave it to starboard. They should turn downwind to round the mark.
 - i. they should turn right and ease the sail.
 - e. Have the participant sail downwind and gybe so they are heading to the wing mark again on starboard gybe. They should round the wing mark, leaving it to port.
 - i. they should gybe to get around the wing mark.
 - f. Have the participant sail downwind on port gybe towards the leeward mark. They should round the mark and leave it to port.
 - i. To get around the mark, they will have to turn left and trim in until they are on a close-hauled course.
 - g. Have the participant sail upwind to the upwind mark by tacking back and forth.
5. If there is any time left, just let them sail around.

Sailing Lesson # 5: Heeling

Perhaps the most frightening part of sailing is heeling over. As experienced sailors know, sailing usually involves heeling over, and they are used to the feel. New sailors are not used to this feeling, and this can be especially frightening for someone who cannot use their legs. Therefore, it is best to introduce heeling over once the participant knows how to trim sails and steer so that they will not be too concerned when they find themselves tilting over.

Heeling over is a good therapy for the trunk muscles and for the proprioception. In order to flatten the boat, the sailor must first realize that they are leaning over (proprioception and orientation) and then they should have a natural tendency to lean to right the boat (core muscles, coordination).

- Objectives:
1. To make participant comfortable with heeling over.
 2. To have participant perform basic sailing maneuver with heeling over as a factor.

Note: unlock emergency stop

Terminology:

1. **Heel:** when the sailboat tips sideways; the lean caused to a sailboat by the winds force on the sails.

Chalk Talk: ***What is heeling over?***

Why does it happen?

- 1 (a) Heeling is the result of the force of wind on the sails.
 - Not all the force produced by the sails pushes the boat forward except when the boat is on a run with the wind directly behind it.
 - As the force of the wind is transferred into the forward motion, any excess is transferred to sideways motion.
 - The strength of the sideways force depends on the point of sail the boat is on.
 - The sideways force is at its greatest when the boat is closed hauled and diminishes as the boat bears away from the wind.
 - The sideways force causes the boat to lean to one side.
- 1 (b) Part of the total force produced by the sails pushes the boat sideways. The sideways force is resisted underwater by the keel.
 - The keel provides a lifting force in the opposite direction, so the boat just goes forward.
 - The keel is used to resist sideways force; stabilize the boat.
2. We heel to:
 - a. gain advantage in point of sail.
 - b. get closer to wind (closer point of sail)
 - c. promote more lift.
3. Heeling happens due to:

- a. Lateral component of the wind (unless the wind is directly in front or behind you) there is a lateral component.
- b. Sail trim is the primary cause of heeling.
- c. Weight of rigging is another reason.

4. Ways to reduce heel:

- a. Come up into the wind, thus reducing the amount of wind into the sails. (less wind into the sails)
- b. Let out the sheet (easing the sails)
- c. Shift weight to windward side.

1. Setting up Variables

- a. Under BOAT, check **Liberty Motor Sailor**.
- b. Under SAILOR
 - i. Click **Mass**.
 - ii. Enter mass of sailor (this can be approximate).
- c. Under WIND, WAVES, and TIDE
 - i. Click **Speed**
 - ii. Check **8 knots**.¹⁰
- d. Under BUOYS, check **None**.

2. Let the participant sail around for a few minutes.

3. Under RAMS, check **Enable Heel Ram**.¹¹

4. **Make sure emergency stops are off.**

5. **Make sure the participant is ready.**

6. Have the participant release the sheet.¹²

7. Press Play button on computer.
8. Have the participant **trim the sheet and heel over.**
9. Have the participant over-trim on a beam reach.
10. Have them flatten the boat. ¹³
11. Under BUOYS, check **Trapezoidal.**
12. Have the participant tack and gybe a few times.
13. Have the participant stop next to a mark and then start again.
14. Generally, the point of this lesson is just to sail around to get use to heeling over.

Week # 6: High Wind

Objectives:

1. To ensure that participant know how to deal with gust and wind shifts.
2. To make sure that participant is comfortable when these occur.

Terminology:

1. **High Wind:** A very strong wind.
2. **Gust:** Sudden brief increase in wind
3. **Wind shift:** A change in wind direction.

Chalk Talk:

1. What happens in high wind?
2. How do you flatten the boat?
3. What can you expect in a gust.
4. What is a shift?

Set Variables

- a. Under BOAT, check **Liberty Sailor**.

- b. Under SAILOR.
 - i. Click **Mass**.
 - ii. Enter Mass.
 - c. Under LOCATION, check **Black Rock, Australia**.
 - d. Under WIND, WAVES, & TIDE
 - i. Click **Speed**.
 - ii. Check **8 knots**.
 - e. Under BUOYS, check **Trapezoidal**.
 - f. Under RAMS, check **Enable Heel Ram**.
-
1. Have participant sail around, keeping boat flat with sails.
 2. **Increase wind speed by 2 knots every few minutes, once they are ready.** ¹⁴
 - a. **Hit Hotkey 3, then 4, then 5, then 6.** ¹⁵
 3. Have the participant sail around.
-

Week # 7: Gust and Shifts

Up until this point, the wind has been consistent in both speed and direction. Now we introduce variable wind speed (gusts) and variable wind direction (shifts). These phenomena often occur on the water.

Objectives: 1. To expose participants to wind gusts and shifts.

2. To teach participants how to react appropriately.

- ***Unlock emergency stop.***

Terminology:

1. **Gust:** **Change in force of the true wind.** *Short blast of wind; sudden brief increase of the wind. A short burst of high-speed wind. Duration of gust usually less than 20 seconds.*
2. **Shift:** **Change in direction of true wind.**

Chalk Talk: What to expect:

Gust:

5. Wind speed increases suddenly.
6. Signified by darker, choppier water.
7. Increase in magnitude of apparent wind.
8. Lift force increases so boat goes faster and heels over more.
9. May need to flatten boat by **easing sails or leaning**.
10. May need to slow down by **easing sails or falling off**.

Shifts:

1. Wind direction changes suddenly.
2. Angle of sail must then change accordingly.
 - a. Come up or fall off.
 - b. Trim or ease
 - c. Change course or change point of sail.
3. Boat may heel over more.
 - a. In this case ease sails or fall off

Set Variables:

- a. Under BOAT, check **Liberty**.
- b. Under SAILOR, enter Mass under **Mass**
- c. Under RAMS, check **Enable Heel Ram**
- d. Under WIND, WAVES, & TIDE
 - i. Under **Speed**, check **10 knots**.
 - ii. Under **Gusts**, check **Repeatable**.
- e. Under Location, check **Sydney Harbour, Australia**

Activity:

1. Have the participants sail on a beam reach with sails trimmed correctly.
2. Once participants hit a gust, the boat should heel over further. Have them flatten the boat.
3. Have participants tack and gybe to hit as many gusts as possible in 15 minutes.

Add Variables:

- a. Under WIND, WAVES, & TIDE
 - b. Check **Shifts**
 - c. Under **Gusts**, check **None**.
4. Have participants sail and ensure that they are adjusting to shifts appropriately (easing vs. trimming, coming up vs. falling off)

Add Variables:

- a. Under WIND, WAVES, & TIDE
 - b. Under **Gusts**, check **Random**.
5. Have the participants sail around.



International Center for Spinal Cord Injury
at Kennedy Krieger Institute
Research. Restoration. Recovery.

Follow-up Questionnaire

IRB NA_00044093

Virtual Sailing Simulator in Individuals with Spinal Cord Injury.

PI:

Albert Recio, MD

Subject ID: _____

Date Administered: ____/____/____

Data Period: ____ 6 Month Follow-up ____ 12 Month Follow-up

Over the Phone: ____ No ____ Yes

Administrator's Name: _____

Instructions: This survey asks for your views about sailing and your sailing abilities.

If you are unsure about how to answer a question, please give the best answer you can.

Use a black or blue pen. Do NOT use a pencil.

1. How do you rate your sailing abilities?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EXCELLENT	VERY GOOD	GOOD	FAIR	POOR

2. Since your last VSail training session, have you done more training on the VSail?

<input type="radio"/>	<input type="radio"/>
YES	No

3. If you answered Yes in question 2, please answer the following questions:

Amount of training: _____

Were you tired after your sailing session?

What were/are the road block to VSail training?.....__ Easy, __ Difficult

Go to Question 5.

4. If you answered No in question 2, please answer the following questions:

Did you considered doing more VSail training?.....__ Yes, __ No

What were/are the road block to VSail training?

Go to Question 5.

5. Since your last VSail training session, have you been sailing on the water?

<input type="radio"/> YES	<input type="radio"/> No
------------------------------	-----------------------------

6. If you answered Yes in question 5, please answer the following questions:

Type of Sail boat: _____
Amount of sailing: _____
Were you sailing with a crew or alone?.....__ Crewed, __Alone
Were you the skipper on the boat?.....__ Yes, __ No
Were you tired after your sailing session?

What were/are the road block to go sailing on the water?.....__ Easy, __ Difficult

Go to Question 8.

7. If you answered No in question 5, please answer the following questions:

Have you considered going sailing on the water?__ Yes, __ No
What were/are the road block to go sailing on the water?

8. Do you have any comments?

You are done with the questionnaire, thank you.

NOTE: If the subject is not able to come to the center, the information will be collected over the phone.

Study: NA_00044093

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