Operator’s Manual
Reclining Beach Wheelchair
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Project for Matthew and Jack Davies
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Important Safety Instructions

- This product is meant for beach use only. Never use the wheelchair on hard or sharp surfaces.

- This product should be stored indoors away from rain, snow and ice.

- This product should be dried thoroughly before storage.

- This product is only designed to carry passengers up to 200 lbs. Passengers weighing more than 200 lbs should not ride in the reclining beach wheelchair.

- The tires on this product must remain inflated to a PSI between 2 and 4. A gauge has been included. PSI should be checked before each use.

- This product should not be ridden without the safety harness.

- The wheelchair is designed for one passenger. Never use this wheelchair with more than one rider.

- Never use this product on steep inclines, hills, steps, or rough terrain.

- Never use this product on public streets, alleys, roads or paved surfaces.

- Never recline the rider of this chair without thoroughly checking that the reclining mechanism is locked into place. Adult supervision required.

- Adult supervision is required when using this product. Supervisor should ensure that the chair is completely assembled and safe before rider is placed in the chair.
Parts and Accessories:

- Upper portion of wheelchair frame

- Lower portion wheelchair frame
• Reclining Mechanism

![Image of reclining mechanism]

• Plates to lock reclining mechanism at set angles

![Image of plate locking mechanism]

• Swivel foot on bottom of reclining mechanism

![Image of swivel foot]
• Adjustable locking pin setup on locking mechanism

• Plate connecting upper arms of wheelchair frame to the lower portion of the frame

• Folding mechanism
• Tumbleforms chair

• Rear polyurethane balloon tire (49 cm diameter)

• Front polyurethane balloon tire (24 cm) and manufacturer’s caster
• Caster modification

• Armrest

• Legrest
• Velcro (on tumbleforms chair)

• Velcro (on wheelchair)

Features:

- Removable reclining leg
- Large, removable beach tires
  - Custom-built attachments
- Custom removable cushion system (Tumbleforms)
- Foldable wheelchair frame
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1 Introduction

1.1 General Overview

The reclining beach wheelchair was fabricated using an existing 16.5” youth wheelchair frame. This frame was modified to result in a portable beach wheelchair that could recline. All additions and modifications were built from aluminum, which was chosen for its strength to weight ratio.

The tires chosen for the chair are large polyurethane beach tires. Additions were built to allow these tires to be mounted to the wheelchair frame. The size and pliability of these tires will make the chair able to float on the top layer of sand at the beach. The back tires, which are considerably larger, can be removed from the wheelchair using quick-release pins, allowing the chair to be folded down and making it easier to pack. These tires can be seen in Figures 1 and 2.

![Figure 1: Rear tires.](image)

A tumbleforms chair has been attached to the wheelchair frame to seat the rider comfortably and safely. This chair is removable and can be taken off to allow the wheelchair to fold down. The tumbleforms chair
has a seatbelt, which is essential for rider safety. The tumbleforms chair can be seen in Figure 3.

![Tumbleforms chair](image)

*Figure 3: Tumbleforms chair.*

The reclining mechanism was built for this wheelchair as an alternative to the more expensive and less practical reclining mechanisms on the market. It works as a third leg, allowing the wheelchair to be tipped and balanced on the two back tires and the reclining leg. This position takes a lot of pressure off of the rider’s lower back, and increases comfort and circulation. The chair in the reclining position is depicted in figure 4.

![Reclined beach wheelchair](image)

*Figure 4: Reclined beach wheelchair.*
1.2 Operating the Reclining Beach Wheelchair

The Reclining Beach Wheelchair was designed for transport of Jack Davies by an adult. Adult supervision is essential for the safety of the rider. It is recommended that the rider is always wearing the seatbelt while the chair is in motion or in the reclined position.

The entire chair must be assembled before the rider is placed in the tumbleforms chair. This means that both of the sets of wheels are properly attached, the tumbleforms chair is secured via the Velcro system and the reclining arm is locked in the proper position (either reclining or flush against the back of the wheelchair.) Once the chair is assembled, the rider may be placed in the tumbleforms chair and strapped in using the four-point harness.

Before pushing the chair, the adult supervisor should ensure that the rider’s feet are secure on the foot strap and are not dangling near the front castors. Once secure, the adult may push the wheelchair forwards using the two large handles on the back of the wheelchair. The adult needs to keep an eye out for sharps and edges on the path, because the polyurethane beach tires are susceptible to popping.

To recline the chair, the adult should “park” the chair by engaging the brakes and locking the back tires. Once locked, the adult may change the length of the reclining arm using the quick release pin. They may then move the arm to the reclining position, using both of the quick release pins on the arm plates of the reclining mechanism. The adult should double check that all pins are secure before tilting the chair and rider back to rest on the reclining leg. The adult should also ensure that the rotating foot is flush on the ground and is dispersing the weight of the rider on the sand. Once the rider is secure, the adult may step away from the chair and allow the rider to recline. It should be noted that the rider should still be strapped in using the harness at this point.

To break the chair down for transportation, the rider should first be removed from the tumbleforms chair. The tumbleforms chair may then be taken off the Velcro system. The back tires may be removed by taking off the outer quick-release pins and sliding the tires off of the axles. The reclining arm can be removed using the quick release pins or folded flush against the chair. The back supports can be folded down against the seat of the wheelchair. If the reclining arm was removed, the entire wheelchair may be folded inwards until the front castors touch.
2 Maintenance

2.1 Tires
The tires must be kept between 2 and 4 PSI when in use. Over inflating the tires voids the warranty and increases the chance that the tires will rupture. The pressure of the tires should be checked before every use. The custom built casters (figure 5) are secured using a system of four bolts. The bolts should be checked before each use, ensuring that they are secure. Additionally, the weld should be inspected. Should the weld come loose, the chair should not be used until it can be re-welded by a professional.

Figure 5: Custom built caster attachments.

2.2 Frame
The frame of the wheelchair should be cleaned regularly, just as a normal wheelchair would be cleaned. Grease and sand should not be allowed to accumulate near any of the moving parts of the wheelchair. If part of the chair is clogged or stuck due to an accumulation of sand or grease particles, an adult should clean the chair and attempt to free this moving part before it is used again.

2.3 Reclining Arm
As with the frame, the reclining arm should be cleaned regularly. It is essential that sand does not become trapped in the sliding arm, as this will likely create friction and could break the arm. In the event that the arm does become stuck, an adult should attempt to free the sand and should not try to force the arm to slide. The friction could create heat and warp or damage the arm. If the arm is at all warped or damaged, it should not be trusted to support weight and should not be used.
Figure 6: Sliding arm should not be clogged with sand and should always slide smoothly. Do not force the arm to slide.

2.4 Tumbleforms Attachment
Since the tumbleforms chair is affixed to the wheelchair using Velcro, it is essential that this Velcro maintains a good bond. To ensure that the Velcro remains strong, it should be brushed and cleaned after each use to remove any sand particles which may hinder its’ ability to bind.

3 Technical Description
The Reclining Beach Wheelchair is a system made up of many sub-units, which will be described in detail in the following sections. The finalized project is depicted in the figure below.

3.1 Frame
The frame was bought used, and is a 16.5” Quickie youth wheelchair frame. This model was chosen because it comfortably takes the width of the Tumbleforms seat, and it folds down fairly small to allow for easy packing. The removable back axels were another reason for choosing this wheelchair, as they allowed for the extensions for the back beach wheels to be built without deconstructing the original frame.

3.2 Seat
The seat is a tumbleforms chair that Jack’s family already owned. Using this cushion provides a built-in harness system to keep the rider secure in the beach wheelchair. It is also tall enough to support the head and neck. Additionally, the removable chair allows the family the option to change the cushion when Jack gets older, so he may continue to use it for transportation at the beach.

3.3 Wheels
Instead of normal wheelchair tires, the beach wheelchair has large polyurethane tires to help it float on the top layer of sand. The back tires are Wheeleez brand 49 cm PU beach wheels. The front tires are 24 cm PU beach wheels with beach castors. The tires need to be inflated between 2 and 4 PSI to remain under warranty. Over inflating the tires greatly increases the risk of popping them. Keeping the tires within this PSI range is also ideal for allowing them to float on the sand. The back
tires can be removed by taking off the quick release pins on the axel and sliding the tire off. Care should be taken to ensure that the spacers and axels are secure and do not fall off of the wheelchair. Without the spacers, the back tires will rub on the chair and have a great chance of getting punctured.

3.4 Reclining Mechanism

The reclining mechanism was built entirely from scratch and was designed to allow the rider to recline while the seat and back remain at a 90-degree angle. This takes a good deal of pressure off of the lower back, but keeps the rider secure in the chair and maintains the shape of the Tumbleforms cushion. The mechanism was built to allow the user to change the angle by removing the quick release pin and sliding the bottom pole in or out to make the reclining leg shorter. The pivoting foot on the bottom of the leg disperses the weight of the rider and keeps the leg from sinking into the sand. Struts were built into the design simply to ensure mechanical strength. At the top end of the reclining mechanism, the user can use the quick release pins to secure the reclining leg to the back of the wheelchair and keep it out of the way. When in use, the mechanism must be opened to the largest angle and secured with the quick release pins in the farthest-back holes.

4 Troubleshooting

Problem: Wheelchair is not rolling over sand smoothly.

Possible causes:

1. Tires are not inflated to correct PSI
2. Moving parts (axel, caster) may be jamming.

Possible solutions:

1. Check pressure of tires with tire gauge, inflate/deflate if necessary. PSI should remain between 2 and 4 PSI.
2. Check that the axels and casters are operating properly. Greasing back axels may facilitate movement

Problem: Reclining mechanism is not working.

Possible causes:

1. Quick release pins are not set in place.
2. Rider’s weight is not evenly distributed.
3. Rotating foot is not flush on the ground surface.

Possible Solutions
1. Ensure that all pins are fully engaged in the proper hole.
2. Change the length of the reclining leg to balance weight until rider is secure.
3. Adjust the rotating foot so that it is touching the surface of the ground.

Problem: Rider is not secure in the chair; chair appears to be moving.

Possible causes:

1. Tumbleforms chair is not correctly mounted.
2. Rider is not wearing the safety harness.
3. Tumbleforms chair may not be right size for rider.

Possible Solutions:
1. Affix tumbleforms chair securely to all velcro spots.
2. Secure rider using the 4-point harness system.
3. Do not use the chair until a cushioning system suitable for the rider can be found.

Problem: Polyurethane balloon tire not holding pressure

Possible Causes:

1. Tire has been punctured by object
2. Tire has been overinflated and a leak has formed

Possible Solutions:
1. Patch tires using rubber provided and according to manufacturer's instructions
   - After repair check to ensure tires inflated to pressure between 2 and 4 psi

Problem: Beach wheelchair is sinking into the sand

Possible Causes:

1. Tire has been overinflated

Possible Solutions:

1. Remove air from tire and check pressure to ensure tire is properly inflated
Problem: Beach wheelchair is rattling

Possible Causes:

1. A bolt has come loose on the wheelchair
2. A locking pin is not securely in place

Possible Solutions:

1. Check wheelchair for loose bolts and tighten as needed
2. Check the locking pins to make sure they are securely in the hole

Problem: Rear tire is rubbing on side of frame

Possible Causes:

1. Spacer on side of the tire has broken or fallen off
2. Extensions on the rear of the frame have come loose and are rubbing on the tire
3. Extensions on the rear of the frame have bent outwards

Possible Solutions:

1. Replace spacer or ensure it is snug against both the frame and the tire
2. Tighten the bolts attaching the extensions to straighten them
3. Attempt to bend extensions back to their normal shape

Problem: Brake no longer makes contact with rear tire

Possible Causes:

1. The extension on the brake has bent away from the tire
2. The brake has come loose and has slid down the tube away from the tire

Possible Solutions:

1. Bend the brake extension back towards the tire until it is straight
2. Move the brake back into position and tighten down to lock it into place

Problem: Armrests are wiggling

Possible Causes:
1. Armrest brackets have loosened from frame
2. Adjustability pin on armrest has become loose and is allowing armrest extra play

Possible Solutions

1. Tighten the armrest brackets using the 4 bolts on the back side
2. Adjust locking pin on armrest so it is securely in one of the pre set positions (marked by holes)