In-Home Gravity Harness System

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Disclaimer

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Document Revisions

Date	Version Number	Document Changes
01/17/2017	0.1	Initial Draft
03/13/2017	0.2	Changes to materials
04/17/2017	0.3	Updates to procedure with new materials
4/26/2017	1.0	Complete for final product

Table of Contents

1 Introduction

1.1 Purpose

This manual can be used to build an In-Home Gravity Harness System that is used to enable children with mobility disabilities to walk unaided. The system is constructed with an Easy Up frame, a pop up tent-like apparatus that can be unfolded to turn any space into playtime. This removes the need for parents to drill permanent holes in a ceiling to support their children's weight as well as allowing them to control the space in which their child can move. The open plan enables the child to interact with both the environment covered by the frame and other children or adults.

This user's guide is provided to instruct family and friends of a child with disability to construct the device without a need for specialized training or equipment. The parts included in this manual can be found at most chain hardware stores such as Home Depot or Lowes, with additional sources to help each builder adapt this design to fit their own needs. The tools required for assembly include items often already found in most people's garages. This manual will show the process for assembly step by step, as well as a section for increasing the aesthetic appeal of the device to the user.

1.2 Process Overview

This manual organizes the process of construction by:

1. Required materials and tools
2. Construction of Easy Up base and guide rails
3. Middle bar assembly
4. Assembly of harness and attachments
5. Disassembly instructions
6. Additional resources for customization

2 Parts and Materials

2.1 Assembly Parts

The parts and materials required for assembly can be found below along with sources, approximate prices, and important considerations when shopping around. Images showing select parts can be found in the Appendix and are denoted with (*).

Part Number	Part Name	Function	Approximate Cost	Source(s)	Important Considerations
1*	Easy Up	Base Structure	$200	Home Depot Amazon Ezup.com	Steel frame required (not aluminum)
2	PVC Pipe	Wheel Connector Weight Distributor	$10	Home Depot Hardware Stores	Need 1” diameter Need at least 5ft total
3*	Tow Strap with Easy Release Buckle	Connect PVC to swivel	$20	Target Amazon	
4*	Jumper Harness	Hold user (0-25lbs)*	$16	Walmart Target	Choose based on weight range
5*	L-Shaped Slotted Steel Angle	Make guide rails	$9 each	Home Depot	Using 4ft sections, need 10
6*	Simpson Strong Tie Steel Strap	Reinforce L-shaped steel	$1 each	Home Depot	Need at least 8
7*	Training Wheels	Move middle bar	$15	Target	Need 4 Must accommodate 0.3” axle

Part Number	Part Name	Function	Approximate Cost	Source(s)	Important Considerations
8	Middle Bar	Span Easy Up	$12	Lowes Home Depot	Common chain link fencing post Must be >10ft
9*	Rock Climbing Swivel	Allow rotation on harness	$30	Amazon	
10*	Linear Ball Bushing Bearing	Move harness along middle bar	$20	VXB.com Amazon	Fit over 1.3” pipe (middle bar diameter)
11	T-Shaped PVC Pieces	Create wheel attachments	$2	Home Depot Hardware Stores	Connect 1” pieces of PVC pipe
12	Bungee Cord	Connect swivel to middle bar	$5	Target Home Depot	High tension is best

2.2 Tools and Fasteners

Tool/Fastener	Appx. Price
Wrench (Combo Set) • Open ended wrenches • Allen wrenches	$30
Screwdrivers (Assorted Sizes/Types)	$20
Power Drill	$50
Drill Bit Assortment • Cone shaped bore	$20-30
Hack Saw (cut steel)	$10
PVC Adhesive	$6
Bolts (sizes/quantity) • ¼" diameter variety, lengths as needed	$0.50-2

3 Frame Construction

3.1 Easy Up Base

This section covers the unpacking and assembly required to configure the Easy Up into a usable base.

3.1.1 Unpack Easy Up

1. Unfold Easy Up according to the instruction manual enclosed with product
2. Remove the nuts in each of the top corners of the Easy Up with a wrench or screwdriver (**Figure 1**)

Figure 1. Top Bolt Removal

   a. Collect nuts and bolts and keep for potential reuse
3. Completely remove upper members on the top of the Easy Up frame (**Figure 2**)

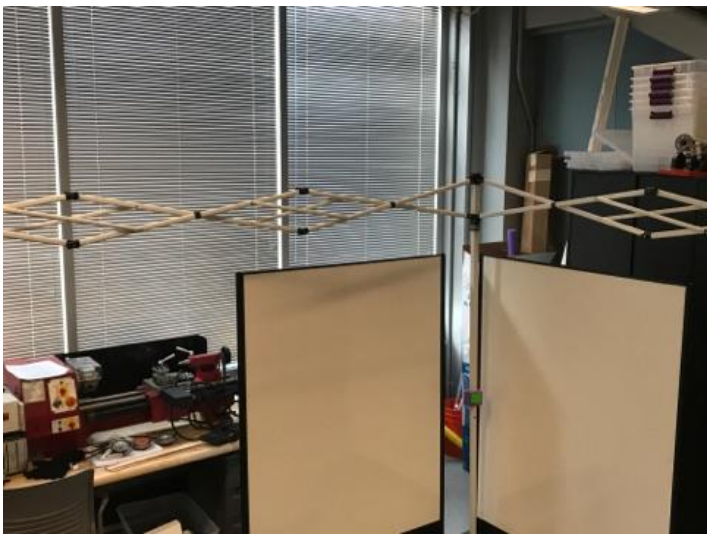


Figure 2. Easy Up with Top Removed

CAUTION: The legs of the Easy Up may contain sharp edges and need to be covered to avoid user injury. We used sections of pool noodle to cover our sharp corners, but Easy Up design may vary (Figure 3).

Figure 3. Sharp Corner on Easy Up Safety Precaution

3.2 Assemble Guide Rails

1. Take two sections of L-shaped slotted angles and attach to each other using flat-head screws to create an overlap between two sections (**Figure 4**)
    a. Use screws every 20 holes on the bottom overlapping section to secure connection

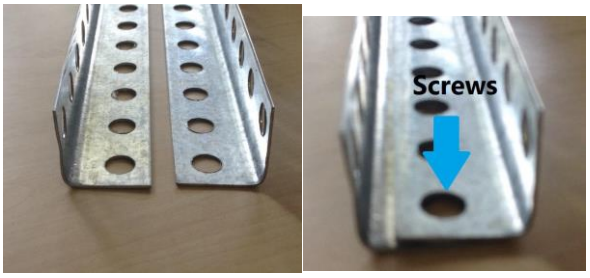


Figure 4. U-Shape Track Construction

b. If U shaped sections are less than 10ft you will need to combine several to span the Easy Up

2. Use reinforcement straps to connect multiple U shaped sections
   a. Place one of the U-shaped sections inside the other with an overlap ~8 holes
   b. Place 2 reinforcement strips underneath track to line up with holes
   c. Use washers with the screws to prevent bolt heads from slipping through the holes of the U-sections. (**Figure 5**)

Figure 5. Reinforced Guide Rail

3.2.1 Attach Guide Rails

1. Start with unfolded Easy Up that has the top tent section removed (**Figure 2**)
2. Place the guide rail to rest on the EZ-up frame. There should be ~4 inches of overlap on each side for a stable resting position (**Figure 6)**

Figure 6. Guide Rail Placement on Easy Up

3. Securely attach the rails to the frame using the nylon parachute cord or zip ties at the following locations (**Figure 7**)

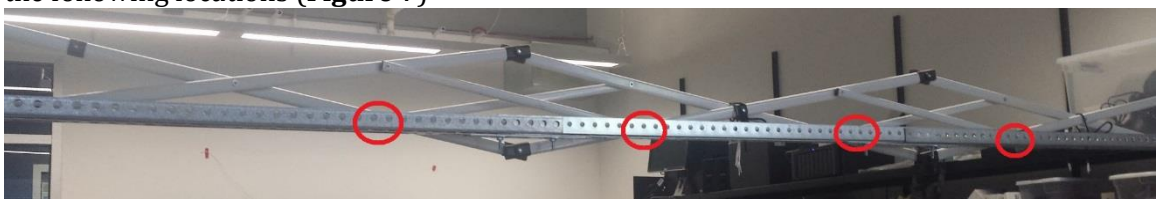


Figure 7. Zip Tie Locations to Secure Guide Rail

4 Middle Bar

This section covers how to create a middle bar that moves easily and covers the entire span of the Easy Up.

4.1 Wheel Section

1. Trim 1" diameter PVC into four 6" long pieces
2. Insert 6" long PVC pieces into T-Shaped PVC. Mark ~3.5in from the T-Shaped join with sharpie to mark location of hole drilling (**Figure 8**)

Figure 8. PVC Section (6") Drilling Locations

3. Drill ~0.4" diameter holes at marked locations on 6" PVC using bore
4. Take T shape PVC corners and use PVC Glue to place 6" pieces in both sides (**Figure 9**)

CAUTION: Follow manufacturer directions for PVC adhesive use. Be sure to use only in well ventilated area and avoid inhaling fumes. Allow to dry fully before continuing

Figure 9. PVC adhesive on T-Shaped Section

5. Place each of the training wheels on a ~0.3" diameter screw, then place two washers on the screw following the wheels (**Figure 10**)

Figure 10. Wheel Washer Placement

6. Insert screw through the hole in the 6" PVC and place a nut on the end of the screw. Tighten the nut to secure the wheel, do not overtighten wheel to the point where it will not rotate
7. Follow steps 2-6 for the second side of the middle bar, there should be one full set (T-shaped PVC, two 6" PVC, and two training wheels) per side

4.2 Middle Bar

1. Trim middle bar to ~9.8ft as an initial cut (you may need to trim later depending on size of Easy Up and wheel protrusion

CAUTION: Use appropriate personal protection when using the saw (safety glasses and work gloves recommended)

8. Attach both T-shaped PVC units to the middle bar (**Figure 11**)

Figure 11. Final Middle Bar

You may need to further trim the middle bar so that the entire piece (Figure 11) fits with the wheels inside the guide rails (Figure 12). If middle bar motion is stilted due to wheels rubbing against the frame you will need to trim it more.

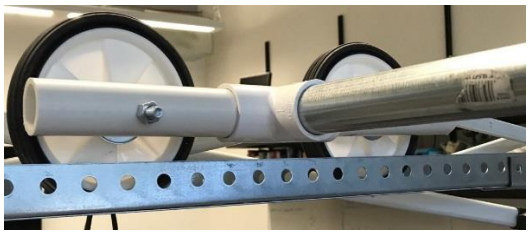


Figure 12. Wheels Inside Guide Rail

5 Harness Assembly

This section details how to build the harness assembly that the user sits in.

5.1 Assemble Harness Components

1. Remove jumper harness from box
2. Put loops from the harness over the PVC section (**Figure 13**)

Figure 13. Harness to PVC Connection

3. Run adjustable tow strap through the PVC section and rock climbing swivel and adjust to desired height (**Figure 14**)

Figure 14. Adjustable Tow Strap to Swivel

CAUTION: The adjustable tow strap contains two safety hazards: a loose end potentially causing choking hazard and a potential pinch point in the buckle. To address, the free end of the strap should be trimmed to <1ft and fastened so the loose end does not exceed 3". The buckle can be covered with a sock or other soft

material to prevent child from injuring themselves (Figure 15).

Figure 15. Safety Precautions for Adjustable Tow Strap

4. Attach swivel to bearing using a short bungee cord. The bungee cord loops over the bearing on the middle bar (**Figure 16**)

Figure 16. Swivel Attachment to Bearing

After this step the four major components are completed (frame, guide rail, support bar, and harness) and should look like the assembly shown in **Figure 17**.

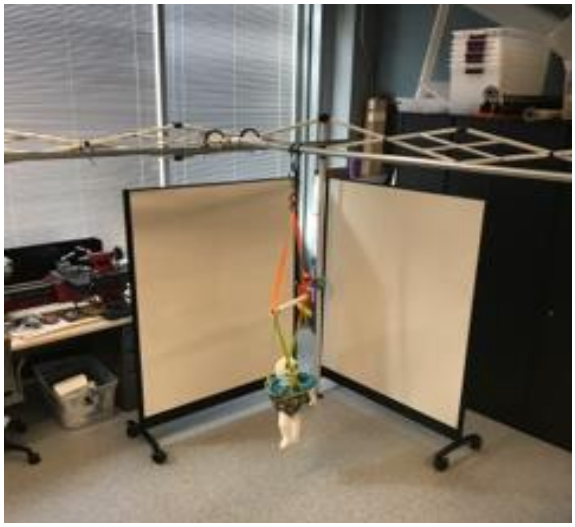


Figure 17. Final Assembly

CAUTION: Never leave children unsupervised with device, even when not in use. Serious injury can occur if the device is not used for the purpose it was intended.

6 Disassembly for Storage

This section details how to disassemble the device safely for storage.

1. Remove the bungee cord from the ball bearing so that the harness section can detach
2. Take the middle bar off the guide rail and remove the wheeled assemblies. Remove the ball bearing before storing middle bar
3. Untie the nylon cord supporting the track and remove track from Easy Up. The tracks can be further disassembled if storage space is limited, but can remain together in storage is desired
4. Follow the EZ UP instructions for disassembly and storage of the frame
5. The smaller items (harness assembly, ball bearing and wheeled assemblies) can be stored in a child proof box together

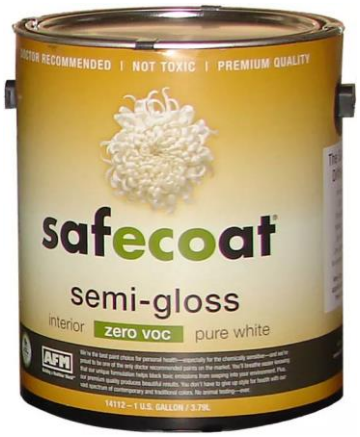
CAUTION: Parts of the device that are out of reach of the user during use may not be when the device is in storage. Keep children away from materials that may be harmful to them (e.g. contain sharp edges, pinch points, or items that may topple when pushed).

7 Customization

This section will contain decorative options to customize device for the user. Feel free to use your imagination!

7.1 Paints

Recommended paints for device frame, track system, and support bar should be 60% water-based paints such as the one listed below.



Safecoat Water-based Paint

Apply according to manufacturer's directions.

7.2 Decals

Decals can easily be peeled off and can be used as temporary customizations to the design.

Example Decals

7.3 Streamers

Streamers can be hung from the frame of the Easy Up and customized according to user

preference. Ensure they are out of reach of the user, as they may present a choking hazard or entanglement risk.

Example Streamers

8 Appendix

Part 1 Easy Up

Part 3 Tow Strap with Easy Release Buckle

Part 4 Jumper Harness (0-25lbs)

Climbing Harness (25-88lbs)

Part 5 L-Shaped Slotted Steel Angle

Part 6 Reinforcement Strap

Part 7 Training Wheels

Part 9 Rock Climbing Swivel

Part 10 Linear Ball Bushing Bearing