CHAPTER 16
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BICYCLE FOR A SMALL CHILD

Designers: B. Parr, B. Plemmons, B. Vandagrifff
Client Coordinator: Jamie Castle Tennessee Early Intervention System
Supervising Professor: Dr. Edward H. McMahon
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INTRODUCTION

A bicycle was designed for an energetic, healthy, intelligent three-year-old boy with achondroplasia (dwarfism). The pedal-powered device enables the client, 28 inches tall, to propel himself in the same way as other children his age. The criteria were ease of mounting and dismounting, pedal power, safety, and durability. The physical restrictions were primarily influenced by his eight-inch inseam and an approximate 5 1/2" range of motion for his leg movement. The initial design was based on a go-cart frame; however, the family preferred a bicycle type device.

The design is based on a single downtube with no cross bar. A local world-class manufacturer of racing bicycles assisted in construction.

SUMMARY OF IMPACT

The bicycle met the child's needs. It was delivered with training wheels and sufficient adjustment in the seat to accommodate future growth. The bicycle was delivered with 12" wheels but was designed to also accommodate 16" wheels.

TECHNICAL DESCRIPTION

The frame was specially designed and built to accommodate the dimensions of the client. It was important that the client be able to get on and off the bicycle independently. Three frame designs were considered and the one shown below was selected. The frame was made by a local bicycle manufacturer out of titanium tubing.

The components for the bicycle were standard, modified as necessary. The front and rear sprockets each have 18 teeth. Either or both may be changed when the child is older. The crank was modified to a 3.5" radius. The spindles, bearing cups, bearings, pedals, and wheels were standard, as well as the chain, fork and stem. A standard seat post was welded to the frame and a standard seat was attached.

Figure 16.1. Bicycle for a Small Child.

The forks used were made for 16" wheels, although the wheels delivered with the bicycle were 12". Standard training wheels were attached.

The cost of the parts for the bicycle was $275. The frame was manufactured and donated by the bicycle manufacturer.

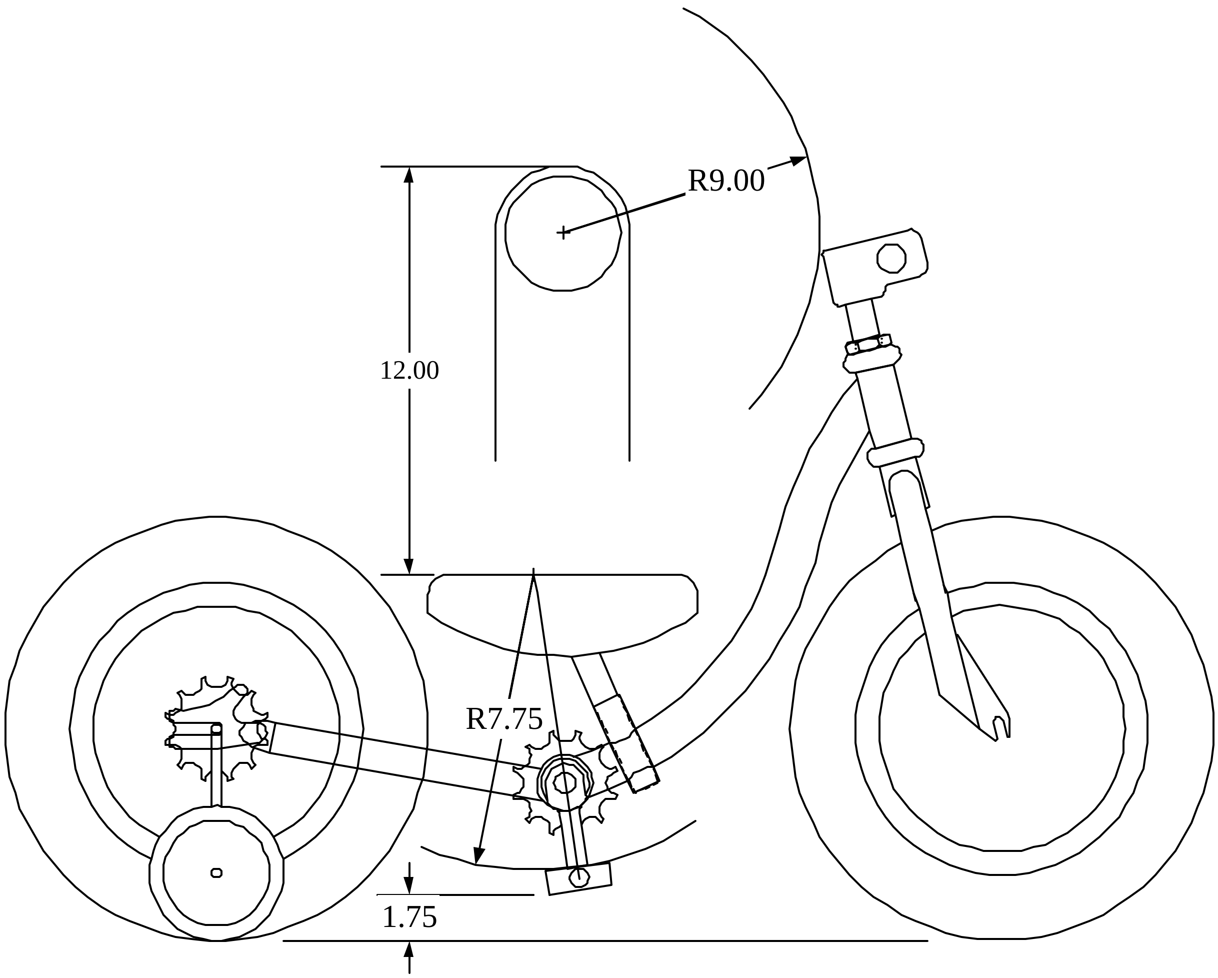

Figure 16.2. Diagram of Bicycle.

COMPUTER WORKSTATION

Designers: A. Elkhadrawy, A Guider, R. Ng, T. VanHoesen
Client Coordinator: Molly Littleton
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INTRODUCTION

A computer workstation was designed for use by a child. The client required a computer workstation with a monitor adjustment from 24” to 40". In addition, the computer workstation should be mobile and fit through a standard doorway (36" wide). The keyboard height was adjustable, and the keyboard could be moved in and out at an adjustable angle. A commercially available keyboard was attached to the monitor support. A motorized screw was used to adjust monitor height. A stationary CPU support was built to accommodate a desktop or tower unit.

SUMMARY OF IMPACT

The workstation met the client’s needs. The child is able to use the workstation while sitting or standing.

TECHNICAL DESCRIPTION

There are two primary components, the frame and the adjustable monitor/keyboard support.

The frame was built primarily from 2" x 2" steel tubing. The overall dimension of the frame were 36L x 30"W x 12"H (excluding the casters). A triangular support was used on the right side of the frame. A square support was used on the left side of the frame to accommodate the CPU table.

The square tubing was miter cut and welded to form the frame. The CPU table was made from 3/4" White Melamine coated board. The frame base was completed with 4" diameter nylon locking swivel casters. A strap was added to the CPU table to secure the CPU in transport.

The basis for the motorized lift was an electric screw-driven lift with a stroke of 12.5" and a lift speed of 10" per minute. The operating range was from 25.5” to 38". The motor was mounted to the frame. The shaft end was mounted to the monitor shelf using a steel plate welded to a center sleeve. To stabilize the monitor tray, two steel pipes were welded to the frame. Two brass rods were attached to the monitor tray and fitted into the steel pipe. The monitor shelf was made of 3/4" White Melamine coated board. A strap was added to secure the monitor during transport.

Figure 16.3. Computer Workstation.

The keyboard support and tray were purchased. The support was mounted under the monitor shelf. The keyboard can be adjusted up and down, in and out, and at an angle. The keyboard has a padded wrist rest.

A power cord and three-way (up, off, down) momentary contact switch completed the construction.

The cost of the device was $600.

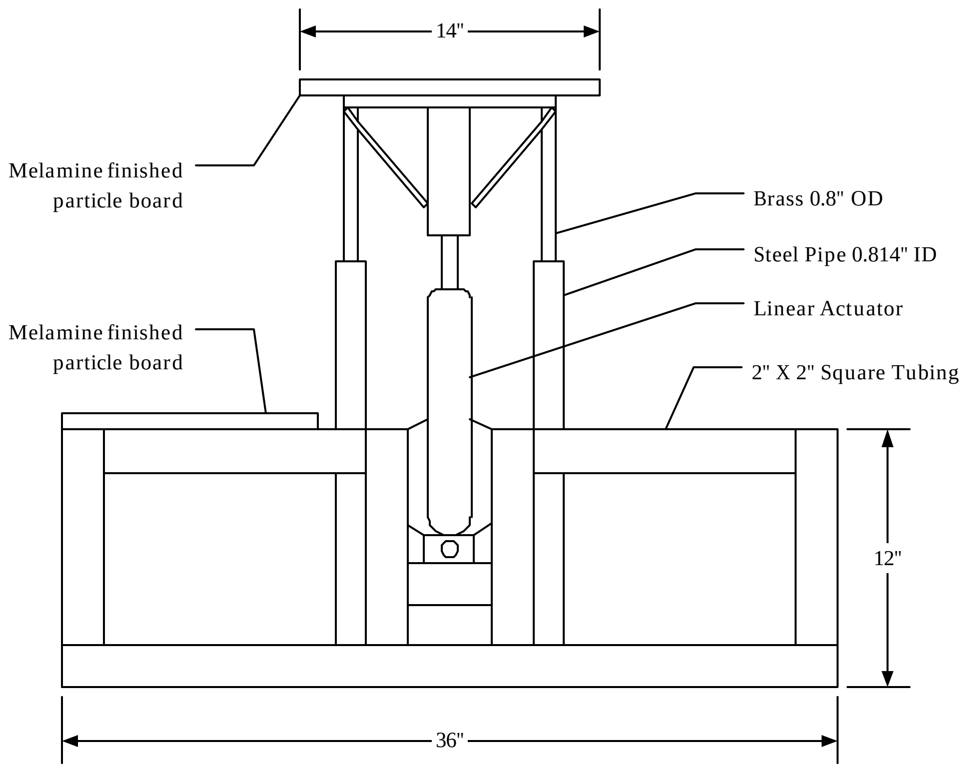

Figure 16.4. Diagram of Computer Workstation.

SUPPORTIVE DINING CHAIR

Designers: S. Grody, M. Hobbs, J. VanSteenburg
Client Coordinator: Rick Rader
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INTRODUCTION

A chair was designed to enable a client with cerebral palsy to sit at a dining table. In a standard dining room chair, the client had to sit on the edge of the seat so that his feet could reach the floor while he supported himself on the table. This position made eating difficult. Critical needs included support for the feet above the floor, an ability to get into the chair, and a sense of stability while in the chair. A chair was designed using PVC pipe. A sliding footrest and lightweight shoulder straps were added for support. The sliding footrest retracts when the client enters the chair and is slid forward to provide support for his feet while he is at the table. The client can enter the chair by himself. The shoulder straps enable him to remain upright.

SUMMARY OF IMPACT

The chair allows the client to sit at the table and eat in an upright position. The removable cushions are easily cleaned.

TECHNICAL DESCRIPTION

A primary concern was the design of the moveable footrest. Mechanisms similar to those used on wheelchairs were considered but would have made footrest adjustments difficult while the client's feet were under the table. The design selected was a chair made from PVC piping (Figures 16.5 and 16.6).

The back of the chair was designed for maximum support and rigidity. A second back support provides handles for moving the chair. The sliding foot support was made by enlarging the inside diameter of the fittings so they would easily slide over the PVC pipe. The footrest is made from PVC cutting board material. The back and seat cushions were made of foam rubber covered with vinyl. The back cushion has snaps at the top and bottom and the seat cushion has snaps on four sides for attachment to the PVC pipe.

Figure 16.5. Photograph of the Chair.

The chair sits on 2 3/4" locking/swivel casters. The casters are attached to the PVC pipe frame by plugs in the bottom of the PVC frame, drilled for the caster shaft.

The PVC pipe and all joints were put together with PVC glue.

The cost of the device, including the cushions, was $300.

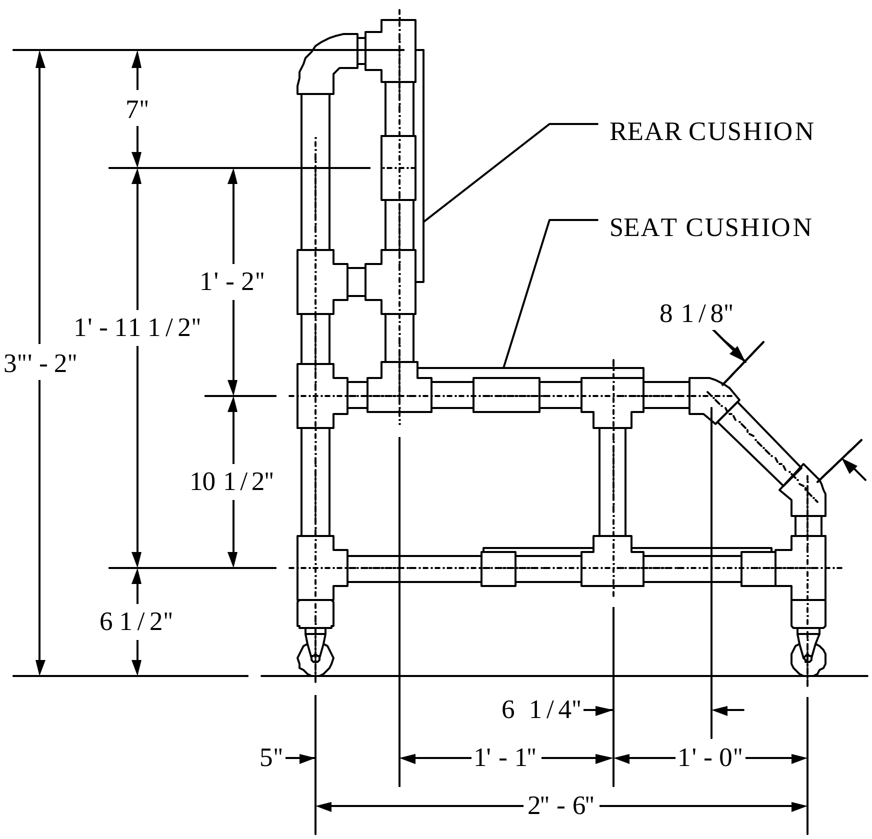

Figure 16.6. Diagram of Dining Chair.

LAPTOP SUPPORT

Designers: B. Bacon, M. Moss, B. Smith
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INTRODUCTION

The laptop computer mount was designed for a 26-year-old graduate with amyotrophic lateral sclerosis. The client uses a laptop computer and a voice synthesizer to communicate. This requires a tray to mount both the computer and an infrared device to access the voice program. It was necessary that the support be mounted on the left side of his wheelchair, be able to swing out of his way with ease, be easily removable and lightweight, and securely hold the computer and sensor.

SUMMARY OF IMPACT

The mount met design criteria. The laptop mounts on a vertical bar on the side of the wheelchair and is easy to move out of the way to facilitate transfer to and from the wheelchair. The laptop can be easily removed from the mount by unlocking a gate latch and removing the tray and laptop as one unit.

TECHNICAL DESCRIPTION

The vertical mount was made from 18" long 9/16" diameter steel tubing. A hole in the tubing and a 1/4" locking pin prevented rotation. The top of the rod was threaded.

A 2.5"x 2.5" x 8" block of aluminum was drilled and tapped for placement on top of the vertical support. The threaded connection was secured with a 10-32 set screw. On the face of the aluminum block, at right angles to the vertical support, two .5" holes were drilled. The two supporting rods for the laptop tray were made of aluminum 12" long and .5" in diameter. One end of each of the rods was threaded and screwed into the corresponding hole in the aluminum block.

The tray was made of .5" thick gray PVC board. It was 12.5" long and 10.5" wide. Four clear plastic .5" diameter tube straps were secured to the bottom of the tray using screws.

Figure 16.7. Laptop Support.

A gate latch secures the tray to the mount. The receiving portion of the latch was mounted to the aluminum block with screws. The post portion of the latch was attached to the bottom of the tray using two screws.

The computer was secured to the tray using four 4" x 2" pieces of industrial strength Velcro. For additional safety, three small clamps were attached to the tray to secure the computer.

The cost of this device was $80.

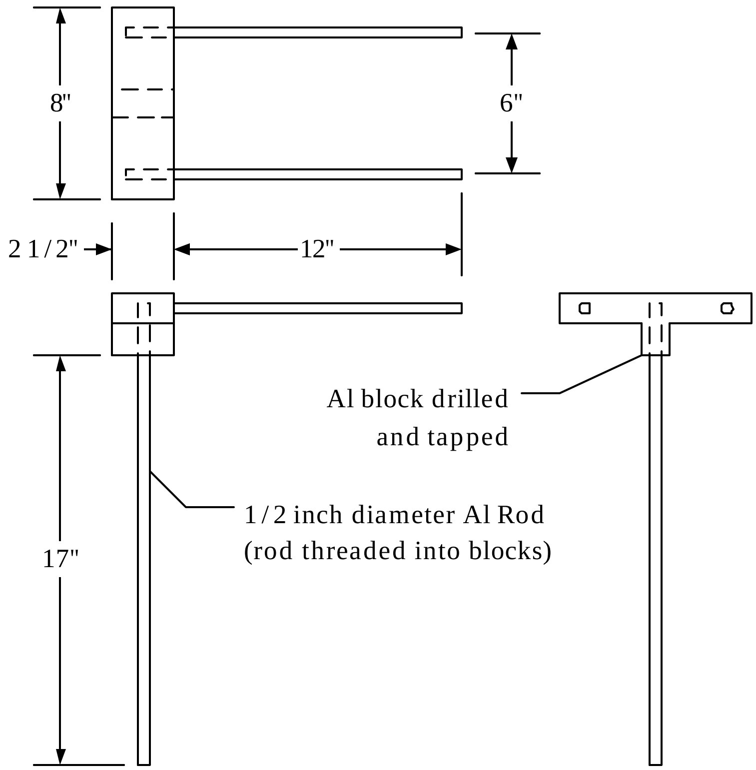

Figure 16.8. Diagram of Laptop Support.

PRINTER SUPPORT

Designers: Scott Brown, Bryan Crawford
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INTRODUCTION

A printer mount for a wheelchair was designed for use by a client with quadriplegia. The client uses a Delta Talker, and augmentative communication device, and desired a printout of the text he developed using the device.

SUMMARY OF IMPACT

A mount used previously interfered with the client's line of sight and did not provide the necessary clearance for the infrared signal to the Delta Talker. The new printer mount secures the printer in an optimal position. It is simple to mount the printer. The mount allows easy access to change paper.

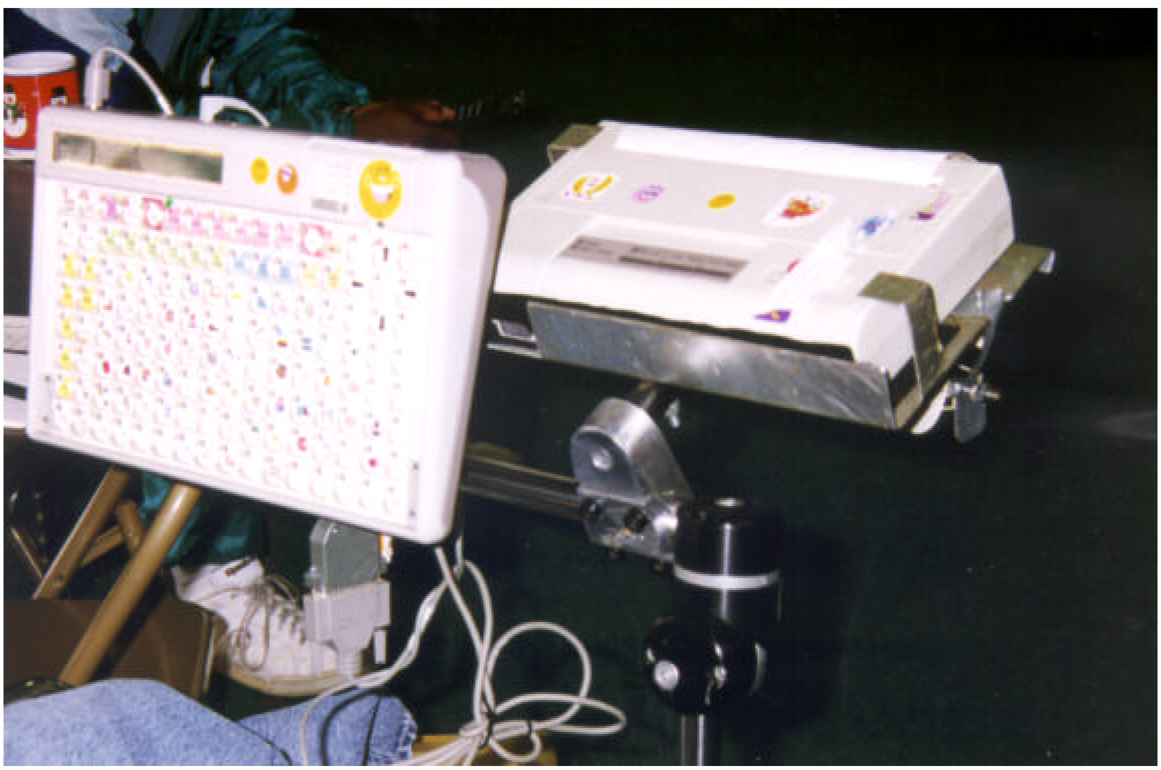

Figure 16.9. Printer Support.

TECHNICAL DESCRIPTION

The basis for the design was an aluminum double gooseneck for a mountain bike. The tubular part of the gooseneck (which normally goes into the bike frame) was milled on an angle to produce a flat surface. Two holes were drilled in this portion for attachment of the printer mounting plate.

The printer mounting plate was constructed from a single piece of 16-gauge aluminum. Tabs in the plate support the printer and the printer paper roll. After the plate was cut the tabs were folded for the printer and paper. A 1/4" diameter rod was threaded on one end and attached to the printer mount for the paper. It was held in place by a wing nut. The printer mounting plate was attached to the modified gooseneck by two bolts. To attach the printer mount to the rod that supports the Delta Talker, the four bolts were removed from the gooseneck and the mount was attached to the rod (where the bicycle handles would normally be attached). The printer is attached to the mount using Velcro.

The total cost for the device was $40.

Figure 16.10. Another View of the Printer Support.