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9/11/19 Team Norms

1. notify group if absent
2. If in disagreement, neutral party will break tie if needed
3. If confusion arise, ask team mates
4. Be respectful to all aspects of group

Daniel McDonough

9/11/19 Questions

C 1 How big is the fuel pump - How does the fuel pump, PUMP?
O 2 what are fuel rail designs
O 3 what is aero dynamics
O 4 what has already been done
C 5 what is the drag coefficient of material's on cars/what are the traits of materials with good aerodynamics
C 6 what are the normal gas milages
O 7 whats better than gas
O 8 what are the safety precautions
O 9 whats are the designs of the car (engine/body)

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9/11/19

Brainstorming Problems

- vision
  - color
  - depth
  - blind
  - night
- physical
  - height
  - amputee
  - poor muscle control
  - broken bone
  -
- mental
  - lack of focus
  - sleep
  - deaf
  -

color blindness at stop lights
depth perception with old people and cars in front
blind people can't drive
at night it's hard to see...
- animals - cars - people
- streets - signs - lights

can't reach the pedels or stearing wheel
doesn't have ~~can~~ much control over amputated limb
muscle twitch making hard to stay staight
driving with injury
driving with crutches, cane, wheelchair
arteritis in truck divers X
people with no legs or arm X
disability hard to get into/out of car
poor muscle control
extremely tall people X
-short arms/legs
- ADD and driving
- Dyslexia X
- Dog jumping out window while driving X
- DUI
DWI

- Height
- Physical Injuries
- Poor Body control

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9/12/19 KWR

1. Height
   I) What we know?
      I. people unable to reach hand or foot controls
      II. tall people being squished in seat
   II) what we need to figure out?
      I) how many people have these problems
      II. what has been done already
   III) what resources do we need?
      I. materials - cardboard/aluminum
      II. time
      III. experts in problem
2. Poor Body Control
   I) What we know?
      I. reduced muscle control causes less smooth driving
      II. age is a factor in driving
   II) What we need to know?
      I. How it effects driving
      II. How many people are affected
      III what symptoms to research
   III) What resources?
      I. Tools, time, materials
      II. experts in problem
3. Physical Injuries
   I) What we know?
      I. it's hard to drive with cast or crutches
      II. hard to drive with wheelchair
   II) Need to know?
      I. affects from left to right or from cast to cast

Injuries and Impairments in driving

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Spinal cord injuries was the most frequent diagnosis (30% of 793 answers) and lower limb disabilities was the most common functional restriction (over 75%). The drivers felt very safe and they had a high level of confidence in the adapted car. They used the car for almost the entire distance travelled (90%), which illustrates how dependent this group is on the car for their mobility. About 1 out of 10 drivers had been involved in an accident during the last 3.5 years, most of them with only material damage. The accident and injury risks of the target group did not differ significantly from the risks of drivers in general. A small number of accidents were attributed to problems with the special equipment in the car. The causes could be unfamiliarity with the controls, an adaptation that did not fully meet the needs of the individual or equipment that broke down.

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http://www.diva-portal.org/smash/record.jsf?pid=diva2:809521

Peters, B. (2004). *Evaluation of adapted passenger cars for drivers with physical disabilities* (Doctoral dissertation, Linköping University Electronic Press).

Summary: Driving can provide independent and efficient mobility. However, according to the driving license directive (91/439/EEC) are persons with locomotor impairments are only allowed drive if their disabilities can be compensated. Compensation can be realised by vehicle adaptations. The directive provides meagre guidance on how vehicles should be adapted or how to verify that the compensatory requirements are fulfilled. This is a gap in the current process for licensing drivers with physical disabilities. Furthermore, the Swedish process from driver assessment to driver licensing and adaptation approval is complex, fragmented, and suffer from lack of communication between involved authorities. The objective of this thesis was to contribute to the development of a method to evaluate vehicle adaptations for driver with physical disabilities. The focus was on the evaluation of adaptations for steering, accelerating and braking. Three driving simulator experiments and one manoeuvre test with adapted vehicles were conducted. A group of drivers with tetraplegia driving with hand controls were compared to able-bodied drivers in the first experiment. Even if the drivers with tetraplegia had a longer brake reaction time they performed comparable to the able-bodied drivers. However, they spent more effort and were more tired in order to perform as well as the able-bodied drivers. It was concluded that the adaptation was not sufficient. An Adaptive Cruise Controller (ACC) was tested in the second experiment in order to find out if it could alleviate the load on drivers using hand controls. It was found that the ACC decreased the workload on the drivers. However, ACC systems need to be adjustable and better integrated. The results from the first two experiments were used to provide some guidelines for ACCsystems to be used by drivers with disabilities. The third experiment was preceded by a manoeuvre test with joystick controlled cars. The test revealed some problems, which were attributed to time lags, control interference, and lack of feedback. Four joystick designs were tested with a group of drivers with tetraplegia in the third experiment. It was concluded that time lags should be made similar to what is found in standard cars. Lateral and longitudinal control should be separated. Active feedback can improve vehicle control but should be individually adjusted. The experiments revealed that drivers with the same diagnose can be functionally very diverse. Thus, an adaptation evaluation should be made individually. Furthermore, the evaluation should include a manoeuvre test. Finally, it was concluded that the evaluation approach applied in the experiments was relevant but needs to be further developed.

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Problem Statement

9/27/19

Original

We aim to assist by helping those with injuries and impairments while on the road. According to BijÖrn Driving can provide independent and efficient mobility. However, according to the driving license directive (91/439/EEC) ~~are~~ persons with locomotor impairments are only allowed to drive if their disabilities can be compensated. ~~Compensation can be obtained~~ by vehicle adaptations. Economically of the people who have disabilities in America ~~1 in 3 don't have a usual healthcare provided,~~ 1 in 3 have an unmet healthcare need because of cost in the past year, ~~and 1 in 4 did not have a routine check-up in the past year,~~ this means many people who are disabled cannot afford proper accommodations for their car.

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First problem statement was too long

9/30/19

ccording to a driving license directive; persons with locomotor impairments are only allowed to ive if their disabilities can be compensated, which can be obtained by vehicle adaptations or odification.

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10/1/19 Patents

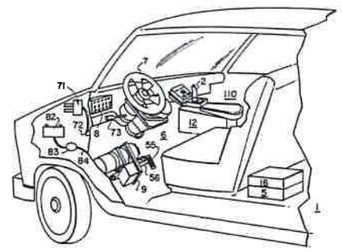
https://patentimages.storage.googleapis.com/d0/8c/5c/dfba5dca1dd9b8/US5086870.pdf

Bolduc, S. (1992). U.S. Patent No. 5,086,870. Washington, DC: U.S. Patent and Trademark Office.

A remotely controlled system for the operation of a vehicle wherein a limited physical input is translated into desired vehicle movement. The invention uses a unitary manipulator with two axes of movement to direct the steering, acceleration and braking functions of the vehicle. The surplus current available from the main battery of the vehicle powers the control system. The steering function of the invention involves the conversion of a mechanical input into a frequency based signal which is processed by a primary steering microprocessor. This microprocessor in turn directs a frequency-based motor controller to operate a motor which rotates a steering shaft of the vehicle. The acceleration and braking functions operate in the same way, wherein a primary acceleration microprocessor acts upon a frequency-based signal to direct a frequency based motor which is connected to the accelerator and brake pedals of the vehicle. In order to provide a smooth transition from the manipulator input to motor operation, the motors of the present invention are pref. erably stepper motors. The invention can be disengaged to permit standard operation of the steering wheel and accelerator and brake pedals of the vehicle.

Pros: Great for people with limited muscle control, easy to use, similar to regular driving(not much need to learn to those recently disabled)

Cons: Person who use it still need muscle control in legs, such little physical input is needed so easier to accidently brake/accelerate,



https://patents.google.com/patent/US20050057031A1/en

Ahnafield, B. (2005). U.S.Patent App*lication No. 10/903,444.*

A system for use by a physically impaired driver for controlling a vehicle includes an actuator assembly operably coupled to the pedals and an actuator assembly coupled to the steering shaft. The actuator assemblies include electrical motors operable to depress the brake pedal and the accelerator pedal and to rotate the steering shaft. A joystick controller is mounted to the vehicle and is operable in a fore-aft direction to control braking and acceleration, and can be tilted side-to-side to control vehicle steering. The steering control feature utilizes three sensors to determine a commanded steering and three drive motors to convert that command into a desired steering.

Pros: Easy to use, easy to install

Cons: can be expensive

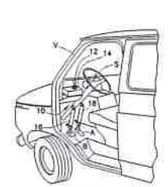


FIG.1
(PRIOR ART)

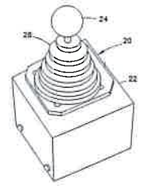


FIG. 2

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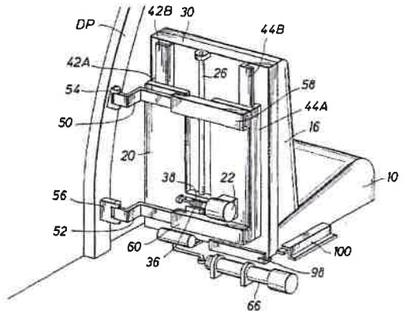
https://patentimages.storage.googleapis.com/99/6b/2c/ac776d445bac96/US5746465.pdf

Jones, D. L., & Drenner Jr, G. L. (1998). *U.S. Patent No. 5,746,465.* Washington, DC: U.S. Patent and Trademark Office.

ABSTRACT: A method and apparatus are provided for transferring a physically disabled person through a vehicle's driver side door opening to and from a driving position behind the steering wheel of the vehicle. The method and apparatus contemplate the use of a seat assembly, including a seat having a back support, a seat frame, and lift means for lifting and lowering the seat relative to the seat frame. A hinge assembly is mounted inside the vehicle for pivoting the seat assembly about a vertical axis and supports the weight of the seat assembly. The lift means is slidable relative to the hinge assembly. Powered means are mounted to a floor within the vehicle for rotating the seat assembly via the hinge assembly between an outwardly facing position, wherein the lift seat may be lifted or lowered by the lift means outside the vehicle, and an intermediate forwardly facing position inside the vehicle. The powered means also provide for lateral movement of the seat assembly between the intermediate forwardly facing position and a driving position behind the vehicle's steering wheel.

Pros:Allows easy entrance to the car for those who are in a wheelchair, Sturdy, Both lateral and vertical movement

Cons: Only helpful for those in a wheel chair, Does not address wheel chair needing to be moved in and out of the car, Only allows a way to get into the car(does not allow assistance with driving)



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10/8/19 Brainstorming 10/14/19

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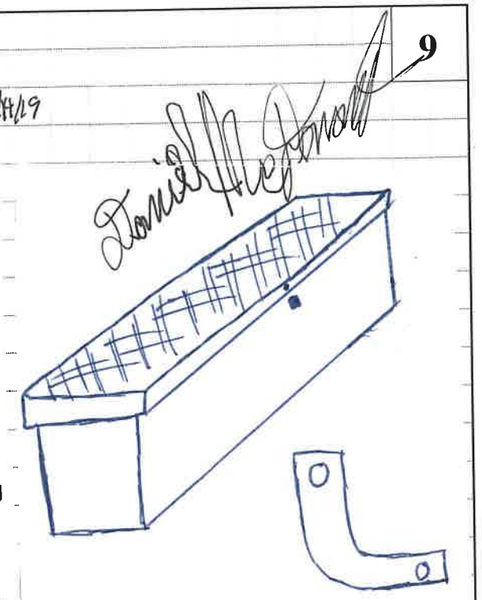
original Ideas

- Hand controls
- Bottom powered breaks/gas on steering wheel
- Cast holders on steering wheel
- Arm supports for cast
- Left footed steering
- Crutches holder on bottom/side of car zipper bag
- Extension for left foot driving
- Neck injury blind spot
- Cast softener
- Rotating chair
- Little knob turn thing
- Spring breaks
- Shift extension
- Pedal extension



cargo box & Mount

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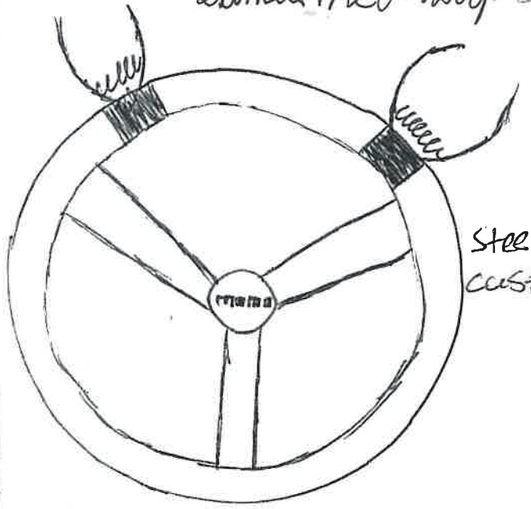

Steering wheel cast assist

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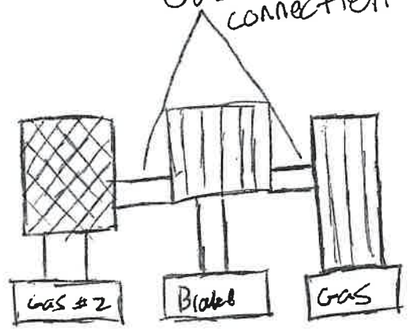

Gas Pedal Extension

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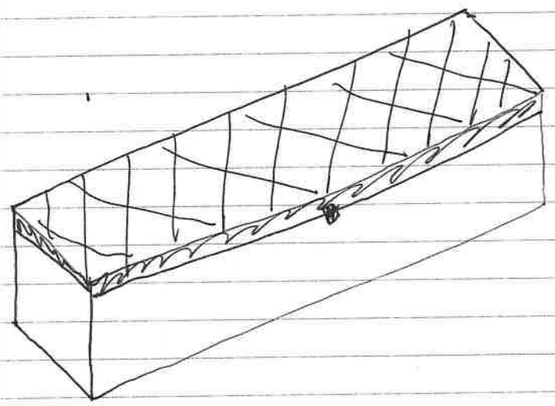
10/21/19 Final Idea (Starting) May be refined

A multi-use box for canes, crutches, and more, that if firmly attatched to the car in such a way that if needed to be taken off it is possible but will not come off while driving. Made from steel, the inside will be paded with foam or another substance to reduce sound made when going down road. Crutches or cane will be held onto sides with a form of clip that is easy to unlatch but strong enough to hold crutches. Box dimentions will be about 6ft x 10in x 8in, and will be able to support upto 300 pounds.



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Criteria

Customer Needs. What does the customer want/need?
Consumers who use crutches, canes, or similar devices and drive cars with above 13 inch off the ground need to be able to get into their car easier and hold their crutches

(2)

10/21/19 Performance. What must the product be able to do? Be specific.
The product must be able hold crutches, use as a step, and safe to drive with

(3)

Target Cost. What is the anticipated cost to the consumer for this product?
The target cost is $100 for the product

(6)

Size and Weight. What size should the product be, or what restrictions to size exist?
6 feet by 10 by 8 inches is the size
What are the weight restrictions on the product?
weight restriction should be light enough to remain safely on the car but heavy enough to safely hold weight

(5)

Aesthetics. Are there preferences in the appearance features of the product (color, surface treatment, shape, material)? If so, describe them.
Aesthetics include dent and impact resistance, has LED lights, and make it look semi professional if possible.

(8)

Materials. Is there a specific material or materials that must be used? If yes, describe it.
The material is Ideally stainless steel, but most likely galvanized steel

(7)

Safety and Legal Issues. Identify potential safety and legal issues that may arise from the use of this product.

(1)
- Crutches safely held
- Can't dent easily
- Can't fall off
- You can't fall off easily

Ergonomics. Identify considerations for the ergonomics of the product.
- Easy to put crutches in box when sitting
- Easy to open lid

(4)
- Easy to close lid
- Does not slam shut
- LED to see box
- Grippy top with diamond tripping

Operating Environment. Identify the environmental conditions relevant to the manufacture and use of the product (temperature, corrosion potential, dust or dirt, pressure, humidity, vibration, noise, degree of abuse, etc.).

(2)
- Dent proof
- Stay on car
- Withstand all weather
- Withstand temperatures (don't crack in cold and not going to burn if you touch it)
- Hold 300 pounds

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10/21/19 Costeria

- Doesn't rust

Global Environment. Will the product include any toxic or dangerous substances? What is the plan for disposal of the product at the end of its useful life?

(1) - No toxic or dangerous substances
- Can be metal recycled at metal recycle facilities

Service Life. What is the required service life of the product?

(2) - Duration of injury

Product Life. What is the anticipated length of time that the product will be produced before it is replaced by a newer version or alternate product?

(2) - Paint - 3 years of heavy use
- Metal - 10 years(rust)

Durability and Maintenance. Will the product require routine maintenance during its service life? If yes, answer the following.

- Only would need paint job, and possibly new tread

(2) - What specific parts of the product must have easy access for maintenance?
- What is the anticipated maintenance schedule?
- Easy to detach, but in a safe way
- Are special tools required? How will they be acquired?
- Tools to remove sidestep from box
- Will replacement parts be required? How will they be acquired?
- No, at most replacement bolt

Additional Criteria

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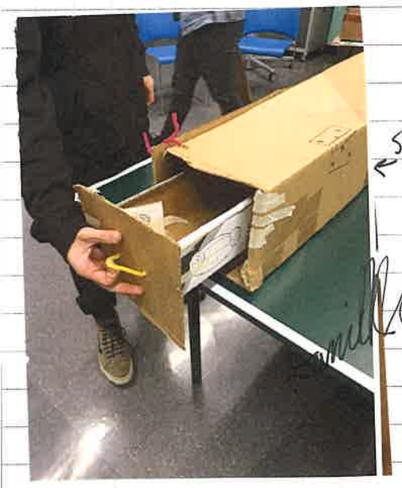
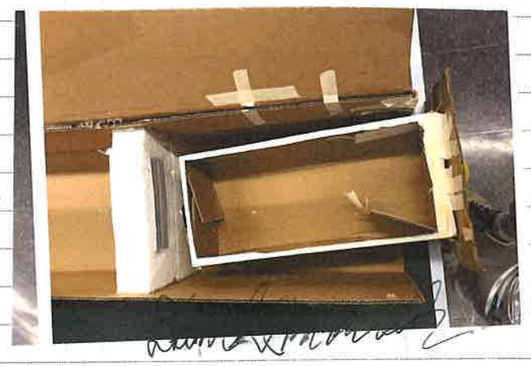
10/30/19 Mockup photos



Slide Box on End →



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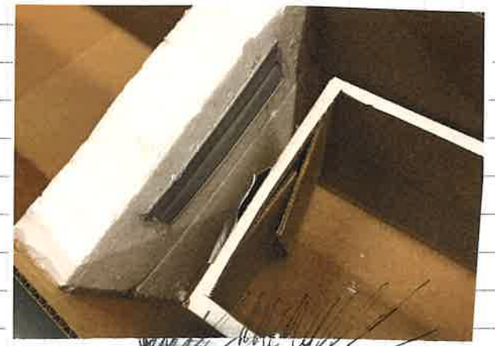

Magnetic backing on Slide Box

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Full side of box

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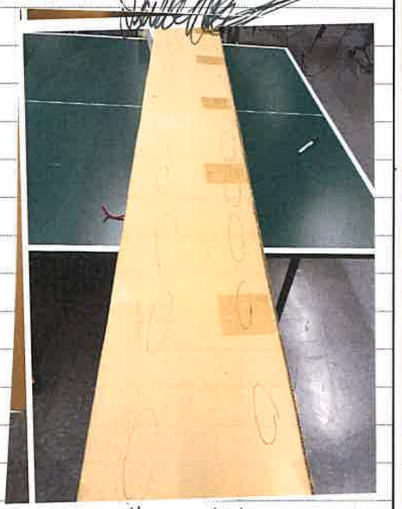

Bottom of Box

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11/20/19 CAD Drawings

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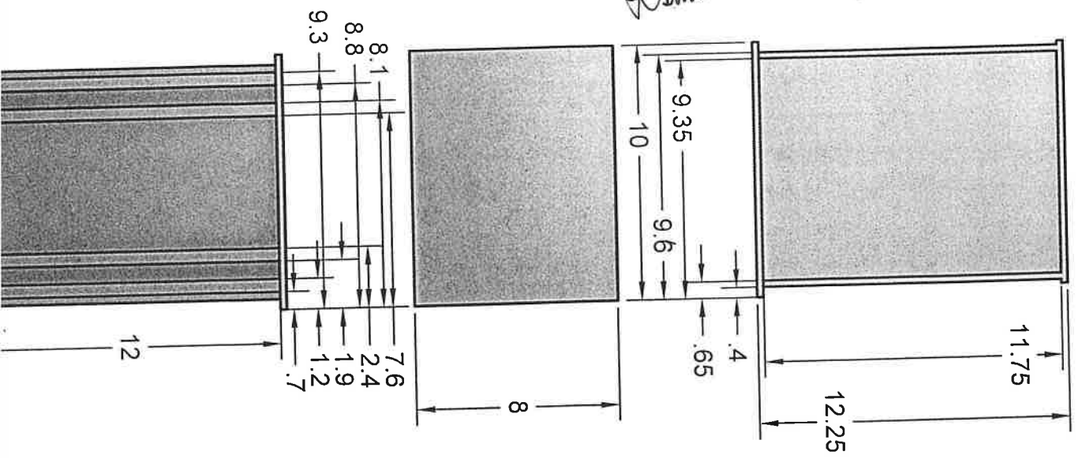
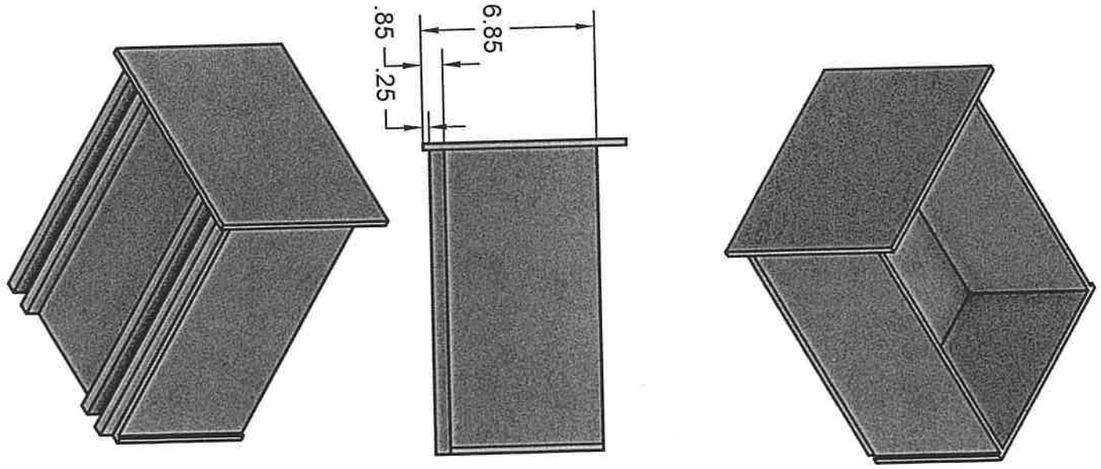


Drawer



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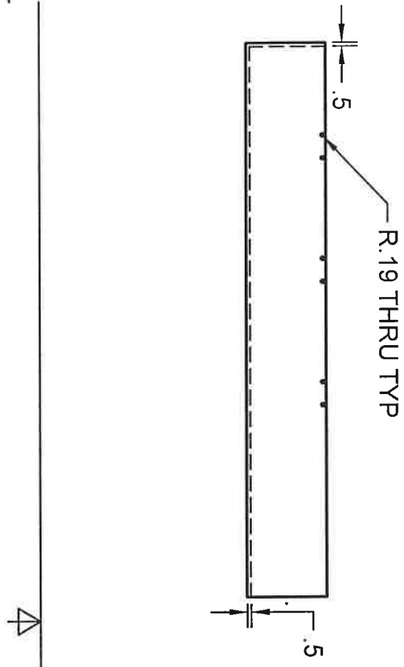
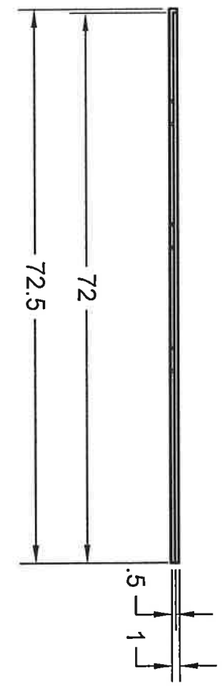
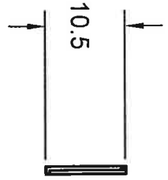
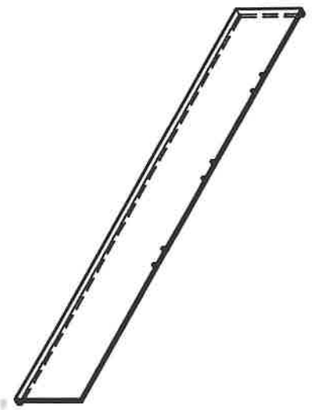
Lid









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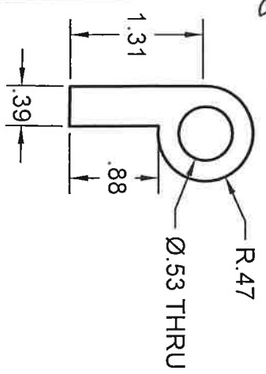
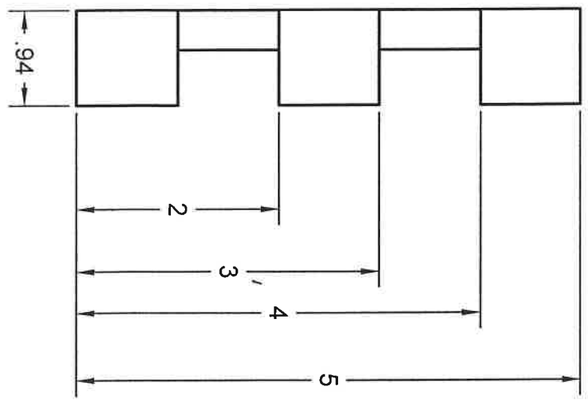
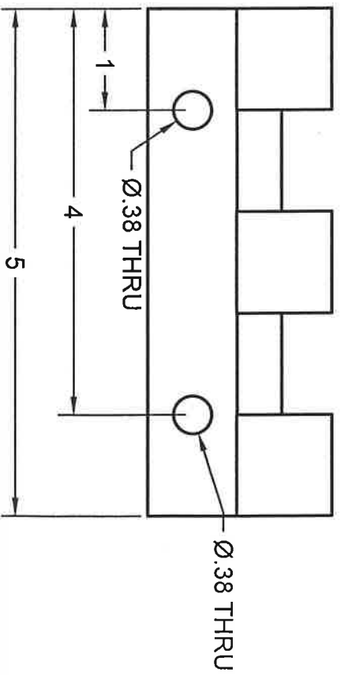
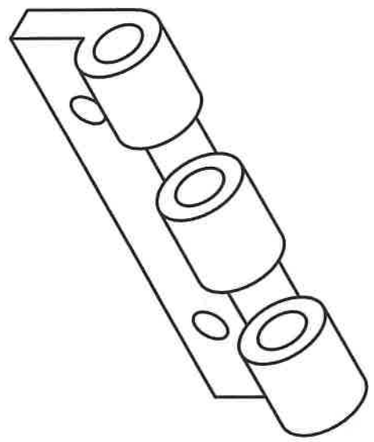
Hinge









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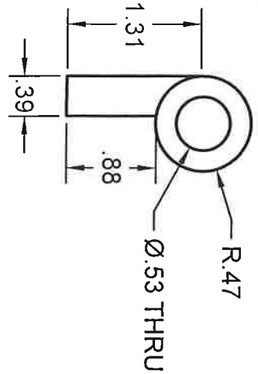
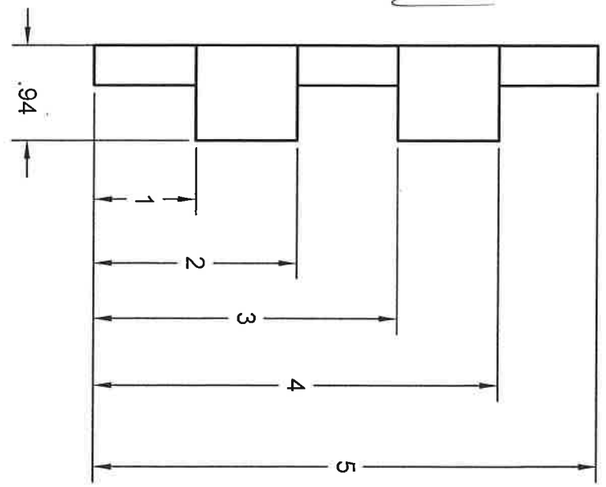
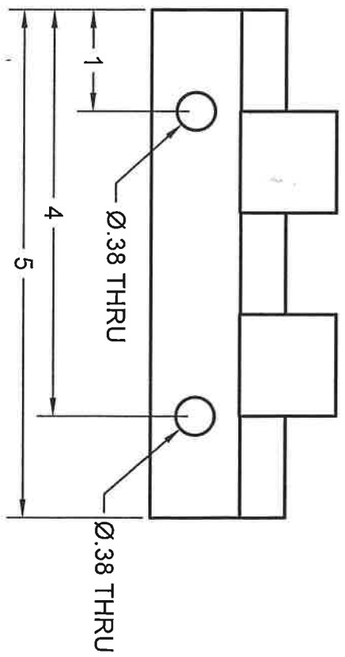
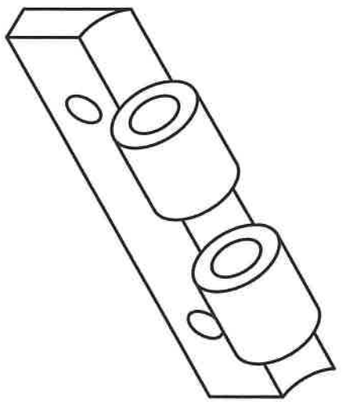




Hinge





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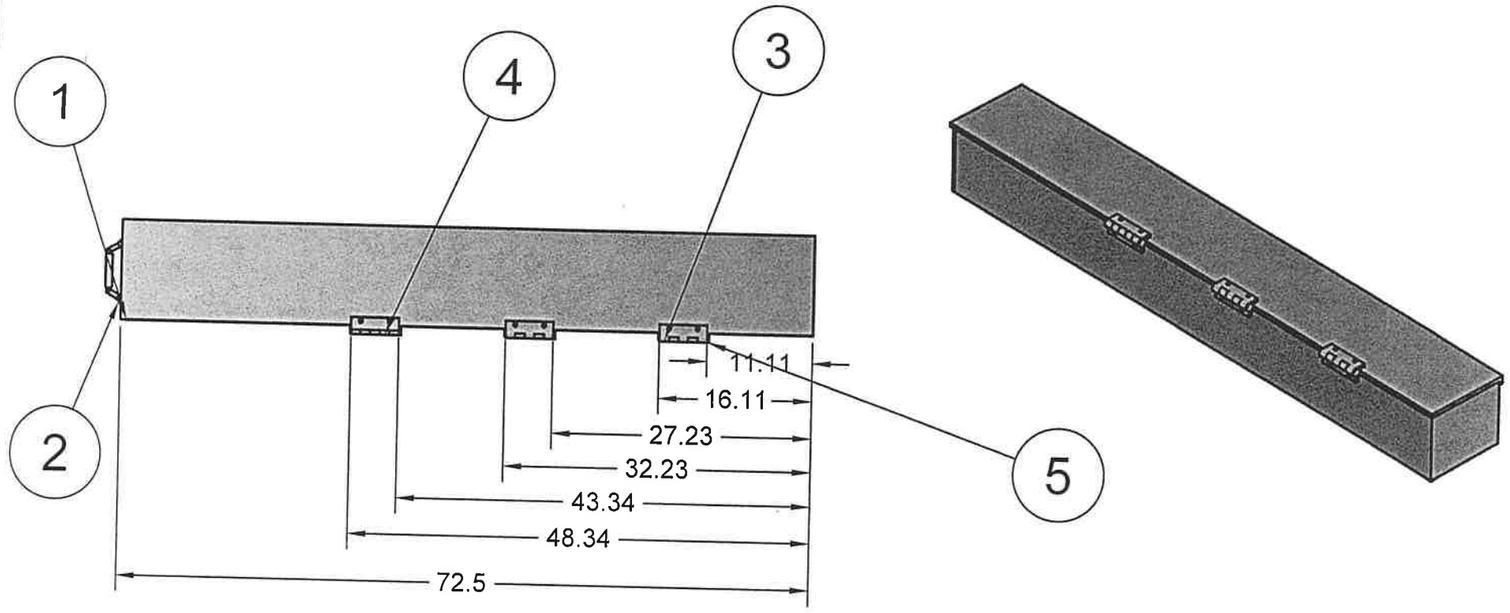
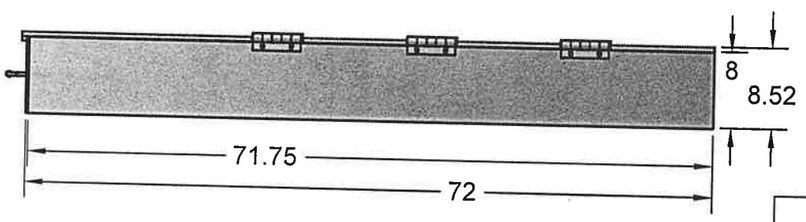
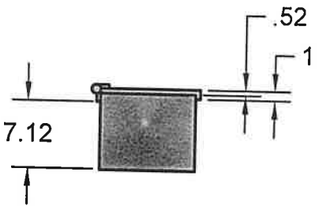






PARTS LIST			
ITEM	QTY	PART NUMBER	MATERIAL
1	1	BOX DRAWER	STEEL
2	1	DRAWER HANDLE	STEEL
3	3	HINGE	STEEL
4	1	LID	STEEL
5	3	BOLT	STEEL

Box whole

11/20/19

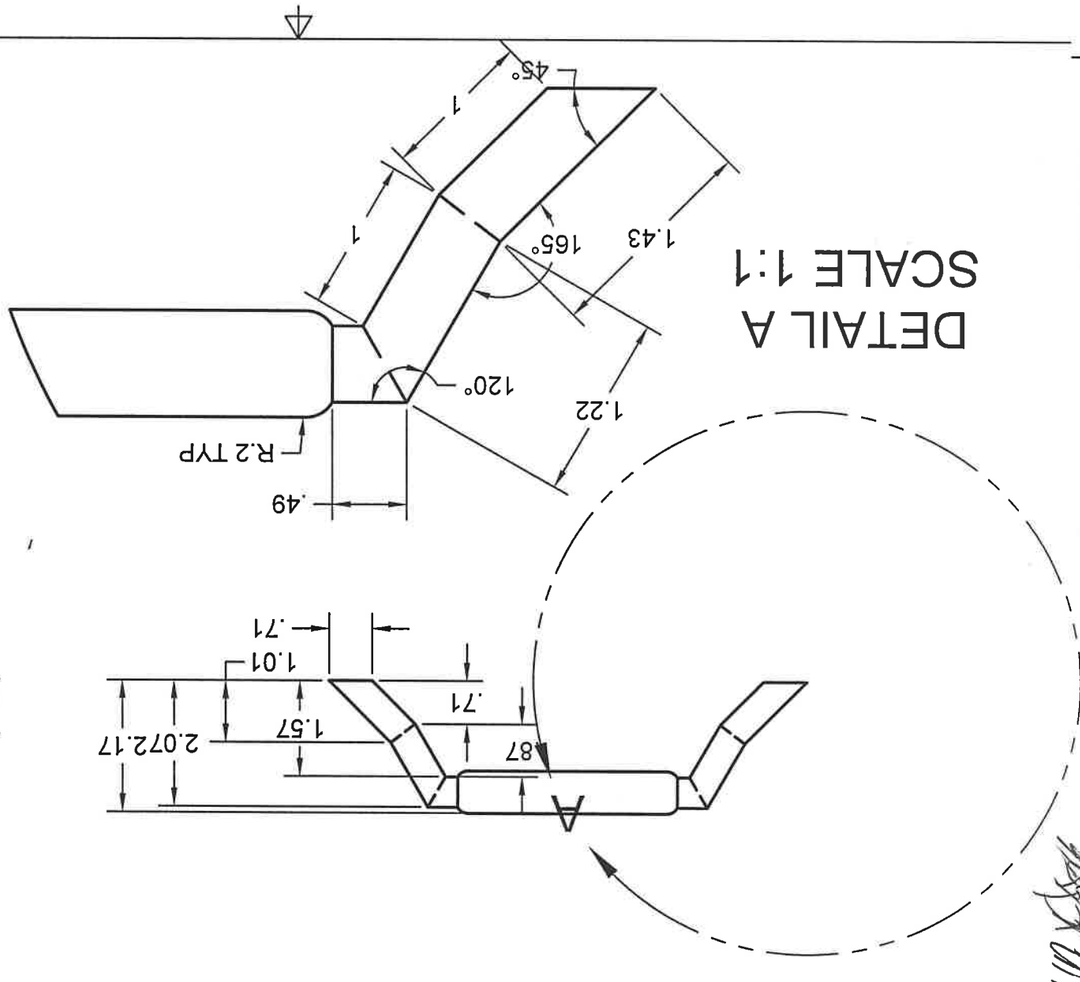
DATE 11/20/19

PROPRIETARY INFORMATION

DISCLOSED TO AND UNDERSTOOD BY

Pamela McDonald

DATE



Handle

11/20/19

Continued to page

DATE 11/20/19

PROPRIETARY INFORMATION

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SIGNATURE Pamela McDonald

DATE