



CIRCULAR SAW

**Research Process
Booklet**

**Tyson Erwin
IND 361**

MODULE 1:

Part 1 - About the Chosen Product





MODULE 1:

Part 1 - About the Chosen Product

Contextual Research

What does it do?

The circular saw allows people to make a straight cut in various materials. It's compact and lightweight design allows for it to be operated with one hand. While holding the material down with your non-dominant hand and the circular saw with your dominant hand, you can quickly make long straight cuts. The circular saw is commonly used on larger sheets of wood such as particle board and plywood (typically found in most building construction).

Where is it found being used?

The circular saw is most notably found at construction sights for large projects that may require long and straight cuts. The advantage that a circular saw has over other saws is the circular saw's ability to make a seamless and continuous cut.

Why is it valuable to the user?

The circular saw allows the user to cut through most materials single-handedly with a relatively powerful motor and can be transported from place to place with ease.

How does it work generally?

The saw blade rotates and is pushed through a material to create a continuous straight cut

Who are users of who uses it?

Any person that is knowledgeable in power tools, carpentry, and any other activity or job that requires portable cutting.



Competitors



DEWALT 6-1/2-Inch 20V MAX Circular Saw, Tool Only (DCS391B)

by DEWALT

★★★★★ 839 ratings | 227 answered questions

Amazon's Choice for "dewalt 20v circular saw"

Price: [See price in cart](#) & **FREE Shipping**. [Details & FREE Returns](#)

Note: Available at a lower price from other sellers that may not offer free Prime shipping.

Free Amazon tech support included

Style: **Circular saw**

Circular saw Price Hidden	Circular saw w/ blade \$108.87	w/ Cordless Starter Kit \$191.88	w/ ToughSystem Tote \$115.31
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- Powerful 460 MW, 5,150 RPM motor delivers power and speed to make the most demanding cuts with ease
- High strength and lightweight magnesium shoe provides jobsite durability for long-term cut accuracy
- 0-50°(degree) bevel capacity allows for aggressive bevel cuts for a multitude of applications
- Optimized rubber overmolded comfort grip delivers optimal balance and control; Power Tool Type: Cordless
- 6.5-Inch carbide-tipped blade for cutting 2 times material at 90° and 45° and more cuts per charge
- Includes: DCS391 6.5-Inch Circular Saw and 6-5-Inch Carbide-tipped Blade
- Battery & Charger Sold Separately

Competitor: Skil 7-1/4-Inch Circular Saw Beam Laser Guide

Unique Features: Laser Guide

Price: \$59.99



SKIL 5280-01 15-Amp 7-1/4-Inch Circular Saw with Single Beam Laser Guide

by Skil

★★★★★ 1,119 ratings | 191 answered questions

Amazon's Choice for "circular saw"

Price: **\$59.99** & **FREE Shipping**. [Details & FREE Returns](#)

Free Amazon tech support included

Style: **Saw**

- Powerful 15-amp motor delivers 5,300-RPM for greater speed and faster cuts
- 7-1/4-in carbide-tipped blade included. Spindle lock for easy blade changes.
- 51 degree bevel capacity for a wide variety of cuts. Arbor size: 5/8 inches, cord length: 6 feet
- Lightweight 6.95-lb design reduces fatigue
- Dust blower keeps line-of-cut free of sawdust for improved visibility. Anti-sag lower guard reduces snags when making narrow cut-offs



Competitors



Makita 5007Mg Magnesium 7-1/4-Inch Circular Saw

by Makita

★★★★★ 317 ratings | 66 answered questions

Amazon's Choice for "makita circular saw"

List Price: ~~\$289.00~~

Price: **\$127.00 & FREE Shipping**. Details & FREE Returns

You Save: \$153.00 (55%)

Free Amazon tech support included

Style: Circular saw

Circular saw w/ 10-pk of blades
\$192.79

Circular saw
\$127.00

- Magnesium components create a lightweight saw (10.6 pounds) that is well balanced and jobsite tough
- Powerful 15.0 AMP motor delivers 5,800 RPM for proven performance and jobsite durability
- Two built in L.E.D lights illuminate the line of cut for increased accuracy
- Large cutting capacity (2 to 1/2 inches at 90 degree) and bevel capacity (0 degree to 56 degree) with positive stops at 22.5 degree and 45 degree
- 1 year warranty

Competitor: PORTER-CABLE 7-1/4-Inch Circular Saw

Unique Features: Heavy Duty Steel Shoe

Price: \$53.37



PORTER-CABLE 7-1/4-Inch Circular Saw, Heavy Duty Steel Shoe, 15-Amp (PCE300)

by PORTER-CABLE

★★★★☆ 201 ratings | 49 answered questions

Amazon's Choice for "porter cable circular saw"

List Price: ~~\$59.99~~

Price: **\$53.37 & FREE Shipping**. Details & FREE Returns

You Save: \$6.62 (11%)

Note: Available at a lower price from other sellers that may not offer free Prime shipping.

Free Amazon tech support included

Style: Circular Saw

Circular Saw
\$53.37

w/ Bluetooth Speaker
\$173.36

w/ LED Area Light
\$102.36

- 15 amp motor running at 5,500 RPM provides power and speed through applications
- Steel shoe with optimum line of sight provides accurate cuts and durable construction
- Spindle lock and depth adjustment for quick adjustments on the job
- Only 9.5 lbs, with Aux handle, provide comfort and clear line of sight



Competitors



Milwaukee M18 2630-20 18 Volt Lithium Ion 6-1/2" 3,500 RPM Cordless Circular Saw w/ Magnesium Guards and Included 24-Tooth Carbide Wood Cutting Blade (Bare Tool)

by Milwaukee

★★★★☆ | 420 ratings | 91 answered questions

Price: **\$97.26** & **FREE Shipping**. [Details](#) & [FREE Returns](#)

Note: Available at a lower price from [other sellers](#) that may not offer free Prime shipping.

[Free Amazon tech support included](#) ▾

Style: **2630-20**

- N/A
- Imported
- **ELECTRONIC BRAKES** will stop your blade quickly when you're finished with your cut. You won't need to waste time waiting around for the blade to slow down, so you can get back to work quickly
- **SOFT GRIP HANDLE** provides maximum comfort so you can work with precision in slippery environments
- **BEVEL AND DEPTH ADJUSTMENT:** You can adjust the depth up to 1 1/2" and the bevel up to 45 degrees, giving you a huge degree of versatility in your cuts
- **MAGNESIUM GUARDS** on the top and bottom of the blade well keep the unit protected from impacts like bumps and drops of several feet. This will allow you to work confident in the safety of your tool and yourself
- **M18 COMPATIBLE:** This cordless circular saw is compatible with Milwaukee M18 18 Volt Lithium Ion batteries. Compatible models include the 48-11-1860, 48-11-1850, 48-11-1828, 48-11-1815, 48-11-1840, and 48-11-1820

Competitor: Ryobi One+ 5-1/2-Inch Cordless Circular Saw

Unique Features: 18V Lithium Ion Cordless

Price: \$48.64



Ryobi One+ 18 V Lithium Ion Cordless 5 1/2 Inch Circular Saw P504G, (Bare Tool Only, Non-Retail Packaging)

by Ryobi

Price: **\$48.64** & **FREE Shipping**. [Details](#) & [FREE Returns](#)

Note: Available at a lower price from [other sellers](#) that may not offer free Prime shipping.

- Front pommel handle for 2-handed operation
- Compact design for better handling
- Adjust your bevel up to 50 degrees and your depth from 0 - 1 9/16 inches with conveniently located knobs
- Bare Tool, Battery and charger sold separately
- This item is removed from retail packaging for shipping purposes (Bulk Packaged, No Retail Packaging) and will arrive in a generic shipping box or bag



Competitors



BLACK+DECKER 20V MAX 5-1/2-Inch Cordless Circular Saw (BDCCS20C)

by BLACK+DECKER

★★★★☆ 214 ratings | 64 answered questions

Amazon's Choice for "cordless circular saw"

Price: **\$66.97** & **FREE Shipping**. [Details](#)

Note: Available at a lower price from [other sellers](#) that may not offer free Prime shipping.

[Free Amazon tech support included](#)

Style: **Circular Saw**

w/ 5 1/2-Inch Blade
\$81.17

Circular Saw
\$66.97

- High torque motor 5-1/2-inch. Fast cutting blade for a variety of cuts
- Tool-free depth of cut allows for easy depth adjustments
- Bevel adjustment with detents at 45 and 90 degrees
- 12T Carbide blade allows for fast cutting in a variety of applications and materials
- Backed by BLACK+DECKER 2 year limited warranty

Competitor: Bosch 6-1/2-Inch Cordless Circular Saw

Unique Features: 18V Lithium Ion Cordless

Price: \$119.00



Bosch Bare-Tool CCS180B 18-Volt Lithium-Ion 6-1/2-Inch Lithium-Ion Circular Saw

by Bosch

★★★★☆ 249 ratings | 52 answered questions

Price: **\$119.00** & **FREE Shipping**. [Details](#) & [FREE Returns](#)

Note: Available at a lower price from [other sellers](#) that may not offer free Prime shipping.

[Free Amazon tech support included](#)

Style: **Bare-Tool**

- **PRECISION:** The Bosch CCS180B Circular Saw Bare Tool has a 6-1/2-inch saw blade capacity and provides the ability to cut through 2-inch thick material at 90 degrees and 1-9/16-inch thick material at 50 degrees.
- **POWER:** The cordless saw is balanced and compact with 3,900 no-load rpm and weighing only 6.6 lbs. for an outstanding power-to-weight ratio.
- **CONVENIENT:** Featuring a left-blade design for a clear view of cut line when saw's main handle is held in right hand. The cordless saw also provides an adjustable, easy-to-read bevel and a depth-of-cut gauge for consistent locking and improved accuracy.
- **ACCURACY:** The saw features the Bosch-exclusive anti-sag lower guard for easing the blade into the work piece and an electronic brake to quickly stop the blade for quick and easy use.
- **DURABLE:** The Bosch CCS180B Circular Saw Bare Tool was built to withstand years of the toughest jobs with a heavy-duty aluminum foot and upper guard. It also includes Bosch's Motor and Cell protection to prevent overload and overheating.
- The 6 1/2-inch saw blade can completely cut through 2-times material even at full depth of cut
- Exclusive anti-sag lower guard for easing into the work piece



Human Interface and User Contact Points



**Blade Guard
Down**



Blade Guard Up



**Blade Guard
In Context**



Human Interface and User Contact Points



**Cutting
Grip/Position**



**Angle Cuts:
Adjustable Foot**



**Blade
Tightening Nut**



Contextual Research

Who are the Stakeholders in the product's success or failure?

Manufacturers: Chervon (HK) Ltd (North America and the European)

Retail Vendors: Home Depot, Ace Hardware, Lowe's, Walmart Supercenter

Shippers: FedEx, UPS, Amazon, USPS

What are the predominant technologies used in the product and for how long have they been the same?

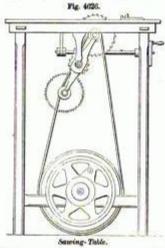
1. The **cordless/battery** operated circular saw was patented by Black and Decker Inc on August 13, 1998. However, there are still a wide range of corded circular saw still on the market due to power constraints. Patent Number US6996909B1 [<https://patents.google.com/patent/US6996909>]
2. The first power tool with a **brushless motor** was patented by Max Co Ltd on January 1, 2007. Brushless motors are great for power tools as it reduces the chances of motor failure caused by debris. Patent Application Number US20100253162A1 [<https://patents.google.com/patent/US20100253162A1/en?q=power&q=tool&q=brushless+motor&q=patent&og=power+tool+brushless+motor+patent>]



Product History

INVENTING THE CIRCULAR SAW: A BRIEF HISTORY

It's commonly told that Samuel Miller was awarded **British Patent #1152 in 1777** for what is considered the first circular saw machine. Some assert that the wording in his patent indicates the **circular blade** itself was in common use by that time — it was the sawing machine itself that Miller had invented.



A patent drawing for an early table (circular) saw. Being a Shaker, Tabitha Babbitt did not patent her original version.

As with many inventions, accounts of the circular saw's early history are conflicting. Some evidence shows that Gervinus of Germany built something similar in 1780, while others claim it was the Dutch who invented the device some hundred or so years earlier.

A little while later, we hear about a man named Walter Taylor who supplied the Royal Navy with high-quality rigging blocks into the early 19th century. Taylor was responsible for a variety of patents centered on wood processing, although none on the machine itself. But, history has proven he used circular saw blades in his mills.

Like many inventions of the time, the circular saw was a concept developed similarly and independently throughout parts of the developing world. All these stories of the circular saw's rise in Europe seem completely separate from its emergence in America — or, at least, from American legends.

<https://www.yorksaw.com/history-circular-saw/>

THE SPINNING WHEEL'S INFLUENCE

The spinning wheel was an early machine used to transform natural fibers into spinning thread or yarn. It was composed of a drive wheel, table, treadle and legs as well as parts that held the fibers. A weaver by trade, Babbitt noticed that the drive wheel spun in a continual circular motion and didn't need to be continually reset like the inefficient pit saw. By carving a circular saw blade and attaching it to her spinning wheel, every movement of the disk made a cut.

As a Shaker, Babbitt's religious beliefs prevented her from receiving a patent. While members of the religion were widely admired for their inventiveness and hard work, they believed in sharing ideas freely and leaving their inventions unpatented. But, fortunately, history has remembered her yet.

When attached to a table, the circular saw acts much like the wheel on a spinning wheel, paying homage to Babbitt's original prototype. Both the saw and its alleged ancestor work in a continual circular motion to produce consistent results without the need to stop and reposition the machine.

<https://www.yorksaw.com/history-circular-saw/>



Product History

EARLY VERSIONS AND EVOLUTION

As with the spinning wheel, early prototypes of the circular table saw were powered by a treadle — a pump on the floor that was pushed by foot to make the saw spin. Saws during this time were not mechanical, nor were they portable. These early models of the circular saw table were used in America throughout the 1800s.

In 1922, the first circular saw attached to a radial arm was created by Raymond Dewalt, allowing for greater control of cutting depth and direction than ever before. However, it wasn't until 1929 that inventor Art Emmons created the first handheld circular saw.

Emmons' helical-drive saw featured an electronic motor that was lightweight enough for easy portability. This design became the basis for all portable circular saws used today and remains the most widely used circular saw design.

Since then, both portable and table circular saws have continued to evolve in technological advances. Today's portable circular saws use a lightweight universal motor that can run off either AC or DC electric power, while table saws typically feature a heavier induction motor.

Safety advances like springs and feeder wheels have been added to prevent users from getting their fingers too close to the blade. Some advanced saws can even sense a change in electric current when a hand comes near the blade and will switch off automatically, making these modern saws safer than ever.

<https://www.yorksaw.com/history-circular-saw/>

THE CIRCULAR SAW TODAY

Since its invention, the circular saw has been used in numerous commercial and personal applications. Small handheld saws can be used for household or construction projects, while larger versions of the table circular saw and blade can cut with extreme **precision in sawmills**, lumber yards and timber processing. Many novices and professionals alike enjoy the circular saw for its enhanced versatility, as it can easily cut both wood and harder materials like plastic and stone. On wood, the saw is used to **crosscut, rip** and make angle cuts.

When the York Saw Works started in 1906, our focus included **machine knives**, but it was saw blades that took the lead in popularity. It makes sense, though. In addition to its history of woodcrafts & industrial ingenuity, Pennsylvania was a timber industry powerhouse at the turn of the last century. Indeed, this was true of much of the Northeastern US at the time. Without the keen eye and inventive contributions of people like Samuel Miller or Tabitha Babbitt, who knows where we'd be today?

From the invention of Miller's first circular saw machine and the legend of Babbitt's spinning wheel saw to the versatility of Dewalt's radial arm attachment and Emmons' handheld invention, the circular saw has a long and fascinating history. We hope we've given you a greater appreciation of this rich and versatile tool.

To learn more about the history of the circular saw, check out the resources below. **Contact us today** for additional questions or **order your circular saw blades online!**

<https://www.yorksaw.com/history-circular-saw/>



Product History



Image credit: Mark Hunter, Flickrr

Over the decades, as tool users have developed loyalties to different brands and as the kinds of circular saws have emerged, it's become more and more popular to just refer to them as circular saws. You might prefer the Skil brand and be okay with calling it a skill saw, but if you like Bosch or Makita or Black & Decker, you probably don't want an offending brand imposed onto your tool.

That is, every skill saw — more accurately called every Skil saw — is a circular saw, but not every circular saw is a skill saw.

A few last words

The question of whether what the difference is between a skill saw and a circular saw reaches back into tool history to right about the time that industrialization was first getting to know the idea of the home workshop. Skilsaw Inc. cornered the market on hand-held circular saws and for decades saw benefit from that popular association.

That has changed, however, and while today people still frequently refer to every circular saw as a skill saw, it's not really the case. But, that's a reminder of the staying power of a really good brand name.

It leads back to a brand

The origin of the name Skill saw goes back to right after the turn of the 20th Century when Edmond Michel and his business partner Joseph Sullivan patented the first portable hand-held circular saw. The saw they invented at the time is today known as the worm-drive saw, but because the company that made it was called Skilsaw Inc., it just became known by the manufacturer. That is, it was called the Skilsaw.

As with just about every other popular tool line, the original was copied and soon other sorts of portable saws hit the market. Even though they were made by different companies, because they had the same basic shape and function as the same tools made by Skilsaw, the latter's name stuck with them. Every portable hand-held saw was eventually referred to as a Skill saw.

Circular saws go big, the name remains the same

From that growth in the marketplace, a new basic tool name evolved. **They were called circular saws**, referring to a cutting disc that rotates around an arbor. But, because of the ubiquitous nature of circular saws made by Skilsaw, they were still generally referred to as skill saws.

<https://sawingpros.com/skill-saw-vs-circular-saw/>



Safety Issues

Makita Recalls Circular Saws Due to Laceration Hazard



Makita 5057KB circular saw

Name of product:
Circular saws

Hazard:
The lower blade guard can malfunction and expose the blade, posing a laceration hazard and risk of injury to the consumer.

Remedy:
Repair

Recall date:
October 20, 2016

Units:
About 450

Importer(s):
Makita U.S.A. Inc., of La Mirada, Calif.

Distributor(s):
Makita U.S.A. Inc., of La Mirada, Calif.

Manufactured In:
Japan

Recall number:
17-019

Recall Details

Description:

This recall involves the Makita 5057KB 7-1/4" circular saw with dust collector. The model number and serial number are located on the black nameplate under the name "Makita." The saw's housing is a blue-green color and "Makita" is printed on the dust cover. The serial number ranges included in this recall are: 12638-12737, 12978-13027, 13208-13257, 13322-13351, 13376-13405, 13578-13627, 13658-13707 and 13900-13979.

<https://www.consumerreports.org/cro/news/2007/08/recall-of-skil-circular-saws/index.htm>



Safety Issues

Robert Bosch Tool Corp. Recalls Skil® Circular Saws Due to Laceration Hazard

 En Español



FOR IMMEDIATE RELEASE

August 15, 2007

Release #07-275

Firm's Recall Hotline: (866) 761-5572

CPSC Recall Hotline: (800) 638-2772

CPSC Media Contact: (301) 504-7908

Robert Bosch Tool Corp. Recalls Skil® Circular Saws Due to Laceration Hazard

WASHINGTON, D.C. - The U.S. Consumer Product Safety Commission, in cooperation with the firm named below, today announced a voluntary recall of the following consumer product. Consumers should stop using recalled products immediately unless otherwise instructed. It is illegal to resell or attempt to resell a recalled consumer product.

Name of Product: Skil® brand Circular Saws

Units: About 811,000

Manufacturer: Robert Bosch Tool Corp., of Mount Prospect, Ill.

Hazard: The trigger switch on the circular saw can be locked on or the switch can be turned on without the use of the safety lock-out. This can cause unexpected operation of the saw, posing a risk of laceration.

Incidents/Injuries: The firm has received five reports of the saw staying on after the user released the trigger. No injuries have been reported.

Description: The recall involves Skil® brand circular saws with model numbers 5650, 5700, 5750 and 5755. The model number and date code are printed on the nameplate located on the front of the saw. The recall includes the following date codes:

No other models or date codes are included in this recall.

Sold at: Home centers and independent hardware retailers nationwide from January 2002 through December 2006 for between \$70 and \$80.

Manufactured in: United States

Remedy: Consumers should immediately stop using the recalled saws and contact the firm for instructions on obtaining a free repair.

<https://www.cpsc.gov/Recalls/2007/robert-bosch-tool-corp-recalls-skil-circular-saws-due-to-laceration-hazard>



Actionable Insights/Safety

1. A circular saw with a blade guard designed so that debris and saw dust will not prevent the guard from retracting. Allow a clear and clean path for the blade guard to retract.
2. Remove any switches or buttons that allow the saw to operate without the trigger being depressed. Design to where trigger must be depressed at all times during operation.
3. Design a mechanism in which the blade or base plate can be adjusted to the depth of the material being cut to prevent unnecessary exposure of the blade underneath.

Serious injury can be negated by implementing some of these actionable insights based on safety concerns.



MODULE 1:

Part 2 - Human Factors Task Analysis





MODULE 1:

Part 2 - Human Factors Task Analysis

Human Factors Task Analysis: Pre-Operational Tasks

Human Factors Task Analysis: Pre-Operational Tasks							
Who / What	User Intention		User/Product		Operation		Modifications
Section	1.a	1.b	2.a	2.b	3.a	3.b	4
What to Answer?	User Intention	User Action: Cognition, Affect, Behavioral	Interface between Human/User	Human Senses Involved	Machine Status	Machine Action	Product Improvement Opportunities Identified
Step 1	Go to garage	Behavioral	None/None	Sight	Inert	None	
Step 2	Grab 2 saw horses	Behavioral	None/None	Sight & Touch	Inert	None	
Step 3	Unfold saw horses	Behavioral	None/None	Touch	Inert	None	
Step 4	Place saw horses approximately 3 feet apart	Behavioral	None/None	Sight & Touch	Inert	None	
Step 5	Find extension cord	Cognitive	None/None	Sight	Inert	None	Saw can be battery operated to eliminate steps 5-8 and 16-18
Step 6	Take extension cord off wall hook	Behavioral	None/None	Touch	Inert	None	Battery/operated
Step 7	Unravel cord and extend from outlet to saw horses	Behavioral	None/None	Sight & Touch	Inert	None	Battery/operated



Pre-Operational Tasks

Step 8	Plug male end of cord into outlet	Behavioral	None/None	Sight & Touch	Tool Inert/Power Cord Live	None	Battery operated
Step 9	Locate piece of material to cut	Cognitive	None/None	Sight	Inert	None	
Step 10	Grab material to cut and place on saw horses	Behavioral	None/None	Sight & Touch	Inert	None	
Step 11	Ensure material is proportionally balanced on saw horses	Cognitive	None/None	Sight & Touch	Inert	None	
Step 12	Figure out last known place of circular saw	Cognitive	None/None	None	Inert	None	Have a built-in rack for the saw to rest and charge
Step 13	Walk to work bench where circular saw is located	Behavioral	None/None	Sight	Inert	None	Built-in rack
Step 14	Grab circular saw and place on floor	Behavioral	Hands/Case Handle	Sight & Touch	Inert	None	Built-in rack
Step 15	Unclip case and open	Behavioral	Hands/Case	Touch	Inert	None	Built-in rack
Step 16	Remove circular saw from case and unravel cord	Behavioral	Hands/Saw Grip	Touch	Inert	None	Built-in rack/Battery operated
Step 17	Make sure saw trigger is fully out to prevent accidental saw activation	Behavioral	None/None	Touch	Inert	Trigger is pulled and released to ensure proper retraction	Adding an indicator light that signals when the trigger is depressed



Pre-Operational Tasks

Step 18	Plug in cord from circular saw into power cord	Behavioral	Hands/Power Cord	Sight & Touch	Inert	Power is live to the saw	Battery operated
Step 19	Put safety glasses on	Behavioral	None/None	Sight & Touch	Inert	None	
Step 20	Firmly grip circular saw handle with dominant hand	Behavioral	Hand/Saw Grip	Touch	Inert/Live Power	None	Create a circular saw where Left/Right hand users can both use it the same way
Step 21	Walk to material located on saw horses	Behavioral	None/None	Sight	Inert/Live Power	None	
Step 24	Trigger will now be functional	Affect	None/None	None	Inert/Live Power	None	



Operational Tasks

Human Factors Task Analysis: Operational Tasks							
Who / What	User Intention		User/Product		Operation		Modifications
Section	1.a	1.b	2.a	2.b	3.a	3.b	4
What to Answer?	User Intention	User Action: Cognition, Affect, Behavioral	Interface between Human/User	Human Senses Involved	Machine Status	Machine Action	Product Improvement Opportunities Identified
Step 25	Use index finger to press trigger and hold	Behavioral	Index Finger/Trigger	Touch	Live Power then Active when trigger is pulled	Trigger is held in and blade begins to rotate	
Step 26	Circular saw will turn on and spin blade	Affect	None/None	None	Active	Blade rotating	
Step 27	Hold material very firmly with non-dominant hand to prevent kick-back	Behavioral	None/None	Touch	Active	Blade rotating	
Step 28	Slowly guide activated saw through material	Behavioral	Hand/Saw Grip	Sight, Touch, Hearing	Active	Blade will begin to cut material	
Step 29	Blade guard will retract and expose blade on underside of material	Affect	None/None	None	Active	Blade guard retracts as the saw it pushed over more material	Sensor can identify the depth of material and can auto-adjust on the fly



Operational Tasks

Step 30	Saw dust will be ejected from blade side and underneath material	Affect	None/None	None	Active	Blade will produce sawdust: from side of saw/underneath	Small exhaust fan can ensure dust is pushed away from user
Step 31	Ensure feet are in safe area away from unsupported material	Behavioral	None/None	None	Active	Blade rotating and cutting material	
Step 32	Cut material from end to end	Behavioral	Hand/Saw Grip	Sight, Touch, Hearing	Active	Saw is guided from one end of material to the other end	Laser sight on front that projects beam up to 8 inches in front of cut
Step 33	At end of cut, unsupported material will fall onto ground	Affect	None/None	None	Active	Blade will rotate freely and will provide no more resistance	Saw Horse with a built-in fold out side ramp
Step 34	Depress trigger post cut while holding saw firmly	Behavioral	Index Finger/Trigger	Touch	Active	Blade rotating/Blade rotation will begin to slow down	
Step 35	Blade safety guard will retract and cover blade	Affect	None/None	None	Active	Blade guard will retract when saw is removed from material	A blade that can retract into the housing to eliminate need of bulky guard
Step 36	Keep non-dominant hand on material and dominant hand on saw	Behavioral	Hand/Saw Grip	Touch	Active	Blade Rotating slowing down	
Step 37	Wait for blade to come to a stop	Behavioral	Eyes,Ears/Blade	Sight & Hearing	Active until Blade comes to rest, then Inert/Live Power	Blade rotation will completely stopped on it's own	As blade slows down, it will slightly recharge the battery
Step 38	Set saw back onto the ground in safe area	Behavioral	Hand/Saw Grip	Sight & Touch	Inert/Live Power	None	Built-in rack



Post-Operational Tasks

Human Factors Task Analysis: Post-Operational Tasks							
Who / What	User Intention		User/Product		Operation		Modifications
Section	1.a	1.b	2.a	2.b	3.a	3.b	4
What to Answer?	User Intention	User Action: Cognition, Affect, Behavioral	Interface between Human/User	Human Senses Involved	Machine Status	Machine Action	Product Improvement Opportunities Identified
Step 39	Unplug saw	Behavioral	Hand/Power Cord	Sight & Touch	Inert	None	Power Safety Switch
Step 40	Walk to garage to get blower	Behavioral	None/None	Sight	Inert	None	
Step 41	Grab blower off shelf	Behavioral	None/None	Touch	Inert	None	
Step 42	Grab battery off shelf and plug in to blower	Behavioral	None/None	Sight & Touch	Inert	None	
Step 43	Walk back to where cut was made	Behavioral	None/None	Sight	Inert	None	
Step 44	Turn on blower and blow dust into grass and street	Behavioral	None/None	Sight, Touch, Hearing	Inert	None	
Step 45	Return blower to garage and walk to shop vac	Behavioral	None/None	Sight & Touch	Inert	None	
Step 46	Unwind cord on shop vac and plug into outlet	Behavioral	None/None	Sight & Touch	Inert	None	



Post-Operational Tasks

Step 47	Attach hose and wand	Behavioral	None/None	Touch	Inert	None	Vacuum attaches to saw
Step 48	Turn on shop vac and vacuum extra debris near garage	Behavioral	None/None	Sight, Touch, Hearing	Inert	None	Vacuum attaches to saw
Step 49	Unplug, wind up cord, and put shop vac away	Behavioral	None/None	Sight & Touch	Inert	None	
Step 50	Walk back to circular saw	Behavioral	None/None	Sight	Inert	None	
Step 51	wrap up cord and return circular saw in it's case	Behavioral	Hands/Saw and Case	Sight & Touch	Inert	None	Built-in rack/Battery operated
Step 52	Put case back on shelf	Behavioral	Hands/Case	Sight & Touch	Inert	None	Built-in rack/Recharge station
Step 53	Put away the remaining items	Behavioral	None/None	Sight & Touch	Inert	None	



Actionable Insights

1. The Pre-Operational tasks seem very lengthy in comparison to the Operational tasks. By eliminating some of the Pre-Operational tasks, users can accomplish Operational tasks quicker.
2. Post-Operational tasks are dependant on the mission which can be difficult to modify; However, by reducing the amount of cleaning needed in Post-Operation, it is necessary to reduce mess during the Operational tasks.

Step Count:

Pre-Operational: 24

Operational: 14

Post-Operational: 15+ (dependent on situation)



MODULE 1:

Part 3 - Interview Process



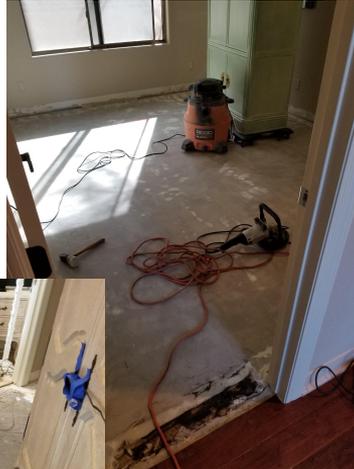


MODULE 1:

Part 3 - Interview Process

Self Assessment

Being employed in an industry that uses power tools on a daily basis, I can say with confidence that I am relatively familiar with the circular saw. John and Deon (my bosses) have been working in the hardwood flooring and home remodeling business for over 40 years combined and were just the right people to ask about what they thought of the circular saw.



Discussion Guide

- How often do you use a circular saw in your profession?
- What type of tasks require you to use the circular saw?
- Do you feel the circular saw is necessary to have in your tool kit?
- Are there other tools that are more important for your business?
- What is the biggest issue you face with the circular saw?
- What do you feel would be the best ways to fix this issue?
- Is there any other tool that can accomplish what a circular saw can?
 - If so, what tool is used and how is the task completed?
- Would you prefer a corded circular saw or a cordless circular saw and why?
- If you could combine the circular saw with another tool, which tool would be the best fit?



Interviewee Respondent Plan



Name: John Sullivan
Business: Hardwood Flooring
Tool Familiarity: Very High
Interview Date: Feb 19, 2020

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Sullivan Hardwood Flooring Inc

A 102 REVIEWS

Founded 1999 • Angie's List since June 2010



Description

My name is John Sullivan. Installing wood and laminate flooring became my passion in 1996 in Indianapolis, Indiana. When I moved to Arizona in 1999 I started Sullivan Hardwood Flooring, Inc. I have always believed in being hands on during all of my projects. While most companies sub contract their hardwood and laminate flooring jobs, I personally show up to install your flooring. The best p...

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Verified Reviews 1

[Write a review](#)

102 Total Reviews

Reviews by Rating

A Rated	<div style="width: 98%;"></div>	98
B Rated	<div style="width: 1%;"></div>	1
C Rated	<div style="width: 0%;"></div>	0
D Rated	<div style="width: 2%;"></div>	2
F Rated	<div style="width: 1%;"></div>	1

Overall Grade Breakdown

Professionalism	A
Responsiveness	A
Price	A
Punctuality	A
Quality	A

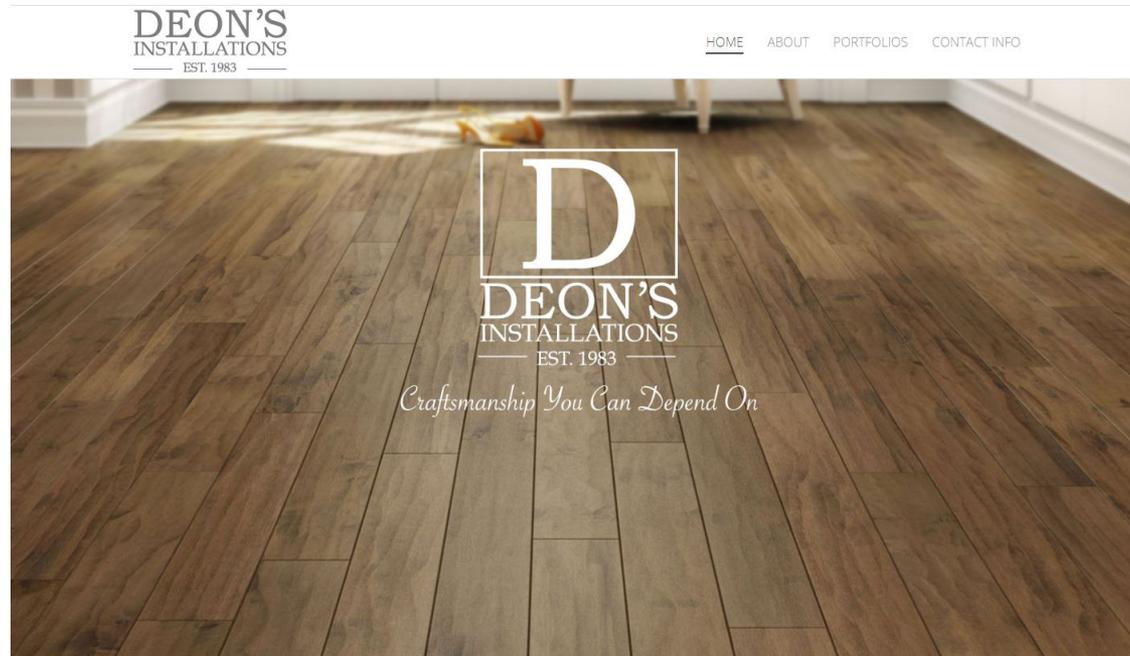
[Read reviews by category](#)



Interviewee Respondent Plan

Name: Deon Miller
Business: Home Remodeling
Tool Familiarity: Very High
Interview Date: Feb 15, 2020

Name: TJ Rickard
Business: Flooring/Remodel
Tool Familiarity: High
Interview Date: Feb 15, 2020



Interview Results: John Sullivan

How often?

Once or twice a month...

Tasks?

Wood floor repairs...

Necessity?

It's a must have...

Importance?

Could halt work without...

Issue?

Dust:
7- $\frac{1}{4}$ inch to 4- $\frac{1}{4}$ inch...

Power?

Inside vs
Outside...

Combination?

Miter Saw or
Table Saw...



Interview Results: Deon Miller and T.J.

How often?

Once or twice a month...

Tasks?

Custom
Platforms...



Power?

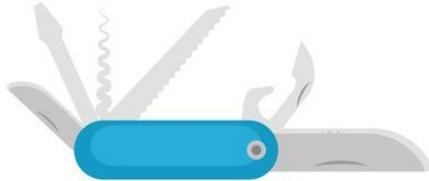
Portability...

Issue?

Versatility...

Combination

Miter Saw or
Table Saw...



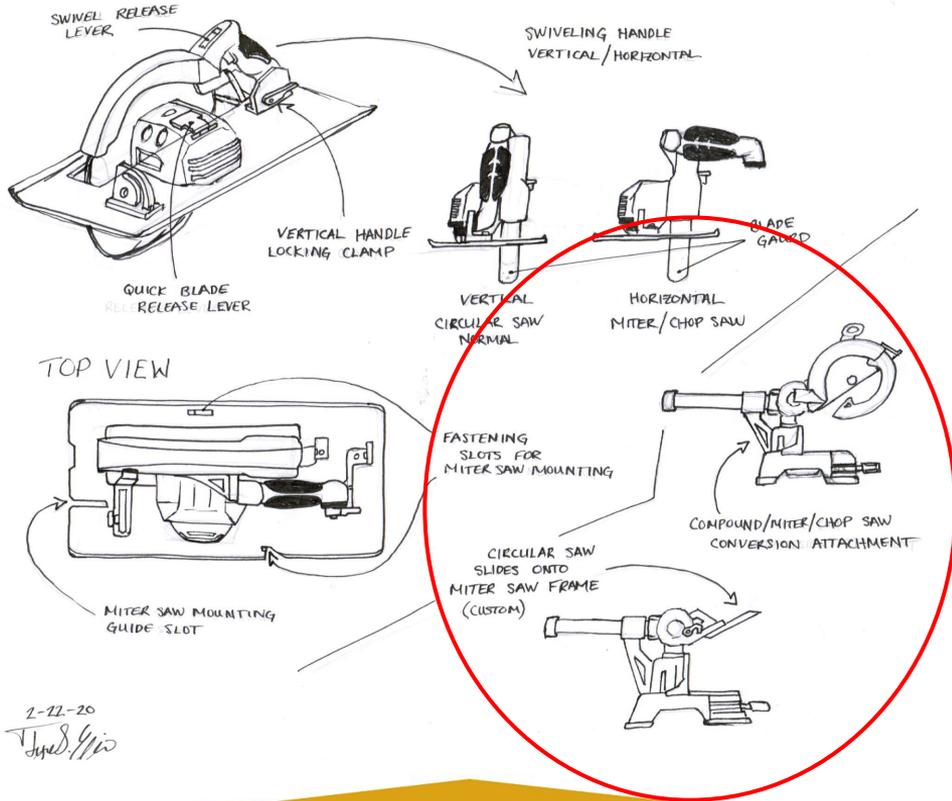
Importance

Some tools more
important...

TOP PRIORITY



Important Insights

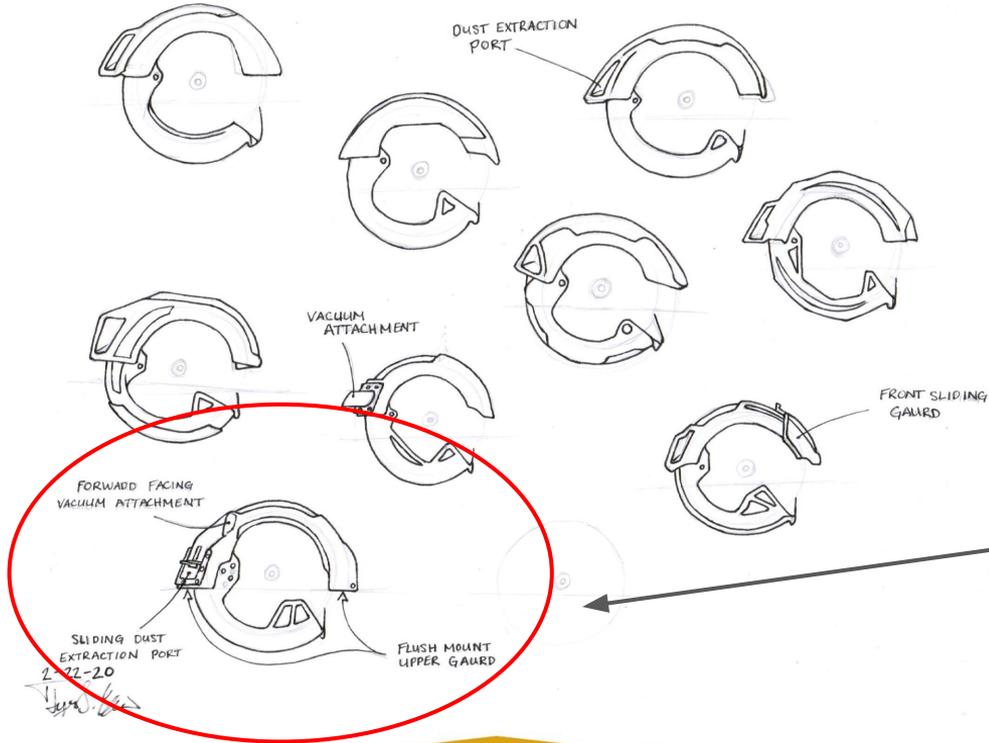


Attach circular saw to miter saw frame

2-22-20
T. J. S. / J. S.



Important Insights



Extraction and vacuum options for dust retention



User Needs Hierarchy/Product Specifications

Users Needs Hierarchy:

1. Implement multi-tool functionality
2. Makes cuts with reduced dust
3. Power to cut and portability
4. Make customers comfortable in their own home
5. Keeping noise and dust to a minimum

Product Specifications

1. Reduce dust by 20%
2. Adjustable speed up/down by 25%
3. Quiet motor noise by 50%
4. Create multi-tool versatility
5. Ergonomic comfortability by 10%



MODULE 1:

Part 4 - Interview Findings





MODULE 1:

Part 4 - Interview Findings

Human Factors Task Analysis: Pre-Operational Tasks

Human Factors Task Analysis: Pre-Operational Tasks							
Who / What	User Intention		User/Product		Operation		Modifications
Section	1.a	1.b	2.a	2.b	3.a	3.b	4
What to Answer?	User Intention	User Action: Cognition, Affect, Behavioral	Interface between Human/User	Human Senses Involved	Machine Status	Machine Action	Product Improvement Opportunities Identified
Step 1	Go to garage	Behavioral	None/None	Sight	Inert	None	
Step 2	Grab 2 saw horses	Behavioral	None/None	Sight & Touch	Inert	None	
Step 3	Unfold saw horses	Behavioral	None/None	Touch	Inert	None	
Step 4	Place saw horses approximately 3 feet apart	Behavioral	None/None	Sight & Touch	Inert	None	
Remove Step 5	Find extension cord	Cognitive	None/None	Sight	Inert	None	Saw can be battery operated to eliminate steps 5-8 and 16-18
Remove Step 6	Take extension cord off wall hook	Behavioral	None/None	Touch	Inert	None	Battery/operated
Remove Step 7	Unravel cord and extend from outlet to saw horses	Behavioral	None/None	Sight & Touch	Inert	None	Battery/operated
Remove Step 8	Plug male end of cord into outlet	Behavioral	None/None	Sight & Touch	Tool Inert/Power Cord Live	None	Battery operated



Pre-Operational Tasks

Step 9	Locate piece of material to cut	Cognitive	None/None	Sight	Inert	None	
Step 10	Grab material to cut and place on saw horses	Behavioral	None/None	Sight & Touch	Inert	None	
Step 11	Ensure material is proportionally balanced on saw horses	Cognitive	None/None	Sight & Touch	Inert	None	
Step 12	Figure out last known place of circular saw	Cognitive	None/None	None	Inert	None	Have a built-in rack for the saw to rest and charge
Step 13	Walk to work bench where circular saw is located	Behavioral	None/None	Sight	Inert	None	Built-in rack
Step 14	Grab circular saw and place on floor	Behavioral	Hands/Case Handle	Sight & Touch	Inert	None	Built-in rack
Step 15	Unclip case and open	Behavioral	Hands/Case	Touch	Inert	None	Built-in rack
Remove Step 16	Remove circular saw from case and unravel cord	Behavioral	Hands/Saw Grip	Touch	Inert	None	Built-in rack/Battery operated
Alternate Step (Step 16)	Remove circular saw and battery from case	Behavioral	Hands/Saw Grip	Touch	Inert	None	Battery operated
New Step	Get shop vac and plug hose into circular saw	Behavioral	Hands/Vacuum and Saw	Sight & Touch	Inert	Vacuum is now attached to Saw	Vacuum dust as it cuts



Pre-Operational Tasks

Step 17	Make sure saw trigger is fully out to prevent accidental saw activation	Behavioral	None/None	Touch	Inert	Trigger is pulled and released to ensure proper retraction	Adding an indicator light that signals when the trigger is depressed
Remove Step 18	Plug in cord from circular saw into power cord	Behavioral	Hands/Power Cord	Sight & Touch	Inert	Power is live to the saw	Battery operated
Alternate Step (Step 18)	Plug battery into circular saw	Behavioral	Hands/Power Cord	Sight & Touch	Inert	Power is live to the saw	
Step 19	Put safety glasses on	Behavioral	None/None	Sight & Touch	Inert	None	
Step 20	Firmly grip circular saw handle with dominant hand	Behavioral	Hand/Saw Grip	Touch	Inert/Live Power	None	Create a circular saw where Left/Right hand users can both use it the same way
Step 21	Walk to material located on saw horses	Behavioral	None/None	Sight	Inert/Live Power	None	
Step 22	Place non-dominant hand on material to cut	Behavioral	None/None	Touch	Inert/Live Power	None	
Step 23	Use thumb to depress and deactivate safety on circular saw	Behavioral	Thumb/Safety Button	Touch	Inert/Live Power	Depressing safety button releases lock on trigger	
Step 24	Trigger will now be functional	Affect	None/None	None	Inert/Live Power	None	



Operational Tasks

Human Factors Task Analysis: Operational Tasks							
Who / What	User Intention		User/Product		Operation		Modifications
Section	1.a	1.b	2.a	2.b	3.a	3.b	4
What to Answer?	User Intention	User Action: Cognition, Affect, Behavioral	Interface between Human/User	Human Senses Involved	Machine Status	Machine Action	Product Improvement Opportunities Identified
Step 28	Slowly guide activated saw through material	Behavioral	Hand/Saw Grip	Sight, Touch, Hearing	Active	Blade will begin to cut material	
Step 29	Blade guard will retract and expose blade on underside of material	Affect	None/None	None	Active	Blade guard retracts as the saw is pushed over more material	Sensor can identify the depth of material and can auto-adjust on the fly
Step 30	Saw dust will be ejected from blade side and underneath material	Affect	None/None	None	Active	Blade will produce sawdust: from side of saw/underneath	Small exhaust fan can ensure dust is pushed away from user
Step 31	Ensure feet are in safe area away from unsupported material	Behavioral	None/None	None	Active	Blade rotating and cutting material	
Step 32	Cut material from end to end	Behavioral	Hand/Saw Grip	Sight, Touch, Hearing	Active	Saw is guided from one end of material to the other end	Laser sight on front that projects beam up to 8 inches in front of cut
Step 33	At end of cut, unsupported material will fall onto ground	Affect	None/None	None	Active	Blade will rotate freely and will provide no more resistance	Saw Horse with a built-in fold out side ramp
Step 34	Depress trigger post cut while holding saw firmly	Behavioral	Index Finger/Trigger	Touch	Active	Blade rotating/Blade rotation will begin to slow down	
Step 35	Blade safety guard will retract and cover blade	Affect	None/None	None	Active	Blade guard will retract when saw is removed from material	A blade that can retract into the housing to eliminate need of bulky guard



Operational Tasks

Step 36	Keep non-dominant hand on material and dominant hand on saw	Behavioral	Hand/Saw Grip	Touch	Active	Blade Rotating slowing down	
Step 37	Wait for blade to come to a stop	Behavioral	Eyes,Ears/Blade	Sight & Hearing	Active until Blade comes to rest, then Inert/Live Power	Blade rotation will completely stopped on it's own	As blade slows down, it will slightly recharge the battery



Post-Operational Tasks

Human Factors Task Analysis: Post-Operational Tasks							
Who / What	User Intention		User/Product		Operation		Modifications
Section	1.a	1.b	2.a	2.b	3.a	3.b	4
What to Answer?	User Intention	User Action: Cognition, Affect, Behavioral	Interface between Human/User	Human Senses Involved	Machine Status	Machine Action	Product Improvement Opportunities Identified
Remove Step 41	Grab blower off shelf	Behavioral	None/None	Touch	Inert	None	Vacuum attaches to saw
Remove Step 42	Grab battery off shelf and plug in to blower	Behavioral	None/None	Sight & Touch	Inert	None	Vacuum attaches to saw
Remove Step 43	Walk back to where cut was made	Behavioral	None/None	Sight	Inert	None	Vacuum attaches to saw
Remove Step 44	Turn on blower and blow dust into grass and street	Behavioral	None/None	Sight, Touch, Hearing	Inert	None	Vacuum attaches to saw
Remove Step 45	Return blower to garage and walk to shop vac	Behavioral	None/None	Sight & Touch	Inert	None	Vacuum attaches to saw
Remove Step 46	Unwind cord on shop vac and plug into outlet	Behavioral	None/None	Sight & Touch	Inert	None	Vacuum attaches to saw
Remove Step 47	Attach hose and wand	Behavioral	None/None	Touch	Inert	None	Vacuum attaches to saw
Remove Step 48	Turn on shop vac and vacuum extra debris near garage	Behavioral	None/None	Sight, Touch, Hearing	Inert	None	Vacuum attaches to saw



Post-Operational Tasks

Remove Step 49	Unplug, wind up cord, and put shop vac away	Behavioral	None/None	Sight & Touch	Inert	None	Vacuum attaches to saw
Step 50	Walk back to circular saw	Behavioral	None/None	Sight	Inert	None	
Step 51	wrap up cord and return circular saw in it's case	Behavioral	Hands/Saw and Case	Sight & Touch	Inert	None	Built-in rack/Battery operated
Step 52	Put case back on shelf	Behavioral	Hands/Case	Sight & Touch	Inert	None	Built-in rack/Recharge station
Step 53	Put away the remaining items	Behavioral	None/None	Sight & Touch	Inert	None	



Insights Gained

1. By having a vacuum attachment to the saw, the amount of cleanup during the Post-Operational tasks can be significantly reduced.
2. Implementing a cordless version of the circular saw, time spent and cord interference is eliminated. Instead, that time spent can be used towards Operational tasks.
3. Removal of trigger-lock buttons can reduce manufacturing costs and safety concerns.

New Step Count:

Pre-Operational: 24

Operational: 14

Post-Operational: 4+ (dependent on situation)



Customer Needs

Heavy Body: Increase amount of light metals/other durable materials by 20%

Heavy Body: Reduce amount of heavy metals by 20%

No Safety Button/Switch: Reduce faulty activation by 90%

Too many different clean up tools: Reduce cleanup by 60%

Saw speeds produce dust: Create optional speed control



MODULE 2:

Part 1 - Product Boundaries





MODULE 2:

Part 1 - Product Boundaries

Visual User Profile

Circular saws are a necessary tool for the everyday construction worker that builds homes. The circular saw can be also be used in other various job sites that require a specific function.



Life Cycle Assessment

Circul Saw LCA Table

Part Name	Material of Item/Part	# of Item/Part	Weight/Length	Label	Impact Factors								
					Extraction	Impact/lb	Total Impact	Manufacture Process	Impact/lb	Total Impact	Disposal Process	Impact/lb	Total Impact
Base Plate	Steel Average	1	0.35	lbs	--	5.3	1.855	Steel Sheet Rolling	0.72	0.252	Controlled Landfill	0.02	0.007
Left Body Housing	Magnesium Primary	1	0.2	lbs	--	17	3.4	Iron Casting	18.5	3.7	Open-Pit Landfill (Steels)	2	0.4
Right Body Housing	Magnesium Primary	1	0.7	lbs	--	17	11.9	Iron Casting	18.5	12.95	Open-Pit Landfill (Steels)	2	1.4
Motor Housing	Magnesium Primary	1	0.6	lbs	--	17	10.2	Iron Casting	18.5	11.1	Open-Pit Landfill (Steels)	2	1.2
Blade Guard (Upper)	Magnesium Primary	1	0.5	lbs	--	17	8.5	Iron Casting	18.5	9.25	Open-Pit Landfill (Steels)	2	1
Blade Guard (Lower)	Magnesium Primary	1	0.4	lbs	--	17	6.8	Iron Casting	18.5	7.4	Open-Pit Landfill (Steels)	2	0.8
Trigger	ABS Primary	1	0.06	lbs	--	2.4	0.144	Injection Molding	0.72	0.0432	Controlled Landfill	0.61	0.0366
Trigger Housing	ABS Primary	1	0.09	lbs	--	2.4	0.216	Injection Molding	0.72	0.0648	Controlled Landfill	0.61	0.0549
Trigger Circuit Board	Circuit board, Pb	1	0.01	lbs	--	-	0.01	-	86	0.86	Controlled Landfill	3.6	0.036
Screw Short	Stainless Steel	2	0.02	lbs	--	13	0.26	S.steel Turning	13	0.26	Controlled Landfill	0.51	0.0102
Screw Medium	Stainless Steel	5	0.1	lbs	--	13	1.3	S.steel Turning	13	1.3	Controlled Landfill	0.51	0.051
Screw Long	Stainless Steel	2	0.06	lbs	--	13	0.78	S.steel Turning	13	0.78	Controlled Landfill	0.51	0.0306
Blade Bolt/Nut	Stainless Steel	1	0.15	lbs	--	13	1.95	S.steel Turning	13	1.95	Controlled Landfill	0.51	0.0765
Wing Nut	Stainless Steel	2	0.16	lbs	--	13	2.08	S.steel CNC Turning	14	2.24	Controlled Landfill	0.51	0.0816
Lower Blade Guard Lever	Aluminum Primary	1	0.1	lbs	--	13	1.3	Al. forging 1 stroke	0.5	0.05	Controlled Landfill	0.39	0.039
Motor Fan	ABS Primary	1	0.05	lbs	--	2.4	0.12	Injection Molding	0.72	0.036	Controlled Landfill	0.61	0.0305
Motor Brush	Pig Iron	2	0.12	lbs	--	0.92	0.1104	Iron Casting	18.5	2.22	Controlled Landfill (Lead)	3.6	0.432
Motor Brush Contact	Copper Primary	8	0.24	lbs	--	140	33.6	Copper Sheet Rolling	1.5	0.36	Controlled Landfill	0.98	0.2352
Motor Brush Spring	Steel Low Alloy	4	0.12	lbs	--	7.6	0.912	Steel Drawing auto	0.18	0.0216	Controlled Landfill	0.02	0.0024
Motor Wire Cover	Pig Iron	8	0.64	lbs	--	0.92	0.5888	Iron Casting	18.5	11.84	Controlled Landfill (Lead)	3.6	2.304
Motor Brush Casing	ABS Primary	2	0.02	lbs	--	2.4	0.048	Injection Molding	0.72	0.0144	Controlled Landfill	0.61	0.0122
Motor Bushing	Stainless Steel	2	0.18	lbs	--	13	2.34	S.steel CNC Turning	14	2.52	Controlled Landfill	0.51	0.0918
Motor Outer Wire Coil	Copper Primary	1	0.3	lbs	--	140	42	Copper Wire Drawing	1.6	0.48	Controlled Landfill	0.98	0.294
Motor Inner Wire Coil	Copper Primary	1	0.35	lbs	--	140	49	Copper Wire Drawing	1.6	0.56	Controlled Landfill	0.98	0.343
Wire & Insulator	Cable 3-cond	1	8	in	--	1	8	Generic Rubber	0.7	5.6	Open-Air Incineration	70	560
Gear	Stainless Steel	2	0.84	lbs	--	13	10.92	S.steel Milling	13	10.92	Controlled Landfill	0.51	0.4284
Gear Pin	Stainless Steel	2	0.3	lbs	--	13	3.9	S.steel rolling	1.2	0.36	Controlled Landfill	0.51	0.153
Power Cord & Insulator	Cable 3-cond	1	60	in	--	1	60	Generic Rubber	0.7	42	Open-Air Incineration	70	4200
		Total:	#REF!			Total:	262.2342			Total:	129.132	Total: 4769.5499	

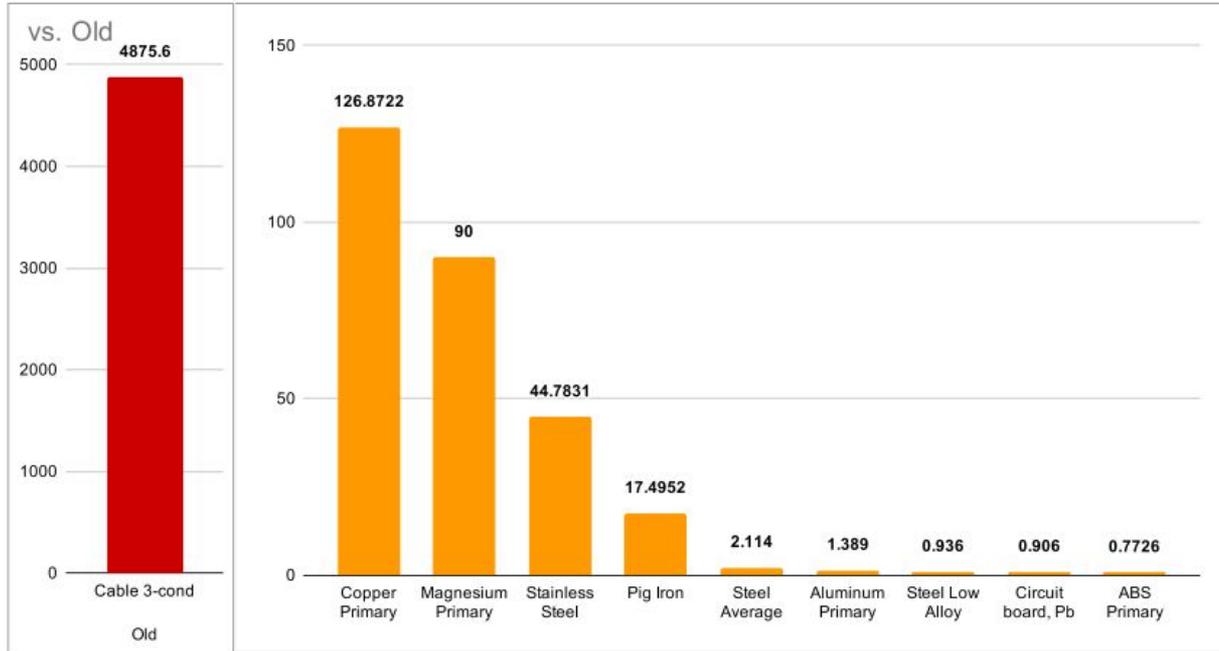
15yrs	7 hr/yr	105 hrs/yr
115V	9.0 amp	108,675 kwh
6.93lbs	1731 mi @ 3/ton-mi	1.99 ton-mi

Overall Impact Total =	5160.9161	5170 Okala
Impact/Hour =	737.2737286	740 Okala/hr



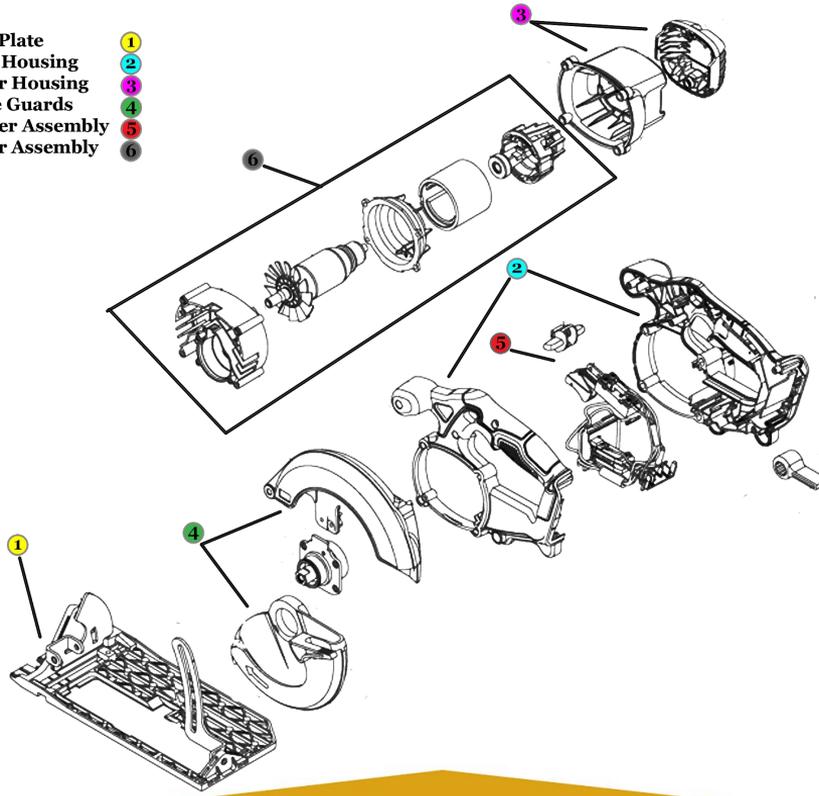
Estimated Impacts

Old	
Steel Average	2.114
Magnesium Primary	90
ABS Primary	0.7726
Circuit board, Pb	0.906
Stainless Steel	44.7831
Pig Iron	17.4952
Steel Low Alloy	0.936
Copper Primary	126.8722
Cable 3-cond	4875.6
Aluminum Primary	1.389



Exploded View

- Base Plate 1
- Body Housing 2
- Motor Housing 3
- Blade Guards 4
- Trigger Assembly 5
- Motor Assembly 6



Actionable Insights



1. Reduce weight in the saw by using a high strength nylon polymer for housings and blade guards.
2. Internal rechargeable battery to eliminate the use and disposal of rubberized power cords.
3. Use a brushless motor to reduce weight while maintaining life expectancy.
4. 3 speed variable switch to adjust to user needs, materials, and extending battery life.
5. Reduce overmolding and unnecessary material production.
6. Explore moto configurations for ergonomic use.



MODULE 2:

Part 2 - Drawings/Models

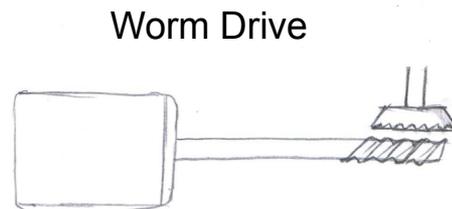
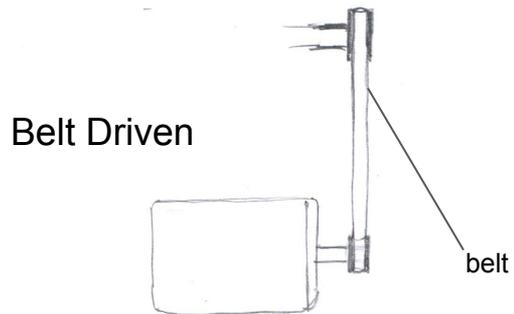
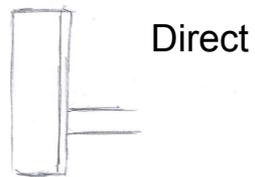
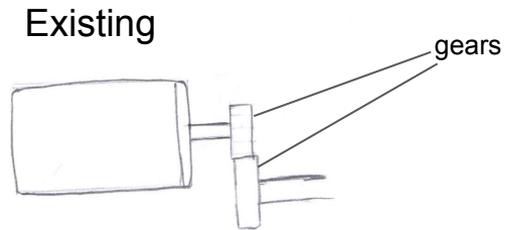




MODULE 2:

Part 2 - Drawings/Models

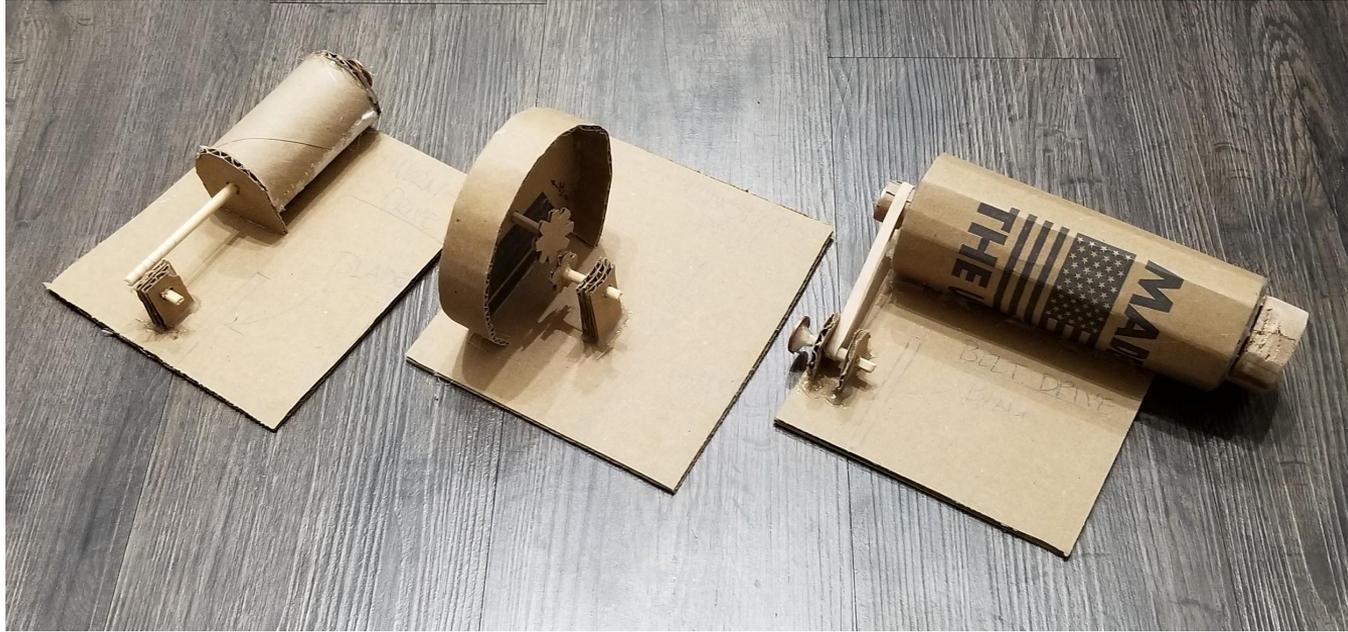
Existing and 3 new Drive-Train Config.



Motor Technology



3 Motor Variations



1:1 Scale Model Cardboard



1:1 Scale Model Cardboard

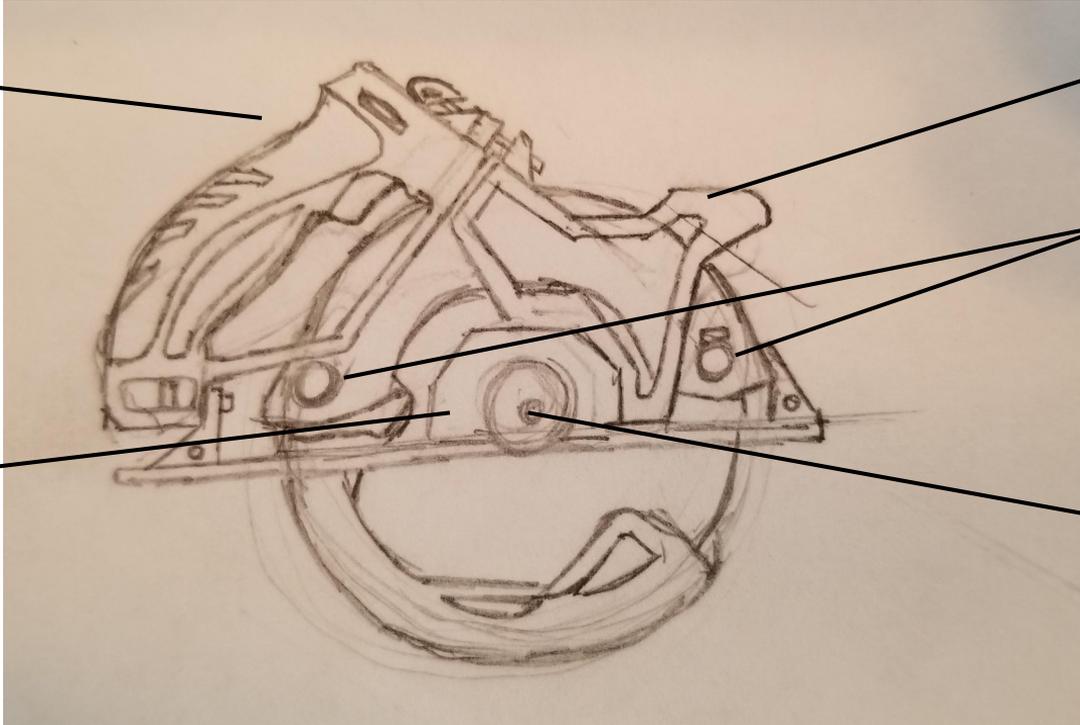
Pivoting
Handle

Reduction of
Materials

Two vacuum
ports

High Torque
Gear Box

Brushless
Motor



Improvement Opportunities

- Reduction of overall weight to the housing components and blade guards will significantly reduce user fatigue during operation.
- Creating a multi-tool function with a miter saw will allow the user to purchase at a lower cost while achieving the same goal.
- Incorporating a lower Amp/hr battery with a 'between use' rechargeable station (the case) will reduce weight and overall Okala impact factors.



Design Statement

“A worker who can is much more effective than a worker who can't.
Give workers a tool that will improve their performance”



MODULE 3:

Part 1 - Additional Findings





MODULE 3:

Part 1 - Additional Findings

Future of Batteries

Graphene and batteries

Graphene, a sheet of carbon atoms bound together in a honeycomb lattice pattern, is hugely recognized as a “wonder material” due to the myriad of astonishing attributes it holds. It is a potent conductor of electrical and thermal energy, extremely lightweight chemically inert, and flexible with a large surface area. It is also considered eco-friendly and sustainable, with unlimited possibilities for numerous applications.



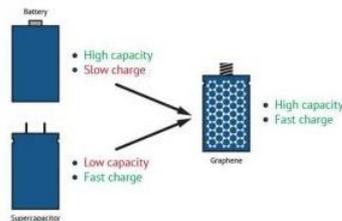
- Higher capacity
- Faster charging
- Light weight
- Flexibility
- High temperature range

The advantages of graphene batteries

In the field of batteries, conventional battery electrode materials (and prospective ones) are significantly improved when enhanced with graphene. A graphene battery can be light, durable and suitable for high capacity energy storage, as well as shorten charging times. It will extend the battery's life, which is negatively linked to the amount of carbon that is coated on the material or added to electrodes to achieve conductivity, and graphene adds conductivity without requiring the amounts of carbon that are used in conventional batteries.

Batteries and supercapacitors

While there are certain types of batteries that are able to store a large amount of energy, they are very large, heavy and release energy slowly. Capacitors, on the other hand, are able to charge and discharge quickly but hold much less energy than a battery. The use of graphene in this area, though, presents exciting new possibilities for energy storage, with high charge and discharge rates and even economical affordability. Graphene-improved performance thereby blurs the conventional line of distinction between supercapacitors and batteries.



Graphene batteries combine the advantages of both batteries and supercapacitors

<https://www.graphene-info.com/graphene-batteries>



Improvement Opportunities

-Reduction of overall weight to the housing components and blade guards will significantly reduce user fatigue during operation.

-Lighter weight large DC motor, towards the rear of the saw will affect weight and balance, giving the overall saw a more lightweight feel.

-Graphene Cell Batteries are lighter, smaller, and pack a larger charge which will greatly improve weight reduction during operation.

-Incorporating a lower Amp/hr battery with a 'between use' rechargeable station (the case) will reduce weight and overall Okala impact factors.

-Solid State Graphene Cell battery production reduces the amounts of carbons which in turn creates a more eco friendly battery.

-With the future of Graphene in general, high energy, high capacity, and high output are all possible, creating a very powerful and portable form of energy.



MODULE 3:

Part 2 - Comparison/Improvement



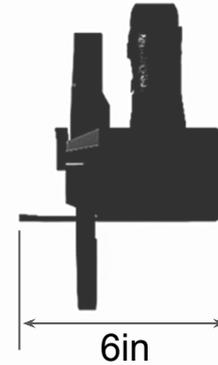
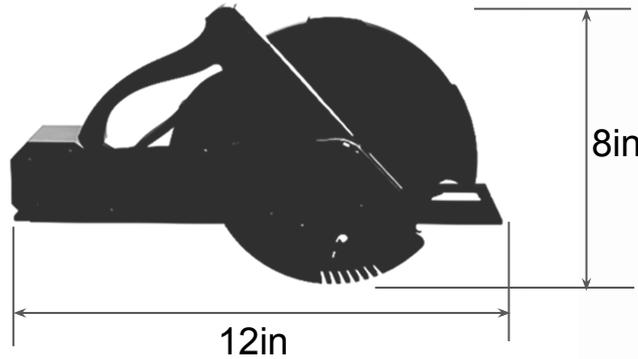


MODULE 3:

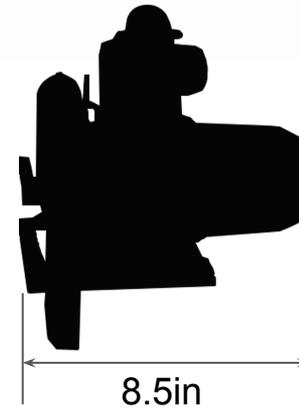
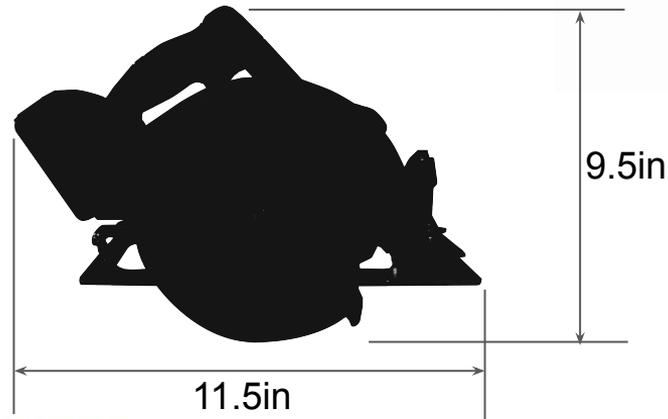
Part 2 - Comparison/Improvement

Profile Comparison

2½ inches thinner



1½ inches top to bottom less

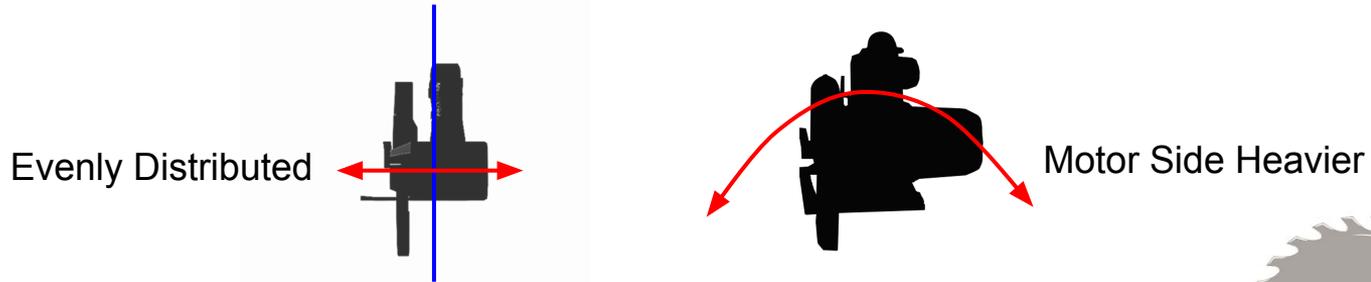


ONLY ½ inch longer



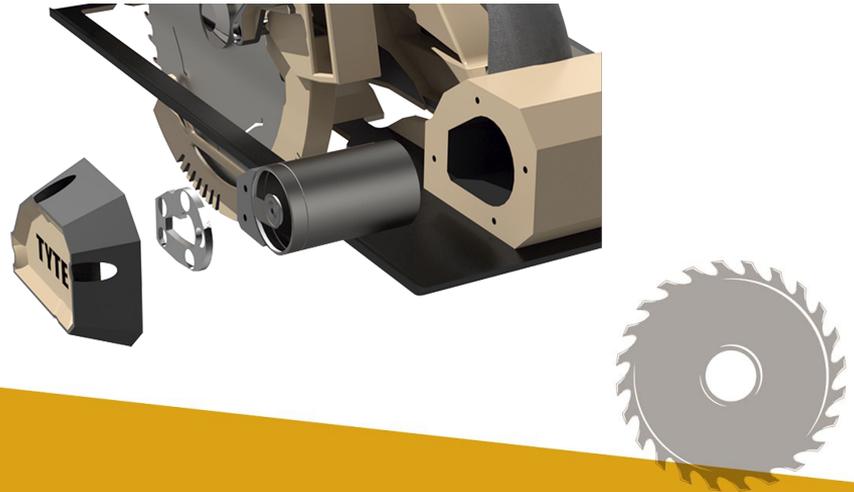
Profile Comparison Improvement

- I was able to reduce the width of the saw by **2 inches** without much adjustment to the overall length of the saw.
- Reducing the width also helped in **balancing left to right** as the rear motor and blade are **positioned in a linear fashion** from front to rear.



Material Improvement

- Replaced steel and magnesium parts with kevlar reinforced polymers for lighter weight without sacrificing durability and safety.
- Large AC brush motor was replaced with a high powered brushless DC motor with equal power.



MODULE 3:

Part 3 - Final Direction





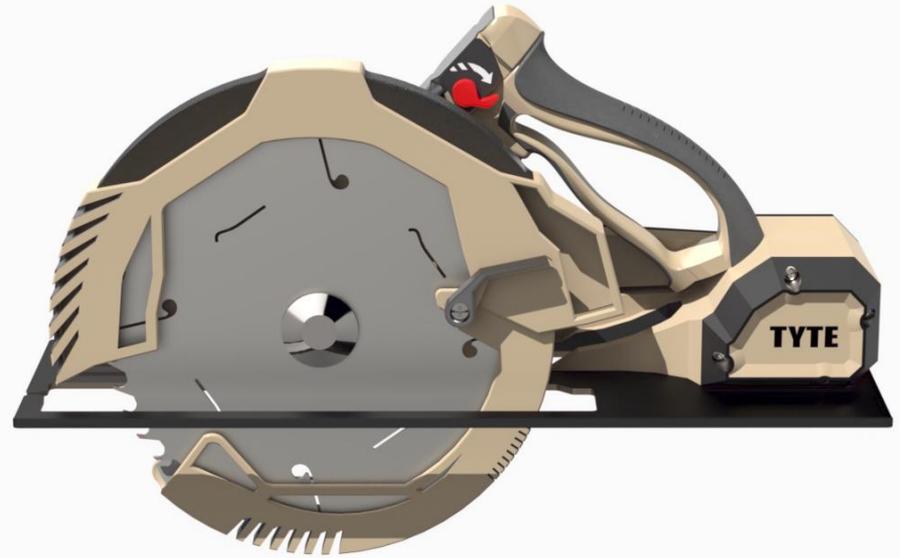
MODULE 3:

Part 3 - Final Direction

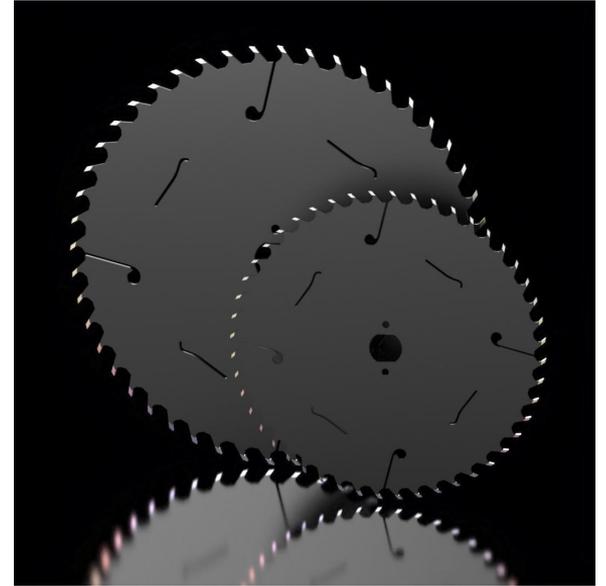
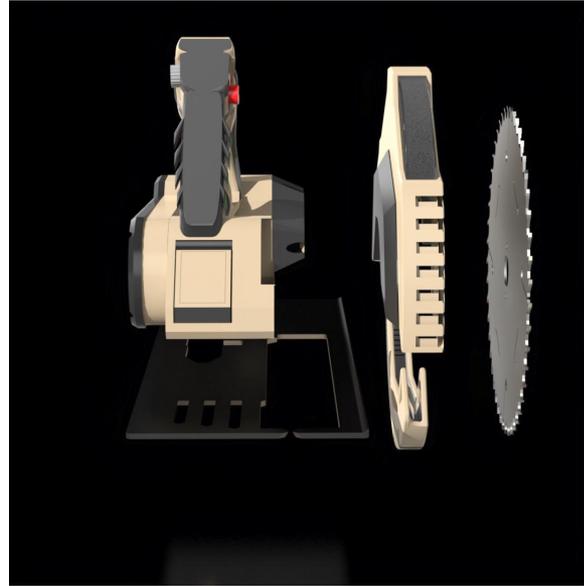
TYTE Tool Circular Saw in Use



Final Models/Renders



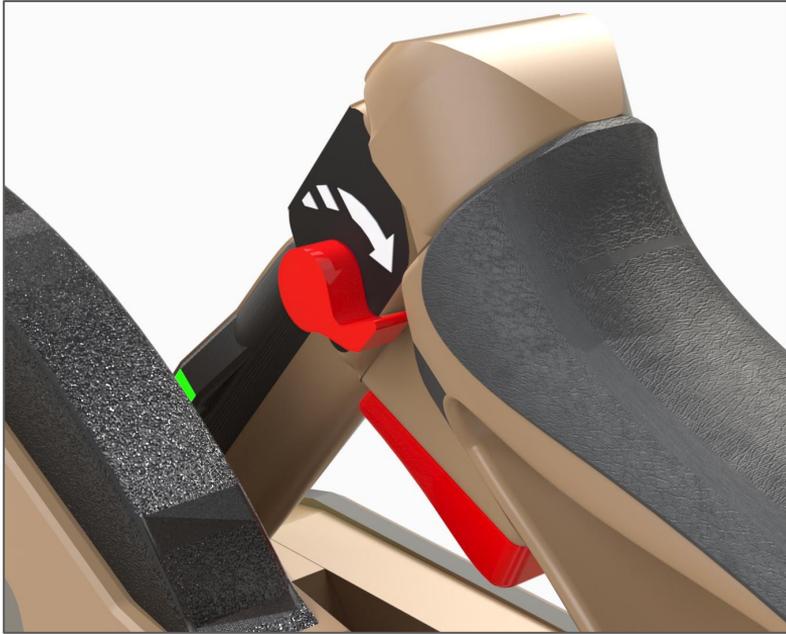
Final Models/Renderers



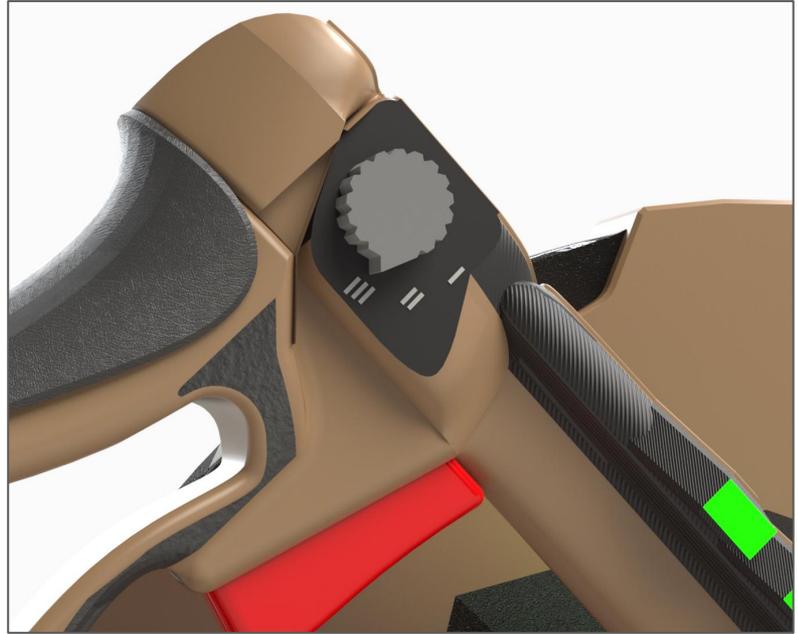
Customizable options: Blade size, Guard size, and Base plate



Final Models/Renders



Safety Lever



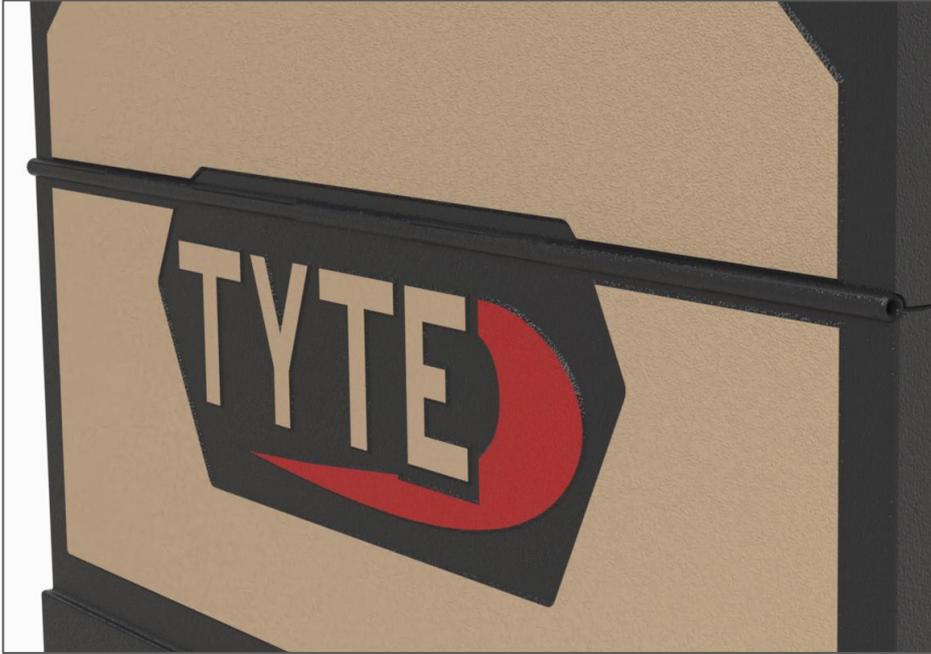
Speed Adjustment



Final Models/Renders



Final Models/Renderings



Rotational molded textured case with added paints



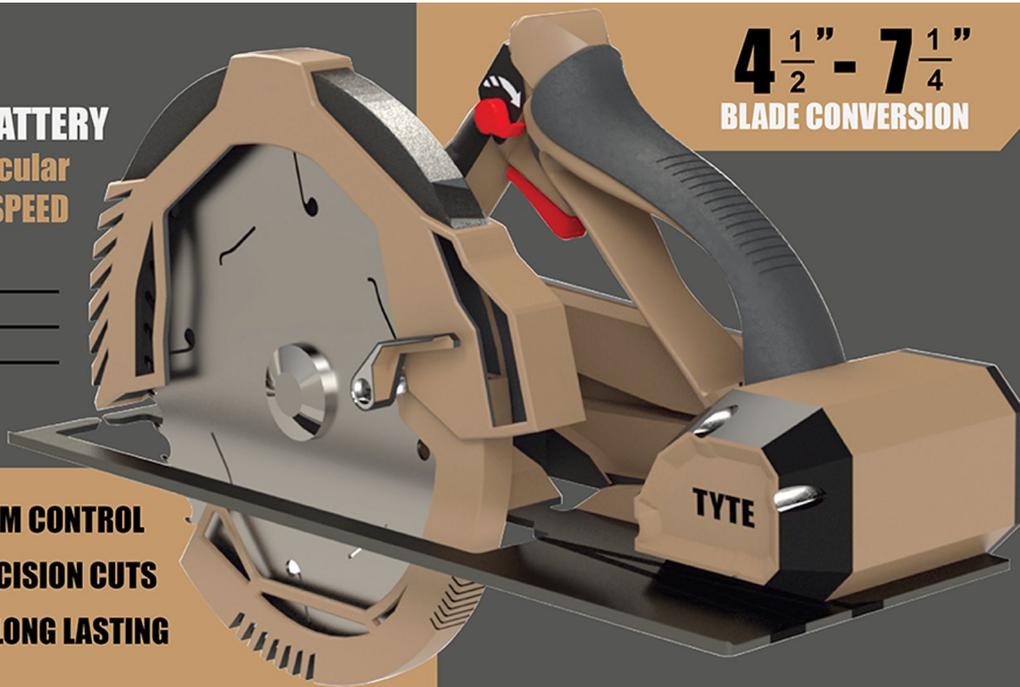
Final Models/Renderers

TYTE

65v
GRAPHENE CELL BATTERY
20AMP Cordless Circular
Saw with VARIABLE SPEED

What you want
When you want
Where you want

4 $\frac{1}{2}$ " - 7 $\frac{1}{4}$ "
BLADE CONVERSION



MAXIMUM CONTROL
PRECISION CUTS
LONG LASTING



Final Models/Renders

