

"At face value, the knife is a simple tool - a sharpedged blade attached to a handle- that dates back millions of years. Yet, it looms large not only in human history but in literature and legend as a utilitarian device and weapon... But as conceived and created by metalsmiths, this ancient instrument becomes an astounding work of art"

- 500 Knives - Lark Books

By listening to many great thinkers, I have learned the best way to learn something is to jump right in.

This document is a combination of learning by looking at as many facts as possible while training the body and hands to do the work. While making this, I created around 50 knives, which 10 were folders. I learned alot, failed alot, but most important if you are reading this I am still fighting, grinding, and repeating every day.

- Ted

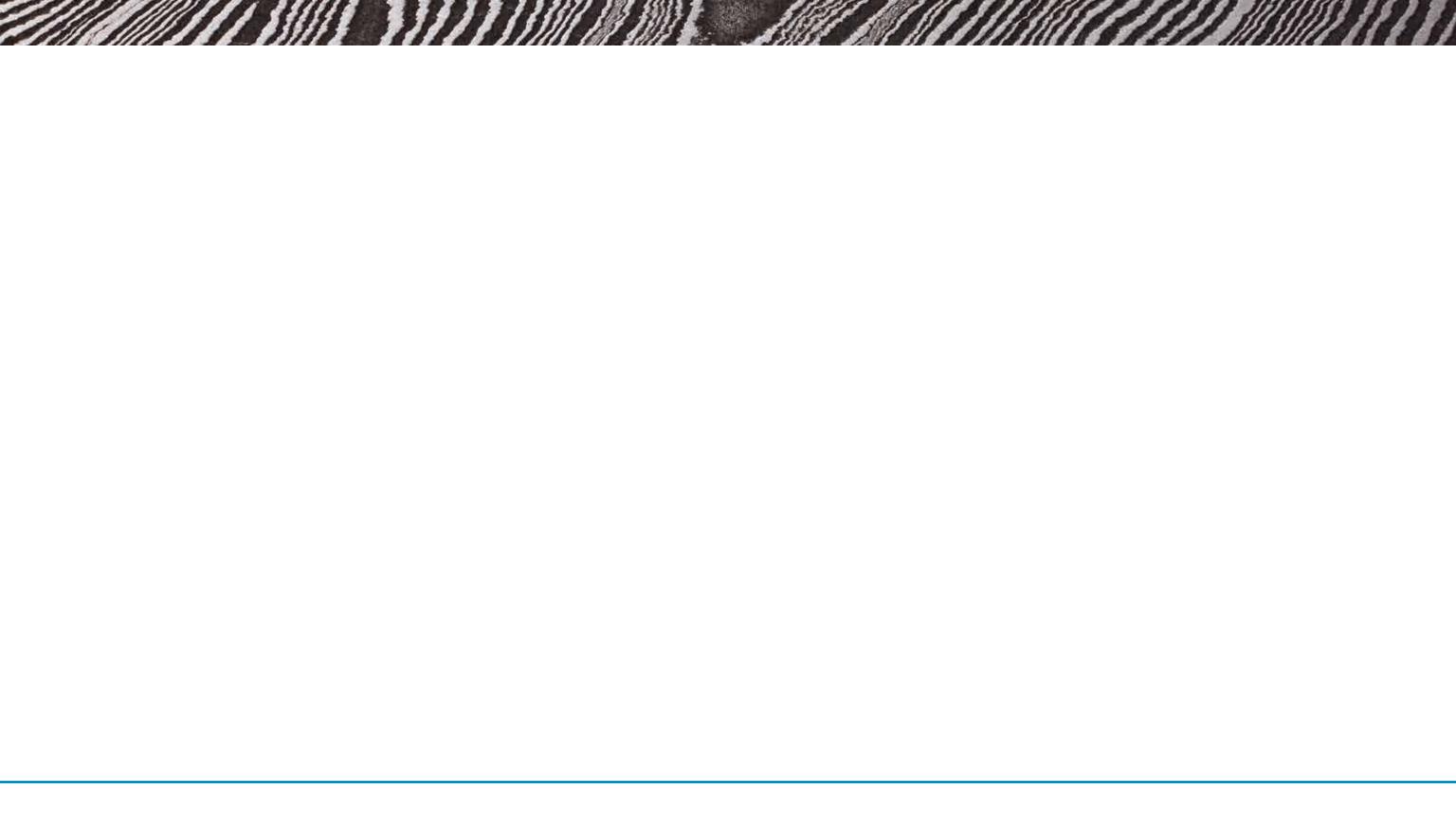
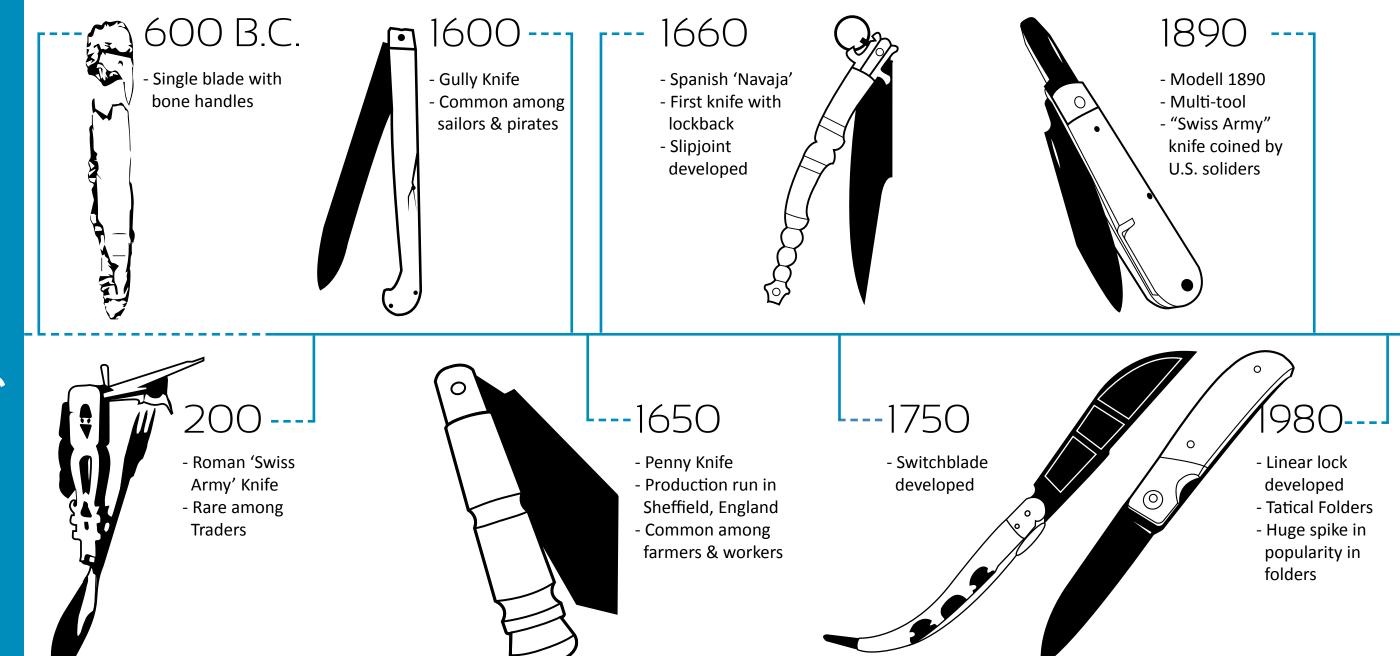


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History of the Pocket Knife



Overview of Knives





Art Knives





Culinary



Production Market

- High volume production
- Cost Range:
 - Low cost from outside countries
 - Higher cost from specific brands
- Patented locks and style markers
- Custom maker production replications



Spyderco

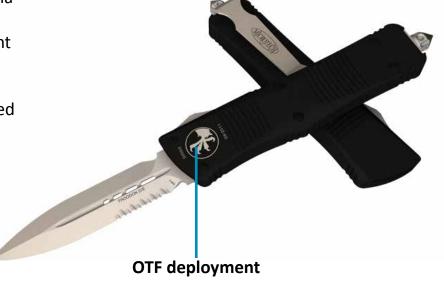
- Golden, Colorado
- Known for 'abnormal' style
- Spends alot on research
- Over 86 Patents and trademarks
- First company to use a clothing clip in 1981
- Round hole makes for easy one hand opening





Microtech

- Bradford, Pennsylavania
- Established in 1994
- Known for out the front (OTF) knives
- Produces fixed blades,
 OTFs, Butterfly, Assisted
 opening knives
- Also produces one-off customs





Custom Market

- Makers range in original fields before knives
- Styles differ largely between makers
- Higher prices
- Sold on secondary market for even more
- Higher tolerance and hand fit
- Each piece is unique/individualized
- Series continuely evolving in some form







Tuff Knives (B)

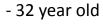


- 28 year old
- Penndel, Pennsylavania
- Current Models: Tanics \$800+ War Toad \$300+
- Sold War Toad to Boker







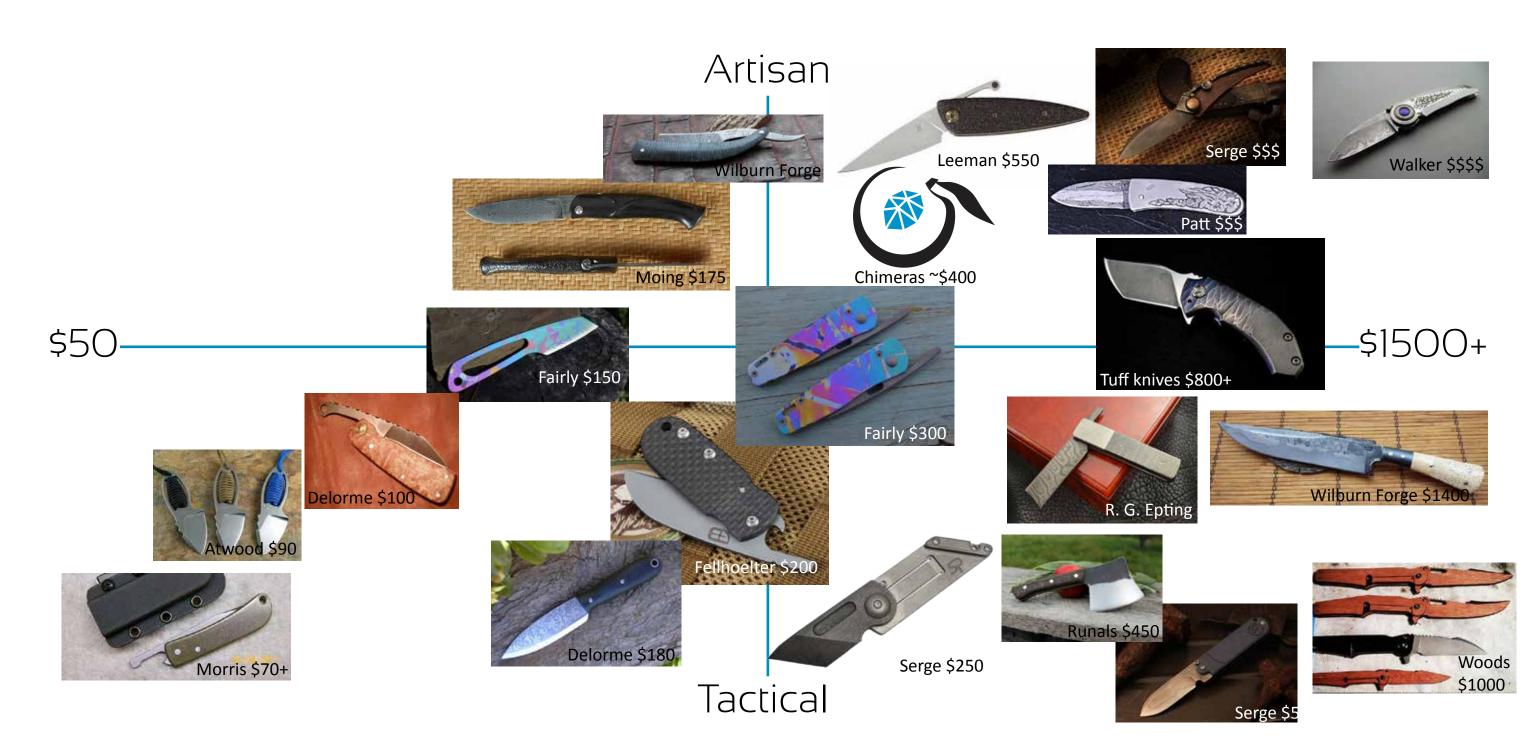


- Originally from Ukraine
- Current Models: Bean Folders \$550+ Coin Claws \$250
- Sold Dog Tag to Spyderco



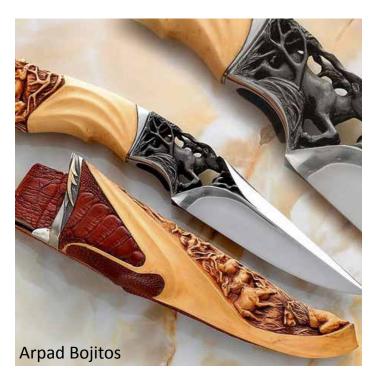






Art Knife Market

- Full custom knives
- Cost easily moves up to \$10,000
- Decoration goes well beyond normal
- Use of exotic/rare materials
 - Mosaic Damascus
 - Precious metals (Gold)
 - Precious stones (diamond)
- Incorporates jewelry-like skills
 - Engraving
 - Setting pieces/stones



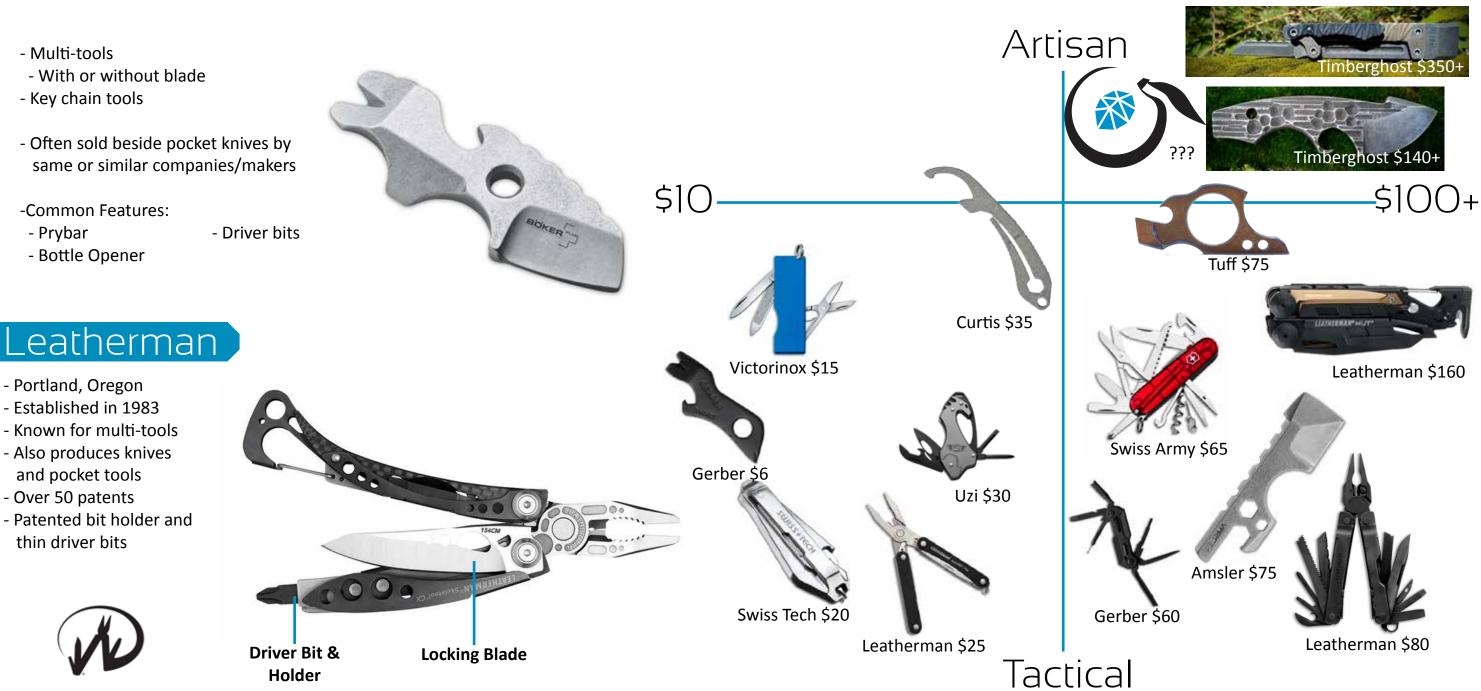








Multi-tool Market



Europe

Anti-locking Countries



Denmark

- All locking and fixed knives illegal
- Single-handed opening illegal
- Non-locking knives legal under 3"
- Knife will be confiscate if illegal



France

- Non-locking knives legal with no limit
- "Category 6"
- Any weapon that can constitute a danger to public
- Low knife crime rate



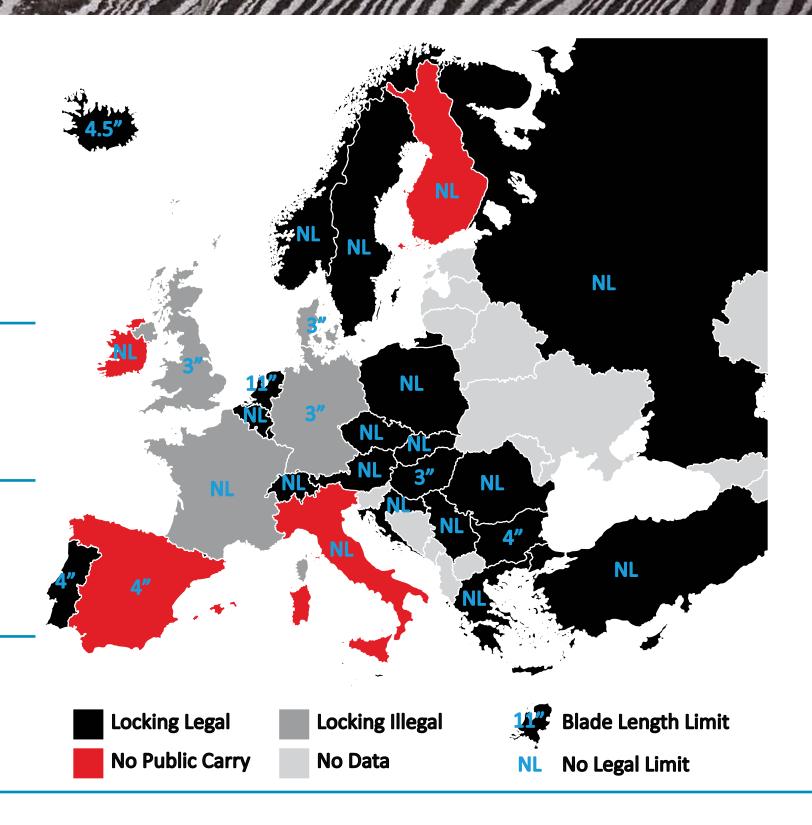
Germany

- Non-locking knives legal under 3"
- Single-handed opening illegal
- Exception for hunting or profession related knives



U.K.

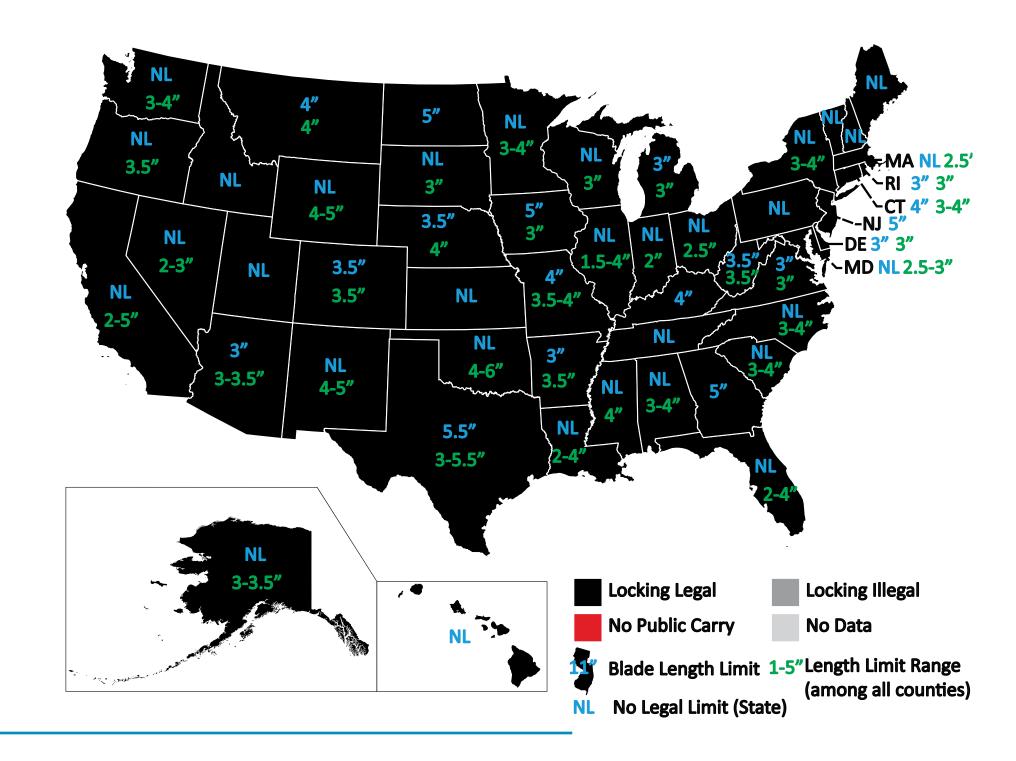
- Non-locking knives legal under 3"
- Must have justified reason for carry
- Swiss Army knives very popular
- Higher knife crime than USA

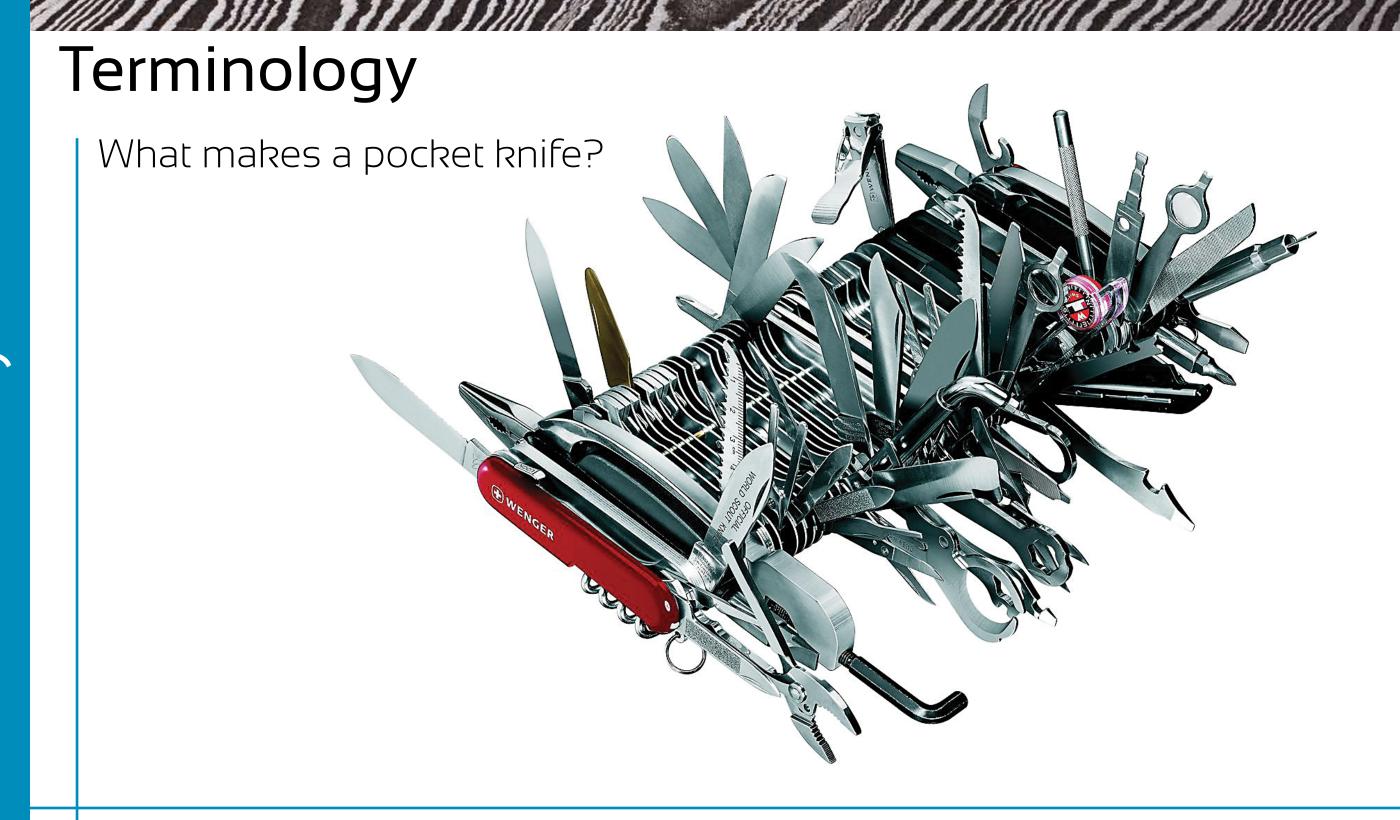


U.S.A.

Federal Laws

- Switchblade and ballistic knives are illegal to carry
- Any knife with <2.5" blade is not considered "dangerous"

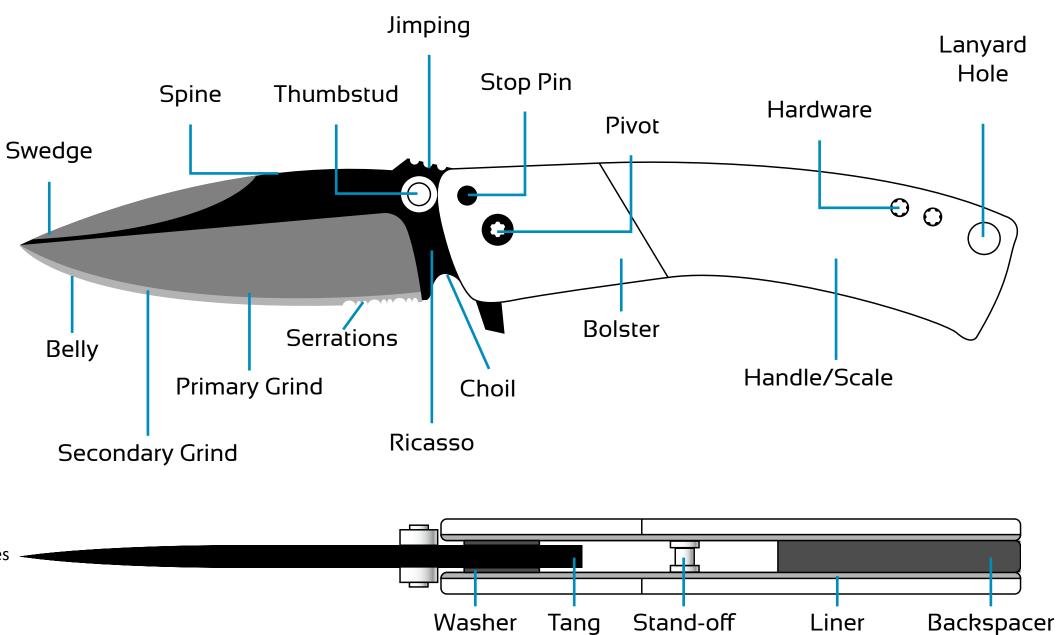




Parts of a Knife

- Parts differ depending on:

- Lock
- Blade Profile
- Grind
- Terms:
 - Belly
 - curved part of the blade, width affects point sharpness
 - Bolster
 - metal ends that support pivot
 - Choil
 - where blade meets handle, can be sculpted with finger groove
 - Jimping
 - notches designed into blade for better thumb control
 - Ricasso
 - flat section between guard and bevel/grind
 - Serration
 - set of "teeth" to aid in cutting
 - Spine
 - thickest part of blade, found in the middle on double edged blades
 - Swedge
 - bevel on back of blade, known as false edge and can be sharpened



Blade Profiles

Normal

- Flat back allows user to apply finger pressure
- Good at chopping, picking, and slicing

Spey

- Lacking a point
- Suitable for skinning
- Not meant for piercing

Tanto

- Kamasu Kissaki (Japanese)
- Point aligned with spine
- Strong, thick tip
- Good for piercing

Warncliffe)

- Straight edge
- Dull back curves down
- Usually very thick and heavy

Clip-point

- Ground sides start low on blade
- No secondary bevel/edge
- Thin but sharp edge

Trailing-point

- Large cutting area/belly
- Allows for larger edge
- Optimized for slicing or slashing

Drop-Point

- Convex back towards point
- Stronger tip than Clip-point

Sheepsfoot

- Back curves down near tip
- Prevents accidental cuts from tip during carry

Blades Grinds

Hollow

- Concaved ground sides
- Thin edge = Sharp
- Low durability

Flat

- Straight ground sides
- Easy to sharpen
- Moderate durability
- Can have second bevel edge

Convex

- Sides tape but slight curved outwardly
- Very strong edge

Chisel

- Only one side is ground
- Sharpest edge
- Japanese put a small hollow on back to reduce drag



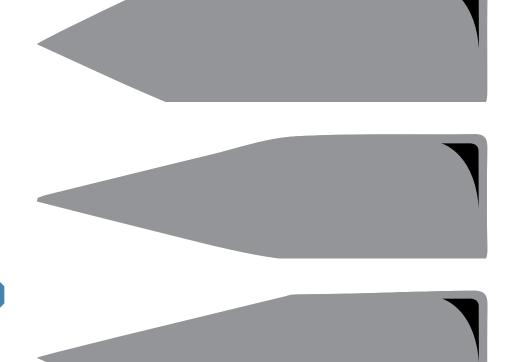
- Ground sides start low on blade
- No secondary bevel/edge
- Thin but sharp edge

Saber

- Ground sides begin half way down blade
- Good for tougher jobs
- Best with second edge

Assymetric

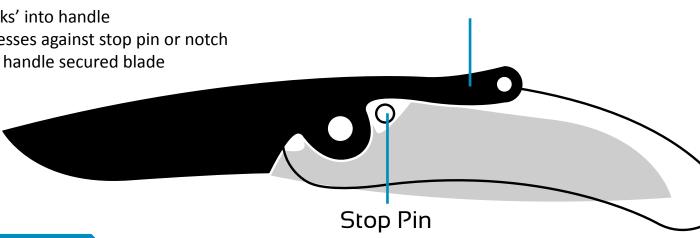
- Combines grinds on each side individually depending on use
 - assymetric flat
 - semi-convex
 - chisel with back bevel
- Adds durability
- Weakens sharpness



Stepped Tang

Friction Folder

- Tang 'locks' into handle
- Blade presses against stop pin or notch
- Gripping handle secured blade



Slip Joint

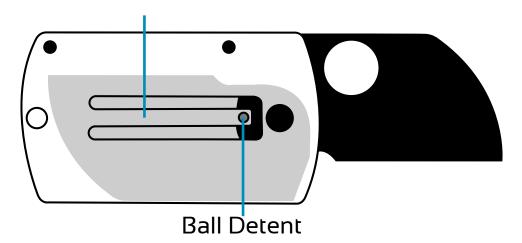
- Spring presses on back of blade except when open or closed
- Helps hold blade open but not locked
- May have detent for extra firmness when closed or opened



Long Tang

Notch for tang

Integral Spring



Locking Styles

Collar Lock

- Ring around bolster turns to lock blade when open and closed
- Found on Opinel knives

Lock Back

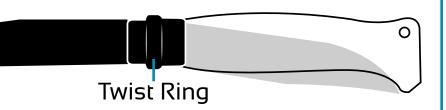
- Pivoted spine locks into blade when open
- Variations: Mid lock

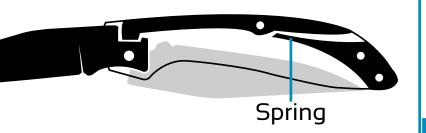
Liner Lock

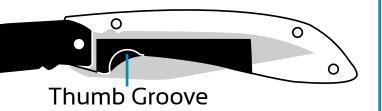
- Tensed part of liner locks against back of blade
- Variations: Compression

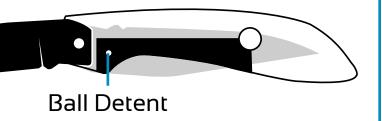
Frame Lock

- Tensed part of scale locks against back of blade
- Heavier than liner lock









Button Lock

- Push button locks into notch in blade
- Similar to lever lock

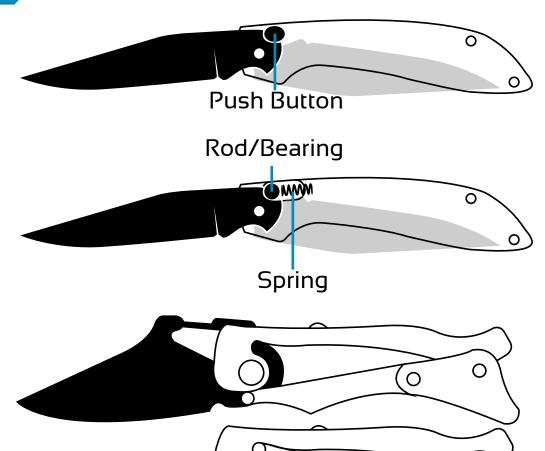
Bolt Lock

- Rod is pressed against notch in blade
- Many versions exist as company patents

Other...

- New versions are being created daily with some better than others
- Makers such as Hawk Knives focus on locking systems

Hawk 'ET'



External Toggle

Choosing Materials

How to Choose

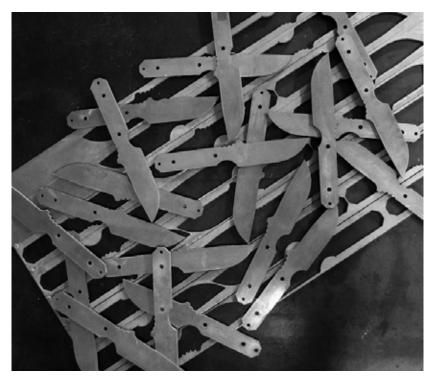
- Performance is affected by many factors including but not limited to:
 - Geometry of blade
 - Type of Grind
 - Hardware
 - Material Choose
 - Intended Use
- Thus choosing the right material depends on many factors such as skill level and tools available to maker since new tools are required for different material sometimes





Blade

- Choice of Carbon or Stainless
- Performance of edge relies on:
 - Type of steel
 - Blade geometry
 - Heat treatement
- Material choice depends on:
 - Performance
 - Environment
 - Durability
- Intended Use and skill level often decides material



Handle

- Often decorated or textured
- Wide range of material combinations
- Material choice depends on:
 - Aesthetics
 - Environment
 - Durability
 - Lock style



Metallurgy

Terminology

- Metallurgy
- Branch of science focus on metal properties, production, and purification
- Alloy
- Metal made by combining metallic elements
- Choose of alloy is a balance between:
 - Corrosion Resistance
 - Ability to stand up to environment conditions before rusting
 - Strength
 - Ability to withstand applied pressure
 - Toughness
 - Ability to absorb energy and plastically deform without fracturing
 - Tougher = worse at edge retention
 - Wear Resistance
 - Resistance to abrasion during use
- Particle Metallurgy (PM)
- Steel is formed into powder
- Powder is then bonded and compacted
- Results in uniform composition of alloy

Ingredients

- Strength vs Toughness
- Alloy Ingredients
 - Increasing Strength













- Increasing Toughness







- Others









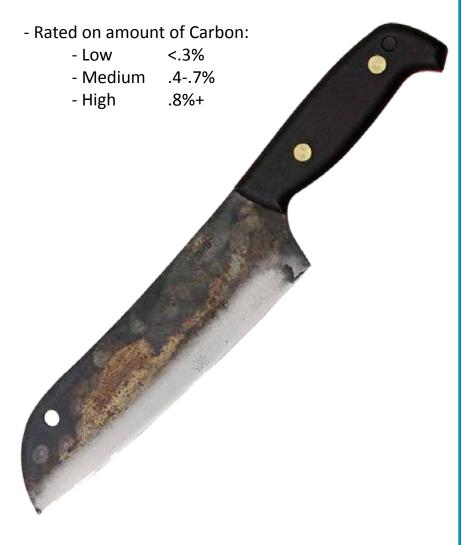




Blade Steel Types

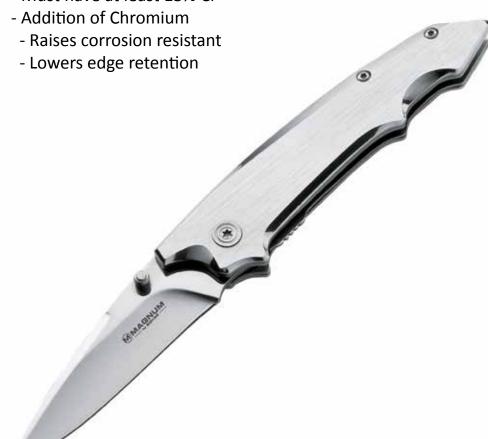
Carbon

- Quickest to rust
- Require maintance by oiling



Stainless

- Will still rust if left unattended
- Stain resistant
- Must have at least 13% Cr



Damascus

- Made by folding alloys into single billet
- Can be either carbon or stainless
- Alloys create the pattern within
- Complexity depends on amount of alloys and skill of blacksmith during forging
- Still hand forged resulting in highest cost among steels
- Includes Mosaic Damascus patterning



Handle Materials

Metal

- Common among custom and higher end production pieces
- Provides a solid response to user's grip
- Locking mechanism options differ by metal
 - Zirconium
 - Titanium



Synthetic

- Man-made resin/plastic parts
- Often seen as having plastic/soft feel to user
- Composites
- Use of resin to bond to fibers or structure
- Issue with voids/air pockets
- Requires shaping/texturing
- Plastics
- Can be used to mimic natural materials
- Fully molded plastic parts



Natural

- Very traditional style
- Range of prices due to large variety in materials
 - Bone/horns variety
 - Wood variety
- Further shaping and carving possible
- Raises price of piece



Metal Handles

Stainless)

- Pros: Durable, corrosion resistant
- Cons: Heavy, slippery
- Textures needed to help grip



Aluminum

- Pros: Light, color options
- Cons: Cold grip, slippery, cheap susceptible to scratches easily
- T6-6061 is most common



Titanium)

- Pros: Strong, light, colorful
- Cons: Relatively expensive
- Grade 5 common for knives
- Often seen as liner locks



Precious 2

- Usually only used as accents
- Can be used as plating



Damascus

- Mosaic Damascus
- Most often seen on art knives
- Wide range of patterns
- Not corrosion resistant if carbon

Zirconium

- Pros: color options
- Cons: Expensive, flamable
- Not springy enough for use as frame or liner locks

Timascus

- Similar to Damascus in process
- Alloys react differently to heat allowing for crazy color
- VERY expensive

Mokume

- Similar to Damascus in process
- Different types/mixes
- Used as accents/inlays usually
- Very expensive



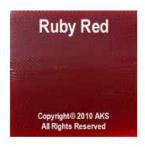




Synthetic Handles

- Pros: Tough, light-weight
- Cons: Brittle
- Laminated colored fiberglass
- Many options for coloring



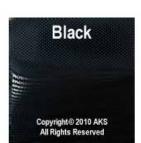






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Coyote Brown









Micarta

- Pros: Durable, light
- Cons: Brittle
- Laminated linen/cloth
- Lots of pattern/color options



Carbon Fiber

- Pros: Strong, light, eye-catching
- Cons: Expensive, brittle
- Laminated carbon
- Reflects light within pattern



C-tek

- Pros: Strong, color options
- Cons: Expensive
- Resin filled Aluminum honeycomb

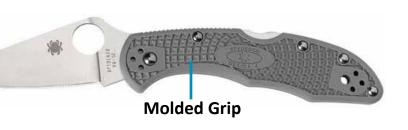


Acrylic

- Pros: Moldability, Cheap
- Cons: 'Plastic' feel, slippery
- One of many thermoplastics
- Can be dyed in wide range



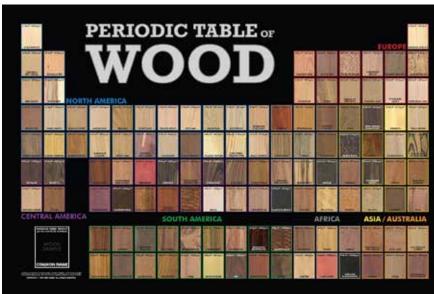
- Pros: Moldability, zero maintance
- Cons: 'Plastic' feel
- Needs grip molded in
- Practically industructable



Natural Handles

Wood

- Pros: Durable, comfortable
- Cons: Porous, Instable
- Wide variety of species
 - Unique colors and grains
 - Wide range of price
- Can be stablized with resin to create new patterns
- Dyable for range of colors



Dymondwood

- Lamination of wood veneers and resin
- Stable and colorful



Mother-of-Pearl

- Comes from mollusks
- Expensive
- Most seen on 'art' knives
- Albalone alternative

Bone/Horn

- Comes from wide range of animals such as elk and cow
- Dyable in range of colors



Stone

- Usually used as accents
- Must be set into handle
- Seen ground into resin for details

Leather

- Commonly only seen on hunting knives and such





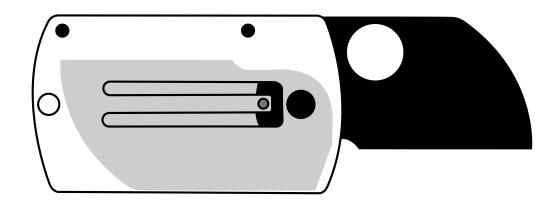
A Direction

10 weeks into my research and about 40 fix blades later. I was ready to design my first folder.

Non-Locking

The simplicity of a non-locking knife seemed a good choose as a first run into the world of knifemaking. There is a growing popularity for friction folders and slipjoints alike. This is caused by several reasons, mostly being carry laws restrecting size and locks in several areas.





Small Market

The market for custom EDC knives is still growing with the use of social medias and forums.



EDC-Proof

Since EDC stands for every day carry, the knife must be able to stand up to the abuse of the user as well as the elements from the environment.

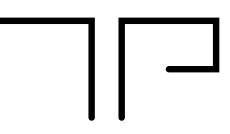
Thus tough materials must be choosen such as stainless and titanium.





Branding

Looking at the layout of the market, branding of oneself is the most important part as a knife designer and maker. This meant that all older logos and brands must be re-worked. The key being that the logo could be easily scaled and placed within the design.







Detail-Oriented

Often higher end custom knives would feature details such as file work or texturing to add value to the piece.
This would also add value to the design.
Also looking to jewelry, the addition of negative space would add an uncommon feature that would help separate the design from others in the market.





Rebranding Oneself

Peacher?

After looking over market I wanted to find a way to incorparate my last name into the brand as honor of tradition among fellow knifemakers.

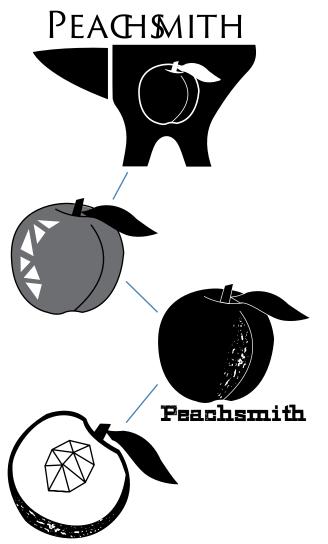
Peachsmith?

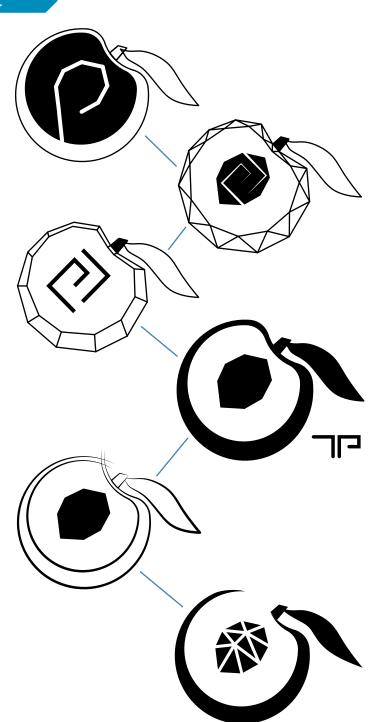
Peacher is often misread as peaches when people first learn my full name and while it use to both me I have come to embrace the fact after living in Georgia for a while. I add smith to my peach as I became a metalsmith in college.



Logo Development

Upon deciding on a name, I quickly began developing a simple logo that could be easily read in a range of scaled sizes and over several different mediums.



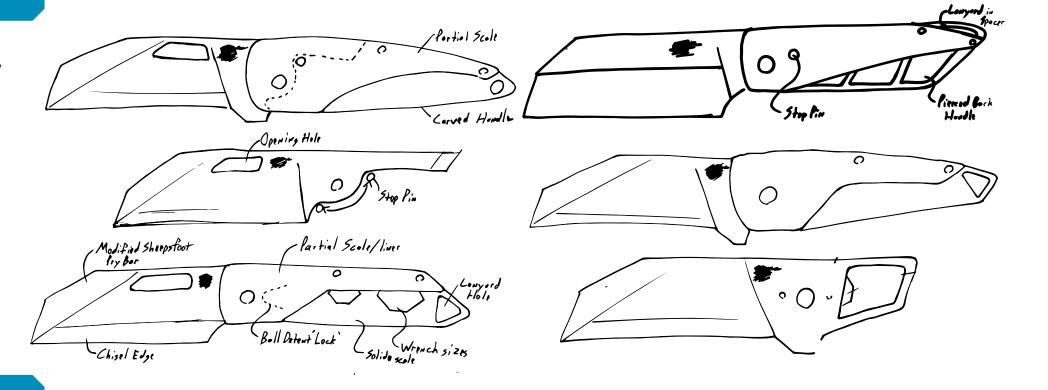




Steel Blue #4086AA Black #000000

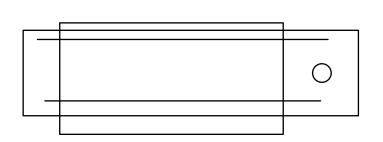
Round O

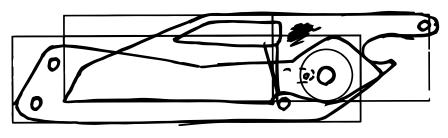
Having never sketched a knife before I worked mostly from memory to just play around but quickly moved toward using templates to help with basic hardware.

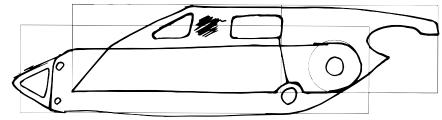


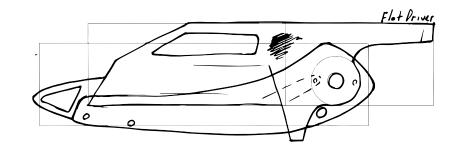
Round 1

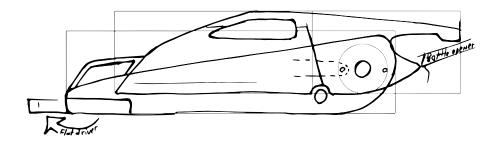
The first template was very simple with only reference lines for dimension.





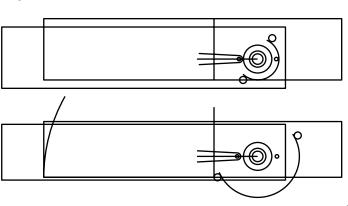


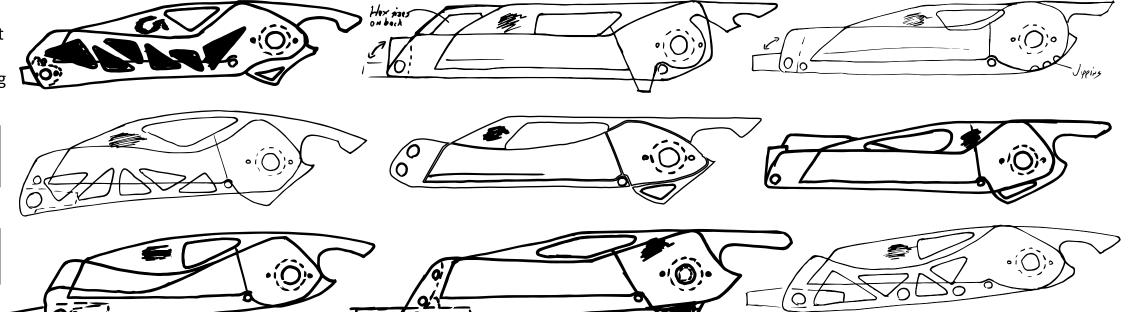




Round 2

Adding stop pin locations and changing reference lines allowed for quick development of form and also the addition of more function in the form of a secondary pivoting arm.

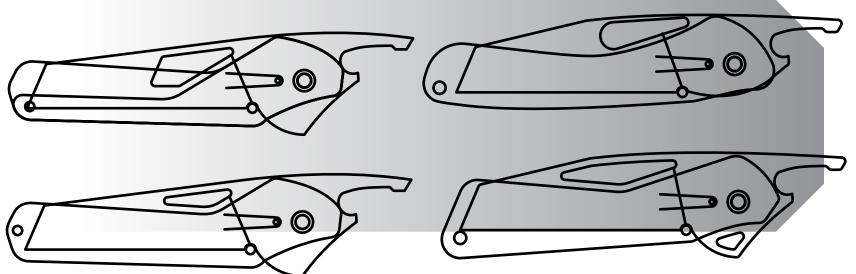




Mock-ups 1

Made from laser cut cardboard profiles, these rough moke ups were to better understand the human factors of possible forms.

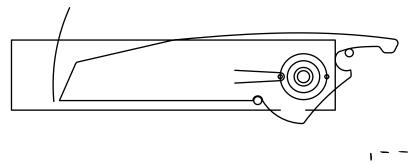


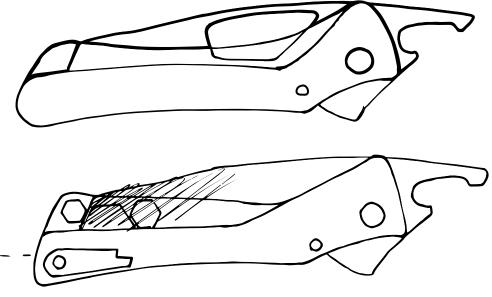


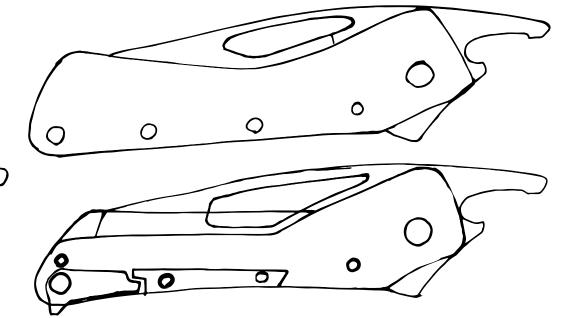
Sketches & Prototypes

Round 3

At this point I continued to develop for this time with the addition of more geometry.



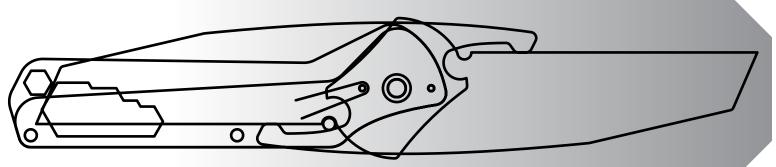




Mock-ups 2

Though thinner than the cardboard, the acrylic moke-up allows for testing of chosen stop pin and action of opening the knife.





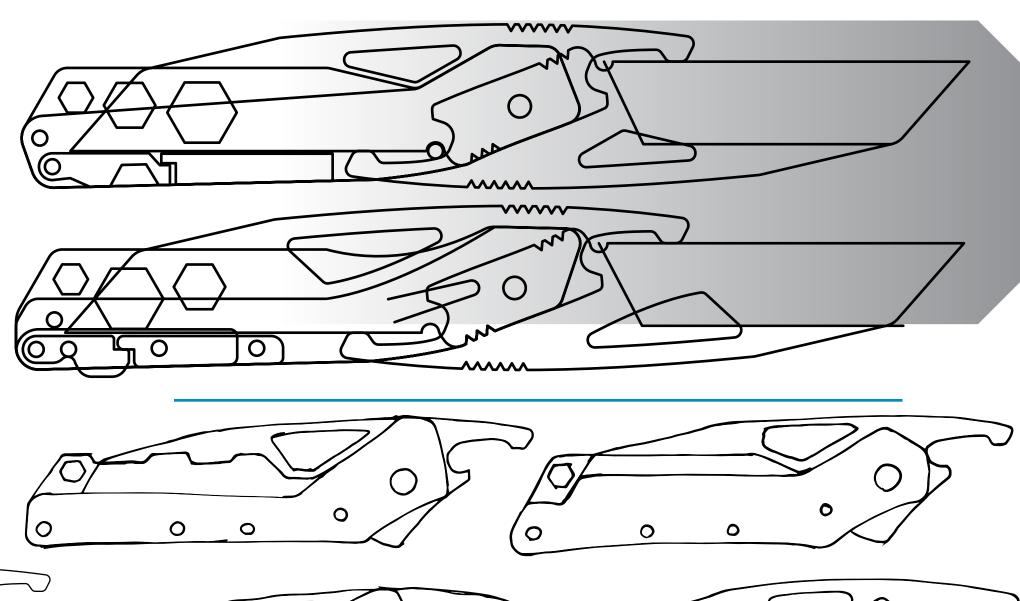
Mock-ups 3

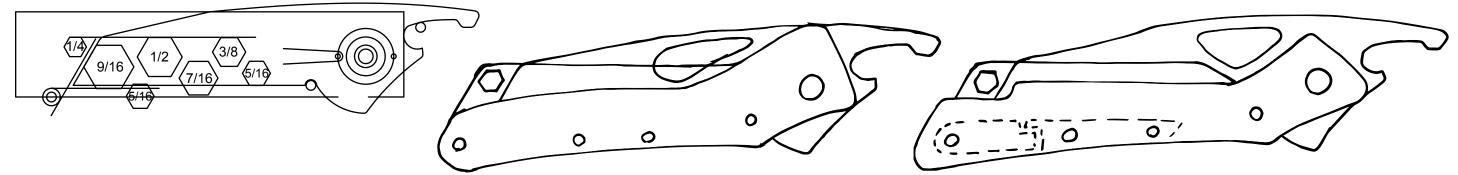
A few more changes done to the form to see interaction of all functional parts.



Round 4

The final round of sketches were to finalize the form of the scales. The template held many essential geometry from the mockups above.



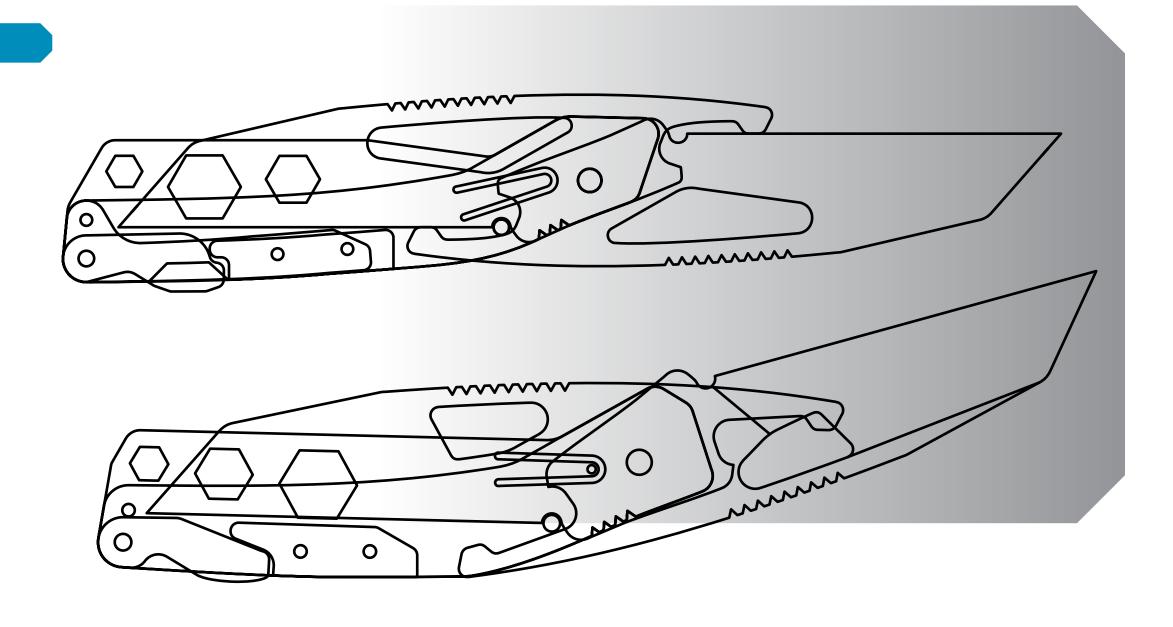


Mock-ups

Mock-ups 4

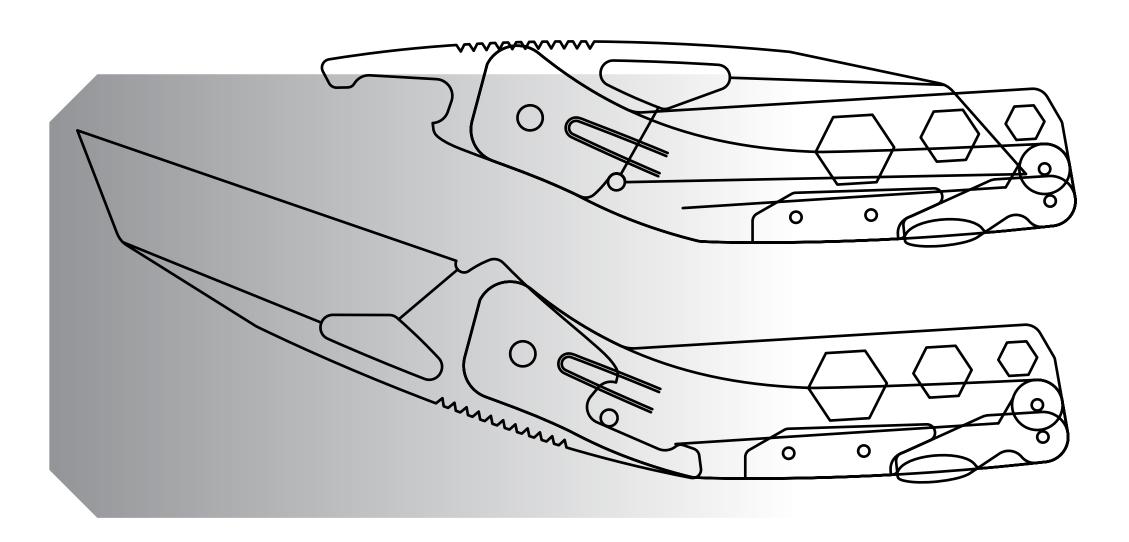
At this point all further development happened through cad and mock-ups. A simple change of pivot location was made changing the pivoting action 160 degrees instead of a full 180.





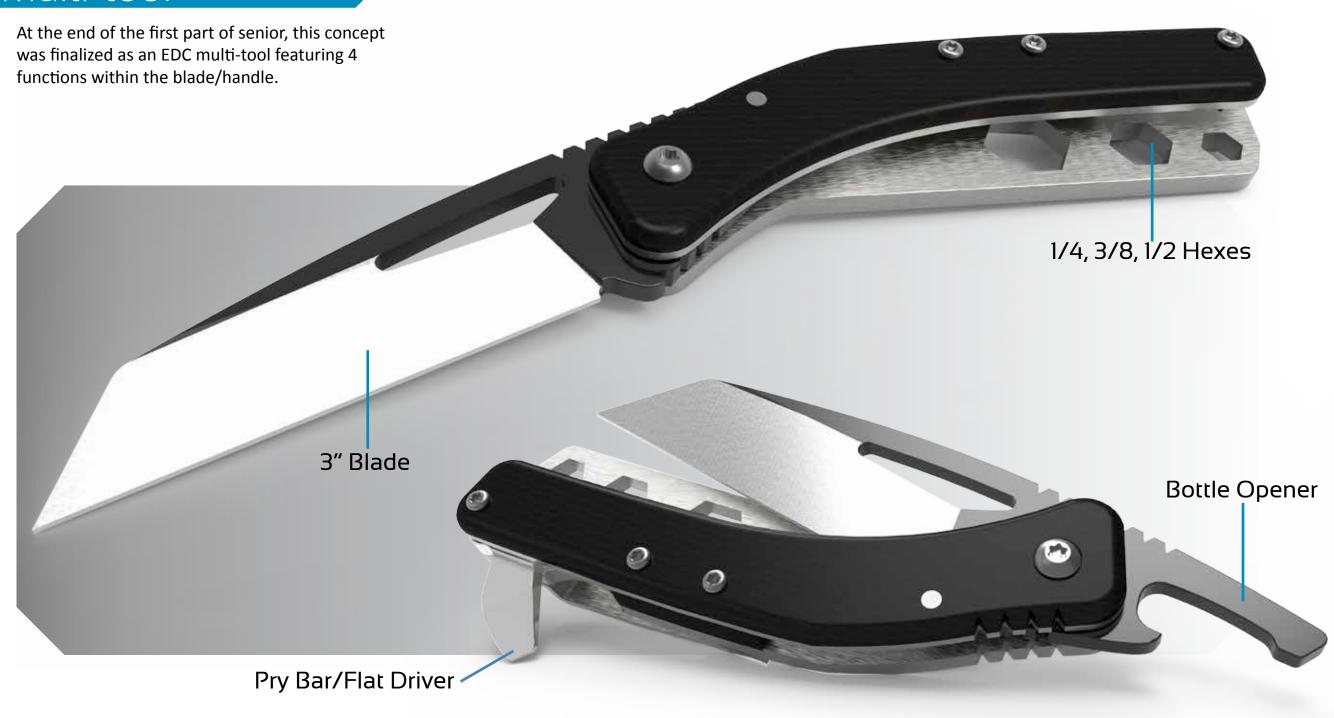
Mock-ups 5

Finding the new pivot location better in grip and overall fit, a few more adjustments were made to solidy the form within this mock-up.





Multi-tool



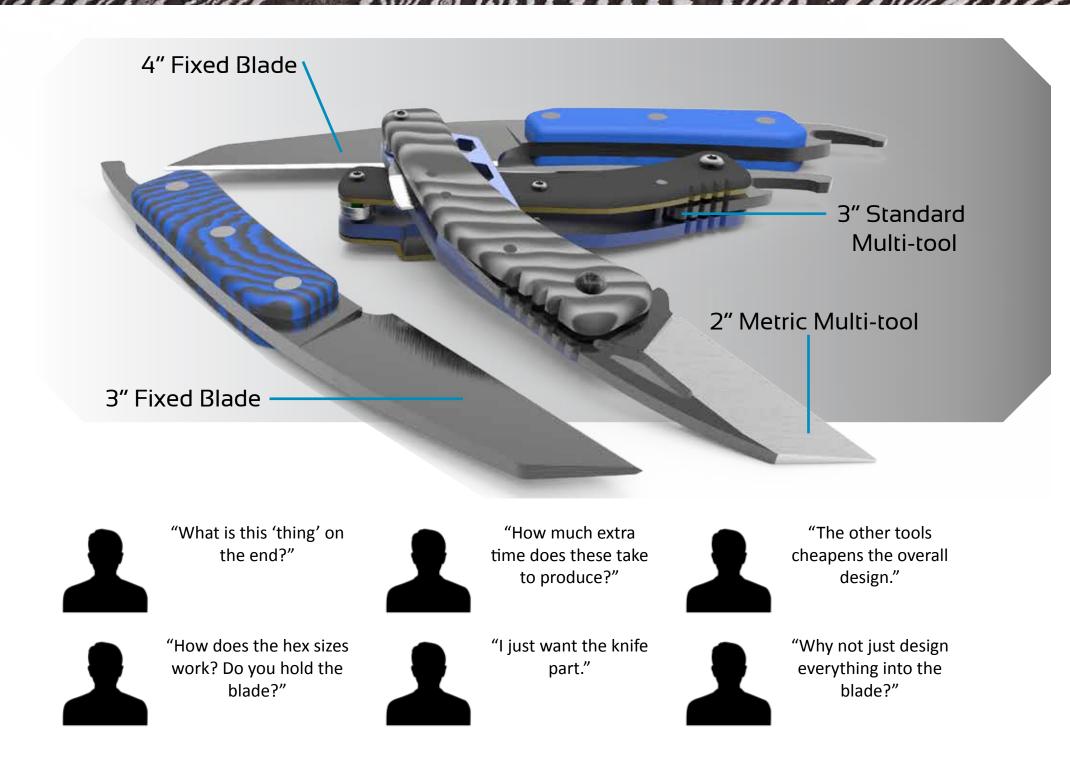
Initial Family

By adjusting the mutli-tool, a family was made to add other possible price points and markets to my concept.

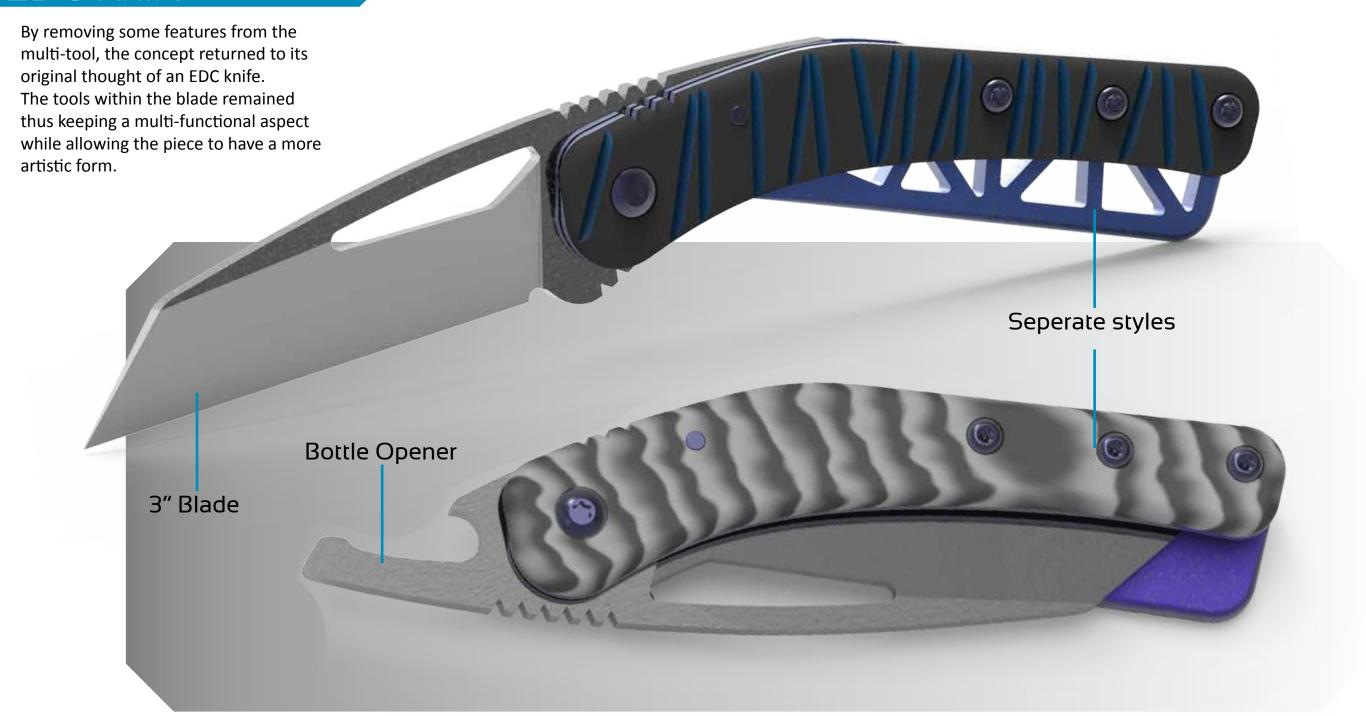


Insights

Upon further editing of the design and user interactions with the mock-ups over a week, it became clear that the multi-tool was hard for users to figure out and would also cause build time and final cost of each piece to go beyond a marketable price.

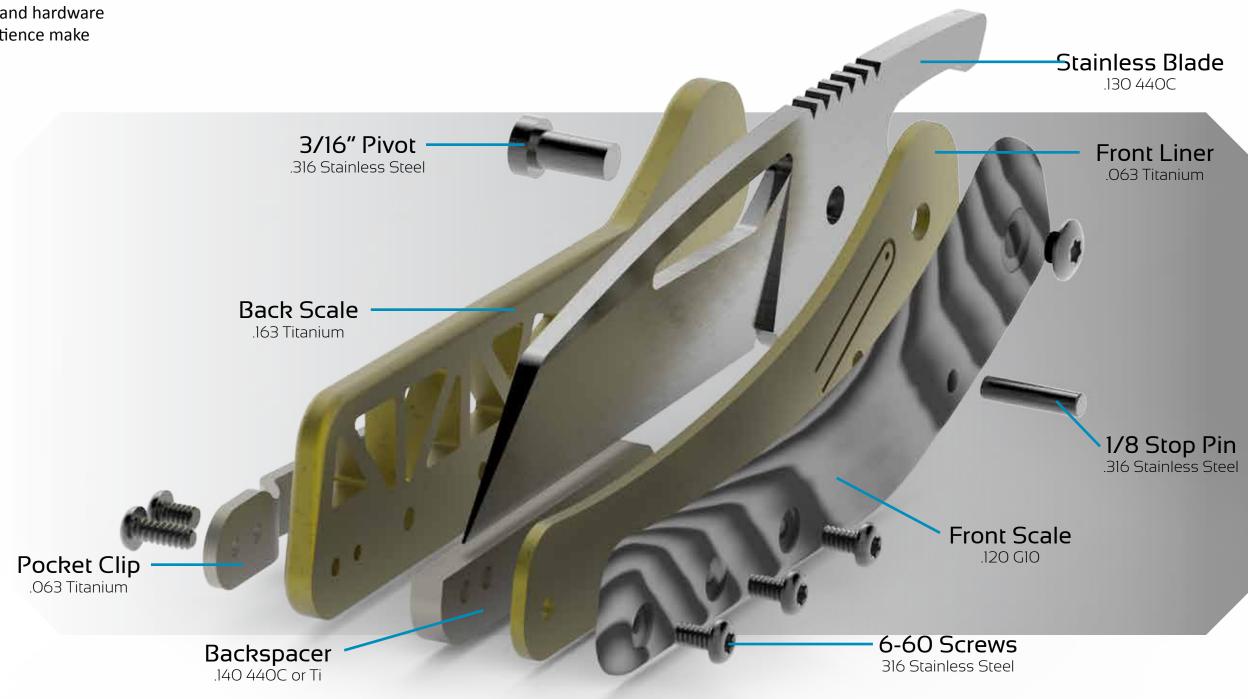


EDC Knife

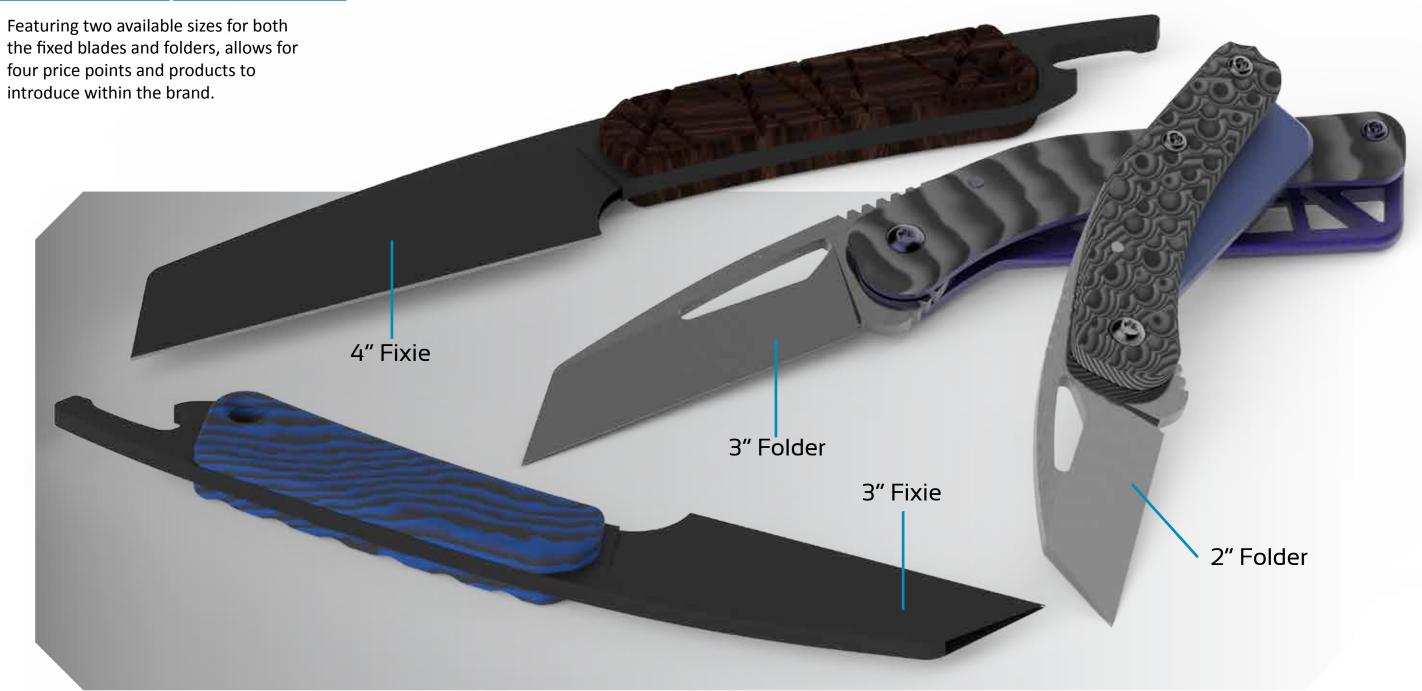


Break Down

High quality materials and hardware along with skill and patience make quality knives.



The Family



Family Mock-ups

One final group of mock-ups were made for further user interaction/ feedback while preparing for the first prototype production of the fix blades.

Small adjustments to both the folders and fix blades while gathering supplies and preparing for waterjet.

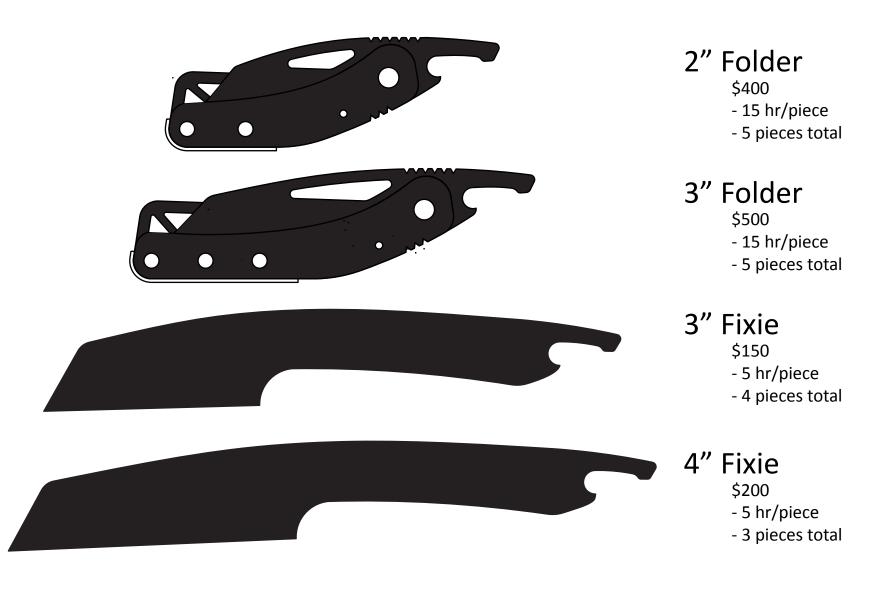






Cost Breakdown

Price Range:



Tools

McMaster - \$380 - Drill bits etc

Rio Grande - \$55 - Files

Otto Frei - \$90 - More Files Lakeshore - \$125 - Mill bits

Consumables

Pop's Sandpaper - \$240 - Belts

Home Depot - \$50 - Sandpaper Cerakote - \$70 - Coating

Material/Hardware

USA Knifemaker - \$200 - Fixie hardware Alpha Knife Supply - \$270 - Hardware/G10

New Jersey Steel - \$210 - Steel

AMX Metals - \$240 - Titanium

McMaster - \$80 - Screws

Ghost CF - \$20 - Carbonfiber

Services

Waterjet - \$300

Paul Bos - \$115 - Heat treat Etsy - \$70 - Felt cases

Branding

Moo Cards - \$40 - Business cards
Photo Props - \$95 - Notebooks
Webbly - \$180 - Website

Total: \$ 2,830

Estimated Total Sales: \$5,700

The Serpents





Production

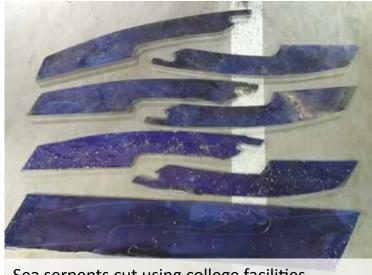
Metal Work



Laser cut templates used for scribing metal



Practice blanks cut first using bandsaw



Sea serpents cut using college facilities



Profiles ground cleaning up dimensions



Bottle openers ground with small wheel



Main bevels ground freehand using a Bubble Jig guide



Everything sanded to 120g



Heat-Treat





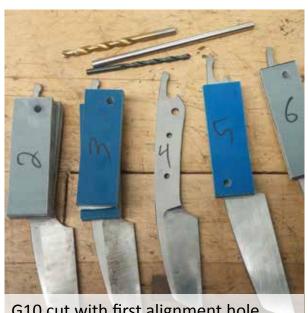


Tempered in oven in cycles

Heated to slightly over 1500° in forge

Dunk in vegatable oil to cool/harden blades

Handle Work



G10 cut with first alignment hole



Blades used as drilling guide



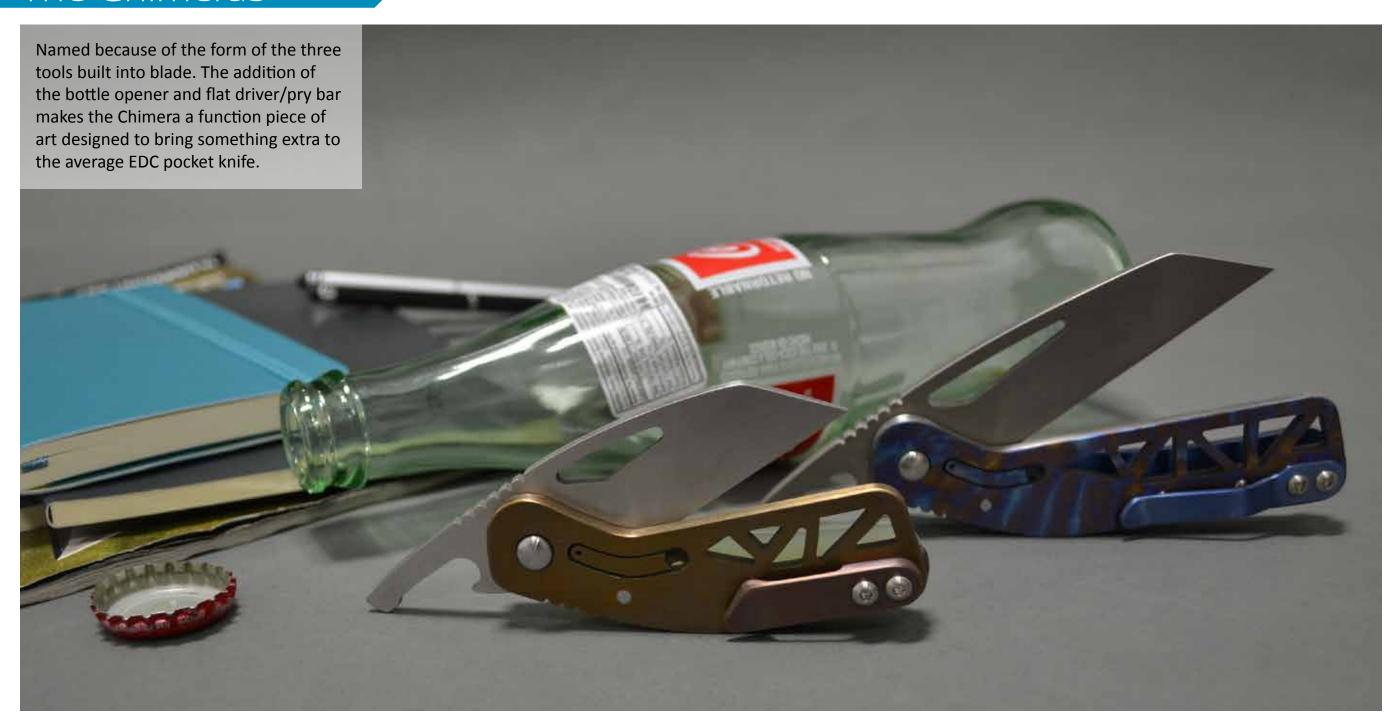
Handles shaped to blades

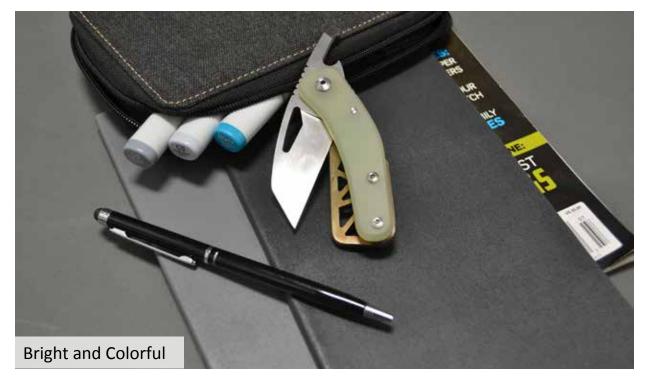


Small wheel attachment used for patterning



The Chimeras











Production

Waterjet









Grinding bevels





Triangle jipping filed clean and straight







Laser cut package for heat treat

Machining Scales



A .5 thick aluminum block machined square



Hole pattern machined and tapped

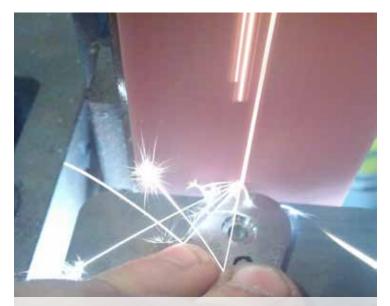


Highlighted dimensioned guides



Counterboring titanium spring with 3/16 bit

Finishing Scales



Extra machining tab ground off



File clean up of triangle patterns



Parts all sanded to 320 grit before anodizing



Heat anodizing with smith torch

"At face value, the knife is a simple tool ... Yet, it looms large not only in human history but in literature and legend... But as conceived and created by metalsmiths, this ancient instrument becomes an astounding work of art"

- 500 Knives - Lark Books

You actually made it to the end of this book? Thanks!

Today, I have moved shops many times and even moved from Georgia where I started this wild knife making journey to Portland, Oregon where I try to keep learning and practicing with the daily grind, literally.

Cheers, - Ted