Open Hardware Design for BusKill Cord

Presented at DEFCON32
Demo Lab by Melanie Allen
AKA @goldfishlaser

Who is BusKill?

Founder

Michael Altfield
<michaelaltfield.net>

Links

@BusKill@mastodon.social
https://docs.buskill.in

Contributors

Sam <youtube.com/@samxplogs>
Steven Johnson <linkedin.com/in/sj2019/>
Jacob Neplokh <jacobneplokh.com/>
François Marier <fmarier.org/>
Cyberkryption <github.com/cyberkryption>

Who am I?

Ex-BusKill Lead 3D-Printing Developer (Volunteer)

@goldfishlaser

Melanie Allen <mnallen.net>

Project Goal

- Create a design for BusKill that is suitable for decentralized, home lab manufacture using 3D printing and easily sourced parts to avoid interdiction for high risk individuals such as journalists, activists, and whistleblowers.

(TS//SI//NF) Left: Intercepted packages are opened carefully; Right: A "load station" implants a beacon

In 2013, TAO infected 85,000 computers/routers, and they were targeting to increase that to millions (Source)

Project Goal

140 Journalists and Media Workers killed between 2023 and 2024 / Motive Confirmed or Unconfirmed (Source)

Purpose

- Allow high risk individuals a method to quickly secure sensitive information when *separated from their laptops*

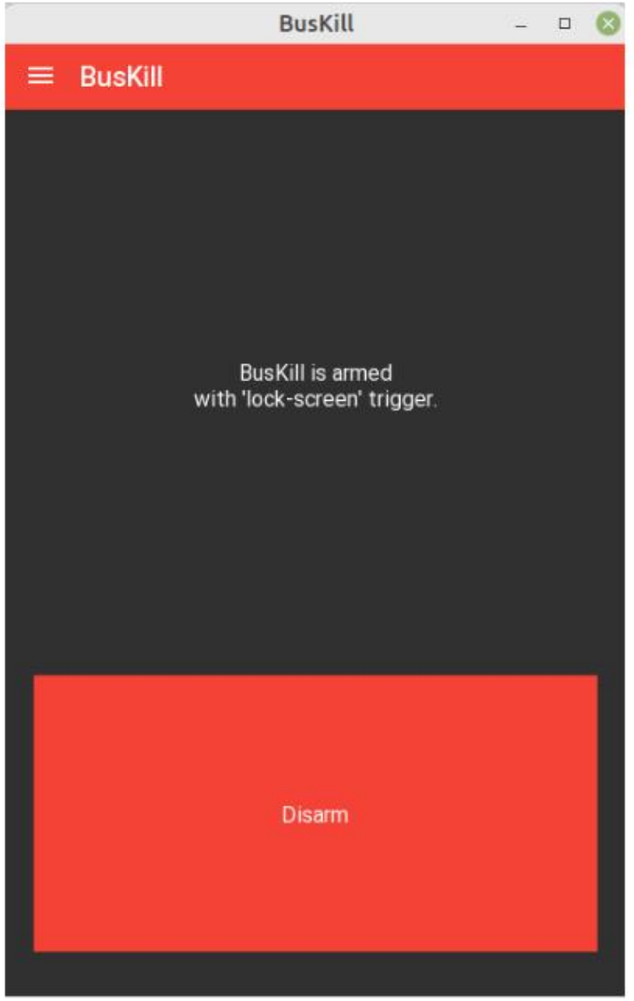
BusKill Software Capabilities

- Lock screen and soft shutdown works in Windows, Mac, and Linux
- Self destruct works in Linux only

Platform	Version	Remark
Windows	10	Supported
MacOS	10.15 (Catalina)	Supported
MacOS	12.6.5 (Monterey)	Supported
MacOS	13.4 (Ventura)	Supported
Linux	Ubuntu 20.04 LTS (Focal Fossa)	Supported
Linux	Ubuntu 18.04 LTS (Bionic)	Supported

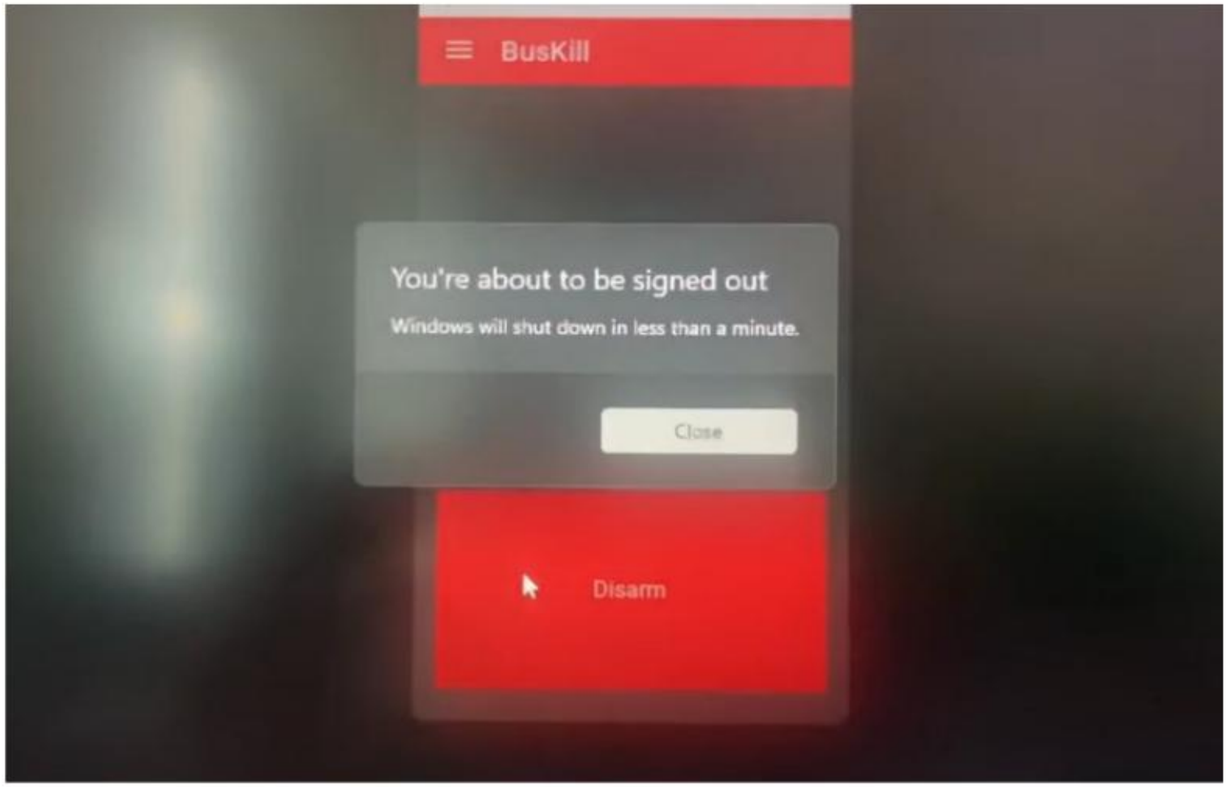
BusKill Software Capabilities

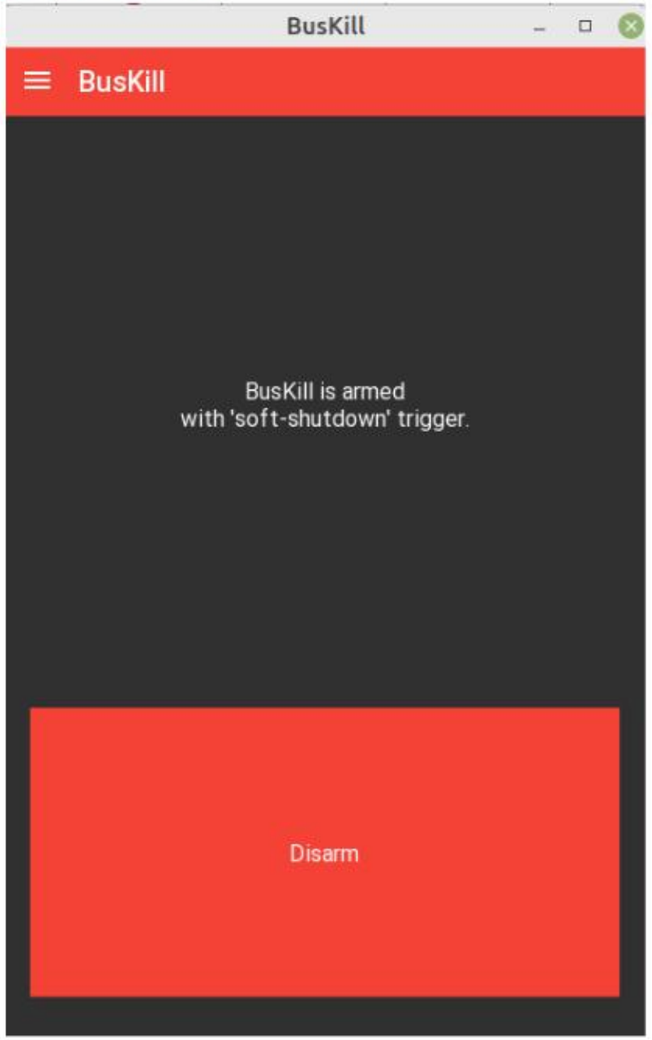
Lock the computer



BusKill Software Capabilities

Shut down the computer

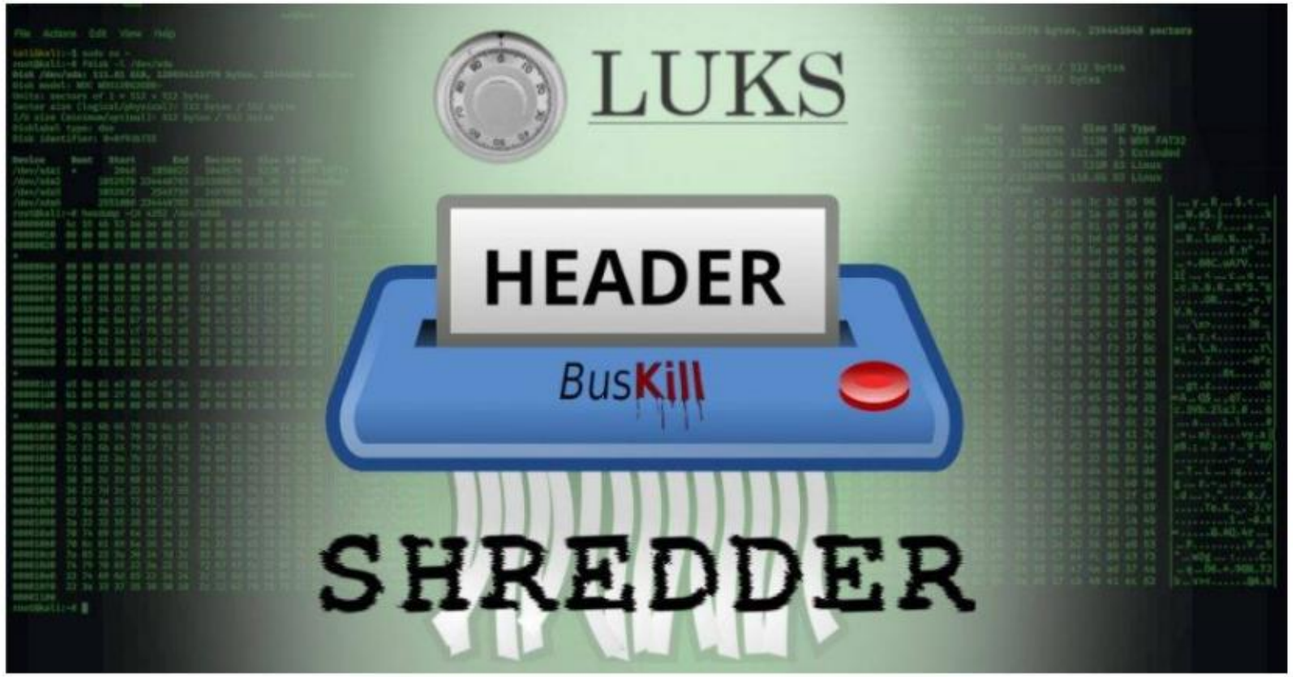




BusKill Software Capabilities

Shred your keys

```
root@kali:~# hexdump -Cn 4832 /dev/sda6
00000000  4c 55 4b 53 ba be 00 02  00 00 00 00 00 00 40 00  |LUKS..........@.|
00000010  00 00 00 00 00 00 00 03  00 00 00 00 00 00 00 00  |................|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000040  00 00 00 00 00 00 00 00  73 68 61 32 35 36 00 00  |........sha256..|
00000050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000060  00 00 00 00 00 00 00 00  5e 4d 69 a0 3c 96 b1 9c  |........^Mi.<...|
00000070  f7 84 2f 71 82 bb af 05  2f 4a 4c fe 60 f5 74 16  |../q..../JL.`.t.|
00000080  ea 52 a8 8b 34 7a 0f b4  a9 36 82 2a c1 4f 3f 89  |.R..4z...6.*.O?.|
00000090  c7 4e e4 5d 4a d1 39 b3  c7 e1 c5 20 4d bf c3 a8  |.N.]J.9.... M...|
000000a0  53 01 38 33 a4 f0 2e ae  31 31 37 35 39 64 62 61  |S.83....11759dba|
000000b0  2d 61 33 36 32 2d 34 30  38 37 2d 39 31 34 66 2d  |-a362-4087-914f-|
000000c0  38 61 62 64 32 61 61 66  31 35 66 33 00 00 00 00  |8abd2aaf15f3....|
000000d0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
000001c0  7b cf a2 6c 86 ae 22 03  48 75 49 7a 8b 92 1e 28  |{..l..".HuIz...(|
000001d0  fa 64 a0 bc cf e7 7a 83  1b 75 d9 96 09 79 b5 8e  |.d....z..u...y..|
000001e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00001000  7b 22 6b 65 79 73 6c 6f  74 73 22 3a 7b 22 30 22  |{"keyslots":{"0"|
00001010  3a 7b 22 74 79 70 65 22  3a 22 6c 75 6b 73 32 22  |:{"type":"luks2"|
00001020  2c 22 6b 65 79 5f 73 69  7a 65 22 3a 36 34 2c 22  |,"key_size":64,"|
00001030  61 66 22 3a 7b 22 74 79  70 65 22 3a 22 6c 75 6b  |af":{"type":"luk|
00001040  73 31 22 2c 22 73 74 72  69 70 65 73 22 3a 34 30  |s1","stripes":40|
00001050  30 30 2c 22 68 61 73 68  22 3a 22 73 68 61 32 35  |00,"hash":"sha25|
00001060  36 22 7d 2c 22 61 72 65  61 22 3a 7b 22 74 79 70  |6"},"area":{"typ|
00001070  65 22 3a 22 72 61 77 22  2c 22 6f 66 66 73 65 74  |e":"raw","offset|
```



Qubes

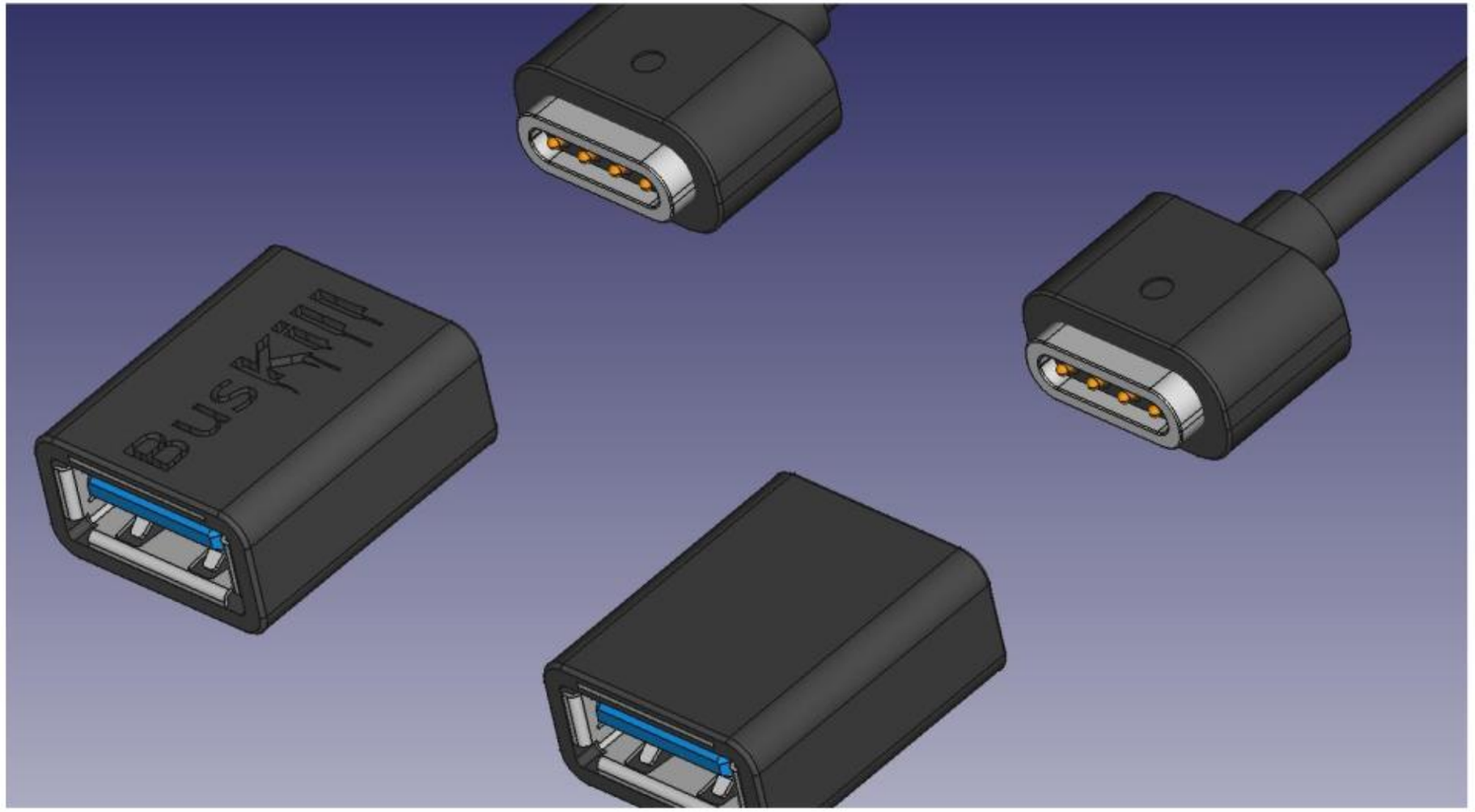
- BusKill was originally designed to work for Qubes and works with a simple udev command
- There’s no GUI for Qubes OS but there’s an installation guide in this article.

BusKill Hardware Requirements

- Suitable for home manufacture
- Can disassemble and inspect
- Doesn’t block other USB ports
- Separates easily, yet not have false positives

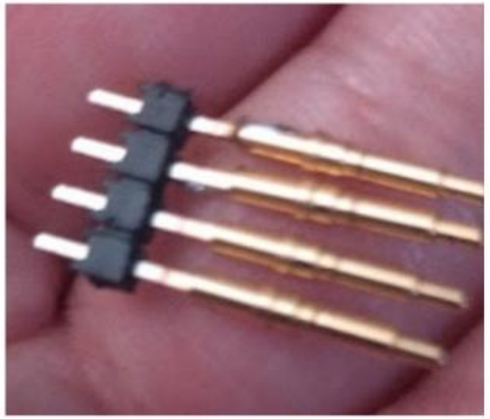
Manufactured Version

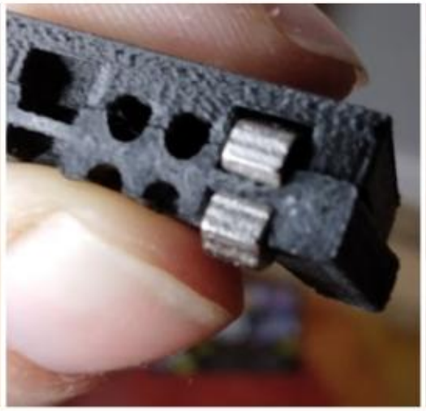
- Engineering drawings available on github
- For purchase on buskill.in

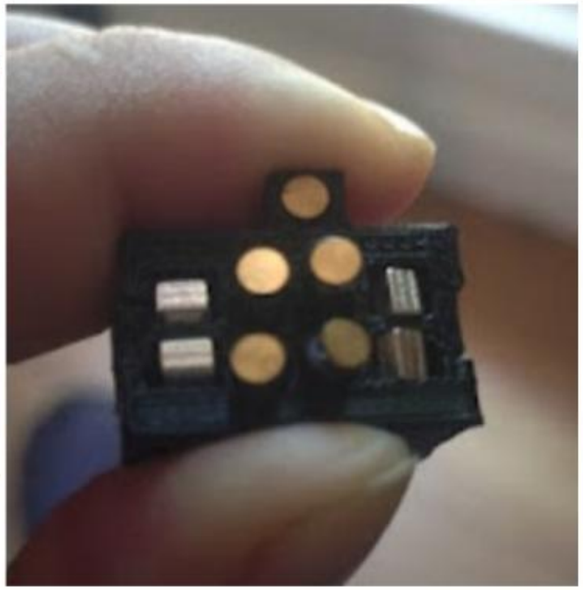
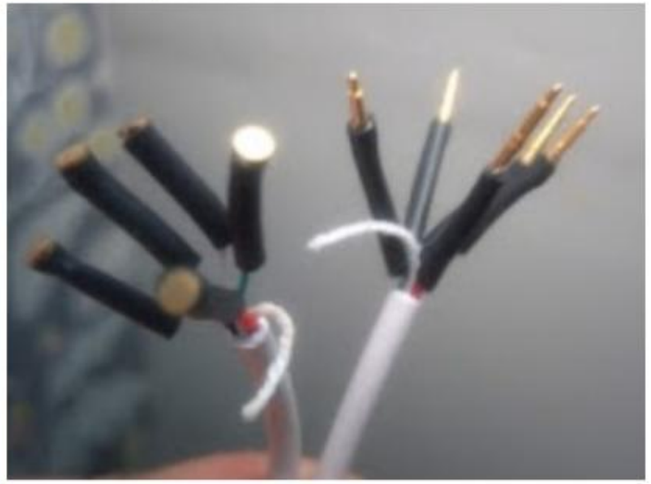


Hardware Development History

- How do we do this?!

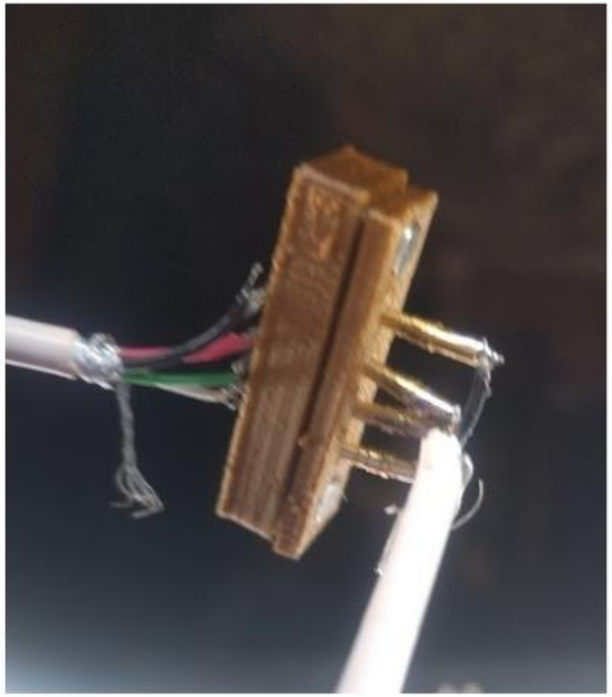


Hardware Development History

- That time we killed a USB drive

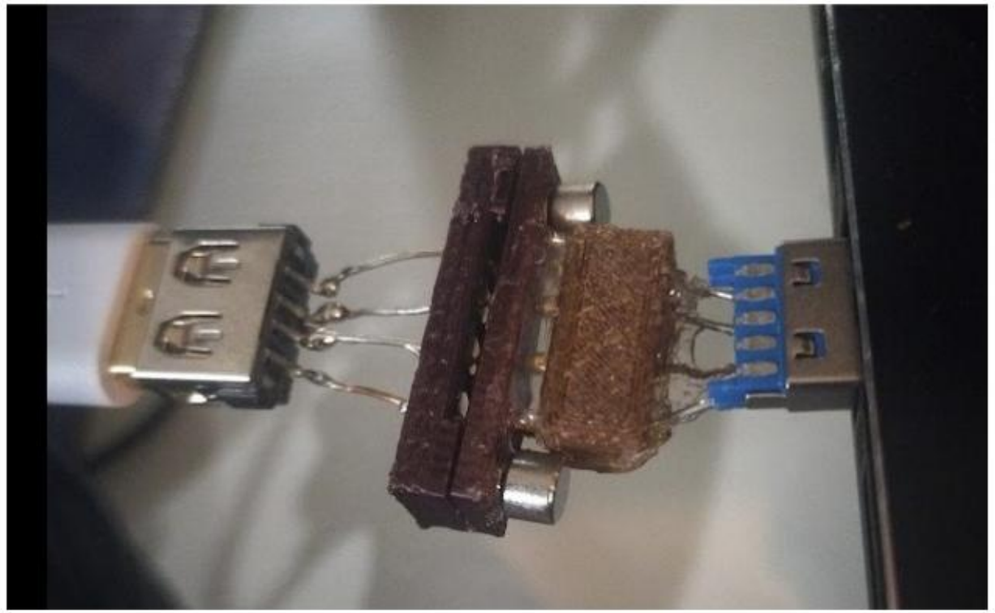


michaelAndIJustBrok...bleTogether_dmsg.log ×

```
[   40.627838] ath: doing EEPROM country->regdmn map search
[   40.627841] ath: country maps to regdmn code: 0x3a
[   40.627843] ath: Country alpha2 being used: US
[   40.627845] ath: Regpair used: 0x3a
[   40.627848] ath: regdomain 0x8348 dynamically updated by country element
[   40.634176] IPv6: ADDRCONF(NETDEV_CHANGE): wlp2s0: link becomes ready
[   40.715695] wlp2s0: Limiting TX power to 24 (24 - 0) dBm as advertised by 6c:4b:b4:b5:bc:2c
[  418.995789] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  419.963813] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  419.963923] usb usb1-port5: attempt power cycle
[  421.007775] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  421.975772] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  421.975887] usb usb1-port5: unable to enumerate USB device
[  456.472911] systemd-journald[373]: File /var/log/journal/b76cc7b1bbdc489e93909d2043031de8/-
user-1000.journal corrupted or uncleanly shut down, renaming and replacing.
[  458.047393] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  458.348925] nouveau 0000:01:00.0: Enabling HDA controller
[  459.015025] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  459.015236] usb usb1-port5: attempt power cycle
[  460.063390] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  461.031359] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  461.031560] usb usb1-port5: unable to enumerate USB device
[  466.578805] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  467.555297] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  467.555359] usb usb1-port5: attempt power cycle
[  468.602849] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  469.574813] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  469.574930] usb usb1-port5: unable to enumerate USB device
[  539.538279] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  540.506264] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  540.506378] usb usb1-port5: attempt power cycle
[  541.550246] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  542.518232] usb usb1-port5: Cannot enable. Maybe the USB cable is bad?
[  542.518350] usb usb1-port5: unable to enumerate USB device
[  633.312268] usb 1-2: new low-speed USB device number 20 using xhci_hcd
```

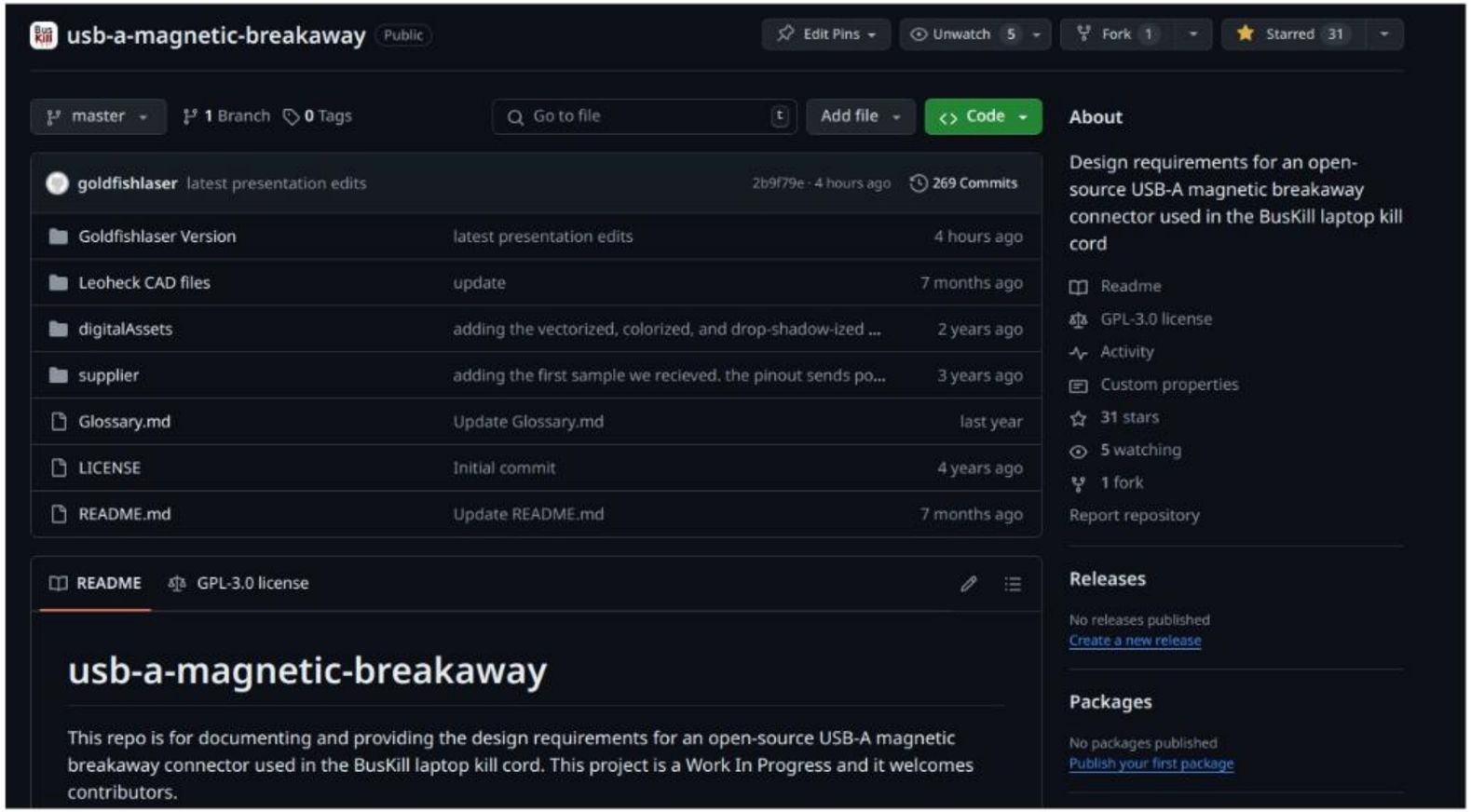
Hardware Development History

- Magnets, how do they work?



3D-Printed “Goldfishlaser Version”

- BusKill repo has older files and history documented on Issue#2



Repo! The Generic Opera

- Since I’m no longer affiliated with BusKill, latest files are here:
- https://github.com/goldfishlaser/usb-a-magnetic-breakaway/tree/master

usb-a-magnetic-breakaway

This repo is for documenting and providing the design requirements for an open-source USB-A magnetic breakaway connector. Originally created to be a solution for BusKill cables. I am no longer directly associated with the BusKill project, but welcome the continued use of these files towards those ends. Perhaps you have another reason you want to quickly magnetically detach a USB? Then here's your thing. This project is a Work In Progress and it welcomes contributors.

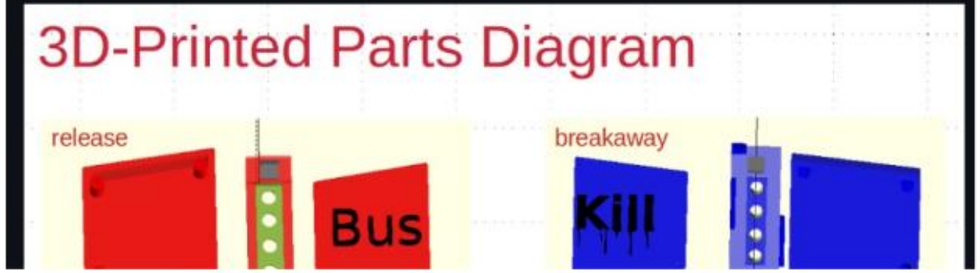
What's New?

Updates to goldfishlaser Version:

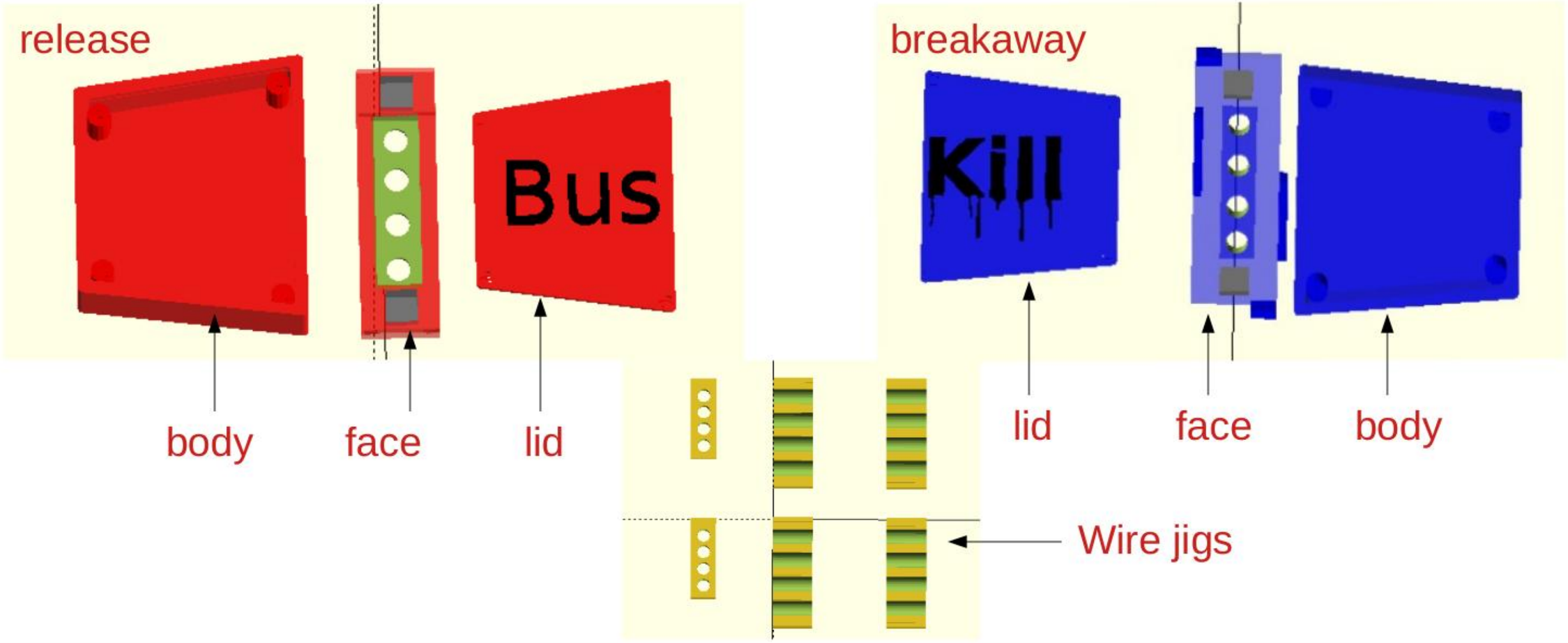
- Recommend using 4.0 - has latest changes with a new type of pogo receptor
- If continuing to use 3.9 be aware that there are a few issues with it that will need your attention.
- I'm giving a talk at DEF CON! Read about it here: https://crashxblossom.wordpress.com/2024/06/24/defcon32-announcement/

What's in this Repo?

This repo contains full documentation for how to create this gadget. It contains documented 3D print files (SCAD and STL), Bill of Materials, and more.



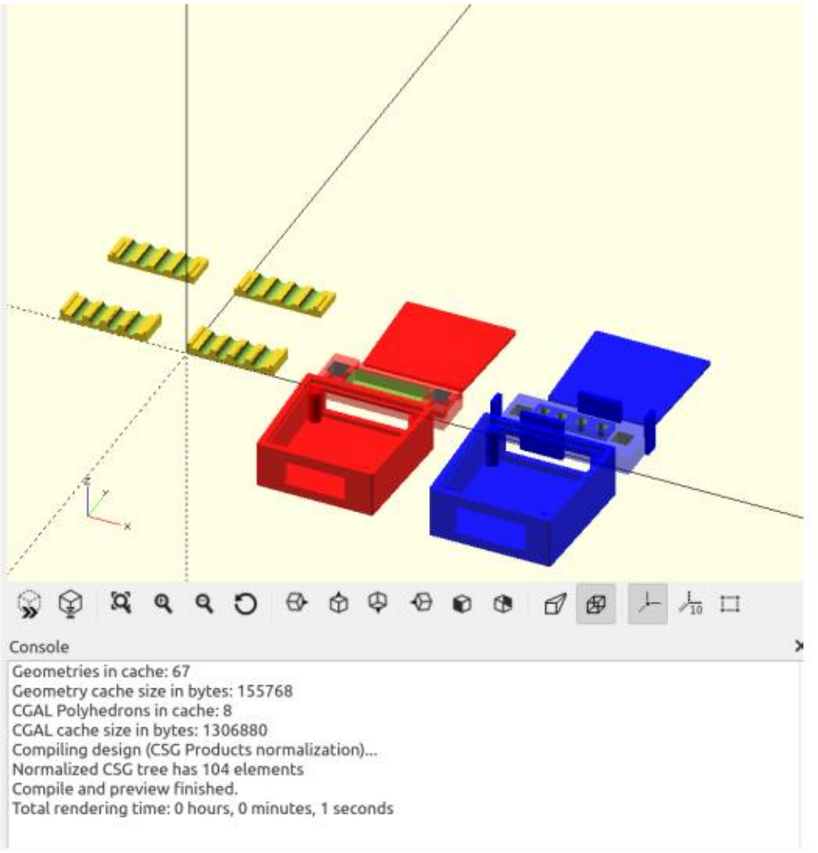
3D-Printed Parts Diagram



OpenSCAD Code Tour

- Built in OpenScad

```
/*
  usbamagb_v04.0
*/
/*
USB-A Magnetic breakaway Shell Assembly
GNU General Public License v3.0
Author: Melanie Allen
*/


/*
Description

The magnetic breakway consists of a "breakaway" (blue) and a "release"
    (red). When the magnets on the breakaway and release connect, the pogo
    pins and pogo receptors meet and establish the USB connection. When
    the parts are separated, the USB connection is severed.

The "breakaway" consists of three plastic pieces. The enclosure, the lid,
    and the face. The face contains areas for two 1/8" cube magnets and
    pogo receptors. The enclosure allows for the housing of a wire jig,
    wires and female usb port. The lid screws onto the enclosure with 4 x
    1.5-2M screws.

The "release" consists of three plastic parts. The enclosure, the lid, and
    the face. The face contains areas for two 1/8" cube magnets and pogo
    pins. The enclosure allows for the housing of a wire jig, wires, and
    male usb. The release plugs into the computer. The lid screws onto the
    enclosure with 4 x 1.5-2M screws.

"Jigs" serve purposes such as housing wires and holding hardware in place
    during assembly and use. (yellow)

The code in this file is divided into five section: Parameters, Hardware,
    Breakaway, Release, and Assembly
```



OpenSCAD Code Tour

- Parameters and hardware sections for editing components and wire jigs

```
/********** PARAMETERS **********/

//magnet parameters
magnet_position_x=3;
magnet_position_z=18.1;
magnet_position_y=4;
magnet_distance=23; //distance between magnets
magnet_size=3.175; // for 1/8" cube magnet
magnet_tolerance= .2; //to allow room for press fit


//USB male parameters
u_h = 14; //height
u_w = 12; //width
u_d = 4.7; //depth

//USB female parameters
u_f_h = 16; //height
u_f_w = 14.25; //width
u_f_d = 5.7; //depth


//pogo parameters

pogo_length=7.6;
pogo_diameter=2.8; // pogo thickness
pogo_distance=1.5; //distance between pins
shift=2.1; //distance from pins
spread=4.8;
shift2=2; //distance from top
```

OpenSCAD Code Tour

- Release section for everything related to the Release

```
/********** RELEASE **********/

 //RELEASE FACE

innie_tolerance=.5;
face_distance=26.5;  //distance from release face

       module releasef(){
 i_x = i_l_h; //base width
i_z = 10-1.75; //base length diff=-2
i_y = 2.5; //base height diff=.3
    color("red",.55)
 translate([25,.2,0])
           rotate([90,0,0]){
           translate([face_distance,0,2]){ // +1 to switch faces
               cube(size = [i_x, i_z, i_y], center = false);

           }
                        translate([face_distance,0,2])
           rotate([-90,0,0])
           cube(size = [r_extrusion_x, r_extrusion_y, r_extrusion_z],
    center = false);

           translate([face_distance+magnet_distance+.25,0,2])rotate([-90,0
    ,0])
           cube(size = [r_extrusion_x, r_extrusion_y, r_extrusion_z],
    center = false);

          translate([face_distance,0,.75])
           cube(size = [i_x, r_extrusion_y, r_extrusion_y], center = false
    ); //rail2
```

OpenSCAD Code Tour

- Breakaway section for everything related to the Breakaway

```
/********** BREAKAWAY **********/

//BREAKAWAY FACE

//variables
i_l_h =25.25; //width
i_l_w = 10; //height
i_l_d = 3.75; //length

b_extrusion_x=5;//extrusion x for magnet
b_extrusion_y=.1; //extrusion y for magnet
b_extrusion_z=8;//extrusion z for magnet

module stopper(){
 stopper_x=i_l_h/3;
 stopper_y=1;
 stopper_z=8;

     level=3.75;

color("blue")
 translate([i_l_h+41.25,-6,i_l_d-level])
 cube(size = [stopper_x,stopper_y,stopper_z], center=false); //bottom slot

 color("blue")
 translate([i_l_h+48,i_l_w-6,i_l_d-level])
 cube(size = [stopper_x,stopper_y,stopper_z], center=false); //top slot
```

OpenSCAD Code Tour

- Assembly section for actually generating the parts.

```
/*********** ASSEMBLY ***********/

 //comment or uncomment below to render desired parts

/** all **/
module make_all(){
  make_r_face();
 make_enclosure_r();
 translate([0,0,0])make_b_face(); //translate to accomodate change for pins
 make_enclosure_b();
 jig();
    jig2(); translate([-25,0,0])jig2();
 translate ([-25,0,0])jig();
}

make_all();

/** only release **/
module only_r()
{
    translate([0,0,0])make_enclosure_r();
    make_b_face();

    }

//only_r();

/** only breakaway **/

module only_b()
{
```

How you can help – 3D-printing

- Make one
- Improve it
  - The more compact the design, the better
  - The cheaper the design, the better
  - The more parametric the design, the better

How you can help – BusKill Software

- Develop more self-destruct triggers:
  - Veracrypt
  - FileVault
  - Bitlocker

BusKill Links

- What is BusKill?
- BusKill web site
- BusKill docs (3D printed BusKill instructions coming soon!)
- BusKill software repo
- BusKill USB-A repo

- BusKill YouTube
- BusKill Crowdsupply
- BusKill Open Collective
- Qubes article
- LUKS shredder article
- Tails article

My Links

- Blog: https://crashxblossom.wordpress.com/category/project-updates/buskill/
- BusKill playlist (YouTube): https://www.youtube.com/watch?v=vN3olfXvnqU&list=PLVAB3xpMUPupq8n_yrcdGf2Lr6ilV3fc

Questions? Comments?