

Digitálne výrobné technológie

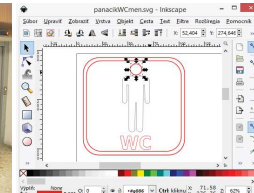
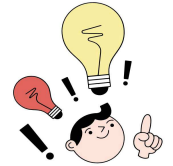


1. Nálepky
2. Projekty DVT 2019
 - a) Raná starostlivosť
 - b) Škoda auto
3. **LASER**
4. Qcad introduction

Nálepky



Prejdite sa po škole a nájdite miesto, ktoré by si zaslúžilo nejaký informačný piktogram. Obrázok vložte do rámička 10x10 cm, šírka 5mm a zaoblenie rohov 1cm.



FEI STU Bratislava, Blok D, prízemie, r. 2018

Projekty

- vlastné
- FIT2 something (FA + FEI)
- Raná starostlivosť

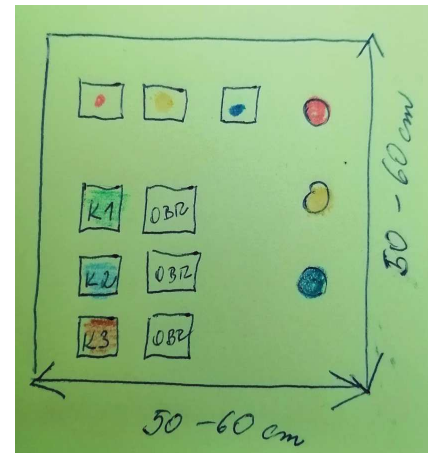
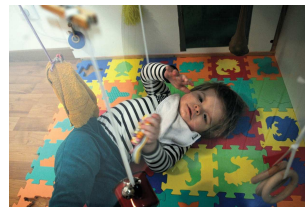


Foto: Peter Župník z webu <https://www.ranastarostlivosť.sk/pre-rodiny>



STU
FA



LOGIC



CREATIVE



Laser



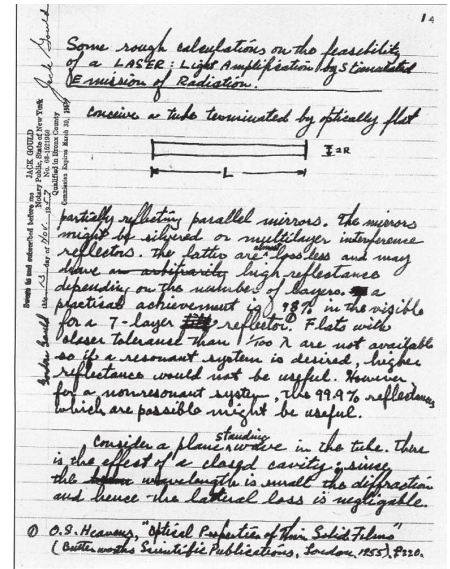
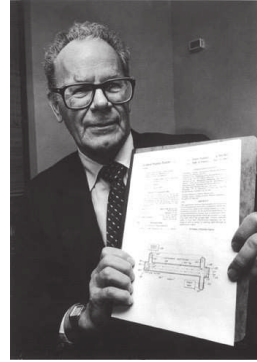
The Greek mathematician and scientist **Archimedes** is credited with inventing the first directed-energy (DE) weapon during the siege of **Syracuse** in **214-212 B.C.** Writing four centuries later, the Roman author Lucian recorded Archimedes's use of mirrors to focus sunlight on to invaders' ships and set them on fire, although modern experimenters have failed to reproduce the weapon. H.G. Wells reintroduced the idea to the popular imagination in 1897 in *The War of the Worlds*, where the Martian invaders' heat ray can destroy an armored warship. Even today, the chances of doing that are a million to one.



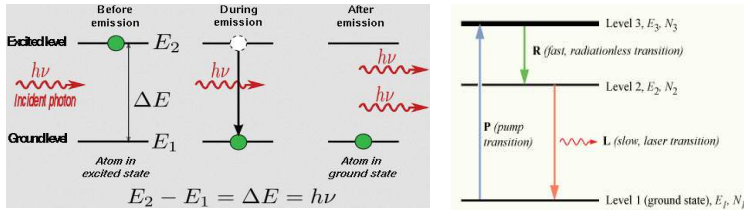
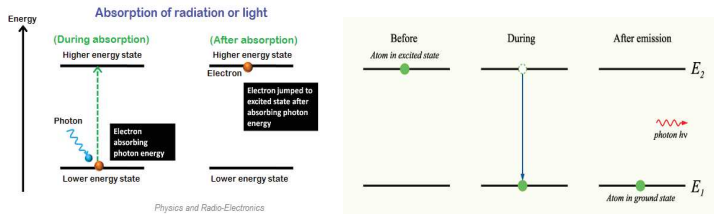
The **personnel halting and stimulation response rifle (PHASR)** is a prototype non-lethal laser dazzler developed by the Air Force Research Laboratory's. Its purpose is to temporarily disorient and blind a target.

Gordon Gould

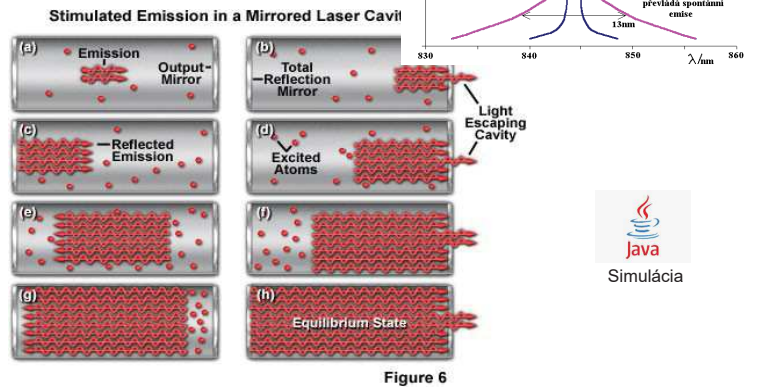
(17. 6. 1920 – 16.9. 2005)



Laser: absorpcia, spontánna a stimulovaná emisia



Zdroje svetla: polovodičový laser



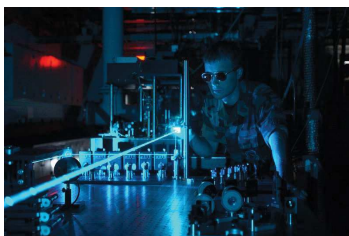
Zdroje svetla: LASER

Podľa aktívnej látky

- Pevnolátkové**
 - Rubín
 - Safir
 - Nd:YAG laser
 - Polovodič (GaAs, AlGaInP, GaN)
- Plynové**
 - N, CO₂
 - He, Ne, Xenón
 - Excimerové (ArF, KrCl, KrF)
- Kvapalinové (farbivové)**
 - organické farbivá
 - anorganickými farbivá

Režim činnosti

- Pulzné** (pulsed mode)
- Spojité** (continuous)



Zdroje svetla: LASER



Power

1 – 5 mW

5 mW

100 mW

250 mW

400 mW

1 W

1 – 20 W

130 – 100 W

100 – 3000 W

10 – 100 kW

Use

Laser pointers

CD-ROM drive

High-speed CD-RW burner

Consumer 16x DVD-R burner

DVD 24x dual-layer recording

Green laser in Holographic Versatile Disc prototype

Majority of commercially available solid-state lasers used for micro machining

Typical sealed CO₂ surgical lasers

Typical sealed CO₂ lasers used in industrial laser cutting

Weapons

Examples of pulsed systems with high peak power:

700 TW (700×10¹² W) – National Ignition Facility, a 192-beam, 1.8-megajoule laser system adjoining a 10-meter-diameter target chamber[88]

1.3 PW (1.3×10¹⁵ W) – world's most powerful laser as of 1998, located at the Lawrence Livermore Laboratory[89]

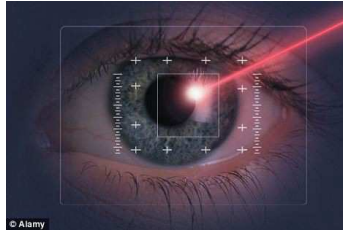
Zdroje svetla: LASER



Záleží nielen na výkone, ale aj dobe expozície a vlnovej dĺžke

kategória I ($P_{max} < 0,4 \mu W$)

relatívne neškodné aj pri priamom pohľade
CD prehrávače a čítačky čiarového kódu



kategória II ($P_{max} < 1 mW$)

nemali by spôsobiť poškodenia oka (zatvorí sa za 0,25 s)
laserové ukazovátka

kategória III ($P_{max} (cont) < 5 mW$, $P_{max} (imp) < 0,5W$)

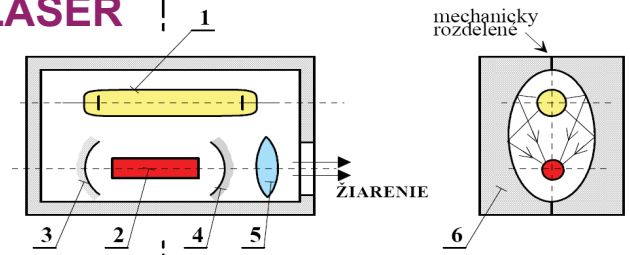
difúzný odraz žiarenia nespôsobuje poškodenie zdravia.
DVD-R napalovačka

kategória IV

zneprístupnený kľetkou – aj difúzný odraz spôsobuje vážne poranenia vrátane popálenín
chirurgický laser (30-100 W), vyrezávacie (100-3000 W)
~50 W ťažké popáleniny, od 200 W prerezú človeka napoly,
od 10 kW vyššie ostanú z človeka len dymiace topánky)



Zdroje svetla: LASER



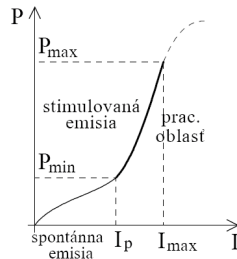
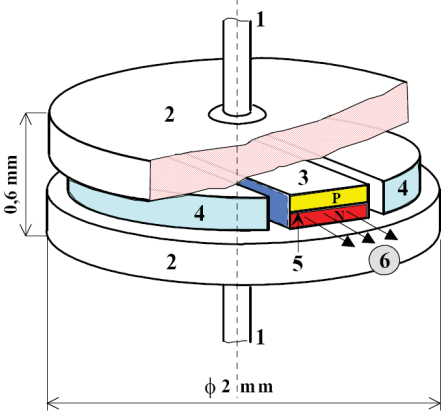
1 - výbojka (zdroj svetelnej energie)
2 - aktívna (svetlo emitujúca) látka
3 - odrazné, nepriepustné zrkadlo
Optický rezonátor (2-3-4)

4 - polopriepustné zrkadlo
5 - šošovka (kolimačná)
6 - delené eliptické zrkadlo

Nevýkonové využitie laserov:
prenos informácií (optovlákná)
holografia
meranie vzdialeností (geometrické, interferenčné)

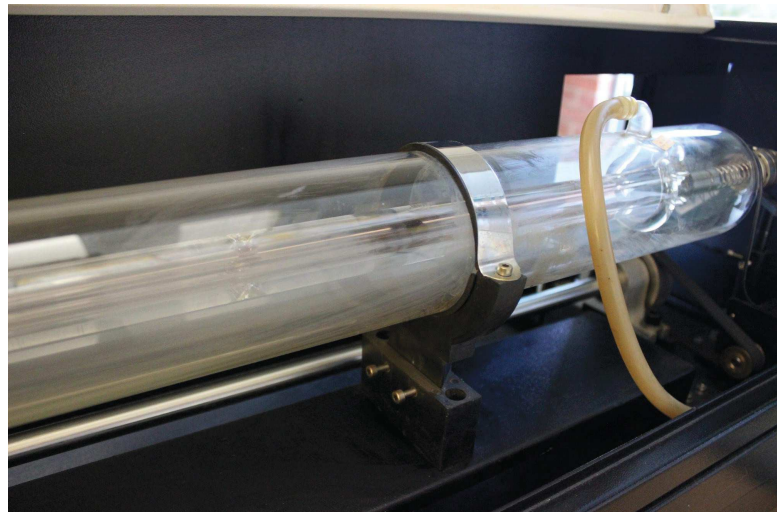
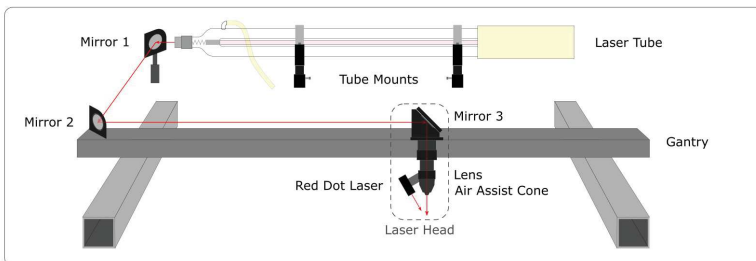
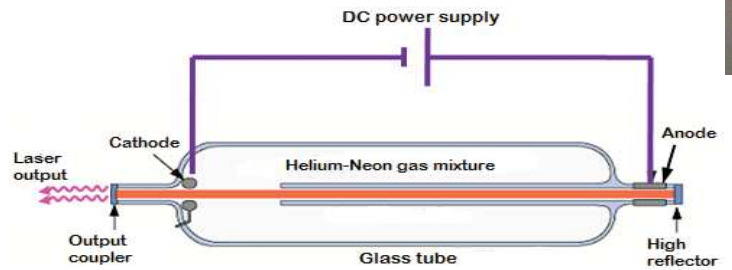
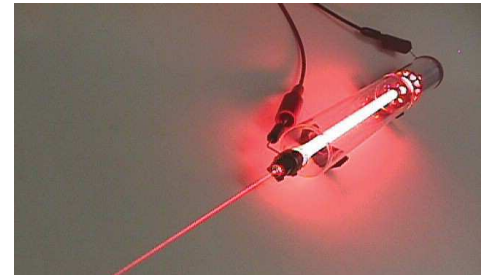
Poznámka: Koherentnosť charakterizuje tzv. "koherenčná dĺžka". Na tejto vzdialenosti (rádovo 1 m), je s určitou presnosťou fáza zaručená.

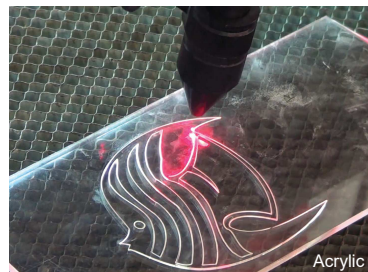
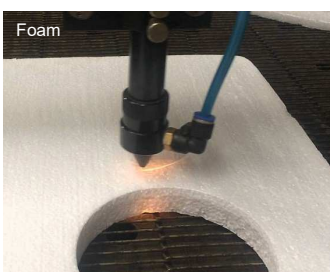
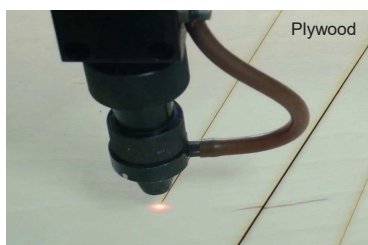
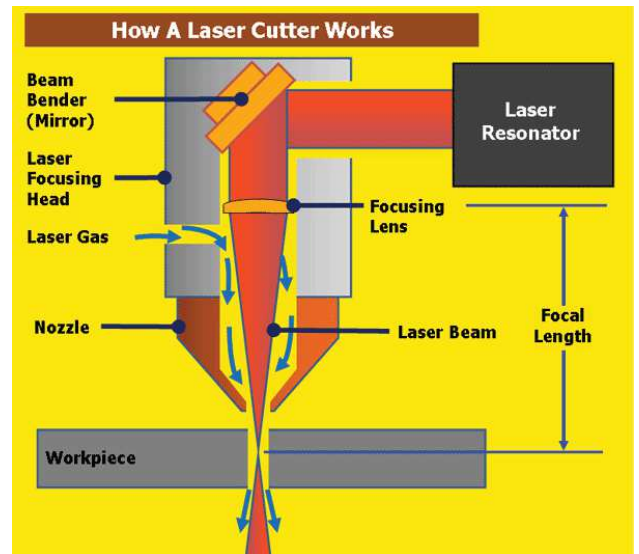
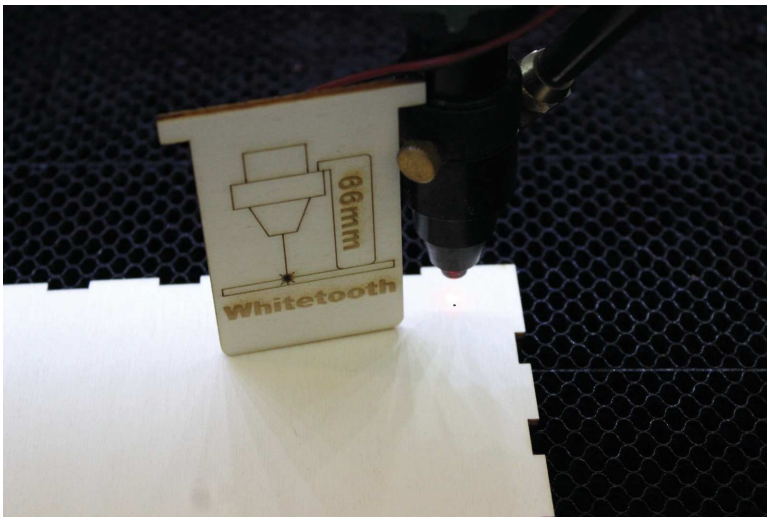
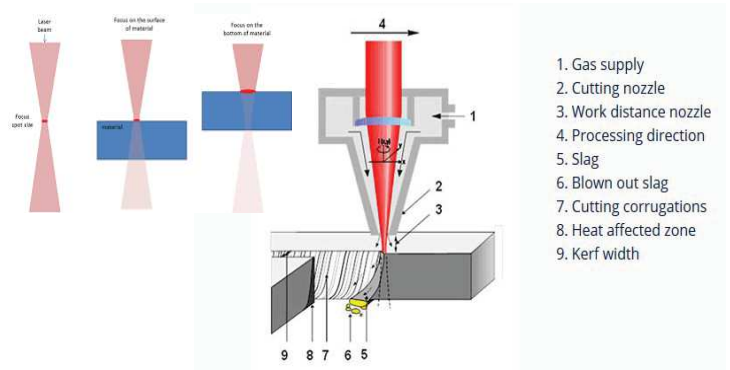
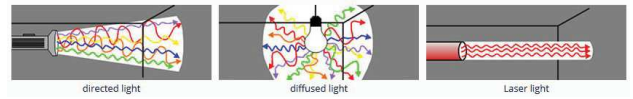
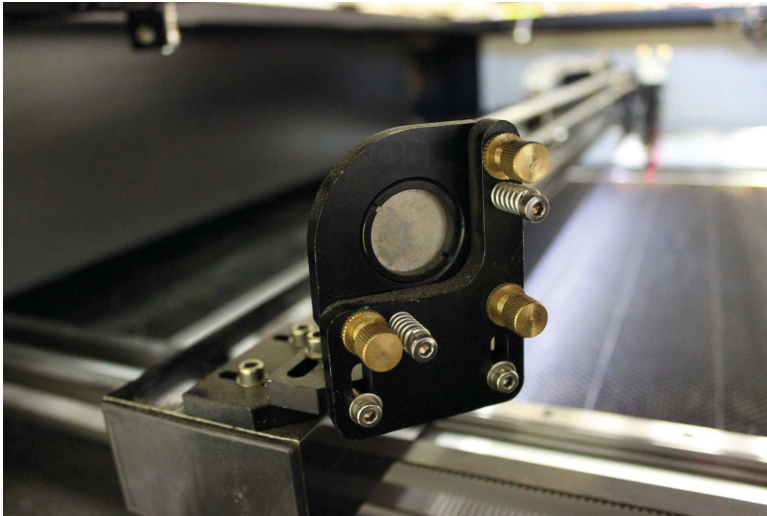
Zdroje svetla: Polovodičový laser



- $I_p = 80 - 150 \text{ mA}$
- $\eta > 40\%$
- Impulzy 1ps
- div $5 \times 25^\circ /$ kolimačná šošovka

Zdroje svetla: Plynový laser





Cutting depth

$$h \propto \frac{P}{vd}$$

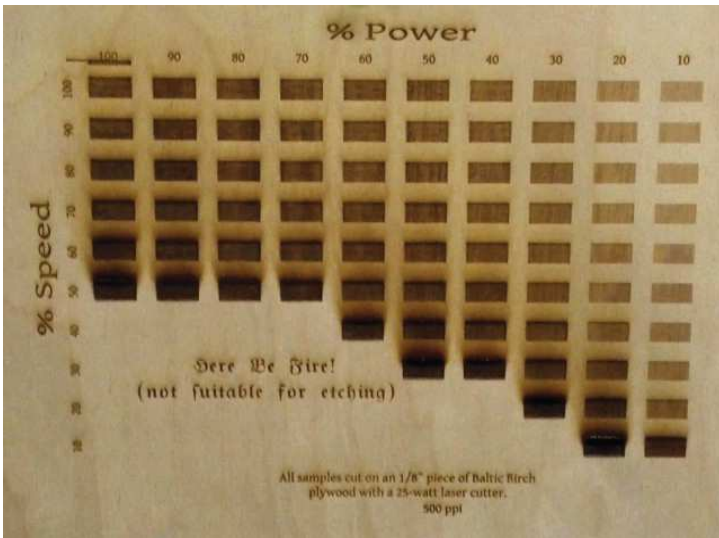
kde

h – hĺbka vniku,

P – výkon lasera

v – rýchlosť rezu

d – priemer laserového lúča



GCC X252 80W - výkon 80W, posun 100 cm/s (teoreticky maximálny)

| p.č. | Material | Hrúbka [mm] | Rezanie: | Rychlost [%] | Výkon [%] | PPI | Gravírovanie: | Rychlost [%] | Výkon [%] | PPI |
|------|--------------------------|------------------|----------|--------------|------------|-----|---------------|--------------|-----------|-----|
| 1 | Akryl sheet - priesvitne | 1 | Ok | 1,6 | 50 | - | Ok | 90 | 85 | - |
| 2 | Akryl sheet - red | 3 | Ok | 1 | 50 | - | Ok | 90 | 85 | - |
| 3 | Akryl sheet - red | 4 | Ok | 1 | 55 | - | Ok | 90 | 85 | - |
| 4 | Akryl sheet - black | 5 | Ok | 1 | 60 | - | Ok | 90 | 80 | - |
| 5 | Balza - modelárska | 1,65 | Ok | 3,1 | 25 | - | OK | 20 | 25 | - |
| 6 | Banán | Banana for scale | - | - | - | - | Ok | 50 | 70 | 400 |
| 7 | Cokoláda | No | Nie | - | - | - | Ok | 40 | 60 | - |
| 8 | Kapadocka | 1 | Ok | 3 | 70 | - | ok | 90 | 55 | - |
| 9 | Kartón | 2 | Ok | 4, 5, 10 | 30, 35, 70 | - | - | - | - | - |
| 10 | Koža | 1,5 | OK | 2 | 40 | 400 | Ok | 65 | 90 | 600 |
| 12 | MDF | 3 | OK | 1 / 1,5 | 35 / 65 | - | Ok | 25 / 80 | 30 / 80 | - |
| 14 | HDF | 3 | OK | 1 | 55 | - | Ok | 90 | 60 | - |
| 15 | Papier 300g | - | Ok | - | - | - | Ok | 30 | 4 | - |
| 16 | Papier 1mm | 1 | Ok | 6 | 50 | - | Ok | 50 | 65 | 400 |
| 17 | Pauzovací papier | 3 ks 100g | OK | 8 | 67 | - | - | - | - | - |
| 18 | Preglečka Topol | 4 | Ok | 1 | 25 | - | Ok | 90 | 75 | - |
| 19 | Preglečka * | 8,3 | OK | 1 | 70 | - | Ok | 90 | 40 | - |
| 20 | Kapadocka - plastová | neznáma | Ok | 5 | 80 | - | - | - | - | - |
| 21 | Skló | nerozhodujúce | Nie | - | - | - | Ok | 25 | 25 | - |
| 22 | Syntetická koža | - | OK | 6 | 70 | - | Ok | 20 | 60 | 400 |

Nevhodné materiály:

- PVC a plasty na báze PVC
- Komatax
- Plasty na báze polykarbonátu
- ABS
- Teflón
- HPS

Poznámky:

- Rezanie projektu pri S : 1% trvá 24 minút
- Rezanie toho istého pri S : 10% trvá 6 minút

EPILOG LASERCUTTER SETTINGS

- Each of our Epilog Lasercutters at Pier 9 require custom settings for a successful cut or etch operation.
- As the lasertubes degrade over time, the ideal settings for a material change.
- Use the tabs below to find recommended settings for your laser!

Note: This is a User-Run Google Doc. If you find a new setting that works well on one of the machines, please update the machine's tab and add the date when you make this improvement.

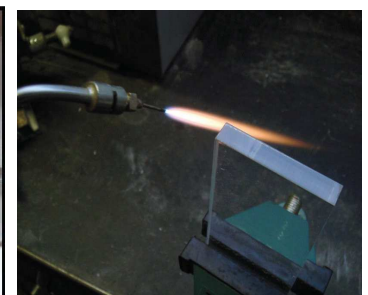
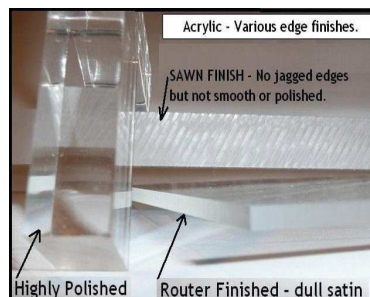
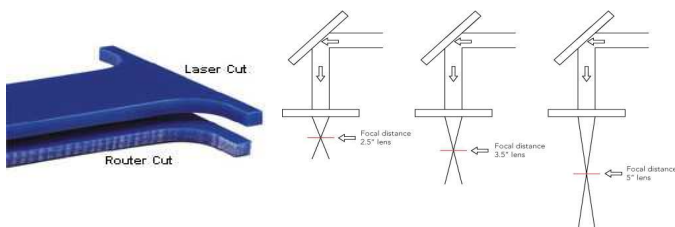
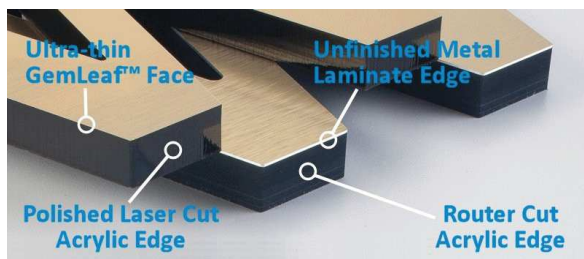
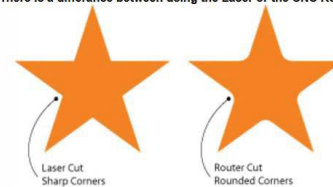
| Epilog Approved Materials | | | Epilog Forbidden Materials | | |
|---------------------------|---------|-----|-------------------------------|------------------------------|---|
| Material | Engrave | Cut | Material | Danger | Consequence |
| Wood | X | X | PVC (Polyvinyl Chloride) | Emits Pure Chlorine Gas | Gas will run lens, corrode Metal, and ruin motion control system. |
| Acrylic | X | X | Pleather / Artificial Leather | Emits Pure Chlorine Gas | Gas will run lens, corrode Metal, and ruin motion control system. |
| Fabric | X | X | Moleskin Notebooks | Emits Pure Chlorine Gas | Gas will run lens, corrode Metal, and ruin motion control system. |
| Cloth | X | X | Polycarbonate / Lexan | Cuts poorly, Discolors, Fire | This Material absorbs infrared Radiation so the laser is very ineffective. |
| Ceramic | X | | ABS | Emits cyanide gas and melts | ABS tends to melt, making a mess. It also has a higher chance of catching fire. |
| Delrin | X | X | HDPE / Milk Bottle Plastic | Catches fire and melts | It melts, tending to make a mess and ruin the material tray. |
| Linoleum | X | X | Polystyrene Foam | Catches Fire | It catches Fire and melts. #1 material to cause laser fire. |
| Leather | X | X | Fiberglass | | Like Polystyrene, it melts, catches fire and the melted drops continue to burn and turn into rock-hard drips and pebbles. |
| Marble | X | | Coated Carbon Fiber | Emits Noxious Fumes | A mix of two materials. Thin carbon fiber can be cut, with some fraying - but not when coated. |
| Matte Board | X | X | Any Powder | | Compressed Air will blow it away. |
| Coated Metals | X | | Butane Lighters | Explode / Catch Fire | |
| Paper | X | | Gasoline or other Liquids | Explode / Catch Fire | |
| Cork | X | X | People | XX | |
| Tile | X | X | Animals | XX | |
| Glass | X | | | | |
| Chocolate | X | X | | | |

Outside Cut: **RED (RGB 255,0,0)**



Text or Etch/Engrave: **BLUE (RGB 0,0,255)**

There is a difference between using the Laser or the CNC Router



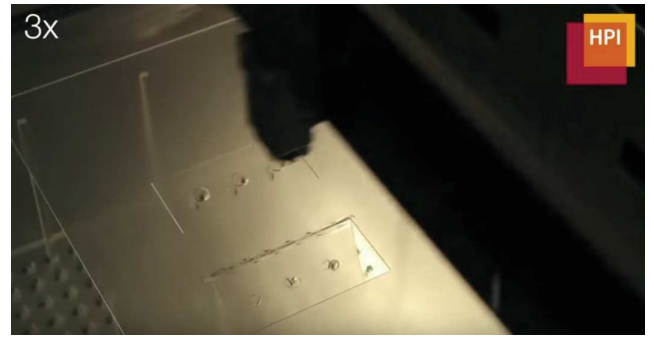


pocket sized robots by Junichi Tsuneoka.

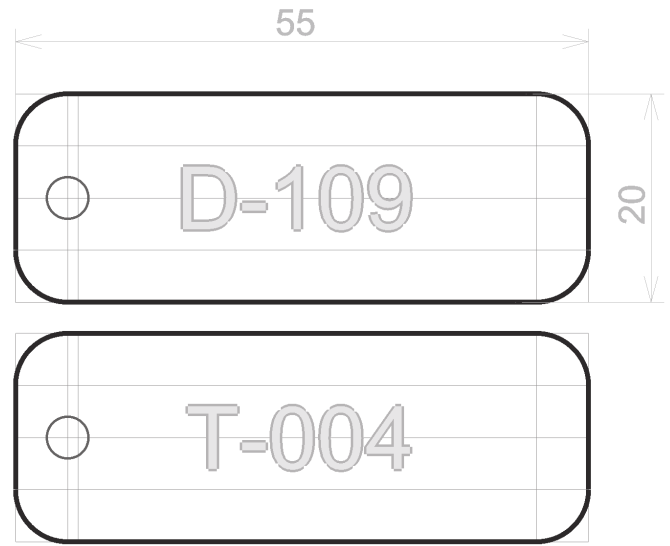
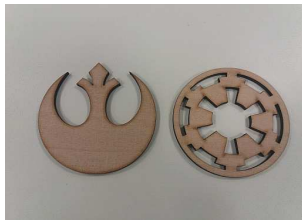


Laser origami

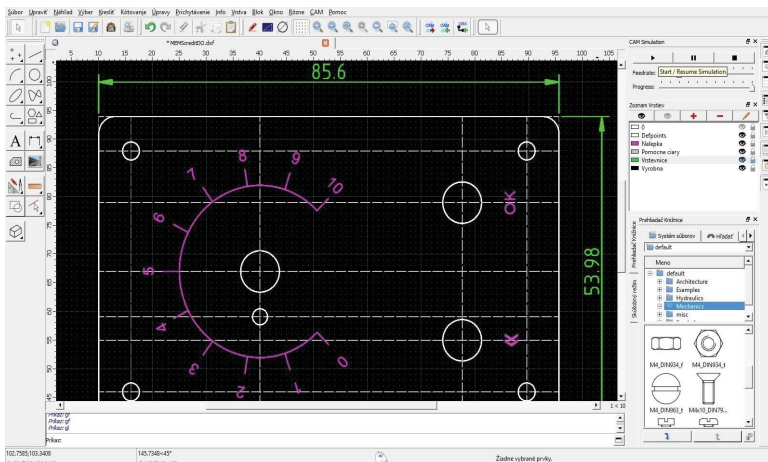
<https://youtu.be/arjRtCjI9AQ>



Prívesok



Qcad (LibreCAD)



Rekapitulácia

- P1: úvod
 - C1: FabLab: prehliadka a zoznámenie s priestormi
- P2: bitmapy/vektory, rezanie (notebook)
 - C2: tvorivé cvičenie vo FabLabe s Radkou
- P3: laser
 - C3: rezanie nálepky (notebook)
- P4: úvod do 3D tlače (notebook)
 - C4: vyrobíme si prívesok
- **myslite na projekt dňom i nocou**