Nuts and Bolts of Starting and Running an Integrated K-8 Maker Program

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Top Toys of All Time! (Geek Dad via Wired)

Who is a Maker?

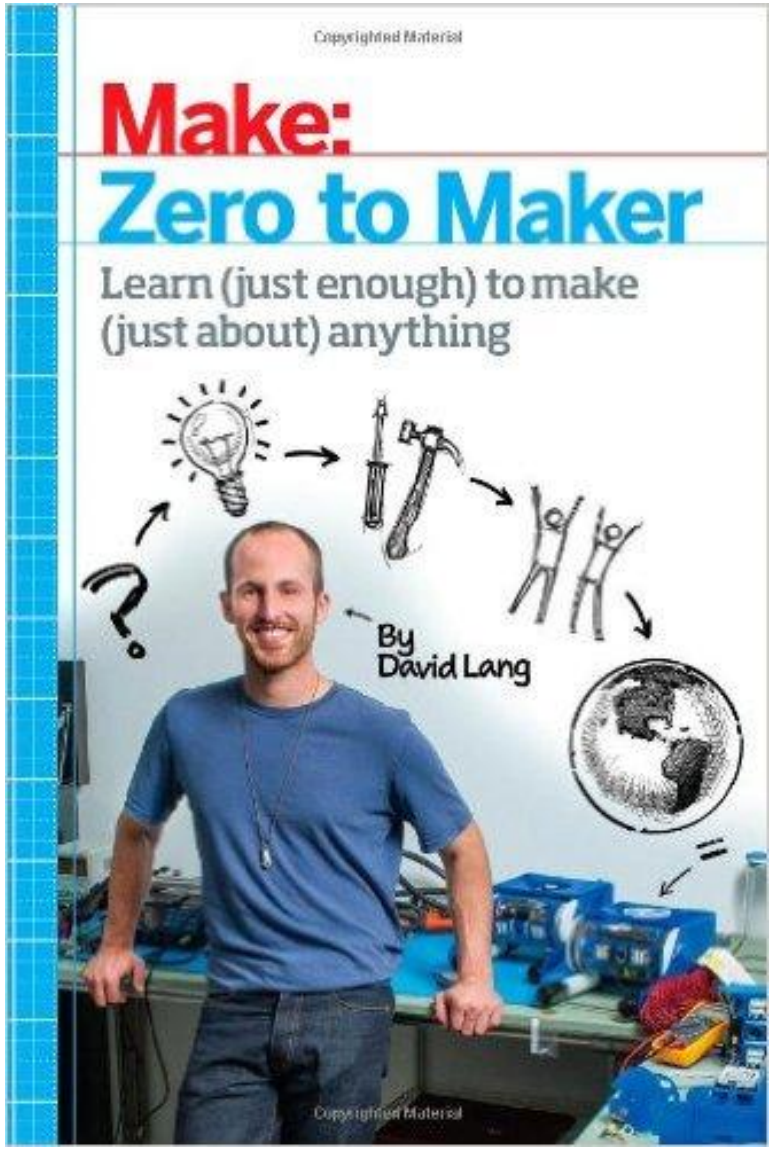
Are You a Maker?

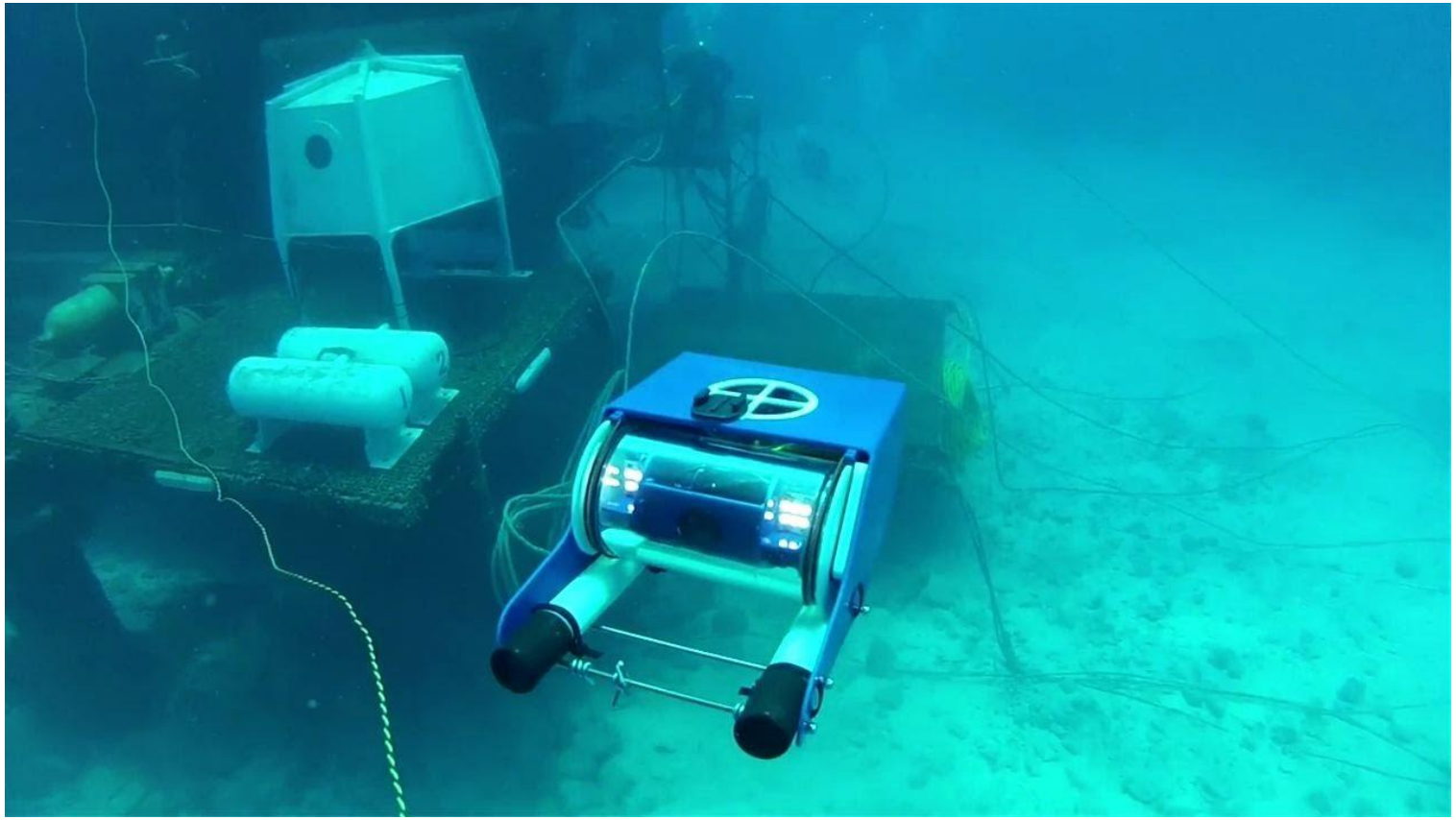
“America was built by makers — curious, enthusiastic amateur inventors whose tinkering habit sparked whole new industries”

Dale Dougherty

Founder and CEO Maker Media

Who is a Maker?

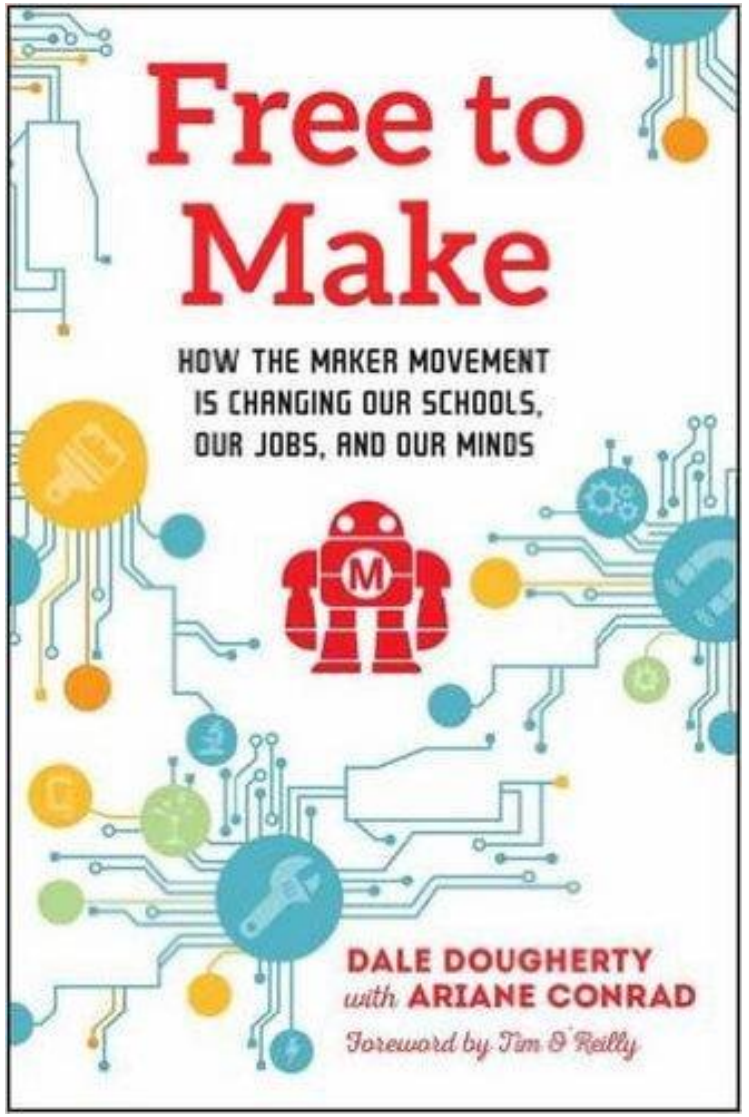




From Dale's Book

A maker is someone who creates and shares projects.

- A maker…
  - Is **creative**
  - Is **not afraid of failure**
  - Is **playful**
  - Makes all kinds of things for **personal**, **social** and **commercial** purposes
  - Values **making** and **creating** over using and consuming
  - Can be **any age** and from **any culture**
  - Loves to **share** their projects



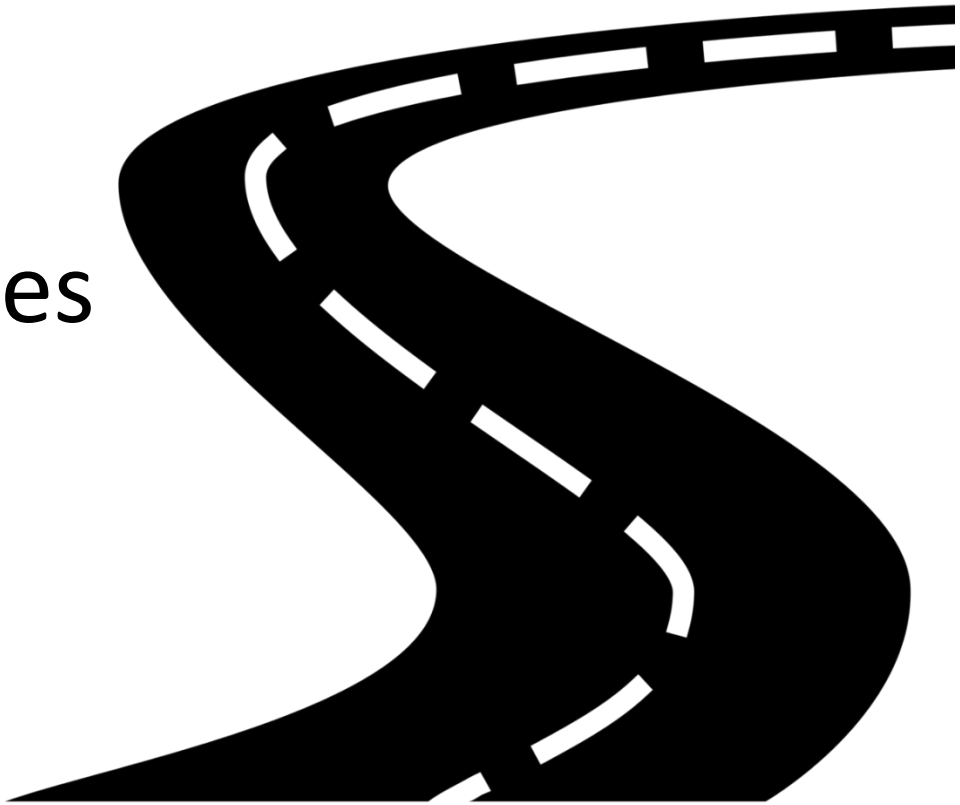
Making is in our human DNA – We were born to make.

Who is a Maker?

- Maker Faire's Slogan…
- Maker Faire – Where Makers Share!

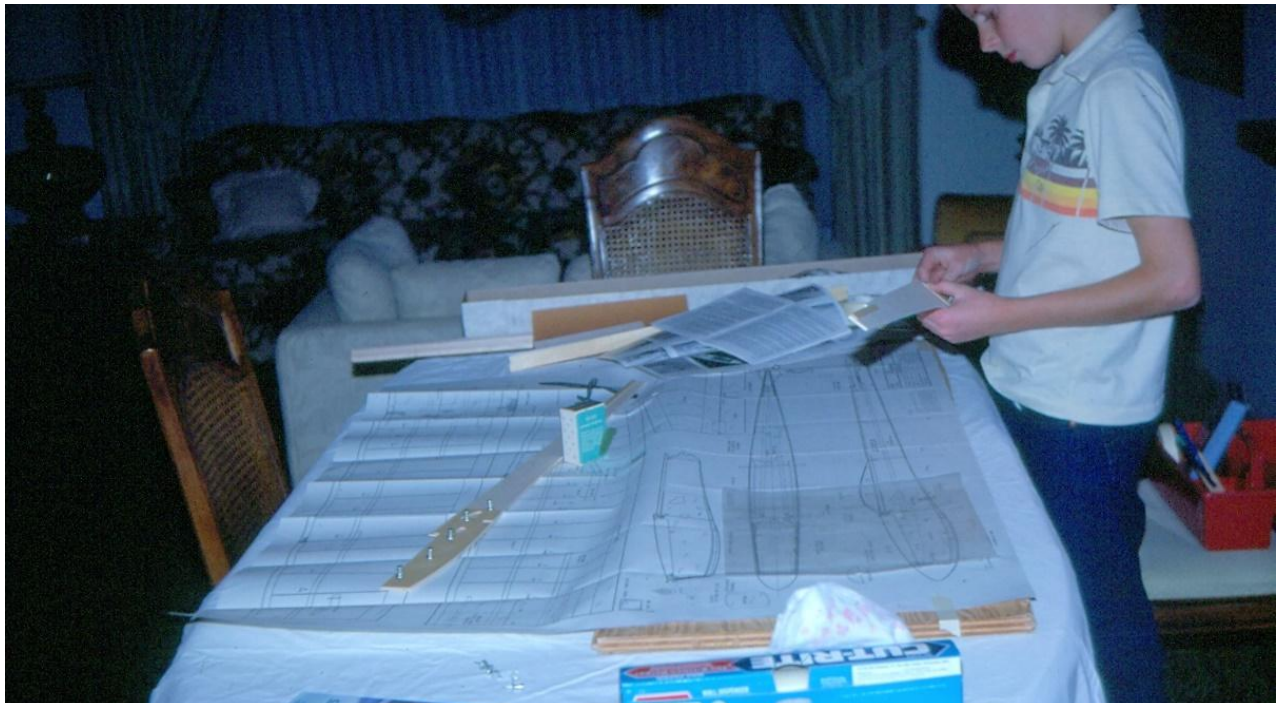
What we'll cover from here…

- My Maker Story
- Taking Making to the Classroom
- Programming
  - Your space
  - Breaking it down by K-8 grades
  - My Makerspace Favorites!

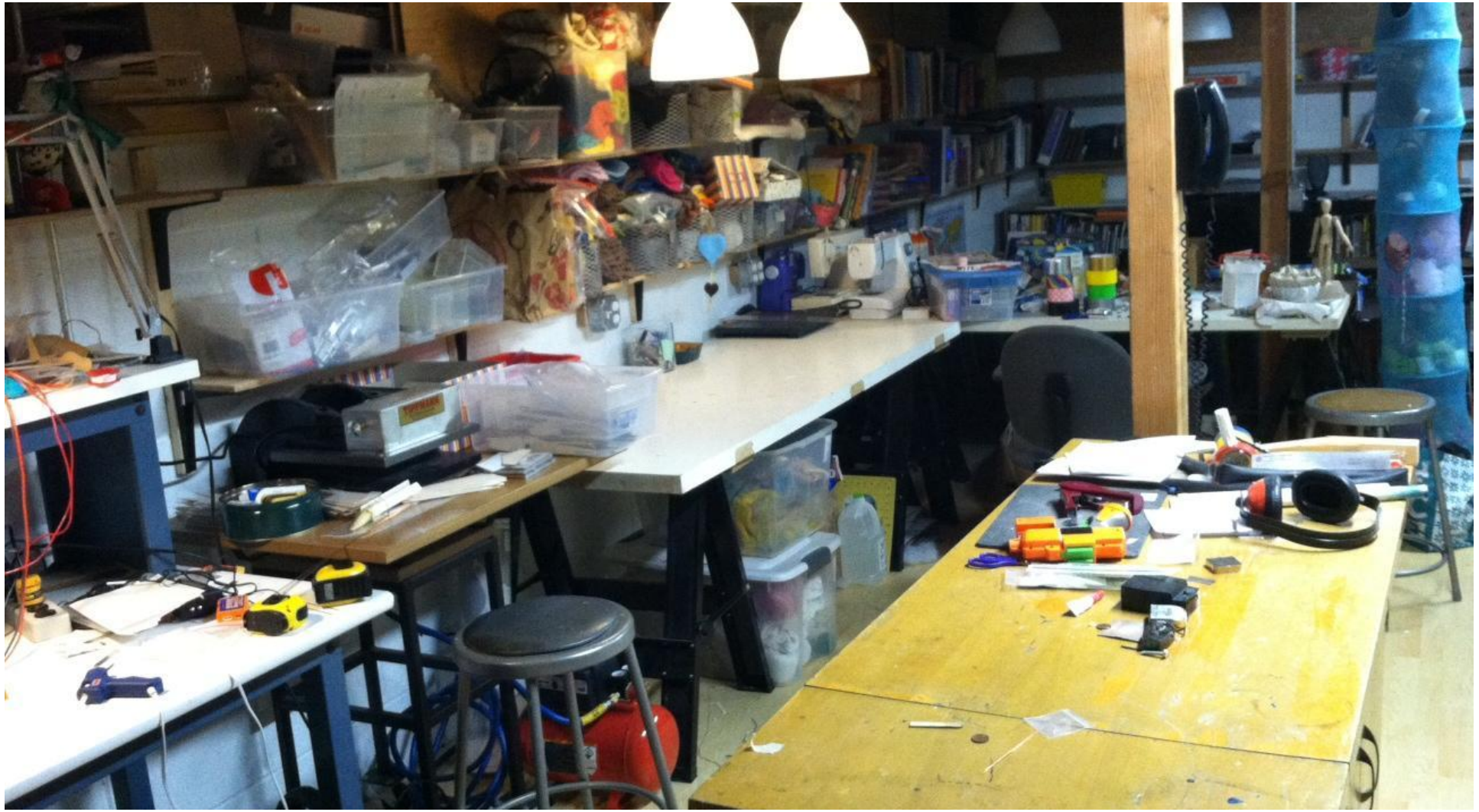


My Journey as a Maker

- As a kid…



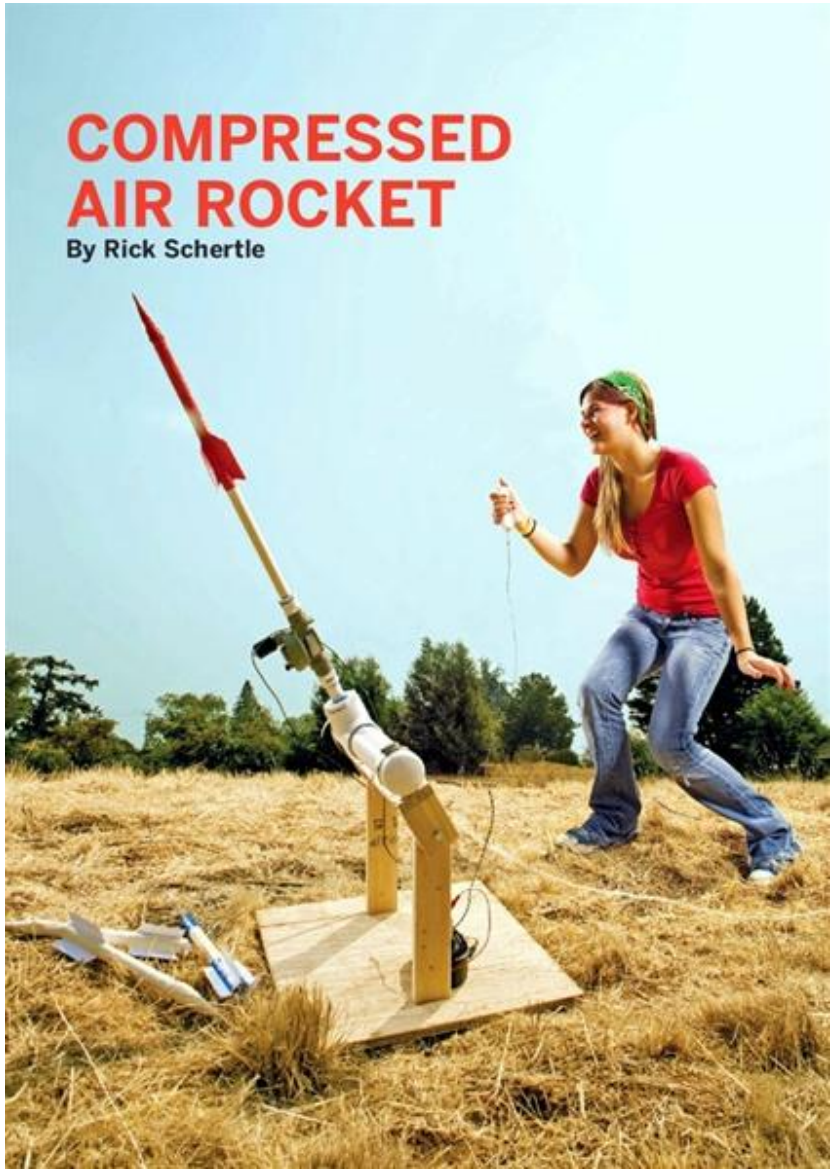
Family Maker Space



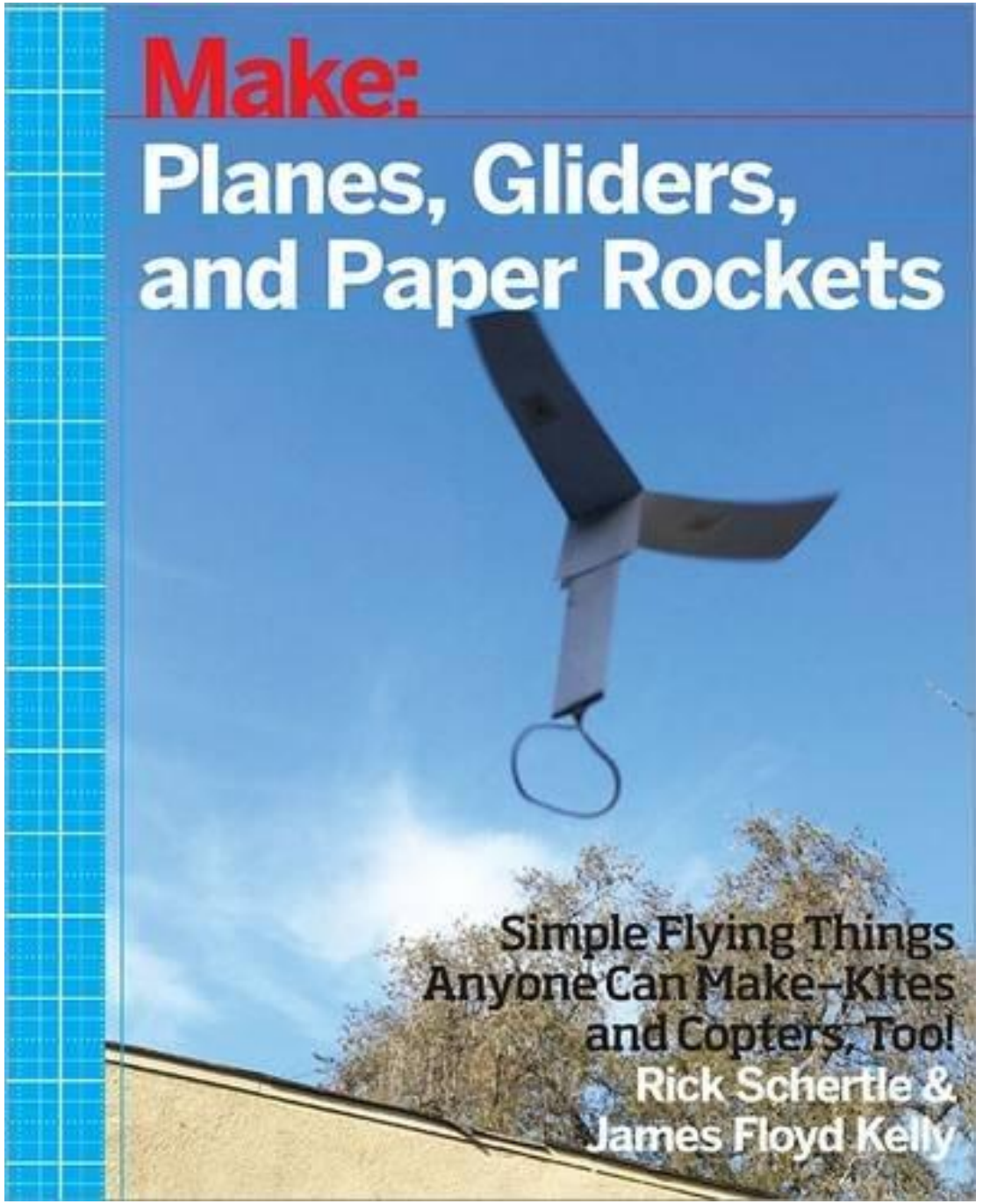
My Journey in the modern “Maker Movement”

First hearing about MAKE: magazine from Brian…

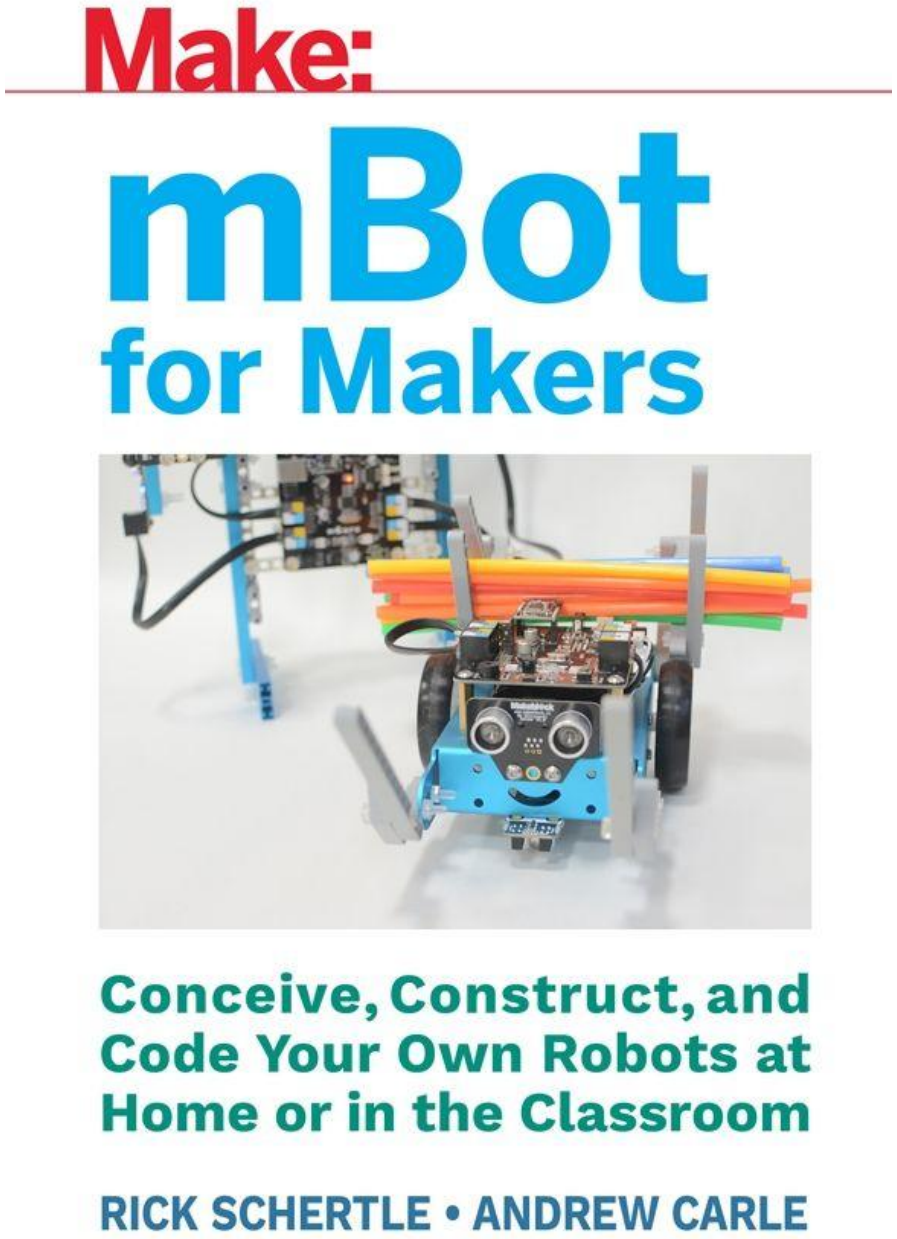

Make:
technology on your time
www.UWWWB.com
Paper Air Rockets Blast 200 Feet!
page 102 »
VERY SKILLED!
DIY MUSIC: 10 ROCKIN' INSTRUMENTS TO BUILD & PLAY page 53
WAY HARD-CORE!
RAISE YOUR GOBLET OF ROCK!
POWER STANCE!
THE GUITAR ZEROS SHOW YOU HOW TO MOD YOUR GUITAR HERO CONTROLLER INTO A REAL INSTRUMENT!
PLUS:
» Evil Computer Mouse Prank
» Giant Smoke Ring Cannon
» 2-Mile Camera Remote
» Penetrating Magnet Magic
O'REILLY
makezine.com


COMPRESSED AIR ROCKET
By Rick Schertle

Dozens more articles -then my first book published 2015!



Second Book – January 2018



Air Rocket Works… from Hobby to Business

AirRocketWorks.com

High Pressure Rockets for Fun and Science

NASA

ULA®

United Launch Alliance

PAPER & TAPE **ROCKET** TEMPLATE

AirRocketWorks.com

1 CUT & FOLD

Use the cut and fold lines to prepare the components of your rocket:

CUT ———————————

FOLD - - - - - - - - - - - - - - -

This rectangular portion of paper will become the **body tube** of your rocket. *You will use this entire 8.5 x 11 sheet of paper (no scraps) to make the rocket.*

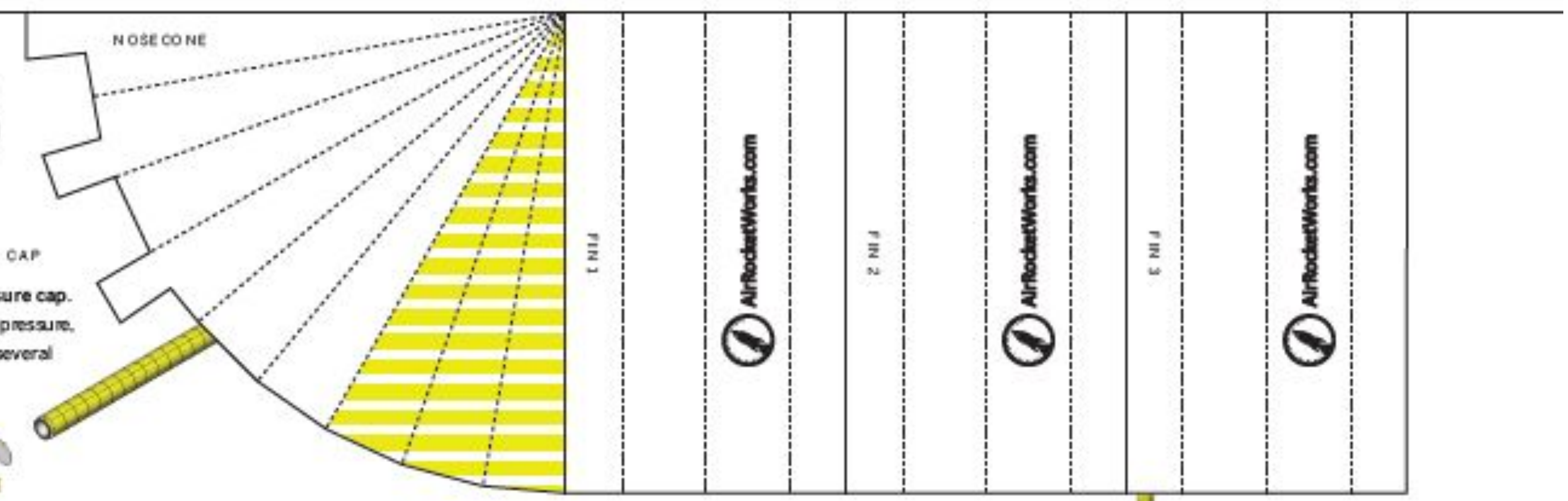
2 WRAP BODY TUBE

Read step 3 before proceeding. Wrap the **body tube** paper (this sheet) around the 1/2-inch PVC pipe, aligning with one end of the pipe. Add a piece of tape to the top, middle, and bottom. ***Important: Do not tape the paper to the PVC pipe.***

3 TAPE BODY TUBE

Wrap the entire **body tube** with tape, overlapping the tape as you move down the length of the tube.

BODY TUBE



4 PRESSURE CAP

Cut out the **pressure cap**. It will hold the air pressure, so secure it with several pieces of tape.

5 NOSECONE

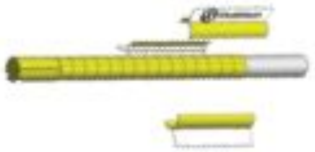
Cut out the **nosecone**, and roll it into a funnel shape, overlaping to hide the stripe pattern. Tape along the seam. Set aside.

6 CUT & FOLD FINS

Cut out the three **fins** and fold each into a 'W' shape.

7 ATTACH FINS

Tape the smaller tabs on the **fins** to the **body tube**. *Trim the shape of the fins, if desired.*



8 FINAL ASSEMBLY

Read step 9 before proceeding. Take all paper scraps (including instructions), and crumple into a cone-shaped lump. Pack this lump into the **nosecone** and tape it over the **pressure cap** onto the **body tube** of the rocket. Cover the **nosecone** with tape.

9 DECORATE

Decorate your rocket. ***Slide the rocket off of the PVC pipe.*** Your rocket is ready to launch!

MAKE: PROJECTS

High-Pressure Foam Rocket

Toy or not, this rocket really packs a punch.

By Rick Schertle Time Required: 1–3 Hours Difficulty: Easy

Print this Project

December 18, 2012, 11:00 pm PDT

PARTS / TOOLS

- Packing tape, clear (optional)
- **Duct tape** Fun colors are now available.
- **Zip tie, 8"**
- **Foam sheet, 2mm thick, 9"×12"** available at craft stores or online
- **Foam pipe insulation, ½" inside diameter** You can build 8 rockets with a 6' piece (instructions here are for one rocket).

Calling a rocket that sprints over 100 feet into the air a "toy" might be a bit of a stretch. Toy or not, this rocket really packs a punch. Fly it using the Compressed Air Rocket launcher from MAKE Volume 15 (get the kit at makezine.com/go/launcherkit) or a stomp rocket launcher (makezine.com/go/stomplauncher).

Rocket Party Taichung!

Laura and Steve in Taichung

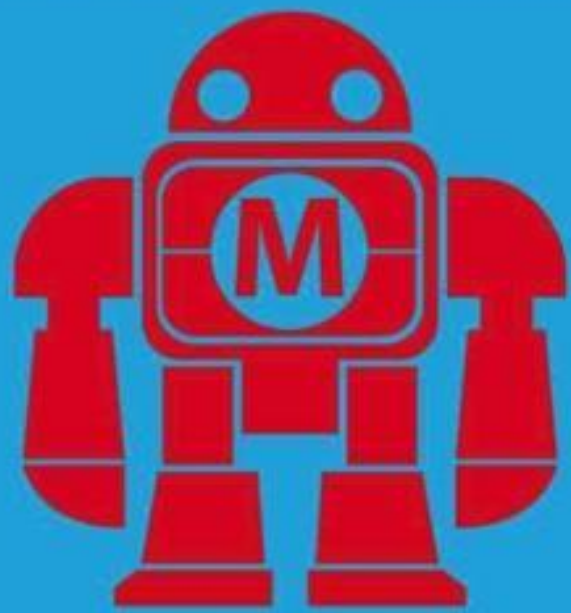

Make:
火星
自造計劃
加入DIY太空專案
Make:
格鬥・今際：
這機器人幾乎
要殺了我！
+34
Make:
一起玩火吧：丙烷入門指南
虛擬實境玩創意
Make:
Technology on your time
ROBOTS,
DRONES
Make:
升級你的
自造力
Make:
生物駭客
的瘋狂實驗
請勿在家嘗試


當機器人遇上開放原始碼：遙控捕蠅草 • 火星機器人 • 微型陽光探索機器人 • 迷你太陽能倉鼠球機器人
Make:
3D列印GoPro加農砲攝影機！
流言終結者
格蘭・今原：
這機器人幾乎要殺了我！
+34
動手做專題
FLORA NEO GEO定位手錶
氣動火箭滑翔機
窯烤烤爐
光刻金屬元件
CNC開放原始碼傢俱
國際中文版 Vol.15
MAKER MEDIA 歐林授化
www.makezine.com.tw


PROJECTS
氣動火箭滑翔機
Air Rocket Glider

Maker Faire Taipei 臺北創客嘉年華 10/26-27

AI
Robot
IoT
STEAM
Science
3D Printing
Dev Board
Makerspace
Digital
Manufacturing
VR
AR
MR
Dark Room
Art
DIY
Fabrication
Drone



TAIPEI.MAKERFAIRE.COM

2019 Greatest Show and Tell on Earth

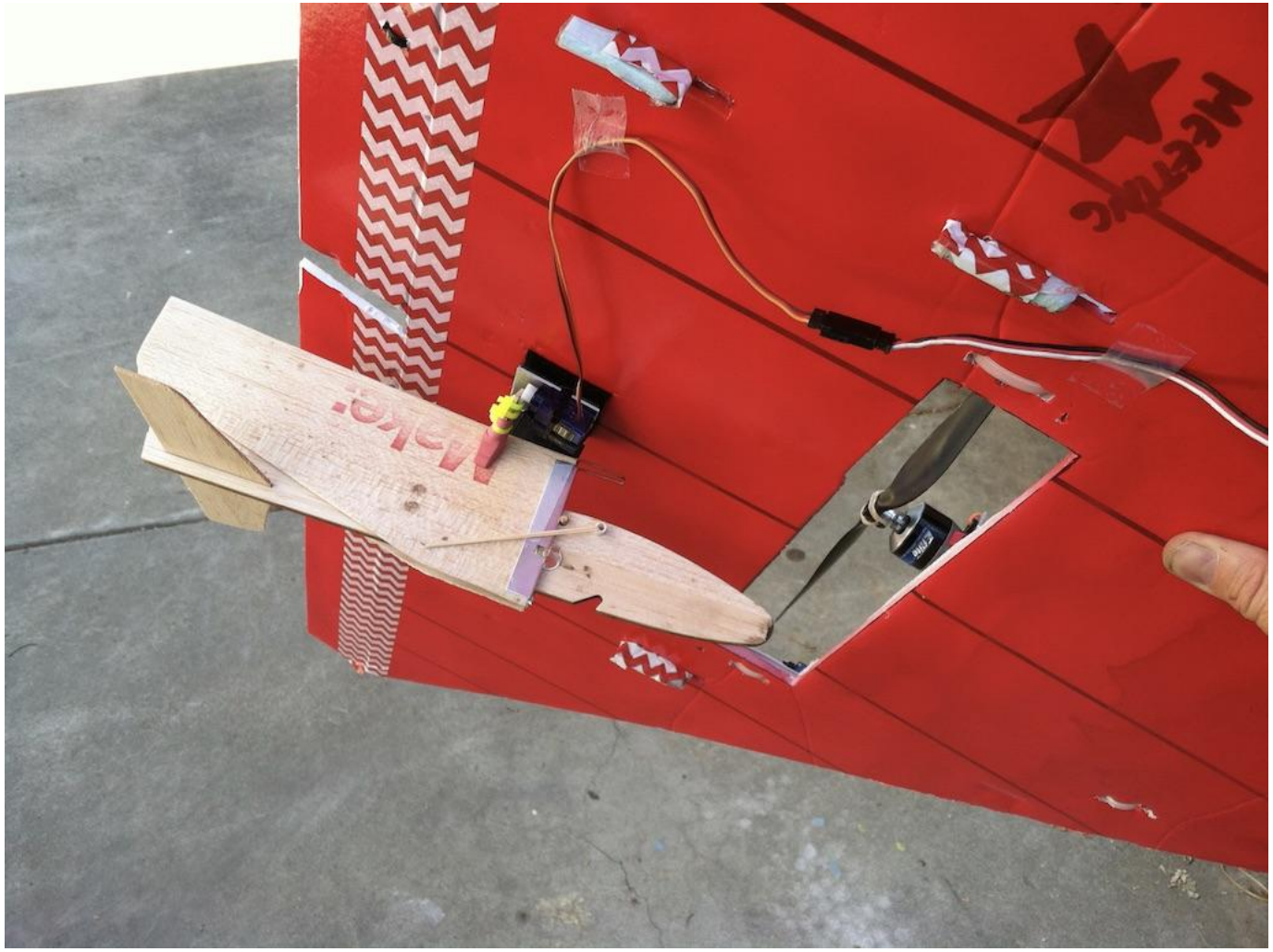
Maker Faire®

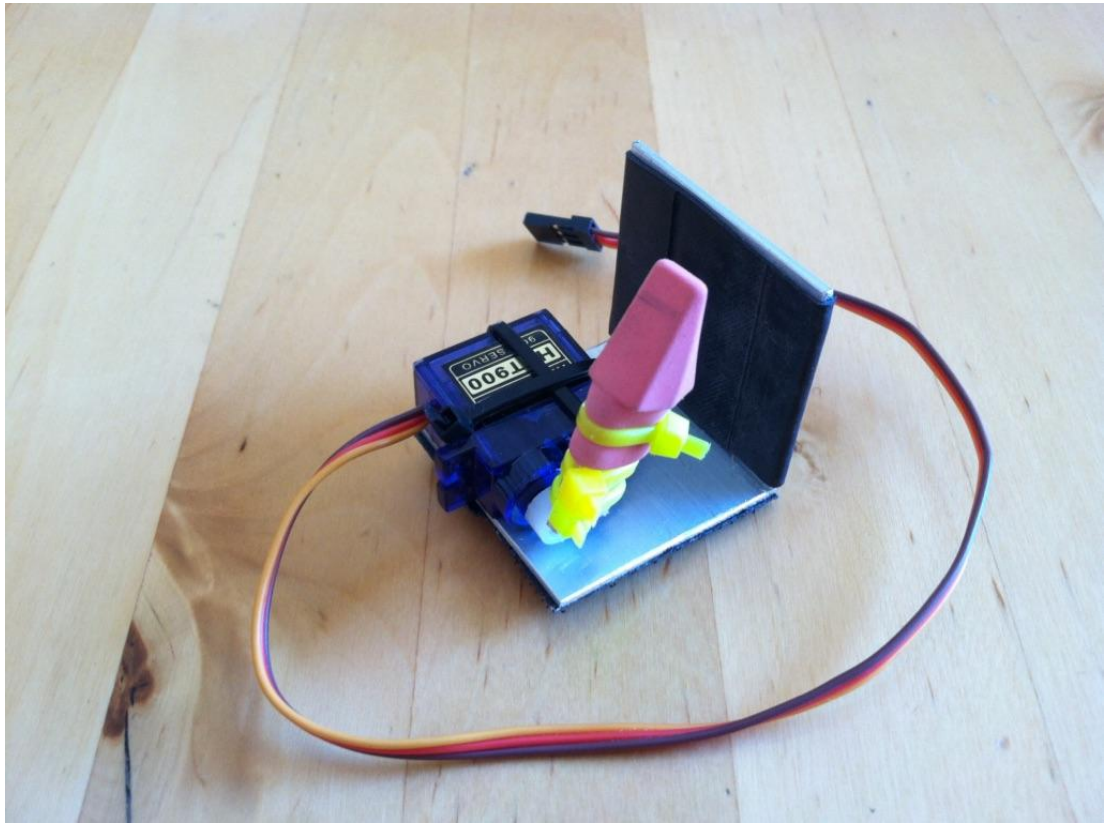
A place where makers share, collaborate and get inspired!

BAY AREA Maker Faire® MAY 18–20 2018

My current personal projects - Breck and the Towel

R/C Drop Mechanism





https://makezine.com/projects/rc-remote-drop-mechanism/

PROJECTS FROM MAKE: MAGAZINE

R/C Remote Drop Mechanism

Carry a toy (or pizza) high in the air and drop it from your R/C plane or copter!

By Rick Schertle Time Required: 1–3 Hours Difficulty: Moderate Print this Project

April 1, 2014, 4:00 pm PDT

PARTS | TOOLS

PARTS

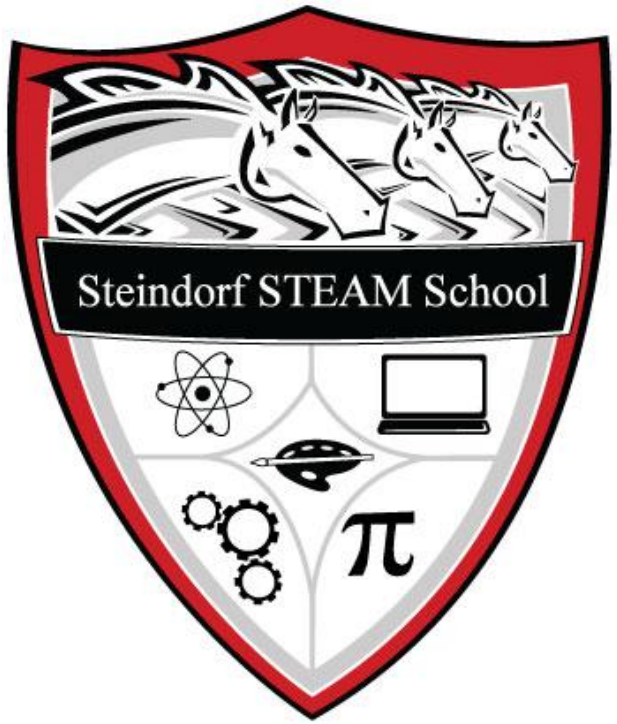
- Wooden craft stick, small aka popsicle stick
- Velcro tape, self-adhesive
- Zip ties, super thin: 8" (2)
- Zip ties, super thin: 4" (2)
- Old bike inner tube, road bike size You only need a 1½" "slice."
- Pencil cap eraser the kind that slips over the pencil top
- Servomotor, 9g such as Hobby King HXT900
- Servo extension cable, 12"–18" (optional) depending on your R/C aircraft
- Aluminum angle, 1½" legs, 1½" length

What happens on Monday when kids head back to school after being inspired at Maker Faire?

Maker Programs in Schools!

When my Maker World and Teacher World Collided!

- 23 years teaching middle school – US History, World History, Language Arts, Computers and Media Production (20 years at Price)
- 2016 started at Steindorf K-8 STEAM School in same district as Maker Lab Teacher!




A
HEALTH OFFICE

What I’m doing now in a Nutshell…

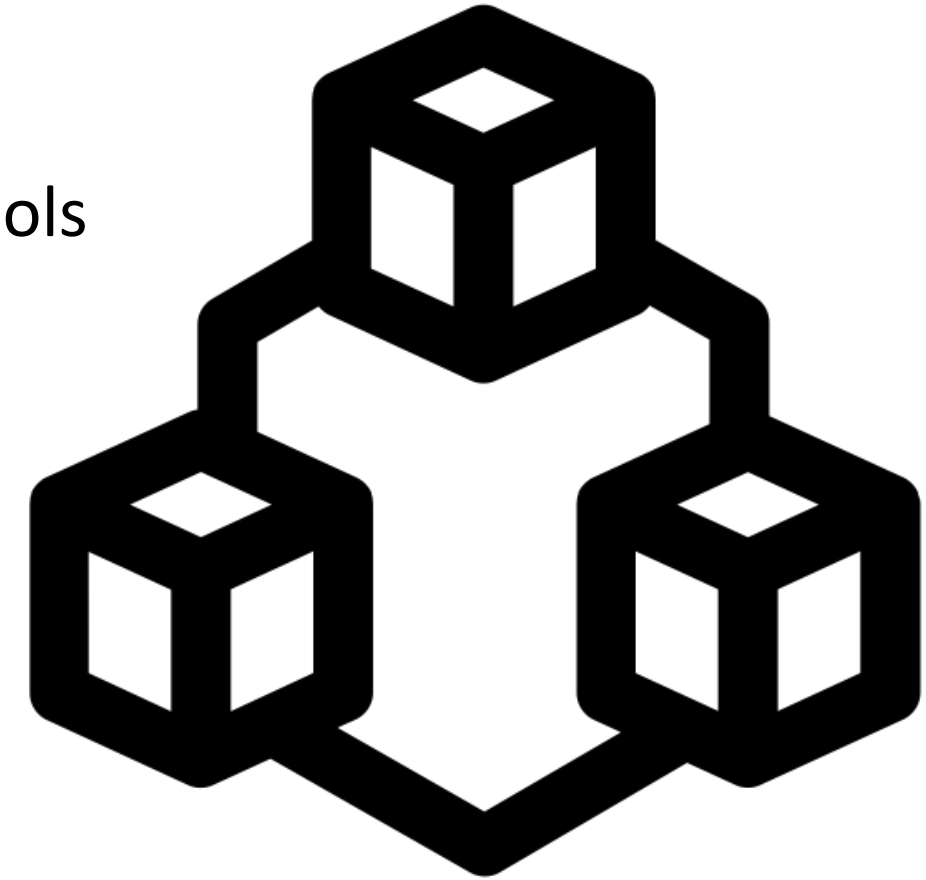
- 350 kids a week (12 classes)!
- One teacher – me ☺️
- Very small budget (public school)

Now, onto …

- Program
- The Space
- Tools
- Favorite Resources

Program

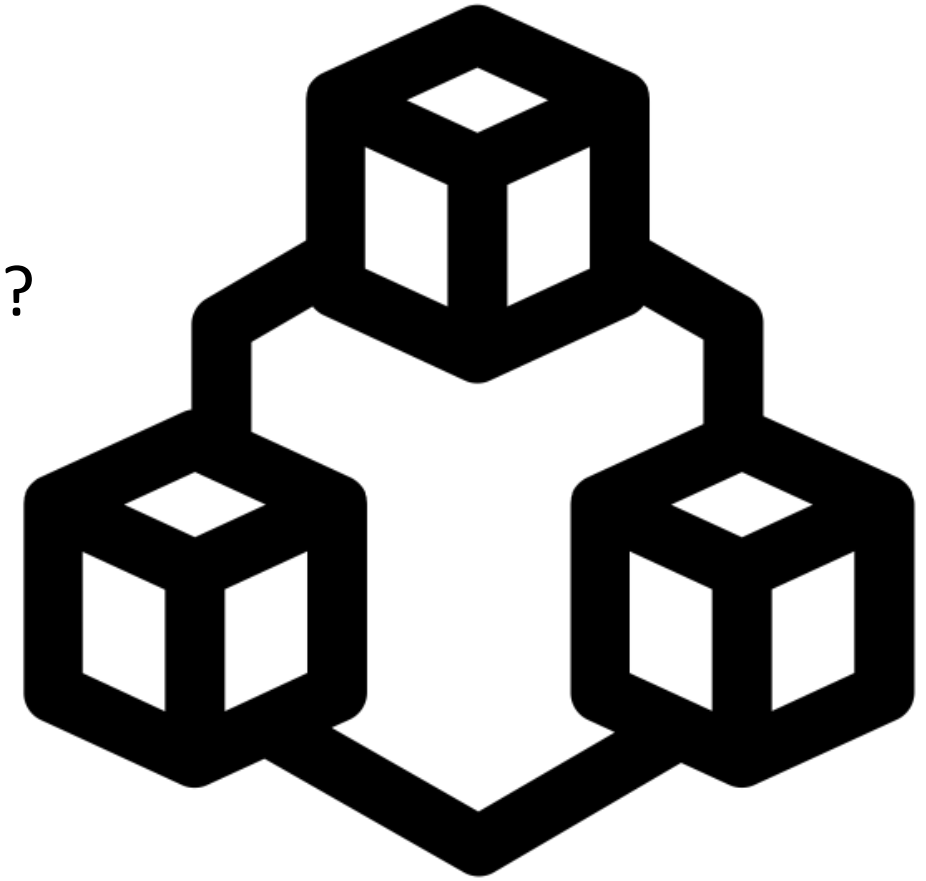
Program Determines your Space Needs and Tools



- There is more and more **RESEARCH** coming out on the value of Maker Education!
- I’m still learning! Building the boat while sailing it…

What does your program or proposed program look like?

- Full-time credentialed Maker Teachers?
- Maker Lab as an elective class?
- Led by classified staff with classes rotating in?



Models of Programming

- Programming of a Makerspace
  - Mobile Maker Carts
  - Rotating Stations within a Workshop
  - Scheduled Classes
- Currently at Steindorf I Teach…
  - **Middle School** (**twice** a week as part of their regular schedule – 100 minutes a week)
    - Two 6th grade
    - Two 7th grade
    - Two 8th grade
  - **K-5**
    - 3 - 5 – Once a week, individual classes
    - K-2 - Once a week, individual classes (taught by another teacher)

Mr. Schertle - MAKER SCHEDULE 2021-2022

A - 6 Blue	C - 7 Ruby	E - 8 Teal	
B - 6 Green	D - 7 Gold	F - 8 Purple	

********A-WEEK********

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
4th (8:35-9:20) Mat/Kann	4th (8:35-9:20) Ericson	D (8:30-9:55)	C (8:30-9:55)	ASSEMBLY
C (9:27-10:21)	5th (9:30-10:20) Foy	BRUNCH	BRUNCH	3rd (9:45 - 10:30) Giannini
BRUNCH	BRUNCH	3rd (10:30-11:15) Horn	PREP (3-8)	BRUNCH
B(10:38-11:32)	5th (10:50-11:35) Pickering	LUNCH	LUNCH	A (11:46-12:36)
F (11:35-12:29)	A (11:35-12:29)	B (12:20-1:45)	F (12:20-1:45)	LUNCH
LUNCH	LUNCH	STAFF MEETING	INNOVATION HOUR	E (1:17-2:07)
(D) 1:09-2:03	E (1:09-2:03)			PREP (6-8)
PREP (6-8)	PREP (6-8)			

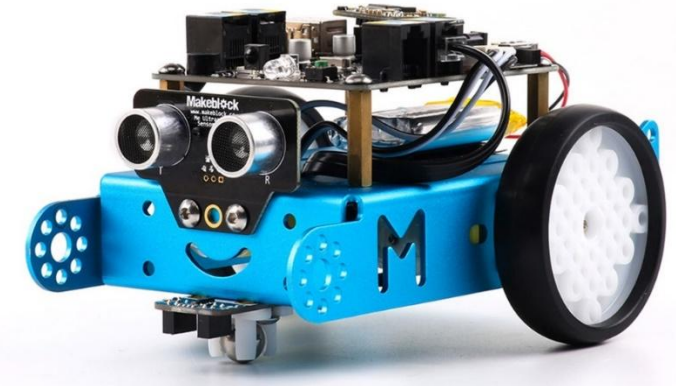
********B-WEEK********

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
4th (8:35-9:20) Mat/Kann	4th (8:35-9:20) Ericson	E (8:30-9:55)	PREP (3-8)	ASSEMBLY
5th (9:30-10:20) Foy	C (9:27-10:21)	BRUNCH	BRUNCH	C (9:46-10:36)
BRUNCH	BRUNCH	3rd (10:30-11:15) Horn	3rd (11:15-12:00) Giannini	BRUNCH
5th(10:50-11:35) Pickering	B (10:38-11:32)	LUNCH	LUNCH	B (10:53-11:43)
A (11:35-12:29)	F (11:35-12:29)	STAFF MEETING	A (12:20-1:45)	F (11:46-12:36)
LUNCH	LUNCH		INNOVATION HOUR	LUNCH
E (1:09-2:03)	(D) 1:09-2:03			D (1:17-2:07)
PREP (6-8)	PREP (6-8)			PREP (6-8)

Updated 8-23-21

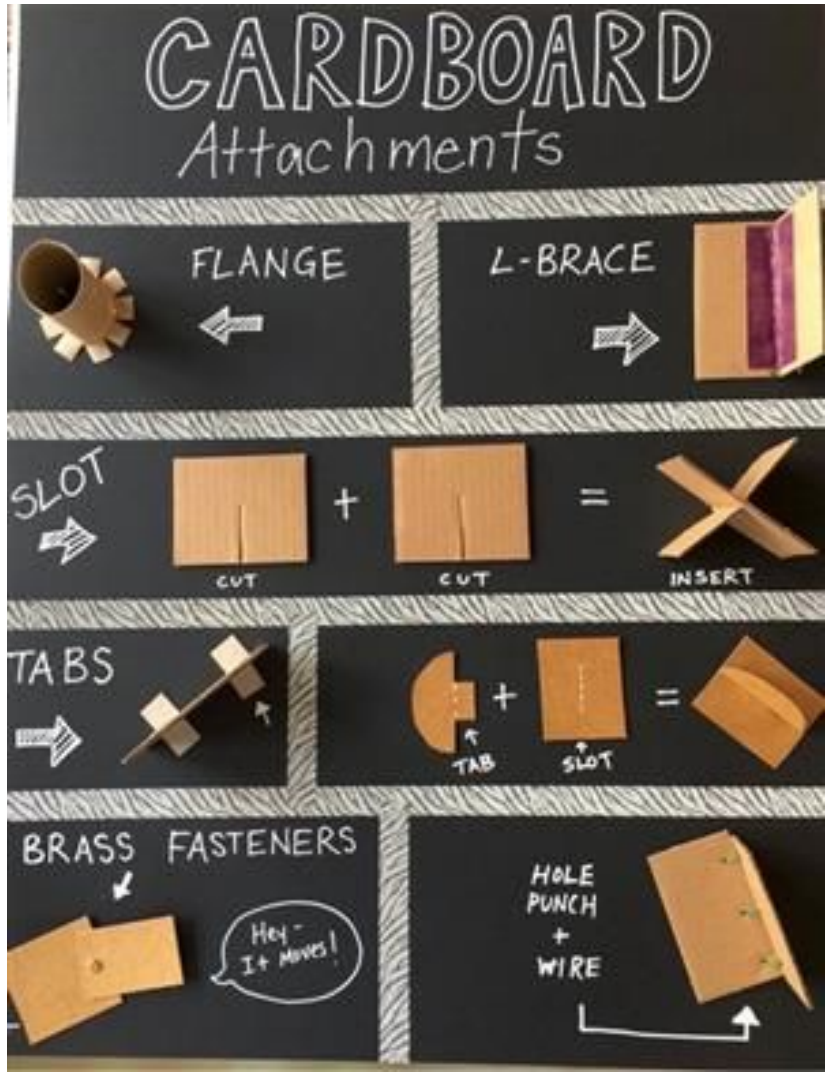
Maker Lab – Current Middle School Program

- Balancing teaching skills, working on projects to practice skills, kid-chosen projects and supporting PBL's
- Core Projects – 4th and 5th Grade
  - 4th Grade
    - Circuits
    - Woodworking and other hand tools
  - 5th Grade
    - Makey Makey
    - Woodworking and Power Tools
- Core Projects – To Start (for all middle schoolers)
  - 6th Grade
    - Micro:Bits – Laser Cutting & 3D Printing
  - 7th Grade
    - mBots (Robot Petting Zoo) -
  - 8th Grade
    - VEX Robotics
    - Passion Projects



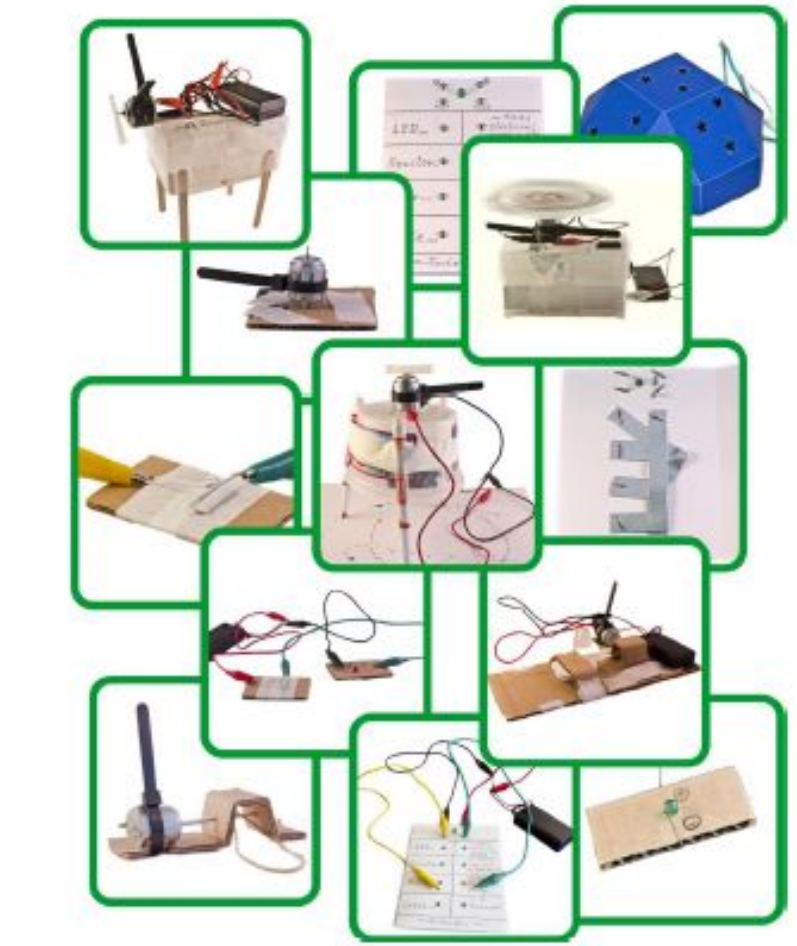
3rd Grade

- Cardboard Attachments
- Simple Circuits
- Tinkering



4th Grade

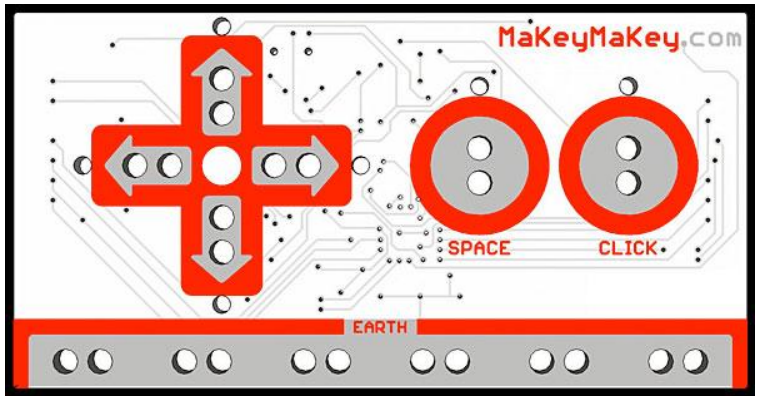
- Analog Circuits
  - Tinkering Kits - Guide
  - Scribble Bots
  - Steadiness Circuits
  - Operation Style Game
- Clamping and Hand Cutting Wood - Other Power Tools
- Intro to Microcontrollers
- Embroidery



Booklet Version 1.0

5th Grade

- Scroll Saw Initials and Other Power Tools
- Makey Makey Projects with Scratch
- Machine Sewing

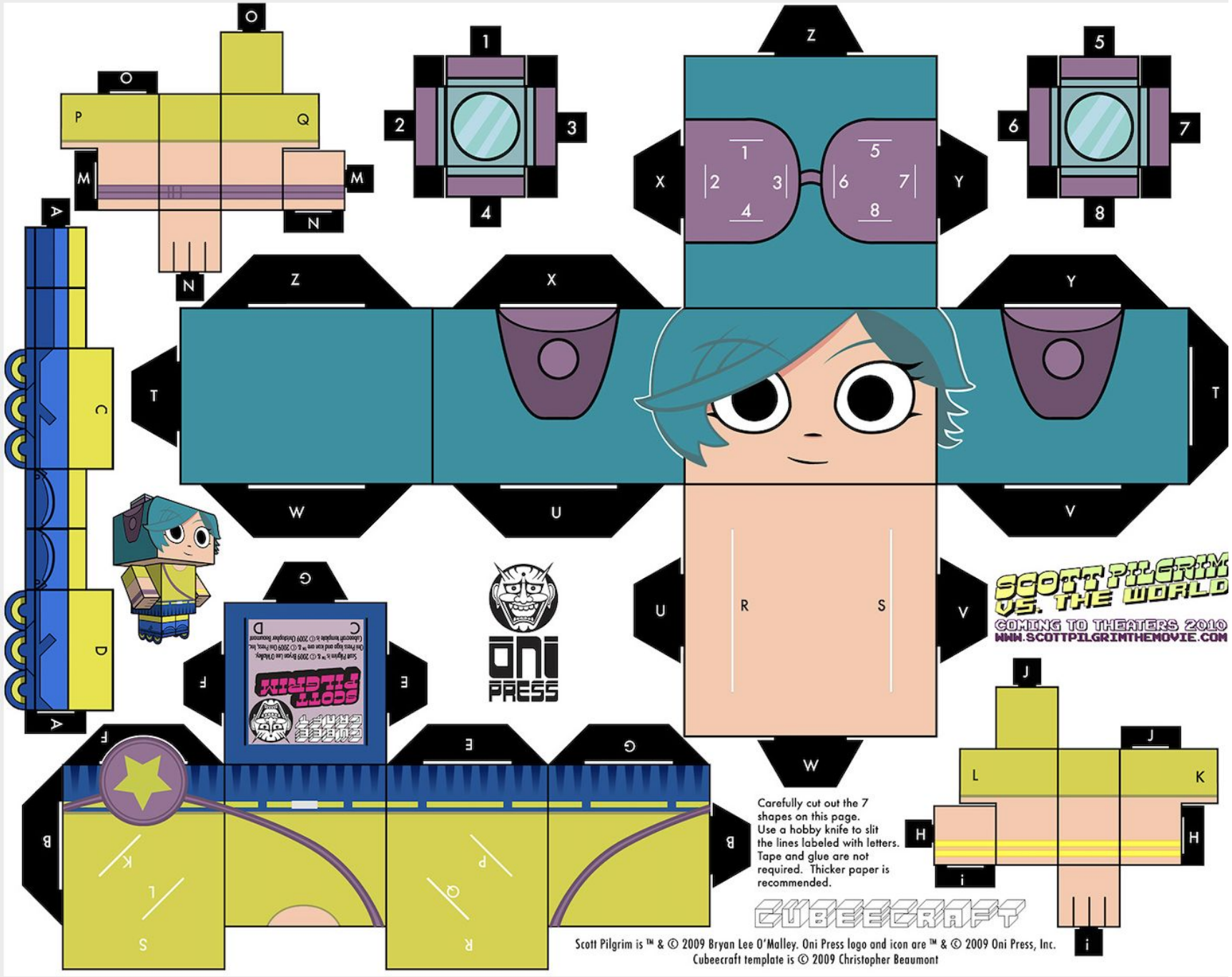


6th Grade

- Micro:Bits and Make Code
  - Micro Pet Projects
  - Fidget Cube
- :MOVE Mini Buggy Kit for Micro:Bit
- Laser Cutting - 3 Levels of Projects
- 3D Printing - Connected Linkages
- Paper Engineering


UNIX
JAVA
PRIMER PLUS
PERL 5
PHP
LOVE

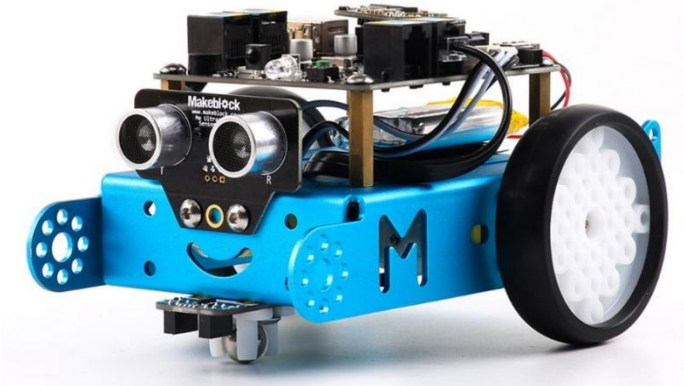

C++
EMBEDDED
INTERNET DESIGN
PRIMER
PLUS
PHP
LOVE



cubeecraft.com

7th Grade

- Robotics with Sensors
  - mBots
  - Robot Petting Zoo
- CardBoard Automata
- Cardboard Engineering



CARDBOARD AUTOMATA

Cardboard automata is a type of mechanical sculpture made of simple materials that lets you bring stories to life. As you build you can explore simple machine elements such as cams, levers, and linkages in a playful way. Making this version of automata lets you quickly get started in building functional mechanisms as your mechanical sculpture ideas develop.

TRY IT!

Gather these materials for building your automata

Small cardboard box (approximately 6" x 6")

Thick foamie sheet - 6mm thick craft foamies for the cams and cam followers

Skewer sticks

Paper drinking straw

Masking tape

Scissors

Hot glue gun and glue stick

Washers and nuts (for weight)

Sharpened pencil

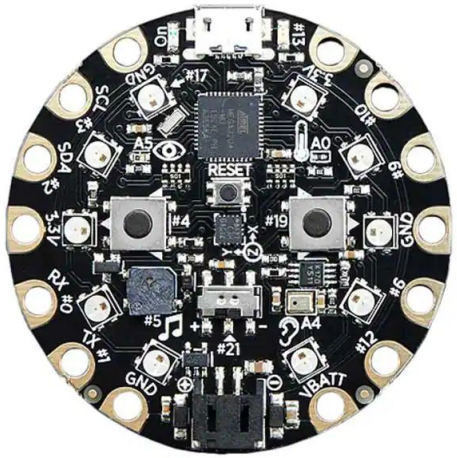
Nail or wood screw
(for poking holes in the cardboard)

the tinkering studio

exploratorium

8th Grade

- VEX Robotics
- Playground Circuit Express with Make Code
- Battle Bots - R/C
- Projects of Choice
- Three-String Guitar
- Aero Engineering - Dragonfly Heli, Rockets, and Drones



Maker Lab – Program (woven in)

- Woodworking
  - Hand tools – Measuring, Clamping and Cutting
  - Power tools - drill press, sander, scroll saw, power drill
  - Design and Fabrication – Software and Hardware
    - Tinker CAD (for .STL files) – 3D Printer
    - Inkscape (for vector files) – Laser Cutter
    - Easel - CNC Router – Heavy Duty Wood Cutting
    - Cameo Silhouette – Paper Cutting

Project Guides (Direction Following and Workflow)

MAKER CLASS

LASER CUTTER

PROJECT GUIDE

PROJECT GUIDE

MY SYMBOL

Create a symbol that represents you. Choose a shape from a library of shapes. Use the laser cutter software to adjust your shape and cut the shape out using the laser cutter. Then, add your name and decorate to create a symbol that is uniquely yours.

MATERIALS

Cardboard
Paint, Pens, Other Decorating Materials

EQUIPMENT

Laser Cutter

SOFTWARE

RetinaEngrave3D

PROCESS STEPS

Choose Your Shape

Adjust Shape in Software

Laser Cut the Shape

Decorate Your Shape

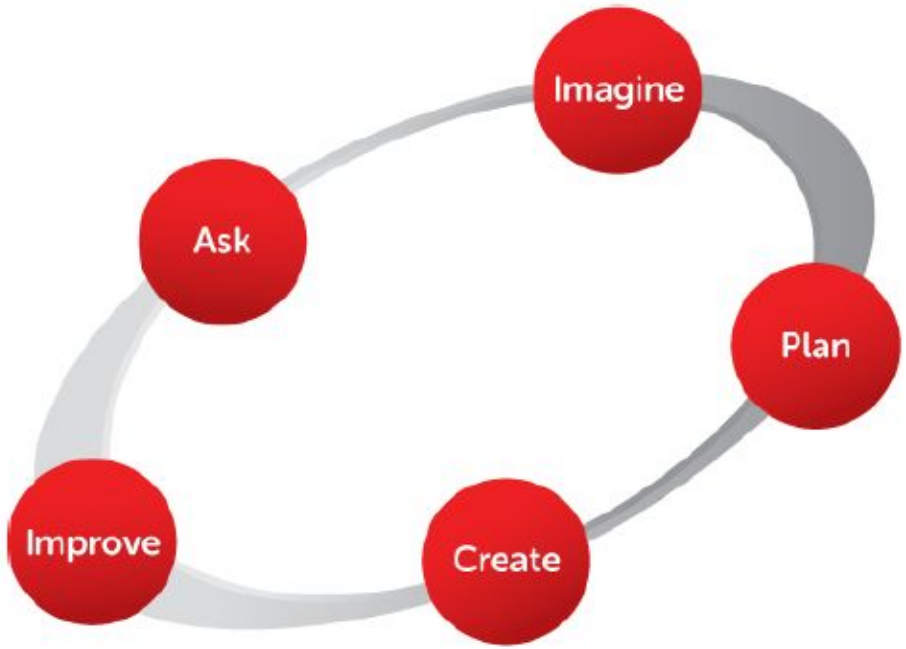
Maker Lab – Middle School (future)

- Electronics
  - IoT (Particle Chip)
- Quads and Fixed Wing
  - Pizza Box Airplanes
  - UAV's
  - Game of Drones
- Electric Go Carts
  - Power Racing Series
- Advanced Robotics and Automation (PLTW)
  - Vex EDR (building on 5th grade, VEX IQ)
- More CHOICES!

POWER RACING SERIES

The Engineering Design Process

*To solve engineering problems, engineers follow a series of steps called the "**Engineering Design Process**"*



ASK: *What is the problem? How have others approached it? What are your constraints?*

IMAGINE: *What are some solutions? Brainstorm ideas. Choose the best one.*

PLAN: *Draw a diagram. Make lists of materials you will need.*

CREATE: *Follow your plan and create something. Test it out!*

IMPROVE: *What works? What doesn't? What could work better? Modify your designs to make it better. Test it out!*

More details at: www.eie.org/eie-curriculum/engineering-design-process

Chorus: (To the tune of "Farmer in the Dell")	**Suggested full body movements:**
We are engineers. We are engineers! We can solve problems because We are engineers!	(one thumb in to chest) (second thumb in to chest) (march in place) (both thumbs in to chest)
Verse: (follow along using poster)	**Suggested full body movements:**
First we Explore, Then we Create, Improve to make it better 'Cause engineers are great!	(look through pretend magnifying glass) (wave hands in front of body) (wiggle fingers high over head) (march in place then jump!)

Kinder : Maker & NGSS- Eng Design 2021-2022

Approx Dates	Plan PBL and/or Science/SS Unit	Activities / Deliverables	New or Repeat
Trimester 1	Social Science /PBL Unit Tools for Community Helpers- needs K and Maker input	Make Tools in Maker Lab	Repeat
	Earth Science Unit How to clean a pond? - needs Maker input/detail	Building pond trash collectors EIE	New
Trimester 2	Physical Science Unit How can we keep Penny the dog cool?	Research different materials and build Penny a shelter. - EIE	Repeat
	Earth Science, Life Science Units Water catchers - K and Maker need to review this as it's just sketched out	Build water collection/distribution devices to support plants during drought	New
Trimester 3	Physical Science Unit Let's solve problems in a potato chip factory	Build Simple Machines- EiE	New

First Grade: Maker & NGSS- Eng Design 2021-2022

Approx Dates	Plan PBL and/or Science/SS Unit	Activities / Deliverables	New or Repeat
Trimester 1	Social Science/PBL Unit Growth Mindset - NEEDS DISCUSSION/DECISION b/w Maker and Grade level	Geo/peg boards with thick and thin string or rubber bands to show strong and “not yet” connections	repeat
Trimester 2	Physical Science Unit Light Energy	Make device for communicating over distance	repeat
	Physical Science Unit Sound Energy	Make instruments (den den daiko, rubber band harmonicas)	new?
Trimester 3	Technology at work - past, present, and future - NEEDS DISCUSSION/DECISION b/w Maker and Grade level	Explore phones, computers, etc. Create something that solves a problem	new

Second Grade: Maker & NGSS- Eng Design 2021-2022

Approx Dates	Plan PBL and/or Science/SS Unit	Activities / Deliverables	New or Repeat
Trimester 1	Physical Science & Life Science Units Packaging Design	Design of Packages to support plants during transportation - EIE	New
	Life Science Unit Hand Pollinators	Build a model of a pollination system - EIE	New
Trimester 2 Maybe an Earth Science activity here?	Life Science Unit Monarch Migration-needs Maker Summary/Details	Seed dispersal drone drop, butterfly garden info. Signs - Original..	Repeat
	Earth Science Unit Land Formation Protections NEEDS Maker Input and DISCUSSION/DECISION b/w Maker and Grade level	Build devices to protect landforms from sliding as a result of environmental forces (earthquakes, rainstorms, other) - Proposed. Needs development	New
Trimester 3	ELA PBL Fairy Tale & Fables needs Maker Summary/Details	Mini golf course - Original	New

Third Grade: Maker & NGSS- Eng Design 2021-2022

Approx Dates	Plan PBL and/or Science/SS Unit	Activities / Deliverables	New or Repeat
Trimester 1	Social Science Unit/PBL Local History: Pioneers, Ohlone, Spaniards, Farmers		Repeat
	Physical Science Unit Which Bridge Still Stands?	Building/Testing Different Bridges - EIE	New
Trimester 2	Earth Science Unit Severe Weather needs Maker input		Repeat
	Earth and Life Science Units Drought pollutes our water!	Designing water filters - EIE	New
Trimester 3	Physical Science Unit Magnetic and Electromagnetic Forces		New
	Physical Science Unit Windy Tower Challenge	Structural Engineers Prepare for natural hazards - Dream Big ** Note this duplicates Bridge-Building project from a Standards Perspective and should precede MagLev project, IMHO	New

Fourth Grade: Maker & NGSS- Eng Design 2021-2022

Approx Dates	Plan PBL and/or Science/SS Unit	Activities / Deliverables	New or Repeat
Trimester 1	Earth Science Unit Landforms Change Over Time	Evaluating Landscapes , Tarpul Design EIE	New
Trimester 2	Physical Science Unit Energy - Circuits	Build complete circuits (Circuits engineering unit) EIE	New
	Physical Science Unit Energy - Wind Power Generators - needs Maker Detail/Summary	Build Mini-windmill generators, Exploratorium, EIE, Dream Big	New
Trimester 3	Life and Physical Science Unit Codes of Communication needs Maker Details	Design and develop device for communicating patterns/codes (Morse Code)	New

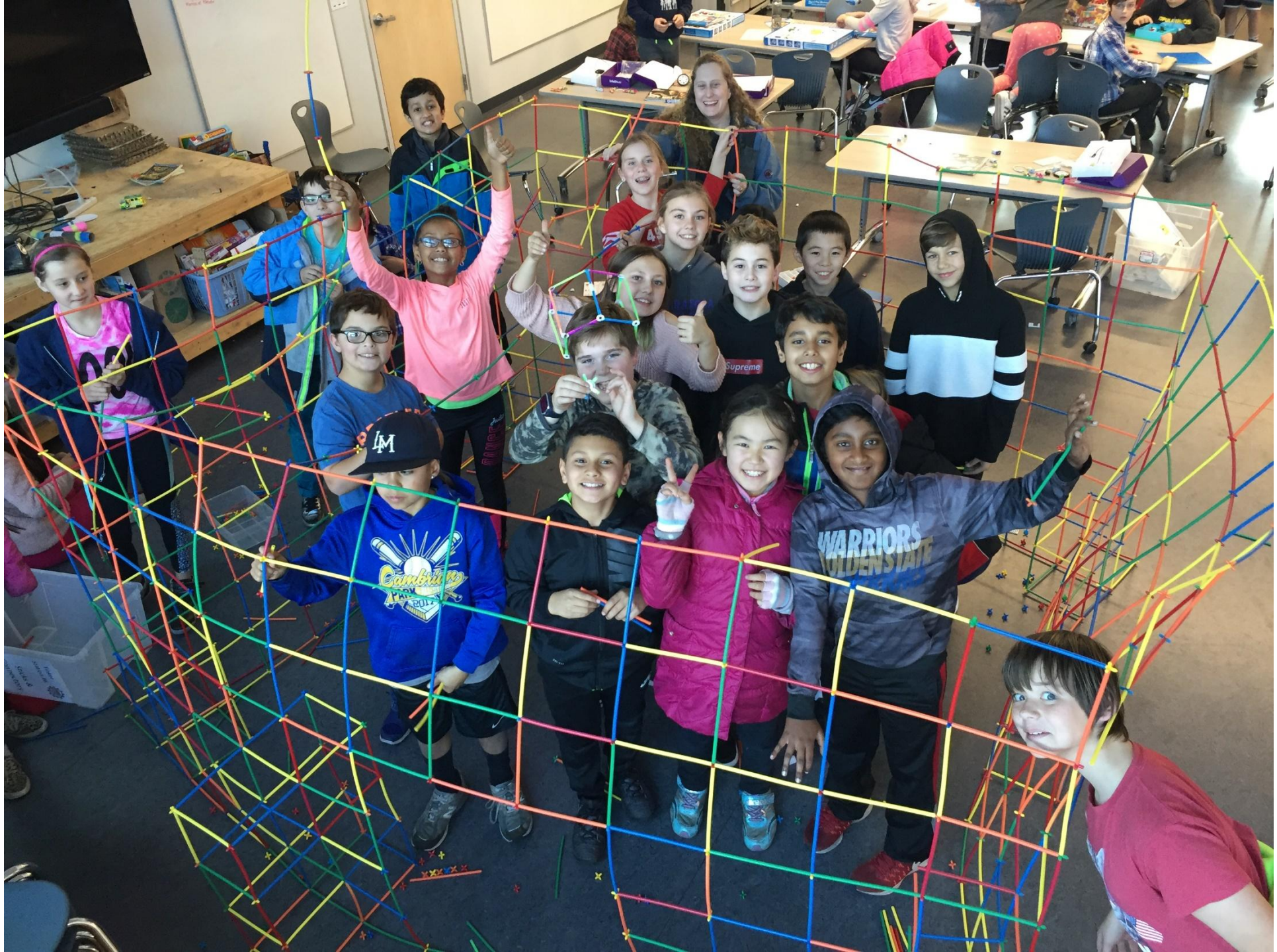
Fifth Grade: Maker & NGSS- Eng Design 2021-2022

Approx Dates	Plan PBL and/or Science/SS Unit	Activities / Deliverables	New or Repeat
Trimester 1	Social Science Unit/ PBL? Who are we in our community? - needs Grade Level input on tree project		repeat
	Social Science Unit/PBL How can learning about our past help us make decisions about the future? -		repeat
Trimester 2	Physical Science Unit What a drag!		New
	Physical Science Unit Have a Blast! (It matters) - needs GradeLevel input/consideration	Mixtures and Explosions	New
Trimester 3	Life Science Unit Ecosystem Engineers - Take out the Trash, River Cleaners Physical Science Unit Hot stuff! - Solar Energy	Designing/Improving Solar Ovens	New New

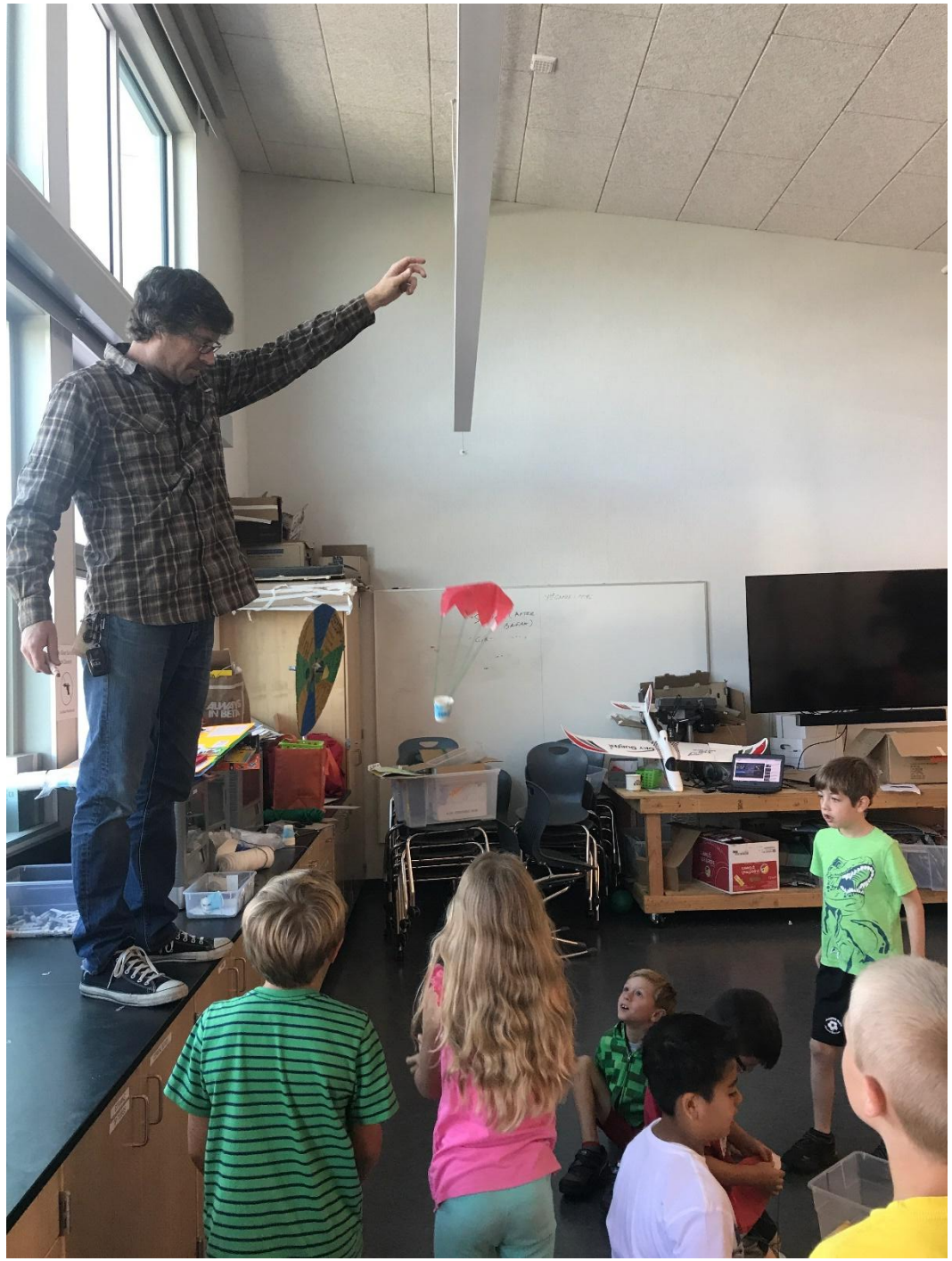

EXIT


littleBits.cc
littleBits.cc
littleBits


GAP
Jumbo
Clear Straws


Supreme
WARRIORS
GOLDEN STATE

PBL Support for K-8



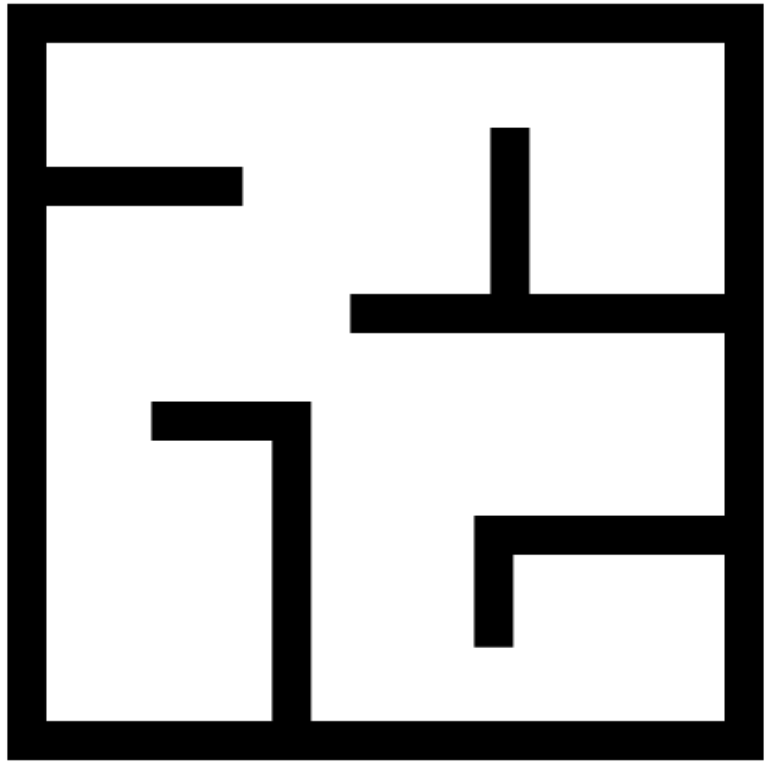

GOLDEN STATE
WARRIORS


Wall
T IS FOR TINKERING
Maker Camp
Maker Lab
Scholastic Book Fairs

The Space

- A look at some different spaces both big and small…

Video Tour



“Maker Corner” in my Old Classroom

Bourn Idea Lab @ Castilleja School

http://www.castilleja.org/bournidealab

FabLab@School

Transformative Learning Technologies Lab
Stanford University

tltl.stanford.edu

Angi Chau, Ph.D.

achau@castilleja.org / @angichau

Director of Bourn Idea Lab

Engineering Faculty, Robotics Advisor


nysci
Maker
Space


1,200 sq. ft.

Makin' It Mobile

4 locations

40 projects

56 students

Ages 8-15

15 weeks

Kristan Hutchison
Makin' It Club Manager

Imagination Unlimited

www.imagination4kids.com

San Jose, CA

(custom 14’ x 16’ CNC workshop)

washington
maker
workshop

Raise a CNC’ed Maker Space Shed

DIY build in Make: 40

What my classroom first looked like…

Over 3000 sq. ft. double -wide classroom


EXIT


EXIT
THANK YOU WONDERFUL
STEINDORF FAMILIES!


EXIT
Tool Wall

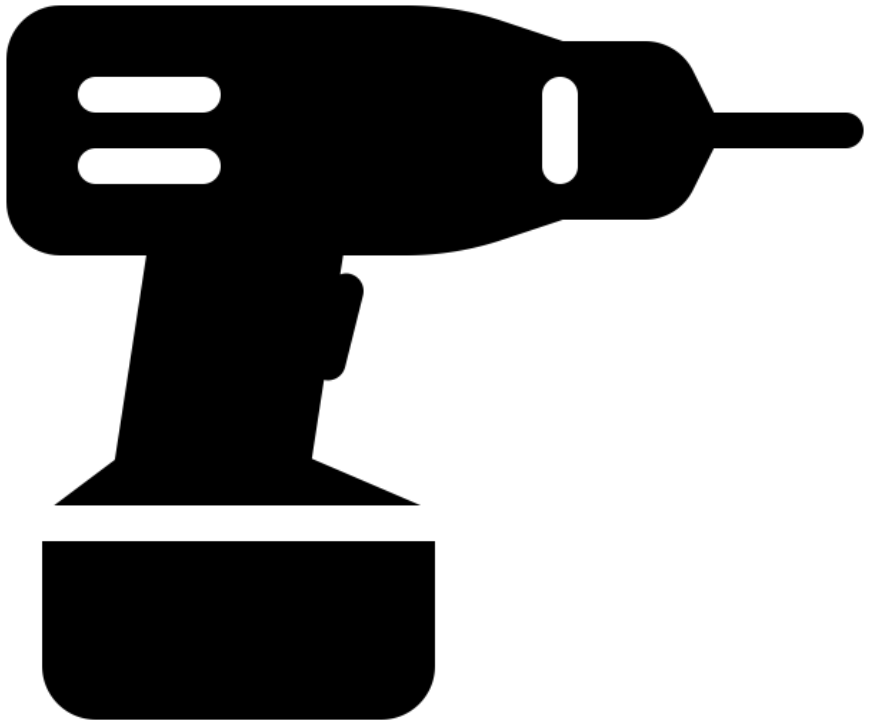
Commercial Mobile Maker Carts

DIY Mobile Maker Carts

Lendy’s Custom DIY Cart

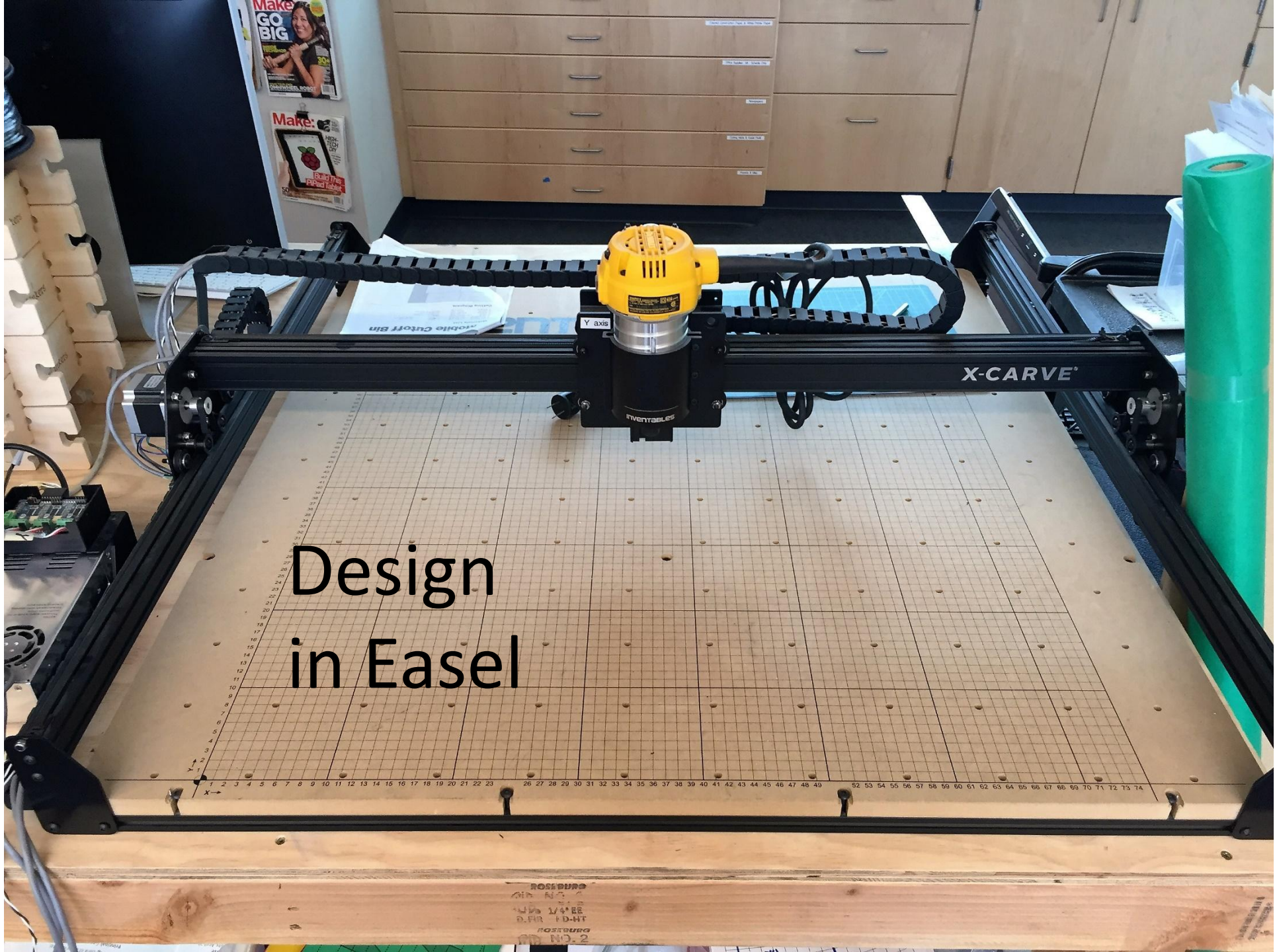
My $150 Huge Workbench

It never goes exactly as planned...



Tools

Tools


Make
GO BIG
Make:
Y axis
X-CARVE
inventables
Design
in Easel

Design in TinkerCAD


Design in
Inkscape
Full Spectrum
LASER
CAUTION

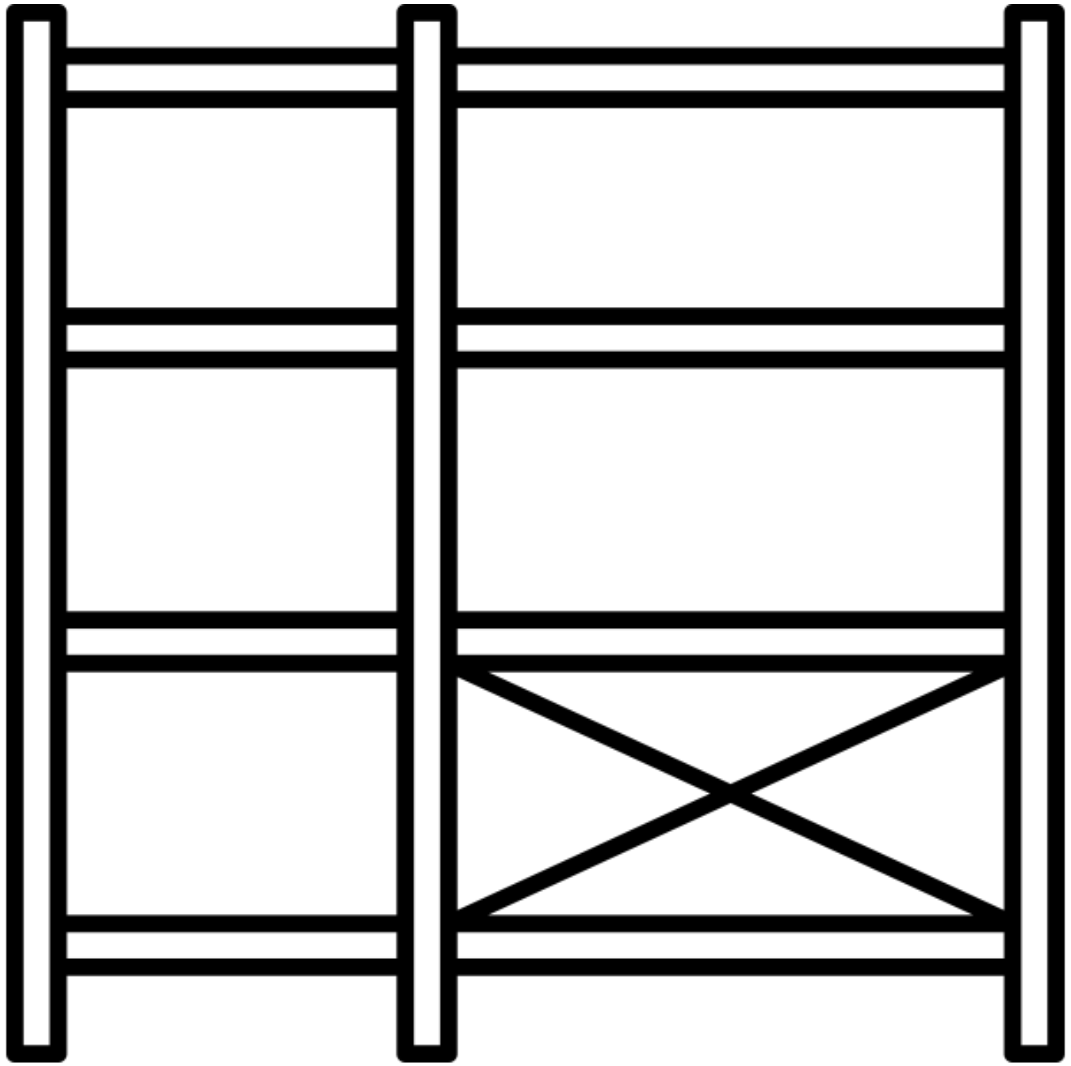

MONT/ROSE
FILA
DEWALT


CAUTION


Tool Wall
RAGE
Scholastic Book Fairs
HUSKY
RYOBI

Favorite Low-Tech Tools

Favorite Low-Tech Materials



Storage


Four Cheese
Good Miniature Golf website
•coolcrestgolf.com
•space-golf.com
-Steindolf strong
Box (lazer cut)
CRAFT SUPPLIES
WOOD STICKS
CRAFT STICK
STRAWS
TUBES
Red Berries


totes
HUNTER
6" GREEN
6" RED
6" BLUE
Tool Wall
STORAGE

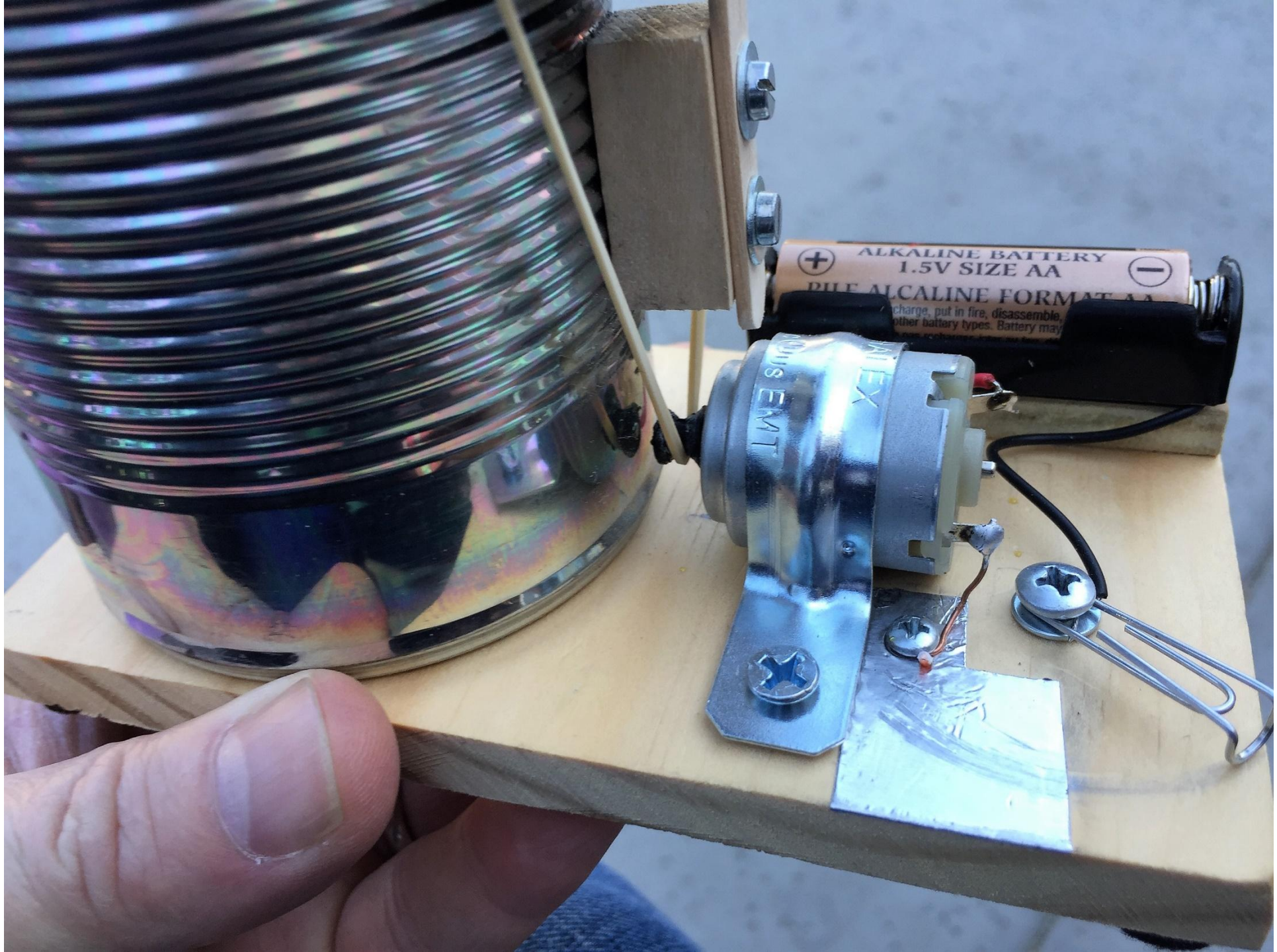

FOY
MASSUDA
8 PURPLE
8 PURPLE
8 PURPLE
8 TEAL
8 TEAL
8 TEAL
6 GREEN
6 GREEN
6 GREEN
6 BLUE
6 BLUE
6 BLUE
7 GOLD
7 GOLD
7 GOLD
7 RUBY
7 RUBY
7 RUBY
PLUMBING


In Action!

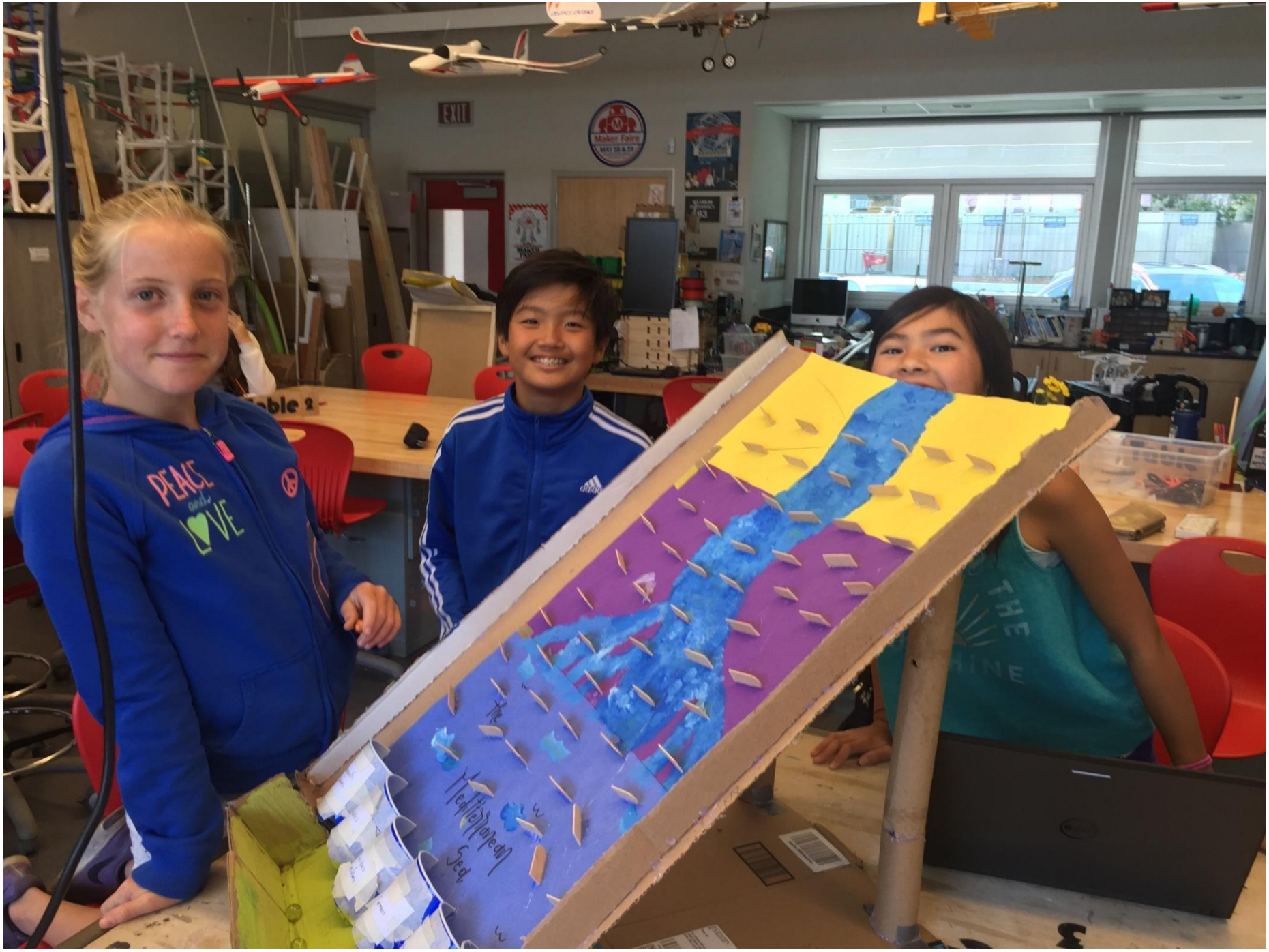

EXIT
Tool Wall


FUTURE FLIGHT CREW
UNIVERSITY OF UTAH
HEALTH CARE


TENNIS BALL LAUNCHER


ALKALINE BATTERY
1.5V SIZE AA


CENTRAL MACHINERY
Making & Science
NO EXCUSES


EXIT
Maker Faire
PEACE
LOVE

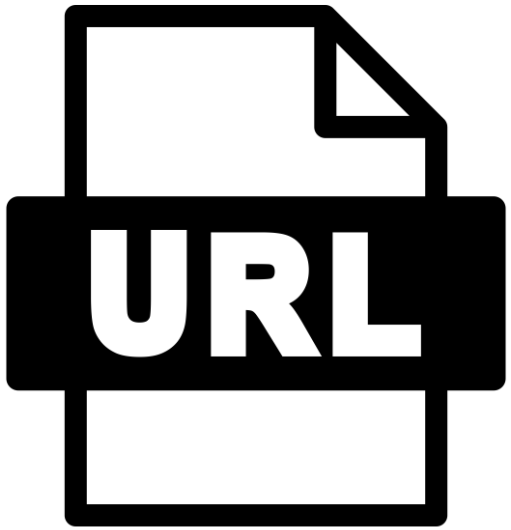

PaperRollerCoasters.com
USA


ZOINKS!

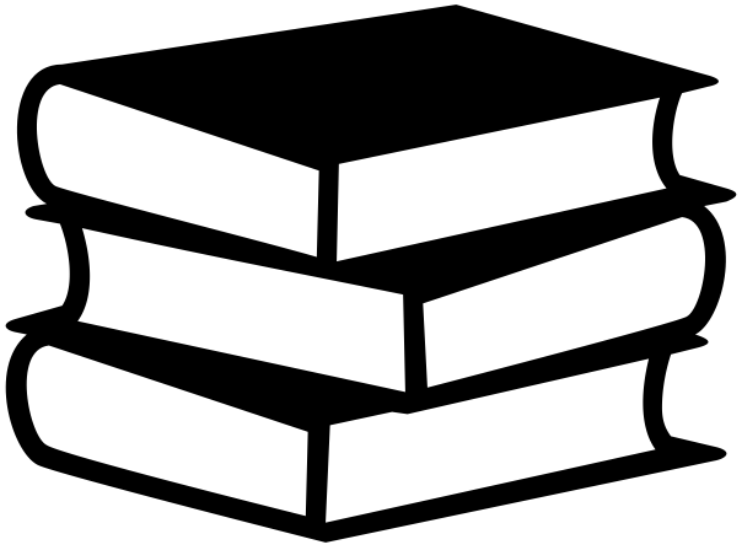

SNOOPY
7


littleBits
HUSKY
NASA


INAUGURAL YEAR
EST. 2016
STEAM SCHOOL



Resources & Management



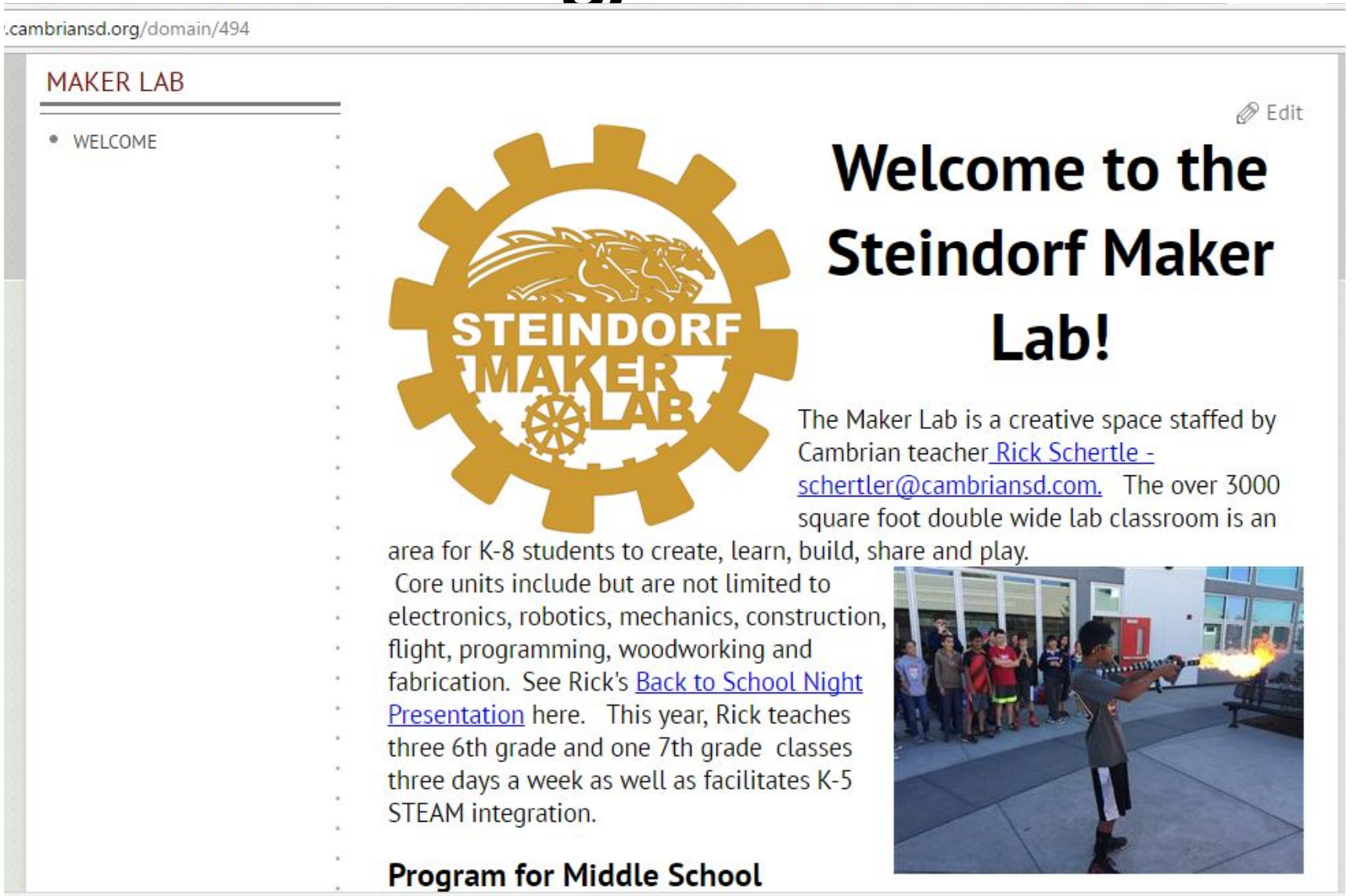
Managing Resources

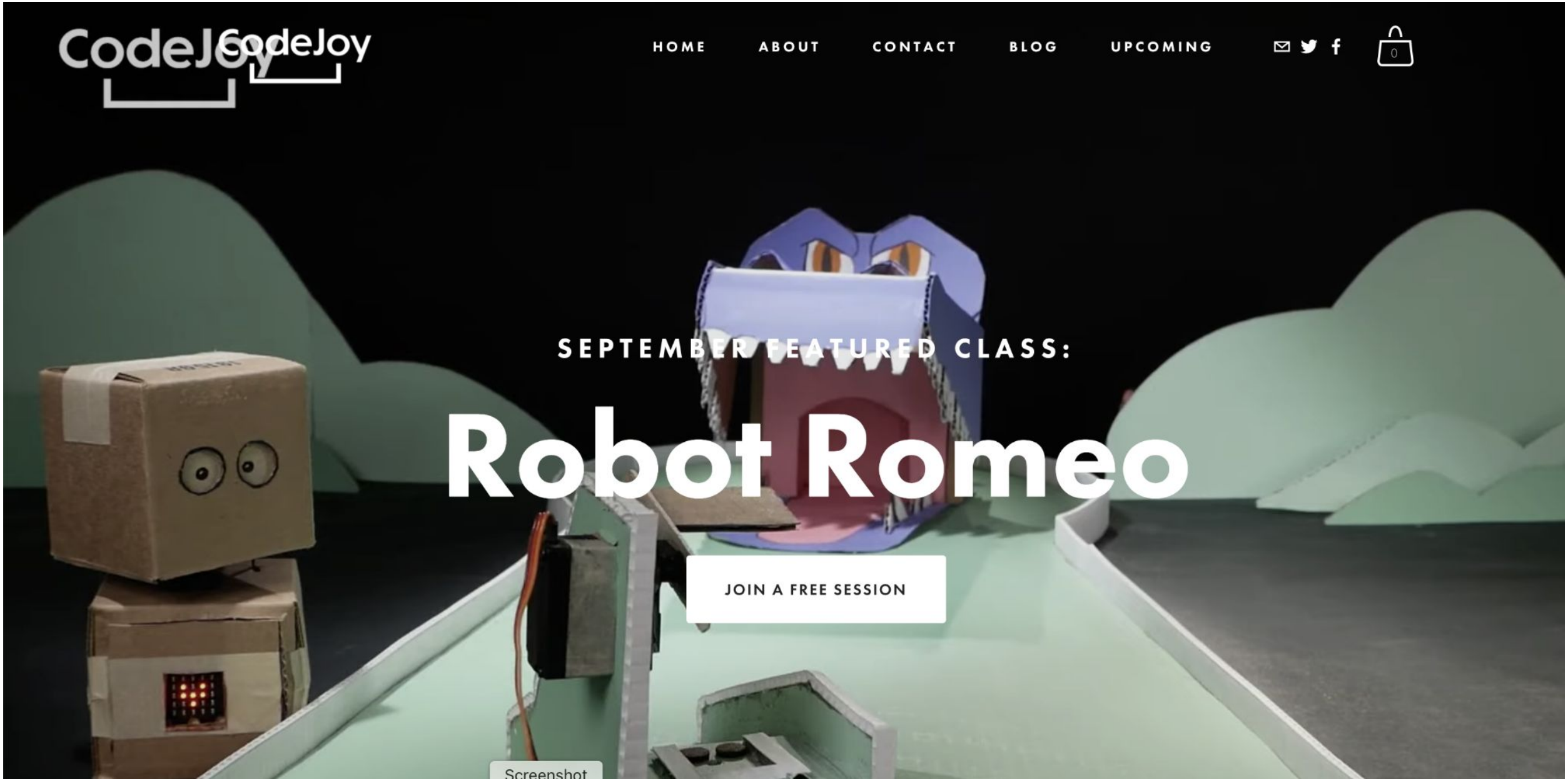
Jobs

Maker Lab Jobs – Week of _____

Class	Clean-Up	Laptops	Materials/Tools
A – 6 Blue			
B – 6 Green			
C – 7 Teal			
D – 7 Yellow			
E – 8 Red			
F – 8 White			
G – 8 Purple			

Web Resources:
www.cambriansd.org/makerlab




CodeJoy
CodeJoy
HOME
ABOUT
CONTACT
BLOG
UPCOMING
0
SEPTEMBER FEATURED CLASS:
Robot Romeo
JOIN A FREE SESSION
Screenshot

https://www.curiositymachine.org/challenges/

CURIOSITY MACHINE

AI Family Challenge | All Challenges | About Us | schertle

Challenges

Categories

- All Challenges
- Family Challenge
- Inspired by BOEING
- Artificial Intelligence
- Aerospace
- Art of Science

All Design Challenges

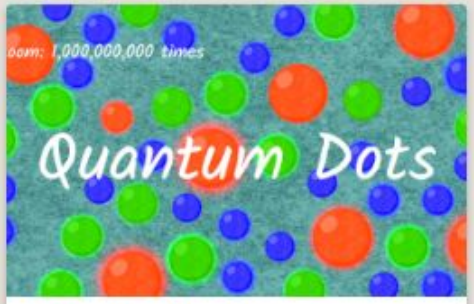
1 2 3 4 5 6 7 8 9

Make a Nanostamp

Create a stamp to reproduce a drawing from a meter away quickly and accurately.

Build a Nanopipe

Create a tube that can separate different objects based on how you you build the walls.



Make Identical Quantum Dots

Make spheres that are all the same size.

Help

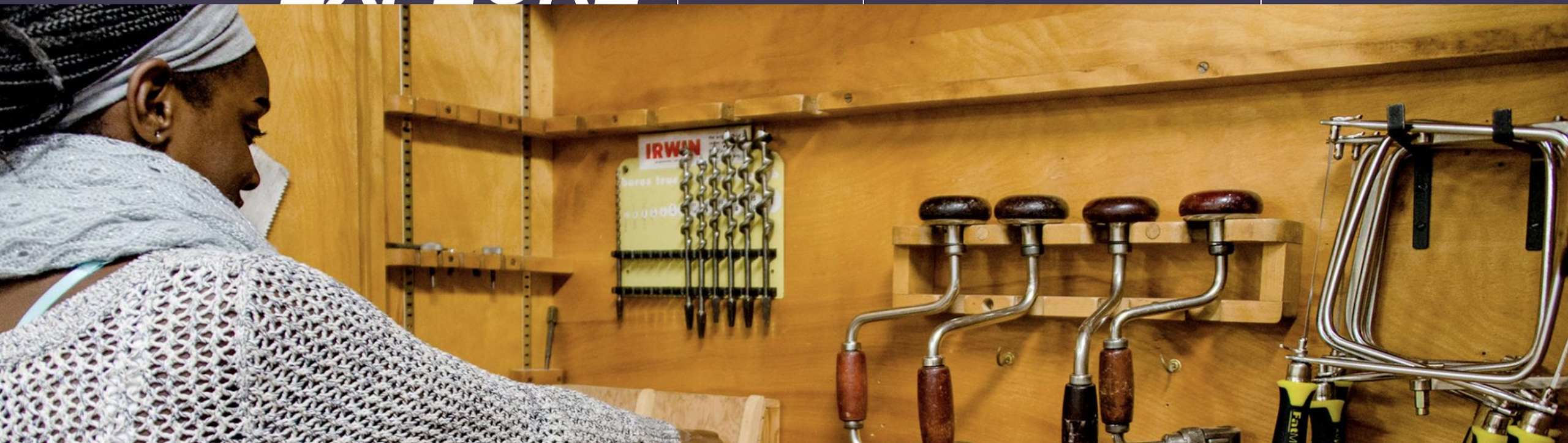
Agency by Design

Not Secure | agencybydesign.org

Agency by Design

About | Projects | Field Notes | Courses + Events | Media + Publications

EXPLORE | The Framework | Thinking Routines + Tools + Practices | Documentation + Assessment



PARTS, PURPOSES, COMPLEXITIES

LOOKING CLOSELY

Choose an object or system and ask:

What are its **parts**?

What are its various pieces or components?

What are its **purposes**?

What are the purposes for each of these parts?

What are its **complexities**?

How is it complicated in its parts and purposes,
the relationship between the two, or in other ways?

Web Resources - www.teachengineering.org

make.co

Make: make.co

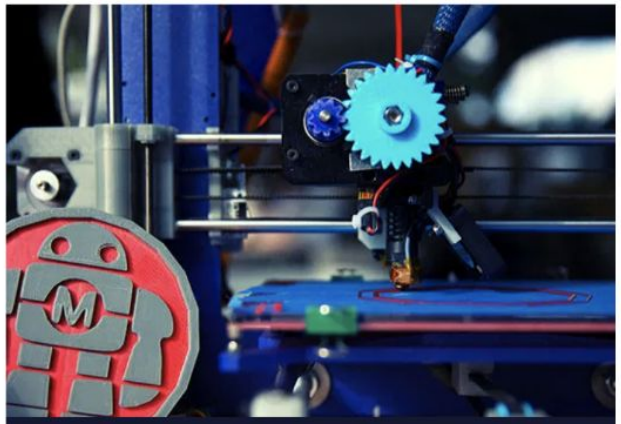
Explore Learn Experience Participate Shop

Subscribe

Directories Membership FAQs Campus Make: Education Forum

- My Dashboard
- Community Feed
- Members
- Groups
- Events
- Digital Library
- Video Library
- Log Out

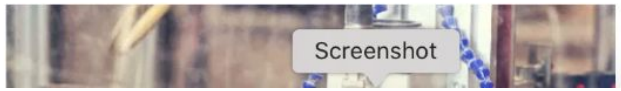
What We Do



READ THE LATEST STORIES
MAGAZINE

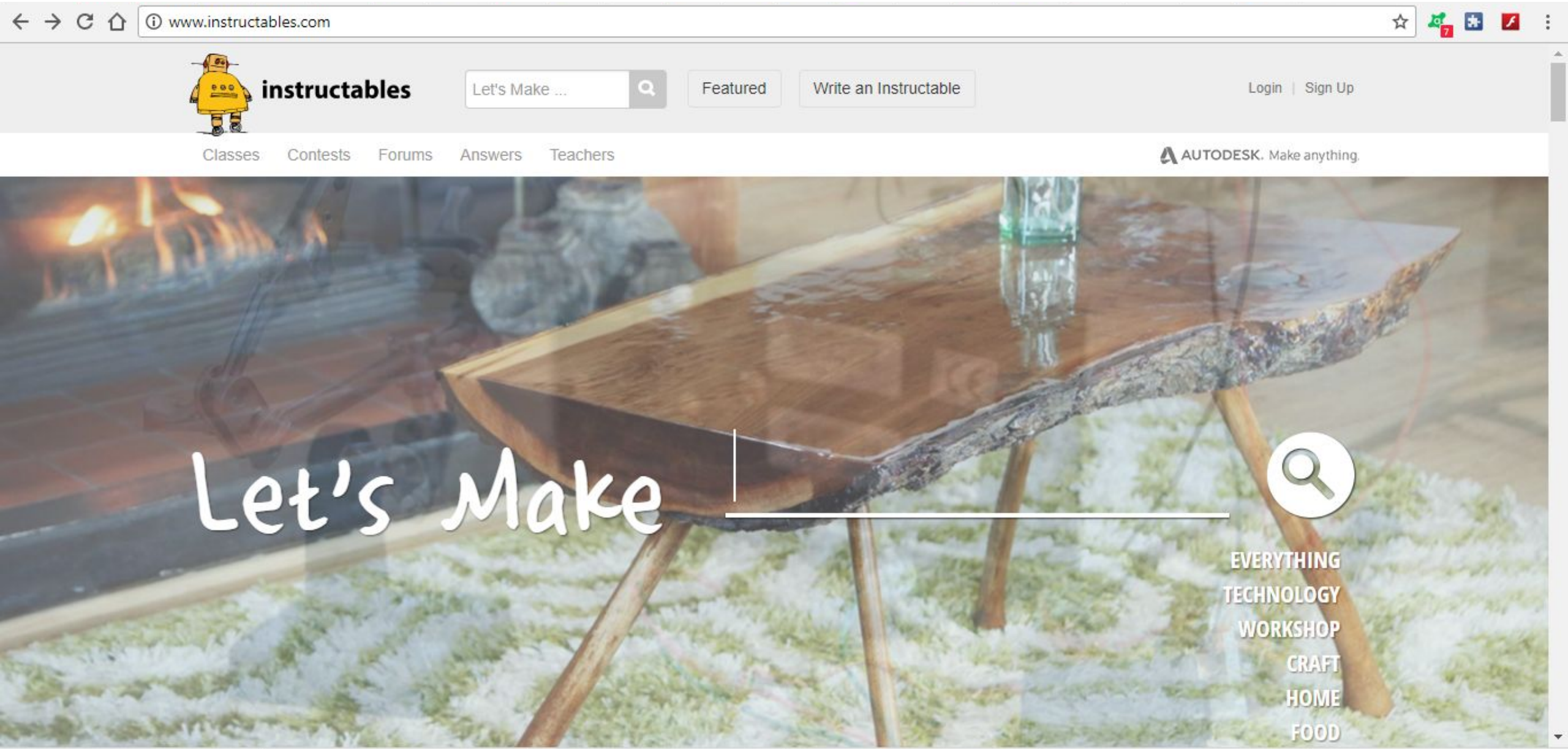
A CELEBRATION OF SHOWING AND TELLING
MAKER FAIRE

THE OFFICIAL STORE
MAKER SHED

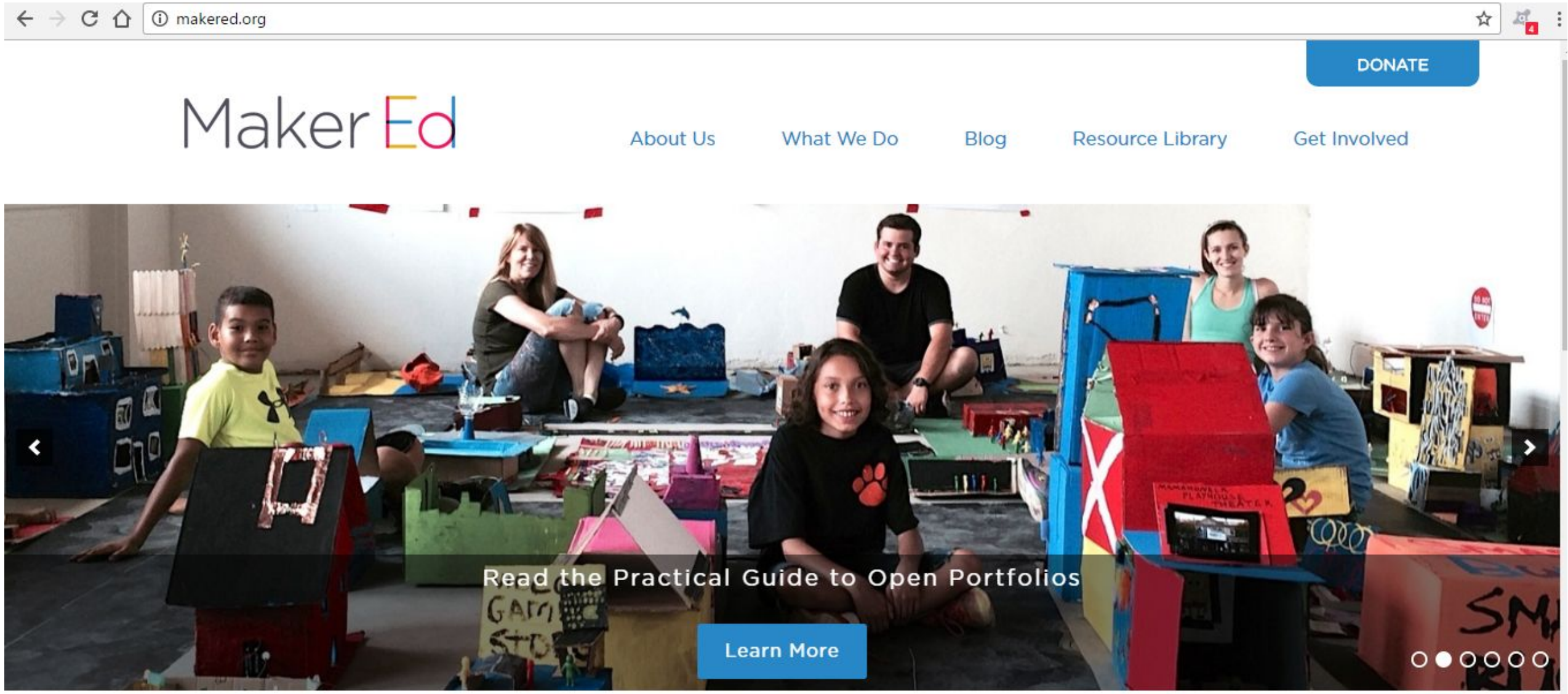


FEEDBACK

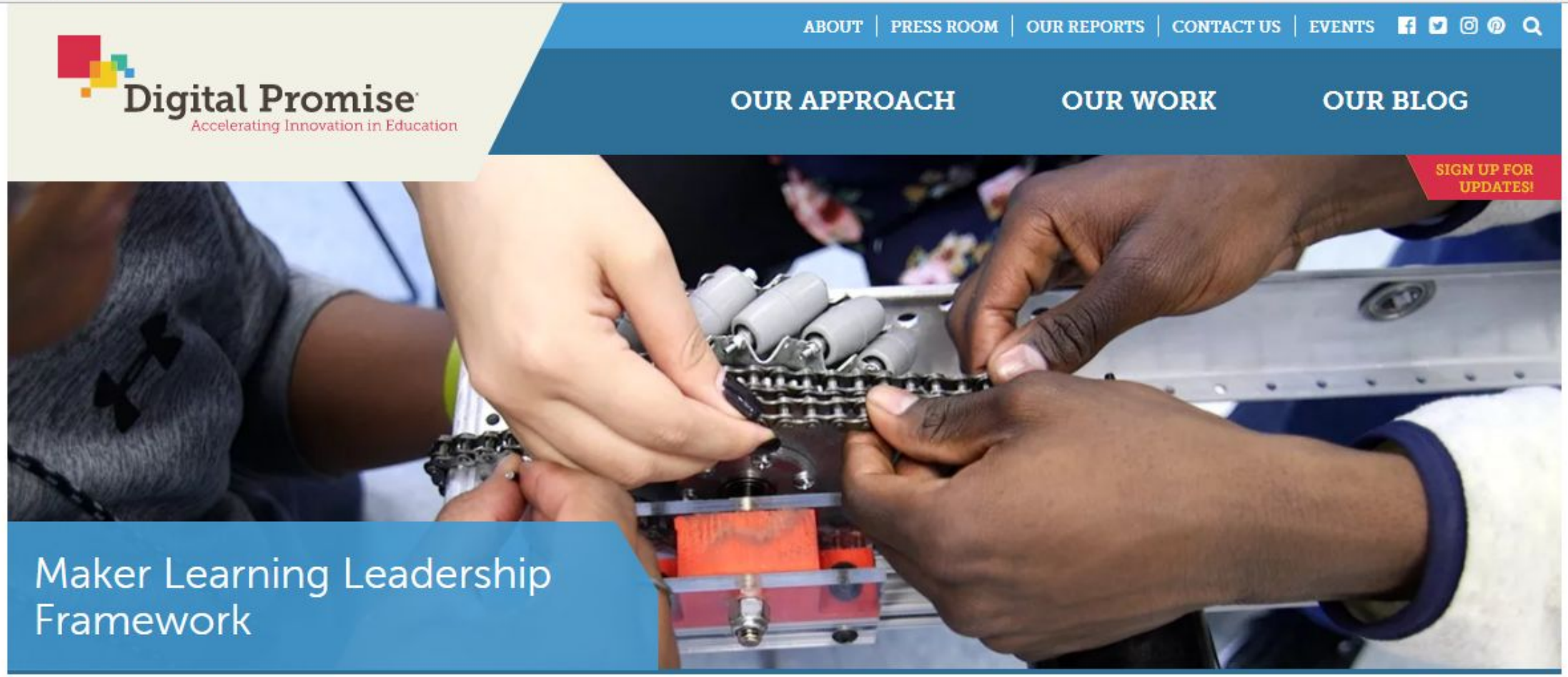
instructables.com

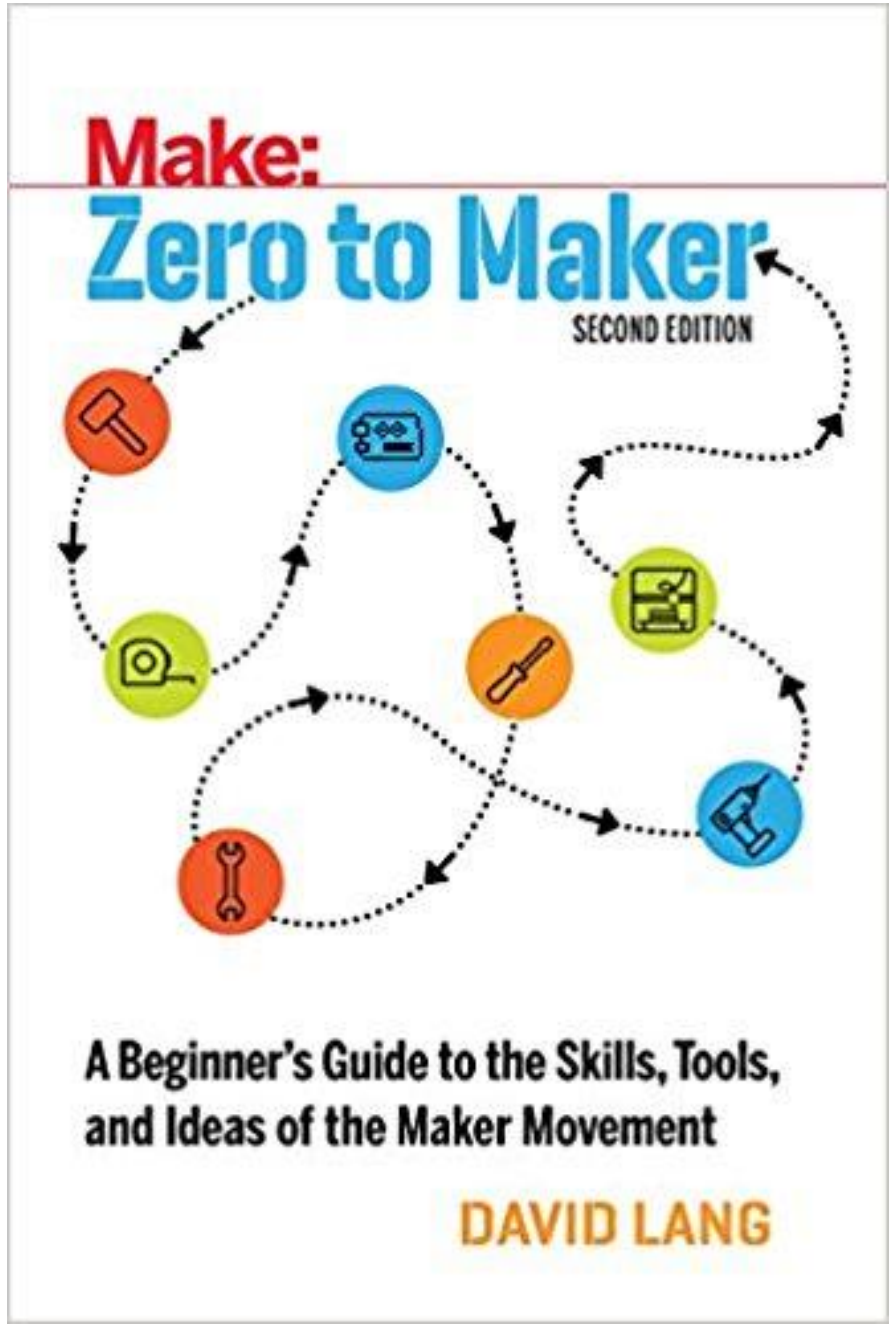


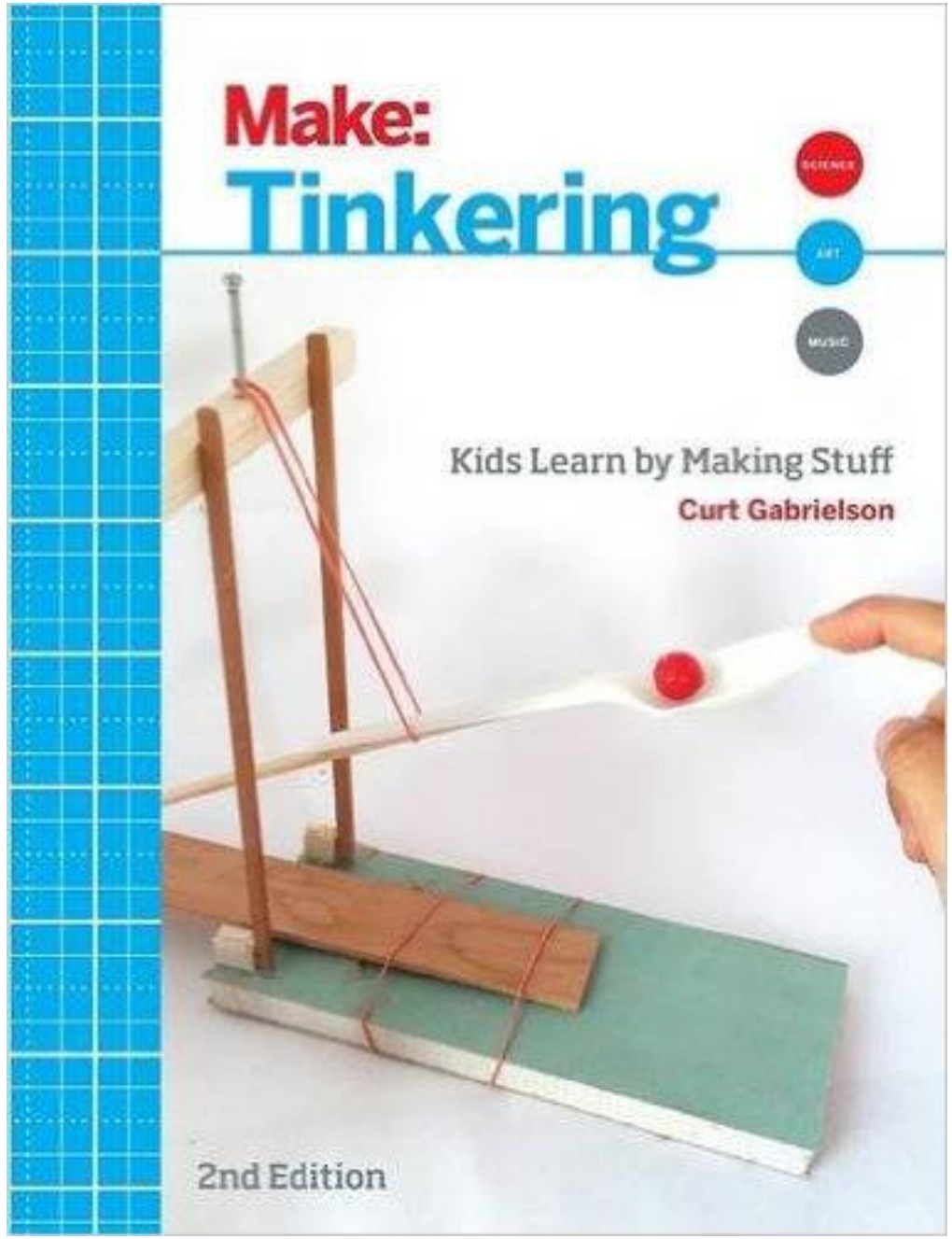
makered.org

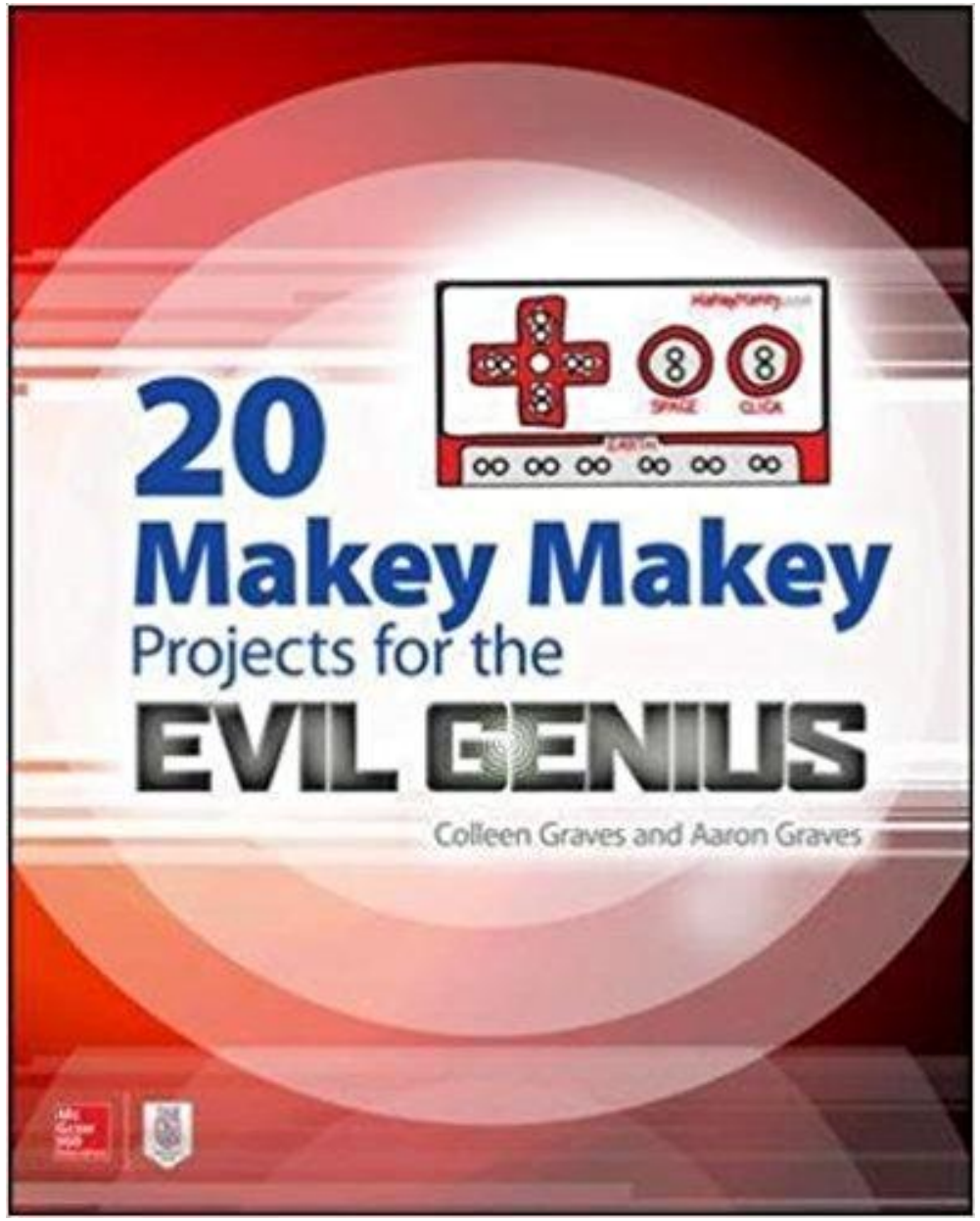

makered.org
DONATE
Maker Ed
About Us
What We Do
Blog
Resource Library
Get Involved
Read the Practical Guide to Open Portfolios
Learn More

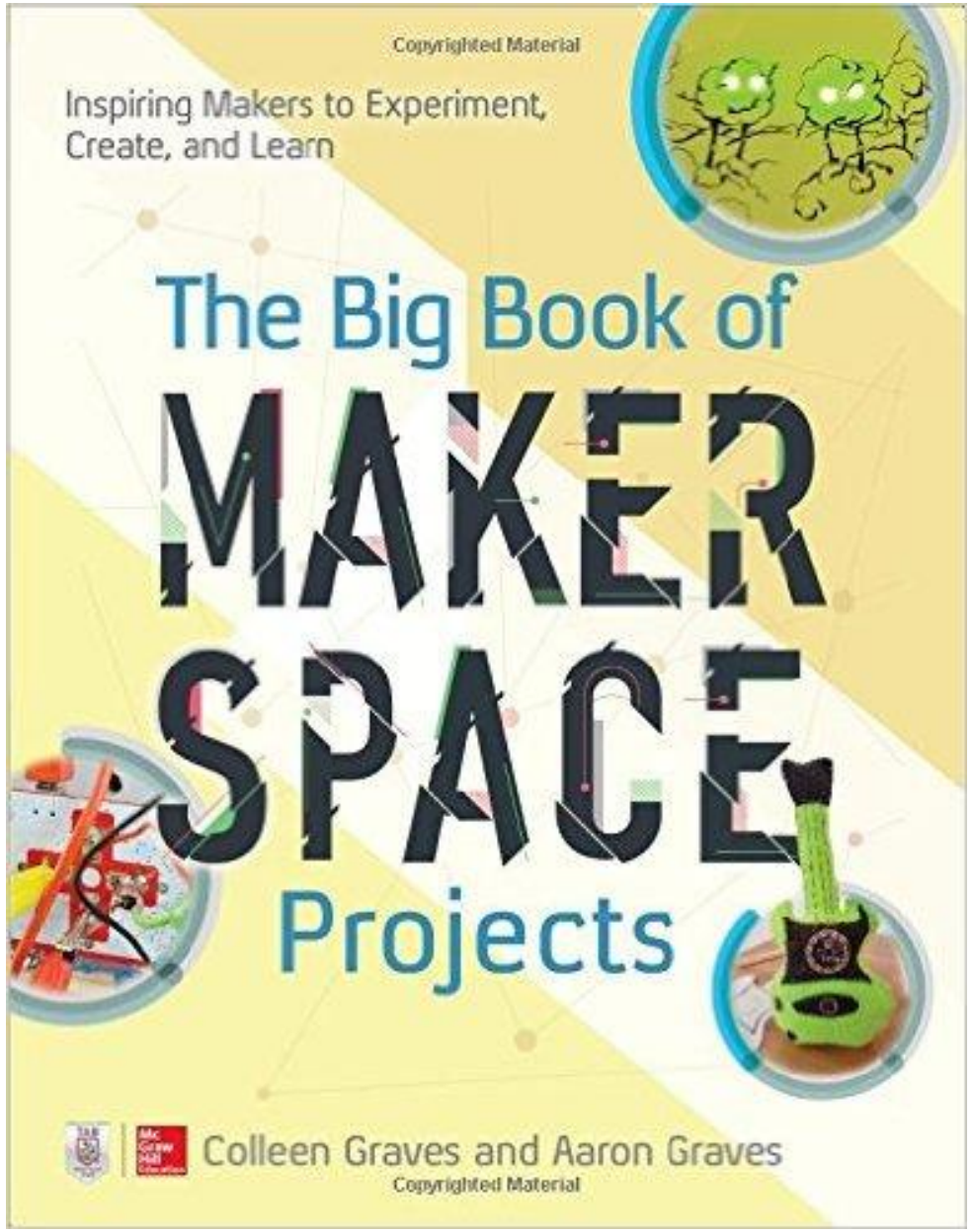
digitalpromise.org/maker-leadership/




Make:
Zero to Maker
SECOND EDITION
A Beginner's Guide to the Skills, Tools, and Ideas of the Maker Movement
DAVID LANG

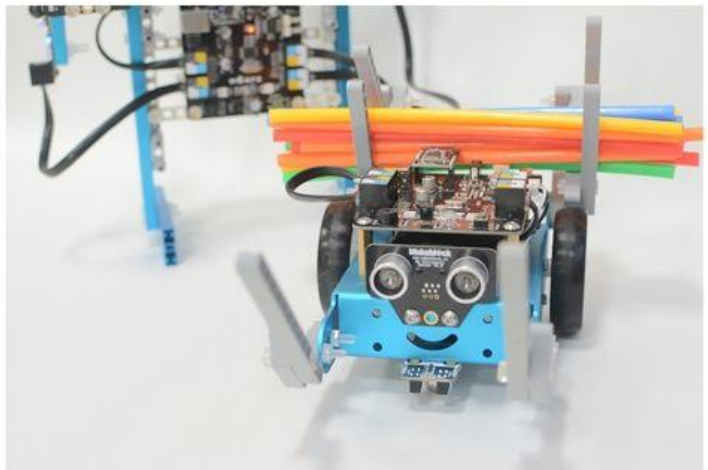

Make:
Tinkering
SCIENCE
ART
MUSIC
Kids Learn by Making Stuff
Curt Gabrielson
2nd Edition


20
Makey Makey
Projects for the
EVIL GENIUS
Colleen Graves and Aaron Graves


Copyrighted Material
Inspiring Makers to Experiment, Create, and Learn
The Big Book of
MAKER SPACE
Projects
Colleen Graves and Aaron Graves
Copyrighted Material

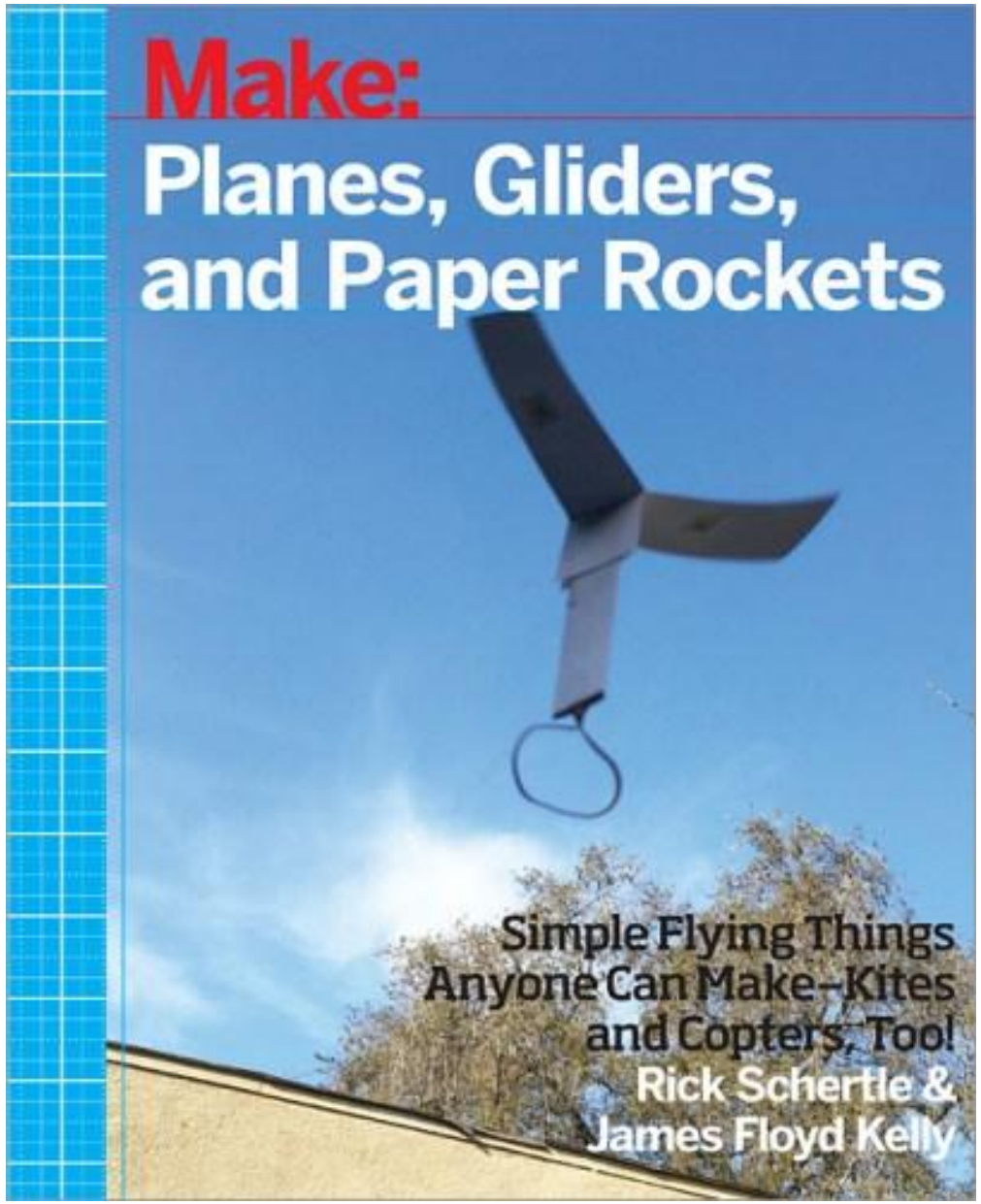
Make:

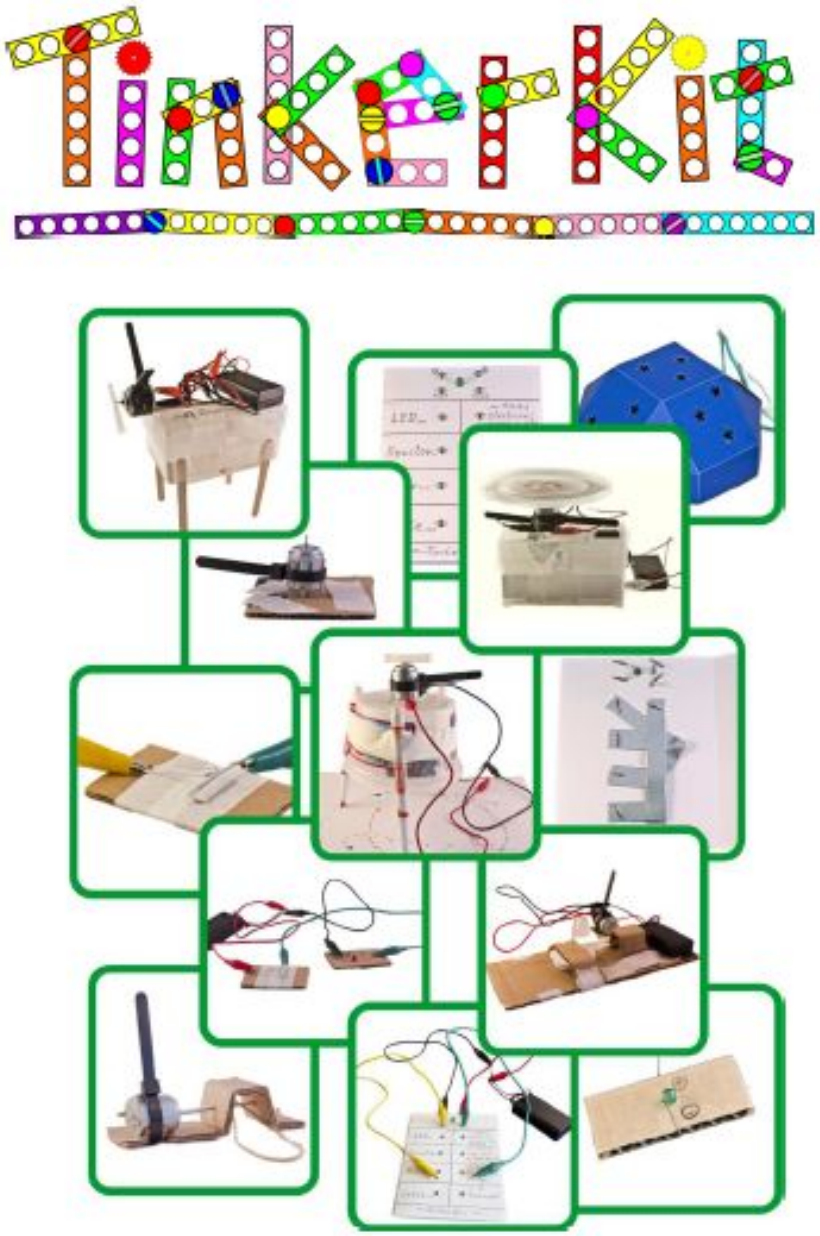
mBot for Makers



Conceive, Construct, and Code Your Own Robots at Home or in the Classroom

RICK SCHERTLE • ANDREW CARLE





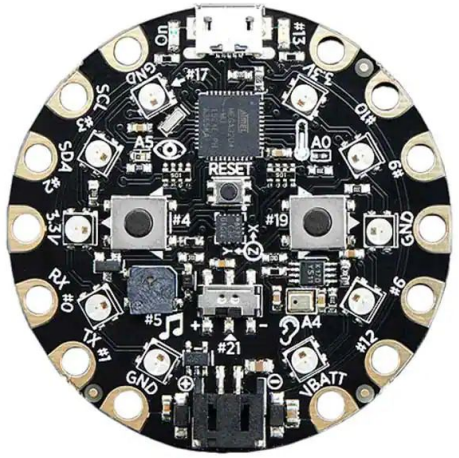
Tinker Kits Include:

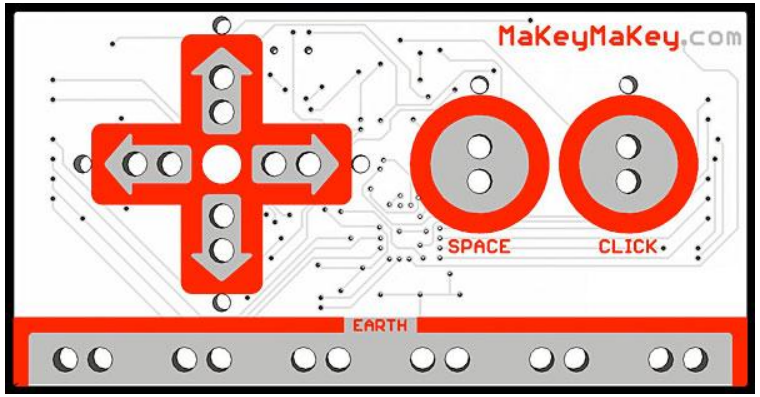
- Electric Motor
- Craft sticks (5)
- Alligator Cables (4)
- Toothpicks (3)
- Battery Holder with On/Off Switch
- Paper Clips (5)
- AA Batteries (2)
- Hot Glue Stick
- Releasable Cable Ties (4)
- Cardboard Square
- LED’s (3 colors)
- 56 Ohm Resistor
- Handy Storage Box
- Cork
- 28 Page Full-Color Tinker Kit Manual

Just add your own masking tape and some creativity and you’re ready for hours of tinkering fun!

If you had $1000 to get started…

- Glue Guns! (less than $5 each)
- Tinker Kits (30 for $150)
- Makey Makey Boards ($50 each, have kids work in teams - Needs to be connected to a laptop for programming with SCRATCH)
- SCRATCH (Free at: https://scratch.mit.edu/) Graphical programming interface to use with Arduino and Makey Makey boards.
- BBC micro:bit – ($15!)
- Playground Circuit Express - ($22)
- Hand tools
- DIY Cart and Storage Bins





More of my Favorite Stuff!

As your budget grows…

- Laser Cutters – Full Spectrum or Glowforge
- Scroll Saw – harborfreight.com
- Paper Marble Rollercoaster - paperrollercoasters.com
- Strawbees – www.strawbees.com
- Sparkfun Inventor Kits – www.sparkfun.com
- Air Rockets – www.airrocketworks.com
- mBots – makeblock.com
- Makey Makey – makeymakey.com
- Scratch – scratch.mit.edu
- DIY R/C Airplanes - brooklynaerodrome.com

STEINDORF MAKER LAB

Rick's Maker Space Highlights

schertler@cambriansd.com

Books for Ideas:

- The Big Book of Maker Space Projects
- Tinkering
- 20 Makey Makey Projects for the Evil Genius
- Make: Planes, Gliders and Paper Rockets
- mBot for Makers

Websites for Ideas and Planning:

- Maker Ed: makered.org
- Make: makezine.com
- Steindorf Maker Lab: **www.cambriansd.org/makerlab**
- Instructables – www.instructables.com
- Digital Promise - digitalpromise.org/maker-leadership/

Events for Inspiration

- Maker Faire! – www.makerfaire.com

If you had a $1000 budget to get started…

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- Makey Makey Boards ($50 each, have kids work in teams - Needs to be connected to a laptop for programming with SCRATCH)
- SCRATCH (Free at: https://scratch.mit.edu/) Graphical programming interface to use with Arduino and Makey Makey boards.
- Hand tools – www.harborfreight.com
- DIY Cart and Storage Bins

Parents can donate many of the materials below to build projects from the books listed above using the tools listed above.

- Cardboard Tubes
- Cereal Boxes
- Craft Sticks
- Aluminum Foil
- Masking Tape
- Rubber Bands

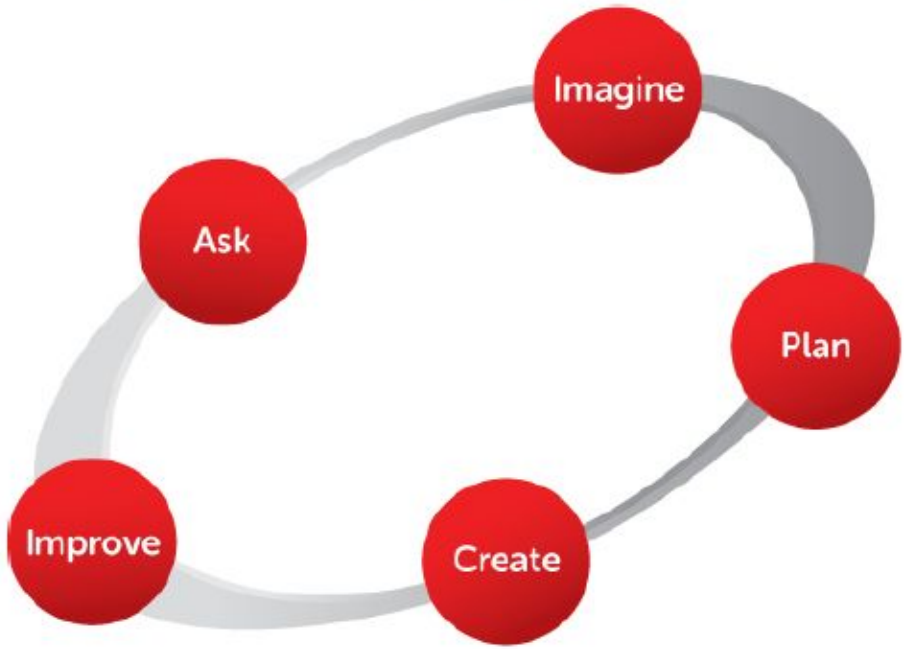
As your Budget Grows

- mBots, sensors and mBot Book – www.makeblock.com & amazon.com
- Sparkfun Inventor Kits – www.sparkfun.com/products/14189
- Particle Chips (For IoT Projects) - store.particle.io/
- VEX Robotics - www.vexrobotics.com
- Laser Cutter - fslaser.com
- Marble Paper Roller Coasters – paperrollercoasters.com/
- Strawbees - strawbees.com
- Engineering is Elementary – eie.org
- Air Rockets and Gliders – www.airrocketworks.com
- Dewalt Scroll Saw - www.dewalt.com

The resources listed above provide for **Open Ended** making experience on a budget, for whole classes of kids. Projects, tools and materials here encourage **Design Thinking** with many different outcomes. For updates to this document go to: **www.cambriansd.org/makerlab**

The Engineering Design Process

*To solve engineering problems, engineers follow a series of steps called the "**Engineering Design Process**"*



***ASK:** What is the problem? How have others approached it? What are your constraints?*

***IMAGINE:** What are some solutions? Brainstorm ideas. Choose the best one.*

***PLAN:** Draw a diagram. Make lists of materials you will need.*

***CREATE:** Follow your plan and create something. Test it out!*

***IMPROVE:** What works? What doesn't? What could work better? Modify your designs to make it better. Test it out!*

More details at: www.eie.org/eie-curriculum/engineering-design-process

Nuts and Bolts of Starting and Running an Integrated K-8 Maker Program

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