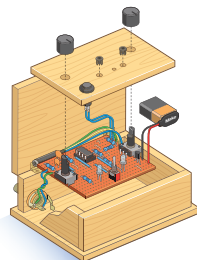


Make:

technology on your time

LUNA MOD:
Mini
Synthesizer
page 80 »



ROLL YOUR OWN

DIY Go-Karts, Skateboards,
Scooters and Racers

19
FUN
PROJECTS
You Can Build



Make this
Drill Kart
in a weekend!

PLUS:
**BUILD
YOUR
SKILLS**

- » Hack Electronic Gadgets
- » Brain Waves and Biosensors
- » Sonic Flame Tube



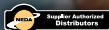
WHY FIGHT THE CROWD?



560,000+ PRODUCTS IN STOCK
470+ SUPPLIER PARTNERS
NEW PRODUCTS ADDED DAILY



GET CONNECTED



Digi-Key is an authorized distributor for all supplier partners. New products added daily. © 2011 Digi-Key Corporation, 701 Brooks Ave. South, Thief River Falls, MN 56701, USA



VISIT **WWW.DIGIKEY.COM** INSTEAD.



*Quality Electronic Components,
Superior Service*

Make: Volume 26

KARTS & WHEELS

40: Red Racer Drill Kart

Build a zippy go-kart powered by twin cordless drills.
By Gever Tulley & MAKE Labs

46: World's Simplest Longboard

Make a terrific skateboard with a minimum of fuss or tools.
By Mark Frauenfelder

48: Make a Motorbike

Add a retro-style, one-cylinder gasoline engine to your bike.
By Lew Frauenfelder

50: OutRun Arcade Car

Building the un-simulation of a driving video game.
By Garnet Hertz

54: Kult of the Kart

Cyclekarts are tiny racers optimized for fun. By Nik Schulz

56: Faster Than the Wind

Mind-bending propeller cart outruns the wind that powers it.
By Eric Chu

60: Gravity Racer

Race past the competition with the Make: Projects contest winner: an all-metal, quad-suspension soapbox cart.
By Jeremy Ashinghurst

65: Wild Wheeled World

A roundup of DIY karts, scooters, and other rolling wonders.

Columns

11: Welcome: That's How We Roll

Karts bring out the kid in us all. By Mark Frauenfelder

12: Reader Input

Arduinophytes and maker services.

15: Maker's Calendar

Events from around the world. By William Gurstelle

16: In the Maker Shed

Get projects in your mailbox. By Dan Woods

26: Tales from Make: Online

Live from MAKE! By Gareth Branwyn

27: Making Trouble

DIT: Raising our collective barn. By Saul Griffith

28: Country Scientist

Ultra-simple sunshine recorders. By Forrest M. Mims III

31: Make Free: Moral Suasion

A wake-up call for anyone who's blithely relying on the cloud.
By Cory Doctorow



RED RACER: Anyone can build Gever Tulley's nifty go-kart, which is powered by a pair of cordless drills. Photography by Garry McLeod. Prop/wardrobe styling by Tietjen Fischer. Makeup/hair styling by Renee Rael.



SIMPLE SKATE: Make this smooth-riding longboard in about a day using plywood and glue.



WEEKEND WARRIOR: Ashinghurst's gravity racer won first place in our Make: Projects contest.

Vol. 26, April 2011. MAKE (ISSN 1556-2336) is published quarterly by O'Reilly Media, Inc. in the months of January, April, July, and October. O'Reilly Media is located at 1005 Gravenstein Hwy. North, Sebastopol, CA 95472. (707) 827-7000. SUBSCRIPTIONS: Send all subscription requests to MAKE, P.O. Box 17046, North Hollywood, CA 91615-9588 or subscribe online at makezine.com/offer or via phone at (866) 289-8847 (U.S. and Canada); all other countries call (818) 487-2037. Subscriptions are available for \$34.95 for 1 year (4 quarterly issues) in the United States; in Canada: \$39.95 USD; all other countries: \$49.95 USD. Periodicals Postage Paid at Sebastopol, CA, and at additional mailing offices. POSTMASTER: Send address changes to MAKE, P.O. Box 17046, North Hollywood, CA 91615-9588. Canada Post Publications Mail Agreement Number 41129568. CANADA POSTMASTER: Send address changes to: O'Reilly Media, PO Box 456, Niagara Falls, ON L2E 6V2

Tough, yet beautiful.

CORNING
Gorilla® Glass

Visually stunning, lightweight, and highly damage-resistant, Corning® Gorilla® Glass is changing the way the world thinks about glass. It helps protect hundreds of the world's coolest smartphones, tablets, PCs, and TVs from everyday wear and tear.

Where it goes next is up to you.

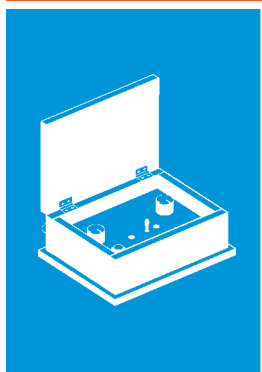
Learn more at CorningGorillaGlass.com



Sonic Flame Tube

See the shape of sound, written in tongues of fire. By William Gurstelle

72



Luna Mod

Make a simple handheld synthesizer and looper box to generate intriguing sonic rhythms. By Brian McNamara

80

Spirulina Superfood Tank

Supplement your daily diet with fresh spirulina “superfood” grown indoors next to a sunny window. By Aaron Wolf Baum

92



PRIMER

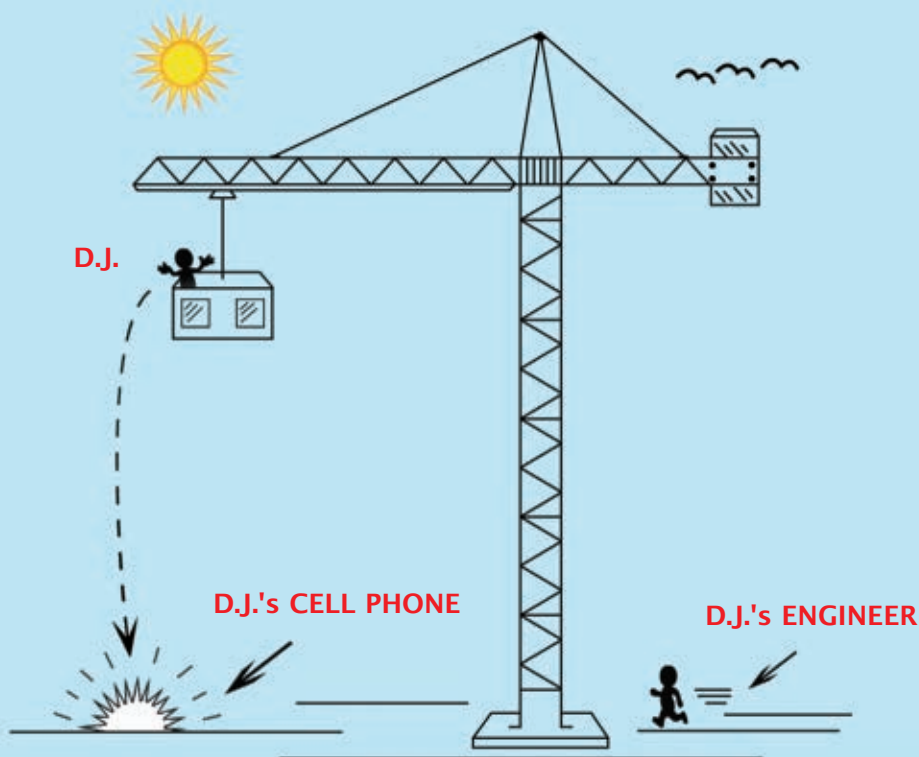
BIOSENSING

Track your body's signals and brain waves, and use them to control things.

By Sean M. Montgomery and Ira M. Laefsky

1.02

Can You Solve This?



FREE!



Sign up for our e-newsletter
and get a FREE comic book.
www.Jameco.com/adventure1

Radio disk jockey DJ. Smith organized a stunt to raise donations for a charity by conducting his radio show for one week while suspended from a 150-foot tall crane. A cell phone with a solar charger served as DJ.'s only link to the radio station. His little home in the sky included foil-wrapped freeze-dried meals, bottled water, binoculars, pencil, notebook, paper clips, rubber bands, pocket knife, MP3 player, and a portable radio. The weather cooperated with light wind, clear skies and pleasant temperatures. All went well until DJ. dropped his cell phone to the concrete below. The stunt rules prevented any physical contact between DJ. and the ground. How did he continue his show? (hint: DJ.'s engineer was an Alexander Graham Bell history buff). Go to www.Jameco.com/unknown10 to see if you are correct. While you are there, sign up for their catalog. Forrest M. Mims III

JAMECO[®]
ELECTRONICS

1-800-831-4242 | www.Jameco.com

Make: Volume 26

Maker

18: Made on Earth

Snapshots from the world of backyard technology.

32: Manufacture Your Project

Take your invention from concept to mass production and live the dream. By Mitch Altman

38: 1+2+3: Paper Clip Paper Holder

A giant clip for your desktop. By Gus Dassios

70: 1+2+3: Bokeh Photography Effect

Create an effect that makes the out-of-focus lights in your pictures appear any shape you want. By Sindri Diego

112: 1+2+3: Jumper Wires

An easy way to make protoboard wires. By Charles Platt

142: Electronics: Fun and Fundamentals

Hack an alarm siren to make a DIY dog repeller. By Charles Platt

146: Make Money

Combination lock made from coins. By Tom Parker

148: Toys, Tricks, and Teasers

Deceive the eye with kinetic toy illusions. By Donald Simanek

152: MakeShift: Charge That Cell!

Stuck in the woods with dead batteries. By Lee D. Zlotoff

154: Howtoons: Spool Racer

By Saul Griffith and Nick Dragotta

156: Toolbox

The best tools, gadgets, and resources for makers.

164: Toy Inventor's Notebook

Make a diving SpudMarine! By Bob Knetzger

166: What I Made

Fashion a bird feeder from soda cans and chopsticks. By Scott Bedford

168: Heirloom Technology: Chinampa Gardens

Craft a self-watering planter using Aztec agricultural techniques. By Tim Anderson

170: Remaking History: Bag Press

Use linen, wood, and the wisdom of ancient Egyptians to make a juicer. By William Gurstelle

176: Homebrew: My Power Wheelchair

By Marcus Brooks



Family fun project

READ ME: Always check the URL associated with a project before you get started. There may be important updates or corrections.



32

MAKER MADE: TV-B-Gone inventor Mitch Altman says manufacturing your invention is its own reward.



113: Circuits
Pendulum challenge,
pushbutton hacks.

120: Outdoors
Solar food dryer,
fabric-formed posts.

128: Home
Fool's stool,
jigsaw puzzle chair,
magnetic knife holder,
simple art easel.



148

LOOPY LOGIC: Tumbling rings are a spectacular illusion you can construct from key rings.

IT'S NOT ROCKET SCIENCE.

OR IS IT?

TURN YOUR HOBBY INTO AN EXCITING NEW CAREER!

So you like making cool stuff that flies, drives, and defies gravity? Then this is your opportunity to work in a small, top secret, elite team where creativity drives every creation. Located in one of the most exciting cities in the world, you'll have the incredible resources that

Hong Kong has to offer to bring your creations to life. Since 1994 Spin Master has been designing, developing and manufacturing some of the most innovative toys around the world. *To join the Spin Master Advanced Research Team (S.M.A.R.T.), apply at spinmaster.com.*

SMART
SPIN MASTER ADVANCED RESEARCH TEAM



"True happiness comes from
the joy of deeds well done,
the zest of creating things new."
—Antoine de Saint-Exupéry

Make:
technology on your time

FOUNDER, GM & PUBLISHER, MAKER MEDIA
Dale Dougherty
dale@oreilly.com

EDITORIAL

EDITOR-IN-CHIEF
Mark Frauenfelder
markf@oreilly.com

MANAGING EDITOR
Keith Hammond
khammond@oreilly.com

SENIOR EDITOR
Goli Mohammadi
goli@oreilly.com

PROJECTS EDITOR
Paul Spinrad
pspinrad@makezine.com

STAFF EDITOR
Arwen O'Reilly Griffith

EDITOR AT LARGE
David Pescovitz

CREATIVE DIRECTOR
Sean DallasKidd
sdallaskidd@oreilly.com

DESIGNER
Katie Wilson

PRODUCTION DESIGNER
Gerry Arrington

PHOTO EDITOR
Sam Murphy

COPY EDITOR
Gretchen Bay

EDITORIAL ASSISTANT
Laura Cochran

ADMINISTRATIVE COORDINATOR
Ramona Minero

ONLINE

DIRECTOR OF DIGITAL MEDIA
Shawn Connally
shawn@oreilly.com

EDITOR-IN-CHIEF
Gareth Branwyn
gareth@makezine.com

ASSOCIATE EDITOR
Becky Stern

DIRECTOR OF TECHNOLOGY
Stefan Antonowicz
stefan@oreilly.com

EDITOR AT LARGE
Phillip Torrone
pt@makezine.com

MAKE TECHNICAL ADVISORY BOARD

Kipp Bradford, Evil Mad Scientist Laboratories,
Limor Fried, Joe Grand, Saul Griffith, William Gurstelle,
Bunnie Huang, Tom Igoe, Mister Jalopy, Steve Lodefink,
Erica Sadun, Marc de Vinck

CONTRIBUTING EDITORS

William Gurstelle, Mister Jalopy, Brian Jepson, Charles Platt

CONTRIBUTING WRITERS

Mitch Altman, Tim Anderson, Jeremy Ashinghurst,
John Baichtal, Kim Bailey, Aaron Wolf Baum, Scott Bedford,
Kipp Bradford, Marcus Brooks, Spike Carlsen, Rick Cavallaro,
Abe Connally, Larry Cotton, Gus Dassios, Ken Delahoussaye,
Sindri Diego, Cory Doctorow, Peter Edwards, Adam Flaherty,
Lew Frauenfelder, Saul Griffith, William Gurstelle,
Garnet Hertz, Laura Kiniry, Bob Knetzger, Ira M. Laefsky,
Todd Lappin, Liz Llewelyn, Brian McNamara, Forrest M. Mims III,
Sean Montgomery, Nick Normal, Meara O'Reilly,
John Edgar Park, Tom Parker, Sean Michael Ragan,
Stacey Ransom, Matt Richardson, Max Rohde, Charles Platt,
Nik Schulz, Donald Simanek, Bruce Stewart,
Jerry James Stone, Owen Tanner, Gordon Thorburn,
Gever Tulley, Marc de Vinck, Thomas Wilson, Lee David Zlotoff

CONTRIBUTING ARTISTS

Roy Doty, Nick Dragotta, Alison Kendall, Timmy Kucynda,
Juan Leguizamon, Tim Lillis, Garry McLeod, Oliver Munday,
Linda Nguyen, Branca Nitzsche, Cody Pickens,
James Provost, Damien Scogin, Jen Siska

ONLINE CONTRIBUTORS

John Baichtal, Chris Connors, Collin Cunningham,
Adam Flaherty, Matt Mets, John Edgar Park,
Sean Michael Ragan, Matt Richardson, Marc de Vinck

INTERNS

Eric Chu (engr.), Brian Melani (engr.), Tyler Moskowitz (engr.),
Ed Troxell (photo), Nick Raymond (engr.)

PUBLISHING

ASSOCIATE PUBLISHER & GM,
E-COMMERCE
Dan Woods
dan@oreilly.com

DIRECTOR, RETAIL MARKETING
& OPERATIONS
Heather Harmon Cochran

OPERATIONS MANAGER
Rob Bullington

DIRECTOR, PRODUCT
DEVELOPMENT
Marc de Vinck

DIRECTOR, MAKER FAIRE,
SALES & EVENTS
Sherry Huss
707-827-7074
sherry@oreilly.com

SENIOR SALES MANAGER
Katie Dougherty Kunde
katie@oreilly.com

SALES ASSOCIATE
PROJECT MANAGER
Sheena Stevens
sheena@oreilly.com

MAKER FAIRE SALES &
MARKETING COORDINATOR
Brigitte Kunde
brigitte@oreilly.com

PUBLISHED BY

O'REILLY MEDIA, INC.
Tim O'Reilly, CEO
Laura Baldwin, COO

Copyright © 2011
O'Reilly Media, Inc.
All rights reserved.
Reproduction without
permission is prohibited.
Printed in the USA by
Schumann Printers, Inc.

Visit us online:
makezine.com

CUSTOMER SERVICE

[cs@readerservices.
makezine.com](mailto:cs@readerservices.makezine.com)

Manage your account online,
including change of address:
makezine.com/account
866-289-8847 toll-free
in U.S. and Canada
818-487-2037,
5 a.m.–5 p.m., PST

Follow us online:

On Twitter: [@make](https://twitter.com/make)
On Facebook: [makemagazine](https://www.facebook.com/makemagazine)

Comments may be sent to:
editor@makezine.com



MAKER MEDIA CARES

MAKE is printed on recycled, process-chlorine-free,
acid-free paper with 30% post-consumer waste,
certified by the Forest Stewardship Council and the
Sustainable Forest Initiative, with soy-based inks
containing 22%–26% renewable raw materials.



PLEASE NOTE: Technology, the laws, and limitations
imposed by manufacturers and content owners are
constantly changing. Thus, some of the projects described
may not work, may be inconsistent with current laws or
user agreements, or may damage or adversely affect some
equipment.

Your safety is your own responsibility, including proper
use of equipment and safety gear, and determining whether
you have adequate skill and experience. Power tools,
electricity, and other resources used for these projects
are dangerous, unless used properly and with adequate
precautions, including safety gear. Some illustrative photos
do not depict safety precautions or equipment, in order
to show the project steps more clearly. These projects are
not intended for use by children.

Use of the instructions and suggestions in MAKE is at
your own risk. O'Reilly Media, Inc., disclaims all responsibility
for any resulting damage, injury, or expense. It is your
responsibility to make sure that your activities comply
with applicable laws, including copyright.

Contributors



William Gurstelle's (*Flame Tube*) neighbors used to wonder just what was going on in his Minneapolis backyard. It took a while, but they seem to have become acclimated to the occasional catapult firings, potato cannon booms, and smoke from the rocket launches. The flamethrower blasts? Well, still not so much. As one of MAKE's contributing editors and technical advisory board members, Bill has written scores of articles for this magazine. His newest book, *The Practical Pyromaniac*, reminds a lot of people of his first book, *Backyard Ballistics*, and not just because they're both alliterative titles. thepracticalpyromaniac.com

Liz Llewellyn's (*Simple Art Easel*) first sentence was "I'll do it myself!" As a teenager, she designed and made a sweater from scratch, even inventing her own crochet stitch. As an adult, she studied mechanical engineering and decided to "seek out a career that would be best described by the sentence, 'I make cool things that work.' Which is what I do now, and it's even cooler than I imagined it would be." She lives in a 100-year-old house in an old mill town west of Boston with her husband, one teenager, one preschooler, two dogs, and a cat. What's her favorite thing to make? "The thing I haven't made yet."



Juan Leguizamon (Special Section opening illustration) lives in the TenderNob district of San Francisco, and has been "tracing" since he was 5. "Now when I see something that I really like, I mentally trace it in my head and make it into something cool on paper," he says. He's a senior designer at Razorfish, an interactive ad agency, does freelance illustration, is "tempted to have a cat even though I've always been more of a dog person," and has always been fascinated with cardboard. "The idea of making something that is not meant to be final or finished intrigues me. It's just like when we were little and with our imagination we could make a simple cardboard box be anything we wanted."

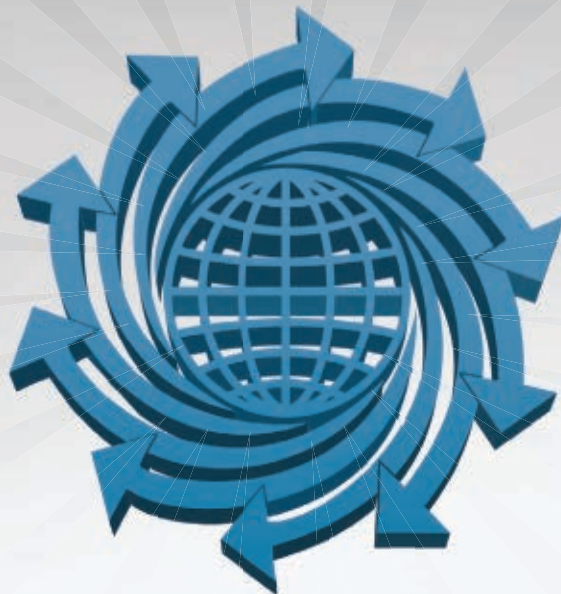
Linda Nguyen's (*Simple Longboard* photography) natural curiosity has led to many photographic adventures in her life. Whether she is out on her own shooting a personal project or on assignments with advertising and editorial clients such as Nike and Enterprise, she's fueled by the inspiration of the given moment. Her current projects include making a music video and concocting the perfect pho recipe, complete with hand-drawn illustrations and instructions, to pass down to her friends and family. She is based in Southern California, where she enjoys the warmth of the sun, sips tea, and listens to jazz records.



Aaron Wolf Baum (*Spirulina Superfood Tank*), aka Dr. Friendly, came to his expertise in DIY algae superfood by way of Harvard, Stanford, Silicon Valley, and Burning Man. He has "a passion for sustainability, teaching, and science in general." Not only is he very friendly, he's committed to using his talents "to do something good, and right now that means looking hard at how our energy choices affect the natural world that sustains us." Check his website (drfriendly.tv) and his blogs (farmeronmars.blogspot.com and draaronwolfbaum.wordpress.com) to learn more about the doctor's pursuits.

Brian McNamara (*Luna Mod*) has been pulling things apart since he was 2 or 3 years old. Many years later he has not only learned how to put some of them back together, but is even able to make new things from scratch. After working in a wide range of electronics workshops, from avionic to scientific, Brian finally decided to set up his own workshop, designing and building unique electronic devices, mostly electronic musical instruments that he sells through his online business (rarebeasts.com, @rarebeasts). Brian loves making music, gardening, and taking his two kids on hiking adventures.





THE GREAT GLOBAL HACKERSPACE CHALLENGE

10 TEAMS HACK THEIR WAY TO ELECTRONICS GLORY

We're excited to present the first ever element14 Great Global Hackerspace Challenge. Ten energetic teams have been chosen to compete from Hackerspaces around the world. Their assignment? To invent and build any electronics-based marvel that can make a positive impact in the field of education. Each team has \$900, a list of must-use parts, and two months to get their hack on. Three finalists will be shortlisted and invited to appear, along with their inventions, at the Bay Area Maker Faire May 21st and 22nd. At the event an esteemed judging panel, including our very own Ben Heck, will vote on and crown the glorious winner.

Follow the teams' journeys at element14.com/hackerspace



BROUGHT TO YOU BY
element14

That's How We Roll

I WAS IN THE SECOND GRADE WHEN MY

father built a go-kart for my cousin and me. It was made from lumber and four new wheelbarrow tires. Steering was accomplished by putting one foot on either end of the front axle, which was connected to the go-kart's frame with a single large bolt. To slow down while going downhill, all you had to do was grab the wooden lever attached to the side of the go-kart with another large bolt, pull back on it, and let friction do its work as the wood dug into the asphalt (we had to replace the brake frequently).

The go-kart was the hit of the neighborhood. All the kids wanted to ride it, and we'd take turns weaving around the tin-can slalom course we'd set up on a gently sloped road, timing our runs with a stopwatch. Soon other dads in the neighborhood built go-karts for their kids and we'd race each other.

In time we graduated from go-karts to minibikes. These gasoline-powered two-wheelers were a step up from gravity-powered vehicles. The noise, smell, and power of the minibikes intoxicated us for a few summers in our junior high school years.

Those memories came flooding back when we started creating the Karts and Wheels package in this issue of MAKE. I hope the projects in these pages will help you rekindle some of your own childhood memories, as well as provide your kids with opportunities for fun, adventure, and learning.

It probably goes without saying, but I'm going to say it anyway: Wear a helmet! When I was a kid, nobody wore helmets when they rode bikes, skateboards, go-karts, or minibikes. Please don't make that mistake today.

One spring day when I was 15 I rode my skateboard down a steep hill, and the only thing I remember from that afternoon is waking up covered in blood in the back of an

MINI-BIKE PLANS!

BUILD COMPLETE FRAME FOR LESS THAN \$10!

Exciting new plans reveal step-by-step details with drawings how to build your own mini-bike! This little charger is ideal for just plain FUN!

SEND \$2!

RUSH YOUR ORDER!

FREE—FREE—FREE
Learn how you can buy new engines \$30 up, wheels \$10 up, with FREE confidential list and coupons when you send \$2 for your plans.

RUSH information about plans. (I enclose 25c) ☐
HURRY and **RUSH** my Mini-Bike Plans and Confidential List. (I enclose \$2 cash, check or M.O.) ☐
Print name & address.
Money Back Guarantee.
PLANS CW
P.O. Box 517, Omaha, Neb. 68102

ambulance. I broke my nose, lost some teeth, received stitches for several cuts on my face, and concussed my brain. Fortunately, I didn't suffer anything worse. Today, my kids put on their helmets automatically whenever they ride their bikes or skateboards.

If go-karts and minibikes aren't your thing, don't despair — we have plenty of wonderful projects in this issue. We'll show you how to make a Rubens tube that emits jets of flame to display waveforms of any sound you play through it. We'll show you how to grow and harvest your own delicious (really!) spirulina in a modified aquarium. And we'll show you how to make a nifty self-contained electronic sound effects box called the Luna Mod.

One more thing: I'd like to remind you about Make: Projects, a terrific free service we set up for anyone to write and publish how-to projects. We recently ran a Karts and Wheels contest — you'll find winner Jeremy Ashinghurst's "Weekend Warrior" gravity racer on page 60. Check makeprojects.com for the upcoming robot competition!

Mark Frauenfelder is editor-in-chief of MAKE.

Arduinophytes and Maker Services


 The Arduino is a very impressive and capable platform (MAKE Volume 25, “Getting Started with Microcontrollers”), but to imply that its programming language is easy for beginners is misleading. No beginner is going to be comfortable with a C-based development environment. The BASIC Stamp 2 or its derivatives are the best starting point.

For more advanced users, the Arduino is a logical choice. However, if you really want power and flexibility, the Propeller can’t be beat. Its native language, Spin, is no more difficult than the Arduino’s, and it has comparable hardware development platforms.


—Mark “DixieGeek” Andrews, Cullman, Ala.

AUTHOR TOM IGOE RESPONDS: In my article I admit to an Arduino bias. That bias is born of comparative experience. Having taught for many years with the BASIC Stamp, the BX-24, the PIC using PicBASIC, and Arduino, I disagree.

I’ve taught hundreds of beginners with Arduino, and they’re comfortable with it. I’ve had similar reports from other teachers of nontechnical students. One of the keys is to keep the language clear and avoid the more complicated structures of C. For example, we’ve mostly been able to avoid pointers, which helps beginners a great deal.

 You asked us to dive into the Arduino revolution (Volume 25). I wasn’t sure what it was, but I bought the Getting Started with Arduino kit from the Maker Shed. As a 54-year-old woman, I’m probably not in your primary demographic, but I have to tell you I’m having a blast. I now have several books, lots of parts, and loads of creative enthusiasm. Thanks.


—Becca Begley, Louisville, Ky.


 I’m a maker, age 12, and I really appreciate MAKE and makezine.com. They are both very helpful and informative, and I’m amazed at all the work that must go into developing them.

My coolest project, so far, is building my own microcontroller. I began with an ATmega Lite Development Kit, then constructed the parallel programmer, loaded the bootloader

into the ATmega, and programmed it with the “Blink” program. One of my best sources for data (ATmega pinout, schematics, etc.) was MAKE Volume 25. This is the best magazine I have ever seen. Thank you so much.

—Chandler Watson, Hillsboro, Ore.


 Visit MAKE’s Arduino site at makezine.com/arduino for more great resources, including Phil Torrone’s essay “Why the Arduino Won and Why It’s Here to Stay.”

 I’m a MAKE subscriber who also subscribed to CRAFT magazine and was very disappointed when it ceased publication. I was mollified by MAKE’s promise to publish more CRAFT-style articles (fiber arts, jewelry making, etc.), and I’m writing to express my wish that this promise not be forgotten. Part of fulfilling that promise could be a stronger emphasis on female makers and writers, to affirm their presence in the creative community.


Don’t misunderstand me, you have a great magazine, but many readers came to it out of CRAFT, and I’d hate to see this element be lost.

—Adrian Miller, Rockaway Beach, Queens, N.Y.

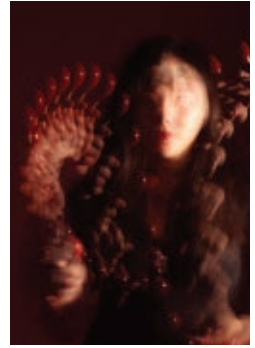
MANAGING EDITOR KEITH HAMMOND RESPONDS: Thanks for sticking with MAKE, Adrian. We agree, and we’re committed to bringing you a full range of makers and projects, from high tech to food, home, arts, and crafts.


 In the 1970s I did a lot of home rocketry, including a rocket very similar to your \$5 Heli-Rocket project (Volume 25). My model has a simpler release device, which might help people trying their own build; it’s described at makezine.com/go/reedrocket. Great article!

—Reed Ghazala, Cincinnati, Ohio

 I made my first project this weekend, the Stroboscope (Volume 24). Here are some photos I made with it: makezine.com/go/jamaal. I really look forward to more projects.

—Jamaal Montasser, Toronto, Ontario




 I finally finished the Squelette amplifier (Volume 23, “Mini Chip Amp”). The instructions were easy to follow. I built my chassis from brass sheet and some cherry for the endpieces. The metalworking is poor, but hey, I’m a woodworker! Pictures of my amp are at brianandonian.com/LM1875chipamp.aspx.

The amp sounds really good: no hum, noise, or buzz. The headphone jack is a must. Ross, thanks for the plans. This was a fun build!

—Brian Andonian, Plymouth, Mich.


AUTHOR ROSS HERSHBERGER RESPONDS: Thanks for the pictures to drool over, Brian. I love the wood/brass combo. As for the sound, don’t be shy about throwing it at some high-end speakers. More than one audiophile has been amazed by what these little chips can do.

 Tell me it isn’t true! I saw the latest issue of MAKE at a bookstore, and it was the same size as every other magazine. I thought *Popular Science* made a big mistake when they “upsized.” Now you appear to be doing the same thing. I’m very sad. Nostalgic, too. But I’ll continue reading MAKE.

—Roger Garrett, Honolulu, Hawaii

EDITOR-IN-CHIEF MARK FRAUENFELDER RESPONDS: The issue you’re describing is actually our MAKE Ultimate Workshop and Tool Guide (makezine.com/2011/workshop). It’s not MAKE magazine but an annual special edition.

Have no fear — we love the size of MAKE as much as you do and have no intention of changing the size!

 I’m from a long line of makers, but my training is in urban public health. In Compton, Calif., most of the community’s health problems (poor food, housing, violence) can be traced to the loss of factories and living-wage jobs for blue-collar workers. Talk all you want

about retraining and scholarships, but we have a lot of good people with good skills who are makers, born to work with their hands.

We need a reboot, and I think the Maker movement is where our renaissance can come from. There are already communal shops being built, and Maker Faire and the internet are bringing marketplaces to more customers.

Why not take a page from big corporations and pass legislation to expand community shops? Provide “Maker Services” — a roving team from the Small Business Administration to help inventors micro-market, finance, and even patent (or Creative-Commons) their inventions. Create a special tax bracket for small-owner fabrication shops.

We need something to help creative minds and hands get their ideas to market, and create jobs while they’re at it.

—Susan J. Hale, MPH, Santa Monica, Calif.

MAKE AMENDS

In Volume 25’s *Secret Knock Gumball Machine*, page 95, we listed the wrong clear plastic globe from 1000bulbs.com. The correct part number is #3202-08020.

In Volume 25’s *Sous Vide Immersion Cooker*, page 107, we listed the wrong clear acrylic box from Amazon. The correct part number is #B000NE9VJE.

In Volume 25’s *Primer: Make and Use an Arduino*, page 65, we erroneously reversed power and ground for pins J-7 and J-9. The text should read: “To connect the chip to power and ground, jumper [...] J-7 to right ground, and J-9 to right power (Figure G).” Figure G is correct.

In the calculation in Volume 25’s *Remaking History*, the crank diameter is 6”, not the “crank handle” (radius). The equation is correct for a 6” diameter and 3” handle.

6th ANNUAL

Maker Faire®

THE
World's
Largest
DIY Festival

A two-day, family-friendly event to **MAKE**, create, learn, invent, **CRAFT**, recycle, think, play, celebrate, and be inspired by arts, crafts, engineering, food, music, science, and technology.

Rockets & Robots ■ DIY Science & Technology ■ Fire Arts ■ Bicycles ■ Arts & Crafts ■ Electronics
Sustainable Living ■ Circuit Boards ■ Maker SHED ■ Tesla Coils ■ 3D Printing ■ Kids' Activities
Alternative Energy Vehicles ■ Arduino Kits ■ Fabrication ■ Food Makers ■ and so much more!



COME
PLAY
WITH 600+
MAKERS
OF ALL AGES!



SAVE
THE
DATES!

Maker Faire Bay Area
May 21 & 22, 2011
San Mateo County
Event Center
San Mateo, CA

Maker Faire Detroit
July 30 & 31, 2011
The Henry Ford Museum
Dearborn, MI

World Maker Faire
September 17 & 18, 2011
New York Hall of Science
Flushing Meadows
Corona Park, Queens, NY

To participate and get more info,
check out the website »

MakerFaire.com

Brought to you by **MAKE** magazine

Jan	Feb	Mar
Apr	May	Jun
July	Aug	Sept
Oct	Nov	Dec

MAKER'S CALENDAR

COMPILED BY WILLIAM GURSTELLE

Our favorite events from around the world.

Maker Faire Bay Area 2011

May 21–22, San Mateo, Calif.

There's always something new and terrific at Maker Faire Bay Area, the world's largest DIY festival, sponsored and organized by MAKE magazine. The two-day, family-friendly event gives everyone a chance to create, learn, invent, craft, recycle, think, play, and be inspired.

makerfaire.com



MAY

» Science Rendezvous

May 7, cities across Canada

More than 1,500 scientists and technologists, representing the cream of Canada's scientific community, throw open the doors of their laboratories to talk "about" their work. This go-round celebrates 2011 as the U.N.-designated International Year of Chemistry.

sciencerendezvous.ca

» Friday Harbor Labs Open House

May 14, San Juan Island, Wash.

Here's an opportunity to meet the scientists and students of a renowned marine biology field station and check out their research and teaching facilities. The FHLOH showcases marine science research, including demonstrations and Q&A. There will be marine plants and animals, microscopes, research ship tours, and activities for visitors of all ages.

depts.washington.edu/fhl/events.html

» NYU Music Technology Open House

May 14, New York, N.Y.

Arduino-lovers and electronic music fans rejoice — it's a night of music, sound, images, and thought brought to you by NYU's music technology community. Check out cutting-edge gadgetry as NYU's creative students present performances and interactive demonstrations. makezine.com/go/nyu

JUNE

» Maker Faire North Carolina

June 18, Raleigh, N.C.

From James Bond-worthy electronic gizmos to Martha Stewart-quality "slow made" foods and homemade clothes, Maker Faire North Carolina celebrates things people create themselves. Maker Faire NC is an up-and-coming, fully sanctioned event, planned and coordinated by Raleigh/Durham makers. makerfairenc.com

» National Threshers Association Reunion

June 23–26, Wauseon, Ohio

Every maker loves a parade, especially when it's made up of lovingly restored, antique steam- and gasoline-powered vehicles. The 67th annual reunion features approximately 50 steam engines, in addition to more than 100 gas tractors and gas engines. Daily demonstrations include threshing, sawmills, shingle mills, plowing, and a machinery parade.

nationalthreshers.com

» Eyeo Festival

June 27–29, Minneapolis, Minn.

This new three-day conference includes a wide variety of talks, demos, labs, and workshops. Subjects vary widely and touch on all topics digital, including digital art and music, coding, Arduino, 3D printing, and more. Sessions include a number of presenters who've been featured in MAKE magazine and on Make: Television. eyeofestival.com

JULY

» The International Bognor Birdman

July 16–17, Bognor Regis, England

Flap your way over to England's International Bognor Birdman and watch in mock horror as stalwart human "birdmen" attempt to fly their outlandish homemade contraptions off the end of a pier in front of thousands of people — for glory and perhaps a bit of prize money. birdman.org.uk

» Maker Faire Detroit

July 30–31, Dearborn, Mich.

Could there be a more fitting place for a Maker Faire than the Motor City? No way! Last year there were more than 325 sponsors, exhibitors, and performers in attendance. This year should be even bigger and better. Don't miss it. makerfaire.com/detroit/2011

*** IMPORTANT:** Times, dates, locations, and events are subject to change. Verify all information before making plans to attend.

MORE MAKER EVENTS:

Visit makezine.com/events to find classes, exhibitions, fairs, and more. Log in to add your events, or email them to events@makezine.com. Attended one of these events? Talk about it at forums.makezine.com.



Projects in Your Mailbox



WHILE SETTING UP FOR OUR FIRST

Maker Faire, I went on a supply run to Jameco Electronics, a short drive from the fairgrounds near San Francisco Bay. As I pulled into the parking lot, I saw four grinning fellows sporting “Make: Void your warranty” T-shirts piling out of a car and kneeling in front of the familiar Jameco sign for an impromptu group photo.

These makers — and thousands like them — didn’t need to be told about the fit between MAKE and Jameco. They just got it.

So when MAKE sought to make it easy for readers to buy the supplies they needed to tackle projects found in the magazine and at Make: Projects (makeprojects.com), our first stop was Jameco. Like that carload of exuberant makers, the team at Jameco got it.

We’re proud to announce that Make: Projects readers can now conveniently purchase just about everything they need for their next project directly from the Make:



Mini Fume Extractor Parts Bundle

\$39.95 Product code JMBUN07 makershed.com/fume

NEW: Just click on the cart in Make: Projects (makezine.com/go/fume) and your Mini Fume Extractor parts will be speeding toward your mailbox.

Projects website. Select the complete project bundle, or just the components you need, then click on the shopping cart link to complete your order in a single, easy Maker Shed transaction.

A perfect example is Marc de Vinck’s Mini Fume Extractor project from MAKE Volume 19, released on Make: Projects at makezine.com/go/fume. We’re adding hundreds more projects in the weeks to come. And when you drop by the Maker Shed (makershed.com) you’ll find thousands more Jameco products identified with their familiar icon.

Dan Woods is MAKE’s associate publisher and general manager of e-commerce.

Photography by Marc de Vinck