“A civilization flourishes when people plant trees under whose shade they will never sit.”

- Greek Proverb

Published by Copernicus Educational Products Inc.

Canada - 8194 County Road 109, R.R. #3, Arthur, ON N0G 1A0
USA - PMB#459, 60 Industrial Pkwy, Cheektowaga, NY 14227
P: 1 800 267 8494 **W:** www.copernicused.com

www.copernicused.com

Copernicus educational products

Have you ever wondered how the equipment you use in your classroom is made? It can be pretty cool.

This is how the Tech Tub2®, which your school uses to store and charge devices, was designed and manufactured.

- Design
- Tooling
- Production
- Delivery
- **An extra step...** Lesson Plans

My brain hurts!

1 Brainstorming

Before a product can be manufactured, the Product Development Team at Copernicus meets up to brainstorm ideas to come up with a solution for storing and charging iPads® and Chromebooks™ in the classroom.

These meetings can go on for 1 day to 4 weeks! Thankfully, Brandon, the manager, always comes prepared with coffee and doughnuts!

Great ideas can come from anyone, anywhere and at anytime.

A really important stage in our product development is getting great ideas from teachers (we call them our "Masterminds").

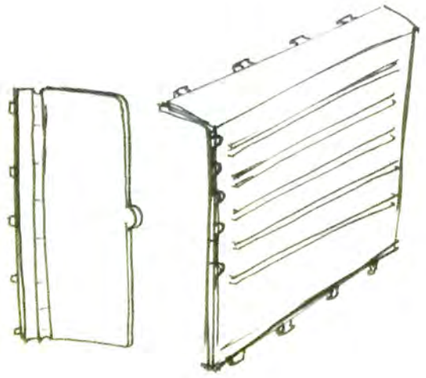
We meet up, share ideas and get a better understanding of what teachers really need for their students and classrooms.

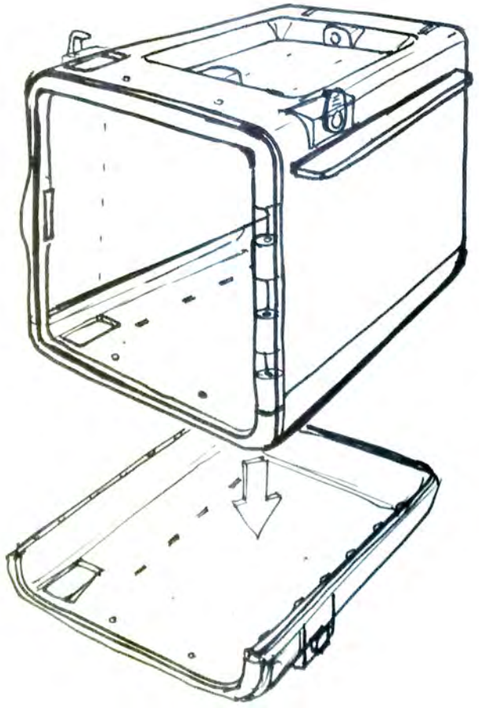
3 Sketch initial concepts

Concepts had to ensure that Tech Tub2® could:

- Store iPads® and Chromebooks™ in the same tub
- Have a system that keeps cords neat and tidy
- Be portable and strong
- Load devices from the front and...

*... **look great!***





Any color, as long as it's...

... green and dark grey. These are the colors we use for Tech Tub® designs and it probably wouldn't make sense to change those now.

These are the kinds of decisions we have to make when we start to sketch out concepts. How large will the tubs be? What shape? What colors?

And more importantly, how can we improve on previous designs?

4 CAD - Computer Aided Design

- We use a program called SOLIDWORKS to develop concepts on the computer
- SOLIDWORKS can take our drawings and make sure that 3D Printers and laser cutting machines can start to actually make Tech Tub$^{2®}$ components

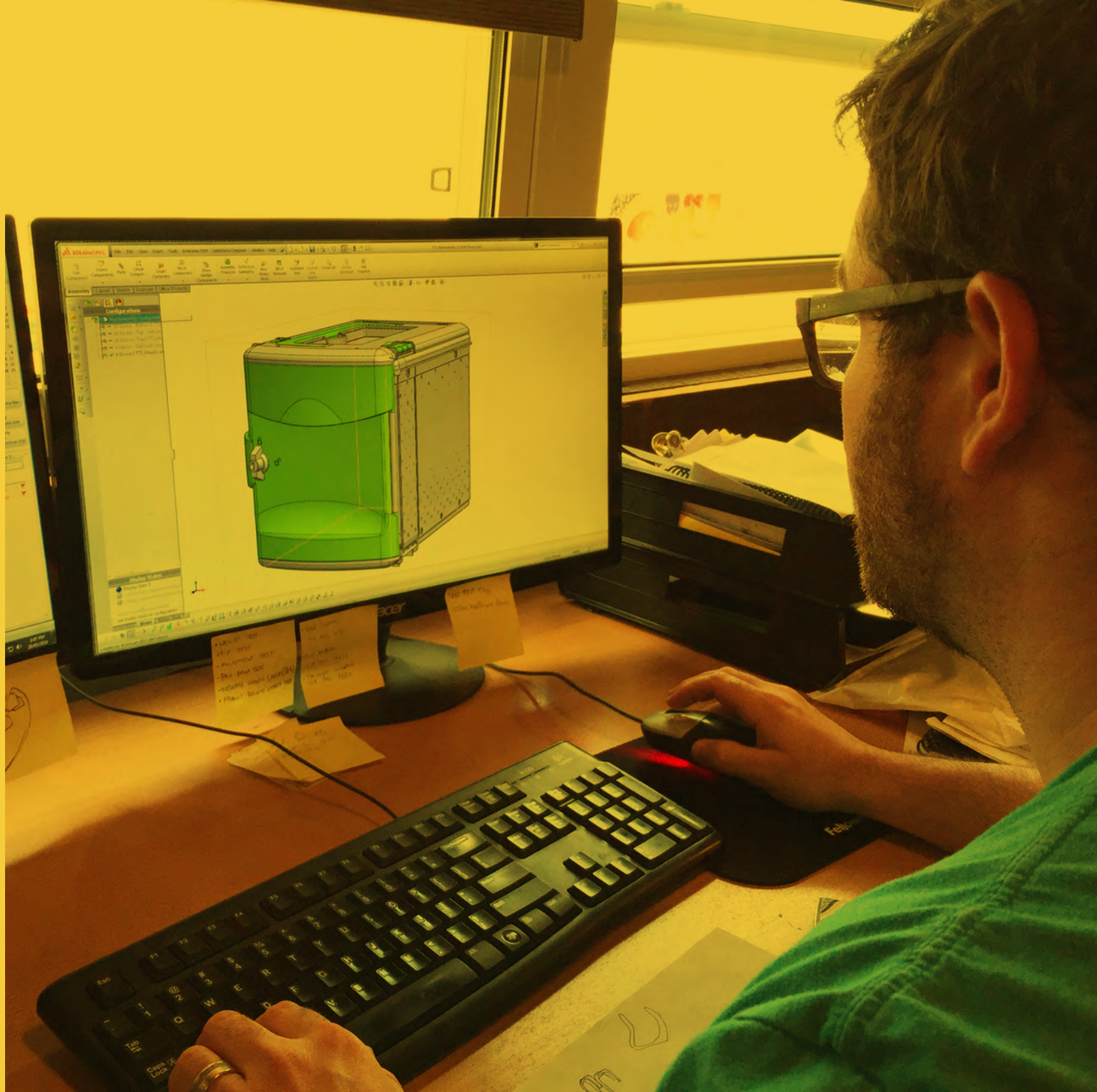
Time to refine the concepts.

Once the Industrial Designers' sketches are completed, reviewed and approved it is time to generate computer renderings.

Why do we do this?

We use the CAD rendering software to ensure our sketched ideas can actually be made in real life. Finding mistakes, like pieces that don't fit together perfectly, can be fixed at this stage. Fixing things now can save us time and money later on.

Once in the computer, the Tech Tub$^{2®}$ starts to really take shape.



5 Crafting prototypes

Recycling cardboard, not ideas.

Another way the Industrial Designers visualize a product is by building it out of cardboard and sometimes out of steel.

Although they get a lot of paper cuts, it's worth it because they can build something that is the same size and shape as their sketches and CAD.

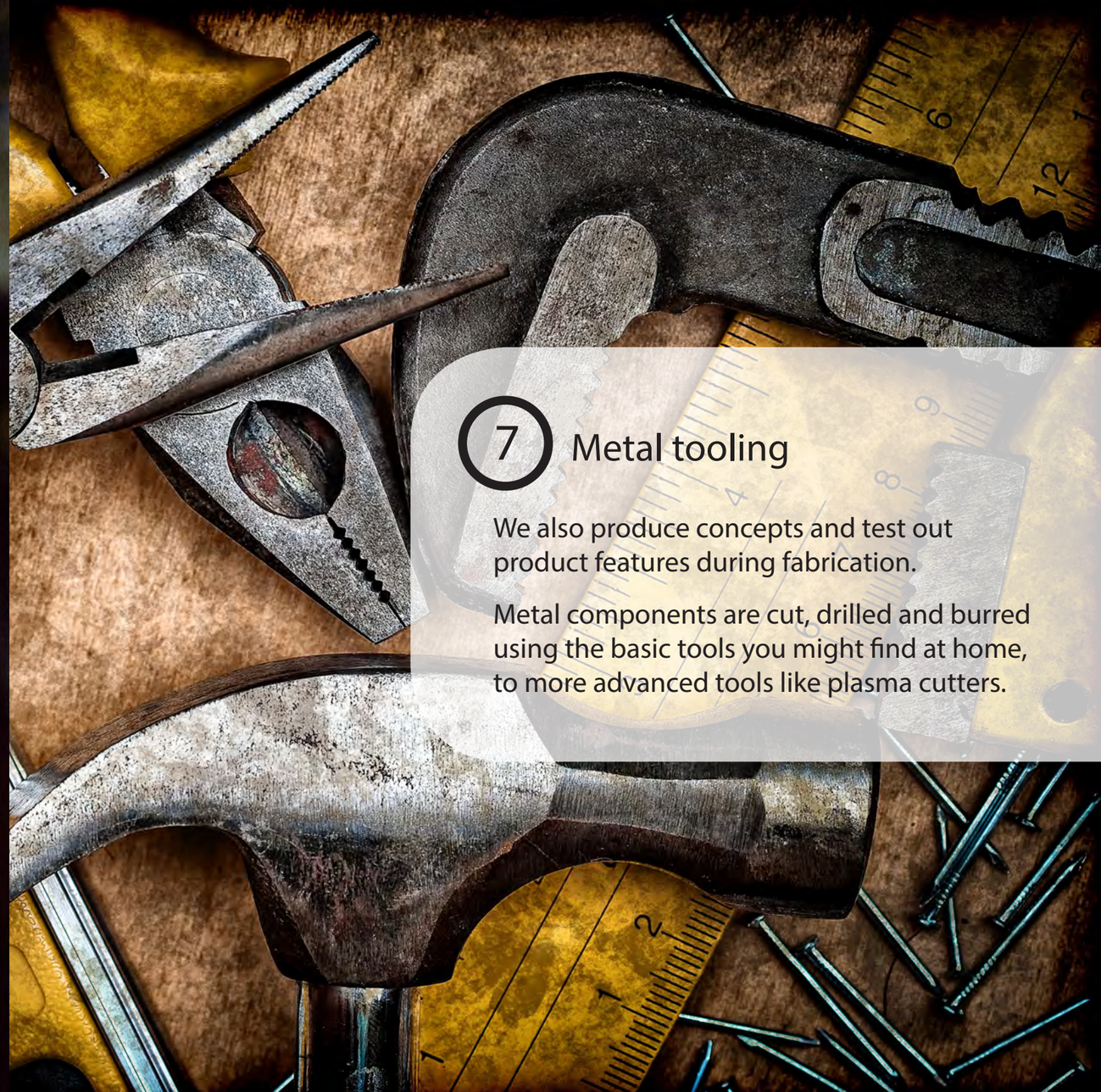
6 3D printing

A 3D printer is used to create a more detailed prototype or sample.

The 3D printer the Designers use is as big as a fridge and and we call him Theodore, as he is an important part of our design team!

Theodore prints the smaller parts like the handle and an even bigger 3D printer makes the larger parts, like the doors. Both of them take a very long time to make the parts. It took about 7 days to make this sample, printing non-stop. That's 168 hours!

The prototypes are then tested by teachers and students to see how they are actually used.



7 Metal tooling

We also produce concepts and test out product features during fabrication.

Metal components are cut, drilled and burred using the basic tools you might find at home, to more advanced tools like plasma cutters.

Nearly there!

8 Final design

With final concepts based on the 3D and metal prototypes approved, the technical drawings are sent over to the Production Department. In the olden days, this would have been all printed out on paper, but today, everything is shared digitally.

Cool facts about plastic injection molding.

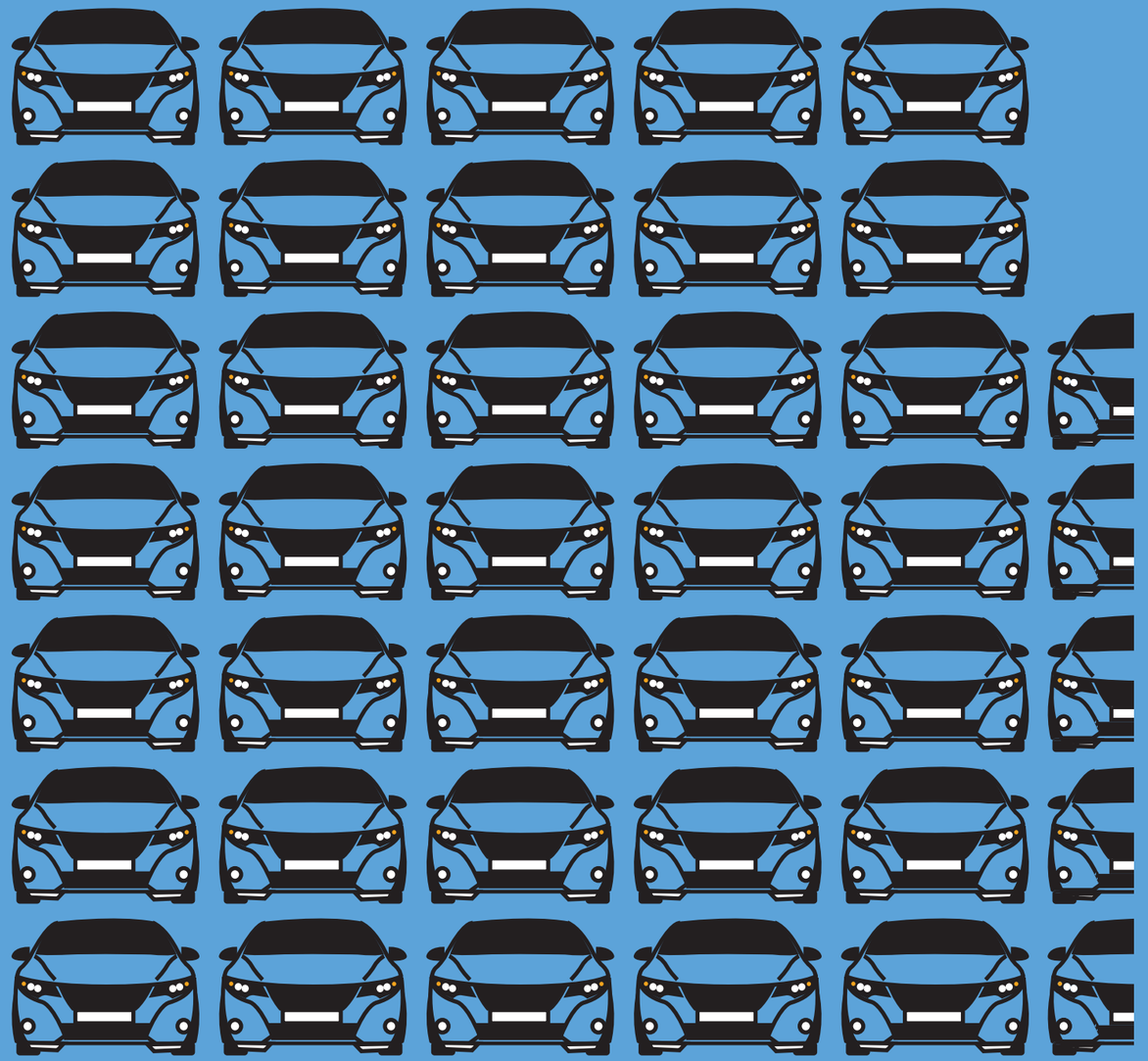
9

Now it's time for the big machines to get in on the action!

The Tech Tub$^{2®}$ is made of very durable plastic but how does it get its shape? It's not carved like a sculpture, or welded together like a swing set, it's molded into shape.

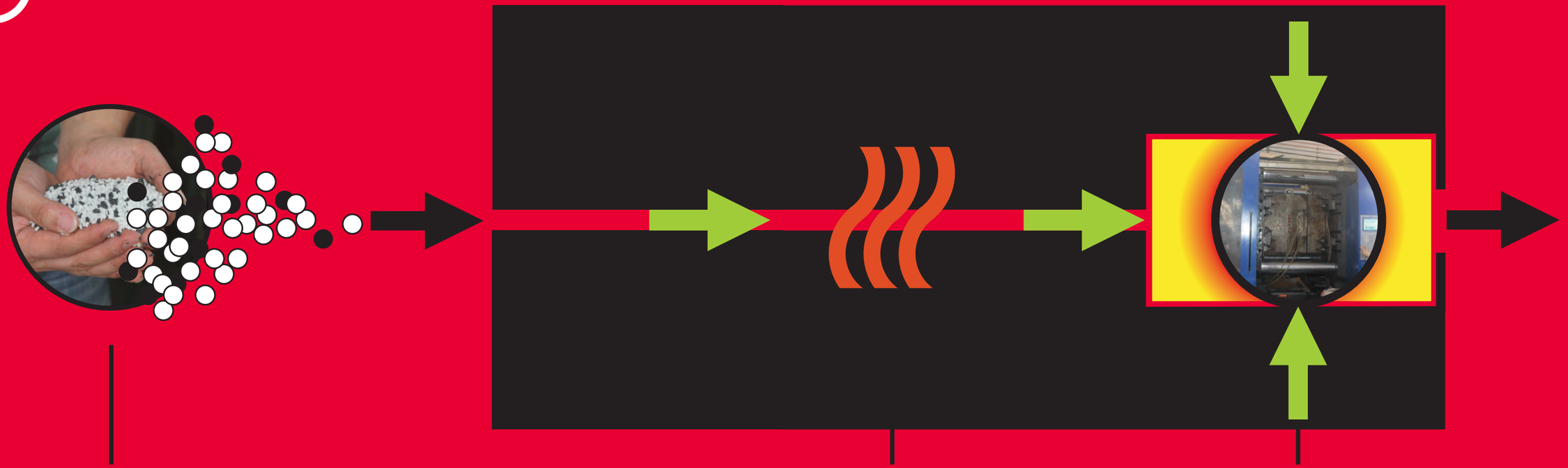
Here are some interesting facts to give you an idea of how BIG the mold is that made the Tech Tub$^{2®}$.

- The machine is 36 feet (11 metres) long and 13 feet (4 metres) tall.
- The machine weighs over 100,000 lbs (45 metric tons). That's the same as 37.5 Honda Civics!
- To run, the machine requires almost 400 gallons (1500 litres) of hydraulic oil. Imagine 400 gallons (1500 litres) of ice cream! That's a lot!



Under pressure!

10 How the machine works



Black and white plastic beads are added to the giant extraction machine. Most of the beads are actually white. These beads are made from a material called Acrylonitrile butadiene styrene (ABS). This is a strong, plastic that is often used to make things like car parts and canoes. This makes the Tech Tub$^{2®}$ strong and lightweight.

The plastic beads are heated to a temperature of 580 F/304 C to melt the plastic into a liquid.

The liquid is then pressed into a mold, with pressure added from the top, sides and bottom. This creates the shape for the top and sides of the Tech Tub$^{2®}$. The black and white beads are blended together to create the final grey color of the tub.

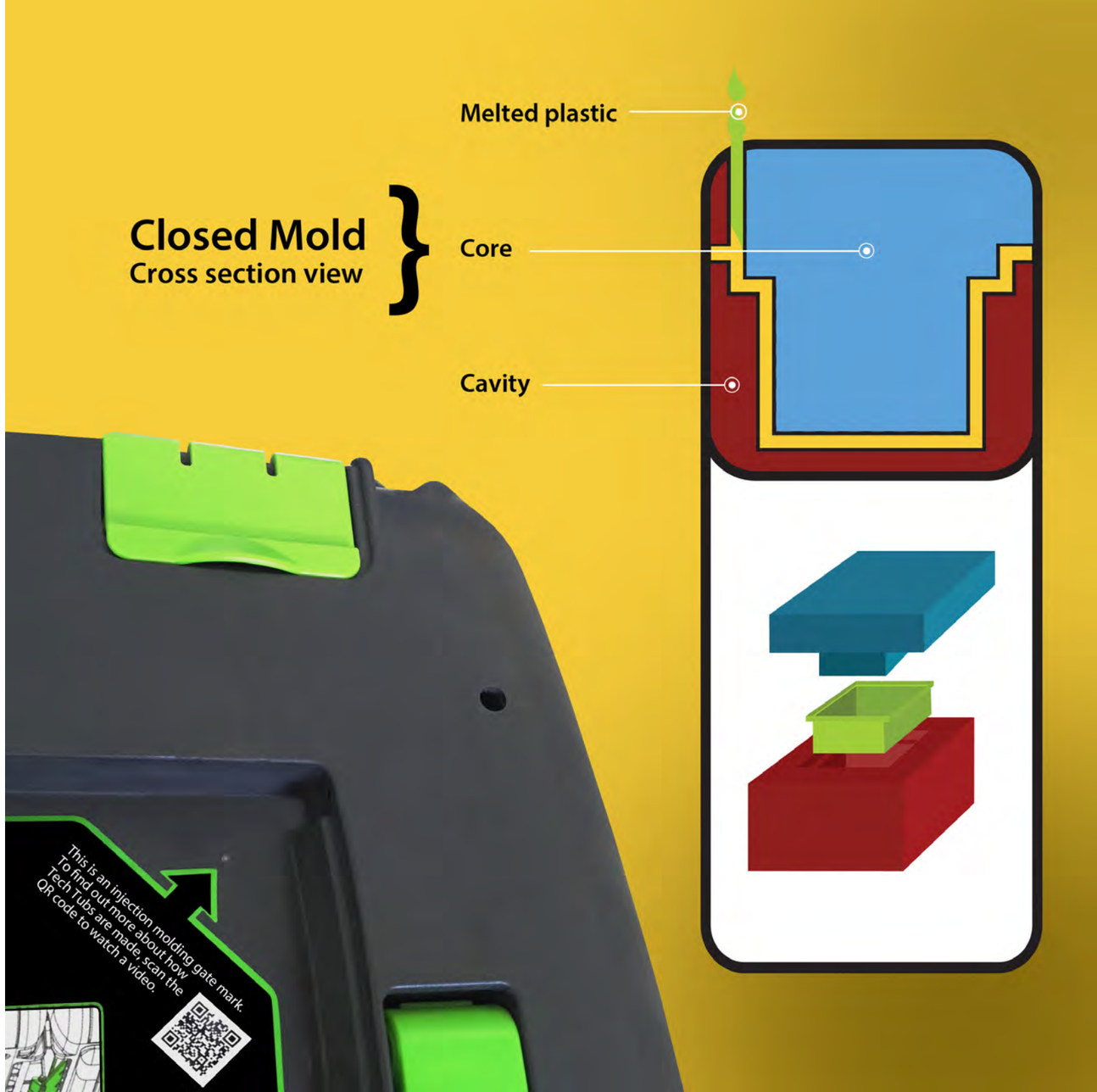
How does a mold shape the tub?

11 Molding the Tech Tub$^{2®}$

The mold has two parts, the core and the cavity. There is a small gap in between the two shapes where the melted plastic goes. The melted plastic is forced into the mold by the injection machine. On the Tech Tub$^{2®}$ it's forced in from the top. Take a look at the top and you will see an arrow pointing to what is called a gate mark. That's where the melted plastic was poured into the mold.

Once the plastic has cooled, it becomes a solid again. Then the mold is opened and the plastic tub is ready for final finishing to remove any rough edges.

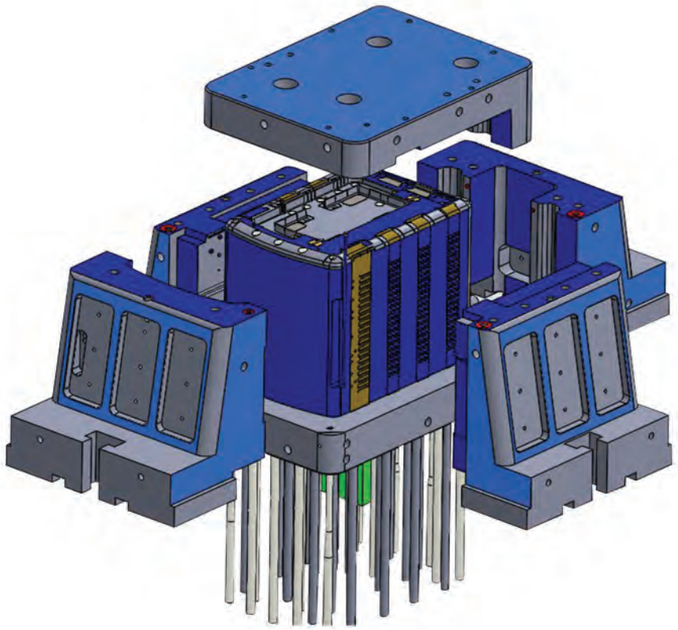
The molding only takes 2 minutes!



six directions!

12 How is the Tech Tub$^{2®}$ mold so different?

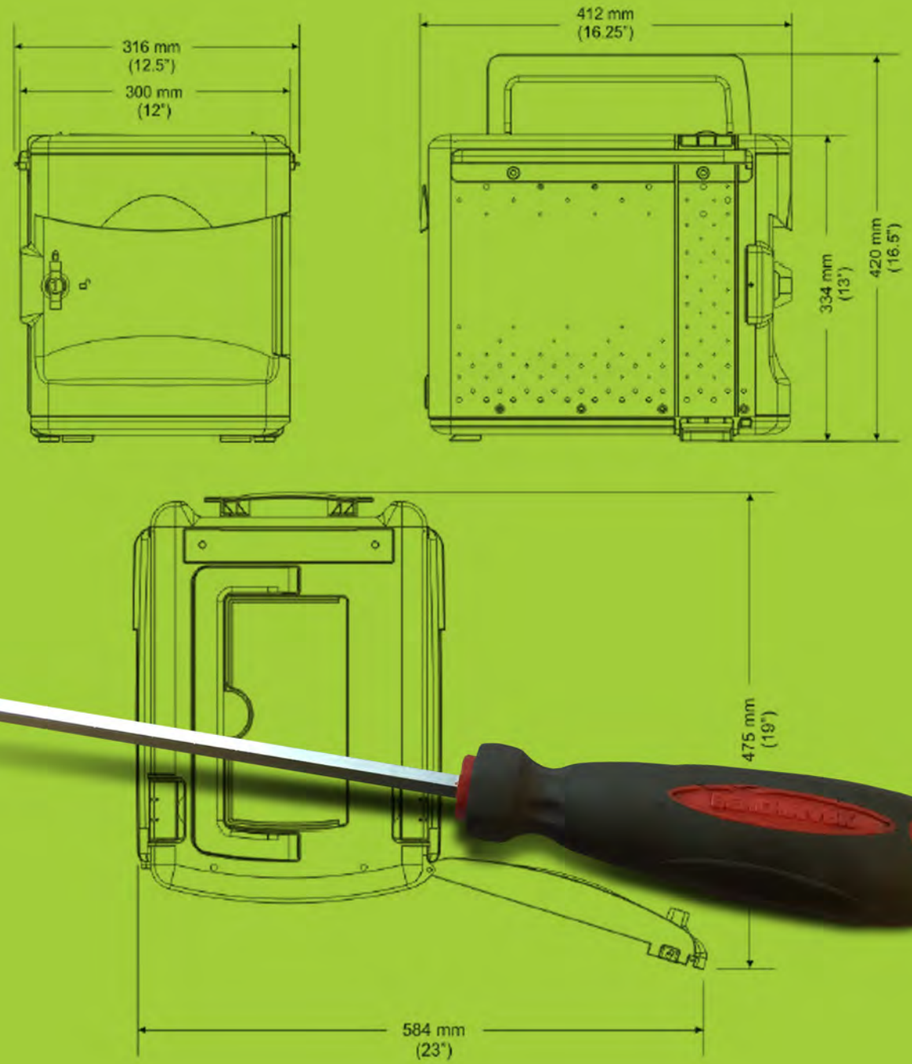
Most molds, like one you just saw, press in two directions; from the top and bottom. The Tech Tub$^{2®}$ mold is different because the shape of the dark grey body is more detailed and needs to be pressed from 6 different directions; top and bottom PLUS all 4 sides!



Now all the pieces can fit together.

(A little like a 3 dimensional puzzle).

13 After the dark grey body is finished, the door, handle and cable organizers are all put together. All these parts are molded through the same process, with each part having its own unique mold.



Viola!

14

Some parts are purchased from other suppliers, like the keys and lock. Other parts are made by metal manufacturers, like the locking pin.

A logo designed by the Marketing Department was then screen printed onto the Tech Tub®.

Finally, product labels are printed and attached.

Here is the final Tech Tub²®

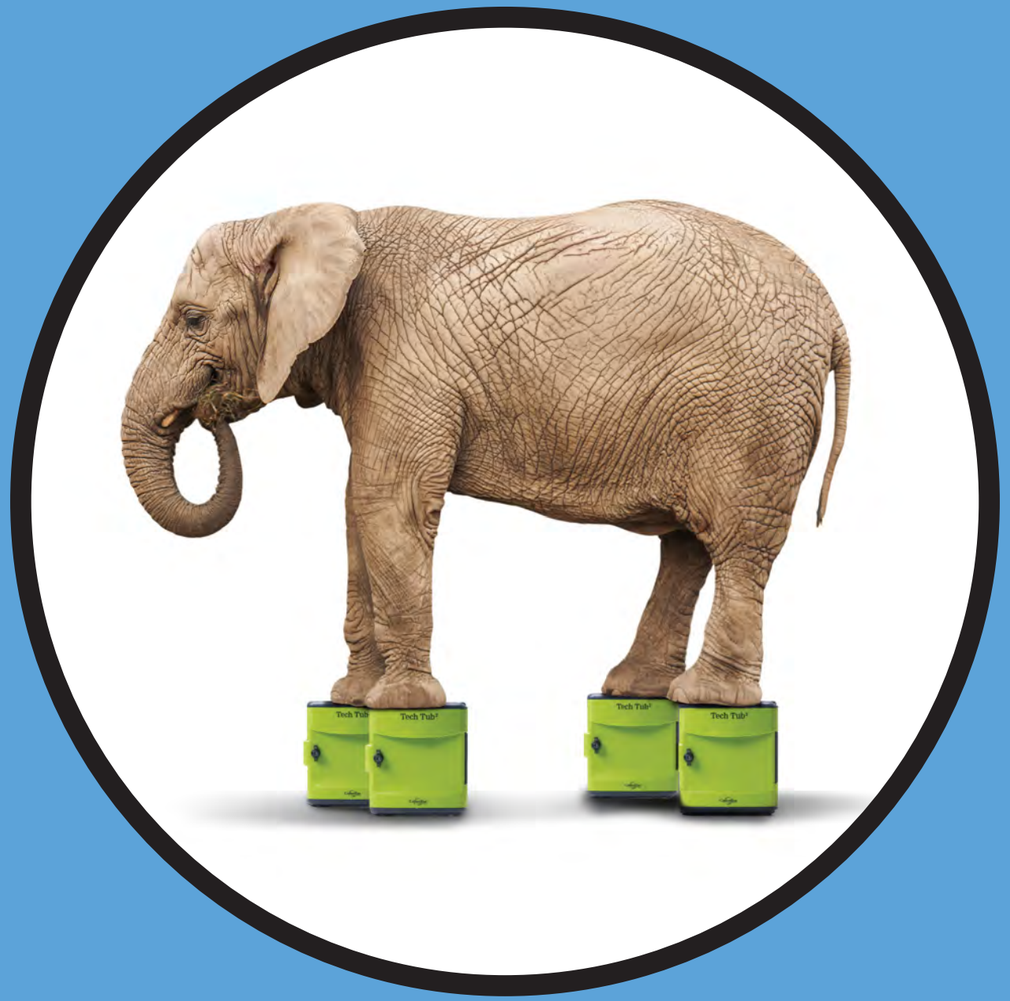
Quality control

15

How do you make sure each Tech Tub$^{2®}$ is exactly the same? Each tub is inspected by a person with very keen eyes! The inspection is called Quality Control or QC for short.

We test the finish to make sure it doesn't scratch easily. We test the strength by dropping the Tech Tub$^{2®}$ over and over again. We also fill the tub full of heavy weights to make sure it can hold devices. And sometimes, we even do what we call "Extreme Product Testing!"

(No elephants were hurt in the testing of this product.)



Shipping

16 After the Tech Tubs® have been checked over and are ready to go, they are carefully packaged in a cardboard box. These boxes are stored in our warehouse ready to be shipped when an order is placed.

Even better... all of our packaging is recyclable!


And there you have it.
The story of how your Tech Tub2® is designed and produced.