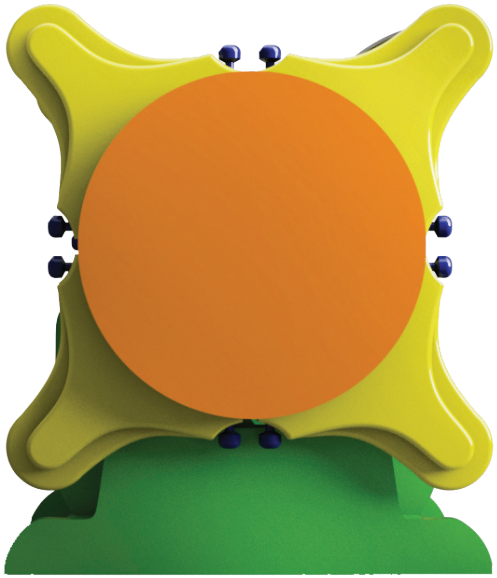

ROOTS: Turning today's trash into a brighter future

1 Submission Information

1.1 Contact Information

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1.2 Submitting Category

I am submitting as a Student
I used Autodesk Fusion 360

2 Product Description and Image

2.1 Product title and description

The mission of the ROOTS compost tumbler is to educate our growing generations on biological nutrient cycles and technical nutrient cycles. The tumbler does this by making both of these cycles visable through user interaction. This interaction is broken into two categories: the interaction with the tumbler, and an online service that serves as a journal for their tumbler.

The Tumbler

The ROOTS elementary school composter is a composting tumbler that packs and ships within its own composting drum. Every step of the tumbler use process from assembly to use is a teaching and learning opportunity for students and teachers.

Assembly:
Students learn about recycling and homogenous materials.
The assembly is even kid friendly, making for an active and dynamic lesson.

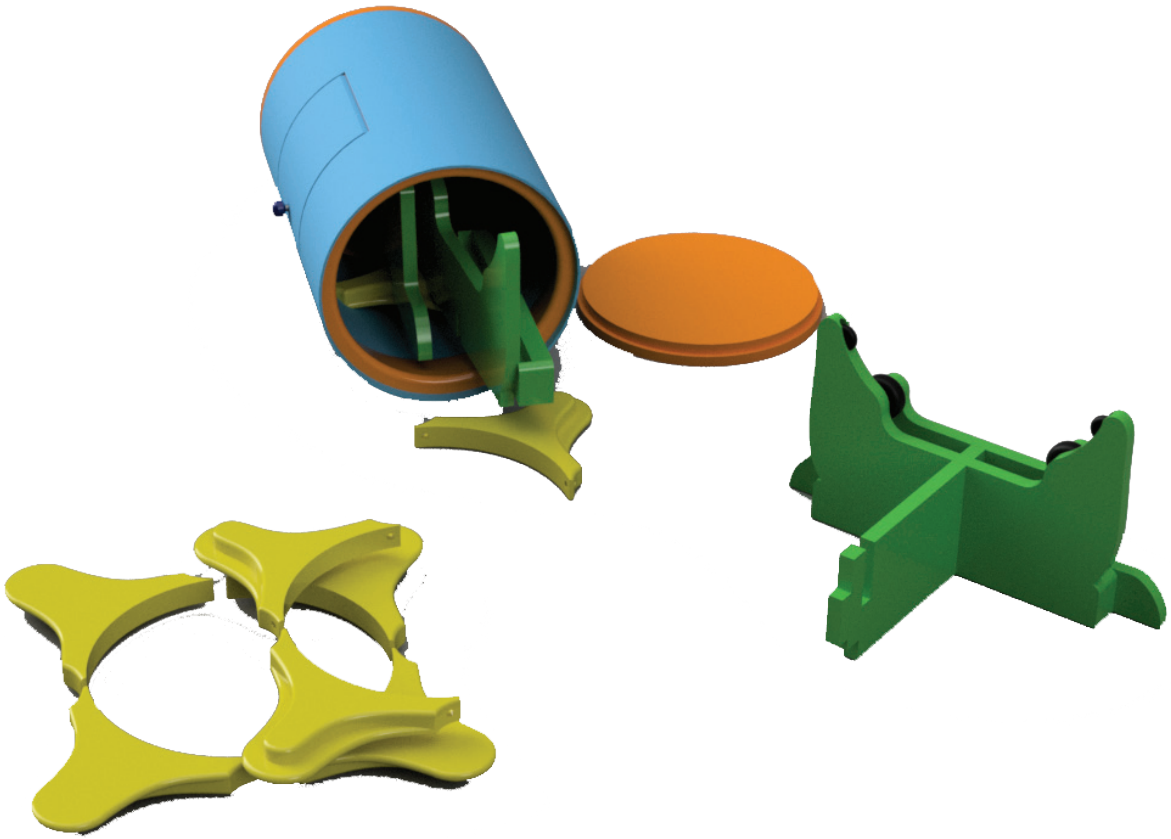
Use:
Supervised students fill and turn the tumbler regularly.
The design of the tumbler allows multiple students to operate it.
It's appropriately sized so that all students can observe the tumbler's contents

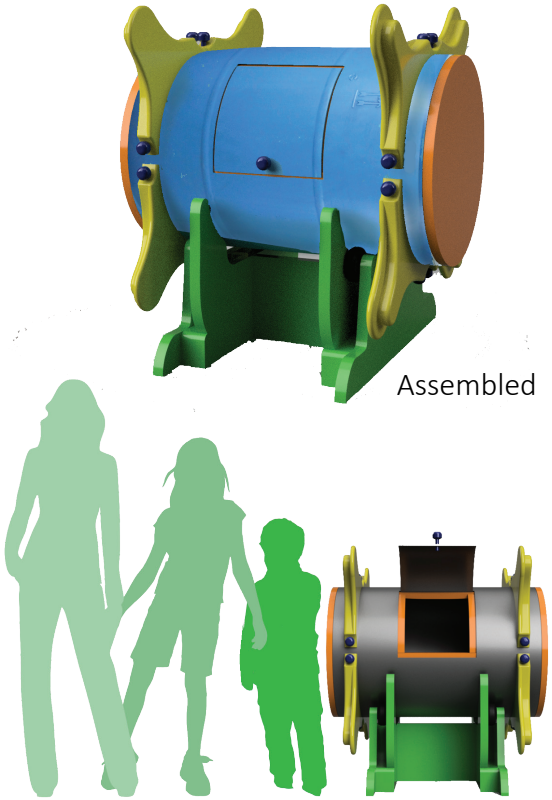
Return:
ROOTS offers a milkman style return and refurbish service.
Schools that produce more compost than they use can sell the compost back to ROOTS for an empty tumbler and discounts on additional tumblers
Through this process students can learn about the uses for compost outside of their school, including bioremediation, erosion control, and methane capture renewable energy.
A new class of students gets to assemble the new tumbler.

Online Tumbler Journal

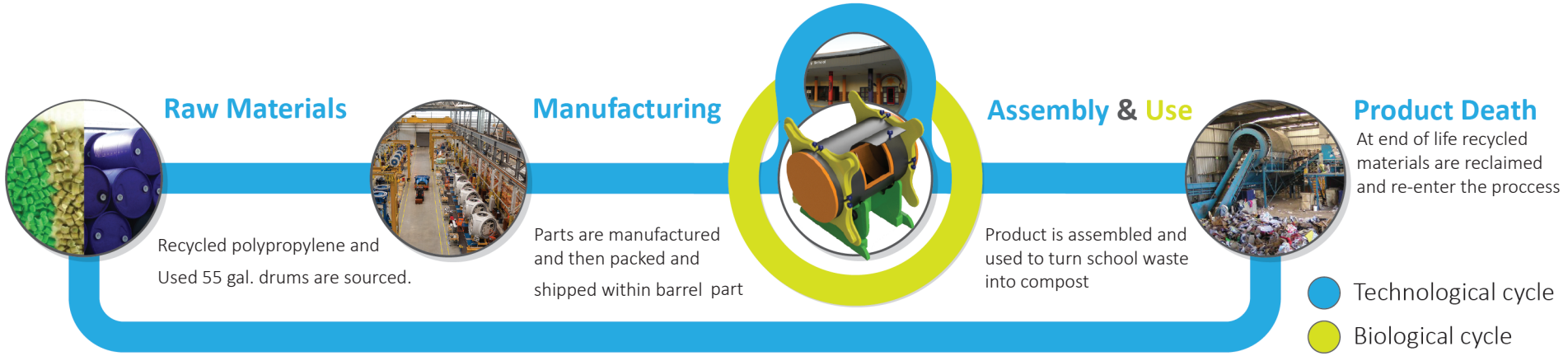
Each tumbler is pad stamped with a unique ID number and QR code that directs to an online website. This website houses resources about operating and maintaining the tumbler as well as a journal of the life of their unique tumbler. Through this service students can see how many other schools have used their tumbler, information about what it's made of, and how much waste it has diverted from landfills. They can also write and post their own entries for the tumbler.

2.2 Image



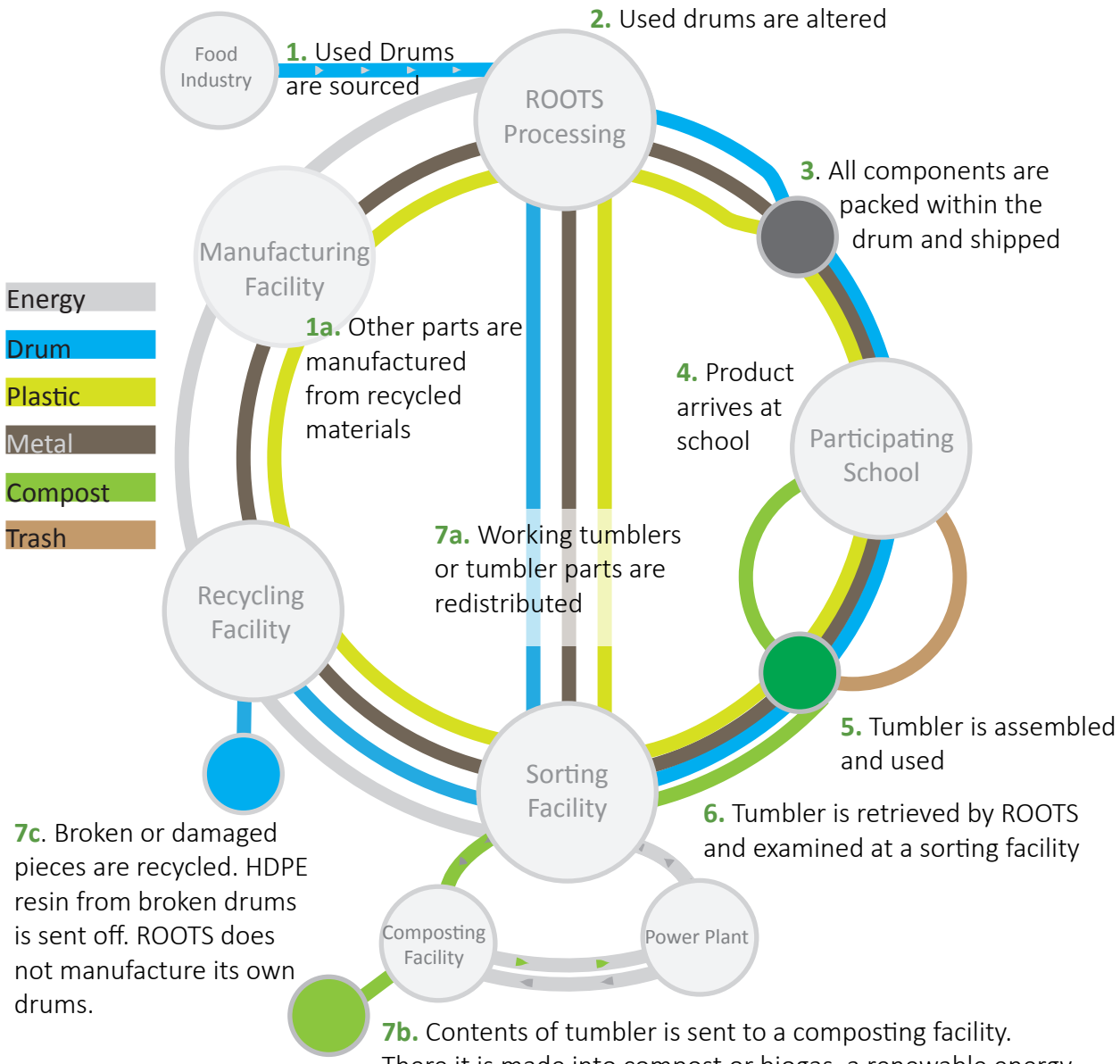


2.3 Illustration of ROOTS System



3 Reutilization Cycle and Business Model

Roots tumbler life cycle



Business model

External Grant Funding
Seek grant funding to supplement sales profit.

Sell Tumblers
Sell tumblers to elementary schools

Retrieve Full Tumblers
Schools that produce excess compost can trade full tumblers for an empty tumbler and discount on their next tumbler purchase

Distribute Tumbler Cotents
ROOTS examines contents and diverts them to methane capture facilities and industrial compost facilities

Refurbish Used Tumblers
Used tumblers are examined and undergo any necessary repairs and cleaning. Refurbished tumblers are repacked and sent to a participating school

4 Material Selection

4.1 Overview

HDPE & Rubber

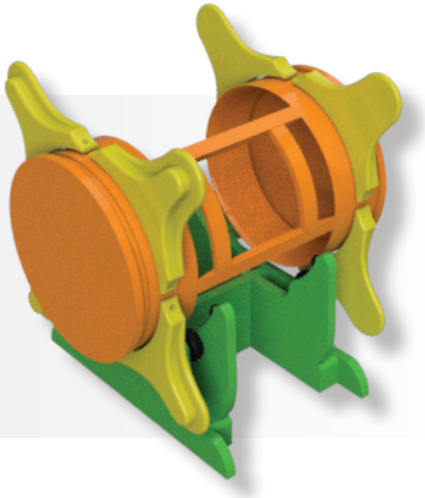
(Used 55 gal. Foodsafe Barrel)

Easy to dissassemble,
All recyclable/reusable materials.
Standard in the food industry,
Available in bulk for <$10 each
Highly weather resistant

100% Recycled Polypropylene

Wheels, endcaps, base, inner support

easy, commonly, and fully recylable
rotomoldable = low tooling cost
adequate stiffness and loadbearing qualities.



C2C Certified Galvanized Steel

Fasteners, hinges, axels, endcap latches

Strength to support drum with compost.
Highly weather resistant
Recyclable after processing

4.2 Reutilization score

100

The ROOTS compost tumbler is **99% Recyclable**. The galvanization coating and ink are non recylable.

4.3 Material Health

HDPE & Rubber

The only HDPE and rubber used has a **food safe designation**.
Additionally **HDPE as an NFPA health core of 0.**

Polypropylene

Polypropylene has an **NFPA score of 0**

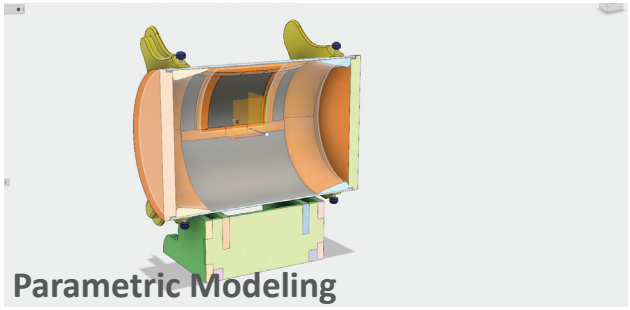
Galvanized Steel

The galvanized steel to be used is **C2C certified**. It is the least healthy material in this product because it uses: zinc plating during the coating process and and low concentration HCL during the recycling process to strip the zinc coating.

5 Design with Autodesk Fusion 360

Overview

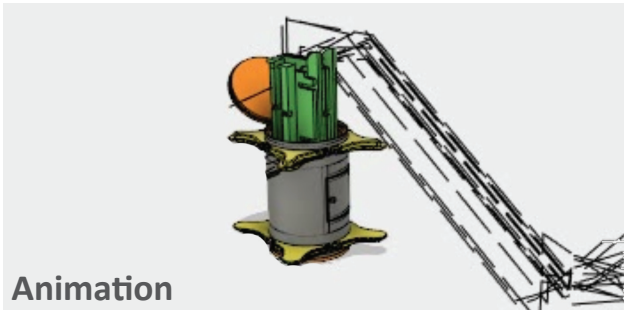
I used Fusion 360 extensively in this project. To be honest making the transition from competitors' software to Fusion was not easy. However, after this experience I am seeing major benefits and distinctions in Fusion compared to other modeling softwares. The biggest overarching strength in this software is the inclusivity it has between various CAD functions. During this project I used Fusion to create working assemblies, prepare models for CAM software, render assemblies with different materials, animate assemblies. I was able to do all of this in one single file. That fact alone made me a



Parametric Modeling

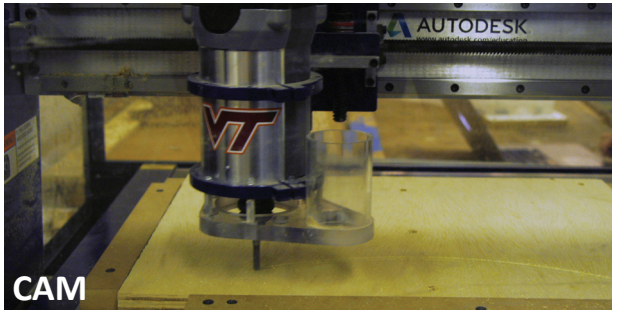
I used parametric modeling, not direct. Most of the components in my model appear more than once in my assembly. By using the time-line feature, arrays, and mirrors, I was able to change one component's parameters and have that change be reflected in all of the dependent bodies.

Fusion's ability to switch back and forth between compenents in one workspace is key to many C2C workflows. It makes managing and modeling multipart assemblies easy, and in a C2C context, it is easy to model a complex assembly of homogenous pieces. In other softwares, each piece is its own file, creating a more time consuming workflow. In Fusion I could also use finished bodies as tools to make new bodies through the intersect tool.



Animation

I first dabbled in the animation workspace to make animations for presentations. However, I quickly realized this separate space was perfect for testing the packability aspect of my product. In the animation work space I could move all of the parts and pieces without disrupting the assembled model which lived safely in the Modeling Workspace. I used this heavily in designing the inner skeleton portion of my product, fur I could see if and how all of the pieces fit within the barrel assembly.



CAM

I used the CAM workspace to move from digital to physical. In the image above, a CNC router is following a toolpath created in Fusion to cut out one of the tumbler petals or handles. This was immensly helpful because it allowed me to create full scale prototype pieces very quickly. From seeing and holding these 1:1 scale pieces I got a sense of size and feel for the product and made tweaks in the model accordingly.

For C2C and product design this functionality is huge. It allows users to quickly jump between digital and physical, and it greatly simplifies flatpack design workflows. A designer can work in the modeling space with an assembly, and prepare tool paths for prototypes without dissassembling or reorienting their assmebled model