After completing this session, students should have a more detailed understanding of the different types of parts and assemblies for the model they choose to build. Teams should be defined, and teamwork should begin in all key areas. A detailed BOM should be developed.

Preparation
- Select members for key roles.
- Prepare features and drawbacks for 2-3 viable models.
- Arrange to have a demo machine on-site, or prepare detailed photos of the different machine options.
- Prepare science notebooks for each student for use throughout the project.
- Bring an old (traditional) printer or two for disassembly, and bring tools to use in that process.

Goals
- Decide which machine model to build.

- Understand parts and subassemblies.
- Create a BOM for the project machine.
- Develop some funding ideas and promotional items.

Assignments

Looking Ahead
- Finalize BOM.
- Order parts, or source locally.
- Raise funds.

Overview

Break this and future meetings up into two parts: general meeting and teamwork. The Build Master should eventually lead the general meeting, if possible. Use this meeting for group discussion and to discuss project updates as a group.

Preparation Bring at least one old or unused machine (such as a printer), and a good selection of tools that can be used to disassemble it. Bring science notebooks and snacks, if appropriate.

General Meeting

Model Selection Review the benefits and drawbacks of the different build options, and make a selection as a group.

General Part Overview Reivew the major types of parts and subassemblies of the machine, and take questions. Types of parts should include the plastic parts (also called RP, or rapid protoype parts), hardware (nuts, bolts, threaded rods), electronics (power supply, motors, wires), motion control parts (smooth rod, bearings, belts), and other parts (filament, tools, supplies). Machine subassemblies should include X, Y, and Z axes, the extruder, and the frame.

Key Role Selections Identify those students who have been selected for key roles, and describe how the group will be broken up for teamwork.

Teamwork

Build Master & Build Team For this teamwork session, this group should ideally include 3-4 members, but no more than six. Members will identify the parts and quantities required for each subassembly, and will report their findings (when complete) to the BOM team. An adult facilitator should be on hand to help team members with part names. The subassemblies can be defined as follows:

- **Extruder**: Things that involve moving and melting filament.
- **X Axis**: Things that move or enable movement in the X direction (side to side), but not the extruder.
- **Z Axis**: Things that move or enable movement in the Z direction (up and down), but not the X axis or extruder.
- **Y Axis**: Things that move or enable movement in the Y directon (front to back).
- **Frame**: Things that provide structure and support for all of the above.
- **Other**: Everything else, including electronics, power, wiring, filament, and special tools or supplies.

BOM Manager / BOM Team The goal for this team is to create organized lists of parts that will make up the bill of materials (BOM) for the project build. Adult facilitators should guide the members through the process of creating two lists: An **Assembly View** will be used to record the

names, quantities, and types of individual parts required for each general subassembly as they are identified by builders; and a **Master BOM** will be used to track totals for each part. It's a good exercise to start each list on paper, but they should later be moved to a spreadsheet so they can be easily sorted and tracked.

The **Master BOM** can either be created at the same time as the **Assembly View**, or at a later time. It is the master part list, and should eventually include columns for Part Number, Name, Size/Description, Quanity, Type (e.g., plastic, hardware, electronics), Source, Expected Price, and Date Needed. Some of these fields will be blank or will change until the build plan and the Assembly View is complete.

The **Assembly View** will be created in real-time as builders identify what parts are required for which assemblies. This view should include columns for Part Number, Name, Size/Description, Quanity, Type (e.g., plastic, hardware, electronics), and subassembly. It may be helpful to collect this information into a notebook using one page per subassembly.

Accountant / Accounting Team The goal of this team is to create a general ledger, a method of tracking and managing both cash and noncash donations, and some sample verbiage that can be used to request contributions and educational discounts.

The ledger should provide a detailed accounting of all cash funds, including seed funding, cash contributions, and outlays. It should be clear who requested what funds for which purpose and when. It should also be clear which contributions require or have received **tax receipts** and **thank-you cards**. (Out of professional courtesy, each contribution, gift, or discount should receive a personalized card from the team in response, and the accounting team should coordinate this effort.)

The accountant must plan carefully to be sure the available funds are never exceeded, and should begin to develop a **budget** (perhaps organized by subassembly) in order to keep the project in line. An adult facilitator can provide guidance on how to work with the other team members to manage costs, negotiate requirements, develop alternatives, or raise funds.

Blogger / P.R. Team The goal of this team for this session is to begin documenting the progress of the team, and to begin the development of promotional materials that can be used to provide information or request support.

Documentation involves taking **notes, photos, and video** of every step of the build process, and using them to write public **blog posts**. Public posts should be reviewed by a faculty sponsor before being published.

This team should also begin the development of an **informational flier** that can be used to help describe the purpose and goals of the team to those who are either generally interested, or may be willing to help support.

Membership Team The goal of this team is to create and keep information on team members and adult facilitators, including primary teams or roles, **contact information**, and any pertinent privacy requirements. The team should begin to identify areas where either more or fewer resources are required, and should help place or recruit team members accordingly.

The team should also create a **calendar** of meeting times, dates, and locations, and if appropriate, information on who is providing snacks for which meetings.

Makers The team of makers for this session is made up of anyone who is not already working with another team. Their job is to work together to disassemble one or more old or broken machines in order to scavenge for useful parts. The machines should be disassembled without cutting, deforming, or breaking any parts. The machines should be **completely disassembled**, and useful parts saved. Useful parts might include motors, springs, screws, LCD displays, switches, power supplies, and cables.

An adult facilitator should be available to help with this process and to provide guidance on what various parts might be used for in the machine, and to help team members use the tools and identify all the parts.

Student Assignments
- Complete the tasks started at this meeting.
- Begin raising funds and requesting parts.
- Begin sourcing parts and checking prices.
- Prepare brief status updates for the next meeting.

In the Interum
- Review BOM and help to fill in missing parts.
- Help members source, price, and request parts.