Prototype to Full Production Cup

Geocup: the hot cup with cool zones.
(geocup.com)

Geocup is sustainable packaging for hot drinks to-go. It is composed of two unique components: the 8-port safety-sip plastic lid and the paper hot cup with two opposing, full-height insulating strips or cool zones. Producing the cup design is within the parameters of both the primary forming machine (cup) and the continuous thermoforming machine (lid).

1.) SAMPLE PROTOTYPES: Create 500 to 1000 units using existing cup geometry[1].

- Use "off the shelf" cup geometry (6º sidewall slope/3.5"Ø rim) for 16 oz. paper cups. These cups are made from unbleached kraft cupstock with polyethylene (PE) film on inside face.[2]
- Manually cut and attach opposing insulating strips or cool zones to cup sidewall.[3]
- Cut new single cavity mold and thermo-form 500 to 1000 plastic lids to fit premade cups.

Δ Estimated cost of prototypes: $15K

2.) TEST MARKET PROTOTYPES: Create 50,000+ units using a combination of primary or cup forming machine (PFM), paper handle machine, new finishing module and new or existing tooling.

- Use either "off the shelf" cup geometry (16 oz. cup w/6º sidewall slope & 3.5"Ø rim) or engineer and cut new tooling (for ideal cup geometry) to reflect increased sidewall thickness at insulating strips.
- Use same unbleached cupstock as sample prototype.
- Mechanically cut and attach opposing insulating strips or cool zones to cup sidewall:
  Option 'A': Blank insulating strips off-line by corrugated paper maker and attach in-line to finished paper cups. One strip is attached at the PFM station. The other is attached downstream at a paper handle machine (heat seal or cold glue attachment TBD). This strategy requires only recalibration of the production line and not major retooling.
  Option 'B': Finished cups are transferred to new finishing module where insulating strips are cold-glued to cup sidewall. The finishing module requires engineering and prototype development by machine manufacturer.
- Use same plastic lids as sample prototype or cut new multi-cavity die to create several thousand lids.

Δ Estimated cost of engineering and prototyping finishing module: $250-280K
Δ Estimated cost of new multi-cavity die for lid forming machine: $30-50K

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[1] Proper cup geometry–i.e. cup height, sidewall slope and bottom depth–maximizes nesting of cups while allowing their easy de-nesting. Using an "off the shelf" geometry not engineered for the increased total board thickness of the cool zones will inhibit proper de-nesting of sample cups.

[2] Polyethylene (PE) film for the cup (.075") and polystyrene (PS) for the lid (0.14") are totally chlorine-free resins. Of the seven polymers, PS ranks third in terms of impact to the environment and PE ranks fifth (Tellus Institute).

[3] Insulating strips are made from unbleached single-face, micro-flute corrugated (recycled) paperboard type 'G'.

3.) FULL-SCALE PRODUCTION RUN OF CUPS: 12, 16 & 20 oz. Geocups require only new tooling (for ideal cup geometry) for the primary forming machine (PFM). The new finishing module (to attach cool zones) is a peripheral machine to the primary forming machine. In order to produce the Geocup, a cup manufacturer would only need to purchase the finishing module and new tooling for the PFM. Some recalibration of the production line would also be required.

- Cups: Engineer and machine new "tools"–to reflect ideal cup geometry–and recalibration of two PFM's @ $60-$80K each. Engineer and build new off-line finishing module to attach 1" wide, diametrical insulating strip blanks to sidewall blanks @ $250K ± (estimates by Paper Machinery Corp. and Sherwood Tool, Inc.).
- Cupstock: Unbleached 50/50 fiber blends. The target mix for these alternative blends is 50% post-consumer recycled fiber and 50% non-wood and/or "tree farm" fibers w/PE film one-side.[4]
- Lids: New multi-cavity dies for continuous thermoforming machine @ $20K to $30K (estimates by TJ Design).

Δ Estimated cost of production cups:
- New tooling for primary forming machine, including recalibration: $60-$80K per machine.
- New finishing module to attach insulating strips: $250-280K.
- New multi-cavity die for lid forming machine: $30-50K.

4.) PAPER CUP CONVERTER OVERVIEW: The primary forming machine (PFM) produces a range of cup sizes–or geometry's–by its interchangeable "tools." The PFM is the most expensive and intricate converting machine in the high-speed production line. Any ancillary forming process–e.g. attaching opposing strips–must be arranged so as not to affect the PFM if it "goes down." Any new cup design must respect the parameters of the PFM and its position in the line.

- Full production run of Geocup requires a new set of "tools" for two PFM's (one for 12 oz. & 16 oz. sizes, and one for 20 oz. sizes). A cup's geometry includes its height, sidewall angle, board thickness, base and orifice diameter. Any one of these constraints may be altered to allow proper nesting of finished cups. Geocup's sidewall strips do increase overall board thickness but it is mitigated by a slight adjustment to the cup's sidewall angle. A slight increase in stack height also occurs but does not affect cube efficiencies for shipping.
- Full production run of Geocup requires a new finishing module to attach insulating strip blanks to sidewall blanks. This process happens "off-line" and upstream from the PFM–minimizing any impact to the production line. Also, blank-fed PFM machines–verses roll-fed machines–allow easier "change overs" and are fast becoming an industry standard.
- High-speed thermo-forming of Geocup's plastic lids require a new set of interchangeable dies.
- Transport packaging: Transport costs are determined by volume not weight. Both cup and lid of the Geocup system are within the current cube efficiencies for shipping containers[5].

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[4] The goal of transitional designs like Geocup is to evolve into 100% recyclable artifacts with no toxic legacies. In future versions, Geocup's plastic moisture barrier will evolve into an aqueous clay coating, totally inert and recyclable–this coating has been developed by Jefferson Smurfit of Middletown, Ohio.

[5] Transport package sizes for 48 ft. and 53 ft. long trailers are controlled by width and height. Including skids, cube clearance is 100 in. in width and 110 in. in height.