CAPSTONE EXPERIENCE 2015

Purdue University Creamery

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PROBLEM STATEMENT:
A lack of on-campus internship opportunities for Biological Engineers, coupled with the absence of a student run production facility.

OBJECTIVES:
1. Design a student run creamery that allows for internship opportunities and departmental research
2. Provide homemade ice cream products using locally sourced ingredients
3. Restoration of the previously successful Purdue creamery
4. Flexibility in production as demand changes

PROJECT BACKGROUND:
- 15+ university creameries exist (5 are BIG 10!)
- Purdue's original creamery operational 1913-1969

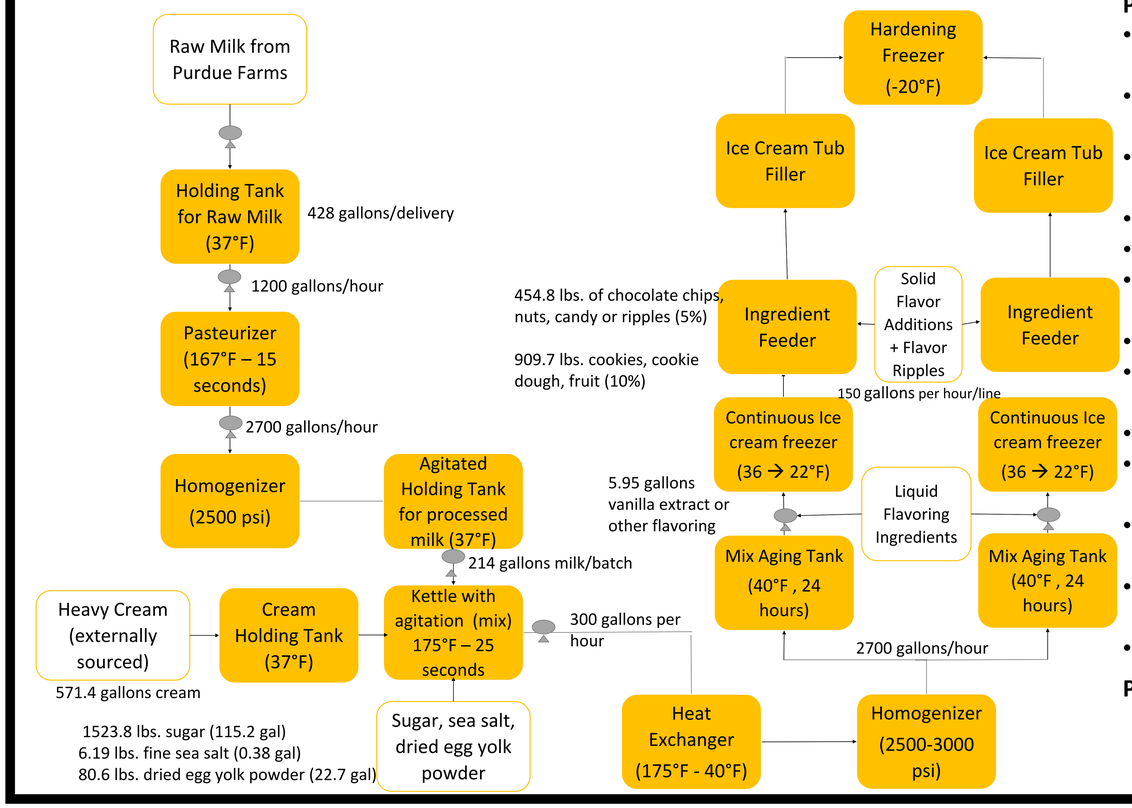
MARKETING AND CONSUMPTION:
- Midwest consumes 17.9% of U.S. ice cream
- Purdue market includes 15,000 students

ICE CREAM INGREDIENT FUNCTIONALITY:
Dairy: Milk, Cream, Nonfat solids (NFS)
- Fat: Provides creaminess and richness of ice cream
- NFS: Stabilizes air and influences body and texture

Sweeteners: Sugar, Corn Syrup, Sucralose
- Lowers freezing point of mix, allowing fraction of water to remain unfrozen
- Allows product to be scooped and eaten more easily

Emulsifiers: Egg yolks, Mono- and Diglycerides
- Keep the fat evenly dispersed in the product during freezing and storage
- Smooth product achieved from even fat distribution, stabilize the air incorporated

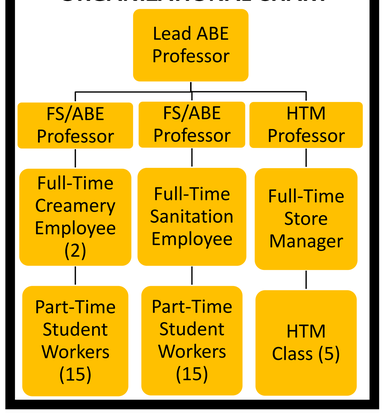
Scheduling Information	
Monday	Milk delivered and processed, process ice cream up to aging
Tuesday	Freeze ice cream
Wednesday	Clean in place
Thursday	Process ice cream up to aging
Friday	Freeze ice cream
Saturday	Clean in place



PROCESS BREAKDOWN:
- Holding Tank: Raw milk sourced from Purdue dairy farms will be held at 37°F.
- Pasteurizer #1: Raw milk will pass through to ensure killing of microorganisms.
- Homogenizer #1: Milk passes through to ensure stability of final emulsion, by decreasing globule size.
- Agitated Holding Tank: Stores milk at 37°F.
- Cream Holding Tank: Stores externally sourced cream at 37°F.
- Kettle with Agitation: Ice cream mix ingredients are brought together and heated to kill microorganisms.
- Heat Exchanger: Cools mix down to storage temperature of 40°F.
- Homogenizer #2: Final ice cream mix is homogenized to ensure acceptable texture of final product and stability during aging.
- Aging Tanks: Emulsifiers adsorb onto fat droplets and flavor develops.
- Continuous Ice Cream Freezer: Converts ice cream mix to a semi-frozen product.
- Ingredient Feeder: Allows addition of solid ingredients to specialized ice cream flavors.
- Ice Cream Tub Filler: Dispenses semi-frozen product into 3 gallon and quart containers for sale.
- Hardening Freezer: Allows final freezing of ice cream and safe storage

Production:
16,000 gallons per month [April – September]
8,000 gallons per month [October – March]
144,000 gallons per year [Total]

ORGANIZATIONAL CHART



Works Cited
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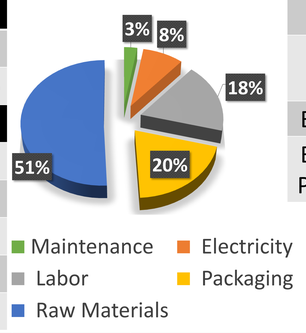
- Goff, H. and Harte, Richard. (2013). *Ice Cream*.
- Penn State (2014). *Berkey Creamery Process Flow Diagrams*.
- Pennsylvania Code, The. (December 6, 2014) *Raw Milk Testing Schedule and Standards*.

ECONOMIC ANALYSIS

Initial Costs	$
Equipment	$536,500
Plant	$3,104,495
Annual Costs	**$/year**
Electricity	$133,264
Labor	$278,688
Packaging	$313,920
Raw Material	$794,354
Maintenance	$42,586



Yearly Data	Values
ROI	57.2%
Annual Profit	$2,456,708
Breakeven	1.25 years
Breakeven Production	70,250 gallons/yr

Revenue Source	Peer $	Purdue $	% Sales	$/year
Individual Scoops (6 oz.)	$2 - $3	$2.50	30%	$2,304,000
Pint	$5 - $6	$5.00	12%	$691,200
½ Gallon	$5 - $9	$8.00	8%	$184,320
Commercial (3 gallon)	$26 - $40	$35.00	50%	$840,000

PROCESSING ALTERNATIVES:
- Making cream from raw milk
- Using traditional pasteurization method
- Combined pasteurizer and homogenizer system
- Shorter aging time

FORMULATION ALTERNATIVES:
- Simple Mix: good flavor, slightly grainy
- Custard Mix: thick, intense egg flavor, good mouthfeel
- Cornstarch Mix: off taste, left coating in mouth

SUSTAINABILITY:
- Environmentally, little to no waste in production
- Economically, self sustaining and profitable

GLOBAL/SOCIETAL IMPACT:
- Increase student opportunities and University funds
- Support of the Purdue dairy and local suppliers
- Interest by Purdue alumni in the reappearance of the Purdue creamery