



Organ Vitality System

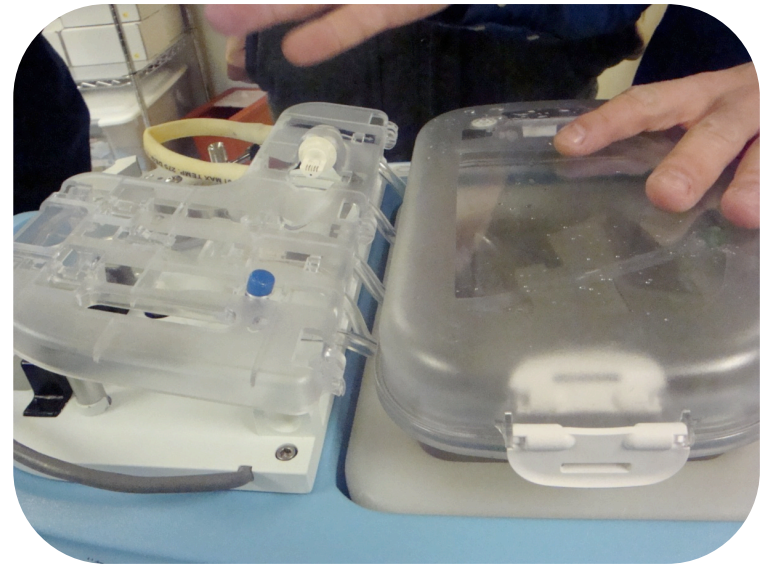


Prolonging organ viability during transport

Purple A
Fall 2009

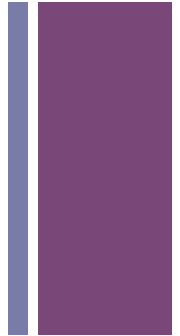
+ Customer Contacts

- MGH Transplant Research Center
- Brigham Transplant Program
- New England Organ Bank



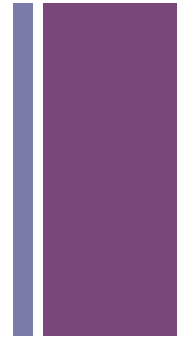
+ Customer Needs

- Major needs
 - Controlled cooling with fluid circulation
 - Portable power
- Other needs
 - Easy to carry
 - Maintain sterility
 - Tracking and monitoring





Key Challenges



- Cooling capability
 - Maintain 2 - 4°C at ambient temperature of 25°C
 - Portable power
- Technical analysis
 - Lumped-element thermal model
 - Must remove 10.4W heat in worst case

+ Cooling Options Matrix



Criteria	Peltier	Vapor Compression	Stirling	Vapor Absorption (Propane cooling)
Size	50X50X3.1mm	19.3X18.3X20.25in	175X175X280mm	59.7X69.9X141.6cm
Power (W)	245W	COP=3, 66.7W	0-48W	350W
Weight(lb)	1 oz.	43	4.1	45
Price	\$25	High(unlisted)	\$560	\$450
Cooling Capacity (W)	40*	200	35-40	200 (COP=.57)
Cooling/Vol (W/cm ³)	5.16	0.001706	0.004665	3.442X10 ⁻⁴
Cooling/Weight (W/lb)	640	4.65	9.75	4.44
Cooling/Power -> COP	0.163	3	1.2	0.571

*For T value of 21C to 25C

+ Solution

- Twin Bird UC04 Stirling Unit
 - COP = 1.2 (average)
 - Weighs 4.1 lbs
 - Consumes 8.7W to remove ~10.4 W heat (from 38C to 2-4C)
 - System powered for 48 hours with 6 lithium polymer batteries*



*Thunder Power RC Pro Lite MS

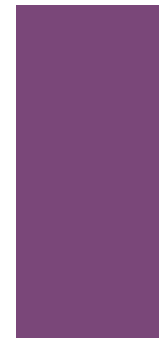


Product Contract

Product description: Portable cool-fluid organ preserver

Intended customer: Organ procurement organizations

Market: Organ Transport



Customer Need	Product Attribute	Engineering Specifications(s)
Active cooling	Refrigeration cycle	Stirling, COP=1.2, Extract 10-20W
Portable power	Battery life	Using >6 Lithium polymer, 8Ahr., ~48 hours
Ability to control flow and pressure	Pumping and sensing capabilities	Pump, pressure and flow sensors, 60-100 cc/min, about 40mmHg
Longer preservation time	Ability to soak all organ surfaces with cool fluid	Fluid circulation at 2-4°C, 60-100 cc/min, about 40mmH
Ability to maintain sterility	Sterile disposable components, Closed fluid circuit	Yes
Easy to carry	Weight, Size	Total weight less than 30lbs unloaded, total volume less than 81260 cm ³
Data transmission capable	Cellular components	Yes via 2G GSM chip
Store data during transport	Data storage and acquisition	Store more than 1MB
Location information capable	Cellular components	Yes, <500m location data (2G GSM)

+ Open Issues

- Create experimental setup with Stirling cooler
 - Complete integration with fluid circulation and portable power
- Test possible failure modes
 - Thermal model for Stirling failure
 - Emergency cold packs?
- Addressing secondary customer needs
 - Monitoring/tracking data in transport

