

New Technologies for Cardiac Arrest



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The Problem

- About 1.5 million people suffer from cardiac arrest and heart attacks each year in the U.S
 - Over 500,000 die
- Many survivors suffer from brain damage within minutes of the attack
- *However;*
 - *CPR along with the use of an AED within the first 3 minutes of attack increases chances of survival by 70% and reduces brain damage*

Objective

- Developed three different technologies to help victims of cardiac arrest
 - Increase survival
 - Decrease brain damage

Agenda

- Team Structure
- Team Obstacles
- Shaker
- Cooler
- Patch
- Business Group
- What's Next
- Conclusion
- Acknowledgments
- Questions

Team Structure

- Four Sub-Teams
- Met Once a week as entire group
 - Reported findings, progress, and obstacles from the week
- Work in Sub-teams remainder of the week

Team Obstacles

- High expectations, not enough time
 - Had to adjust project plan
- New ideas, solutions, and findings
 - Had to adjust project plan and designs accordingly

Shaker Sub-Group

Why Does Shaking Work?

- Whole Body Periodic Acceleration (WBPA) involves oscillating the body along the spinal axis
- Creates better blood flow than traditional CPR (Chest compressions) and reduces brain damage
- Eliminates side effects caused by traditional CPR
- Easier to use with AED

Previous IPROs

Achievements:

- Researched optimal acceleration for oscillation
- Determined optimal wheel and spring size to best achieve optimal acceleration
- Created a prototype

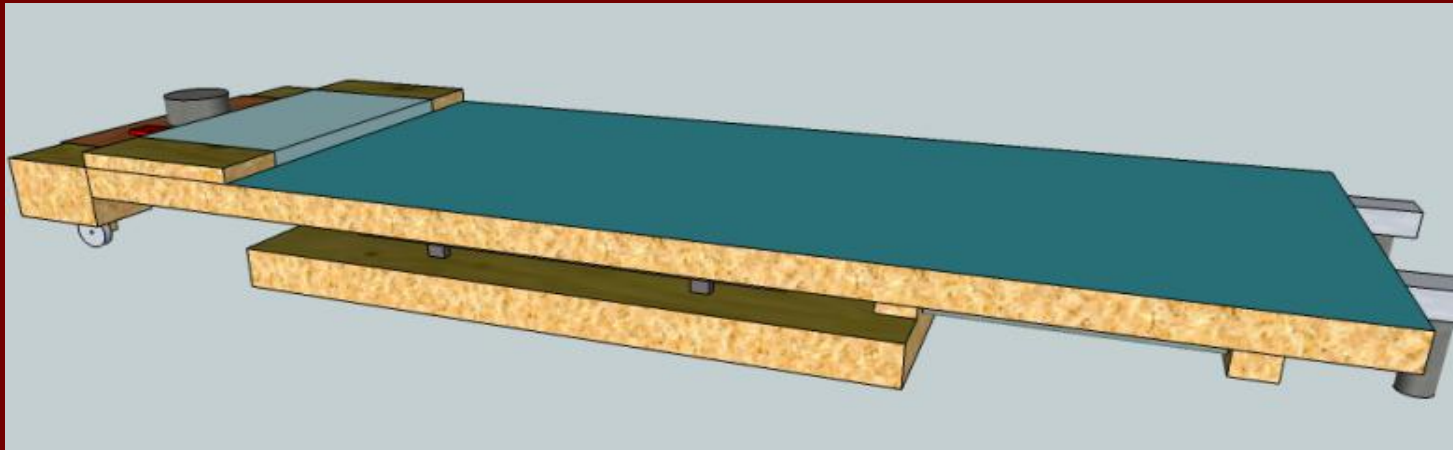
Previous IPROs

Areas for Improvement:

- Surface friction was unpredictable
- Human force provided to move shaker made difficult to insure reaching optimal acceleration

What We Accomplished

- Attached a track system better controlling friction
- Attached a motor



What We Accomplished (Cont.)

Cooler Sub-Group

Why Does Cooling Work?

- Therapeutic hypothermia lowers body temperature to 32-34°C which reduces risk of ischemic injury to tissue
- Ischemic injury occurs when there is a restriction in blood flow to respective tissue
- The faster cooling is applied the lower the risk for brain damage

Previous IPROs

Achievements:

- Determined a solution to be used as a cooling agent, and developed prototype

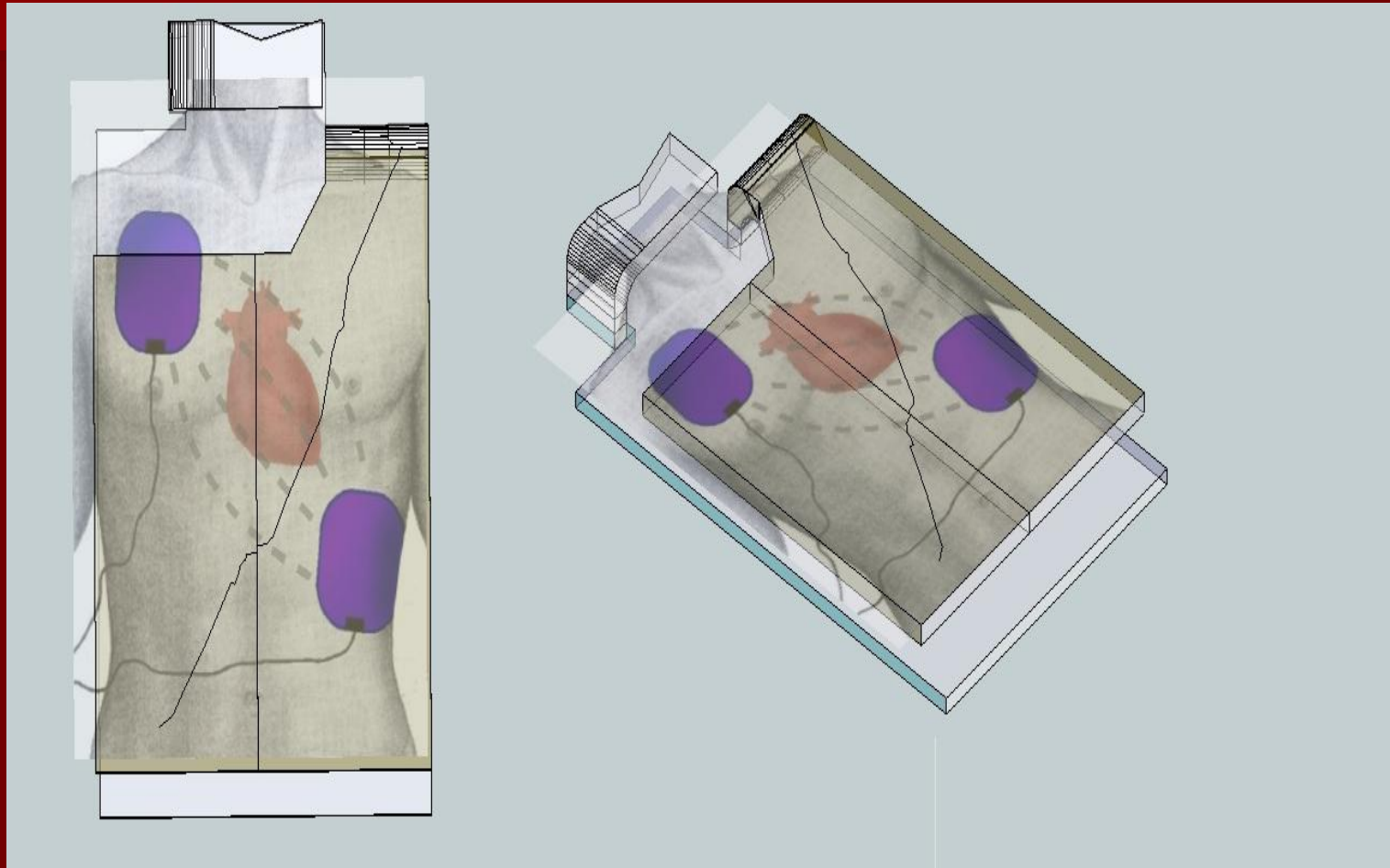
Issues:

- Design did not allow for quickest cooling
- Designed not easily portable

What We Accomplished

- Determined best materials to use
- Designed vest in a manner that would cover as much surface area as possible and cool body quickly, but not interfere with AED
- Made vest easily portable to continue cooling once victim in transit

What We Accomplished (Cont.)



Patch Sub-Group

The Problem

- Massive brain damage occurs once a victim is resuscitated due to rush of oxygen
- Cooling helps to reduce brain damage, but wanted to explore other solutions that may further decrease brain damage

What We Accomplished

- Found that by inducing a hibernation state and slowly reviving one from such state would slowly re-introduce oxygen to system
- Determined the ideal solution (H_2S) to induce hibernation state
- Investigated ways to introduce H_2S
 - Trans-dermal Patches

Business Sub-Group

Problem

- In-depth research of underlying technology incomplete and not compile in detail
- Solid and research supported technologies, but what next?

Solution & Findings

- Compiled definitive supporting research for various proposals and deliverables
 - BME Idea & ASME Innovations Showcase
- Investigated testing requirements
 - Animal testing, Clinical human testing, Regulatory pathway: Pre-Market Approval

Solutions & Findings (Cont.)

- Examined existing patents in great detail
 - Current patent for similar technology, expires in 7 years
- Investigated market potential and possible distribution channels
 - Used AED market as model
 - Cardiac Science over 9,800 units sold last year

What Next?

- Fine-tune shaking and cooling technologies
 - Shaking: Improve range of acceleration
 - Cooling: Determine best way to infuse vest with cooling agent
- Testing and government approval for Shaker and Cooler as combined product

What Next? (Cont.)

- Revisit patents, investigate means of mass production, distribution, and marketing of product
- More research needed in the patch area to confirm technology

Conclusion

- Two effective technologies, combined into one life saving product
- Technologies are nearly perfected, and there is a market need for them
- Time to move toward bringing the product to market

Acknowledgments

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Resources

- <http://www.heartratemonitors.us/>
– Picture, slide one
- <http://www.americanheart.org>
- <http://www.womensheart.org>

Questions?