

# LEMELSON-MIT

Celebrating invention, inspiring youth



**Stephen John and Joseph Barnett, Western Michigan University (Kalamazoo, MI)**  
**\$10,000 Lemelson-MIT “Cure it!” Undergraduate Team Winner**  
*Respiratory Solution for Premature Infants around the World*



Photo courtesy of Western Michigan University

**The Challenge:** The World Health Organization’s Global Burden of Disease program lists respiratory problems as one of the leading causes of death for children under the age of five despite extensive progress in non-invasive technologies. Medical professionals in many developing countries lack proper medical equipment to deliver dual level Non Invasive Positive Pressure Ventilation (NIPPV), a safe and proven intervention for neonates often used in first-world countries. Machine’s used in first-world settings are not only too costly, difficult to operate and repair, but also require substantial power to operate. For developing countries, where electricity is often unreliable and funding is often limited, many hospitals can only offer the more basic Continuous Positive Airway Pressure (CPAP). While this procedure is both simple and effective, it is often insufficient for infants with moderate to severe respiratory distress.

**The Solution:** Stephen and Joseph have developed NeoVent – a safe, affordable, user friendly and low power “dual level respirator” to help infants breathe. This device provides Non-invasive Positive Pressure Ventilation (NIPPV) for neonates struggling with Respiratory Distress Syndrome (RDS). The

device uses existing bubble CPAP setups - one of the methods by which CPAP is delivered to spontaneously breathing newborns that runs off compressed air alone - and an innovative oscillatory relieve valve mechanism to produce clinically relevant waveforms with an appropriate upper pressure level, lower pressure level, frequency and duty cycle of oscillation. Medical centers can readily offer biphasic or NIPPV without additional energy, cables or batteries, since the bubble CPAP exhaust solely powers the mechanism – a feature only offered by Stephen and Joseph’s design. This allows healthcare workers to deliver the next level of treatment by simply replacing the exhaust pipe in their existing bubble CPAP circuits, without a steep learning curve or expensive financial investment.

**Application and Commercialization:** Stephen and Joseph seek to equip medical centers in developing countries with NeoVent, allowing medical professionals to provide more comprehensive respiratory support to infants. Their invention meets the needs of hospitals in poor and underserved regions of the world that would otherwise be without this life saving technology. Stephen and Joseph plan to launch their implementation effort with the NeoVent in Nepal, where there are 94 hospitals. If each of these facilities were to treat 25 patients a year, the NeoVent would have the potential to prevent 2,350 of the estimated 7,462 neonatal deaths that are attributed to prematurity each year (RDS is often a symptom of prematurity). If successful in Nepal, the team plans to expand to regions of Africa and Asia, where a number of physicians have already requested the device.