

## **2010 March Madness for the Mind Teams**

### **SolarEase**

University of Pittsburgh

While solar energy is an attractive option to provide green energy, it remains burdened by high installation costs and has not been widely adopted. Part of the problem is the physical process of installation: solar panels require mounting brackets, outside breakers and ground connections, and through-holes for the wiring. This E-Team is developing a solar panel system that utilizes novel wireless energy transfer technology (WiTricity) to transmit solar power from outside panels to storage units inside, eliminating the need for cable connections through walls, interior/exterior wiring, and structural modifications. Reducing cost, complexity, and long term investment risk normally associated with solar installation will encourage adoption of this green source of energy, coinciding with government initiatives and energy efficiency programs.

### **OneBreath**

Stanford University

The recent H1N1 pandemic ignited concern in the healthcare community over the preparedness of our nation's healthcare system in the event of a mass critical care emergency. If a 1918-like flu pandemic were to occur today, millions of people could die from acute respiratory distress syndrome (ARDS), a common consequence of severe influenza. Many of these deaths could be prevented by placing the patient on a ventilator, but the US doesn't have enough ventilators to support patients with respiratory distress in even a mild flu pandemic. Looking outside the US, many countries face a chronic shortage of ventilators, even in the absence of a pandemic. For example, in the US there are approximately 205,000 ventilators for a population of 300 million, but in India, where the population exceeds 1.1 billion, there are 35,000 ventilators available.

This E-Team is developing an extremely low-cost ventilator designed for acute respiratory distress patients in low-resource, pandemic and emergency environments. To fill the need in all cases, the device is low-cost (\$300), rechargeable, portable, and disposable.

### **Anza**

Brown University

Anza (meaning "Start" in Swahili) is a technology-focused international development company that sells low-cost, high-utility products made from recycled materials to villagers in rural Africa. Anza, which currently sells solar cookers made from recycled plastic bags in East Africa, is now developing a cart for transporting water and other items, such as firewood and produce. By designing a wheel from upcycled automobile tires and a frame from low-cost, locally available materials (including bamboo, wood, and rubber lashings cut from old tires themselves), the cart can carry over 200 pounds of water and will retail for under \$10.

The Anza cart opens up the potential for small-scale farmers to collect enough water to irrigate a small kitchen vegetable plot. Due to the low supply of off-season vegetables, a simple 100-200 acre plot irrigated with the Anza cart could enable a family to earn between \$150-\$300 in supplemental income per year and pull themselves out of poverty.

### **ApneAlert**

Northwestern University

A popular alternative to incubator care for premature infants in developing areas is kangaroo mother care (KMC), a technique in which the infant is kept on the caregiver's chest at all times. While KMC is accepted as a valid alternative to incubator care by the World Health Organization, premature infants remain at risk for apnea when the caregivers are sleeping or distracted and therefore unable to monitor breathing.

This E-Team is developing the ApneAlert, a low-cost, KMC-compatible apnea detection system. The device detects apnea by monitoring signs of sufficient breathing, and if an apnea episode is detected, an alarm is activated. In addition, data can be stored and accessed easily, allowing further detailed evaluation.

Applications of the ApneAlert can even be extended beyond KMC practice. Many exciting opportunities are currently under development.

### **Banyan Environmental**

Brown University

While compact fluorescent lamps (CFLs) last longer and use much less electricity than standard incandescent light bulbs, they also contain 3-5 mg of volatile mercury per lamp. Mercury exposures are anticipated to rise as a result, and this Brown University E-Team, incorporated as Banyan Environmental, Inc., is looking to combat them. Brown University researchers identified a form of elemental selenium (nSe) with the ability to capture mercury vapor, a finding that was widely reported in the news in the summer of 2008 (New York Times, Discovery, etc.). Banyan is now developing user-friendly disposal and remediation methods to minimize accidental mercury exposures from fractured or broken fluorescent lamps, including box liners for CFL packages and shipping/recycling containers, consumer clean-up kits, air cleaning products for large spills, and dental office products. The company's mission is to provide a safer environment through cost-effective technologies tailored to customers' needs.

### **Bombyx Technologies**

Cornell University

Each year seven million people suffer from eye injuries caused by trauma, disease, infection, or surgery. Eye wounds are extremely painful and can cause vision loss. The most severe incidences can take months to heal and may even result in blindness. Bombyx Technologies in collaboration with Cornell University is developing a transparent bandage that rapidly heals eye wounds. The bandage resembles a contact lens and when placed on a damaged eye it relieves pain and protects from further damage. Most importantly, the bandage regenerates and heals damaged tissue while dissolving naturally over a few days. No other regenerative eye bandage

exists today. The material is completely unique, patented, inexpensive to produce, and reaches a half a billion dollar US market.

### **AYZH**

Colorado State University

AYZH is a new venture taking a for-profit approach to developing, commercializing, and scaling low-cost, high-quality products that rural women want and need to help improve their standard of living. The first two products AYZH is bringing to market, JANMA and SHEBA, are focused on women's health. JANMA is an inexpensive (\$2) clean birth kit intended to reduce maternal and infant mortality. SHEBA is an innovative household water filter targeted specifically at women in rural Indian communities. It consists of an internal filtration system that can be customized according to local needs. The water filter is shown above.

### **Chemotherapy Preparation and Delivery Device**

University of Iowa

The National Institute of Occupational Safety and Health (NIOSH) estimates that 5.5 million healthcare workers (pharmacists, nurses, technicians, and others) are exposed to toxic chemotherapy pharmaceuticals in the workplace. NIOSH confirms the health risks from these exposures include cancers, liver/kidney damage, infertility, miscarriages, birth defects, and congenital malformations. Independent research shows current products fall short in addressing all the market needs, with many users complaining current devices are: ineffective at eliminating exposure, difficult to use, error-prone, inefficient, and costly.

This E-Team, incorporated as J & J Solutions, is an emerging medical device company that has developed innovative technology to optimize safety, increase efficiency, and reduce the cost of preparing and administering chemotherapy pharmaceuticals. Hospital pharmacies and oncology clinics create a \$500 million U.S. market potential, with a current market opportunity near \$100 million and growing over 20% annually. The Company has pending patents, working product, proven technology, strong management, and commitments from cancer centers across the country.

### **LoChlorine**

University of California, Berkeley

Chlorination is a cheap and safe method to disinfect water that actively continues to disinfect for several days, unlike other methods that cannot guard against biological recontamination. Programs in the developing world using chlorination at the household level have seen water-borne illness decrease by 22-84%, but have faced issues with dosing errors, leading to under-chlorinated or over-chlorinated water. In Kenya, simple community chlorine dosers increased chlorine usage from 8-61%; however these dosers were limited in their ability to adapt to different volumes of water.

LoChlorine has developed two products, the LoChlorine Producer and LoChlorine Doser, which aim to safeguard family health by improving both access to and the performance of chlorination. The LoChlorine Producer is a local method of chlorine production that yields a reliable concentration of chlorine for pennies using local materials and human power. The LoChlorine Doser is unique in its ability to

automatically and appropriately dose arbitrary volumes of water. The design has no moving parts, uses no electricity, and could be mass-manufactured for less than ten dollars.

### **Enhancing Bio-Morphological Helmet**

Michigan Technological University

Today's standard football helmet design includes a hard outer shell, protective foam layer, and comfort foam layer resting on the head. An impact occurring directly to the hard shell is distributed over the padding, which deforms in compression. This works well for direct impacts, protecting against concussion, but doesn't perform as well for indirect or rotational impacts, since the padding is relatively stiff with respect to the shear forces. This E-Team is developing the Enhanced Bio-Morphological Helmet Layer, an improved design better able to withstand indirect impacts. The design of the helmet layer imitates the protection system of the human brain, i.e., the scalp and skull. The scalp is simulated by a viscoelastic material sandwiched between the outer shell and an inner composite shell mimicking the skull. The layer, which can be inserted into a helmet in addition to the regular helmet liner, is being designed for football, lacrosse and motorcycle helmets.

### **Universal Joint**

San Jose State University

This E-Team is looking to solve three interrelated problems in Lebialem, Cameroon with products derived from bicycle parts. Most people in Lebialem earn \$2 a day, primarily from agriculture, which requires people to walk 20-40 kilometers to get to market bringing only what they can carry. While there is a longstanding metalworking industry in the region, it's currently on the decline. The E-Team is developing three products, derived mostly from old bicycles, to help stimulate the metalworking industry and overcome the first two problems: the Market-Cart, the Bamboo Backpack and the Universal Joint Assembly (a steel joint that can be the central unit for other products). The team's goal is for families to increase their incomes by at least 30% in the first six months of ownership.

### **LifeServe Innovations**

Lehigh University

A cricothyrotomy is an emergency incision through the throat to secure a patient's airway during emergency situations including choking, swelling, a patient who is unable to breathe adequately on his own, and cases of major facial trauma. While cricothyrotomy is the most common pre-hospital emergency practice, it is invasive, often results in complications, and the airway created is temporary and must be replaced at the hospital. Tracheostomy provides an alternative, but is difficult to perform in the field.

This E-Team, incorporated as LifeServe, is developing a product line for critical care airway management using a patent-pending, minimally invasive technique called the SMART (Seldinger-Modified Airway Rescue Tracheotomy) Emergency Airway Technique. The team has developed three novel airway devices for its product line: The Cobra: SMART Percutaneous Tracheostomy Kit, The Viper-Cric Emergency Percutaneous Cricothyrotomy Kit, and The Fang: Transtracheal Catheterization Device. These devices are designed to improve outcomes for these procedures and serve previous unmet needs in the emergency airway market, including pediatric

applications and the ability to perform a definitive emergency tracheostomy under non-ideal conditions in the hospital and in the field.

### **Human-powered Nebulizer**

Marquette University

A nebulizer is a device that delivers aerosolized liquid medicine deep into the lungs. Commercial nebulizers use electric compressors to maintain a constant rate of air flow, and while this is effective, it presents a problem in the developing world where electricity is often unavailable. At the same time, chronic respiratory diseases and acute lower respiratory infections are the third major cause of morbidity and mortality in the developing world.

This E-Team is developing a human-powered nebulizer (HPN) to replace the electric compressor with a leg-powered source of air flow. The HPN is a two-piston system, with each piston connected to a pedal. Stepping on the pedal generates air flow from the pistons, and the flow is dampened by a one-liter plastic bottle. The idea has been tested and confirmed as a workable low-cost alternative to traditional compressor-based nebulizers.

### **OrthoIntrinsics**

Rice University

OrthoIntrinsics is a medical device venture positioned to be a leader in the orthopedic space focused on hand-related disorders. For initial market entry, OrthoIntrinsics is targeting carpal tunnel syndrome; this affliction accounts for 500,000 surgeries and costs society \$2 billion dollars each year. However, 20% of surgeries are unsuccessful. Often times carpal tunnel manifests in the weakening of intrinsic hand muscle strength (IHMS). OrthoIntrinsics' first product, PRIME (Peg Restrained Intrinsic Muscle Evaluator), is a medical device that provides the first method to accurately, reliably, and directly measure IHMS. The current gold standard, manual muscle testing, involves an examiner physically estimating a subject's strength by feel on a 0-5 scale. This method lacks sensitivity to clinically significant change and reports high bias. PRIME has been validated in clinical studies at two leading hospitals and the technology has been highlighted in international conferences, boasts three pending peer-reviewed publications, and has been featured in prestigious media sources such as Mechanical Engineering Magazine and Medical Device Daily. As a true platform technology, PRIME can be expanded to spinal cord injury, muscular dystrophy, and other neuromuscular disorders.

### **OsmoPure**

Rensselaer Polytechnic Institute

This E-Team is developing OsmoPure, a low-cost water purification device for developing countries based on simple membrane filtration technology. While there are a number of water filtration devices being marketed to the poor, many of them don't work in murky water (they get easily clogged), often require a large energy input in order to work (e.g., hand pumping), and fail to remove all contaminants. OsmoPure is a compact, cartridge-based, multi-stage water purification system. To produce potable water, the user fills a plastic bottle with dirty water, screws on the purifier like you would screw on a cap and squeezes the bottle to dispense clean water. When the filter looks dirty, the user simply shakes the fluid inside to remove debris.

The purifiers are meant for plastic bottles that exist currently as rubbish in the target areas, cutting production and distribution costs and creating an environmentally friendly solution to the global water crisis.

### **Polytech Bag**

California Polytechnic State University, San Luis Obispo

Providing people with clean drinking water is one of the biggest challenges following a natural disaster, when thirst can force survivors to drink contaminated water. Currently, relief agencies and government aid workers deliver five-gallon jugs of water, which is a costly and slow undertaking. Alternatives like mobile treatment units require technicians, setup time, and provide only a few centralized water sources.

This E-Team is developing a new way to ensure people have access to safe, clean drinking water after a disaster strikes: the Polytech Waterbag. The Waterbag is a ten-liter plastic bladder equipped with carrying straps and an integrated filter with a dispensing port. It is designed to be used with Procter & Gamble's PUR® chemical treatment packets; by using the packet along with the filter, particles and pathogens are removed to provide complete water treatment. The Waterbag has other integral features, including: a wide mouth for easy filling in shallow streams, a sediment trap to prevent recontamination, and baffles to enhance mixing. Waterbags are twenty times more compact than five-gallon water jugs to ship, and can treat enough water to supply a family of four for up to ten days.