

## Appendix – Past and Completed E-Team Projects

- **Closed-Loop Stimulation of the Nervous System:** Implantable vagus nerve stimulators reached the US market in 1997 to reduce epileptic seizures. The E-Team proposed to automate stimulation via EEG feedback. They worked with specialists at the Neuroscience Center of the Miami Children's Hospital, where EEGs from epileptics were recorded routinely. The project did not reach its goal, a major task that has never been mastered anywhere to date.
- **Magnetic Field Detector:** Various links have been identified between childhood leukemia, breast cancer among male line workers, brain cancer, and strong 50 or 60 Hz magnetic fields. The effect is real and has been widely studied around high voltage power lines, step-down transformers and even in house wiring. An inexpensive, yet accurate sensor to produce a map was developed (3 orthogonal coils with electronics and a display). Once recognized, most problems can be corrected. The unique device detects, analyzes and graphically displays the risky sites. This also led to an MS thesis for the team leader.
- **Knee Simulator to Train Surgeons:** A model was developed to improve surgical skills. A realistic knee model was developed with help from orthopedic surgeons with potential commercialization. This project received an Advanced E-Team Grant and continued for a second year, leading to an improved prototype.
- **Weather Protection for Wheelchair Users:** The team designed a simple and inexpensive device that may be clamped on to virtually any wheelchair. It had two articulated joints and a clamp to hold an umbrella with a straight or J-shaped handle.
- **OASIS (Orthopedic Assisting Surgical Irrigation System):** A water-cooled drill for cranial surgery to prevent damage to bone from excess temperature.
- **Portable Cooler:** A container for transporting perishable biological substance such as insulin. Cooling was provided by a fan cooled, battery powered thermoelectric junction. The only moving part was the fan blade. This project also received an Advanced E-Team Grant. This project was revisited three years later by a BME E-Team working with an MAE group of seniors and three student consultants from the SBA.
- **Breast Implant Surgical Instrument:** This E-Team also received an Advanced E-Team grant. The instrument facilitates the implantation breast augmentation sacs via an axillary approach. Five sequential prototypes evolved and clinically tested. A patent was applied for.
- **Precisely Controlled Heater to Protect Cancer Patients Against Hair Loss:** Patients undergoing chemotherapy usually suffer hair loss. A life scientist proposed intravenous administration of a protective chemical agent that is potentiated by local heating within a narrow temperature range in the vicinity of 43°C. A feedback controlled heater was developed for tests on mice treated with chemotherapy.
- **Finger Force Sensor to Track the Progress of Quadriplegics:** The E-Team worked with a physical therapist whose patients perform exercises to strengthen their fingers to grasp. The instrument measured and recorded the data according to a protocol. The prototype did work, but commercialization was not justified.
- **Walker with Novel Braking System:** The brakes on this walker may be activated either when the person leans heavily on the handles or the normally active brakes are released when applying a certain level of force on the handles.

- **Improved Life Saver in the Sea:** A new, multifunctional life saving flotation system was developed to keep the victim of a boating accident afloat with a life jacket, it included a donut shaped inflatable raft to raise the torso above the water. A chemical heater compensated for heat loss.
- **Metal Ribbon Dam for Dental Filling:** A prototype was completed and tested by a dentist, the mentor of the team. This device eliminates the tool that is normally attached to the ribbon that protects the adjacent teeth during the filling of a cavity. The modified system is safer and makes the procedure more comfortable for the patient to endure as well as it helps the dentist.
- **Prevention of Decubitus Ulcers:** This is the second prototype phase in the development of an electrode array to be placed over a potential site of an ulcer and powered by a specially designed stimulator. It delivers electrical stimuli in a pseudo-random sequence to a randomly selected pair of electrodes for a certain time period. It is expected that low-level stimuli would cause muscle twitching, which in turn would improve circulation, build up tissues and reduce the risk of the development of a decubitus ulcer. The treatment of decubiti is expensive and it is a major concern for wheelchair users, the spinal cord injured and others with diabetes related ulcerations.
- **Suspension Mechanism for Ambulation (Antigravity Walker):** A commercially distributed walker for paraplegics was redesigned for a company to improve the suspension system, the user's control of the direction and speed of travel and the process of getting in and out of the walker.
- **Automated Infant Massage Unit:** The concept is that neonates who receive massage from loving hands develop faster, this is especially true for premature babies. As time and personnel are not available for such treatment in Neonatal Intensive Care Units, the team attempted to develop a prototype of a massager that is safe and effective. The outcome was not satisfactory, but another SDP emerged from it with similar results.
- **Negative Pressure Neonatal Ventilator:** The team worked with the personnel of the Neonatal Intensive Care Unit to develop a ventilator that does not require the intubation of the neonate. It is based on a transparent polymer "cocoon" enveloping the infants body with a seal around the neck. A pressure pump drives the pressure within the cocoon and the system acts as a miniature iron-lung. The design considered easy direct access to the infant using a continuous zip-lock seal. The project was continued by one of the E-team members as Masters Design Project. More work is needed to improve the seals.
- **Water Resistant Assistive Listening Device (R-Tone):** The E-Team had two goals: to provide a waterproof radio for serious swimmers and a one-way communication system from the coach to competitive swimmers and waterpolo players during practice and competition.
- **Waterproof Conversational Hearing Aid:** The E-Team's second attempt in the same area of technology resulted in an RF coupled hearing assist device between a speaker and the hearing impaired listener. The speaker's voice from a shielded and focused microphone to block background noise was sent on a modulated RF carrier to the listener's receiver and converted into speech. Tests in a crowded and noisy auditorium proved the devices effectiveness. (This system is similar to the hearing assistive devices used in theaters, with the distinction that RF instead of IR is the carrier, hence obstructions between the speaker and the listener do not block the link.
- **Sore-No-More:** The E-Team created a special stretcher to transport spinal cord injury victims with the goal to minimize further damage arising from the victim's transportation to a hospital.

- **Forehead Maneuver Controlled Electric Wheelchair:** This project was aimed to advance several years of effort by other students. Bipolar concentric sensors detect EMGs from the forehead when deliberate facial movements are executed by the user and converted into commands to control a wheelchair. The specifications call for acceleration, braking and turning signals, among others. The University received a US Patent for this concept prior to the E-Team project.
- **Vein Finder:** Veins are hard to find and puncture in obese individuals, children and others with "bad veins." An inflatable "snake" tourniquet was developed for one-handed inflation to encourage the engorging of the veins at the surface. Although most technicians and nurses claim to succeed every time, there are myriads of anecdotes about poorly executed entry into the vein in the antecubital region.
- **Fool-Proof Eyedropper:** to deliver but one drop: Eye drops, especially for the chronic treatment of glaucoma are expensive. The drops are metered by the vial's orifice, but delivery from the vial is not trivial when self-administered. The drop is detected electro-optically and signals the delivery. Three consecutive prototypes have been developed based on different design ideas. The third one appears to be appropriate for commercialization. A disclosure was filed.
- **Firefighter's Helmet:** with lights, walkie-talkie. This project integrated numerous ideas for an improved helmet. The team was led by a professional firefighter.
- **FirePox:** A commercially produced O<sub>2</sub>SAT probe with an RF communication link in a helmet was developed allowing the supervisor to monitor the well-being of each firefighter at risk for asphyxiation and for intervention.
- **Arm Support for Wind Instrument Players:** during long practice sessions injuries may develop from overuse. A conveniently portable and multiply adjustable support system was developed over a sequence of several individual design phases.
- **Chest Protector - For Young Athletes Against *Commotio Cordis*:** aimed to prevent sudden death from an unfortunate blow to the chest. This E-Team also received an Advanced E-Team award.
- **Simulator for Training Surgeons in Sentinel Lymph Node Resection (SNR):** lumpectomy with SNR requires a great deal of practice on human subjects. This system simulates the detection of radioactivity from Tc90 by a system of metal balls imbedded in a breast model and detected with a miniature metal detector.
- **Improved Helmet for Football and Hockey Players to Prevent Head and Neck Injuries:** The E-team, so far, has evaluated a number of impact absorbing techniques and has configured and tested a "non-linear spring" using opposing sets of high-strength ceramic magnets integrated with the helmet and the shoulder pads. The test bed was designed and built by the team. This project is a work in progress.