**Sponsor: KINEX**

**General Information**
Contact Name:
Contact Phone Number:
Contact Email Address:

**Restrictions**
United States Citizen Required: No
Non-Disclosure Agreement Required: Yes
Intellectual Property Assignment Required: Yes

**PRF Capstone Plus Projects 33 and 34**
Listed below are the various competitive cold therapy units that are on the market. The first 3 are mainly cold purchase items where a patient would buy the product from the manufacturer or a Distributor. Breg has an iceless unit (Vpulse) that is a rental product and items 4-6 are rental products as well. The Thermotech, Pulsar Scientific, and the Breg VPulse all have DVT compression therapy, but I would say that is not critical in the new device that we are looking for.

**Cold Therapy Products:**

1. Don Joy Iceman Clear 3: www.djoglobal.com/products/donjoy/donjoy-iceman-clear3
2. Breg Cold therapy Products: www.breg.com/products/cold-therapy/
3. Ossur Cold therapy Products: www.ossur.com/injury-solutions/products/cold-therapy
4. Thermazone: https://www.schoolhealth.com/thermazone-continuous-thermal-therapy-device
5. Thermotech Vascutheram product: www.thermotekusa.com/product.php?pid=102
6. Pulsar Scientific: http://www.pulsarscientific.com/products/recovery/

KINEX

www.kinexmedical.com

# Kinex Medical Cold Therapy Project

Over the last 30 years, improvements in orthopedic surgery and rehabilitation have been tremendous. Patients who elect to have a joint replacement surgery such as a total knee replacement (TKR) would have expected to stay in a hospital 5-7 days following surgery 30 years ago. Today, the average length of stay following a TKR is 2.5 days, and that number continues to decrease. There are now surgery centers around the country who are even performing 23 hour admissions on TKR's.

Although TKR procedures continue to improve and length of stay in a hospital setting continues to decrease, the need to provide post-acute care following these procedures in a home setting becomes critically important in the home setting. Innovative payment models such as Bundled Payment Care Initiatives (BPCI Advanced) and Comprehensive Joint Replacement (CJR) are rewarding doctors and hospitals for achieving high outcomes while reducing costs. The number of total joint replacements will increase over 500% over the next 15 years as the population in the United States continues to age.

One of the critical variables to manage following TKR is pain control. The use of cold therapy has been used for decades to manage pain in the first few weeks following surgery. Cold therapy has been proven to decrease pain and swelling, improve patient tolerance to mobility, and is non-addictive.

One big barrier to the use of cold therapy is the insurance company view on cold therapy reimbursement. Many insurance companies view cold therapy as a convenience product, and do not reimburse for cold therapy products. The stance is usually that a patient can make "ice bags" at home or use a bag of "frozen peas". However, due to the relatively low cost of emerging cold therapy products along with the nation's opioid epidemic, cold therapy should be considered immediately following orthopedic surgery to help manage pain control.

For over 30 years, Kinex Medical Company has been providing post-operative rehabilitation products in over 30 states across the United States to patients following orthopedic surgery. One of our highest volume products is cold therapy. Although insurance companies rarely pay for the products, patient demand and willingness to pay out of pocket allow Kinex to supply thousands of cold therapy products every year.

Kinex Medical Company, LLC • 1801 Airport Rd, Suite D Waukesha, WI 53188 • Phone: (800) 845-6364 • Fax: (888) 845-3342

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Our goal in this Capstone project is to design a new cold therapy product that is:

- Iceless
- Lightweight
- Comfortable
- Safe
- Inexpensive

There are currently no iceless cold therapy units on the market today that are routinely for patient purchase. Most iceless cold therapy devices are rentals only. Kinex believes that patients will continue to buy reasonably priced cold therapy following surgery to help manage pain. Furthermore, if we can keep costs down, we may get insurance companies to start reimbursing for these products if we can demonstrate their effectiveness in managing post-operative pain control in the home setting.

**Sponsor: PRF OTC**

**General Information**
Contact Name:
Contact Phone Number:
Contact Email Address:

**Restrictions**
United States Citizen Required: No
Non-Disclosure Agreement Required: Yes
Intellectual Property Assignment Required: Yes

**Separation of Rare Earth Elements from Waste Sources**

**Problem**
Rare earth elements (REE) are widely used in high value products (e.g. smart phones, TV, magnets for wind turbines and electric vehicles, advanced battery applications, etc.). Currently, China controls 85-95% of the production of REEs which represents of supply risk for manufacturers of high technology products and utilizes old methods for extraction and purification of these resources for ores that leads to massive amounts of toxic waste being flushed into the environment.

**Solution**
Purdue researchers have developed a process that allows for the extraction and purification of REEs from waste sources. The Purdue process is capable of generating REEs in in a process that is more efficient and effective that leads to a smaller footprint with less cost than China's process and with essentially zero waste. This process allows for the socially responsible way to recover materials to make our modern life possible.

**PRF Capstone Plus Project 35: Description – Separation of the Crude REEs from a waste source**
The separation of REEs from waste sources is a multi-stage process. Project 1 will focus on recovery of the crude REEs from waste source. At several points in the process solids and liquids must be separated. The project is to continue and improve on the design that was developed last year. The team will be able to study and work with the current system. The team will also be encouraged to interact with the faculty member, Purdue's Office of Technology Commercialization, and potential industrial partners on this project.

**PRF Capstone Plus Project 36: Description – Final Purification of the Crude REEs to Purity (99+%)**
Project 2 will work with a product of Project 1. The product from Project 1 is a crude material of REEs that are mixed together. This crude mixture needs to be separated into the individual REEs to be salable. The system to accomplish this process needs to be retrofitted and upgraded (new computer, control system, and software) to operate the unit. The team will also be encouraged to interact with the faculty member, Purdue's Office of Technology Commercialization, and potential industrial partners on this project.

**Sponsor: Global Security Inc.**

**General Information**
Contact Name: Paul Wood
Contact Phone Number: 317-270-9700
Contact Email Address: PaulW@GlobalSecurityInc.Org

**Restrictions**
United States Citizen Required: No
Non-Disclosure Agreement Required: Yes
Intellectual Property Assignment Required: Yes

**PRF Capstone Plus Project 37: Child Car Safety Seat Upgrade**
One of the most important jobs you have as a parent is keeping your child safe when riding in a vehicle. Each year, thousands of young children are killed or injured in car crashes. Therefore, the proper use of car safety seats are essential to keeping children safe.

However, even with the proper use of a car safety seats children can unbuckle their selves from the car safety seat without parents knowing. The project is to design, build and test a car safety seat that would alert the driver if the child is unbuckled.

**Sponsor: SNARE, Inc. Location: Lafayette, Indiana.**

**PRF Capstone Plus Project 38: Distributed Detection of Radiation Sources**

**General Information**
Business/Organization: SNARE, Inc. – Lafayette, Indiana
Business/Organization Description: Radiative detection systems research and development
Contact Name: Tom Gruenwald
Contact Phone Number: ((630) 699-4124
Contact Email Address: jgruenwa@purdue.edu

**Restrictions**
United States Citizen Required: Maybe
Non-Disclosure Agreement Required: Yes
Intellectual Property Assignment Required: Yes

**Project Information:**
Project Title: Distributed detection of nuclear radiative threats
Project Description: Develop miniature, portable detection hardware and associated system software to process crowdsourced data.

**Background:**
Terrorists acting in concert or alone can inflict considerable damage on Critical Infrastructure and Key Resources (CIKR's) out of proportion to their numbers. Increasingly individuals are acting at the inspiration of terrorist organizations but not necessarily directed by them. These acts are more difficult to discover and prevent since the social footprint is correspondingly smaller. Terrorists have the capability to disable an entire city with a single dirty bomb or disease agent. While there are numerous threats identified by Homeland Security[2], we will focus on the three most serious: nuclear events of any type, and biological and chemical attacks.

We propose a collection of detectors imbedded in mobile devices or operating in conjunction with mobile devices (pen configuration or other small form factors), as well as fixed-location sensors, that together with sophisticated analytics, can detect a nuclear threat and locate it within a few feet. The aim of the system is to detect, disable and deter such attacks through application of networked information gathering and sophisticated processing of this information. The detection system will identify threats as they develop. The advantage we bring over current offerings is a network-analytical approach that significantly improves detection probability and the characterization of background radiation. A single detector, without background calibration, will be plagued with false positives and miss weak signals from threats. Without a network data aggregation system, threat detection is very unlikely.

**The Project**
The Capstone team will assist a hardware engineer in developing a miniature detector with mobile network and Bluetooth communication capabilities. The team will also develop software to aggregate data from large numbers of detectors, apply furnished algorithms to characterize background and apply furnished algorithms to identify radioactive sources.

**Project Deliverables**
1. Test plan for detector
2. Test plan for system software
3. System software high level design document
4. System software -background detector
5. System software-radiation source detection
6. Hardware-software integration plan
7. Integrated working system

[2] "Potential Terrorist Attack Methods Joint Special Assessment", Homeland Security, Office of Intelligence and Analysis, and the Federal Bureau of Investigation