Center for Soldier Innovation (CSI)

Enhancing Human Performance for the Warfighter and Homeland Defender/Emergency Responder Communities

A new business opportunity through strategic collaboration with Natick Soldier Systems Center, MA companies and Universities

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1 Executive Summary

Draper Laboratory (Draper), working with representatives of the Natick Research, Development and Engineering Center (RDEC) / Natick Soldier Systems Center (NSSC) Science and Technology Board, is exploring the potential for establishing a Center for Soldier Innovation (CSI) in the Metro-West Region of Massachusetts. The CSI will establish and grow an economic engine that will align the capabilities and focus of Massachusetts companies and universities with key mission areas of the Natick Soldier System Center. The ultimate goals for this enterprise are:

- Enable close cooperation between Massachusetts organizations and the NSSC,
- Increase Massachusetts development and manufacture jobs and
- Stimulate new company creation.

The goals of the CSI are as follows:

- Capture $29 million in federal and commercial funding the first five years of operation
- Transition products initially developed and demonstrated for military applications to broader commercial markets
- Spin-out multiple start-up organizations ready to seek venture funding.

The CSI will specifically address the critical and unmet needs for the *Soldier*, where *Soldier* is defined as those men and women that protect, serve and defend us; the *warfighter* as US military services and National Guard, and *homeland defender* as fire fighters, law enforcement, Coast Guard, Border Patrol Agents and Emergency Medical Services. The process for selecting program initiatives will include determining the potential for broad adoption in commercial markets, providing a pathway to high volume manufacture and low unit cost for the warfighter and homeland defender.

1.1 Problem Statements

(A) Customer Need - Recent world-conflicts, hurricanes and transportation accidents have demonstrated the critical need for enhancing the endurance and capability of the individual warfighter, homeland defender, and those in occupations where vigilance and alert action is required to maintain public safety. These same technologies transfer to a broad range of commercial applications, including home care and sports performance.

(B) Growing Jobs - Massachusetts ranks #1 in the nation in its ability to attract federal, industry and academic funding[1]. World-renowned education and specialized cutting-edge firms fuel our economy. And yet, we continue to see technology and manufacture companies exit Massachusetts. This significant funding helps draw many of the highest capability students in the world to Massachusetts; however, the large majority of these students leave Massachusetts when their training is completed. A key reason – we do

not have sufficient technology and manufacture jobs here in Massachusetts to retain these future leaders[2]. With the exception of MIT, Massachusetts universities do not produce significant numbers of new start-up companies (a major driver for technology and manufacture job growth). Also, Research and Development (R&D) funding directed toward commercial companies is typically applied to strengthening existing product areas; it is difficult to justify the long-term investments in basic research and prototype development needed for companies to establish themselves in new emerging product areas – investors push for rapid return on investment.

The strong Massachusetts technology economy has established an important benchmark in the nation for others to follow. In response, other progressive States are working hard to attract technology companies to their State. States, including Florida Virginia, Ohio, North Carolina, Pennsylvania are aggressively working to promote the creation of new technology/manufacture companies and building sustaining industry clusters[3]. We must act now – Massachusetts must continue to innovate to maintain its edge as the national and international leader for science and technology.

(C) Retaining Military Leadership in Massachusetts - The Natick Soldier System Center needs an industrial and university community that truly understands soldier needs and environments and that can be called upon for rapid reaction solutions and to assist in developing the programs which address the emerging future warfighter and homeland defender needs. Lack of a strong external support community, diminishes the capability of the NSSC. The US Army Aberdeen Proving Ground (APG) for example benefits from a successful support infrastructure. As a direct result of the supporting cluster groups around APG, the mission of the APG continues to expand and jobs (both for APG and local community) have dramatically increase[4]. Without a strong connection between NSSC and the Massachusetts community, NSSC will remain vulnerable to future, base closure decisions. Should the NSSC close, then Massachusetts will lose the $400M annual impact on the local community[5] and the Center responsible for the technology development leading to $24 billion in soldier equipment purchased by the Army from Massachusetts companies[6]. And the DoD will lose the immediate and easy access to the rich pool of solutions offered by the Massachusetts commercial and university technology organizations.

1.2 Basic Proposal

Form a Center, administered by Draper that, with NSSC, will seek to understand the critical and unmet DOD soldier-centric and homeland defender problems, and build teams with Massachusetts organizations to solve these problems under government and commercial contracts. By bringing together multiple teams working to address different problem sets, we will be nucleating new Massachusetts technology clusters groups. Military and Department of Homeland Security development programs will demonstrate new core technologies that transfer to much larger commercial applications. Cluster groups will broaden and strengthen as they access new commercial markets using the demonstrated technologies. Unique discoveries and

concepts are also expected when addressing difficult customer-focused problems; the resulting Intellectual Property (IP) will become the cornerstone for potential, new spin-out companies.

The Center for Soldier Innovation (CSI) will:

- Work to establish a clear picture of near and long-term needs for the warfighter and homeland defenders. The CSI will share these needs with Massachusetts organizations to encourage focus on these critical customer needs (including realignment of R&D, customer interactions, and government support).

- Build teams to: (1) address rapid fielding/response to warfighter and homeland defender requirements, (2) respond to open competitions and (3) establish new programs to address emerging requirements. The CSI will bring manufacture organizations into these teams early in the development process to ensure successful manufacture deployment after the basic products are demonstrated in relevant environments – quickly putting the new capabilities in the hands that need it most.

- CSI staff will mentor university partners in converting their ideas into new companies.

- Work to ensure that intellectual property (IP) generated by the teams during contract execution will benefit all team members and Massachusetts state.

1.3 Implementation Considerations

- Successful Center Model – The proposed Center for Soldier Innovation is based on the successful implementation of three similar Centers by Stanford Research Institute (SRI) and Draper; National Center for Maritime and Port Security (FL), Center for Advanced Drug Research (CADRE) (VA), and the Center for Bio MEMS (FL). See Appendix A.

- The Center is Needed – This proposal was prepared in collaboration with the representatives of the Natick RDEC/NSSC Science and Technology Board members; Natick Soldier Systems Center, Mass Executive Office of Housing and Economic Development, Mass Technology Collaborative, Mass Development, University of Massachusetts, Mass Technology Defense Initiative, Metro West Chamber of Commerce, Draper Laboratory. We have confirmed that the CSI will provide a valuable new capability for Massachusetts.

- Initial User Community – Warfighters and Homeland Defenders: 4 million Americans.

- Sources of Revenue – The Center for Soldier Innovation, teamed with NSSC and Massachusetts companies and universities will compete for contracts and grants from multiple government and commercial entities. For the proposed initial topic, *enhancing human performance*, in excess of $7 billion has been identified in the GFY 2009 Federal budget. Clearly, not all of these budgets are addressable, however, it is indicative that there is significant interest in enhancing human performance, and that it is a priority for the US government.

- Financial Analysis – The Center for Soldier Innovation will receive $29 million revenue over the first 5 years of operation. The net impact to the local economy will be $64 to $96 million, based on the MetroWest Chamber of Commerce[7] and SRI analysis, respectively. CSI will break even in year 4, and be self-sustaining in year 5. The CSI plans to subcontract approximately 40% of revenues realized to Massachusetts organizations.

Massachusetts is being asked to provide $5 million seed funding over a 4-year period to establish the CSI. The CSI requires $1.5 million in the first year of operation.

2 Background

2.1 The Successful Center Model - Key Innovation

We have modeled the Center for Soldier Innovation (CSI) on previous successful centers established in Florida and Virginia by SRI and Draper (see Appendix A). Key founding principles include:

- Each center focuses on important customer needs – Core to success.
- It is recognized that universities do not naturally focus their efforts on real customer needs, and so conversion of research to practical products is limited. The university(ies) desire(s) cooperation with the Center to: (1) connect their research to important customer needs, (2) work together with the Center to realize new funding sources and growth, (3) increase the university prestige – to draw a stronger student base, (4) create the jobs that can enable the students to remain local and join in building the local technology cluster, (5) build and strengthen an entrepreneurial culture and (6) enhance revenues from university IP.
- Each center promises to obtain new funding and jobs for the local economies. Job growth is realized in the Center, company team partners, university team partners, and new spinout companies. Each center possesses an advisory board that provides oversight and determines if predetermined milestones are met each year; subsequent funding is based on achieving milestones.
- Combinations of state, local and university support are provided to establish the center. The first cadre of new hires focuses on defining the customer need, preparing proposals and developing data to support proposals. Subsequent hires execute the sponsored research and development.
- The centers achieve financial break-even within 3-4 years.

2.2 Customer Need

The recent US experience in Afghanistan and Iraq has underscored the importance of the individual warfighter, and the critical need to properly equip and protect this asset. A key lesson learned by the US military over the past five years has been the importance of, and need for, having *boots on the ground* for extended periods. As the focus of operations for the combat soldier has shifted from high intensity conflict to nation builder, we have witnessed:

- A marked increase in the breadth of tasks that the soldier is expected to perform
- Recognition of the importance of maintaining optimum human performance in harsh conditions for longer periods
- A clear need to provide the tools for these forward emissaries to win the hearts and minds of the people in these liberated countries

Focusing the resources and mindshare of Massachusetts companies and universities on the critical soldier needs will materially enhance the survival and health of these warfighters. .

The warfighter is called upon to work under difficult conditions. Their performance can be affected by the equipment they carry (weight, complexity, communication with peers, situational awareness), the environment (extreme temperatures, humidity, altitude, weather), and their resulting physiology (stress, cognitive load, sleep deprivation, hunger, thirst). These same factors are important for homeland defenders and many occupations where vigilance and alert action is required to maintain public safety. The very human nature of combat operations, peacekeeping missions and first responder events requires a focused effort to best prepare the "soldier" for dealing with both the stress of the environment on mind, body and spirit as well as working effectively in the population that he or she is supporting or fighting for. Sharing technological solutions between these user communities will create synergy. The CSI center will work toward promoting the technologies developed for all user communities.

2.3 Natick Soldier Systems Center (NSSC)

NSSC, located in Natick, Massachusetts employs ~2000 (military, civilian and contractors) personnel. Their mission is *RDT&E to maximize the Warfighter's Survivability, Sustainability, Mobility, Combat Effectiveness and Field Quality of Life by treating the Warfighter as a System*. Their science efforts result in products for all DoD Services and a broad variety of other government agencies, including the Department of Homeland Security, Department of Justice and NASA. Moreover, NSSC is responsible for the research, development, engineering of all food, clothing and individual equipment (less weapon), shelters (hard and soft), canopies (personnel and cargo), integration on the warfighter all systems worn or carried by the soldier, and medical research to improve and sustain soldier performance. The NSSC has in place important and specialized testing capability and deep knowledge of soldier requirements. Today, the US Army executes contracts totaling over $24 billion/year in Massachusetts for products whose science originated in the NSSC. The NSSC is an important asset for Massachusetts and New England.

The NSSC has unique facilities that are available to Massachusetts organizations, including: world-unique, man-rated environmental chambers that permit testing equipment under all environmental condition the soldier may be exposed to, soldier biomechanics laboratory, 3-D anthropometric laboratory, bone health laboratory, DoD combat feeding laboratory, thermal test facility, fiber production and research facility, textile testing facilities, and rapid prototyping capabilities for expedient transfer to solders in the theatre of operations.

The primary funding sources for the NSSC are military budget allocations and congressional directed additions to military budget line items. Work performed at the NSSC is constrained by:

- Available funding,
- Approved hire levels (for researchers and contract monitors) and
- The number of organizations that understand the warfighter/homeland defender requirements, needs and operational environment

We can expect contraction in future military budgets; NSSC will need to rely more heavily on non-military advocates to ensure that the needed support for the warfighter is retained, or more importantly increased, in future years.

The CSI will work closely with the NSSC to:

- Identify the emerging critical and unmet needs for the warfighter and homeland defender
- Establish teams of organizations focused on these requirements
- Utilize the NSSC facilities and capabilities in the development of new products
- Ensure that the needs of our defenders are prominent in the minds of our elected officials

Note: The Natick Soldier Systems Center is the only remaining active component Army military base in New England.

2.4 Massachusetts Understanding Of The Need

Lessons learned continue to emerge from the on-going overseas military as well as homeland-bound national response experiences. A broad range of user groups, including military, federal/state and local governments, hospitals, and laboratories are identifying capability gaps for equipment, training and human endurance. Industry and academia may well be developing important solutions that could directly benefit our defenders, but they are often unaware of the military and emergency response capability gaps. Today, it is very difficult for Massachusetts companies and universities to sort through the large volumes of data and then identify willing and capable teammates to work together to fill these needs quickly. The result is that few

organizations can apply the resources needed to effectively research and understand the warfighter and homeland defender problems, and if they do, most work toward solutions alone – and progress is minimal.

The CSI will work closely with the NSSC to establish a description of the most critical and unmet warfighter and homeland defender needs, leveraging the full experience and capabilities of the NSSC. The CSI will then reach out to provide these findings to the Massachusetts commercial, university, and targeted research communities. This approach will broadly disseminate the key needs and serve as the basis for then building strong collaborative teams and programs to respond to these needs.

3 Center for Soldier Innovation (CSI)

3.1 Unique Massachusetts Center for Soldier Innovation Elements

The CSI will achieve the benefits outlined for all of the SRI and Draper-type centers; solving important problems, establishing high technology cluster groups, increasing university and local company funding, and new high tech jobs for the community. Nevertheless, the CSI mission focus is far more important to the greater good. The Natick Soldier Systems Center (NSSC) is the lead organization for developing everything that the soldier eats, wears or carries. Support of the NSSC mission as an industrial/university consortium will save lives.

Creation of the CSI can be an important element in increasing focus on the warfighter and homeland defender. The CSI teams will work to obtain funding from traditional military and non-military government organizations (going beyond the funding vehicles available to NSSC), but the justification and the need will be validated by the warfighter and homeland defender communities.

Key Unique Elements for the Massachusetts CSI:

- The CSI will define the warfighter and homeland defender needs. The CSI will share this information with Massachusetts companies and universities. This information is not easily available to these organizations. This will enable organizations to focus on these needs as an individual company/school or in collaboration with CSI. Access to warfighter and homeland defender needs enhances opportunities for universities, existing companies and new start-up companies.

- The Natick Soldier Systems Center is the last remaining Army base in New England. Demonstrated close ties with the CSI and the resulting cluster groups will reduce the likelihood that NSSC is considered for elimination during the next Base Realignment and Closure (BRAC) review. NSSC represents over $400 million annually to the Massachusetts economy.

- The CSI Business Plan contributors have worked to reduce the state and local financial investment for establishing the CSI from the typical $10-20 million to only $5 million over the first four years of operation.

3.2 Establishing the Center for Soldier Innovation

In partnership with Natick Soldier Systems Center, and Massachusetts companies and universities, the CSI's objective is to establish a world-class center of excellence focused on enhancing human performance.

The process for establishing the CSI and building the Massachusetts cluster teams is as follows:

3.2.1 Establish the Advisory Board

Includes one appointment each by Draper, Lead University, and one non-government subject matter expert to be named by the governor of Massachusetts. This advisory board will provide oversight and determine if predetermined milestones are met each year; subsequent funding is based on achieving milestones. The advisory board will participate in the selection of the CSI Director.

3.2.2 Establish CSI

The CSI Director is the first key hire – he/she will set the direction and deployment of the Center's resources to achieve the Center's defined objective. Qualifications will include strong technical background, experience with the warfighter or homeland defender community, a proven track record and extensive experience in working with research and development teams and transitioning applied research into systems, experience leading multi-disciplinary and multi-institutional teams, demonstrated experience in securing commercial, government, and foundation funding for applied research and technology development. An example CSI Director job description is provided in Appendix B.

The cost model includes five core staff (including the Director) to write proposals to federal agencies, conduct the initial research necessary to get data for proposal submissions and establish the facility. Prepare detailed operating procedures, topic selection criteria, IP terms and teaming responsibilities will be prepared.

Note: The CSI will seek to attract one or two world-class scientists with reputations that will help attract business. To recruit the caliber and number of Principle Investigators (PIs) needed, the Center will look to the Natick Science and Technology Board to help identify candidates.

3.2.3 Define the Critical Problems to Be Addressed

In partnership with the Natick Soldier Systems Center, develop an understanding of the most pressing and unmet problem areas impacting the soldier. This will include assessing requirements information form: TRADOC Schools, PEO Soldier, the U.S. Army Research, Development and Engineering Command, Walter Reed Army Medical Center, Army Knowledge Online (AKO) Lessons Learned. Concurrently work with other government agency partners such as the Department of Homeland Defense, Department of Homeland Security and Department of Justice, to review homeland defender and emergency responder critical areas of interest.

3.2.4 Exchange Information

The CSI will bring Army, industry and academic technologists into structured discussions around the application of advanced technologies to meet the identified critical soldier problem areas.

3.2.5 Form Focus Teams

Form focus teams to address specific problems. These organizations may align their internal R&D to focus on the problem area and bolster subsequent proposal efforts. Funded research supporting proposals may be accomplished by the CSI or focus team members, as appropriate. Teams will include Natick Soldier Systems Center, companies, universities, and other entities as may be needed to accomplish the objective.

Each focus team will enter into a formal teaming relationship. Members of the team will share in any revenues for IP generated during the performance of any team contract

3.2.6 Develop R&D Proposals

Focus teams will prepare responses to solicitations with the objective of demonstrating solutions to the problems. By combining organizational resources, the perceived and actual capability, credibility and financial stability of the team will be significantly enhanced.

The focus team may also shape a new program; this can include obtaining validation and support from army organizations, and together as a team seek congressional funding support to solve the new identified problem area.

Focus teams will also work with the NSRDEC's Natick National Protection Center to determine if the technologies are appropriate for homeland defender applications. If so, work to impact this important community.

Proposal decisions will include consideration of production manufacturer and potential for commercial applications early in the process.

3.2.7 Execute Programs

Research and development programs shall be directed toward prototype manufacture and demonstration of the new technology in a relevant operational environment.

3.2.8 Showcase Technology

Demonstrate new capabilities for the military and homeland defenders.

3.2.9 Transition Demonstrated Solutions

Focus teams will seek out spiral insertion opportunities into DoD programs of record. Products will be included in future programs of record for subsequent acquisition by the user communities.

Commercial Manufacture – CSI will plan for commercialization early in the development and demonstration activities, with preference given to team members and Massachusetts companies.

The CSI will encourage/mentor/support university members interested in creating new small companies. Draper technology spin-out examples are provided in Appendix C

3.3 Initial Topic Area Thrust

Natick Soldier Systems Center has identified the area of "Human Dimension" as a key unmet challenge facing the soldier. This is consistent with the TRADOC "Big Five" challenge, where TRADOC (responsible for writing the requirements for the Army) has identified Human Dimension as one of the top five challenges for the Army.

TRADOC has defined the human dimension challenge as: "Provide Soldiers and leaders the ability to excel in a challenging and increasingly complex future operating environment by developing tools and technologies that enhance Soldier cognitive performance in order to function efficiently as an integral component of a network. Soldiers must be able to interface with multiple unmanned systems, conduct multi-modal human computer interface, and multitask across a wide spectrum of information input while mitigating the proportional increase in physiological and psychological stress"[8].

The Human Dimension encompasses many of the NSSC product areas, working to improve the human performance under all environmental conditions. Human performance is affected by the gear they carry (weight, complexity, communication with peers, situational awareness), the environment (extreme temperatures, humidity, altitude, weather), and their resulting physiology (stress, cognitive load, sleep deprivation, hunger, thirst).

After significant discussion with the NSSC staff and scientists, we propose to address a subset of Human Dimension: Cognition and Stress in Operational Environments.

Example topics in Cognition and Stress in Operational Environments:

- Soldier Availability - There is currently no adequate method for quantifying the real-time stressors and assessing the resulting cognitive and physical state of the individual. Soldiers in Iraq and Afghanistan are constantly facing a broad spectrum of stressors (physical and psychological): the impact to the individual from sleep, water and food deprivation, dehydration, multiple traumas, temperature extremes, and observing senseless death to name a few. These stressors affect each soldier differently, nevertheless the commander needs to know who is best able to accomplish the next patrol/mission.

- Soldier Injury - If a soldier should become injured or otherwise impaired, it is critical to assess the extent of their injuries and their physiologic state as quickly as possible. On the battlefield, this would help protect both the injured soldier's life and the lives of those trying to save them.

Cognition and Stress in Operational Environments is also important to the First Responder and individuals in roles that can impact public safety, e.g.,

- Firefighters are faced with stress. One-half of today's fire fighter deaths are attributed to stress related heart attacks[9].

- The train or truck driver, who may be tired or otherwise impaired, and falls asleep, and the vehicle crashes killing themselves and injuring dozens.

Each of these examples could have an improved outcome if a monitoring system were available to measure human cognitive and or physical performance readiness. This tool could then be used directly to make decisions regarding the fitness of the individual or used to develop new methods, innovations and equipment improvements to avoid individual injury and protect the community.

The CSI, in collaboration with Natick Soldier Systems Center, industry, and universities, will have the capability to develop such monitoring systems. The system would include the development and integration of existing and novel sensors, the algorithms to interpret the data and infer cognitive and physical state of the individual, and a central repository to store the data and provide quantitative lessons learned to improve individual job tasks. Collectively, this will lead to increased understanding of human performance limitations and establishing processes and equipment to maximize human effectiveness. Development of this system will require interdisciplinary resources for basic and applied research, prototyping, and human testing and manufacture – it will take true collaboration to achieve this ambitious goal.

Possible spin-off products may include small and lightweight sensors patients can wear in home care, hospital patients, and sports enthusiasts. The condition of the individual can be measured and necessary corrective action can be implemented to realize optimum performance outcomes. Another example would be in-cab sensors for locomotive engineers and long-haul truckers that could be installed to improve vigilance and prevent sleep-related accidents.

Development Example:

Cognition and stress Sensor System

Year 1	System requirements for NSSC soldier nutrient testing (CSI, NSSC) Breadboard soldier system (CSI) Develop algorithms to infer cognition and stress from sensors Preliminary lab testing (blood O2, sugar, hydration, cognition test) (NSSC) Initiate basic research for non-electrode EEG sensor (university) Investigate application for Fire Fighter (National Protection Center, university) Investigate application for home care monitoring (medical instrument co.)
Year 2	Brass board (form fit function), field test soldier nutrient testing Algorithms correlate measurements with inferred cognition and stress Bread board Fire Fighter stress system, lab test Initiate basic research for special Fire Fighter stress monitor sensor Initiate basic research for special home care monitor sensor
Year 3	NSSC adopts soldier system and applies to nutrient, food, and clothing testing Brass board Fire Fighter stress monitor, field test Bread board home care system lab test Soldier system adopted for training application – Brigade
Year 4	Soldier system modified for medic application Soldier system used in testing taken to theater – Brigade Soldier and fire fighter System transitioned to commercial manufacture co. Brass board homecare system, field test – shown as non-invasive insulin test
Year 5	NSSC incorporates soldier system in clothing, field demonstration Army includes soldier system in Ground Soldier Equipment spiral insertion (program of record) System Initial soldier and fire fighter systems license revenues Spin-out company forms based on unexpected pain reduction result Clinical testing of home care system

Army adoption = >1-200,000 units
Fire fighter = >1-200,000 units
Home care = >2-6 million units[10].

A discussion of the emerging Remote Patient Monitoring for Home Healthcare Market is provided in Appendix E.

3.4 The End Users

The CSI will first focus on the needs of the warfighter and homeland defender population. We can affect the lives of over 4 million people that have placed their lives in harm's way to protect us. Technologies developed for these warfighters and homeland defenders will then be applied to broader commercial populations. By expanding the population of ultimate customers, we can expect the economies of scale during manufacture, reducing the unit cost for all users.

Warfighters

- Army Active Component: 518,000
- Army National Guard: 353,000
- Army Reserve: 190,000
- Marines 194,000
- Air Force 316,600
- Navy 325,300

Homeland Defenders

- US Customs & Border Protection 44,414
- US Immigration & Customs Enforcement 16,854
- Federal Emergency Management Agency 6,409
- US Secret Service 6,409
- Coast Guard 47,798
- Law Enforcement 861,000
- Fire Services
    - Career 317,000
    - Volunteer 824,000
- Emergency Medical Services 201,000

3.5 Sources of Revenue

Virtually every government agency has revenue opportunities related to enhancing human performance; this includes how we can anticipate and mitigate injury, how to sustain optimum human mental and physical acuity, and/or enhance human capability and effectiveness.
US Government Human Performance Related Funding GFY'09 Budgets include:

Army	$70M[11]
Navy	$183M[12]
Air Force	$97M[13]
NASA	$161M[14]
DARPA	$185M[15]
DHS	$65M[16]
FAA	$2M[17]
NSF	$326M[18]
EPA	$1,205M[19]
NIH	$4,887M[20]

As the CSI focus teams consider proposal topics, CSI technology focus areas will be compared to the solicitations associated with the above federal budgets. The Center will seek to use both military and non-military revenue funds to support the objectives of the CSI. Note: much of the potential funding defined above is not currently being sought by the NSSC or Massachusetts industry or universities.

3.6 Financial Analysis

The business model for the CSI will be essentially the same model that Draper (as an independent, non-profit company) employs for government contracts. The Center will secure and execute on government contracts.

In order to implement this proposal, we are requesting that Massachusetts provide funding over the first four years of the Center's operation. The State support will enable us to hire the staff necessary to organize the CSI, write proposals, and conduct the necessary research to obtain data for proposal submissions. We will also commit to partner with Massachusetts companies and universities; we expect approximately 40% of the proposed work effort to be performed by these team partners.

We have budgeted $2.35M in capital for special equipment needed (not resident at NSSC or Draper facilities) to get the operation started during the first four years of operation. We have also budgeted $1M in year two to build out and occupy the state-supplied building.

The Massachusetts support will cover the short fall between revenues and expenses during the first four years of operation. It is estimated that the operation will be break even in year 4, and be self sustaining in year 5.

The work done at the CSI center will complement, not compete with, the work performed at the Natick Soldier Systems Center.

We project the CSI will receive $29 million revenue over the first 5 years of operation, including $11.6 million to be subcontracted to team partner organizations.

3.6.1 Financial Projections

	Year 1	Year 2	Year 3	Year 4	Year 5
Total CSI Revenue ($M)	**-**	**1.0**	**4.0**	**9.0**	**15.0**
CSI Realized Revenue ($M)	**-**	**0.60**	**2.40**	**5.40**	**9.00**
Partner Subcontract Revenue ($M)	**-**	**0.4**	**1.6**	**3.6**	**6.0**
CSI Cash Flow ($M)	**(1.51)**	**(2.34)**	**(1.15)**	**0.00**	**0.51**
MA State Investment (M)	**1.51**	**2.34**	**1.15**		
CSI Staff (FTE end year)	**5**	**8**	**12**	**23**	**30**

3.6.2 Assumptions

Cost Containment:

- The CSI will be included in the Draper cost center, hence, Draper can provide all Facility, IT, Finance, and Contract Management support.
- During the first year, the CSI core team will be located at the Draper Cambridge facility.
- During the second year, the CSI will build out and occupy the 10,000 sq. ft. facility supplied by Mass Development in the proximity of NSSC. Build out cost is approximately $1M, to be leased at no-cost for 10 years.
- CSI will be able to compete for internal Draper IR&D funds through the existing Draper internal process (~$18 million available annually).
- CSI university partners will be able to compete for internal Draper University grant funds through the existing Draper internal process (~$2 million available annually).

Shared Benefit:

- Income from Intellectual Property licenses will be shared equally by the organizations that teamed on the associated project. Massachusetts will receive an equal share of all CSI revenues and/or equity derived from venture spinout opportunities.

Governance:

- This center will be part of Draper Laboratory, a 501(C)(3) non-profit organization
- The CSI Director will be hired to start the CSI, the balance of the Center's initial cadre (four additional people) will be new hires or transfers from Draper's Cambridge

campus, thereafter, additional staffing will be added as contracts are won and revenues support the additional hires.

- The Advisory Board will include one person from Draper, one from the Lead University partner and one to non-government subject matter expert to be named by the governor of Massachusetts. This advisory board will provide oversight and determine if predetermined milestones are met each year; subsequent funding is based on achieving milestones.

- The CSI, led by the Director, will integrate the needs for the army, homeland defender and related special human performance challenges that impact the Nation.

- The Director will coordinate information exchange opportunities/discussions around the application of advanced technologies to meet the defined critical soldier problem areas. Such opportunities will include direct university contact and the Defense Technology Initiative (DTI) collaboration. Interest and capabilities will be sought from university and industry. The Director will build proposal teams. The order of priority for information exchange is as follows: 1) MA organizations; 2) New England organizations; 3) companies that possess unique capabilities to provide solutions to the critical problem.

Organization Interaction:

- Proposals will complement the Natick Soldier Systems Center; focus teams will not directly compete for the funding received by NSSC.

- Contract and grant funding is intended to increase the total funding for all focus team members; all members are to derive benefit.

- First preference for focus teams will be given to Massachusetts organizations. Second preference will be given to organizations in New England. Natick is the only remaining active component Army installation in New England. Support from the combined New England congressional delegations can increase funding directed toward the soldier needs.

- Natick personnel may be loaned to the CSI under a federal government Interagency Personnel Agreement (IPA) to develop concepts, perform research, and collaborate on strategies for integrating solutions onto the soldier. Such decisions will be determined on a case-by-case basis by CSI and NSSC management.

- The CSI will offer sponsored graduate research assistant opportunities to both civilian and military Masters and PhD candidate students. A portion of the Massachusetts seed funding for the CSI will be applied toward Science, Technology, Engineering and Mathematics (STEM) initiatives.

3.7 Related and Analogous Organizations

The Federal Government funding efforts to broadly advance understanding and applied solutions for enhancing human performance. An example is funding for Traumatic Brain Injury (TBI) (which can result from a single trauma or the cumulative effect of multiple traumas)[21]. Much of this broad work is fragmented and lacks coordination. Natick Soldier Systems Center is initiating work to coordinate the leading Army sponsors of improved human performance work to provide a forum for integrating efforts across the Army.

The US Army Research Laboratory (ARL) and the US Army Aberdeen Proving Ground (USAAPG) Science and Technology Initiative are working in similar areas. However, the CSI intends to seek out both critical and unmet needs of the soldier, and the broad user community that we are to address significantly expands our areas of interest beyond those pursued by USAAPG. In fact, the NSSC is now working to coordinate the Army efforts in the area of human dimension may well lead toward making USAAPG an important collaborating partner to the CSI mission.

General Dynamics has developed the EDGE facility[22]; this facility is open to component manufacturers to integrate their near-COTS equipment into warfighter platforms. The EDGE might seen as a duplication of activities at the Natick Soldier Systems Center. General Dynamics does understand many aspects of the individual soldier as evidenced by their supply of the Land Warrior system. They are also investigating warfighter advancements and providing a forum for all military services to investigate alternative soldier equipment candidates. Again, rather than view the EDGE as duplicative, there is a potential to establish collaborative demonstrations with the EDGE, better utilizing the capabilities of each organization to achieve a product goal.

3.8 Risk Mitigation

The primary risks to success of this business plan are twofold: 1) that the CSI will not be able to hire and retain key staff; and 2) that the projected revenue volume will not be achieved. The CSI will mitigate these risks as follows:

1) If availability of key hires becomes an issue, Draper will commit to allocate personnel to the CSI to bridge the temporary shortfall.

2) Implement the Cost Reduction steps listed in the financial section (above), including;
    - Draper Cambridge Facility will provide Facility, IT, Finance and Contract Management support.
    - During the first year, the CSI core team will be located at the Draper Cambridge facility.
    - CSI will be able to compete for internal Draper IR&D funds through the existing Draper internal process (~$18 million available annually).

- CSI university partners will be able to compete for internal Draper University grant funds through the existing Draper internal process (~$2 million available annually).

3) A CSI Oversight Board of Directors will be established to determine if predetermined milestones are met each year, subsequent funding is based on achieving milestones. Annual mid-year review of the CSI in the early years will allow business plans to be modified, based on the emerging environment.

4) After the first five CSI staff are in-place (necessary to write proposals to federal agencies, conduct the initial research necessary to get data for proposal submissions and establish the facility), incremental additional staff will be hired based on the CSI success in developing opportunities. Facilities and resources will be matched to task, with new capabilities added when needed. The CSI Oversight Board of Directors will strive to ensure the CSI is "right sized" through its growth phase.

3.9 Potential Sources of Funding

The State of Massachusetts is being asked to provide $5 million seed funding over a four-year period to establish the Center for Soldier Innovation. $1.5 million is required in the first year of operation.

During the preparation of this Business Plan, there was much discussion concerning the magnitude and sources of the CSI seed funding. Alternatives considered included seeking funding from other New England states and paid corporate membership. These alternatives are not attractive because the significant CSI benefits would no longer be focused on Massachusetts organizations or there were significant risks associated with the potential change in the CSI focus from non-profit to a for-profit.

The best alternative would be for the funding to come from Massachusetts directly.

Possible alternative funding sources may include; no interest loans, matching funds, charitable contributions from commercial companies.

4 Appendix A: Successful Center Model

The proposed Center for Soldier Innovation is based on the successful implementation of three similar Centers by SRI and Draper; National Center for Maritime and Port Security (St. Petersburg, FL), Center for Advanced Drug Research (CADRE) (Harrisonburg, VA), Center for Bio MEMS (Tampa, FL) and MCM Pilot Facility (Tampa, FL).

The goals for the three centers are similar in that they have annual requirements for jobs created and grant proposals submitted. When an annual goal is achieved, the next tranche of financing is provided for the subsequent year activities. For all four centers, each has met or exceeded its goals after 2 years, 1 year, 5 months and 5 months, respectively.

Background Information:

National Center for Maritime and Port Security
http://www.seagrantfish.lsu.edu/pdfs/biloxi_07/GaryBrown.pdf
Funding sources: $20M State, $20 Local Community match (includes land and building)
Contact: former Gov. Jeb Bush

Center for Advanced Drug Research
http://www.sri.com/biosciences/cadre/
Funding sources: $22M State, Local Community provide building
Contact: Gov. Tim Kaine

Center for Bio MEMS
Funding sources: $10M State, $6M Local Community, $4M University
Contact: Gov. Charlie Crist

MCM Pilot Facility
Funding sources: $5M State, $4M Local Community

Editorial from the Tampa Tribune, Published: October 28, 2008

Tax money given as an incentive to a private business to create jobs raises the question of how taxpayers at large will benefit from the deal. Most of us, for example, aren't qualified for any of the 165 jobs Draper Laboratory plans to create in Tampa and St. Petersburg. But the expansion of the celebrated lab here is in many ways a success more important than winning a Super Bowl or a World Series. Football isn't rocket science, but Draper is. Baseball won't cure cancer, but Draper is working on it. It is a big boost to local pride that Draper isn't coming just because of the $20 million or so in incentives, the biggest piece provided by the state Innovation Incentive Fund. The independent laboratory at the edge of the MIT campus in Cambridge is expanding here largely because this area has the talent pool it needs to work on solving some of the world's toughest scientific problems, say Draper scientists. Its labs here will need scientists and researchers and also machine operators and testers, with pay averaging $75,000 a year. The business and academic climate here is good for attracting companies that can build on a commercial scale the products Draper invents. Credit for bringing Draper here is shared among USF, the governor's office, the Tampa Bay Partnership, SRI-St. Petersburg and local governments, including Hillsborough County and Pinellas County. The nonprofit lab concentrates on four areas: security, health, energy and education. This area is a good fit for each. In security and defense work, Draper will be near the

headquarters of Central Command and Special Operations Command at MacDill Air Force Base, as well as near the Port of Tampa and not far from the Kennedy Space Center. Draper's technology guided the Apollo moon missions and enables missiles fired from submarines to hit distant targets. It is working on surveillance aircraft the size of a schoolboy's paper airplane and maybe smaller. "We can make things really, really small," a Draper researcher told us. How small? "Machines one-quarter of an inch long," he said. "Others so small you can't see them." On health issues, Draper scientists plan to work with USF, the James A. Haley Veterans Hospital, and the H. Lee Moffitt Cancer Center. The small machines and computer chips Draper makes can be useful to doctors as well as soldiers. Some of their most exciting work is with implantable machines that can deliver drugs internally, in small doses, directly to the spot needed, reducing or eliminating side-effects. While the work is expensive, the results promise lower cost diagnosis and cures for people worldwide. Among the many projects on the drawing board is a breath sensor to detect TB. In energy, one current project uses concepts Draper perfected in designing sensors for the space shuttle and the harsh environment of space. Working with Progress Energy, Draper soon will be putting sensors inside the combustion chambers of coal-fueled power plants so operators can adjust the mix for optimal burning. Len Polizzotto of Draper tells us the real-time information can improve efficiency 10 percent, which will lower electric bills and reduce emissions. In education, Draper will use some USF graduate students in its work, among other things. Maybe one will someday write a doctoral thesis on how the lab found a cancer cure, or how it steered a spaceship to Mars.

5 Appendix B: Example CSI Director Job Description

The CSI for Soldier Innovation has been established to create an economic engine that will align the capabilities of select Massachusetts companies and universities, with key mission areas of the Natick Soldier Systems Center (NSSC). The ultimate goals for this enterprise are:

- To produce close cooperation between Massachusetts organizations and the NSSC,
- Increase Massachusetts research development and manufacture jobs,
- Stimulate new company creation. Products initially developed and demonstrated for military applications will be transitioning to broader commercial markets and multiple start-up organizations will be formed/expanded.

The CSI will specifically address the critical and unmet needs for soldiers, where "soldier" is defined as those men and women that protect, serve, and defend the United States, which includes warfighters and homeland defenders. The warfighter is defined as US military services and National Guard. The homeland defender is defined as fire fighters, law enforcement, Coast Guard, Border Patrol Agents and Emergency Medical Services. The process for selecting program initiatives will include determining the potential for broad adoption in commercial markets, providing a pathway toward high volume manufacture and low unit cost for the warfighter and homeland defender.

Responsibilities

The Center Director will lead all of the CSI efforts toward enhancing the performance of the warfighter and homeland defender, working in partnership with Natick Soldier Systems Center. The Director will play the lead role in the identification of warfighter and homeland defender needs, presentation of these needs to the Massachusetts community, and development of business and marketing plans to address defined markets. The Director will then establish the teams (combining the resources of CSI, NSSC, and Massachusetts commercial and university organizations) capable of addressing the defined challenges, and propose new solutions to government and commercial sponsors. The Center will demonstrate the defined technology in relevant operational environments and work to transition the technology to a production manufacturer. In this latter role, the Center will coordinate a process that will connect companies to supporting resources (state and federal opportunities) to support expanded output.

The principle responsibility of the Director is to grow the CSI by leading collaborative teams that successfully win funded research contracts and subsequently demonstrate new products and capabilities that address critical soldier applications. These soldier application areas include: increasing soldier cognitive and physical performance under operational and environmental conditions, increase survivability against ballistic, chemical biological, environmental (flame, thermal, concussive, blast, etc) and developing materials and products that enhance soldier sustainability and mobility.

Qualifications

Requirements:

- Broad and diverse experience in multiple technical fields (i.e. chemistry, physics, biology, neuroscience, polymer science, textile science, engineering, nanotechnology, physiology).

- Demonstrated experience for successfully establishing and leading collaborative-based research, development and/or production/manufacturing teams.
- Demonstrated experience in securing commercial and government funding for applied research and technology development in areas applicable to the CSI, including a wide range of established contacts with potential CSI sponsors.
- 10 years of experience leading multi-disciplinary and multi-institutional teams toward the successful development of advanced system solutions.
- Strong technical qualifications in medicine, biomedical engineering and/or soldier-focused product development/transition, with a MS or higher (MD/PhD preferred). Strong written and verbal communication skills.
- Strong internal and external team building skills.
- Applicants selected will be subject to a government security investigation and must meet eligibility requirements for access to classified information. U.S. Citizenship is required.

Desired:

- Experience working with the warfighter or homeland defender community, including knowledge of requirements, operations and equipment.
- Demonstrated experience in successful technology development from conception to production/manufacturing
- Experience building and/or supporting start-up companies.
- Prior military combat experience or extensive experience with battle field scenarios and/or combat medical requirements (battlefield triage, trauma, and point of care)

6 Appendix C: Draper Technology Spin-out Examples

A key element of the Center for Soldier Innovation is the transition of new technology developed within the Center to a broader marketplace, thereby creating larger manufacture volumes which will lower costs to DoD and state and local government adopters of the technology and provide growth opportunities for industry. As a not-for-profit R&D laboratory, Draper has a long history of transitioning its technology developments to industry for both military and commercial applications. Without a manufacturing capability at the Lab, it is only through technology transition to industry that Draper has maintained its relevance over more than fifty years of operation in a rapidly changing technology environment. Technology transition occurs a numbers of ways at Draper including, licensing to existing and start-up companies, spin-out companies, a liberal publishing policy, and the movement of our employees and students to industry and start-up companies. A few specific examples, including some in the healthcare area, include;

Technology Licensing:

1. Best in class MEMS inertial instrument intellectual property developed at Draper was licensed to Honeywell Industries for both the commercial and military applications. Honeywell is currently producing more than 10,000 navigation systems per year based on the licensed technology.
2. Draper was contacted by the Boston based start-up company Bioscale, Inc. seeking to license Draper MEMS intellectual property associated with a chemical and biological detector for both biodefense, environmental monitoring, and biomedical applications. Bioscale is now supplying product to the market.
3. Draper was contacted by a west coast start-up company seeking license to optical measurement technology developed at Draper with application to the diagnostics for non-centralized healthcare. This company is now in initial product development with product roll-out scheduled for 2010.

Spin-out Companies:

1. In 2001 Sionex Corp, Woburn, Ma, was established as a spin-out company from Draper. Sionex is active in the chemical and explosives detection business, producing a highly sensitive and broadly applicable spectrometer based chemical and biological sensor.
2. In 2006 MTPV Incorporated, Boston, MA was established as a spin-out company from Draper. With technology aimed at converting waste heat into electricity, MTPV is an alternative energy company which has raised its second round of funding, established beta test sites with large manufacturing companies, and is currently developing a prototype for field testing.

As a not-for-profit, Draper does not bind it employees or resident graduate students with non-compete employment agreements. Each year up to 60 graduate students, who have been instrumental in technology innovations during their residency at Draper, graduate and transition their knowledge and ability to industry. In addition a number of Draper employees have followed their desire and entrepreneurial spirit, transitioning innovations they have developed at Draper to successful start-up companies, again, often in the Massachusetts community. Two examples include SRU Biosystems, Inc, Woburn, MA, and SatCon, Inc., a Massachusetts

company based on flywheel technology developed at Draper which is now being employed in the alternative energy market.

Draper has experience in technology transition via a number of channels to both defense and commercial industries. Most recently Draper's technology transition has grown to include more of a focus on technologies related to healthcare. Draper has the experience need to transition the CSI innovations for soldier applications to not only suppliers for the DoD, but also to industry dedicated to commercial healthcare applications.

7 Appendix D: Local Economy Impact Analysis

Prepared by: MetroWest Economic Research Center at Framingham State College

Why MetroWest?
The MetroWest Cohesive Commercial Statistical Area (CCSA), a leading center of research and development activities in Massachusetts, includes the town of Natick, home of the U.S. Army Soldier System Center. The addition of over 100 new professional positions at the Center for Soldier Innovation (CSI) would certainly benefit the MetroWest economy by increasing regional employment and payroll. Even more importantly, siting the CSI in the MetroWest region would offer the Center numerous strategic advantages: a vibrant leading edge regional economy, a striking variety of firms engaged in research and development in many different industries, a highly skilled workforce, and easy access to the many internationally known hospitals and universities located in the Boston MSA. The proximity of such resources will enable the CSI to carry out its mission to meet critical soldier needs by leveraging the experience and capabilities of the Soldier System Center with MetroWest and Boston/Cambridge industry, medical, university and research communities.

Regional economy:
Located 20 miles west of Boston and served by Interstate 90, Route 9 and commuter rail, the MetroWest CCSA economy generated 107,600 jobs with a total payroll of $6.8 billion in 2007. Over 6,600 establishments provided an average annual wage of $63,000, 13.9% higher than the Massachusetts average annual wage of $55,300. The region's strong and diversified industrial base in Professional and Business Services, Trade, Education & Health, and Manufacturing attracts firms and contributes significantly to the Massachusetts economy. In addition, MetroWest enjoys a well earned reputation as a center for research and development. Locating in MetroWest offers the CSI the opportunity to gain synergy from the very firms with which the CSI plans to build relationships and seek federal grants.

Previous MERC research has documented both the concentration of a highly educated management and professional resident labor force and the concentration of research and development establishments. When compared to state residents, MetroWest resident workers are more likely to be employed in industries characterized as professional, scientific, and management services, and information. They are also far more likely than state residents to be in such occupations as those in management, business operations and financial specialties, computer and mathematical areas, engineering, and life, physical and social sciences.

Building on this exceptionally highly educated and highly skilled labor force, the region has attracted firms such as Boston Scientific (medical products), Bose (acoustical engineering), Genzyme (biotechnology), EMC (computer), The MathWorks (computing) Raytheon (defense), Computer Associates (software), NMS Communications (telecommunications), as well as hundreds of smaller entrepreneurial establishments. The North American Industry Classification System (NAICS) typically classifies such establishments engaged in scientific research and product development in the Professional, Scientific and Technical Services (PSTS) sector or Manufacturing supersector depending on the processes used. It is important to note that MetroWest manufacturing establishments typically do not engage in traditional line manufacturing, but instead concentrate on research, development and prototype design in science and engineering. Production is located elsewhere. In 2007 the average annual wage in

the combined Professional, Scientific, and Technical Services and Manufacturing sectors of $95,400 exceeded the regional average annual wage by 51% and the Massachusetts average annual wage by 73%.

These two sectors, Professional, Scientific and Technical Services and Manufacturing as well as the Information sector, form a high technology cluster with a disproportionate number of high technology jobs concentrated in the MetroWest region. In 2007 over 1,100 Professional, Scientific and Technical Services establishments, 220 Manufacturing establishments and 150 Information establishments generated 28,200 jobs in MetroWest, one quarter of the region's total employment. In 2007 MetroWest provided an 11% larger share of Professional, Scientific and Technical Services jobs, a 42% larger share of Manufacturing, and a 52% higher share of Information jobs than these sectors provided statewide. Thus, in the immediate locale of the U.S. Soldier Systems Center and CSI, MetroWest offers high technology cluster groups within which to identify firms that will stimulate innovation and deliver soldier technology breakthroughs. Moreover, within 20 miles of the U.S. Soldier System Center lie the internationally known industry/university/medical institutions of Boston/Cambridge. The new establishment, CSI, would both benefit from and add to the Professional, Scientific, Technical Services, Manufacturing, and Information cluster already located in the MetroWest region.

Direct Impact of CSI on MetroWest:
Using the output multiplier of 1.61 as developed in the January 2008 UMass Donahue Institute report, *The MA Defense Industry: Characteristics and Economic Impact*, an increase of $20-25 million in new contracts results in additional downstream benefits of $12.2 - $15.25 million. This gives a total estimated output benefit of $32.2 - $40.25 million.
Using the employment multiplier of 2.2 as developed in the January 2008 UMass Donahue Institute report, *The MA Defense Industry: Characteristics and Economic Impact*, a gain of 100 jobs will result in an additional 120 jobs. Assessing each of the initial 100 jobs at an average combined wage of $95,400 gives an estimated direct payroll increase of $10 million annually.

8 Appendix E: Remote Patient Monitoring for Home Healthcare Market

Remote patient monitoring today in both centralized and non-centralized healthcare settings (including the home setting) is about a $9B business worldwide, projected to grow to about $16B by 2012. Further, the fastest growing segment of the remote patient monitoring market is non-centralized healthcare settings which is projected to grow at 15% CAGR over this same time period while the centralized healthcare market is projected to grow by only 6%.

Remote patient monitoring for centralized healthcare is fairly mature; however, in the non-centralized setting, including the home setting, remote patient monitoring is still an emerging business with significant room for innovation based on new technology solutions and new provider models. In this home setting, remote monitoring is an important tool for preventive care, chronically ill care, and continuity of care, leading to better health outcomes and overall cost savings. The tools required for remote monitoring in the home setting are analogous to the monitoring devices for warfighters and emergency responders as described earlier in the Center for Soldier Innovation Business Plan. For example, typical sensors needed for home remote monitoring include blood pressure, glucose meter, weight scale, pulse oxidation, peak flow, ECG, medication use, and digital camera, as well as others. Also needed for home health monitoring is the communications and information technology infrastructure required to collect and transmit this vital data to care givers. All the basic elements needed for soldier monitoring systems as will be developed by CSI are applicable to the non-centralized healthcare application.

There are a variety of factors driving this emerging market in non-centralized health care, and remote monitoring in particular. First and foremost is the worldwide aging population. In the U.S. alone the population over 65 years of age will grow over 40% by the year 2025 to almost 65 million people. Or stated another way, the over 65 demographics of the entire U.S. will be equal to that of the state of Florida today where just under 18% of the population over 65. A second driver is the trend among “baby boomers”, who make up this growing retirement population, to actively take charge of their own healthcare through use of both home diagnostic kits and monitoring of vital signs, and to do so in their own home in non-critical care situations. Added to this is the concern that in the relatively near future there will be a significant shortage of primary care physicians. While past projections of physician populations have been somewhat problematic, a recent GAO study concluded that there will be a significant gap between supply and demand of primary care physicians by about 2018. This shortage of primary care physicians can only be made up through wider spread use on non-centralized healthcare, starting in a home setting.

Remote patient monitoring in the non-centralized setting, including the home setting, is an emerging business with a demand trend that will continue to grow well past mid-century and the worldwide population continues to age. This growth will only be fueled by innovation in basic physiology and cognitive monitoring systems. The sensor, communications, and information

technologies developed by CSI for soldier systems will be directly applicable to remote patient monitoring in a home healthcare setting, further leveraging the developments of the Center.

Remote patient monitoring today in both centralized and non-centralized healthcare settings (including the home setting) is about a $9B business worldwide, projected to grow to about $16B by 2012. Approximately three fourths of this growth will be in the non-centralized healthcare market which is projected to grow at a 15% CAGR rate over this time period while the centralized healthcare market will grow at 6% CAGR. Remote patient monitoring for centralized healthcare is fairly mature; however, in the non-centralized setting, including the home setting, remote patient monitoring is still an emerging business with significant room for innovation based on new technology solutions and new provider models. In this home setting, remote monitoring is an important tool for preventive care, chronically ill care, and continuity of care, leading to better health outcomes and overall cost savings. The tools required for remote monitoring in the home setting are analogous to the monitoring devices for warfighters and emergency responders as described earlier in the Center for Soldier Innovation Business Plan. For example, typical sensors needed for home remote monitoring include blood pressure, glucose meter, weight scale, pulse oxidation, peak flow, ECG, medication use, and digital camera, as well as others. Also needed for home health monitoring is the communications and information technology infrastructure required to collect and transmit this vital data to care givers. All the basic elements needed for soldier monitoring systems as will be developed by CSI are applicable to the non-centralized healthcare application.

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Remote patient monitoring in the non-centralized setting, including the home setting, is an emerging business with a demand trend that will continue to grow well past mid-century and the worldwide population continues to age. This growth will only be fueled by innovation in basic physiology and cognitive monitoring systems. The sensor, communications, and information technologies developed by CSI for soldier systems will be directly applicable to remote patient monitoring in a home healthcare setting, further leveraging the developments of the Center.

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