Department of Health and Human Services
Public Health Services

Grant Application

LEAVE BLANK—FOR PHS USE ONLY.

Type	Activity	Number
Review Group		Formerly
Council/Board (Month, Year)		Date Received

1. TITLE OF PROJECT
STATag - Real-Time Equipment Tracking for Hospitals

2. RESPONSE TO SPECIFIC REQUEST FOR APPLICATIONS OR PROGRAM ANNOUNCEMENT OR SOLICITATION ☒ NO ☐ YES
Number: N/A Title: N/A

3. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR — **New Investigator** ☒ **No** ☐ **Yes**

3a. NAME (Last, first, middle)
Tubbs, Daniel Lee

3b. DEGREE(S)
AS BS

3h. eRA Commons User Name
N/A

3c. POSITION TITLE
Project Manager

3d. MAILING ADDRESS
838 Old George Washington Hwy
Suite D
Chesapeake, VA 23323

3e. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Research

3f. MAJOR SUBDIVISION
N/A

3g. TELEPHONE AND FAX
TEL: 757-647-5911 FAX: 757-558-5585

E-MAIL ADDRESS:
tubbs_d@cs.odu.edu

4. HUMAN SUBJECTS RESEARCH ☒ No ☐ Yes

4b. Human Subjects Assurance No.
N/A

4c. Clinical Trial ☒ No ☐ Yes

4d. NIH-defined Phase III Clinical Trial ☒ No ☐ Yes

4a. Research Exempt ☒ No ☐ Yes

If "Yes," Exemption No. N/A

5. VERTEBRATE ANIMALS ☒ No ☐ Yes

5a. If "Yes," IACUC approval Date
N/A

5b. Animal welfare assurance no.
N/A

6. DATES OF PROPOSED PERIOD OF SUPPORT		7. COSTS REQUESTED FOR INITIAL BUDGET PERIOD		8. COSTS REQUESTED FOR PROPOSED PERIOD OF SUPPORT	
From	Through	7a. Direct Costs ($)	7b. Total Costs ($)	8a. Direct Costs ($)	8b. Total Costs ($)
1-3-045	5-1-06	$471,500	$481,000	$471,500	$481,000

9. APPLICANT ORGANIZATION
Name Digital Inventory Systems
Address 838 Old George Washington Highway
Suite D
Chesapeake, VA 23323

10. TYPE OF ORGANIZATION
Public: → ☐ Federal ☐ State ☐ Local
Private: → ☐ Private Nonprofit
For-profit: → ☐ General ☒ Small Business
☐ Woman-owned ☐ Socially and Economically Disadvantaged

11. ENTITY IDENTIFICATION NUMBER
Application Pending
DUNS NO. N/A Cong. District N/A

12. ADMINISTRATIVE OFFICIAL TO BE NOTIFIED IF AWARD IS MADE
Name Tubbs, Daniel Lee
Title Project Manager
Address 838 Old George Washington Highway
Suite D
Chesapeake, VA 23323
Tel: 757-647-5911 FAX: 757-558-5585
E-Mail: tubbs_d@cs.odu.edu

13. OFFICIAL SIGNING FOR APPLICANT ORGANIZATION
Name Tubbs, Daniel Lee
Title Project Manager
Address 838 Old George Washington Highway
Suite D
Chesapeake, VA 23323
Tel: 757-647-5911 FAX: 757-558-5585
E-Mail: tubbs_d@cs.odu.edu

14. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR ASSURANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. I agree to accept responsibility for the scientific conduct of the project and to provide the required progress reports if a grant is awarded as a result of this application.

SIGNATURE OF PI/PD NAMED IN 3a.

DATE 12/13/04

15. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 13.

DATE 12/13/04

DESCRIPTION:

From 1997 to 2001, spending on hospital care increased by $83.6 Billion. Hospital gross margins have also declined annually every year since 1997. This is due in large part to higher wages due to nurse shortages and a higher volume of patients. By 2003, 57% of total hospital expenses were due to wages and benefits.

For nurses alone, wages and benefits account for 36% of all hospital costs. With this in mind, a real problem is at hand. Hospitals have a history of losing and spending unnecessary money. This money is wasted consequently on inefficiency of nurses and hospital staff. From our studies, 35-60% of a nurse's time is wasted on searching for equipment, clarifying orders, and entering redundant information. All together this cost of inefficiency rounds in at about $58 - $99 billion annually. At this point, hospitals need to reduce total costs in order to increase profitability.

The use of STATags will aid in reducing this cost. It provides a solution for real-time equipment tracking (RTET). With STATags, man-hours searching for equipment will be reduced drastically. As a result, this will increase staff efficiency and improve equipment utilization. Also, operating costs are higher than it should be. STATags will lower operating costs by means of reducing overtime, and providing an increased turnaround rate.

Thus more hospitals will be able to maintain profitability and continue to provide services to the public.

PERFORMANCE SITE(S) (organization, city, state)

Digital Inventory Systems
838 Old George Washington Highway
Suite D
Chesapeake, VA 23323

KEY PERSONNEL.

Name	eRA Commons User Name	Organization	Role on Project
Tubbs, Daniel	N/A	Digital Inventory Systems	Project Lead
Hilton, Chad	N/A	Digital Inventory Systems	Personnel Director
Mayor, James	N/A	Digital Inventory Systems	Manufacturing Director
Simon, Latricia	N/A	Digital Inventory Systems	R&D / QA Manager
Sadler, Jason	N/A	Digital Inventory Systems	Marketing Director
Easton Brian	N/A	Digital Inventory Systems	Finacial Director

OTHER SIGNIFICANT CONTRIBUTORS

Name	Role on Project
Software Engineer 2	Software Engineer
Technical Writer	Technical Writer
Contract Manufacturer	Contract Manufacturer
Graphics Designer	Graphics Designer
Office Manager	Office Manager
Installation Engineer	Installation Engineer
Network Engineer	Network Engineer
Lawyer	Lawyer

RESEARCH GRANT

TABLE OF CONTENTS

Principal Investigator/Program Director (Last, First, Middle): Tubbs, Daniel Lee

DETAILED BUDGET FOR INITIAL BUDGET PERIOD
DIRECT COSTS ONLY

FROM 1-3-05 THROUGH 5-1-06

PERSONNEL NAME	ROLE ON PROJECT	TYPE APPT. *(months)*	% EFFORT ON PROJ.	INST. BASE SALARY	DOLLAR AMOUNT REQUESTED *(omit cents)* SALARY REQUESTED	FRINGE BENEFITS	TOTAL
Daniel Tubbs	Principal Investigator	17	100%	$4,000	$4,000	$0	$68,000
Jason Sadler	Marketing Director	17	100%	$3,500	$3,500	$0	$59,500
Latricia Simon	R&D / QA Manager	17	100%	$3,500	$3,500	$0	$59,500
Brian Easton	Financial Director	17	100%	$3,500	$3,500	$0	$59,500
James Mayor	Manufacturing Director	17	100%	$3,500	$3,500	$0	$59,500
Chad Hilton	Personnel Director	17	100%	$3,500	$3,500	$0	$59,500
SUBTOTALS →					$21,500	$0	$365,500

CONSULTANT COSTS
Software Engineer 2,Technical Writer, Contract Manufacturer, Graphics Designer, Office Manager, Installation Engineer, Network Engineer, Lawyer — $19,000

EQUIPMENT & SUPPLIES
Furniture, Computers, Network/Server, Development Software, Error Reporting Software — $37,000

TRAVEL
Airfare to tradeshows — $4,000

OTHER EXPENSES
Telephone, Internet, Utilities, Office Space of 2600 sq. ft. — $46,000

SUBTOTAL DIRECT COSTS FOR INITIAL BUDGET PERIOD	**$** $471,500
TOTAL DIRECT COSTS FOR INITIAL BUDGET PERIOD	**$** $481,000
FEE REQUESTED	

BUDGET JUSTIFICATION PAGE MODULAR RESEARCH GRANT APPLICATION						
Total Direct Costs						$ $481,000

Personnel

Daniel Tubbs, Project Lead (100% effort) - will supervise and coordinate the entire project, and will perform compter engineering tasks.

James Mayor, Manufacturing Director (100% effort) - will coordinate hardware manufacturing and assist in software development.

Chad Hilton, Personnel Director (100% effort) - will locate and hire personell and assist in software development.

Jason Sadler, Marketing Director (100% effort) - will design web interface, raise public awareness, and lead the marketing campaign.

Latricia Simon, R&D / QA Manager (100% effort) - will assist in product development and ensure quality assurance standards are met.

Brian Easton, Financial Director (100% effort) - will oversee funding and expenditures and assist in software development.

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Tubbs, Daniel Lee	Project Lead
eRA COMMONS USER NAME N/A	

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Thomas Edison State College, Trenton, NJ	A.S.A.S.T.	1996	Nuclear Engineering Tech.
Old Dominion University, Norfolk, VA	B.S.(Pending)	2000-2004	Computer Science

A. Positions and Honors.

1986-1988 Manager, Adam's Tri-city Enterprises, Kennewick, WA.

1988-1996 Engineering Watch Supervisor, United States Navy, Norfolk, VA.

1996-2004 Senior Network Analyst, Capital Group Companies, Inc., Norfolk, VA.

2004-Present Owner, Chesapeake Digital Solutions, Chesapeake, VA.

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Easton, Brian E.	Financial Director
eRA COMMONS USER NAME N/A	

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Liberty University, Lynchburg, VA		2001-2002	Computer Science
Old Dominion University, Norfolk, VA	B.S.(Pending)	2002-2004	Computer Science

A. Positions and Honors.

2001-2002 RESNET Technician, Liberty University, Lynchburg, VA

2000 – Present Head Technician, Providence Computers, Chesapeake, VA

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Mayor, James	Manufacturing Director

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Old Dominion University, Norfolk, VA	B.S. (Pending)	2001-2004	Computer Science

A. Positions and Honors.

2001 Developer - SPAWAR Systems Center

2004 Developer - ABACUS Communications

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Hilton, Chad	Personnel Director

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Old Dominion University, Norfolk, VA	B.S. (Pending)	2000-2004	Computer Science

A. Positions and Honors.

2001 - Present Northrop Grumman Information Technology – Internal Information Systems – Newport News Sector

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Sadler, Jason Ray	Marketing Director

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Paul D. Camp Community College, Suffolk, VA	AA&S	1996-2000	Computer Science
Old Dominion University, Norfolk, VA	B.S.(Pending)	2001-2004	Computer Science

A. Positions and Honors.

1999-1999 Computer Service Technician, Peninsula Computers, Yorktown, VA

1999-2000 Computer Service Technician, NTK Computer, Richmond, VA

2000-2000 Computer Service Technician, Technology Source, Suffolk, VA

2000-2001 Computer Service Technician, Interlink Computer, Newport News, VA

2003-Present OCCS Student Technology Support, Old Dominion University, Norfolk, VA

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Simon, Latricia	Personnel Director

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Christopher Newport University, Newport News, VA		1999	Accounting
Old Dominion University, Norfolk, VA	B.S.(Pending)	2000-2004	Computer Science

A. Positions and Honors.

1998-2002 Sales Associate, Stein Mart, Virginia Beach, VA

2002-2003 Pool Attendant, Brandywine Apartments, Virginia Beach, VA

A. Specific Aims

According to a recent Price Waterhouse Coopers study conducted to uncover the reasons for increases in health care spending over the last decade from 1997 to 2001, spending on hospital care increased by $83.6 Billion and hospital gross margins have declined annually every year since 1997. The study leads one to the conclusion that Hospitals are being asked to do more with less.[1]

Of the total of all health care costs in American hospitals wages and benefits for nurses account for 36%, or $166.4 Billion annually.[2] That figure is derived by taking the total cost of all health care wages and benefits ($462 Billion), of which 36% is nurses' wages and benefits.

Additionally there are currently 5,794 hospitals registered with the American Hospital Association with a total of 975,962 registered beds.[3] Our estimate based on these statistics is that there is approximately 10 pieces of mobile medical equipment in a hospital per registered bed. These items would include EKGs, portable X-Ray machines, crash carts, IV poles, wheelchairs, mobile beds, glucometers, ultrasound machines, transfusers, drug carts, and many other pieces of equipment. Additionally, almost every piece of hospital equipment that is not physically installed in a room is mobile. All hospital equipment is very costly.

According to another recent study performed by Mark Murphy showed that finding needed equipment is one of the top ten most wasteful activities at hospitals. [4] Therefore, up to the minute inventory tracking is a real problem in hospitals all across America today.

The goal of the STATag project is to enable hospitals to eliminate waste, reduce operating costs, and stay in the business of providing health care to the community.

Digital inventory system's solution for reducing cost in hospitals is the STATag. It is a real-time inventory-tracking system that will reduce the man hours needed to search for equipment, lower operating costs and increase staff efficiency in maintaining medical devices. All this is accomplished using the five modules contained inside STATag, the user interface and a database server.

STATags will reduce the effort needed to locate a device by displaying its location on an easy-to-use interface. No longer will hospital staff have to go room to room to locate medical devices. All the staff will have to do is query the database for the item they desire and a picture diagram will appear on the screen, showing the locations of the device they queried. The viewer of the diagram will be able to tell which device is not in use because it will show up active on the screen. From there all the staff member will have to do is go and get the item because the floor and room location of the device will be specified in the diagram.

In addition to reducing searching efforts, operation cost and staff efficiency in maintaining the equipment will be affected. The type of reports this system will generate will give insight to the duration of time they had a particular item, price by usage, inventory, equipment utilization, and missing equipment report

The STATag is capable of impacting the hospital community in this fashion because of the hardware components. IEEE 802.15.4 is a self configuring system capable of communicating in noisy environment using a minute amount of power. We use flash ram memory to back up the information gained in the environments where the communication signal may not be to strong. In addition to this, we have a movement module that tracks the location of the device as it moves around the hospital. All these components together provide the environment the type of communication that will be productive in a hospital environment.

B. Background and Significance

From 1997 to 2001, spending on hospital care increased by $83.6 Billion.[5] Hospital gross margins have also declined annually every year since 1997.[6] The main reasons for this are higher wages due to nurse shortages and a higher volume of patients. By 2003, 57% of total hospital expenses were due to wages and benefits. For nurses alone, wages and benefits account for 36% of all hospital costs.[7] With this in mind, a real problem is at hand: hospitals have a history of losing and spending unnecessary money.

This money is wasted consequently on inefficiency of nurses and hospital staff. From our studies, 35-60% of a nurse's time is wasted on searching for equipment, clarifying orders, and entering redundant information. All together, this cost of inefficiency rounds to about $58 - $99 billion annually. At this point, hospitals need to reduce total costs in order to increase profitability.

In the near future, profitability of hospitals will become increasingly difficult as the Baby Boomer generation moves to retirement. This shift of the largest population segment will have severe effects:

- A shortage of nurses
  - The number of nurses approaching retirement age is much greater than the number of nurses currently in training. This will result in greater upward pressure on nurse's wages.
- Increased patients
  - As the Baby Boomers continue to age, they will account for growing percentage of patients requiring health care.
- Decreased reimbursements
  - The shift of the Baby Boomers from private health insurance to Medicare and Medicaid will drastically reduce the amount of money that hospitals receive in exchange for their services. This is the effect of private health insurance paying approximately 90% of costs vs. Medicare and Medicaid paying only 45%.

C. Preliminary Studies

Mark Murphy of the Murphy Leadership Institute found that reducing wasteful work results in an increase in the operating margin. It is this fact that the STATag will leverage to accomplish its goals of enabling hospitals to eliminate waste, reduce operating costs, and stay in the business of providing health care to the community.

Discussions with Cindy Jimmerson, a national lecturer on hospital efficiency, revealed that up to 65% of nurses' time is wasted searching for equipment, entering redundant information, and clarifying orders. In one example, eliminating the need to search for equipment (a glucometer) was found to save the nurse involved 13 minutes, for each patient.

The principle of "Dead Reckoning" has been proved in such areas as NASA's space shuttle program. However, until recently, the technology was too expensive and impractical for large scale adoption, but advances in Micro-Electro-Mechanical Systems (MEMS) have changed that.

The technology needed to build the STATag is already commercially available. The basic building blocks that make the STATag function are the MEMS accelerometers, MEMS gyroscopes, 802.15.4 radios, and the ZigBee protocol standard.

D. Research Designs and Methods

The STATag project is sectioned into four phases. The overall objective of our multiple phase work breakdown structure is to design, develop, test, evaluate, benchmark and (deploy) bring to production release an equipment tagging system that will affectively monitor hospital devices. This project is sectioned into the following four phases:

Phase 0 – We established the feasibility and technical ability to produce STATag. Phase 0 consisted of seven major tasks. Following is a list of specific tasks that addressed the key objectives of Phase 0 research.

1. Developed an initial concept and a starting point
2. Selected a project topic to develop further
3. Researched the topic to gain background knowledge of the ideal solution
4. Researched the feasibility of our topic
5. Researched the milestones that were defined in our coarse schedule
6. Researched all the components of an SBIR grant proposal write-up
7. Developed STATag's webpage

Phase I – We developed a lab prototype and all its specifications. Phase I consisted of five major tasks. Following is a list of specific tasks that addressed the key objectives of Phase I research.

1. Hired personnel such as a technical writer and a software engineer to maintain integrity in all aspects of STATag's production
2. Specified, implemented, tested, and designed our lab prototype
3. Developed, executed, and evaluated test problems to demonstrate the feasibility (compatibility) of the software and hardware components
4. Updated the webpage information
5. Prepared Phase II grant proposal
6. Submitted Phase II grant proposal

Phase II – We will establish, in a hospital, a real-world functioning model. Phase II will consist of nine major tasks. Following is a list of specific tasks that will address the key objectives of Phase II research.

1. Hire additional staff
2. Develop a software design and a plan for integration
3. Design a software web interface
4. Specify, implement, test, and design for real-world integration
5. Develop, execute, and evaluate test problems to demonstrate interface compatibility of the software and hardware components
6. Develop user and testing documentation
7. Produce finalized result of the extensive software testing
8. Contract a legal representative
9. Begin Phase III real-world installment of STATag
10. Develop a market plan for the continuation of DIS without grant assistance

Phase III – We will achieve self-sustenance. Phase III will consist of nine major tasks. Following is a list of specific tasks that will address the key objectives of Phase III research.

1. Hire additional staff
2. Produce ramp-up
3. Establish full production of STATag
4. Develop a support department
5. Establish a support department
6. Train installation engineers
7. Enhance our marketing and sales techniques
8. Establish ourselves in tradeshows
9. Develop an in-depth support team which will consist of updates, warranty, and telephone support

E. Literature Cited

1. Mark Murphy, Research Brief: Eliminating Wasteful Work in Hospitals Improves Margin, Quality and Culture, Murphy Leadership Institute, 2003
2. Hospital Statistics, American Hospital Association, 2004
3. Cost of Caring: Key Drivers of Growth in Spending on Hospital Care, PriceWaterhouseCoopers, 2003
4. Cindy Jimmerson, RN, Dorthy Weber, MSW, and Durward Sobek, PhD, Reducing Waste and Errors: Piloting Lean Principles at IHC, not yet published.

Principal Investigator/Program Director (Last, First, Middle): Tubbs, Daniel Lee

PERSONAL DATA ON PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR

DATE OF BIRTH	11/22/33	SEX/GENDER
SOCIAL SECURITY NUMBER (last 4 digits only)	XXX-XX- 6789	☐ Female ☒ Male

ETHNICITY

1. Do you consider yourself to be Hispanic or Latino? Select one.

☐ **Hispanic or Latino**

☒ **Not Hispanic or Latino**

RACE

2. What race do you consider yourself to be? Select one or more of the following.

☐ ***American Indian or Alaska Native.*** A person having origins in any of the original peoples of North, Central, **or** South America, and who maintains tribal affiliation or community attachment.

☐ ***Asian.*** A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian **subcontinent**, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam. (Note: Individuals from the Philippine Islands have been recorded as Pacific Islanders in previous data collection strategies.)

☐ ***Black or African American.*** A person having origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black" or African American."

☐ ***Native Hawaiian or Other Pacific Islander.*** A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or **other** Pacific Islands.

☒ ***White.*** A **person** having origins in any of the original peoples of Europe, the Middle East, or North Africa.

☐ Check here if you do not wish to provide some or all of the above information.

Mailing address for application

Use this label or a facsimile

All applications and other deliveries to the Center for Scientific Review must come either via courier delivery or via the United States Postal Service (USPS.) Applications delivered by individuals to the Center for Scientific Review will no longer be accepted.

Applications sent via the USPS EXPRESS or REGULAR MAIL should be sent to the following address:

CENTER FOR SCIENTIFIC REVIEW
NATIONAL INSTITUTES OF HEALTH
6701 ROCKLEDGE DRIVE
ROOM 1040 – MSC 7710
BETHESDA, MD 20892-7710

NOTE: All applications sent via a courier delivery service (non-USPS) should use this address, but CHANGE THE ZIP CODE TO 20817

The telephone number is 301-435-0715. C.O.D. applications will *not* be accepted.

Mailing address for application

Use this label or a facsimile

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