

Topic: N122-134

Propel LLC

Seam Engineering: Stitchless Seam Technology

Propel LLC, a human-centered textile technologies design company, has applied stitchless seaming technology in order to enhance the performance of DOD clothing, personal protective equipment, and other textile items. Successful testing of stitchless seam garments in relevant field environments validated laboratory test data. Manufacturing assessments indicate that the transition from low rate to full rate production in sufficient quantities to meet Navy requirements is highly feasible. The completion of a Phase III contract to design and prototype a new Navy Damage Control (Steam) Suit confirms the technology's value and transition capability. Integration of Propel's stitchless seam technology into suitable new and existing clothing items and textile systems will enhance their form, fit, and function and reduce item weight.

Technology Category Alignment:

Satellite Communications (SATCOM)

Robotics/Automated Material Handling Equipment

Shipyards/Shipbuilding

Supply; Storage

Satellite Communications (SATCOM)

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Supply; Storage

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Satellite Communications (SATCOM)

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Shipyards/Shipbuilding

Robotics/Automated Material Handling Equipment

Robotics/Automated Material Handling Equipment

Robotics/Automated Material Handling Equipment

Robotics/Automated Material Handling Equipment

Protection, Sustainment, and Warfighter Performance

Medical Chem-Bio Defense

Military Infectious Diseases

Propulsion and Extreme Environments

Fixed Wing Vehicles (includes UAS)

Survivability

Maintainability/Sustainability

Unmanned Ground and Sea Vehicles

Corrosion

Advanced Computing/Software Development

Networks and Communications

Modular/Open/Reconfigurable Architectures

RF Components for sensing, transmission and communication

Electronics Integration

Broadband/Multispectral Components and Systems

Sensors, Electronics and Photonics

Radio Frequency (RF) (non-EW)

Survivability

Broadband/Multispectral Components and Systems

RF Components for sensing, transmission and communication

Radio Frequency (RF) (non-EW)

Networks and Communications

Guidance, Navigation & Control (GN&C) and Data Links
RF Components for sensing, transmission and communication
Networks and Communications
Cognitive/Adaptive Capabilities
Preemptive/Proactive Effects
Broadband/Multispectral Components and Systems
Advanced Computing/Software Development
Networks and Communications
Personalized Assessment, Education, and Training
System Interfaces & Cognitive Processes
Aircraft Propulsion, Power and Thermal
Modeling, Simulation & Test Infrastructure
Rotary Wing Vehicles
Fixed Wing Vehicles (includes UAS)
Fixed Wing Vehicles (includes UAS)
Acoustic, Seismic and Magnetic
Rotary Wing Vehicles
Structures and Protection
Energy storage
Unmanned Ground and Sea Vehicles
Mobility
Power and Energy
Synthesis/Analytics/Decision Tools
Information Collection/Management
Advanced Computing/Software Development
Survivability
Unmanned Ground and Sea Vehicles
Radio Frequency (RF) (non-EW)
Power Generation/Energy Conversion
Energy storage
Power and Energy
Sensors, Electronics and Photonics
Maintainability/Sustainability
Advanced Computing/Software Development
EO/IR Components for sensing, transmission and communication
Microelectronics and Nanoelectronics
Networks and Communications
Mobility
Broadband/Multispectral Components and Systems
Sensors, Electronics and Photonics
Structures and Protection
Electro-Optical/Infrared (EO/IR)
Human/Autonomous System Interaction and Collaboration
Maintainability/Sustainability
System Interfaces & Cognitive Processes
Aircraft Propulsion, Power and Thermal
Power Generation/Energy Conversion

High Energy Lasers (HEL)
Propulsion
Biomedical Informatics / Health Information Systems & Technology
Protection, Sustainment, and Warfighter Performance
Modeling, Simulation & Test Infrastructure
Maintainability/Sustainability
Mobility
Personalized Assessment, Education, and Training
RF Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
Sensors, Electronics and Photonics
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Radio Frequency Weapons (RFW)
Energy storage
Power Generation/Energy Conversion
Thermal Transport and Control
Unmanned Ground and Sea Vehicles
Acoustic, Seismic and Magnetic
RF Components for sensing, transmission and communication
Guidance, Navigation & Control (GN&C) and Data Links
Survivability
High-Speed/Hypersonics
Power Generation/Energy Conversion
Acoustic, Seismic and Magnetic
Radio Frequency Weapons (RFW)
Electronic Materials
Electronics Integration
RF Components for sensing, transmission and communication
Electromechanical conversion
Energy storage
Power Control and Distribution
Power Generation/Energy Conversion
Thermal Transport and Control
EO/IR Components for sensing, transmission and communication
RF Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Fixed Wing Vehicles (includes UAS)
Distributed/Coordinated/Net-Enabled Systems
High-Speed/Hypersonics
Propulsion and Extreme Environments
Energy storage
Ordnance
Human Computer Interfaces (HCI) for Decision Making
Information Collection/Management
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EO/IR Components for sensing, transmission and communication
Rotary Wing Vehicles

Protection, Sustainment, and Warfighter Performance
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Assuring Effective Missions
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Maintainability/Sustainability
Acoustic, Seismic and Magnetic
Test, Evaluation, Validation, and Verification
Maintainability/Sustainability
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Networks and Communications
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EO/IR Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Information Collection/Management

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Military Infectious Diseases
Military Operational Medicine
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Mobility
Modularity
Survivability
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Propulsion
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Biomedical Informatics / Health Information Systems & Technology
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High Energy Lasers (HEL)
EO/IR Components for sensing, transmission and communication
Networks and Communications
Sensors, Electronics and Photonics
Electro-Optical/Infrared (EO/IR)
Human Computer Interfaces (HCI) for Decision Making
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System Interfaces & Cognitive Processes
Clinical & Rehabilitative Medicine
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Military Operational Medicine

Protection, Sustainment, and Warfighter Performance
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Advanced Electronic Protection Techniques and Technology
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Modular/Open/Reconfigurable Architectures
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Fixed Wing Vehicles (includes UAS)
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Trust Foundations
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Agile Operations
Personalized Assessment, Education, and Training
Protection, Sustainment, and Warfighter Performance
Human/Autonomous System Interaction and Collaboration
Human Computer Interfaces (HCI) for Decision Making
Synthesis/Analytics/Decision Tools
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Aircraft Propulsion, Power and Thermal
High-Speed/Hypersonics
Propulsion
Aircraft Propulsion, Power and Thermal
Electro-Optical/Infrared (EO/IR)
RF Components for sensing, transmission and communication
Networks and Communications
Distributed/Coordinated/Net-Enabled Systems
Radio Frequency (RF) (non-EW)
EO/IR Components for sensing, transmission and communication
Networks and Communications
Sensors, Electronics and Photonics
RF Components for sensing, transmission and communication
Networks and Communications
Distributed/Coordinated/Net-Enabled Systems
Radio Frequency (RF) (non-EW)
EO/IR Components for sensing, transmission and communication
Test, Evaluation, Validation, and Verification
Electro-Optical/Infrared (EO/IR)
Modeling, Simulation & Test Infrastructure
Fixed Wing Vehicles (includes UAS)
Fixed Wing Vehicles (includes UAS)
Structures and Protection
Modeling, Simulation & Test Infrastructure
Networks and Communications
Trust Foundations
Fixed Wing Vehicles (includes UAS)
Test, Evaluation, Validation, and Verification
Unmanned Ground and Sea Vehicles
Modeling, Simulation & Test Infrastructure
Machine Perception, Reasoning and Intelligence

Synthesis/Analytics/Decision Tools
Cognitive/Adaptive Capabilities
Preemptive/Proactive Effects
Propulsion and Extreme Environments
Manufacturing Technology for Affordability
Manufacturing Technology for Affordability
Ordnance
Propulsion
Machine Perception, Reasoning and Intelligence
Networks and Communications
Assuring Effective Missions
Trust Foundations
Cognitive/Adaptive Capabilities
High-Speed/Hypersonics
Corrosion
Power and Energy
Sensors, Electronics and Photonics
Acoustic, Seismic and Magnetic
Structures and Protection
Human Computer Interfaces (HCI) for Decision Making
Maintainability/Sustainability
Corrosion
Structures and Protection
Energy storage
Power and Energy
Survivability
Propulsion and Extreme Environments
Sensors, Electronics and Photonics
Ordnance
Aircraft Propulsion, Power and Thermal
Fixed Wing Vehicles (includes UAS)
Power Generation/Energy Conversion
Power and Energy
RF Components for sensing, transmission and communication
Radio Frequency (RF) (non-EW)
Protection, Sustainment, and Warfighter Performance
Readiness
Structures and Protection
Undersea Weapons
Machine Perception, Reasoning and Intelligence
Broadband/Multispectral Components and Systems
Electro-Optical/Infrared (EO/IR)
Radio Frequency (RF) (non-EW)
Electronics Integration
RF Components for sensing, transmission and communication
Sensors, Electronics and Photonics
Sensors, Electronics and Photonics

Maintainability/Sustainability
Sensors, Electronics and Photonics
RF Components for sensing, transmission and communication
Preemptive/Proactive Effects
Power Control and Distribution
Acoustic, Seismic and Magnetic
Power Control and Distribution
Acoustic, Seismic and Magnetic
Fixed Wing Vehicles (includes UAS)
Aircraft Propulsion, Power and Thermal
Rotary Wing Vehicles
Aircraft Propulsion, Power and Thermal
Aircraft Propulsion, Power and Thermal
Power Control and Distribution
Propulsion and Extreme Environments
Propulsion
EO/IR Components for sensing, transmission and communication
Satellite Communications (SATCOM)
Networks and Communications
Trust Foundations
Electro-Optical/Infrared (EO/IR)
RF Components for sensing, transmission and communication
Networks and Communications
Advanced Electronic Protection Techniques and Technology
Distributed/Coordinated/Net-Enabled Systems
Radio Frequency (RF) (non-EW)
Unmanned Ground and Sea Vehicles
Maintainability/Sustainability
Modularity
Survivability
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
EO/IR Components for sensing, transmission and communication
RF Components for sensing, transmission and communication
Networks and Communications
Broadband/Multispectral Components and Systems
Electronics Integration
Protection, Sustainment, and Warfighter Performance
Clinical & Rehabilitative Medicine
Combat Casualty Care
Medical Chem-Bio Defense
Energy storage
Protection, Sustainment, and Warfighter Performance
Human Computer Interfaces (HCI) for Decision Making
Synthesis/Analytics/Decision Tools
Undersea Weapons
Human Computer Interfaces (HCI) for Decision Making

Information Collection/Management
Synthesis/Analytics/Decision Tools
Power and Energy
Propulsion and Extreme Environments
RF Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Broadband/Multispectral Components and Systems
Preemptive/Proactive Effects
Radio Frequency (RF) (non-EW)
Energy storage
Manufacturing Technology for Affordability
Power and Energy
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Synthesis/Analytics/Decision Tools
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Unmanned Ground and Sea Vehicles
Aircraft Propulsion, Power and Thermal
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EO/IR Components for sensing, transmission and communication
Networks and Communications
Preemptive/Proactive Effects
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Sensors, Electronics and Photonics
Scalable Teaming of Autonomous Systems
Networks and Communications
Unmanned Ground and Sea Vehicles
Acoustic, Seismic and Magnetic
Test, Evaluation, Validation, and Verification
Propulsion and Extreme Environments
Fixed Wing Vehicles (includes UAS)
Networks and Communications
Mobility
Unmanned Ground and Sea Vehicles
Fixed Wing Vehicles (includes UAS)
Rotary Wing Vehicles
Manufacturing Technology for Affordability
Readiness
Lower Atmosphere Battlespace Environments
Human/Autonomous System Interaction and Collaboration
Machine Perception, Reasoning and Intelligence
Human Computer Interfaces (HCI) for Decision Making
Survivability
Unmanned Ground and Sea Vehicles
Aircraft Propulsion, Power and Thermal

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Protection, Sustainment, and Warfighter Performance
Individual Warfighter
Synthesis/Analytics/Decision Tools
Collaborative Analysis and Decision-making
Survivability
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Fixed Wing Vehicles (includes UAS)
Human/Autonomous System Interaction and Collaboration
Scalable Teaming of Autonomous Systems
Synthesis/Analytics/Decision Tools
Acoustic, Seismic and Magnetic
Undersea Weapons
Frameworks for Interoperability
Information Collection/Management
Synthesis/Analytics/Decision Tools
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Human/Autonomous System Interaction and Collaboration
Machine Perception, Reasoning and Intelligence
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Synthesis/Analytics/Decision Tools
EO/IR Components for sensing, transmission and communication
RF Components for sensing, transmission and communication
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Synthesis/Analytics/Decision Tools
Electromechanical conversion
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Power Control and Distribution
Power Generation/Energy Conversion
Electronics Integration
Energy storage
Power Control and Distribution
Power Generation/Energy Conversion
Survivability
Fixed Wing Vehicles (includes UAS)
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Energy storage
Power Generation/Energy Conversion
Unmanned Ground and Sea Vehicles
Electromechanical conversion

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Power Control and Distribution
Power Generation/Energy Conversion
Thermal Transport and Control
Thermal Transport and Control
Protection, Sustainment, and Warfighter Performance
Modeling, Simulation & Test Infrastructure
Microelectronics and Nanoelectronics
RF Components for sensing, transmission and communication
Modularity
Acoustic, Seismic and Magnetic
EO/IR Components for sensing, transmission and communication
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Guidance, Navigation & Control (GN&C) and Data Links
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Maintainability/Sustainability
Manufacturing Technology for Affordability
Corrosion
Readiness
Test, Evaluation, Validation, and Verification
Advanced Computing/Software Development
Synthesis/Analytics/Decision Tools
Distributed/Coordinated/Net-Enabled Systems
Aircraft Propulsion, Power and Thermal
Energy storage
Thermal Transport and Control
High Energy Lasers (HEL)
Power and Energy
Mobility
Modularity
Electronic Materials
RF Components for sensing, transmission and communication
Manufacturing Technology for Affordability
Personalized Assessment, Education, and Training
Protection, Sustainment, and Warfighter Performance
System Interfaces & Cognitive Processes
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Structures and Protection
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Electronics Integration
RF Components for sensing, transmission and communication
Acoustic, Seismic and Magnetic
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
Electronics Integration
Information Collection/Management
Maintainability/Sustainability

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Structures and Protection
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Manufacturing Technology for Affordability
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Test, Evaluation, Validation, and Verification
Maintainability/Sustainability
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EO/IR Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
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Fixed Wing Vehicles (includes UAS)
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Personalized Assessment, Education, and Training
EO/IR Components for sensing, transmission and communication
Electro-Optical/Infrared (EO/IR)
Radio Frequency Weapons (RFW)
Sensors, Electronics and Photonics
RF Components for sensing, transmission and communication
EO/IR Components for sensing, transmission and communication
Scalable Teaming of Autonomous Systems
Test, Evaluation, Validation, and Verification
Biomedical Informatics / Health Information Systems & Technology
Information Collection/Management
Protection, Sustainment, and Warfighter Performance
Individual Warfighter
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Rotary Wing Vehicles
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Maintainability/Sustainability
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Cognitive/Adaptive Capabilities
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Rotary Wing Vehicles
Test, Evaluation, Validation, and Verification
Maintainability/Sustainability
Fixed Wing Vehicles (includes UAS)
Rotary Wing Vehicles
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Synthesis/Analytics/Decision Tools
Fixed Wing Vehicles (includes UAS)
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RF Components for sensing, transmission and communication
EO/IR Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
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EO/IR Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
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High Energy Lasers (HEL)
EO/IR Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
Survivability
High Energy Lasers (HEL)
Manufacturing Technology for Affordability
Ordnance
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EO/IR Components for sensing, transmission and communication
Electro-Optical/Infrared (EO/IR)
Propulsion and Extreme Environments
Fixed Wing Vehicles (includes UAS)
High-Speed/Hypersonics
Guidance, Navigation & Control (GN&C) and Data Links
Protection, Sustainment, and Warfighter Performance
Human Computer Interfaces (HCI) for Decision Making
Synthesis/Analytics/Decision Tools
Computational Research Engineering Acquisition Tools and Environment
Maintainability/Sustainability

Frameworks for Interoperability
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Unmanned Ground and Sea Vehicles
Advanced Computing/Software Development
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Integrating Architecture and Capability Demonstrations
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Machine Perception, Reasoning and Intelligence
Test, Evaluation, Validation, and Verification
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Assuring Effective Missions
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Trust Foundations
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RF Components for sensing, transmission and communication
Sensors, Electronics and Photonics
RF Components for sensing, transmission and communication
Information Collection/Management
Preemptive/Proactive Effects
Radio Frequency (RF) (non-EW)
Sensors, Electronics and Photonics
Microelectronics and Nanoelectronics
RF Components for sensing, transmission and communication
Radio Frequency (RF) (non-EW)
Radio Frequency Weapons (RFW)
Machine Perception, Reasoning and Intelligence
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Sensors, Electronics and Photonics
Electronics Integration
Test, Evaluation, Validation, and Verification
Advanced Computing/Software Development
Conceptual, Computational, and World-Wide Environmental Representation
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Fixed Wing Vehicles (includes UAS)
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Space and Terrestrial Environmental Monitoring
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Aircraft Propulsion, Power and Thermal
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Protection, Sustainment, and Warfighter Performance
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Readiness

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Networks and Communications
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Information Collection/Management
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Protection, Sustainment, and Warfighter Performance
Energy storage
Power Control and Distribution
Power and Energy
Propulsion and Extreme Environments
Ordnance
Energy storage
Power and Energy
Test, Evaluation, Validation, and Verification
Synthesis/Analytics/Decision Tools

Modular/Open/Reconfigurable Architectures
Collaborative Analysis and Decision-making
Readiness
Structures and Protection
Aircraft Propulsion, Power and Thermal
Corrosion
Propulsion and Extreme Environments
Readiness
Sensors, Electronics and Photonics
Structures and Protection
Electronics Integration
Networks and Communications
None
None
Aircraft Propulsion, Power and Thermal
Fixed Wing Vehicles (includes UAS)
None
None
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SYSCOM: NAVSUP

Contract: N00189-15-C-Z087

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00189-15-C-Z087

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

Topic # N122-134

Seam Engineering: Stitchless Seam Technology

Propel LLC

WHO

SYSCOM: NAVSUP

Sponsoring Program: NCTRF

Transition Target: NEXCOM
Uniform Program Management
Office

TPOC:
(508)233-1321

Other transition opportunities:
Clothing and Personal Protective
Equipment for
> NAVAIR
> US Army PM-SPIE and PM-SCIE
e.g US Army's Cold Temperature
and Arctic Protection System
(CTAPS)
> MARCORSYSCOM PM-Infantry
Combat Equipment (ICE)
> JPEO Chemical and Biological
Defense



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WHAT

Operational Need and Improvement: Need for improved technical performance including a reduction in bulk and weight, better moisture management (breathability), wind/water resistance, durability, abrasion resistance, flexibility and improved human factors and ergonomics. Need for rapid prototyping of test quantities of garments using the selected stitchless technologies to support developmental garment programs versus current cost-prohibitive approaches.

Specifications Required: Reduced weight, bulk and stiffness of seams. Reduced manufacturing costs with material and other cost savings. Reduce manufacturing complexity, e.g. reduction in number of different machines for different stitch types as well as simplification of garment manufacturing flow. Reduction of labor intensive mechanical stitch processes.

Technology Developed: Propel developed a stitchless technology tool set and an optimized stitchless technology design engineering process to deliver best form, fit and function with high manufacturing readiness and rapid prototyping capability. Propel's innovations optimize the performance of garments and other textile end items by replacing sewing with needle and thread with stitchless technologies.

Warfighter Value: Prototype Phase II field tested Stitchless Jacket is 30% lighter than the Navy's incumbent in-service garment. Stitchless seam technology results in lower bulk and a reduced packing cube. Improved flexibility and lower weight of Stitchless technologies result in better ergonomics. Stitchless seam garments have low water weight gain and improved surface integrity, and are quieter in field use. A new 1-piece US Navy Steam (Damage Control) Suit was designed and prototyped under a follow-on Phase III RD&E contract, and is 42% lighter and with a donning time that is 50% less than for the in-service incumbent 2-piece ensemble.

WHEN

Contract Number: N00189-15-C-Z087 **Ending on:** December 31, 2017

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|--------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------|------------|----------------|
| Field Trial of 10 Prototype Stitchless Jackets | Med | Garments meet the needs of the users as measured by user surveys, focus groups and evaluation of tested garments | 7 | December 2017 |
| Manufacturing Feasibility Study | Med | Stitchless garment is ready for transition to low rate manufacturing | 7 | December 2017 |
| Production of 300 Prototype Stitchless Jackets (Phase II Option) | Low | Garments pass end item testing protocols for performance | 7 | September 2018 |
| Navy administered Operational Field-Test of 300 Stitchless Jackets | Med | Garments meet Navy's improvement goals | 7 | May 2019 |

HOW

Projected Business Model: Propel's business model is to apply the Stitchless technology tool set together with the optimized Stitchless technology design engineering process, via RDT&E contracts, in order to improve existing military clothing, gear and textile end items as well as for new items using the Stitchless technologies. Propel will hold any follow-on acquisition contracts, teaming with highly qualified military contractors for manufacturing. At this time scale-up to full rate manufacturing is limited by the equipment on hand, which is only sufficient for prototype quantities. Needed equipment is readily available for purchase, but additional capital investment will be required to close this technology transition gap.

Company Objectives: Propel's objective is to connect with Navy and other DOD program offices for whom current clothing systems and textile end items could be significantly enhanced by application of the Stitchless technologies. The Stitchless technologies lend themselves to rapid prototyping of better solutions for user protection - engineering the design of the Stitchless garment or textile end-item to a specific need rather than the one garment fits all needs approach that is more typical of current approaches. Propel's advanced technologies can be implemented to improve protection as well as form, fit, function for the user, together with the potential for cost savings from assembly automation and materials reduction.

Potential Commercial Applications: Industrial Workwear, protective and safety gear. Other Militaries (e.g. NATO).

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