NAVSEA WARFARE CENTERS NEWPORT

Technology Effort: Photonics and Laser Technology

Status of Availability As of *08/16/2021*: Concept/initial validation

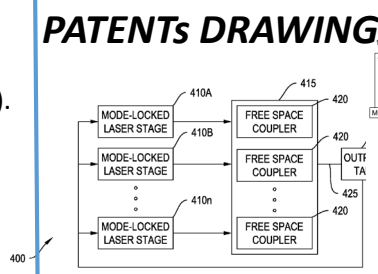
Description: (what it does and how – what need/problem does it address):

The present inventions are directed to on Photonics Technology of an Optical amplifier, LIDAR and free space multi frequency stealth laser communications and innovative optical amplifier pumping scheme(s).

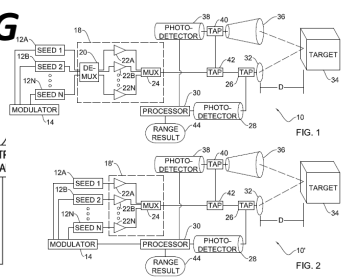
1. First object of the invention (US, 10,090, 6341B1; US 10,408,925B1 and US 8,842361B1) to provide a stealth Laser Range Finder, robust laser communications transceiver that transmits a robust signal at a variety of frequencies, and mode lock laser system with free space optical feedback system.
2. Another object of the above three patents that has been identified as is to provide a stealth robust laser communications system with optical feed back, transceiver that can utilize modulate the transmitted light in a variety of schemes to enhance security and transmission rates under stealth operations.

Accordingly, laser communications apparatus for sending and receiving messages using optical frequency. A processor encodes user messages for a optical modulator. The optical modulator provides control signals related to the encoded message to a plurality of seed lasers. Each seed laser can provide light at a different optical wavelength. Optical amplifiers are used to amplify light from the seed lasers.

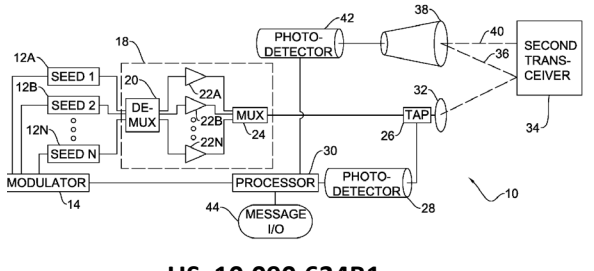
PATENTs DRAWING



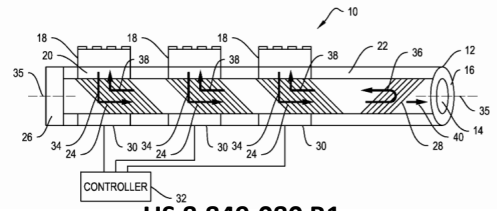
US 8,842,361 B1



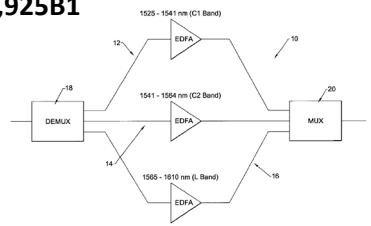
US 10.408,925B1



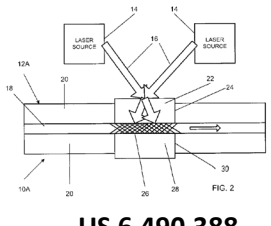
US 10,090,634B1



US 8,849,080 B1



US 6,307,668



US 6,490,388

Development Timeline: (what has been done; what is needed to be done; Availability for use):

Current technology status of (US, 10,090, 6341B1; US 10,408,925B1 and US 8,842361B1) is at TRL level 3 to 4. Further Technology feasibility study and system development for the validation of the patents and required addition R&D development for lab prototype demonstration.

Time: 6 to 12 months

Fun: TBD

Red – concept and initial validation of the technology & Prototype demo

US, 10,090, 6341B1; US 10,408,925B1 and US 8,842361B1 patents requires additional recourse time and fund for system development and integration of the technology at TRL 5/6 from current TRL 3/4 for commercial or DoD application and integration into platform. Further recourse shall also be required to meet the additional challenge(s) of the required system requirements for the system deployment.

Time: 12 months based on the additional requirements

Fund: TBD

Green – technology ready for commercialization & DoD/use

PATENT NUMBER(S), Title & TRL

Patent#	Title	Year	TRL
US 10,408,925B1	LOW PROBABILITY of INTERCEPT OPTICAL RANGE FINDER	2019	3/4
US 10,090,634B1	Robust Laser Communication	2018	3/4
US 8,842,361 B1	Mode-Locked Laser with Free Space Optical Feed-Back	2014	4
US 8,849,080 B1	MONOLITHICALLY INTEGRATED MULTI-WAVELENGTH HIGH POWER WAVEGUIDE/FIBER OPTIC COUPLER	2014	4
US 6,307,668	Ultra-wide bandwidth fiber based optical amplifier	2001	6/7
US 6,490,388	Side-pumped fiber laser	2002	6

Team: (Org Name – POC – contact info)

Tariq Manzur, Ph.D; FInstP; Fellow SPIE; Fellow APS
Naval Undersea Warfare Center (NUWC, DIVNPT); Newport, RI-02841
Email: tariq.manzur@navy.mil; SIPR: tariq.manzur1@navy.smil.mil
Ph: (401) 832-6887; Cell: (401) 862-7273; Fax: (401) 832-7345

Red – concept and initial prototype design | **Orange – initial prototype available** | **Yellow – full prototype available for testing** | **Green – technology ready for commercialization/use**

Partnering interest? *Contact:*
Technology Partnership Office
nuwc_npt_tpo.fct@navy.mil

TPO TECHNOLOGY PARTNERSHIP OFFICE

NAVSEA WARFARE CENTERS NEWPORT

Technology Effort: Inflatable Structures & Experimental Test Fixtures

Status of Availability As of *06/09/2021*:

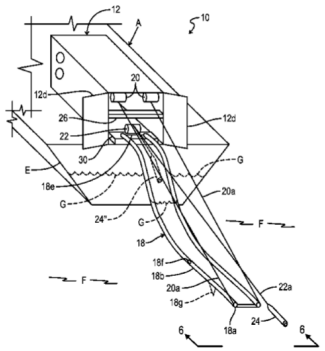
Description:

Novel design solutions providing temporary and rapid deployment, large deployed/stowed volume ratios, minimum weight and fail-safe overload protection through elastic wrinkling versus yielding and fracture were developed using inflatable structures technologies. Examples include Inflatable Launch & Recovery Systems for Underwater Towed Bodies, an Inflatable Fendering System for marine vessels and HAZMAT and bulk material transfer packages for use in severe environments.

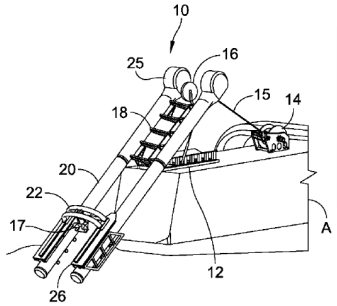
A suite of experimental fixtures is included that supports the design and Physics-Based Modeling of inflatable structures. The fixtures enable characterization of the unique pressure-dependent constitutive behaviors and load-carrying capacities of High Performance Fabrics and membranes when used in inflatable structures subjected to multi-axial stress states.

Need:

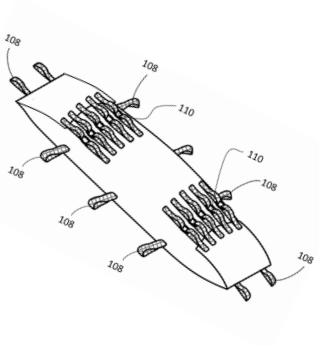
Inflatables are uniquely qualified for military and commercial use as deployable launch and recovery systems, hazardous and bulk materials transport packages and dynamic impact energy absorbers.



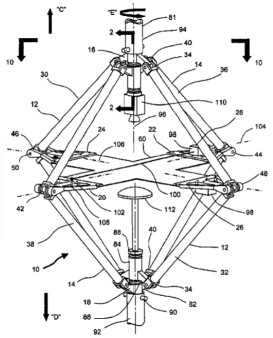
Inflatable Launch & Recovery System Pat. No. 9,340,262



Variable Length Launch & Recovery System Pat. No. 9,708,035



Robust Soft Textile Transfer Case for HAZMAT & Bulk Materials Pat. No. 10,702,439



Combined Biaxial Tension & Shear Test Fixture Pat. No. 6,860,156

Development Timeline:

PATENT NUMBERS & STATUS BY COLOR CODE:

- Robust Soft Textile Transfer Case for Contaminated Materials with Non-Rigid Ends (No. 10,702,439)
- Robust Soft Textile Transfer Case for Contaminated Materials (No. 10,301,073)
- Variable Length Inflatable Ramp Launch and Recovery System (No. 9,708,035)
- Inflatable Launch and Recovery System for USW Towed Bodies (No. 9,340,262)
- Compact and Standalone Combined Multiaxial and Shear Test Apparatus (No. 8,082,802)
- Deployable and Inflatable Hybrid Fendering Apparatus (No. 8,087,371)
- Biaxial and Shear Testing Apparatus with Proportional Force Controls (No. 7,204,160)
- Triaxial Tension, Compression Shear Test Apparatus (No. 7,051,600)
- Adjustable Flexure Loading Device for Testing Long Span Beams (No. 6,918,306)
- Combined In-Plane Shear and Biaxial Tension of Compression Testing Apparatus (No. 6,860,156)

Team: NUWCDIVNPT, Code 7023 Mechanics of Advanced Structures & Materials Team
Technical POC: Paul Cavallaro
Tel: 401-832-5082 email: Paul.Cavallaro@navy.mil

References:

- "*Air-Inflated Fabric Structures*", P. Cavallaro, A. Sadegh, chapter in Marks' Standard Handbook for Mechanical Engineers, 11th Edition, McGraw-Hill, pp. 20.108–20.118, 2006.
- "*Mechanics of Air-Inflated Drop-Stitch Fabric Panels Subject to Bending Loads*", P. Cavallaro, C. Hart, A. Sadegh, NUWC-NPT TR #12,141, 15 August 2013.
- "*Modal Analysis and Experimental Testing of Air-Inflated Drop-Stitch Fabric Structures Used in Marine Applications*", A. Hulton, P. Cavallaro, C. Hart, 2017 ASME International Mechanical Engineering Congress and Exposition, Tampa, FL November 3-9, 2017, IMECE2017-72097.
- "*Deployable Air Beam Fender System (DAFS): Energy Absorption Performance Analysis*", P. Cavallaro, NUWC-NPT TR #11,799, March 2007.

Red – concept and initial prototype design | **Orange – initial prototype available** | **Yellow – full prototype available for testing** | **Green – technology ready for commercialization/use**

Partnering interest? *Contact:*
Technology Partnership Office
nuwc_npt_tpo.fct@navy.mil

TPO TECHNOLOGY PARTNERSHIP OFFICE

NAVSEA WARFARE CENTERS NEWPORT

Technology Effort: Crimp Imbalanced Fabrics for Improved Fragment and Projectile Impact Protection

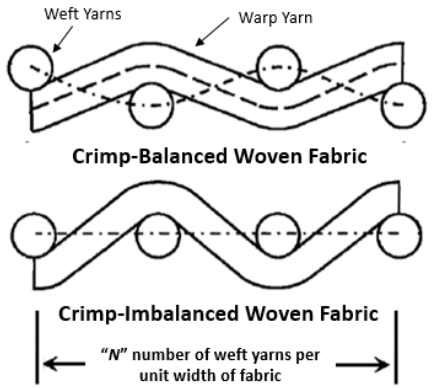
Status of Availability As of *06/09/2021*: Concept and initial prototype design

Description:

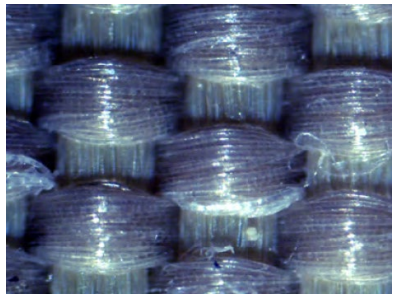
Crimp imbalance (CI) is a simple architectural modification achieved during the weaving process of woven fabrics that can enhance the dynamic impact protection levels in soft armors. Crimp is the amount of waviness in a yarn when woven in fabric form. Crimp imbalance can: (1) increase the energy absorption levels in woven fabrics subject to ballistic and fragment simulating projectile (FSP) impacts, (2) be tailored to controllably alter stress-wave propagations among yarn directions, and (3) can minimize degraded performance effects of stress wave reflections at the yarn crossover regions. Optimal levels of crimp imbalance can be tailored for a range of specific ballistic and fragment impact threat types.

Need:

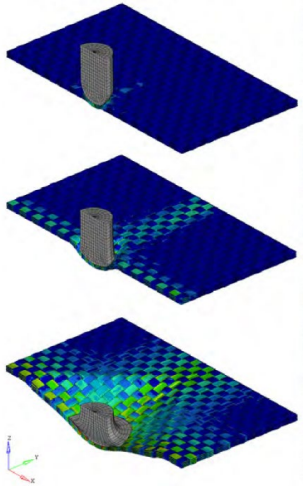
Personnel protection systems such as soft body armors must keep pace with the threats facing warfighters and law enforcement officers while maximizing comfort and mobility and minimizing weight. This CI technology can increase user mobility in protected body regions and provide weight reductions compared to conventional crimp-balanced (CB) fabric armors.



Crimp-Balanced vs. Crimp-Imbalanced Woven Fabric Layer



Example of Crimp-Imbalanced Fabric Layer



Deformable Projectile Impact on Multi-Layered CI Fabrics

Development Timeline:

Research was performed using numerical models on single and multi-ply crimp-balanced and crimp-imbalanced fabrics subjected to normal and oblique impacts from Right Circular Cylinder (RCC) FSPs at velocities ranging from 600 - 3,000 ft/sec. Different yarn-on-yarn coefficients of friction were evaluated. The CI fabrics were shown to absorb up to 20% more impact energy than CB fabrics.

PATENT NUMBERS:

Crimp-Imbalanced Protective Fabric	(No. 8,555,472)
Protective Fabric with Weave Architecture	(No. 8,689,414)
Protective Fabric	(No. 8,701,255)
Crimp-Imbalanced Fabric	(No. 8,877,109)

Team: NUWCDIVNPT, Code 7023 Mechanics of Advanced Structures & Materials Team
Technical POC: Paul Cavallaro
Tel: 401-832-5082 email: Paul.Cavallaro@navy.mil

References:

- "*Crimp-Imbalanced Protective (CRIMP) Fabrics*", P. Cavallaro, A. Sadegh, NUWC-NPT Technical Report 11,957,31 March 2010.
- "*Soft Body Armor: An Overview of Materials, Manufacturing, Testing, and Ballistic Impact Dynamics*", P. Cavallaro, NUWC-NPT Technical Report #12,057, 01 August 2011..
- "*Mechanics of Energy Absorbability in Plain-Woven Fabrics: An Analytical Approach*", A. Sadegh, P. Cavallaro, Journal of Engineered Fibers and Fabrics, vol. 62, pp. 495–509, March 2012.

Red – concept and initial prototype design | Orange – initial prototype available | Yellow – full prototype available for testing | Green – technology ready for commercialization/use

Partnering interest? *Contact:*
Technology Partnership Office
nuwc_npt_tpo.fct@navy.mil

TPO Technology Partnership Office

NAVSEA WARFARE CENTERS NEWPORT

Technology Effort:

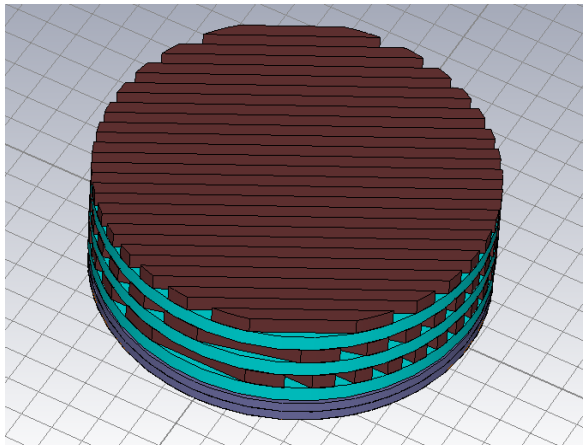
Patch Antenna Retrofit Kit

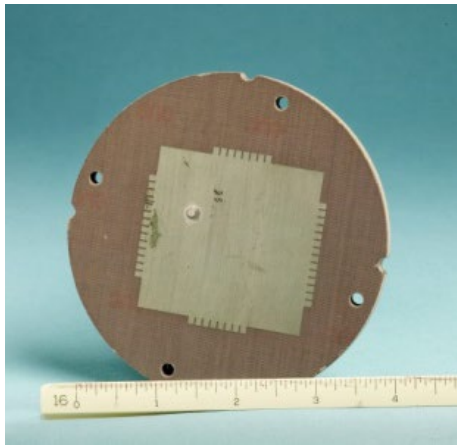
Status of Availability As of *6/23/2021*: Full prototype

Description:

This technology uses custom engineered anisotropic media to create what is in essence a “kit” that can be retrofitted to a microstrip patch antenna. This kit allows both the gain and the bandwidth of the patch antenna to be improved. The bandwidth, for instance, can be improved from 2-3% to 20% or more, depending on the specifics of the antenna and its geometry.

Two important features of this approach are in the low cost of the materials needed, and in the fact that it can be applied to existing antennas in situ.





Development Timeline:

- 2012 : Initial concept developed under ONR funding
- 2013 : First working prototype of Linearly Polarized variant
  - First patent application filed
- 2016 : US Patent 9,281,568 issued for linearly polarized variant
- 2016 : Concept for circularly polarized variant developed and tested
  - Patent application filed Sept. 2016
- 2018 : US Patent 10,069,211 issued for circularly polarized variant

PATENT NUMBER(S), 9,281,568 and 10,069,211

Team:

Dr. David Tonn, Antenna Systems Branch, NUWC Newport, Inventor

Mary Sylvia, Head of Tech Partnership Office, NUWC Newport

Red – concept and initial prototype design | **Orange – initial prototype available** | **Yellow – full prototype available for testing** | **Green – technology ready for commercialization/use**

Partnering interest? *Contact:*
Technology Partnership Office
nuwc_npt_tpo.fct@navy.mil

TPO TECHNOLOGY PARTNERSHIP OFFICE

NAVSEA WARFARE CENTERS NEWPORT

Technology Effort:

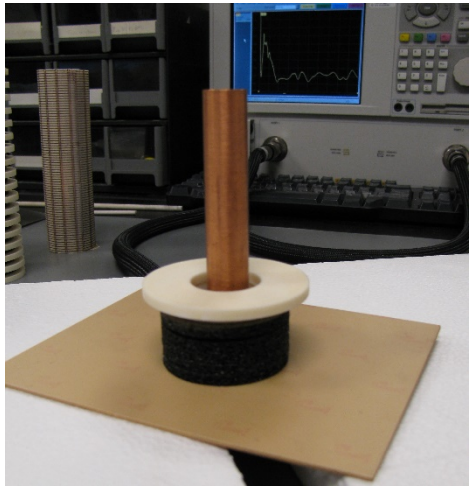
Broadband Linear Antennas

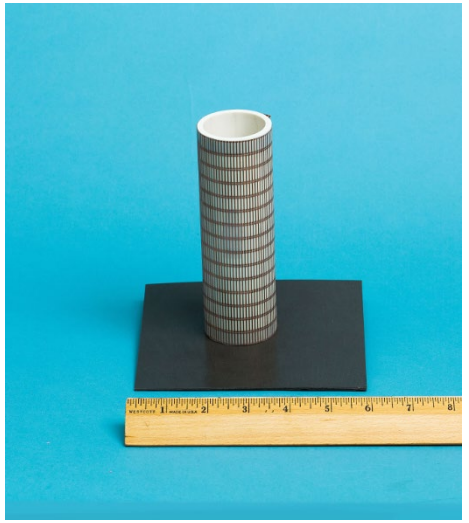
Status of Availability As of *8/30/2021*: Orange – initial prototype available

Description:

This technology uses engineered anisotropic dielectric materials to improve the bandwidth of linearly polarized antennas such as monopoles and slotted antennas. The result is an antenna structure whose bandwidth has been increased to the point where it can support several communications functions on a single antenna.

Two important features of this approach are in the low cost of the materials needed, and in the fact that in some cases the technology can be retrofitted to existing installations.





Development Timeline:

- 2014 : Initial concept developed under ONR funding
- 2015 : First working prototype
- 2016 : US Patent 9,407,010 issued for first working prototype
- 2017 : Concept refinement
- 2018 : US Patent 9,865,931 issued
- 2019 : US Patent 10,170,841 issued

PATENT NUMBER(S) : 10170841 , 10014584 , 9865931 , 9407010

Team:

Dr. David Tonn, Antenna Systems Branch, NUWC Newport, Inventor

Mary Sylvia, Head of Tech Partnership Office, NUWC Newport

Red – concept and initial prototype design | Orange – initial prototype available | Yellow – full prototype available for testing | Green – technology ready for commercialization/use

Partnering interest? *Contact:*
Technology Partnership Office
nuwc_npt_tpo.fct@navy.mil

TPO Technology Partnership Office