OceanLink –

Advanced Underwater Communications
At Speed and Depth

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Dr. Leo Volfson
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OPERATIONAL NEED

Objective: Design and build a 2-way communication system from a submarine to a surface, airborne or underwater platform with as wide an angle of view as possible, while avoiding conspicuous operation and detection by creating a 1Mbps optical channel between a submarine underway and below water surface at distances exceeding 10km.

Value to Naval Warfighter: Anti-jam comms to disadvantaged platforms, while underway. Fiber cable fed out of submarine will contain no electronics and if broken, becomes disposable.

S&T Focus Area: Laser Communications, Fiber (side or 360 degree emitting and receiving sensing)

Impact if Not Addressed: continued operational need

PROPOSED SOLUTION

The Technology:
• Continued development of transmitting and receiving fibers that provide an omni-directional antenna pattern
• Deployment methods from a submarine while underway
• Controllable field of view once the beam breaks the surface from being very wide (120 degrees) to very narrow

Similar/Related Projects:

TRL: Current: 2; Projected at end (FY10) 6

Major goals/Schedule by Fiscal year:
• FY09- Feasibility Study & Breadboard Demo
• FY10- At-Sea Demo (UW to Air & UW to UW)

Last Updated: Mar-09

BUSINESS CASE

Key Metrics:
• Solar Glint Calculations, Selection of Wavelength, Selection of Laser, Link Budget, Turbulence Mitigation, & Final Architecture

Proposed Funding ($M):

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Partners:

Transition Sponsor: TBD

POC Contact Info:
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Greg Hays • 843.412.1818 • greg.hays@tplogic.com
## Project Plan

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### Project Details

**Project Start:** March 2009  
**Sponsor:** Office of Naval Research SwampWorks  
**Project Managers:** SPAWAR Atlantic & PEO LMW
Omni-directional Transmission

- "Glowing Fiber" – product development, concepts:
  - Fiber creates perfect 360 degree antenna
  - Remote viewing of the fiber can be over km
  - Fiber can transmit video, audio and data
  - Multiple viewers can see transmission
  - Fiber transmission provides 1000’s channels
  - Provides persistent day/night surveillance:
    - Surveillance of suspicious buildings
    - Route surveillance
  - No training required for system utilization
Multi-material Fibers Outline

- Insulating Polymer
- Gain Medium
- Amorphous Semiconductors
- Metal
Multi-material Fibers Pre-form Processing

a) THERMAL EVAPORATION
   POLYMER ➔ GLASS

b) Thermal Rotation

c) Thermal Drawing

d) Material Coating

e) Macroscopic Preform

f) Macroscopic Preform
10mm

g) Kilometer-long Nanostructured Fiber
Solar Glint Calculations, Signal Strength & Fiber Depths

Global map of water leaving radiance averaged over 2005.

Courtesy of ESA and MERIS level 3 data *


Link budget for fibers projected from various depths and a surface-floating, side-emitting fiber.

Same as figure to the left but zoomed in on the range to emphasize the handicapped surface-floating fiber operation.
Integration Into LightSpeed Products

Conference Calling

Heads Up Display

Integrated LightSpeed Chip

TPL Glowing
Communication Fiber

LightSpeed Fiber

40mm LightSpeed Projectile

OceanLink

Torrey Pines Logic
OceanLink

- Mature, Reliable Technology
- Family of Products
- Many Stakeholders
- Multiple Applications

Check out product overviews, brochures, specifications, and videos at: http://www.tplogic.com