Optical Wireless

Photonic Technology to Connect, Educate, and Employ the Unconnected
When 4G went to 5G

- Deployment is costly and difficult
  - Many more building and pole locations are needed with high speed backhaul
  - 5Gmm Wave Radios have limited range and line of sight limited
  - Wind loading with radio’s a problem

Expensive Deployments
Poor Call Performance
Dropped Calls
Bad Coverage
Slightly faster internet

Wireless Data Speed - Base Baud Rate (single channel bandwidth)
What Would Be an Ideal Optical Wireless Source?

• Inexpensive
• Invisible and Eye Safe
• Mutable Divergence Angle
• Higher Bandwidth than Fiber
• Have an Extremely Small Formfactor
• Use << Energy than Microwave Sources
• Radiation Hardened and Space Qualifiable
• Higher Powers Are Available and Inexpensive
• Beams Are Steerable Without Mechanical Apparatus
• Propagate Through the Atmosphere Farther Than a Laser

• High Security - Can Be Protected From EMP
OptiPulse’s Optical Wireless Photonic Source

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OptiPulse’s Optical Wireless Photonic Source

- 8 Issued Patents with CIPs
- Multiple Foreign Filings
- Chips Produced a Production Foundry
OptiPulse’s Optical Wireless Photonic Source

Evaluation Boards Available  Q4 2022
Testing of the Chips

Chip Architectures prove fast and powerful

Dr. Lott’s Epitaxial Designs are Significant Advancements in Photonics

16μm apertures ~25mW Avg Pwr (single element) and a freq mod above 20GHz (> 30Gbps)

3mA bias Single VCSEL

3mA bias 105 VCSELs ~ 1.5 Watts at 10Gbps

Early CSU work shatters record for single chip power/speed combo
Scintillation Mitigation by VCSELS Source Diversity

SNR for an array of M - VCSELS:

\[ \langle SNR_M \rangle = \sqrt{M} \langle SNR_1 \rangle \]

\( \langle SNR_1 \rangle = \) single-VCSEL SNR

Scintillation index for an array of M - VCSELS:

\[ \sigma^2_{1,M} = \frac{1}{M} \sigma^2_{1,1} \]

\( \sigma^2_{1,1} = \) single-VCSEL scintillation

Bit Error Rate (BER) for an array of M - VCSELS:

\[ \langle BER_M \rangle = \frac{1}{2} \int_0^\infty p_{\gamma}(u) \text{erfc} \left( \frac{\langle SNR_M \rangle u}{2\sqrt{2}} \right) du \]

\( p_{\gamma}(u) = \) gamma-gamma distribution

Dr. Sami Shakir - Tau Technologies

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OptiPulse Senior Engineering Team

John Joseph
CEO, Co Founder,
20+ issued patents
photons 30 yrs of VCSEL
processing and product
development, Optical
Packaging, QA, applied
systems manufacturing.
Director of QA, Director of
Manufacturing.
Technology Transfer and
Manufacturing

Dr. James Lott
CTO, Co-Founder
Record breaking epitaxial wafer designs for
VCSELs. International leadership in
semiconductors and photonics. Applied
physics professor. Retired military
science/engineering officer

Dr. Kevin Lear
Consulting -Chief Engineer
Leader in VCSEL development,
35+ years developing and managing
semiconductors and optics, professor of
electrical & computer engineering, inaugural
director of biomedical engineering

Dr. Nasibeh Haghighi
Director of R&D
Sensor design and analysis, extensive
experience in VCSEL epitaxial wafer design,
cleanroom processing, and device testing. She leads
OptiPulse’s processing development and
semiconductor device research and development

Dr. Payman Zarkesh-Ha
Consulting Director
Circuit Design
Expert in high-speed RF circuit design and detection
circuits with over 30 years of experience. Associate
director of the Center for High Technology Materials
(CHTM) and professor of electrical & computer engineering at UNM
OptiPulse has developed 3 Prototypes and is now designing Prototype 4.
NSF Funded SBIR Non-Mechanical Beam Steering

Phase I successful in demonstrating 1D non mechanical beam steering

Phase II higher resolution 2D beam steering
- Milestone 1 is a 9-direction 3D beam steering array
- Milestone 2 is a 3D device with 37 different beam directions
A Regional Joint Venture of Synergistic Companies will connect, educate, and employ the unconnected
NSF/Optical Wireless Regional Innovation Engine

Goal: Develop, fabricate, assemble and produce an inexpensive environmentally friendly, high-speed infrastructure to connect the unconnected.

Regional Innovation Engine Proposal

Optical Wireless EcoSystem

Academia Engineering Support

Network Install and test

Deliver to community

Future Token Offering to build world network

NSF $$

Resource POs

Integrate into system

Partnering companies

Sandia National Labs
System Security, FPGA Design

Optipulse

Components

Network

Test

Installation

Content

Development

Smart Pole Manufacture Setup

Smartpole Production

CNM
Applied classes

Students
A Better Way to Distribute Communications

Optical Wireless Smart Poles

- WiFi within 100 ft
- 2.5GHz Spectrum
- Cell Phone Service
- 2 Gbps LiFi
- 25 Gbps backhaul

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SmartPole Mesh Network

The Node - Brain: microprocessor/storage (Edge Computing - Align algorithms, security, encryption, Test IO-GUI)

Community CIO

Other Stationary Customers

Other Stationary Customers

Mobile users

Wi-Fi Antennae

4G Mobile RRU

Emergency

Last Mile

Router

Backhaul

10 Gbps

40 Gbps

100 Gbps

Wi-Fi Antennae

Emergency

Last Mile
The Future of High-Speed Communication is here.

THANK YOU

NSF, DoD, Sandia Labs, and CINT and Tau Technologies
From the OptiPulse Team

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