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MISSION STATEMENT

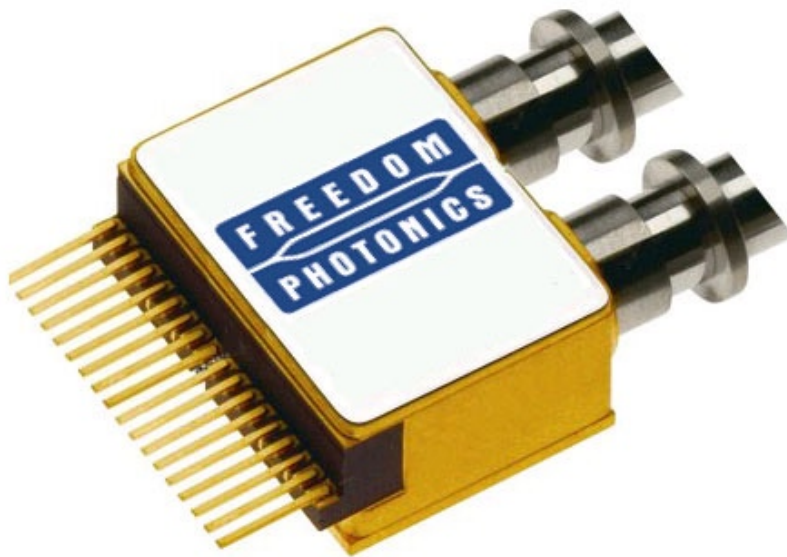
Freedom Photonics' mission is to be a leader in innovative high-speed photonic components, subsystems and applications. We fulfill our mission through a dedication to the highest standards of quality, value, integrity, customer satisfaction, corporate responsibility, and a diverse and team oriented workplace.

COMPANY PRIMARY GOAL AND VISION

Our primary goal is to deliver cutting edge technologies to the market, thus stimulating innovation and competition in the photonics industry. Our vision is to be second to none in applications of advanced photonic integration through dedication to our customers and our team, and by encouraging ideas and a collaborative workplace.

VALUES

Innovation, Initiative, Dedication, Achievement, Individual, Team, Integrity, Quality, Customer Satisfaction



CORE COMPETENCIES

Freedom Photonics core competency is development and commercialization of high-performance, specialized photonic integrated circuits and subsystems.

TECHNOLOGY

Our core technology competency resides in modules and subsystems built around an active photonic integrated circuit engine in compound semiconductors. Our proprietary photonic integration platform can accommodate the following building blocks:

- ▶ Active and passive planar waveguide components
- ▶ Widely tunable lasers
- ▶ High speed modulators (lumped and traveling wave)
- ▶ Semiconductor optical amplifiers (high gain and/or high power)
- ▶ Photodetectors
- ▶ Mode converters
- ▶ Polarization diversity blocks
- ▶ High speed switches
- ▶ Multiplexer/demultiplexer technology

Our technology expertise also spans electronic control, drive circuitry and system integration.

R&D

In the Research and Development arena, we have a track record of developing innovative solutions to challenging problems. Our team has proven capabilities of efficiently going through the cycle of conceptualization, design, fabrication and development of new technology. Our R&D efforts leverage the unique capabilities offered by the \$150 million National Nanotechnology Infrastructure Network's cleanroom facility at the University of California, Santa Barbara. Some examples of our successful R&D areas include: widely tunable wavelength converters, advanced modulation format (coherent) tunable transmitters and receivers, high-power transistors, GaN LEDs, photovoltaics, microfluidic devices, photonic network elements for military local area networks.

Our close ties with UC Santa Barbara, through a number of collaborative projects, and memberships in a DARPA sponsored center for Photonic Integration Technologies PICO (established in 2010), and UC Center for Terabit Ethernet Technologies (TOEC) (established in 2010) insure that we are always on the forefront of the research and new photonic technologies.

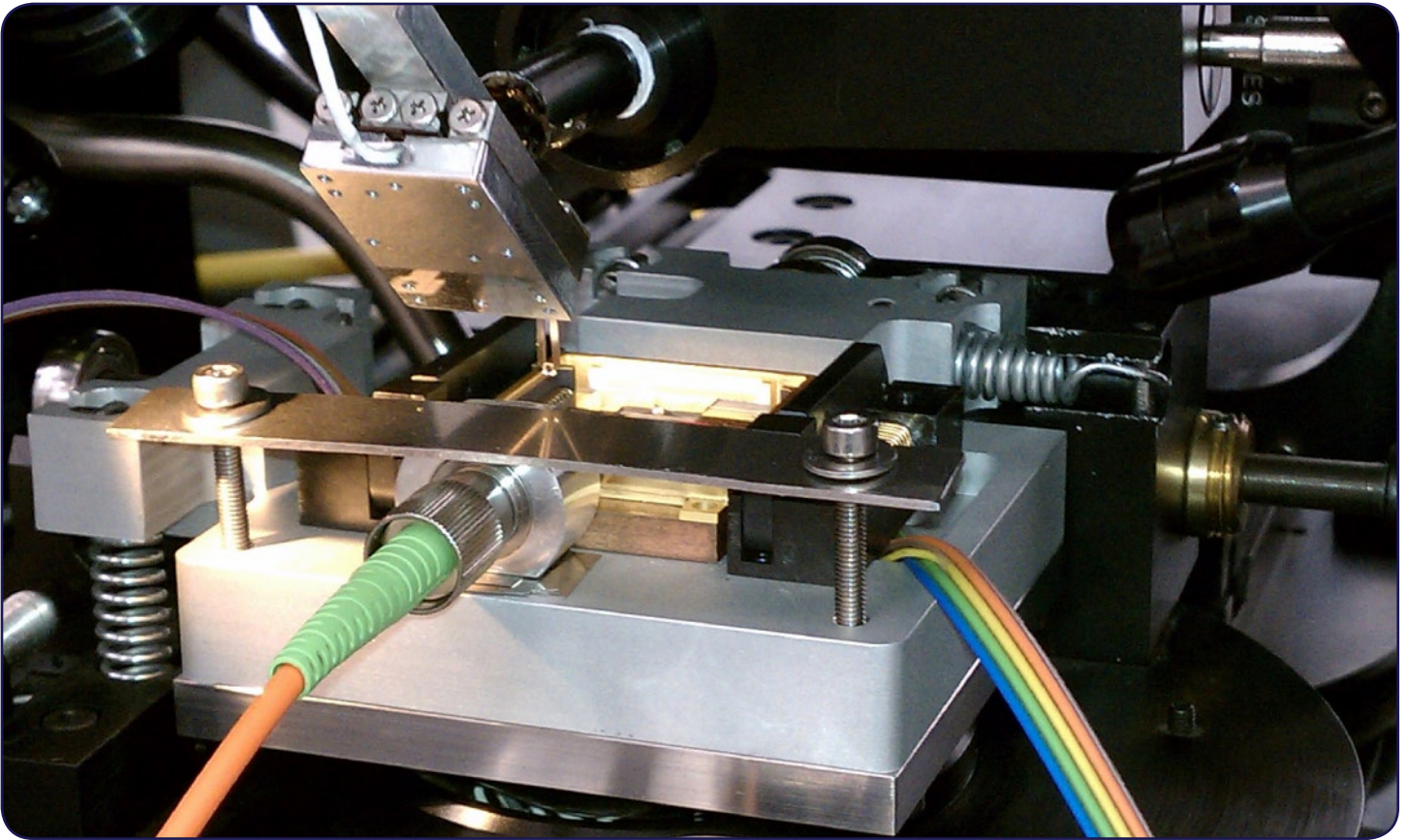
PRODUCTION

- ▶ Internal, quick turn-around cycle pilot runs
- ▶ External, foundries with fully qualified processes
- ▶ Automated, in house packaging tools
- ▶ External, partners for low-cost, high volume packaging
- ▶ Internal and external product qualification testing capabilities

SERVICES

Our team's expertise in photonic device and/or micro fabrication process design and implementation has helped a number of customers design, develop and prove feasibility of a number of micro devices, spanning electronic, optical and medical applications. Our fast turn-around prototyping capability through UC Santa Barbara's Nanofab has been key to our commercial success in this arena. Our customers can benefit from our expertise in:

- ▶ Photonic device design services
- ▶ Mask design and layout services
- ▶ Micro/nano fabrication process design services
- ▶ Full micro fabrication services
- ▶ Packaging services
- ▶ Testing and characterization services
- ▶ Custom product development and production



PRODUCTS

Widely tunable transceiver/wavelength converter (in development)

- ▶ 10 Gbps, 40 nm tuning range
- ▶ Fast tuning speed (1~5 ns)
- ▶ Wide temperature range of operation (-40° to 100° C)

Low V_{π} optical modulators (in development)

- ▶ Subvolt V_{π} , up to 25 GHz bandwidth
- ▶ Phase and amplitude modulators

Widely tunable coherent receiver (in development)

- ▶ 100 Gbps, 40 nm tuning range
- ▶ Polarization multiplexed operation

Widely tunable advanced modulation format transmitter (in development)

- ▶ 100 Gbps, 40 nm tuning range
- ▶ Polarization multiplexed operation

SCOPE OF SERVICES

PHOTONIC DESIGN

- ▶ Commercial & proprietary tools for passive & active waveguide design (native FDTD/BPM code, mode solvers, mask layout, SOA/active region models)
- ▶ Commercial & proprietary tools for epitaxial structure design
- ▶ PICs design (transport modeling and implant design)
- ▶ Mask layout

TESTING

- ▶ In house capabilities include: DC testing (die, submount, package), current, voltage, light, bit error rate performance (2.5 Gbps)
- ▶ UCSB recharge capabilities include: 60 GHz+ network analyzer, bit error rate performance (40 Gbps), optical modulation analyzer (up to 240 Gbps QPSK).
- ▶ In house automation software for maximum efficiency

MICRO AND NANO FABRICATION

- ▶ Fabrication Process Design
- ▶ Fabrication Process Development
- ▶ Lithographic mask design and layout
- ▶ Fast turn-around fabrication in UCSB Nanotech

PACKAGING

- ▶ Optical design using ZEMAX
- ▶ Package mechanical and RF design
- ▶ Packaging process development
- ▶ Packaging using laser welding and/or UV curing in house

ELECTRONICS

- ▶ FPGA design and verification tools
- ▶ Analog bias and control circuit design
- ▶ Commercial tools for multilayer PC board layout
- ▶ Outside (ITAR) foundry for PCB fabrication and stuffing
- ▶ Electronics workstations for assembly and test, including oscilloscopes, sources, & multi-meters



EXAMPLES OF APPLICATION AREAS

- ▶ High-speed fiber optic communication networks
- ▶ Free space optical communication links
- ▶ Local area and data center networks (including avionic and satellite platforms)
- ▶ Antenna remoting
- ▶ Optical signal processing
- ▶ Medical imaging

REPRESENTATIVE PROJECTS

- ▶ Tunable Polarization Insensitive Digital Fiber Optic Wavelength Converter with Built-In Test Capability (NAVAIR/Navy)
- ▶ Space-qualified Optical Transmitters for Satellite Communications (Air Force Research Laboratories)
- ▶ Ultra Low Drive Voltage Electro-Optic Modulator (DARPA)
- ▶ High-Performance Integrated Coherent Receivers (IR&D)
- ▶ Terabit per second Optical Router for Space Based Satellite Networks (Air Force Research Laboratories)
- ▶ Micro-network Connection for Avionics Networks (NAVAIR/Navy)

MARKETS / CUSTOMERS

Our business model utilizes UCSB's National Nanotechnology Infrastructure Network's state-of-the-art cleanroom facility for research work and prototyping, and a state-of-the-art production foundries for volume manufacturing. Our business model enables us to achieve fast product turnaround times, low fixed cost and capital investment and the ability for seamless ramp up of manufacturing volume while leveraging off the ISO9001 production experience of our production partners.

At the same time, we can afford to address niche defense markets, such as the rad-hard space-qualified optical lasercom market or the avionics and satellite network module market, as well as larger commercial markets, like the telecom and data center markets.

NON-GOVERNMENT: Over the past five years, we've had tens of public and private company customers, ranging from startups to several Fortune 500 customers.

GOVERNMENT: Air Force/AFRL, Navy/Navair Navsea, Missile Defense Agency, DARPA.

PARTNERS

Freedom Photonics has been successful in collaboration and building relationships with a number of large businesses such as Boeing, L-3, and Lockheed Martin and Telcordia Technologies, as well as a number of small businesses.

Additionally, we see our strong ties, collaboration and good working relationship with a number of research groups at University of California, Santa Barbara, Nation's premier research institution for photonics and fiber optics, as an invaluable asset.



PROFILE

COMPANY HISTORY

Freedom Photonics is a privately owned limited liability company, organized in California in 2005. The company operates from its own 3100 square foot facilities, which contain 4 laboratories (photonics, electronics and packaging) and company offices. The company currently has 13 employees and several long-term consultants. Our core technical staff has a combined 40 years of experience in all aspects of photonic integration, epitaxial laser and PIC structure design, fabrication, testing, module design and production.

MANAGEMENT

Dr. Jonathon Barton (Ph.D. Electronic Materials, UCSB, 2004)

Expert in photonic integration and nano fabrication (high speed widely tunable transmitter and transceiver technology)

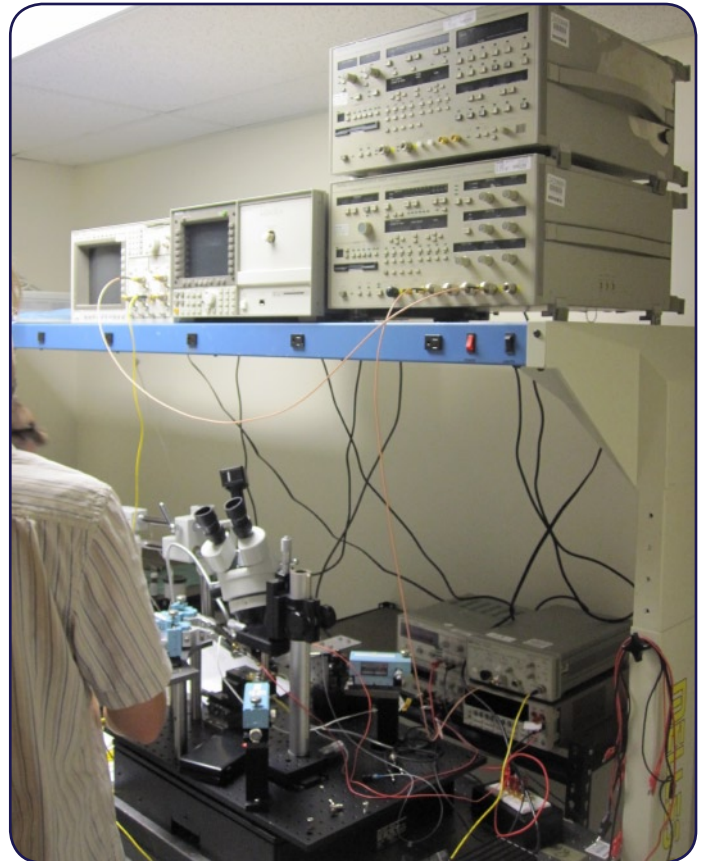
Dr. Leif Johansson

(Ph.D. Electrical Engineering, Univ. College London, 2002)

Expert in advanced modulation format devices, microwave photonics and high speed measurements

Dr. Milan Mashanovitch (Ph.D. Electrical Engineering, UCSB, 2004)

Expert in photonic integration (high speed widely tunable wavelength converters and routers) and packet switched optical networks



CORE ADVANTAGE

- ▶ World-class expertise in photonic integration
- ▶ World-class technical team
- ▶ Strong intellectual property portfolio protecting core technologies
- ▶ Low CapEx/OpEx business model
- ▶ Fast turn-around in development cycle
- ▶ In-house photonic packaging capabilities
- ▶ Expert user status and close proximity to UCSB's world-class NNIN compound semiconductor cleanroom facility.
- ▶ Expert user status and close proximity to UCSB's California Nanosystems Institute's materials characterization and test laboratories
- ▶ Close ties and collaboration with the Materials and Electrical Engineering Departments at UCSB (ranked among top 1 and 5 in the Nation in 2010 NRC rankings)
- ▶ ITAR Registered
- ▶ U.S. Owned Business