
vxtel

Leadership Statement

Voxtel strives to be the industry's
"first choice" solution
for electro-optical devices,
sub-systems, and instrumentation.

Mission

Voxtel specializes in developing and manufacturing innovative photonic devices and systems. The company was founded in 1999 with a strong focus on innovation and on bringing advanced electro-optics technologies to market — quickly and efficiently. We anticipate and translate application needs into innovative and cost-effective solutions, which we deliver to the market on time and with exceptional quality, allowing both Voxtel and our channel partners an optimal return on investment and rate of growth.

About Voxtel

Voxtel gives customers a competitive edge by bridging the gap between innovation and application. Our expertise in designing, building, and deploying next-generation imaging, electro-optical, and photonics systems enables our customers to adapt and exploit new technologies, to enhance their competitive edge and thus to increase their profitability.

Voxtel has demonstrated its strength in both developing these advanced electro-optical technologies and bringing them to market — from custom design, materials growth, fabrication, and packaging through the development and production of support electronics and turnkey systems. This end-to-end capability allows us to efficiently meet our customers' next-generation market needs with integrated solutions that meet the demands of the entire product life cycle.

At each step, Voxtel ensures total customer satisfaction. Mastering these capabilities has allowed us to emerge as a leading developer of advanced electro-optical devices and systems, delivering performance-driven, high-reliability solutions for demanding customer applications — an ability that is rare and hard to come by.

Corporate Background

Founded in 1999, Voxtel is a privately held company headquartered in Beaverton, Oregon. The core management and technical teams have a successful legacy dating back to the early 1980s.

The ability to develop and bring innovation to market in a cost-effective form that can be manufactured reliably and with high quality is key to the past and present successes of the team at Voxtel.

We have achieved continued growth and profitability by maintaining strong multi-disciplinary management and technical talent in the areas of basic material and processing engineering, chemistry, device design, IC design, test, electrical and mechanical engineering, EO system engineering, and application engineering. This breadth of talent and experience is rare, and we retain these valuable resources by providing our employees challenging responsibilities and by rewarding them for their successes.

Our corporate headquarters are located in our 16,000 sq. ft. facility in Beaverton, Oregon, in close proximity to Tektronix and Intel's Hillsboro, Ore. semiconductor fabs and within an hour of both Oregon's coast and the Cascade mountain range.

Voxtel's Optoelectronics Division, Voxtel Opto, is co-located with our headquarters in Beaverton. The cross-functional group of scientists, engineers and management professionals at Voxtel Opto, over 80% which hold advanced degrees, includes device design experts, process development engineers, CMOS ROIC designers, systems engineers, and test and integration experts.

Voxtel's Nanophotonics Division, Voxtel Nano, is formed around a multi-disciplinary group of chemists, engineers, material scientists, biologists, and experts in manufacturing and electro-optics systems. Over 90% of the employees of Voxtel Nano hold PhDs in their respective disciplines. Our experience extends from nanocrystal fabrication and ligand functionalization to ink chemistry, nanocrystal-enabled detectors and photovoltaics, displays, inkjet-printed organic and inorganic device design, and organic chemical and biological detectors. Our work also includes molecular jet deposition integration for MEMS, modeling and integration work surrounding use of NCs in emissive displays, and electrical characterization of inorganic oxide semiconductor materials for transparent displays.

Voxtel Nano is located in Eugene, Oregon. Our private wet labs are located at the 20,000 sq. ft. Lorry Lokey Laboratories, which include the highly specialized instruments necessary to manufacture optical systems on the scale of human cells or to create, atom by atom, materials and structures with novel optical properties. Our facilities house capital-intensive equipment for nanofabrication, photovoltaic characterization, X-ray diffraction, microanalysis, surface analysis (including XPS and UPS), high-resolution transmission electron microscopy (HR-TEM), and semiconductor device fabrication, as well as traditional chemical characterization.

Voxtel's Products

Voxtel's products include high-sensitivity, high-speed detectors and focal plane arrays; integrated circuits for detector control, readout and signal processing; and enabling electronic instrumentation.

Avalanche Photodiodes

Voxtel has industry-leading advanced avalanche photodiodes (APDs) that provide performance over the visible, near infrared (NIR), and short-wavelength infrared (SWIR) spectral regions. Voxtel's APDs are among the most sensitive of the solid-state photodetectors available. In the difficult NIR and SWIR spectral regions, including the telecommunications spectral regions and the eyesafe region beyond 1300 nm, the choices for detector materials are limited, and a majority of the telecommunications APDs are made from InGaAs materials with InP multiplication regions. Unfortunately, InP has noisy avalanche characteristics, which limit the usefulness of the avalanche gain. To overcome this inherent limitation, Voxtel has developed a series of APDs that exploit the non-localized effects of the APD's impact ionization process to reduce the effects of avalanche excess noise. Voxtel's Deschutes™ series of APDs, characterized by an effective ionization coefficient of k_{eff} = 0.18, reduce avalanche noise more than 50% over conventional telecom APDs, and Voxtel's Siletz™ APDs, characterized by k_{eff} = 0.02, offer low excess noise at gains previously unprecedented in the NIR. The Siletz™ series has operational gain that can exceed 8,000, at noise levels below standard telecom APDs, which are only capable of gain levels below 20. These characteristics make Voxtel's APDs uniquely suited for laser rangefinders, laser designators, freespace optical communication, optical instrumentation, and LADAR/LIDAR applications.

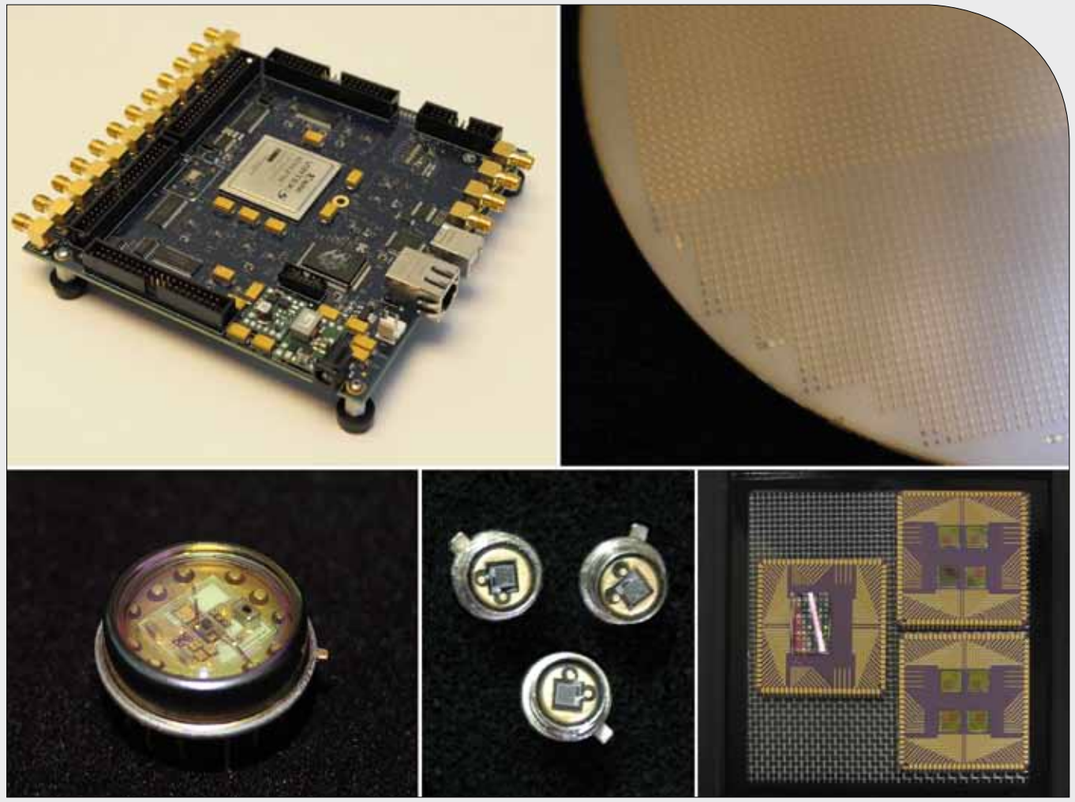
Voxtel offers its APDs in a series of hermetic packages, including those with thermoelectric (TE) cooling, and has developed a series of low-noise photoreceivers that integrate the APDs with transimpedance amplifiers and TE cooling for stable operation at speeds up to 10 GHz.

Custom ROIC Design

The core competency of Voxtel's ROIC design team is our ability to achieve low-noise, high-speed (e.g. GHz-rate) detector signal processing, including densely integrated analog and digital functionality, on a single full-custom CMOS integrated circuit. This unique capability offers tremendous leverage in many applications, including highly sensitive active imaging, LADAR, and LIDAR, where performance demands that the detector and readout circuit be integrally designed.

Our full-custom designs are ideal for applications that require high density, high speed, high performance and flexibility. When density counts, we hand-place every transistor in a design. Full-custom designs allow seamless integration of analog and digital functions. A-to-D functions, combined with Voxtel's expertise in high-speed, low-noise and low-power design, results in devices that offer advanced functionality, simple interfaces and low recurring production costs.

Voxtel has experience in a wide range of technologies and system applications, particularly in the field of radiation detectors and high speed imaging. Our experience includes designs for high-resolution (2k x 2k) SOI CMOS imagers, GHz-rate-scanned single-element LIDAR detectors, sophisticated timing and waveform recording, and high-performance, two-dimensional LADAR sensors, with time-of-flight and pulse sampling. Applications include aerospace, military, and industrial imaging.



Electro-optical Instrumentation

Voxtel develops modular systems that are tailored for many applications, to serve multiple markets. Our integrated sub-systems include low-cost, compact APD receivers, supporting electronics, and detector modules with sophisticated functionality, including <25-ps-accuracy multi-channel photon detection instruments that have utility to numerous markets including: low-volume missile defense seeker applications, tactical missile seekers, UAVs, and relatively high-volume markets addressing systems for soldiers, autonomous navigation, robotics, and national security.

Nanocrystal Taggants and Infrared Paints

Voxtel Inc. offers a series of environmentally friendly, covert, optically transparent nanotaggants called NightMarks, which are composed of environmentally benign nanocrystals. Voxtel's taggant nanocrystals are functionalized with luminophores that have narrow and well defined visible (VIS), near infrared (NIR) and/or short-wavelength infrared (SWIR) emission spectra, allowing unique encoding and detection with silicon cameras, night vision goggles (NVGs), and/or SWIR InGaAs cameras, depending on the taggant chosen.

The nanoparticles are based on nanocrystal quantum dots (NCs), which Voxtel has developed to be dispersed in ink, paint, solvents, or aerosol cans. NCs are tiny crystals ranging in size from 2 to 10 nm (about 10–50 atoms in diameter) and consist, in volume, of hundreds of atoms. Due to these crystals' extremely small size, quantum confinement effects dominate their optoelectronic properties. The size-dependent absorption spectrum and narrow emission peaks of Voxtel's NCs have been used to demonstrate proof of concept for the ability to detect anthrax at long ranges. Voxtel has demonstrated detection of these NCs at ranges exceeding 2.5 km with laser interrogation.

Invisible to the human eye, the patented infrared paints are not activated by sunlight, and luminesce in the near-infrared (NIR) and short-wavelength infrared (SWIR). They are applied via aerosol, ink, acrylic, or

lacquer formulations, or integrated into chapstick, window cleaners, and other everyday materials. When stimulated with either a laser or even with solar radiation, the taggants emit at one or more spectral bands that are detectable with night vision goggles (NVGs) or infrared cameras.

Used with an interrogation/detection system, NightMarks™ have demonstrated 3.8 km detection range. Environmental tests and >10,000 hour field operation have demonstrated their reliability. Applications include TTL (tagging, tracking, and locating), IFF (identify friend or foe), anti-counterfeiting, materiel tracking, and night lighting. NightMarks™ are available for demonstration with existing interrogation/detection systems, and custom turnkey systems are available upon request.

The nanocrystals can also be incorporated into a variety of dye- and pigment-based inks (including black inks) for use in banknotes, concert tickets, lottery tickets, or CDs — and even in varnishes and lacquer finishes.

Nanodevices

Voxtel's versatile capabilities in the synthesis and functionalization of wide-bandgap and narrow-bandgap nanocrystals form the basis of our developments in photovoltaic products and inorganic LEDs. We are working with our partners on a polymer LED solution to realize strong improvements over current devices in energy efficiency and lighting quality.

All of our development in nanodevices focuses on the use of low-cost solution processing to address the cost requirements of competitive markets.

Core Competencies

Our focus is on enabling our customers to design, build, and deploy next-generation optoelectronic systems by providing a highly experienced, multi-disciplinary, customer-focused team that works from concept to delivery to supply creative, high-quality solutions that integrate detectors, emitters, optics, filters, hybrid electronics, and packages to enable our customers to create, control and/or use photons. Our experience has shown that the skills necessary to develop advanced optoelectronic devices and bring them to market — from custom design, material growth, fabrication and packaging, through the development of support electronics and turnkey systems, and total customer satisfaction — are rare and hard to find. The strong presence of these capabilities at Voxtel has allowed us to emerge as a leading developer of advanced photodetectors, avalanche photodiodes, focal plane arrays and electro-optical systems.

We round out our capabilities by maintaining close relations with a number of key strategic industrial partners and universities. We remain committed to maintaining a leadership position in photonic detection technology and to continuous R&D investment in advanced product development.

Some of our key attributes include:

Customer Service

Voxtel is doing everything in its power to satisfy its customers though product quality, cost-effectiveness, on-time delivery, and responsive customer service.

Flexibility

One of the advantages of being a well-established small company with a strong track record and an excellent staff of technical and business professions is that we can respond to customer needs quickly and efficiently, at usually a much lower cost than larger companies. As a fabless company, we are not beholden to one solution, and we maintain fabrication capabilities at qualified domestic foundries.

Engineering Product Development

We have a highly competent and balanced engineering team, with skills covering the full spectrum of capabilities necessary to develop detector concepts into working sensor hardware and systems. Voxtel places a strong emphasis on design analysis, having powerful engineering tools backed by an experienced team. We extend our in-house expertise through our long-term relationships with multi-specialty foundries and program partners who have extensive expertise in optics, materials, mechanical and EMC engineering, and RF circuit design.

Device Design

Voxtel uses a variety of 3D technical CAD (TCAD) tools for device design. These tools replace costly wafer experiments with simulations to deliver shorter development cycles and higher yields. These physics-based tools allow us to analyze the DC, AC, and time-domain responses of our semiconductor device designs in two and three dimensions. Voxtel uses a suite of Silvaco device simulation tools, which include the Simucad S-Pisces™ 2D Silicon Device Simulator and the Blaze™ device simulator for advanced materials, as well as the ATLAS™ framework, which includes Device3D™, a 3D device simulator; Luminous3D™, a 3D optoelectronic device simulator; and the TonyPlot3D™ visualization tool. The Supreme3™ Process Simulation Framework enables us to develop and optimize the semiconductor manufacturing processes by simulating ion implantation, diffusion, etching, deposition, lithography, and oxidation of semiconductor materials.

Voxtel complements the Simucad 2D/3D device modeling tools with in-house band-edge modelers and custom design software. To design our advanced APD devices, Voxtel has developed proprietary Monte Carlo simulators that implement the dead-space multiplication theory (DSMT). The simulators treat material- and field-dependent variation in ionization threshold energy and ionization rates, and carrier transport issues such as 'dead-space' and relaxation effects. Their outputs include spatial ionization distribution, impulse response, and excess noise versus gain.

IC Design

Voxtel uses Simucad and Tanner Research design tools to create schematics, and to simulate, lay out, and verify IC designs.

Schematic Capture: Simucad Gateway is used to graphically create, modify, and netlist hierarchical mixed-signal circuit schematics.

Analog Circuit Simulation: Simucad SmartSpice is used to simulate transistor-level schematics in the DC, AC, and transient domains using foundry-supplied and verified models. The simulator supports both AC and transient noise simulations, as well as an integrated Verilog-A simulator. The tool can be operated in single or multi-processor operating modes, allowing for fast simulation times of complex circuits. In addition to the SmartSpice tool, Voxtel also owns several Tanner Research T-Spice licenses that are routinely used to verify simulation results between tools.

Digital Circuit Simulation: Simucad SILOS-X is an IEEE-1364-2001–compliant Verilog simulator that is used by the group to verify custom digital design.

Mixed-Signal Circuit Simulation: Simucad Harmony combines the accuracy of the SmartSpice analog simulator with the fast simulation time of SILOS-X to perform true mixed-signal design simulations.

Circuit Layout: Simucad Expert is used as our primary hierarchical layout editor (mask design). Expert provides a high level of design assistance though Netlist Driven Layout (NDL) and parametric cell design (PCells). Voxtel also owns several Tanner Research L-Edit licenses that are used to perform mask designs for our large-feature-size detector arrays.

Design Verification: Simucad Guardian is used to perform verification of the design database, including layout extraction, Design Rule Check (DRC), and Layout Versus Schematic (LVS). The tool supports hierarchical netlist extraction and LVS debugging.

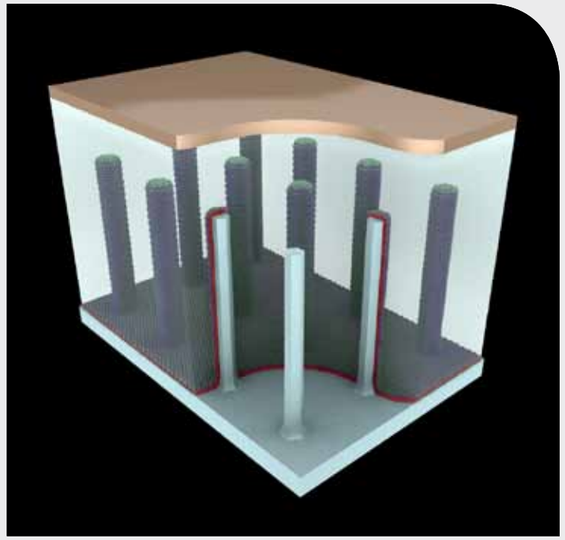
Parasitic Extraction: Simucad HIPEX is used to extract parasitic circuit parameters (resistance and capacitance) from hierarchical layouts. HIPEX can be configured to extract *R, C,* or *RC* in either lumped or distributed modes. Back-annotated netlists can be read directly into SmartSpice for post-layout design verification.

System Modeling and Phenomenology

Voxtel staff members have developed IDL-, MATLAB-, and Mathematica-based electro-optical device simulation and system modeling tools. Voxtel's analysis suite for active imaging systems also includes AFRL's IRMA 5.0 (Infrared Modeling and Analysis code), NVESD's NVLaserD, NVLRG, and CN2 programs, as well as in-house-developed beam propagation code. These models offer numerical solutions to analytically intractable physics: IRMA provides laser radar signatures for realistic targets with complex surface shape and reflectivity, while the beam propagation code facilitates the analysis of the effects of refractive turbulence on key laser radar metrics (carrier-to-noise ratio, velocity noise, etc.) in regimes where analytic solutions do not exist. For atmospheric studies we use LOWTRAN, MODTRAN, FASCODE, and PLEXUS atmospheric simulation programs. For passive system design, we use our in-house developed modeling tools as well as NVESD's NCThermIP, SSCamIP, and IINVD programs. To aid in system analysis we use COMSOL, Inc.'s Femlab finite element analysis software.

Test and Measurement

Voxtel has an extensive suite of test and measurement equipment, including cryogenic test chambers; automated wafer probe stations; a broad range of broadband and laser optical sources, spectrometers and spectrophotometers; and multi-GHz-rate oscilloscopes, frequency analyzers, and pulse counters.



Customers

Government

- NASA
- ONR
- NRL
- US Army
- NVESD
- DARPA
- MDA
- Department of Homeland Security
- AFRL
- SPAWAR
- NAVSEA
- NIST
- Department of Commerce
- Environmental Protection Agency
- NSF
- Bureau of Engraving and Printing
- CNVESD
- SOCOM
- DOE
- OSD
- Army Research Laboratories

Commercial

- Raytheon
- Lockheed Martin
- General Electric
- Harris
- General Dynamics
- Northrop Grumman
- Hewlett-Packard
- DRS
- Elbit
- Sandia National Labs
- Pacific Northwest National Labs
- Battelle
- MIT Lincoln Laboratories
- Aerospace
- SAIC
- ITT
- Ball Aerospace
- FLIR Systems
- Jet Propulsion Laboratories

Partners

ONAMI

Voxtel fosters a deep reach into fundamental science for the next source of innovation, advancing technology from the lab through to commercialization. We fulfill this role through partnerships such as the Oregon Nanoscience and Microtechnologies Institute (ONAMI), an Oregon-based cooperative venture among government and world-class nanoscience and microtechnology R&D institutions and industry in the Northwest. ONAMI's research affiliates include shared facility access, where university faculty are working in conjunction with ONAMI to pursue both fundamental and applied research projects with regional industry, including Oregon Health and Science University (OHSU), Oregon State University (OSU), Pacific Northwest National Laboratory (PNNL), Portland State University (PSU), and the University of Oregon (UO).

BEST

The Oregon Built Environment & Sustainable Technologies center was established by the Oregon Legislature to act as an economic development catalyst in the areas of renewable energy and green building.

Penn State EO Alliance

The Penn State Electro-Optics Center serves as a national resource to advance electro-optics and related technologies by partnering with government and commercial customers for the primary benefit of the U.S. warfighter.

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