Dear Governor Martinez and New Mexico State Legislators,

We are pleased to present the 2017 Annual Report for the New Mexico Small Business Assistance (NMSBA) Program. This report highlights just a few of the hundreds of successful projects from 2017 and quantifies the overall performance of NMSBA, both for the past year and since its inception in 2000.

During 2017, a total of 346 small New Mexico businesses participated in NMSBA. Thanks to the Laboratory Partnership with Small Business Tax Credit Act, the State of New Mexico, along with Los Alamos National Laboratory and Sandia National Laboratories, invested $4.6 million of national laboratory expertise and resources to help small businesses in 28 counties overcome technical challenges and grow.

The success stories in this report demonstrate the impact of NMSBA on small businesses from various industries around the state. Here are just a few points from some of the featured stories:

- Test results and improvements of a new crate and suspension system designed to protect valuable artwork enabled a Santa Fe County company to receive funding for alpha testing and get four major museums to take part in these tests.
- A San Juan County company has diversified its product lines, grown sales, and added jobs after learning how to make their company’s workplace more organized, safe, and efficient.
- Receiving independent test results for a cool ambient technology resulted in a Doña Ana County company securing its first contract to apply their nontoxic coating on structures for an East Coast distribution company.
- Using data from technical research, a Quay County company was able to apply for loans to reconfigure an idle ethanol plant to convert animal manure to biomethane and create local jobs.

One project received the Honorable Speaker Ben Luján Award for Small Business Excellence for demonstrating the most economic impact. UBiQD, Central Park Square, and Stephen Auger Studios’ collaboration on Safe Quantum Dot Materials for Solid-State Lighting has resulted in multiple research grants. The companies have also received $1 million in investment funds and made new hires.

NMSBA has helped New Mexico’s small businesses create jobs, increase revenues, decrease operating costs, and attract new funding opportunities. Since 2000, the two national laboratories have provided $57.9 million in technical assistance to 2,797 businesses, enabling 6,858 jobs to be created and retained across the state’s 33 counties.

Your continued support of NMSBA, which promotes collaboration between our national laboratories and small business community, leads to economic development throughout our great state. Thank you!

Sincerely,

Micheline Devaurs
Los Alamos National Laboratory

Jackie Kerby Moore
Sandia National Laboratories

In 2017, $4.6 million of national laboratory expertise and resources was invested to help small New Mexico businesses.

Matt Geisel
Acting Cabinet Secretary
Economic Development Department
State of New Mexico

NMSBA is a valuable economic development program that benefits small businesses across New Mexico. Nurturing our homegrown talent and technologies is crucial to growing New Mexico’s economy.

John Monforte
Acting Cabinet Secretary
New Mexico Taxation and Revenue Department
State of New Mexico

We’re glad to have NMSBA working alongside us to help nurture innovation in New Mexico’s economy. It’s crucial that we continue to cultivate New Mexico’s innovation ecosystem to help grow and diversify our economy.

NMSBA 2017 ANNUAL REPORT: PERSPECTIVES

OPENING REMARKS
OVERVIEW

In 2000, the New Mexico State Legislature created the Laboratory Partnership with Small Business Tax Credit Act for the purpose of bringing the technology and expertise of the national laboratories to small businesses in New Mexico to promote economic development in the state, with an emphasis on rural areas. As a result, Sandia National Laboratories established the New Mexico Small Business Assistance (NMSBA) Program to provide technical support to small businesses throughout the state. Los Alamos National Laboratory began participating in NMSBA in 2007. Jointly, the labs are committed to solving small businesses’ critical challenges with national laboratory expertise and resources; influencing New Mexico business development by building capacity, capabilities, and competencies; and acting as an advocate for small businesses through an entrepreneurial culture.

While each company utilizes NMSBA in a different way, all use it as a means to maintain or grow their businesses. NMSBA services are provided at no cost to the participating small businesses in the form of lab staff hours valued at up to $20,000 per calendar year for businesses located in rural counties and $10,000 for businesses located in urban counties (currently just Bernalillo County). The total amount of assistance is capped at $2.4 million annually for each laboratory. NMSBA may not provide assistance that is available in the private sector, and no equipment or cash can be given to a participating company.

FUTURE DIRECTION

NMSBA continues to support the growth and diversification of the New Mexico economy by helping to further develop technologies into new and improved products and services ready to move into the marketplace. As NMSBA broadens the types of businesses receiving assistance each year, it increases the range of technical expertise offered by the national laboratories. At the same time, the expertise provided is aligned with the laboratories’ missions. NMSBA also continues to partner with New Mexico universities and leverage other business support programs to make the most of valuable local resources. Businesses receiving assistance from NMSBA cover a wide variety of industries, and are located across the state, including in underserved rural counties.

During 2017, NMSBA helped 346 small businesses across the state reach business goals, develop their products for commercial use, and increase profitability.

NMSBA makes a statewide impact by:

- Enabling New Mexico small businesses to access cutting-edge technology
- Increasing New Mexico small businesses’ technical sophistication and capabilities
- Sharing knowledge and resources between laboratory personnel and small businesses to address issues and develop real-world applications

In 2017, NMSBA helped 346 small businesses across the state reach business goals, develop their products for commercial use, and increase profitability.

TYPES OF SMALL BUSINESS ASSISTANCE

Individual Projects

Individual NMSBA projects involve a single New Mexico for-profit small business. Projects address business-specific challenges that can be solved with national laboratory expertise and resources. Technical assistance challenges are wide ranging; however, the majority include testing, design consultation, and access to special equipment or facilities. Requests for individual projects are accepted year-round until funding is exhausted.

Leveraged Projects

Leveraged NMSBA projects allow a group of small businesses that share technical challenges to collectively request assistance. Leveraged projects address issues that are too large or complex to solve through an individual project. Proposals for projects are reviewed semi-annually by the NMSBA Advisory Council.

Contract Projects

Legislation allows NMSBA to contract with entities that have the capability to provide small business assistance services not available in the private sector. For the benefit of New Mexico’s small businesses, NMSBA has contracts for specific services with the New Mexico Manufacturing Extension Partnership and the state’s three research universities.

The New Mexico Manufacturing Extension Partnership provides training and assessments in the areas of quality and lean manufacturing principles.

The Arrowhead Center at New Mexico State University evaluates small business capabilities and technologies using subject matter experts throughout the university.

The New Mexico Tech Department of Management interfaces with a variety of disciplines taught at the university to help accurately assess the current competitive position of small business technologies.

The University of New Mexico Management of Technology program at the Anderson School of Management evaluates the commercial potential of small business technologies and identifies commercialization challenges and pathways.

The University of New Mexico School of Engineering addresses technical challenges faced by small businesses in computer science and chemical, biological, electrical, computer, civil, nuclear, and mechanical engineering.
Located in Bernalillo County, Advanced Manufactured Power Solutions (AMPS) provides custom, high-quality and high-reliability battery packs for the defense and space industries. The company’s primary customers consist of government organizations and defense contractors.

Wishing to expand the business from this niche market, AMPS Vice President Eric Branson reached out to NMSBA. Branson’s goal was to identify new research areas related to energy storage and identify markets and end users for custom solutions. NMSBA connected Branson and his company to Steve Walsh of the University of New Mexico Management of Technology (UNM-MOT) program.

Walsh and his team of students implemented a technical assessment known as product paradigm development. They applied advanced learning curve techniques and advanced road-mapping processes to identify ways for AMPS to expand their product line and secure new customers.

AMPS used the results of this technical assistance to better position themselves with new business opportunities. AMPS has since formed a spin-off company dedicated to these new markets and has started negotiating a new market space from which to produce new products. AMPS is participating in a joint venture to progress the technology, developing a prototype, and meeting with potential customers. They plan to expand locally.

The people at NMSBA and UNM-MOT helped us technically, but more importantly they helped us understand new markets and establish successful relationships with potential new customers. It certainly gave us a new way to look at things.

Eric Branson
Vice President & CTO
AMPS, LLC

Ben Clapp, Steve Walsh, Greg Flynn, and Nikhil Patel (not shown) University of New Mexico
I attribute much of the current industrial excitement for our product to the technical results we received from our collaboration with Sandia. We can now scientifically support everything we claim.

Tony Burger
Founder & CEO
PJ Woodlands, LLC

Over a century of livestock grazing, fire suppression, logging, predator control, and exotic species introductions have altered most southwestern ponderosa pine forests. This has promoted unnaturally dense stands of small-diameter trees that threaten remaining large trees through competition and by fueling extensive crown fires. A new technology developed by Phil Archuleta in 2001 and 2002 resulted in a wood fiber/plastic composite called Generation I Altree™ for non-structural sign substrates and shaped and flat decking products.

In 2015 and 2016, Archuleta expanded this technology to incorporate a screen mesh into the surface of the waste wood/recycled plastic composite. This new patented product was named Generation II Altree. Preliminary testing indicated that the new Altree could handle more demanding uses, including in building components, and applications where high impact strength or adhesion of another substrate were required, but additional test data was needed.

To address this problem, PJ Woodlands and partnering companies GL Environmental, Inc.; Highway Supply, LLC; Mt Taylor Machine, LLC; P & M Lumber, Inc.; and P & M Signs, Inc. reached out to NMSBA, which connected them with Tom Bosiljevac at Sandia National Laboratories. Bosiljevac and his team performed a battery of mechanical and U.S. standards for roadway signs and building products.

PJ Woodlands now has demonstrable test data to address questions from new customers regarding Altree’s use in a greatly expanded number of eco-friendly product applications. They are now in the process of selecting their strategic partner to build an Altree production facility employing 41 full-time employees within the next three years.
The services the Los Alamos engineer provided were essential to the success of our proof-of-concept—the services not easily found anywhere. Thank you NMSBA for getting us started on protecting priceless artwork for the world to enjoy.

Alex Padilla
Consulting CEO
Georgia O’Keeffe Museum Innovations, Inc.

Located in Santa Fe, Georgia O’Keeffe Museum Innovations (GOKMI) is a for-profit subsidiary of the museum. The company developed a new crate design and suspension system to limit damage caused by vibration, but they lacked the expertise and equipment to test it.

GOKMI reached out to NMSBA, which connected the business with Neil Loychik at Los Alamos National Laboratory. Neil and his team optimized GOKMI’s existing design for shock and vibration loads based on the result of various tests, including a 24-channel laser Doppler vibrometer test, a data-quality assessment, and tests for size and position of the wire-rope isolators.

The optimum design for the new system has been tested and it cuts harmful vibrations by 50%, increasing the travel life of priceless artwork. The successful tests led to $250,000 in funding to produce an alpha crate for more testing.

Four of America’s top ten art museums have agreed to participate in the next set of tests. As for the economic impact, the market needs approximately 100,000 such transportation crates. At $10,000 per crate, GOKMI anticipates a total manufacturing stream of $1 billion.
This NMSBA project with New Mexico MEP brings ownership of business to the workers. Having them work with my crew to implement ideas that they already have is bringing more brainpower into the system.

Jack Kloepfer
Designer & Vice President
Jack’s Plastic Welding, Inc.

Founded in 1982 and located in Aztec, Jack’s Plastic Welding produces inflatable boats, dry bags, and waterproof self-inflating mattresses. Over the years, the company has expanded, concentrating on developing prototypes for products customized for a variety of markets, from amusement rides and scuba diving to emergency spill containers and medical gear.

With custom orders becoming more frequent and time consuming, CEO Errol Baade and Designer and Vice President Jack Kloepfer wanted to create a more organized, efficient, and safe workplace. To accomplish this goal, they reached out to NMSBA, which in turn connected them with the New Mexico Manufacturing Extension Partnership (New Mexico MEP).

Denise Williams Monaghan and her team worked with the business’ employees utilizing a system known as 5S. This system consists of five concepts that start with the letter s: sort, set-in-order, shine, standardize, and sustain. The objectives of 5S are to improve work quality, efficiency, and safety of industrial processes by reducing waste and bolstering value-added activities.

As a result of New Mexico MEP’s assistance, Jack’s Plastic Welding has diversified its product lines and now offers more alternatives with respect to custom orders. Since this technical assistance, sales for Jack’s Plastic Welding have grown by 10%. This consists of $70,000 in new sales and more than $680,000 in retained sales. Value stream mapping and other business facilitation has enabled the company to retain and create 11 jobs, including 4 new hires, as well as realize cost savings of over $183,000.
On any sunny day, the temperature of roofs can increase up to 50 degrees above ambient temperature. This means that more heat on the surface allows more heat to transfer into the building. These higher temperatures in buildings result in increased energy usage and deterioration of roofs over time.

To address this issue in the United States, Mauricio Murguia formed Kool Armor, a company dedicated to using a cool ambient technology known as KoolKat. Already extensively used in Mexico, this water-based, nontoxic coating is designed to dramatically reduce the temperatures of surfaces exposed to the sun. However, until now no testing had occurred in the U.S. to validate the empirical results already observed.

To get the needed data, Murguia reached out to NMSBA, which connected him to the Arrowhead Center at New Mexico State University. The team led by Griselda Martinez and Kristin Morehead tested KoolKat against other types of coatings, and analyzed KoolKat under a variety of temperatures on various types of structures over an extended period of time.

With these independent test results, Kool Armor was able to secure its first contract, with a major distributor on the East Coast. Worth $70,000, this contract consists of Kool Armor applying KoolKat to more than 140 storage trailers over the next six months. Kool Armor is expanding its application and testing of KoolKat on larger suites of materials and is aggressively pursuing more contracts for their product.
Addis Fuhr and Victor Klimov
Los Alamos National Laboratory

The technical assistance we received from Los Alamos through NMSBA gave us the firepower to go to investors, partners, and grant agencies so that we can better compete in this growing worldwide market.

Hunter McDaniel
CEO
UbiQD, LLC

LED systems are becoming the lighting of the future. However, LEDs cannot achieve the purity of color created by traditional bulbs, so can feel too bright. Quantum dots are effective at converting one spectrum of light into another, making them an attractive potential material for LED lighting. Yet most quantum dots are toxic and they haven’t been proven to have the color purity needed.

UbiQD in Los Alamos has quantum dot technology that is nontoxic, but they needed to validate its color purity. To address this issue, UbiQD, and collaborators Central Park Square, LLC and Stephen Auger Studio, LLC, reached out to NMSBA, which connected them with Victor Klimov at Los Alamos National Laboratory. Klimov and his team have extensive expertise in quantum dots. They took UbiQD’s quantum-dot design and quantified its fundamental color purity limits, also known as linewidth or luminescence.

Klimov and his team demonstrated that these single quantum dots have a color purity of approximately 20 nanometers, exceeding the minimum 50-nanometer color purity necessary for LEDs. With this quantitative proof in hand, the collaborators now know that there are no fundamental limitations when it comes to using their quantum dots for LED lighting.

The companies have received Small Business Innovation Research grants including $150,000 from the Department of Energy and $225,000 from the National Science Foundation. They also were awarded a $350,000 grant from Breakout Labs and have received more than $2 million in investment funds to compete in a growing $30 billion industry. They plan to continue to expand and manufacture in New Mexico.
VALUE OF PROGRAM ASSISTANCE IN 2017

In 2017 the State of New Mexico, along with Los Alamos National Laboratory and Sandia National Laboratories, invested $4.699M helping 346 small businesses in 28 counties to solve technical challenges. The following table contains the number of small businesses that received assistance from NMSBA, dollar value of the assistance for calendar year 2017, and cumulative value from 2000 to 2017.

<table>
<thead>
<tr>
<th></th>
<th>Los Alamos*</th>
<th>Sandia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>161</td>
<td>188</td>
<td>346**</td>
</tr>
<tr>
<td>Rural</td>
<td>117</td>
<td>101</td>
<td>216**</td>
</tr>
<tr>
<td>2000 - 2017</td>
<td>886</td>
<td>2,192</td>
<td>2,797**</td>
</tr>
<tr>
<td>Rural</td>
<td>639</td>
<td>1,328</td>
<td>1,977**</td>
</tr>
<tr>
<td>Urban</td>
<td>247</td>
<td>864</td>
<td>1,118**</td>
</tr>
</tbody>
</table>

Value of Assistance Provided

<table>
<thead>
<tr>
<th>Year</th>
<th>Los Alamos*</th>
<th>Sandia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>$2,201,499</td>
<td>$2,399,989</td>
<td>$4,601,488</td>
</tr>
<tr>
<td>Rural</td>
<td>$1,850,407</td>
<td>$1,693,353</td>
<td>$3,543,760</td>
</tr>
<tr>
<td>Urban</td>
<td>$351,092</td>
<td>$706,636</td>
<td>$1,057,728</td>
</tr>
<tr>
<td>2000 - 2017</td>
<td>$2,473,694</td>
<td>$36,437,783</td>
<td>$37,911,477</td>
</tr>
<tr>
<td>Rural</td>
<td>$18,826,544</td>
<td>$27,046,536</td>
<td>$45,873,080</td>
</tr>
<tr>
<td>Urban</td>
<td>$2,647,150</td>
<td>$9,391,247</td>
<td>$12,038,397</td>
</tr>
</tbody>
</table>

*Los Alamos began participating in NMSBA in 2007. ** Some companies are served by both laboratories.

ACCOUNTABILITY & ECONOMIC IMPACT

NMSBA, enabled by the Laboratory Partnership with Small Business Tax Credit Act, is accountable to the State of New Mexico for its expenditures. NMSBA measures its economic impact through client surveys conducted by Research and Polling, Inc., and economic analysis provided by Robert Grassberger, PhD Economist.

ECONOMIC IMPACT FOR BUSINESSES FROM NMSBA PROJECTS 2000-2016*

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Business Jobs Created and Retained</td>
<td>6,858</td>
</tr>
<tr>
<td>Average Reported Salary (2016)</td>
<td>$43,560</td>
</tr>
<tr>
<td>Increase in Revenue</td>
<td>$325,996,166</td>
</tr>
<tr>
<td>Decrease in Operating Costs</td>
<td>$159,445,655</td>
</tr>
<tr>
<td>Investment in NM Goods / Services</td>
<td>$124,854,081</td>
</tr>
<tr>
<td>New-Funding / Financing Received</td>
<td>$130,080,719</td>
</tr>
<tr>
<td>Return on Investment**</td>
<td></td>
</tr>
<tr>
<td>Matching Investment</td>
<td></td>
</tr>
</tbody>
</table>

* Surveys are performed six months to one year after project completion.
** ROI is based on salaries of jobs created and retained.

BENEFITS TO NEW MEXICO SMALL BUSINESSES

New Mexico small businesses achieved positive results after receiving technical assistance from NMSBA. Feedback from companies that participated in the 2016 economic impact client survey revealed that:

- 54% developed a new product or technology
- 47% improved overall operations
- 58% expanded or improved a product or service
- 52% became more competitive in the marketplace
- 52% improved the expertise or capabilities of employees
- 47% dissatisfied with program
- 93% satisfied with program
- 99% would use NMSBA again
- 99% would recommend NMSBA services

LABORATORY CAPABILITIES UTILIZED IN 2017

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>23.9%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>23.1%</td>
</tr>
<tr>
<td>Advanced Modeling and Simulation</td>
<td>9.8%</td>
</tr>
<tr>
<td>Materials Science</td>
<td>8.1%</td>
</tr>
<tr>
<td>Biological and Medical</td>
<td>6.9%</td>
</tr>
<tr>
<td>Energy</td>
<td>6.9%</td>
</tr>
<tr>
<td>Earth and Environmental Sciences</td>
<td>6.1%</td>
</tr>
<tr>
<td>Business Development</td>
<td>4.9%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4.6%</td>
</tr>
<tr>
<td>Micro-Nano Technology</td>
<td>4.0%</td>
</tr>
<tr>
<td>Math and Computer Science</td>
<td>1.4%</td>
</tr>
<tr>
<td>Astronomy and Physics</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

INDUSTRIES OF SMALL BUSINESSES SERVED IN 2017

<table>
<thead>
<tr>
<th>Industry</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Natural Resources</td>
<td>11.3%</td>
</tr>
<tr>
<td>Education Services and Health Care</td>
<td>4.1%</td>
</tr>
<tr>
<td>Oil &amp; Gas, Utilities and Mining</td>
<td>2.9%</td>
</tr>
<tr>
<td>Other Services</td>
<td>2.0%</td>
</tr>
<tr>
<td>Real Estate, Finance, Insurance, and Management Services</td>
<td>1.4%</td>
</tr>
<tr>
<td>Media and Hospitality</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

BUSINESSES ASSISTED BY COUNTY 2000–2017

NMSBA has provided assistance to 2,737 small businesses in all 33 New Mexico counties during the life of the program.

CUSTOMER SATISFACTION IN 2017

Each year, NMSBA surveys the participating businesses to learn about their satisfaction with the program. In 2017, 99% of the businesses responded to the survey.

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Satisfaction with Program</td>
<td></td>
</tr>
<tr>
<td>Satisfaction with Project Manager</td>
<td></td>
</tr>
<tr>
<td>Satisfaction with Lab Technical Staff</td>
<td></td>
</tr>
<tr>
<td>Effect of Assistance on Company</td>
<td></td>
</tr>
<tr>
<td>Would Use NMSBA Again</td>
<td></td>
</tr>
<tr>
<td>Would Recommend NMSBA Services</td>
<td></td>
</tr>
</tbody>
</table>
Agriculture can create a lot of waste products. Tucumcari Bio-Energy has a vision of a synergistic integration of dairy farming, feedlots, municipal waste, biofuel production, and greenhouse farming that would address this issue. As a first step, the company intends to build a high-efficiency biomethane processing facility by reconfiguring an ethanol plant in New Mexico. This facility will take animal manure and convert it to energy. It will also serve as a prototype for other highly efficient digester systems utilizing unused ethanol plants in the Midwest.

As Bob Hockaday and his team at Tucumcari Bio-Energy made plans, they soon learned that the process used to convert manure to energy suffered from various instabilities. Tucumcari Bio-Energy turned to NMSBA, which in turn connected the company with Sal Rodriguez at Sandia National Laboratories.

Rodriguez and his team worked to determine the optimum water-to-manure ratio to maximize energy conversion. Such a ratio minimizes instabilities, such as extreme temperatures, high alkalinity, or the plugging of anaerobic digestion tanks. To perform this analysis, Rodriguez and his team used advanced computational fluid dynamics and theoretical modeling, along with natural circulation dynamics.

Using the information resulting from this technical assistance, Tucumcari Bio-Energy was able to apply for loans to fund the conversion of the ethanol plant in Tucumcari. Once the plant is producing energy, the company anticipates a revenue stream of approximately $10 million per year and the creation of 20 new jobs.
Meet the
PRINCIPAL
INVESTIGATOR

Romeo Fabia
Sandia National Laboratories

In business for 30 years in Albuquerque, Voss Scientific’s areas of expertise include fully integrated data acquisition systems for capturing transient signals, autonomous electromagnetic susceptibility testing of electronic systems, high power short pulse lasers, and computational plasma physics simulations software. The development of the CP-560 sensor naturally grew out of these activities. A little bigger than a dime, the CP-560 allows current measurements for any experiment or application involving electrical signals with ultrafast temporal phenomena, such as protecting explosive ordnance, electrostatic discharge testing of electronics, and even developing improved hard disks for computers.

Although the CP-560 worked well, Romeo Fabia, an engineering technologist at Sandia National Laboratories, contacted his supplier, Voss Scientific, to discuss his program’s need for a higher frequency response. To help tackle this problem, Voss Scientific reached out to NMSBA, which provided a method for Fabia and the company to work together in utilizing the extraordinary instrumentation capability available at Sandia. Working with Fabia and his team, Tom McVeety, senior RF engineer at Voss Scientific, improved the sensor’s performance through a redesign. As a result of Sandia’s technical assistance, the bandwidth of the CP-560 was extended from 6 GHz to beyond 20 GHz. Moreover, the company received outside validation from Sandia regarding the product’s enhanced performance.

NMSBA’s technical assistance enabled Voss Scientific to increase annual sales by $75,000. It also led to the company expanding its customer base to include MIT and the United States Army, with recent product orders exceeding $52,000.

Donald Voss
CEO, Principal Scientist
Voss Scientific, LLC

With the technical assistance provided by Sandia through NMSBA, we are now in a position of manufacturing the highest frequency bandwidth current sensors in the world.

Donald Voss
CEO, Principal Scientist
Voss Scientific, LLC

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In 2017, the U.S. experienced a record number of forest fires, with a total of more than 9 million acres charred. However, the fires themselves are just the beginning of environmental damage. Communities experience disastrous mudslides, flooding, and impacts to drinking water supplies and fisheries.

Keystone Restoration Ecology, Inc., Earth Analytic, Inc., Global Conservation Assistance, and Zeedyk Ecological Consulting, LLC have been working together to rebuild wetlands and water tables in New Mexico and throughout the world. For several years the companies were using a technique known as “Plug and Pond,” but wanted more data about the technique’s effectiveness in improving hydrologic conditions and mitigating excessive nutrient loads from wildfires.

To address this issue, the collaborators reached out to NMSBA, which connected them with Brent Newman at Los Alamos National Laboratory. Newman and his team provided novel sampling methods to evaluate hydrological residence times and obtain fingerprint nutrient sources, transport, and attenuation. The results provided extensive biogeochemical and hydrological characterization of a variety of restoration sites before and after using Plug and Pond.

Demonstrating that Plug and Pond works for post-fire watershed restoration has enabled the collaborators to bolster this technique’s credibility, with Global Conservation tackling places such as Tanzania and Uganda, and Zeedyk Ecological Consulting restoring rangelands across the western U.S. For Keystone Restoration Ecology, the results enabled the company to expand its market, receive approximately $450,000 in grants, and hire two crew members to implement restoration activities.

For us, having NMSBA connect us with Los Alamos enabled us to obtain expertise we could not find anywhere else.

Steve Vrooman
President
Keystone Restoration Ecology, Inc.

Watershed Restoration Leveraged Project

Steve Vrooman
President
Keystone Restoration Ecology

Kina Murphy
Owner/Ecologist
Global Conservation Assistance

Wetherbee Dorshow
President
Earth Analytic

For us, having NMSBA connect us with Los Alamos enabled us to obtain expertise we could not find anywhere else.

Steve Vrooman
President
Keystone Restoration Ecology, Inc.

Watershed Restoration Leveraged Project

Steve Vrooman
President
Keystone Restoration Ecology

Kina Murphy
Owner/Ecologist
Global Conservation Assistance

Wetherbee Dorshow
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Steve Vrooman
President
Keystone Restoration Ecology, Inc.

Watershed Restoration Leveraged Project

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Established in 2000, the NMSBA’s Geometric Dimensioning and Tolerancing (GD&T) courses have enabled representatives from small businesses throughout the state to gain a deeper knowledge of the degree of precision needed to add value to their products. For the past 18 years, Sandia National Laboratories Development and R&D Science and Engineering Team Lead Tony Bryce and Production Team Lead Monico Lucero have taken the time to ensure that anyone taking their courses can successfully apply what they have learned to improving their company’s products.

After beginning with the basic course in 2000, an advanced course was added in 2012. To date, 400 people from 48 companies have participated in this training. A system for defining and communicating engineering tolerances, GD&T uses a symbolic language on engineering drawings to describe geometry and allowable tolerances. GD&T tells manufacturing staff what degree of accuracy and precision is needed on each feature of the part. In other words, GD&T is used to define the allowable variation.

“I am a firm believer that everyone must possess an in-depth grasp of GD&T,” notes TEAM Technologies CEO Bob Sachs. “GD&T ensures that we are delivering the best quality machined parts to our customers. We are extremely fortunate to have this great education available to us for our workforce.”
## LEVERAGED PROJECTS

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>DESCRIPTION</th>
<th>BUSINESS PARTICIPANTS</th>
<th>COUNTIES</th>
<th>FUNDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandia</td>
<td>Altree</td>
<td>The Labs provided technical consultation and material characterization testing of customer-provided samples in order to determine the performance of Altree™ in a battery of ASTM-defined tests.</td>
<td>Bernalillo</td>
<td>$67,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Autophagy Drug Combo</td>
<td>The Labs identified spectral signatures and binding patterns of autophagy stimuli in combination with novel, potentially active synthetic small molecule drugs. The Labs also conducted hyperpolarized imaging time course studies of the localization patterns for these drug combinations. Confocal imaging was also used on an engineered cell line expressing autophagy markers to study the effectiveness of combination drug treatment on inducing autophagy.</td>
<td>Bernalillo, Santa Fe, Torrance</td>
<td>$49,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Battery Inventory</td>
<td>The Labs developed a system for tagging batteries and integrating with a charger/appliance system to enable monitoring of battery state-of-health among field deployed units.</td>
<td>Bernalillo, Otero</td>
<td>$78,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Cancer Detection</td>
<td>The Labs adapted the Center for Integrated Nanotechnologies (CINT) Microfluidic Discovery Platform™ to aqueous antibody conjugation of magnetic nanoparticles. Using real-time analytics to monitor the reaction may enable the production of a consistent product.</td>
<td>Bernalillo, Sandoval</td>
<td>$168,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>Copper Nanoink Development</td>
<td>The Lab investigated the suitability of commercially available copper particles for use as copper inks and examined the synthesis of suitable copper nanoparticles using organocopper compounds.</td>
<td>Bernalillo</td>
<td>$116,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Directional Flame</td>
<td>The Labs provided technical assistance to develop software that calculates and displays real-time heat flux measurements from experiments using Directional Flame Thermometers. Consultation was provided on a model and code that enables viewing experimental results with only a minimal delay, adaptable to variations in hardware. This development will aid the research and the development of fire safety standards.</td>
<td>Bernalillo</td>
<td>$18,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Electrical Bonding</td>
<td>The Labs provided technical consultation to develop the required algorithms for bonded connections on a PV module to its supporting rack via integrated bonding mechanisms. In particular, bonding methods evaluated by the Labs include bonding current, bonding conductor test wire and related bond factors.</td>
<td>Bernalillo</td>
<td>$188,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>FarmPod</td>
<td>The Labs provided technical consulting and assistance on commercial off-the-shelf (COTS) devices as to their ability to meet requirements including automated processes to maintain the health of the ecosystem. The general parameters of these solutions are that they be networked, low power, low cost, high reliability and easily sourced.</td>
<td>Santa Fe</td>
<td>$78,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Gold from Biosolids</td>
<td>The Labs performed thermal analysis, thermal processsing, batch reactor runs, and metals analysis.</td>
<td>Bernalillo</td>
<td>$49,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>High Demand Guar Gum</td>
<td>The Lab evaluated the platform technology proposed by the partnering companies to efficiently produce guar in a high biomass yielding indigenous plant called prairie cordgrass.</td>
<td>Eddy, Santa Fe</td>
<td>$396,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Nitrogen Dosing</td>
<td>The Labs provided technical consulting and design work to investigate modeling and experimental validation of N2 liquid-vapor injection within a variety of canned beverages produced throughout the state of New Mexico. Experimentally validated models were developed to investigate interfacial boiling and optimized injection of liquid N2 with gaseous CO2 in various commercial beverages. Designs were investigated to ensure consistent and optimized dosing was facilitated for ensuring a high-quality delivered product.</td>
<td>Bernalillo, Santa Fe</td>
<td>$100,000</td>
</tr>
</tbody>
</table>

Los Alamos National Laboratory and Sandia National Laboratories provide technical assistance for both individual and leveraged NMSBA projects. The following is a listing of this year’s leveraged projects.
**LEVERAGED PROJECTS CONTINUED**

<table>
<thead>
<tr>
<th>PROJECT</th>
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<tr>
<td>Sandia</td>
<td>Off-Grid Ice Melter</td>
<td>The Labs provided technical consulting and pilot design/operation support directed at evaluating an innovative approach using solar energy to provide heat to melt ice by warming water in livestock water drinkers during cold-weather conditions.</td>
<td>Bernalillo</td>
<td>$68,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>Predictive Algorithms for Recovery after Severe Brain Injury</td>
<td>The Lab explored practical analysis strategies of data for patient monitoring; identified potential sources of signals that could be used to inform algorithms and visualization techniques; reviewed data and existing medical literature; established a data analysis plan; discussed improvements to existing user interface; and explored aspects of patient data, nuances of data processing and sources of errors.</td>
<td>Bernalillo</td>
<td>$30,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Radiation Dose Detector</td>
<td>The Labs tested an advanced solid-state radiation-detector/dosimeter that will directly measure the dose and dose rate in biological equivalent terms, regardless of the type of radiation. In the course of the testing, the Labs developed a screening protocol for isolating non-functioning solid-state tissue-equivalent radiation detectors (SSTEDs) from functioning detectors. Narrow beam and wide beam X-ray radiation was applied to SSTED devices to examine X-ray detection resolution. Then, duration consistency, dwell times, and maximum intensity as a function of the device response was evaluated.</td>
<td>Bernalillo</td>
<td>$89,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>Reactive Tracer Testing to Support the Development and Expansion of a Geothermal Power Facility</td>
<td>The Lab conducted reactive tracer tests and analyzed the data results of these tests to inform the geothermal power facility how best to utilize their use of their wells.</td>
<td>Hidalgo</td>
<td>$63,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>Safe Quantum Dot Materials for Solid-State Lighting</td>
<td>The Lab conducted a single-particle photoluminescence measurements on quantum dots fabricated by UbiQD. The results indicated that it should be possible to achieve narrow ensemble linewidths by refining synthetic protocols so as to reduce sample heterogeneities.</td>
<td>Los Alamos</td>
<td>$59,000</td>
</tr>
<tr>
<td>Sandia</td>
<td>Sprinkler Nozzle</td>
<td>The Labs provided technical assistance with design consultation, modeling, and validation of an advanced fire-sprinkler nozzle design.</td>
<td>Bernalillo</td>
<td>$59,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>Suicide Bomb Detection</td>
<td>The Labs increased the range of the detection from 3m to 10m. Antennas were modified to increase the range and reduce the field of view for more accuracy. Software on the radar and Gill was updated to support the increased range.</td>
<td>Bernalillo</td>
<td>$59,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>The VASP Instrument</td>
<td>The Lab tested the VASP Instrument by repeating materials science calculations on one of Los Alamos’ high performance computer clusters. Real world calculations were performed on the VASP Instrument, gathering data to use in a manuscript to submit for publication.</td>
<td>Bernalillo</td>
<td>$79,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>Validation of an Electromagnetic Stimulation Integrated Bioreactor System for Commercialization</td>
<td>The Lab developed protocols and experimental setup for testing the functionality of a U.S. patent pending electromagnetic algae bioreactor system, a.k.a. “BioStim”.</td>
<td>Bernalillo</td>
<td>$79,000</td>
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<tr>
<td>Los Alamos</td>
<td>Watershed Restoration from Wildfire at the Valles Caldera National Preserve, Surface and Groundwater Chemistry Post Treatment</td>
<td>The Lab characterized redox and hydrological processes within Plug and Pond treatment areas, took depth profiles in constructed ponds, analyzed water samples, and demonstrated various simple sampling approaches that can be used to assess the effects of watershed restoration on biogeochemistry and hydrology.</td>
<td>Bernalillo</td>
<td>$69,000</td>
</tr>
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</table>
Projects from 2017 that achieved outstanding innovations through NMSBA were honored at an Innovation Celebration Awards event in 2018.

One leveraged project received the Honorable Spokesman Ben Luján Award for Small Business Excellence for demonstrating the most economic impact. UBiQD, Central Park Square, and Stephen Auger Studios’ collaboration on Safe Quantum Dot Materials for Solid-State Lighting has resulted in Small Business Innovation Research grants from the DOE and National Science Foundation, as well as a grant from Breakout Labs. The companies have also received $1 million in investment funds and made new hires.

In addition to honoring NMSBA participants, the event provided an opportunity for small businesses, local economic development representatives, elected officials, and community leaders to network and learn what NMSBA offers to help businesses grow.

• Thank you to all the small businesses for participating in NMSBA and creating jobs and economic wealth for New Mexicans.
• Thank you to all Los Alamos and Sandia National Laboratories’ Principal Investigators who applied their expertise and knowledge to help New Mexico small businesses solve their technical challenges.
• Thank you to the Governor’s office and the New Mexico State Legislature for supporting the Laboratory Partnership with Small Business Tax Credit Act.
• Thank you to the Advisory Council for their leadership, advice, and guidance in support of NMSBA.

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Thank you to everyone who contributed to this report.

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