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Strategic Direction Report: Laboratory Ventilation Systems

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MECHANICAL ELECTRICAL PLUMBING POWER

AN ENGINEERING SOLUTION CENTER

IN THIS EDITION..

With just over 50 employees across the Upper Midwest, many would find our experience and expertise in complex research labs hard to believe. But with major agricultural, physics and veterinary medicine programs on campuses just a stone's throw from our front doors – we've been fortunate to have opportunity knock.

We're proud to say our engineers answered the door, and devoted themselves to understanding the complex critical systems that create a sterile, consistent research environment. It's the reason we've had the great privilege of working on some of the nation's top research labs in their fields. We'll share a few of the things we've learned along the way in this edition, but if you want to know more – we'd be happy to talk.

Mark Grebner, P.E. Announces Retirement

It's with mixed emotions that we share that Mark Grebner, P.E., has announced his retirement from West Plains Engineering effective Jan. 1, 2019.

Mark celebrated 25 years with our firm this past Spring, and has served us in countless important ways as a Mechanical Engineer, Office Manager, Board Member and most recently, Building Services Division Manager.

We want to thank Mark for his dedication and leadership over the years. He has become a fixture in all our offices as he traveled across the region to support our staff, clients and communities.

We wish him well as he now focuses on spending more time with his family - as well as investing more energy in his volunteer work with Habitat for Humanity and other charities.

If you have any questions, please call our corporate offices in Rapid City at (605) 348-7455.



Feterl Named to NSBA Leadership Council

Doug Feterl, P.E., President of West Plains Engineering, was recently named to the National Small Business Association (NSBA) Leadership Council. NSBA is the nation's oldest small-business advocacy organization, and operates on a staunchly nonpartisan basis. Feterl joins the NSBA Leadership Council alongside other small-business advocates from across the country as they work to promote the interests of small business to policymakers in Washington, D.C.

Feterl has been with West Plains Engineering since 1991 and previously served as the office manager in Rapid City. A lifelong resident of Wyoming and South Dakota, he is heavily involved in the local business community and has developed strong relationships with leaders in government and the construction industry.

For more information on the NSBA, visit our website.



West Plains Hosts Clients Across South Dakota

Check out more photos from all our events by Liking us on Facebook.



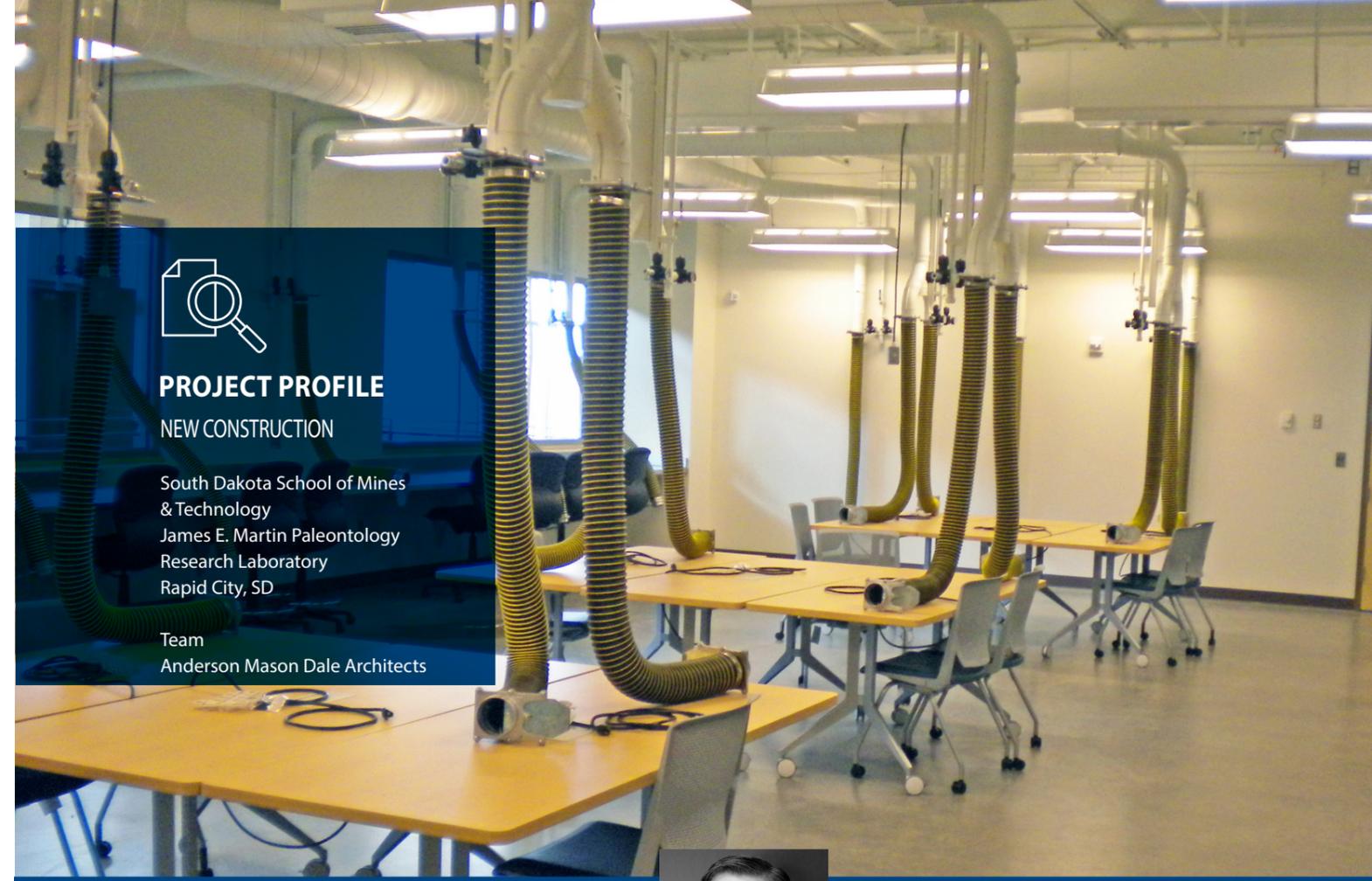
Rapid City | Oct. 18
Hay Camp Brewing Company



Sioux City | Oct. 18
Orpheum Theatre



Sioux Falls | Sept. 28
Our Office



PROJECT PROFILE NEW CONSTRUCTION

South Dakota School of Mines & Technology
James E. Martin Paleontology Research Laboratory
Rapid City, SD

Team
Anderson Mason Dale Architects

LOOKING INTO THE PAST

The James E. Martin Paleontology Research Laboratory houses the important museum archives and research activities for the geology and paleontology programs at the South Dakota School of Mines and Technology. The 33,000 square foot building is home to more than half a million scientifically significant specimens and supports geochemistry, preparation and fabrication laboratories for the conservation of fossils, as well as other geologic and paleontologic research.

With this much highly sensitive research data on site, environmental control was critical to the building's design. The facility notably includes two air handling systems – one serving the preparation areas and labs that produce dust, and the other serving the clean archive areas, offices and other support spaces. The systems also provide humidification control for the building to assure humidity is held within a constant range. Dust collectors in the two labs capture and contain the particles produced during the fossil and casting preparation processes. All systems are monitored and controlled by the building and campus automation systems and include displays of the various system energy use.



Michael Heinrich, P.E., BEMP is a Senior Mechanical Engineer and Head of the Mechanical Department in Rapid City. Michael has been with West Plains Engineering since 2000, and is a designated Building Energy Modeling Professional (BEMP).
michael.heinrich@westplainsengineering.com

But preservation efforts went far beyond the mechanical equipment and also involved unique electrical systems. Not only was the lighting system designed to far exceed LEED criteria, lighting within the archive storage area was specially designed for low Ultra Violet emissions to help preserve the materials being stored. Light of any kind, but especially Ultra Violet light, fuels chemical reactions in materials and leads to deterioration. Minimizing this type of light in these spaces will help to limit the damage caused to specimens over time.

While preservation and research control were priority number one for this project, doing so in an environmentally-conscious, sustainable way wasn't far behind. In fact, the Lab became the first State-owned building in South Dakota to obtain LEED Gold Certification, and was recognized by Mountain States Construction Magazine's Gold Hard Hat Awards Program.



LABORATORY VENTILATION

There is very little room for commoditization in laboratory engineering design. Unlike some buildings, the HVAC systems (especially ventilation) for labs are incredibly complex and specific to the industry. It's a science for a highly skilled, experienced and trained mechanical engineer to meet or exceed these buildings' rigid design standards.

But beyond the design itself, there's an art to delivering a system on budget, that can also be easily operated and maintained by the owner. HVAC systems alone make up 30 to 50 percent of the total construction cost for most labs, so factors affecting design must be thoroughly understood and weighed to assure appropriate comparison between assumed and actual costs.

Ultimately, laboratory ventilation design is not an exact science, or a free-form art. It's both. While designing a complex laboratory ventilation system that checks the requirement boxes may be science, creating one that can be constructed, operated and maintained effectively and economically is truly an art form.

There are a number of different laboratory forms and functions. In the United States, a large majority of research labs are constructed on university campuses where professionals and students can learn and grow together. Within the upper Midwest are many agricultural and animal research and diagnostic labs – some of which are among the most advanced in the world. But research, as well as training and process, labs can also be found in industrial, commercial, medical and many other sectors as well. Regardless of the where or what behind the lab, the systems serving it still focus on two main objectives: keeping occupants safe and the system operational.

The mechanical systems in labs are critical to achieving these sterile, consistent environments best suited for processes and research. In these facilities, the ventilation design frequently takes center stage, as it's responsible for regulating temperature, humidity, relative static pressure, air motion, air cleanliness, sound and exhaust airflow – all keenly important to environmental control. By considering the type and primary function of the lab, appropriate ventilation must first and foremost create a space that is safe and clean. Clean in that the lab is kept free from of contaminants and other variables that might impact results, and safe by understanding and mitigating any airborne hazards created by the laboratory processes themselves. Additionally, the design must consider how ventilation decisions affect and integrate with architectural planning and design, electrical systems, structural systems and other infrastructure utilities.

In this Strategic Direction Report, we'll cover the various components of ventilation design considered for laboratories, including exhaust systems, fume hoods, supply air, outlets and intakes, and containment. We'll also discuss the importance of a well-designed ventilation control system and how the integration of utility systems into the architectural planning is essential to providing a successful lab facility. The lab engineers must be an integral and proactive member of the laboratory facility programming and design team from the beginning of the project through the certification process.

Download the Full Strategic Direction Report

Visit www.westplainsengineering.com/SDR or click on the QR code to the right to download the FREE full white paper on MEP Design for Laboratory Ventilation.



PROJECT PROFILE

HVAC UPGRADE

South Dakota State University
Department of Animal Science
HVAC Improvements
Brookings, SD

A WHOLE DIFFERENT ANIMAL

The Animal Science Department at South Dakota State University plays an important role in vital research that impacts both animal and human well-being across the United States. There are several buildings and facilities on campus dedicated to this work, many of which include advanced laboratory spaces for student and staff research. Facilities such as this that house or care for animals have particularly unique ventilation requirements. Research animals in particular must be housed in comfortable, clean, temperature and humidity controlled spaces in order to minimize research variables.

West Plains Engineering partnered with SDSU for a \$5.3 million HVAC upgrade to this program's Animal Science Building, which is primarily used as a research lab with areas for large animals and the Meat Sciences Department. The ventilation system had fallen into a state of disrepair and needed to be upgraded to maintain acceptable indoor air quality levels. The lab now uses three 100 percent outside air AHUs, coupled with a precision air control exhaust and supply system. High velocity induced flow exhaust fans are utilized on a manifolded exhaust system from the lab areas to provide plume heights well above the building roof level to prevent re-entry of exhausted laboratory fumes.

Our team later went on to perform a subsequent \$1.4 million renovation of the Department's Olson Biochemistry suite of laboratories. The existing lab space was divided into a BSL-2 area and a research area. The renovation added bio-safety cabinets, which required the design of new Phoenix valves, but the space was otherwise able to be efficiently tied into the existing AHU's and exhaust fans.



Marty Christensen, P.E. is a Principal Mechanical Engineer and Sioux Falls office manager. Marty has been with West Plains since 1994, and has been involved with mechanical laboratory systems at South Dakota State University, the University of South Dakota and Iowa State University, as well as many other clients during his career. He has extensive experience in animal labs, and is currently the Project Manager for the new \$60 million SD ADRDL expansion. marty.christensen@westplainsengineering.com



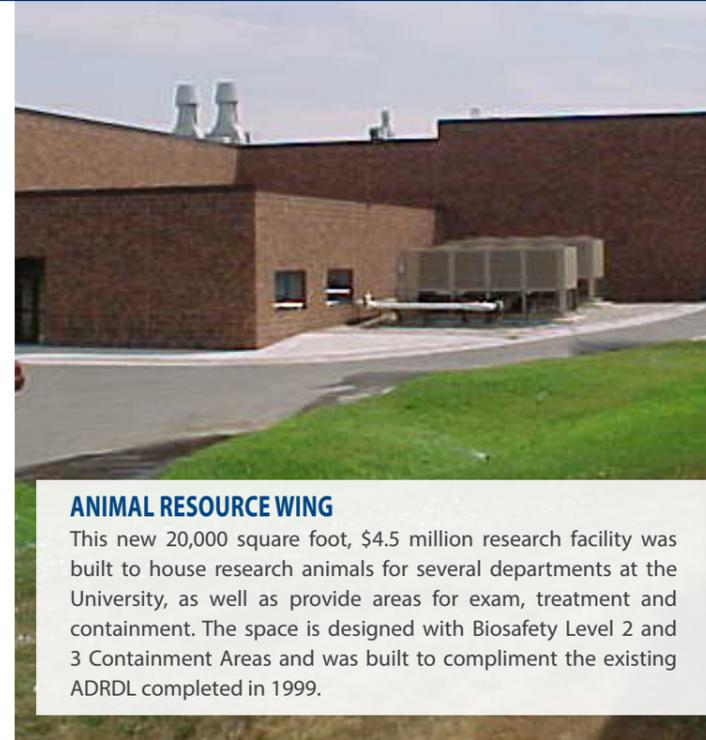
PROJECT PROFILE

SOUTH DAKOTA STATE UNIVERSITY

Animal Disease Research & Diagnostics Lab Expansion & Renovation

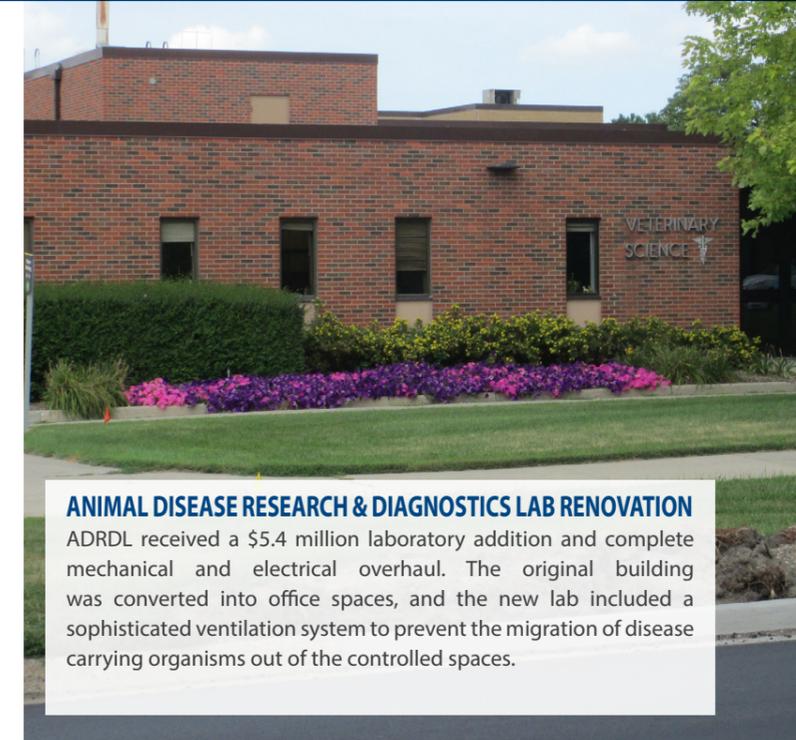
Brookings, SD

ADRDL Evolution



ANIMAL RESOURCE WING

This new 20,000 square foot, \$4.5 million research facility was built to house research animals for several departments at the University, as well as provide areas for exam, treatment and containment. The space is designed with Biosafety Level 2 and 3 Containment Areas and was built to compliment the existing ADRDL completed in 1999.



ANIMAL DISEASE RESEARCH & DIAGNOSTICS LAB RENOVATION

ADRDL received a \$5.4 million laboratory addition and complete mechanical and electrical overhaul. The original building was converted into office spaces, and the new lab included a sophisticated ventilation system to prevent the migration of disease carrying organisms out of the controlled spaces.

LABOR(ATORY) OF LOVE

West Plains Engineering has been proud to support numerous upgrades, remodels and renovations to the Animal Disease Research & Diagnostics Lab over the years, but at \$60 million – this current project is by far the largest.

Our involvement with the newest ADRDL expansion began with a feasibility study with ED2 International in 2014 and continued in 2015 when we joined with architectural group, The Clark Enerson Partners, to begin researching, planning and coordinating what would become a 74,000 square foot addition and 35,000 square feet of renovation to the existing space. In terms of construction dollars, it's one of the largest projects West Plains has ever tackled. But as a longtime partner to SDSU with nearly a dozen alumni on our staff, we had a personal investment in its success.

Over the course of the past three years, nearly every member of our staff has touched this design in some way, shape or form. From our tenured principal PEs to our brand new drafters and support staff – it's taken teamwork across the board to stay on task. And that task...was considerable.

As with most research labs, the mechanical system serving the space was critically important in the upgrade. While the system we designed for the existing space in the early 90s had served it well, it had simply reached the end of its useful life. Plus, with the rate at which technology moves, other options are available now that weren't 25 years ago. For example, the entire controls system previously relied on pneumatic valves and actuators with little space information reported back to a

Present–2015

monitoring system. The new space will be completely upgraded to DDC, giving users unprecedented insight to assure appropriate bio-containment levels and other critical environmental factors.

Additionally mechanical upgrades include a total replacement of the building's water chillers, plumbing equipment and modifications to the air handling units to add much-needed redundancy.

Electrically, the power distribution, lighting, voice/data and security systems were all in surprisingly good shape given their age. But as square footage was added and spaces realigned – lamps, electronic ballasts, data cabling and fire alarm systems (among others) had to be replaced, relocated and upgraded to meet the facility requirements.

A groundbreaking ceremony was held on Aug. 31, 2018, and included a prestigious guest list that reflected the importance of this facility. With Governor Dennis Daugaard, SD Secretary of Agriculture Mike Jaspers and SDSU President Barry Dunn (among others) at the shovels –it's clear that ADRDL is a source of pride not only for the University, but for the agricultural community and the State of South Dakota as well. It's easy to understand why. The research that comes out of this lab has national implications for both animal and human health. Some of the foremost experts in animal disease research use this space to further our understanding of the field – and we're proud to be a local firm helping give them the best place to do it.

2001–1997



1999–1993

What's An ADRDL?

The Animal Disease Research & Diagnostics Lab (commonly known as ADRDL) at South Dakota State University is one of fewer than 40 veterinary diagnostic laboratories accredited by the American Association of Veterinary Laboratory Diagnosticians (AAVLD), and is an important component of the National Animal Health Laboratory Network (NAHLN). The research done in this lab is critical in diagnosing diseases in cattle, pigs and other livestock, which in turn arms veterinarians and health officials with information to protect and improve animal (and by extension human) health.

West Plains Engineering has developed a long-term partnership with the Veterinary and Biomedical Sciences Department at SDSU. Since 2000, our team has supported numerous upgrades, remodels and new construction projects for this department alone, improving the facilities that support their important work.



233 West Broadway, Bismarck, ND 58501
 (701) 751-7322
 1750 Rand Road, Rapid City, SD 57702
 (605) 348-7455
 4609 S. Techlink Circle, Sioux Falls, SD 57106
 (605) 362-3753
 145 S. Durbin, Suite 205, Casper, WY 82601
 (307) 234-9484
 215 2nd Avenue SE, Suite 200, Cedar Rapids, IA 52401
 (319) 365-0030



PROJECT PROFILE

INFRASTRUCTURE UPGRADE

South Dakota School of Mines
& Technology
 Electrical Engineering/Physics
 Building Clean Room
 Rapid City, SD



John Huntley, P.E. is a Mechanical Engineer and Casper office manager. John has been with West Plains Engineering since 2008, and in that time designed dozens of mechanical systems for SD Mines. john.huntley@westplainsengineering.com

PRE-FAB LAB

West Plains Engineering designed the mechanical and electrical infrastructure for a clean room at the South Dakota School of Mines and Technology in Rapid City. The clean room houses research for the Physics Department, which focuses on astroparticle physics, muon and neutrino experiments, and the search for dark matter.

The pre-fabricated laboratory (clean room) was designed to fit an existing space in the Electrical Engineering/Physics building. The room includes a conditioned entry/gowning area, experiment pass through door, observation windows and epoxy coated flooring.

Our role in the project was to design the infrastructure that would support operation of the lab. Mechanically, the air supplied to the clean room is filtered through fan-powered HEPA filters. This required no upgrade to the existing building HVAC system, but the HVAC for the clean room itself involved humidity control for both humidification and dehumidification.

Electrically, we specified the ISO Class 7 lighting fixtures, and designed the expandable power and data connections for the ever-changing needs of the department.