WOODRUFF ENGINEERING

MAGNETS, POWER SUPPLIES & PULSED POWER FOR THE FRONTIERS OF SCIENCE AND ENERGY

Two decades of precision engineering for fusion energy, national laboratories, quantum research, universities and industry. Designed and built in Santa Fe, New Mexico.

Founded 2004
Dr. Simon Woodruff

ISO 9001:2015
Certified quality management

20,000 sq ft
Santa Fe, NM facility

woodruffeng.com
sales@woodruffeng.com

OUR STORY

TWO DECADES OF PRECISION ENGINEERING FOR FUSION AND BEYOND

Woodruff Engineering designs and manufactures high-performance magnets and power supply systems for the fusion energy and advanced industrial sectors.

The company was founded in 2004 by Dr. Simon Woodruff, formerly a post-doctoral researcher at Lawrence Livermore National Laboratory, with a simple mission: to do something useful in fusion. Starting in Seattle and relocating to Santa Fe, New Mexico in 2017, we have grown from a boutique scientific instrumentation provider into a critical supplier to next-generation fusion power initiatives in the United States and internationally.

Many of our engineers and advisors trained at Lawrence Livermore, Los Alamos and Sandia National Laboratories and at the UK Atomic Energy Authority. Across every project we apply rigorous, ISO-based risk mitigation and precision engineering standards.

Today, from our 20,000 sq ft facility at Santa Fe's Midtown Innovation Campus, we design, build and test every system in-house, from bench-top coils to megajoule-class capacitor banks.

2004
Founded by Dr. Simon Woodruff

20+ yrs
Building magnets and pulsed power systems

15+ yrs
Working with New Mexico's national laboratories

ISO 9001
2015-certified quality management on every project

OUR JOURNEY

2004
Founded in Seattle to build power supplies and magnets for plasma and fusion research.

2017
Relocated to Santa Fe, New Mexico, close to Los Alamos, Sandia and AFRL.

Today
Megajoule-class capacitor banks, high-field magnets and custom power systems, integrated from design to delivery.

Next
HTS confinement magnets and modular pulsed power for the first commercial fusion plants.

WHAT WE STAND FOR

Quality
Engineered for precision, performance and reliability, and built to exacting standards in the USA.

Commitment
Engaged from first concept through delivery and beyond, until every system performs as it should.

Integrity
Honest technical assessments and realistic commitments. We stand behind what we deliver.

Communication
Clear, regular updates at every stage, from specification and design review to test and handover.

PRODUCTS & CAPABILITIES

MAGNETS AND POWER SYSTEMS, DESIGNED AND BUILT IN-HOUSE

Every system is modelled electromagnetically, thermally and structurally before it is built, manufactured in Santa Fe, and factory acceptance tested before it ships.

Magnets

- **Helmholtz systems** — single-, two- and three-axis, 100–1000 mm and custom facility-scale cages; up to 500 mT per axis
- **Microscope-stage field systems** — 3-axis, ±3% over a 10 mm imaging volume, ≤10 °C rise
- **Calibration coils** for magnetometers and sensors
- **Solenoids and field-shaping coils** for plasma sources, mirrors and FRCs
- **Large water-cooled magnets and coil arrays**, including our 2 MW large racetrack Helmholtz coil
- **HTS magnet design** and prototyping

Power supplies & pulsed power

- **Capacitor banks** from kJ to MJ class, including modular megajoule banks for fusion developers
- **Pulsed power supplies** to hundreds of kV, with kA to MA peak currents
- **High-current DC supplies** — e.g. 5 kA / 60 V, 300 kW, <0.1% ripple
- **Water-cooled rectifier modules** — 1.6 MW per module, paralleled to multi-MW
- **Supercapacitor pulsed supplies** with programmable pulse profiles and energy recovery
- **Charging, crowbar, switching, protection** and Ethernet control

REPRESENTATIVE SPECIFICATIONS

Product	Key parameters
WE-PS-5KA60V DC supply	0–5,000 A, 0–60 V, 300 kW continuous; ripple <0.1%; Modbus TCP, RS-485, 0–10 V control
WE-RPS-1600 rectifier module	480 VAC 3-phase in; ≤1200 VDC, ≤1400 A per leg; 1.6 MW per module; >97% efficiency; water-cooled
Two-axis Helmholtz systems	20–500 mT per axis; nested 100–1000 mm coil pairs; ±0.2% regulation; AC to 500 Hz options
Microscope-stage field systems	3-axis, up to 80 G; ±3% over 10 mm cube; 1 mG resolution; Zeiss, Nikon, Olympus compatible
WE-CB capacitor banks	Modular kJ–MJ banks for fusion, HEDP and industrial pulsed power; phased or complete delivery

Full datasheets and specification forms are available on request. Custom configurations are our everyday work.

FUSION ENERGY

THE MAGNETS AND POWER SYSTEMS FUSION DEPENDS ON

Every fusion concept — magnetic, inertial or magneto-inertial — depends on two foundational subsystems: the magnets that shape and confine the plasma, and the power supplies that drive them.

We have designed and built both for fusion programs for more than a decade. Through our sister company, Fusion Advisory Services, we track the magnet and power supply requirements of more than 115 fusion programs worldwide, so we understand where your machine is heading, not just what it needs today.

A MARKET MOVING FROM R&D TO POWER PLANTS

$301M
Spent each year today on fusion magnets and power supplies

$15.7B
Projected annual market by 2036 as first-of-a-kind plants are built

~47%
Compound annual growth, 2026–2036

115+
Active fusion programs worldwide

Source: Fusion Advisory Services, Fusion Industry Market Report: Power Supplies & Magnets 2026–2036.

REQUIREMENTS BY CONFINEMENT APPROACH

MFE
Magnetic confinement

HTS coils need DC supplies of 10–80 kA per circuit, ±10–100 ppm stability, ripple below 0.1% and pulses of 100–10,000 s, with quench detection, fast energy extraction and four-quadrant operation.

IFE
Inertial fusion

Laser drivers need pulsed power at 5–15 Hz, where power conditioning and capacitor charging are 60–75% of power-supply cost, and reliability over very long shot lifetimes drives design.

MIF
Magneto-inertial & pulsed

Multi-megaampere pulsed power with nanosecond timing. Moving from under one shot a day to 0.1–1 Hz makes capacitor lifetime, solid-state switching and energy recovery critical.

FROM FIRST-OF-A-KIND TO FLEET

01
Specify

Physics requirements turned into a buildable, testable specification.

02
Design

EM, thermal and structural modelling, with costing through nTtau Digital.

03
Build & test

In-house manufacture and factory acceptance testing in Santa Fe.

04
Scale

Designs frozen for manufacture so cost falls with every unit.

GOVERNMENT & NATIONAL LABORATORIES

PART OF NEW MEXICO'S PULSED POWER AND MAGNET ECOSYSTEM

Santa Fe sits within about an hour of Los Alamos National Laboratory, Sandia National Laboratories and the Air Force Research Laboratory at Kirtland AFB. We have worked alongside this research community for more than 15 years.

LANL

Los Alamos

Our longest-standing laboratory relationship: magnets, pulsed power and control systems for plasma physics and fusion research, including a complete control and data acquisition system for the Laboratory Astrophysical Jet experiment.

SNL

Sandia

Home of the Z Pulsed Power Facility. The disciplines behind Sandia's programs — high-voltage capacitor banks, fast switching, power flow and diagnostics — are at the core of what we build.

AFRL

Air Force Research Lab

The Directed Energy Directorate at Kirtland leads high-power microwave research. We have supported AFRL pulsed power projects and supply HV pulsed power for directed energy test programs.

- ISO 9001:2015 quality management
- US-based design and manufacturing
- SBIR/STTR and government procurement experience
- Concept, simulation, build, FAT and commissioning

QUANTUM RESEARCH

STABLE, PRECISE MAGNETIC FIELDS FOR QUANTUM HARDWARE

Qubits and quantum sensors are only as good as the magnetic environment around them. We design bias coils, multi-axis Helmholtz systems and high-field HTS solenoids with uniformity specified over your working volume, low-ripple matched supplies, and non-magnetic designs that work around optical access, vacuum chambers and cryostats.

Trapped ions & neutral atoms

Bias fields, Zeeman shifting and field nulling around vacuum cells.

Spin qubits & NV centers

Uniform vector fields with per-axis control and rotating fields.

Superconducting qubits

Field cancellation, bias and HTS solenoids for cryogenic platforms.

Quantum sensors

Calibration coils and Helmholtz systems for atomic magnetometers.

ACADEMIA & RESEARCH

RESEARCH-GRADE MAGNETS AND POWER FOR UNIVERSITY LABS

From biophysics labs to plasma physics experiments, we design every system around your experiment — field strength, uniformity, working volume, access and thermal limits — and support grant proposals with detailed specifications and budgetary estimates.

Biophysics & live-cell imaging

3-axis microscope-stage systems with milligauss control and water-cooled axes.

Magnetometry & calibration

1-, 2- and 3-axis Helmholtz and calibration coils with matched multi-channel supplies.

Plasma & beam physics

Field coils (including in-vacuum), capacitor banks, pulsed power and control/DAQ.

> **"Simon and his team were highly responsive to our needs and remained engaged and helpful even after the coils were delivered."**
>
> Plasma physics research customer, on an in-vacuum Helmholtz coil system

INDUSTRY

POWER AND MAGNET SYSTEMS BUILT FOR PRODUCTION DUTY

The engineering behind our fusion and laboratory systems — precise regulation, robust protection and water-cooled power electronics — packaged for continuous industrial operation and integration with SCADA and PLC-controlled lines.

Electrochemical processing

Stable high-current DC for plating, electrolysis and cathodic protection.

Forming, welding & magnetizing

Capacitor banks and pulsed supplies matched to industrial duty cycles.

Testing & NDT

Regulated supplies for thermal and component testing; custom test magnets.

WHY CUSTOMERS TRUST US

ENGINEERING YOU CAN DEPEND ON

Our customers buy from us because the systems work, the numbers are honest and we stay with them after delivery.

- **ISO 9001:2015 certified** quality management, with fabrication drawings produced to ISO standards
- **Simulation before metal** — electromagnetic, thermal and structural models and field maps for every design
- **Factory acceptance testing** before shipping, with documentation and test data
- **Built in the USA** — design, manufacture and test in one Santa Fe facility
- **Protection by design** — interlocks, fault protection and safe energy discharge as standard
- **Support after delivery** — installation, upgrades and spares

Leadership

Dr. Simon Woodruff, Founder & CEO — more than two decades in fusion research and pulsed power engineering.

Alberto Castro, Chief Delivery Officer — responsible for production, delivery and customer projects.

A skilled team

Lead magnet, mechanical and electrical technicians, and a customer relationship manager, supported by advisors from the national laboratories.

Growing the next generation

Paid internships in mechanical and electrical engineering through Santa Fe Community College and the University of New Mexico.

"The system was expertly tailored to our needs... The hardware and services provided by Woodruff Engineering are among the most cost-effective in the industry. Highly recommended."

National laboratory research customer, on a control and data acquisition system

HOW A PROJECT RUNS

01
Requirements
Field, current, energy, duty cycle, interfaces and constraints.

02
Estimate
Budgetary estimate and preliminary design, quickly.

03
Design review
Engineering and manufacturing design reviews with you.

04
Build & deliver
Manufacture, FAT, delivery and commissioning support.

WOODRUFF ENGINEERING

LET'S WORK TOGETHER ON YOUR NEXT PROJECT

Tell us what you need to achieve — field, current, energy or schedule — and an engineer will come back to you with an approach and a budgetary estimate.

EMAIL

sales@woodruffeng.com

PHONE

(505) 407-3259

Monday – Friday

ADDRESS

Woodruff Engineering Inc.
1003 Midtown Calle Central
Santa Fe, NM 87505, USA

ONLINE

woodruffeng.com
linkedin.com/company/woodruff-engineering-inc

© 2026 Woodruff Engineering Inc. Specifications are representative and subject to change; contact us for current datasheets.