

NETL-RUA Scientist Designs Novel Monitoring System for Marcellus Gas Wells

One area of growth in the NETL-RUA research portfolio involves assessing the environmental impacts of shale exploration, drilling and production. Supported by NETL-RUA as part of the Air Quality effort of the NETL Environmental Team, one project, if deployed, will cost effectively ensure that thousands of Marcellus shale drilling sites comply with environmental regulations. Leading this project, with the support of researchers from NETL and URS, [Michael McCawley](#), a research associate professor in the WVU [Department of Community Medicine](#), has developed a monitoring system that enables remote gas wells to be monitored from the computer keyboard in his office, thanks to solar power and cell phones.



To demonstrate the power of his integrated monitoring technology, McCawley has placed three wireless monitoring modules—one upwind, one downwind, and one crosswind—at a test site in Washington County, Pennsylvania where a Marcellus well will be drilled. The modules will regularly measure and communicate data on dust and volatile organic compounds, as well as light and sound coming from the site. Each module in the system includes a radio transceiver, a monitoring device and a battery all packaged in

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E News is your monthly source for the latest information about NETL-RUA's research, activities, and other important news. If you have information that you would like to feature in future newsletters, send that information to julianne.klara@netl.doe.gov.

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NETL-RUA METRICS SNAPSHOT

CURRENT R&D PORTFOLIO

Coal Research	\$45,457,052
Oil & Gas Research	\$12,120,000

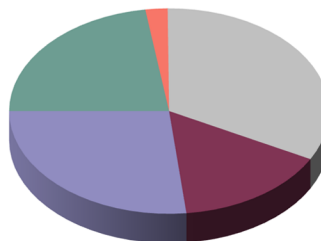
* R&D research portfolio values do not include ARRA funding

PRODUCTS

	FY2011	FY2012
Publications	194	10
Patents	11	2
Licenses	9	4
Students Graduated	20 PhD	9 PhD
	8 MS	6 MS

** Products data is updated quarterly

RESEARCH PERSONNEL



Total = 535



February 2012

Upcoming Events

February 13, 21, 27	Research Committee Meeting
2-3 p.m. EST	
February 15, 2012	Communications Committee Meeting
1-3 p.m. EST	
February 15, 2012	Business Development Committee Meeting
2-4:30 p.m. EST	
March 9, 2012	Spring NETL-RUA Meeting
8:30a.m.-4 p.m. EST	

Strategic Growth Area Update

Seed Funding Available for Two Areas

The NETL-RUA Executive Committee agreed in December on seed funding to invest in both the Grid Technology Collaboration and the Critical Materials and Rare Earth Alliance for Fiscal Year 2012. These resources will be used to aggressively develop other sources of funding with the ultimate goal of becoming self-sufficient.

The seed funding is a mix of cash dollars and in-kind contributions from all of the NETL-RUA Alliance partners. The cash dollars from the universities and URS will be “pooled” into operating funds at Pitt for the Grid Technology Collaboration and at Virginia Tech for the Critical Materials and Rare Earth Alliance to facilitate oversight and expenditure of the funds. Cash dollars from NETL to support seed research efforts in these areas will be managed according to current practice for the NETL-RUA. NETL is working with each of the Strategic Growth Areas (SGA) Team Leads to define the technical scope for the research projects. In-kind contributions will be kept in-house at each of the NETL-RUA partners for those expenditures that are more efficiently handled in that manner (e.g., SGA team member salaries and travel).

Total commitment of in-kind and pooled funds from all seven NETL-RUA members exceeds \$1 M for FY2012, with a breakout of approximate values as follows:

- Real dollars (\$878 K)
 - \$315K from the universities
 - Includes ~\$170K of University Energy Partnership (UEP) dollars for business development support and website development
 - \$23 K from URS
 - \$500K from NETL for research projects
- In-kind contributions from all NETL-RUA members totaling an estimated \$300K
 - Covers SGA team member salaries, travel, other expenses
- ~\$100K placeholder for proposal preparation for a Rare Earth Hub solicitation.

Commitment of funding is based on the following stipulations:

- The SGA Team Leads must provide a detailed plan for use of these funds for FY2012, and continued funding is contingent upon demonstrated return on the investment.
- The SGA Team Leads are expected to provide a role in the SGA for each of the Alliance partners (though any Alliance partner may elect not to participate in an activity).
- NETL will manage the research effort according to current practice for the NETL-RUA. Efforts that outline a clear path for winning new business, and/or that bring in industrial partners, will be preferred.

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one case small and portable enough to be hauled on an all-terrain vehicle and handled by an individual worker. A two-foot by five-foot solar panel (also portable) powers the system locally, and a base station module housing a small, notebook-sized computer receives data from various monitored locations. To test the system and establish a baseline for comparing changes in emissions, McCawley has been gathering data at the demonstration site for the past year.

In West Virginia alone, more than 1,400 Marcellus Shale natural gas wells exist from the State’s northern panhandle to the heart of its southern coal fields. Drilling permits have been issued for another 1,200 and the count keeps climbing. In Pennsylvania the numbers are higher, with over 5000 drilling permits currently issued. Often, the terrain makes the sites difficult to work in and the lack of nearby power and phone lines makes them impossible to monitor using traditional systems. “Now you can monitor where it makes the most sense technically,” McCawley said. “Also, because the system is so portable, it can be rapidly deployed even in emergencies.”

McCawley has been at the forefront of air pollution and occupational health for more than three decades. “Energy can be developed in an environmentally sound manner and that involves quality control. We need to give industry the right tools to control the development of this energy resource,” said McCawley. “Companies could see a lot of benefits from the system. They could monitor their sites 24-7 to detect problems early when they are easier to handle. And, they could promote good community relations by making the data publicly available on their own websites.”



New CT Based Multi-Scale Imaging Capability Now Operational at NETL

NETL-RUA researcher Dustin McIntyre and colleagues have installed and started up a new industrial Computed Tomography (CT) scanner facility to complement the existing imaging capability. CT scanning uses X-rays to image the internal structure of objects along with digital geometric reconstruction to generate three-dimensional representations.

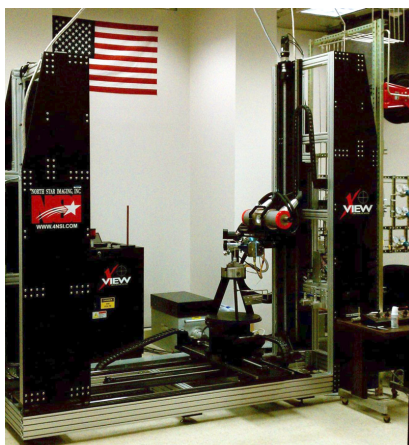
Prior to the new industrial CT scanner, NETL-RUA researchers and several industrial partners have been using a retrofitted medical CT scanner to visualize geologic samples, mimic fluid flow within fractured rock cores, and a myriad of other applications over the past eight years. Joint CT scanning studies have been performed with researchers at the University of Pittsburgh, West Virginia University Penn State, Princeton, Texas Tech, and the University of Kansas; and work with material science researchers and several industrial partners have kept the equipment in high demand. While great research has been performed with this medical scanner, the millimeter scale resolution of the reconstructed images was rather poor compared to available technology.

> See **NEW CT BASED MULTI-SCALE IMAGING**, *Page 3*

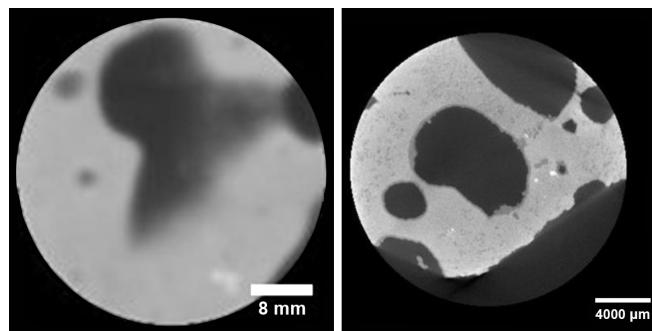
>> **NEW CT BASED MULTI-SCALE IMAGING**, *Continued from Page 2*

In 2010, NETL acquired a micro-focus CT scanner that enabled ultra-high resolution images to be obtained. However, this micro CT scanner is limited to analysis of rather small samples.

The newest addition, an industrial CT scanner, enables large samples to be scanned with a resolution on the order of 10's of microns. The improved level of detail combined with the extensive working knowledge of NETL-RUA will enable greater applications of scanning technology in NETL-RUA research activities and will result in new activities that extend the limits of CT scanning analysis.



Another unique capability of the industrial scanner facility is the ability to mimic flow at pressures observed deep in the Earth's subsurface for geologic flow studies. The ability to visualize 3D fluid migration within geologic cores has been critical to experimentally developed estimates of CO₂ storage capability in various formations and in estimating flows of various fluids through fractured rocks. The industrial CT scanner will enable these fundamental physical phenomena to be explored with greater precision, informing the important technological questions of the future, such as the expected performance of CO₂ reservoirs.

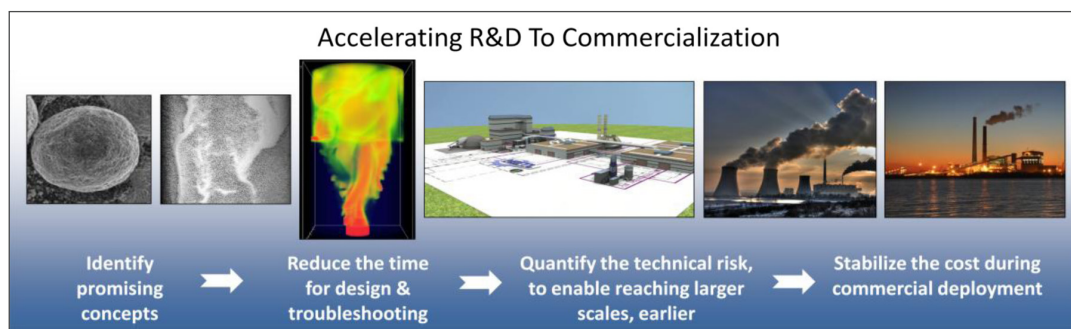


Reconstructed images from the industrial scanner enable a more detailed view of a Grand Ronde basalt core taken from the [Columbia River Basin Basalt Group](#).

NETL Building Powerful Computational Capability to Accelerate R&D

NETL is proceeding to develop a supercomputing [Simulation-Based Engineering User Center \(SBEUC\)](#) at NETL's Morgantown, West Virginia campus. The SBEUC project, funded under the [American Recovery and Reinvestment Act](#) (ARRA), will advance the NETL-RUA collaborative objective of having a unique and state-of-the-art capability for predictive design of thermo-mechanical processes.

NETL has, in recent years, developed a unique multi-scale approach to simulation of combustion and power generation processes, one that promises to dramatically accelerate development and deployment of sustainable carbon capture and reuse technology. The SBEUC represents a unique facility that will further enhance NETL-RUA's tradition of leading edge research on predictive engineering applications for the energy sector.



The SBEUC will have the capability to run modeling tools at various scales from computational chemistry at the molecular scale, through computational process simulations, to enterprise models; all linked to form a truly predictive virtual plant model. The SBEUC will integrate existing facilities to provide enhanced visualization, data analysis, and data storage capabilities for users at the three NETL research sites with access by researchers at NETL-RUA university campuses. The SBEUC will be powered by a high performance computing (HPC) system allowing researchers to simulate phenomena that are difficult or impossible to probe experimentally (e.g., coal jet penetration into a gasifier). The very large (terabyte) datasets that result from such simulations will become accessible to researchers along with advanced visualization hardware and software.

The SBEUC project is aiming to startup the new facility in early 2013. An NETL/URS Integrated Project Team (IPT) identified several changes to the original design during project development, including reduction in the use of power with lower wattage processors that reduce electricity consumption without reducing performance or increasing cost.

Awards and Student Achievements

(Recognizing the Outstanding Achievements of our NETL-RUA Contributors)



Congratulations to NETL-RUA grad student, **Elizabeth Chapman** for successfully defending her Ph.D. dissertation at the University of Pittsburgh on November 21, 2011. Her thesis, titled *"Fossil Fuel Related Water-Rock Interaction in the Appalachian Basin, Pennsylvania and New York: A Geochemical Strontium Isotope Investigation,"* examined the use of isotopic ratios to fingerprint geologic fluids of interest in the Marcellus gas production area. Chapman worked with University of Pittsburgh Professor [Rosemary Capo](#) on the Geochemical Tracers project as part of **NETL-RUA's Quantitative Monitoring, Verification and Accounting (QMVA) Research Team** and contributed five posters, two podium papers, and is the primary author on a recently submitted journal article. Dr. Harry Edenborn of NETL's Geosciences Division represented NETL on her thesis committee.

Kudos to NETL scientist, **Gordon Holcomb**, who was awarded **The Don Waters Engineer of the year for 2011** by [National Association of Corrosion Engineers \(NACE\) Western Area](#). The award was announced at the 2011 NACE Western Area Conference, November 9-11, 2011, in San Diego, California and recognized Holcomb's contributions to both fundamental and applied corrosion science. Holcomb was honored for his research on corrosion control for steel-reinforced concrete bridges—including the Yaquina Bay Bridge in Newport, Oregon, the Richmond-San Rafael Bridge on the San Francisco Bay, and the Perley Bridge in Ontario, Canada—as well for materials used in natural gas pipelines and coal-fired power plants retrofitted to capture carbon dioxide in response to climate change. Holcomb is a materials engineer with **NETL-RUA's Advanced Combustion Research Team** and is located at the Albany, Oregon site.



[Jeen-Shang Lin](#), associate professor, geomechanics and geotechnical engineering at the University of Pittsburgh, [Swanson School of Engineering](#), recently presented findings on Rock Cutting Mechanics at the 2011 American Institute of Chemical Engineers (AIChE) annual meeting in Minneapolis, Minnesota. Lin's group at the University of Pittsburgh has collaborated with NETL researchers to develop a modeling framework to better understand the mechanics of rock cutting during drilling for oil and gas. Essentially, the complex rock cutting process has been decomposed into repeated sequence of four challenging problems: contact detection, material failure, crack initiation and propagation, and fragmentation. This modeling activity uses a unique approach that combines both continuum and discrete methods to understand the rock cutting process. Results from both approaches compare reasonably well with experimental data. Lin presented the findings using a computer-generated movie that simulated the rock cutting process using both the discrete and continuum approaches. Lin is a member of **NETL-RUA's FY2011 Extreme Drilling Team**.



Plan to Attend the NETL-RUA Spring Meeting

You are cordially invited to attend the NETL-RUA Spring Meeting on March 9, 2012, at the Waterfront Place Hotel in Morgantown, West Virginia.

This year's theme is **"Growth Through Collaboration."**

The morning plenary session will provide an overview of the NETL-RUA strategic approach to growing the R&D portfolio, a snapshot of FY2012 programmatic objectives, and highlights of NETL-RUA accomplishments and success stories. A networking session will be open to all attendees during lunch. The afternoon session has been set aside for collaborative meetings of the NETL-RUA research teams and standing committees.

The meeting is open to all NETL-RUA member organizations. The deadline for registration is Thursday, Noon (EST), March 1, 2012, and the cost of registration is \$20. Visit <http://netldev.netl.doe.gov/business/events> for the agenda and hotel information, and to register online.

There are no restrictions for foreign nationals attending this meeting with the exception of foreign nationals from the countries of Sudan, Cuba, Iran, or Syria, which by DOE Order 142.3 are prohibited from attending.

For those who are not able to attend the meeting in person, the morning plenary session will be webcast. Check the NETL-RUA ["News & Events"](#) web page that day for instructions for connecting to the event webcast.

