

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

Dear Homestake Collaboration,

Welcome to the May monthly newsletter for Homestake DUSEL and South Dakota's Sanford Laboratory. We would like to receive your input on news, links to news articles, upcoming workshops, conference notices, scientific updates, information concerning the Collaboration, and other highlights relevant to our shared goal.

IMPORTANT DATES

June 2-4, Majorana collaboration meeting, Sanford Lab

July 10, EHS meeting, Sanford Lab

NEW LOCATION

In June, the Berkeley office will expand its primary location on the UC Berkeley campus. We will occupy a major portion of the third floor in a building on Bancroft Way. We will still maintain office space at LBNL. More details in the near future.

SURFACE INFRASTRUCTURE ALTERATIONS AND UPGRADES

Working with Scott Lewis, the project prepared and issued an RFP for an assessment of existing Homestake surface facilities, including all campus infrastructure and existing buildings. Seven proposals were received. A committee including Steve Dangermond, Scott Lewis, Richard DiGennaro, Michael Headley, and Elizabeth Freer chose three firms to interview: Miller Dunwiddie, ARUP, and HDR CUH2A. Interviews took place at Sanford Lab, after which HDR was tentatively selected to perform the assessment, pending execution of an agreement and refinement of the project scope to conform to the available budget. Staff prepared a priority list of existing buildings to focus on assessment of those most important to planning and which have the largest degree of uncertainty about the existing conditions, with an aim to minimize risk moving forward.

The surface master plan was further developed with Steve Marks and Dave Plate working to identify needs for cryogen facilities. Latest iteration of the surface master plan was reviewed with Dr. Kevin

Lesko, Richard DiGennaro, Steve Marks, Dave Plate, and Michael Headley. A 3D CAD model of the surface topography and facilities was developed to study building massing configurations.

Programming activities continued which included a detailed telephone survey and analysis of conferencing and guest house/user lodge facilities at other labs. Also covered were refinement of Laboratory Population figures in consultation with Richard DiGennaro and Kevin Lesko, and an update of the program based on the latest information for inclusion in the next round of RFPs.



Figure 1:
Preparing for the Laser Survey of the 300L in April

Infrastructure for Underground Operations and Research Space

Development of the 3D Geo-Structural Model: The preliminary 3D structural model of the geology and rock structure is being developed by Drs. Lisenbee and Terry, SDSM&T. Terry, Bill Roggenthen and Zbigniew (Ziggy) Hladysz performed verification inspections of the 4100L.

Geotechnical Site Investigations–RESPEC Contract: The first phase of site investigations at the 300L has been successfully completed. The work involved surveying, laser scanning and manual, walk-through geology mapping of the Kirk drift, the Ross shaft station, and a section of the Oro Hondo drift for a total of 1400 ft. The field crew included personnel from RESPEC, Maptek and Lachel Felice assisted by SDSTA. Manual geology mapping included measurements of rock lithology, locating and identifying, faults, shear and weathered zones, and measurements of the orientation, spacing and persistence of joints and other discontinuities. Laser scanning consisted of scanning of exposed surfaces and simultaneously taking high resolution photographs. Data analysis and development of

computer models were scheduled to be performed and completed by the end of May.

New Contract Extension: A scope change to the existing RESPEC contract was completed. The changes in scope include: a) items that were incorporated in the original RFP, but not included in the current contract, and b) new tasks associated with the LBNE large cavities.

Facility Monitoring Plans: Monitoring of the DUSEL facility will be necessary in future as various aspects of the project are being developed. A process to develop a monitoring framework is in the planning stages and various components for monitoring have been identified.

Site Visits

Four site visits were conducted in April. The first occurred April 6–9, where the following systems were investigated: Waste Water Treatment facilities, Facility Ventilation Infrastructure, Ross and Yates Shaft furnishings. A second visit took place April 13–16 and focused on Geotechnical Site investigations within the following areas: 800L - from the Ross shaft to the Yates shaft, 1250L – around pump room, 1700L – from the Ross shaft to the truck shop and LMU38 storage area, and 2000L – from the Ross shaft to about 500m northwest of the Cal Tech experiment. A third visit occurred April 24–26. This visit continued with assessment of shaft furnishings within the Yates and Ross shafts. The final visit took place on April 28 following up on EH&S components of the assessment and interviewing Susan Von Stein.

Yates Shaft upgrades

Sydney De Vries completed 1) the preliminary analysis of major upgrades to the Yates Shaft to comply with Civil Engineering Standards, 2) the scoping document for analysis of various options for Yates shaft upgrades as well as a comparison of Yates shaft deepening vs new Winze excavation and construction and initiated 3) work on a more detailed analysis of Lab ventilation requirements.

Research Instrumentation and Equipment and Experimental Requirements

On April 13-15, Dr. Steve Marks and David Plate attended a collaboration meeting for the LAr TPC long baseline neutrino detector at FNAL. A concept

for a cryogenic system for a 100kT detector was presented, including cryogen storage, handling and delivery.

On April 29 – May 1, Drs. Steve Marks and Richard Kadel attended a workshop at the University of Wisconsin to discuss cavity liner options for the water Cherenkov long baseline detector. Dr. Kadel presented information on the cost of excavations for the liner, fiducial volume cuts, and preliminary calculations on the cavity deck. Dr. Kadel was tasked with writing a document defining the fiducial volume of the detector and a proposal for the free cavern radius and height.

Three options for the Yates shaft hoist system as presented in the April newsletter were evaluated as part of a cost-benefit study considering the support for access and transportation of scientific equipment and the estimated cost of the various options. Construction plans for a set of model experiments are being used to determine the support each option provides for the installation of the ISE. The first is based upon the 1997 Redpath study. This option maintains the current dual cage configuration but replaces the timber structure with steel, inserts a concrete liner, and adds an automated personnel lift. Option 2 consists of a single super cage replacing the current dual cage configuration and an automated personnel lift. While the increased cage size will accommodate larger objects, additional hoist and headframe modifications will be necessary to accommodate increased weights. Option 3 includes a cage that can accommodate a standard shipping container. Access for a personnel lift would be from the back side. This option will require an upgrade to the hoist and headframe.

Meeting at Berkeley

On April 30, a preliminary design review meeting took place at Berkeley. Issues of concern included vetting of proposed staffing levels, staffing skills, and levels of outsourced engineering and design required to complete the preliminary design. Dr. Alan Paterson chaired the review.

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

"Critical milestone": 4850 Level dry

South Dakota Gov. Mike Rounds made the announcement himself on May 13: The water level at the Sanford Underground Science and Engineering Laboratory had dropped below the important 4,850-foot level. He called it "a benchmark day in the quest to convert the mine into a world-class laboratory for underground science. Sanford Lab crews began hazard inspections of the 4850 Level within days, and they reported that ground conditions look good. Crews are already "mucking" (removing) sand that had collected near the Ross Shaft and in other areas.

The Davis Cavern, which is mostly below the 4850 Level, will have to be pumped dry, and Sanford Lab crews have cleaning and infrastructure repairs ahead of them, but reaching the 4850 was a major step toward reopening Homestake for DUSEL. "It's a critical milestone for the Sanford Lab and ultimately for the NSF's national laboratory," DUSEL Principal Investigator Kevin Lesko said.



Figure 2: Top of Davis cavern (1)



Figure 3: Top of Davis cavern (2)

Early 4850 Science Moving Forward

Dewatering the 4850 Level also was a big step toward installation of the LUX dark-matter detector, which is slated for the Davis Cavern. Meanwhile, preparations are under way to refurbish a Homestake warehouse into a surface facility for the LUX collaboration. Construction is set to begin in June.

The Majorana collaboration, which will share the 4850 Level with LUX, planned a meeting at Sanford Lab June 2-4, and nearly 50 participants are expected.



Figure 4: Shop on 4850

Gravity Lab Expands

Dr. Riccardo DeSalvo of Cal Tech, Dr. Vuk Mandic of the University of Minnesota and their colleagues with the Deep Underground Gravity Laboratory (associated with LIGO) have installed three new seismic instruments at the Sanford Lab. They have also installed new environmental monitoring equipment and a data acquisition computer. DUGL has instruments on the 300 Level, the 800 Level and the 2000 Level, and the collaboration plans to expand to the 4100 Level.

Transparent Earth Paper Presented

Graduate student Jason Van Beek (SDSMT) presented a paper, "Rock Mechanics and Subsurface Imaging at DUSEL Homestake Mine" at the 3rd Canada-US Rock Mechanics Symposium Toronto in May. The authors are Jason Van Beek, Dr. Bill Roggenthen (SDSMT), Dr. Steve Glaser (UC Berkeley) and graduate student Mario Magliocco (UC Berkeley) -- all of the Transparent Earth project.

Transparent Earth will be especially useful during large-cavity excavations at DUSEL. "We'll be able to measure seismic activity to predict potential

hazards," Van Beek says. Transparent Earth also is measuring earth tides -- which, like ocean tides, are a response to the moon's gravity. The project's instruments have been connected to fiber cable to provide Internet access to data. For example, Mario Magliocco set up instruments to e-mail him in Berkeley in the event of problems on the 2000 Level. When the instrument e-mailed "I'm hot," Magliocco called Van Beek who fixed a malfunctioning fan on his next trip underground.



Figure 5: Jason Van Beek

The paper also included findings by Dr. Larry Stetler (SDSMT) and Dr. James Volk (Fermilab).

Van Beek has made more than 50 trips underground during the past year, assisting the Transparent Earth team and several other experiment collaborations.

NASA Grant for 4850 Biology

Dr. Cynthia Anderson of Black Hills State University and Dr. Sookie Bang of SDSMT have received NASA funding to conduct baseline analyses of the biota at the 4850 Level -- including soil seeps and biofilms. Sanford Lab personnel identified low-cost sampling options.

Dr. T.C. Onstott from Princeton is organizing a trip to the site July 1-2 with several researchers (including Dr. Anderson from BHSU and Dr. Susan Pfiffner from the University of Tennessee at Knoxville). Drs. Onstott and Pfiffner will share sampling techniques used in South African gold mines.



Figure 6: Drift on 4850

South Dakota DUSEL Center Meets

The South Dakota DUSEL Research Collaboration adopted a new name: the Center for Ultralow Background Experiments at DUSEL or CUBED. The collaboration held their first collaboration meeting May 19-20 at the Sanford Lab. Nearly 40 participants attended. One of the main goals for CUBED is grounding low-background germanium and cadmium crystals.

Sanford Lab Infrastructure

Contractor RCS Construction has reached the 2000 Level in the Yates Shaft, contractor CAI started work on an Underground Hazard Mitigation project, a power-distribution upgrade is under way (on the surface and underground) and a new deep-level pumping system is operating in #6 Winze, a shaft that drops from the 4550 Level to the 8000 Level.

The Sanford Lab IT Department also completed the planned switch from the state of South Dakota's computer network to an internal network. (Note: Sanford Lab e-mail addresses have changed. Follow the model (First Initial)(lastname)@sanfordlab.org -- as in BHarlan@sanfordlab.org).



Figure 7: Historic 4850 sign

EDUCATION AND OUTREACH

The Sanford Underground Sanford Lab held two "Angels and Demons Lecture Nights" in May. CERN organized these lectures worldwide to mark the opening of the new Tom Hanks-Ron Howard movie of the same name. In the movie, bad guys steal anti-matter to blow up the Vatican. The public lectures were organized to tell the real science story. Sanford Lab Director Jose Alonso, who worked on the ATLAS Detector at LBNL and at CERN, spoke in Rapid City and Spearfish. Nearly 350 people attended the lectures.

Davis-Bahcall Week

Planning is in full swing for Davis-Bahcall week at Sanford Laboratory and SDSMT the first week of July. Ten Davis-Bahcall scholars, top science students from across the state of South Dakota, will be spending a week at Sanford Laboratory, a week touring CERN, Frascati Accelerator Laboratory and Gran Sasso in Europe, and three weeks studying modern physics at Princeton University along with 20 Italian students. The quality of the students was so high that 20 runner-ups were chosen as well. These students will participate in Davis-Bahcall week, followed by several days at either Brookhaven National Laboratory or Fermilab. Funding of the Davis-Bahcall Scholars program is through a donation from 3M Corporation.

While at Sanford Laboratory, the students will receive their first taste of modern physics with introductory lectures and activities on atomic structure, nuclear, particle and astrophysics, neutrinos and dark matter. They will also plan and implement an underground experiment.

Quarknet

The new BHSU/Sanford Lab Quarknet center is starting up this summer at BHSU under the direction of Kara Keeter. Two teachers, Mark Farrand (Rapid City) and another instructor from Aberdeen have been chosen for the first year's activities, which consist of a one-week 'boot camp' at Fermilab, followed by a research experience at BHSU. The teachers will be working with Kara and other faculty at BHSU on an improved technique for determining very low levels of contaminants in the noble gases needed for some of the detectors planned for DUSEL.

Milestone Reached at Sanford Underground Lab (May 13, 2009 Press Release – Bill Harlan, Communications Officer)

LEAD, SD. -- The water level at the Sanford Underground Science and Engineering Laboratory at Homestake reached the 4,850-foot level today, Gov. Mike Rounds announced.

"This is a benchmark day in the quest to convert the mine into a world-class laboratory for underground science," the Governor said. "The historic Homestake Mine yielded 40 million ounces of gold before it was shut down in 2001, but it will someday yield something more valuable than any precious metal: knowledge about the universe and the world around us."

South Dakota Science and Technology Authority Executive Director Ron Wheeler said a four-member crew inspected the level. "The water at 11 a.m. this morning was 2 inches below the 4,850-foot level," Wheeler said. A hazard assessment crew walked more than a kilometer from the Ross shaft to Yates shaft. "They report the ground conditions look good," Wheeler said. "We have some sand built up around the Ross station, but it won't be hard to remove."

The Ross and Yates shafts run from the surface to below the 4,850-foot level. (A "station" is where the shaft accesses a "level" of horizontal tunnels.)

Deep labs protect sensitive experiments from cosmic radiation, and Homestake is 8,000 feet deep. Shafts called "winzes" connect the 4,850-foot level to deeper levels. (See Figure 8 below.)



Figure 8: Left to right: Infrastructure Technician Bill Heisinger, Engineering Project Manager Willy McElroy and Mining Engineer Bryce Pietzyk. Sanford Underground Laboratory hazard-assessment crew poses on the 4850-foot level in front of Six Winze.

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Homestake was slowly filling with water until last year, when the South Dakota Science and Technology Authority (SDSTA) began pumping it out. The high-water mark was 4,530 feet underground. The water level has been lowered 320 feet since then. The SDSTA is reopening Homestake to the 4,850-foot level, and the National Science Foundation (NSF) is considering a proposal to make Homestake a national underground laboratory, with facilities from the surface all the way down to 8,000 feet underground.

"There is broad statewide support for the Sanford Laboratory," Gov. Rounds said. The state Legislature approved about \$40 million to develop the underground lab, and South Dakota used a \$10 million federal grant to rehabilitate the Ross Shaft, which is 5,000 feet deep. The governor said the effort to turn the mine South Dakota Science and Technology Authority 2 into the deepest laboratory in the world took a giant step forward in 2006, when T. Denny Sanford pledged \$70 million for the project. "T. Denny Sanford's generosity has been a key ingredient in the success and progress we've had to date with this monumental project," the Governor said.

Sanford, a Sioux Falls businessman and philanthropist, said many people deserved credit for reaching the 4,850-foot level. "I am overwhelmed that this level and a whole new world has been opened up for the benefit of mankind," he said. "How marvelous! My congratulations to all of the very dedicated people, past and present, who made this happen."

Sanford also noted that the dewatering at Homestake continues despite heavy spring snow and rain. "My hat is especially off to Gov. Rounds and to Ron Wheeler for their efforts in creating this but also for making certain that it happened on schedule, in spite of the weather in Lead."

"Access to the 4850 Level will allow us, in the near future, to start construction of the Sanford Underground Lab," Wheeler said. Hazard assessments will continue for about 30 days, before construction begins. The first physics experiment at the 4,850-foot level will be the Large Underground Xenon detector, or LUX, which will search for a mysterious substance scientists call "dark matter."

Dr. Kevin Lesko, a physicist at Lawrence Berkeley National Laboratory and the University of California

at Berkeley, is leading the team of scientists and engineers who are designing the proposed national laboratory at Homestake. "This celebration recognizes the tremendous efforts by the SDSTA in regaining access to the 4850 Level," Lesko said. "It's a critical milestone for the Sanford Lab and ultimately for the NSF's national laboratory. It allows the re-introduction of physics experiments into Homestake – the birthplace of neutrino astrophysics." The late Dr. Ray Davis won a Nobel Prize for physics in 2002 for a neutrino detector he installed at the 4,850-foot level. The LUX detector will use the same cavern excavated for Dr. Davis in 1965. "We are naturally led to remember Ray Davis, and we quickly recognize strong parallels with Governor Rounds' support and leadership in creating the Sanford Lab," Lesko said.

Wheeler credited the Sanford Underground Lab staff for today's milestone. "The actual achievement of dewatering the Homestake mine to this level has been accomplished by the hard work of all the employees of the Sanford Underground Lab," Wheeler said. He noted that many of those employees previously worked at the Homestake Mine. "They have worked countless long hours in difficult conditions, including blizzards, to keep pumps and equipment running. They have pumped and treated hundreds of millions of gallons of water to get us here. When you work with people that are this capable and dedicated, it makes you proud to be part of the Sanford Underground Lab family."

Wheeler also acknowledged Sanford's generosity, Gov. Rounds' commitment and strong support from the state Legislature and the citizens of South Dakota. "Tremendous public support here has helped us win support throughout the country," he said.

Sanford's \$70 million donation stipulated that \$20 million be used to create a science education center on the campus of the Sanford Underground Laboratory. Planning for it is under way. SDSTA Board Chairman Dave Bozied (pronounced boh-ZAYD) said he and fellow board members felt especially privileged to be part of a project that will have a profound effect on education. "The Sanford Underground Science and Engineering Laboratory will change the future of science education in South Dakota, and the lab's impact will be felt around the world," Bozied said.

Sanford said it was also gratifying to see how the project is revitalizing Lead, contributing to growth in the South Dakota Science and Technology Authority 2 Black Hills and helping to grow the economy of the entire state. "I am so very proud to have my name on an organization that will mean so much to mankind in the future," he said. "I thank everyone involved." ♦

ENVIRONMENT, HEALTH, AND SAFETY

Environmental Compliance and Environmental Impact Statement Efforts

Spill Prevention, Containment, and Countermeasure (SPCC) training was developed and provided to all employees this past month during the monthly EHS talk. SPCC inspections were performed for April.

The Water Discharge and Monitoring Report was prepared and sent to the State and EPA. There were no permit exceedences. A Whole Effluent Toxicity (WET) test was completed for the 1st quarter. There will be no permit exceedences. The May compliance calendar was generated for the Waste Water Treatment Plant (WWTP) operators. A new compliance spreadsheet was prepared for ammonia compliance at discharge rates over 2000 gpm.

Integrated Safety Management

A work plan and confined space permit was developed for the large Baker Sand Filter(s) and confined space and LO/TO safety training was provided for Boss Hydrovac, Donovan Construction, and DOC employees involved with this project. A safety training session was held for Donovan, and others concerning excavations. Daily toolbox safety talks continue to be held with both shift operators and Jim Whitlock. Weekly toolbox safety talks were held with Nancy Geary.

Cultural Outreach

Dr. Bill Roggenthen, Peggy Norris and George Campbell traveled to Kyle, SD to meet with Albrecht Schwalm, Lagarry Hannan, Charles Jason Tinent, Gerald Giraud and Deig Sandoval from OLC. The purpose of the trip was to discuss projects that would be beneficial to OLC and DUSEL. The following projects were discussed: use of the OLC Robot; use of XRF unit; use of Lidar camera; water sample analysis; and teaching classes (perhaps starting next spring).

Dr. Bill Roggenthen and George Campbell discussed the overall progress of the DUSEL project and Cultural Committee work with Dr. Schellenkamp, President of BHSU. BHSU has about 160 American Indian students, and excellent biology and chemistry programs including well equipped biology and chemistry labs and a strong math program. Bill Roggenthen and George Campbell met with Janet Carter and Dan Driscoll, USGS, to discuss their participation.

Connie Giroux, Peggy Norris and George Campbell staffed a table on April 17 and 18 at the 26th annual Lakota Omniciye Wacipi (powwow) at Black Hills State University. Jace DeCory, BHSU, suggested to have the appropriate ceremonies to release any spirits from the mine and to continue the DUSEL work. One medicine man said he was willing to discuss further regarding these ceremonies.

NEW STAFF

Dr. Kem Robinson has recently joined the DUSEL Project team as Deputy Project Director for Design and Construction. He is taking a leave of absence from his role as Engineering Division Director at LBNL to serve in this capacity. Kem, a senior scientist/physicist, has been at LBNL since January 1999. In addition to being the Engineering Division Director, Kem has been Laboratory Project Management Officer, Principal Division Deputy of the Accelerator and Fusion Research Division, and Deputy for General Sciences Projects. Kem also served as a member of the Technical Subcommittee of the original 2000 Bahcall National Underground Science Laboratory Committee.

Before coming to LBNL, Kem was a Principal Research Scientist at a small scientific R&D company that was a spin-off from the University of Washington. He was one of three employees who organized a buyout of the company from the Amoco Corporation and successfully ran the company as its Vice President of Technology Development for six years.

Kem received his doctorate in Physics from Stanford University working on storage-ring free-electron lasers (SRFEL) and was a member of the team that successfully operated the first SRFEL.

Please join us in welcoming Kem to DUSEL!

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DUSEL appointed **Dr. William Pariseau** as the new Geotechnical Advisory Committee Chair. Dr. Pariseau will lead and coordinate all GAC activities, and provide advice and assistance to the DUSEL Geotechnical Manager.

Call for Scientists interested in Education and Outreach

DUSEL Education and Outreach is organizing a special interest group of DUSEL scientists interested in participating in education and outreach activities at Sanford Laboratory and later DUSEL. They are often looking for a scientist to talk to a group of students or teachers, or collaborate on other activities. This can often take place over a video link but this can also take advantage of your trips to Lead for collaboration meetings or early science. E-mail pnorris@sanfordlab.org if you are interested in being on a distribution list to receive periodic updates on planning for the Sanford Education Center and notices of speaking opportunities.

Newsletter Editor: Melissa Barclay

Contributors: Kevin Lesko, Bill Harlan, Kem Robinson, Ben Sayler, Peggy Norris, & George Campbell. Special thanks to Bill Harlan for Figures 1-7. Underground Foreman Jack Stratton provided Figure 8 photo.

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