

Homestake DUSEL and Sanford Laboratory Newsletter December 2007

Dear Homestake Collaboration

November and early December brought many significant changes to Homestake DUSEL and the Sanford Laboratory. The period kicked-off when the broader scientific community met in Washington, D.C. for a Town Meeting to conceptualize and baseline the Initial Suite of Experiments (ISE), as well as to help define the case for DUSEL. November was a month of major personnel changes beginning with Dave Snyder's announcement of retirement as the SDSTA Executive Director. Also during the month of November, a number of key staff positions were filled at SDSTA, including Dr. Jose Alonso as the Laboratory Director for the Sanford Underground Science and Engineering Laboratory at Homestake. The first week of December brought the SDSTA Board and a South Dakota Congressional Delegation to Berkeley to tour the LBNL site and the UC Berkeley campus, to meet with Senior Lab and Campus personnel, and to learn of the operations required for a national user's facility. Please read on for the more details!

Important Dates

**Homestake DUSEL Workshop, April 21-28,
2008 Lead, South Dakota**

Re-entry Diary

The SDSTA Board Goes Underground

The South Dakota Science and Technology Authority Board of Directors and senior personnel toured the progress being made at the Ross Shaft on Friday, November 16. They viewed old and new shaft sets and studdles, as well as utilities on their way down to the 1250 level pump station. Dynatec project manager Jason Teuscher, and SDSTA site manager Greg King led the group.



Continuing Progress

The motor and pump have been installed at the 1250 level; electrical hookups will be completed in a few weeks. First tests of the pumping system are expected by the end of December, and will serve to commission the pump column from 1250 level to the surface, and the flow line to the mill reservoir.



Dynatec crews continue removing and replacing cage compartment steel sets; they are currently working close to the 1750 level. Stabilization of abandoned water columns is on-going, with installation of collars around the pipes at 150 foot intervals anchored to plates secured to the rock wall of the shaft. The 1250 and 1400 levels have been completed.



Notes from SDSTA

On November 16, Dave Snyder, SDSTA Executive Director for the past three years, informed the Board of Directors that he intends to retire upon the Board hiring his successor. One of the original Board members appointed by South Dakota Governor Mike Rounds in August 2004, Dave Snyder took over the reins of the Authority upon the retirement of Dr. Richard Gowen for an agreed-upon six month period that lasted three years. In a letter to the Board Chairman, Dave Snyder listed the following accomplishments he and the Board have made in the past three years:

1. *Creating a strategy that positively differentiated Homestake from the other contending sites.*
2. *Negotiation of the donation of the Homestake mine property with Barrick Gold Corporation and taking possession of it following the generous donation by Homestake Mining Company.*
3. *The South Dakota Legislature funding \$19.9M allowing for the creation of the interim laboratory.*
4. *Mr. T. Denny Sanford's \$70M donation to develop the interim laboratory and further secure our competitive advantage over the other contenders.*
5. *The Board decision to re-enter the mine and pump the water to secure the 4850 level for science.*
6. *The long awaited selection of Homestake by the National Science Foundation as the one and only designated site for the potential Deep Underground Science and Engineering Laboratory (DUSEL).*
7. *Re-entering the mine to rehabilitate the infrastructure and pump water, which is a work in progress with more than 30 contracted employees plus many other contributing outside contractors.*

Homestake DUSEL and Sanford Laboratory Newsletter December 2007

- 8. The Board decision to build the interim laboratory with the \$65M in controlled funds.*
- 9. The recent Board decision to hire the necessary staff to develop, operate and manage the interim laboratory.*

The entire Homestake DUSEL Project team is deeply grateful for all of the many contributions of Dave Snyder to the Homestake DUSEL project. Dave's contributions have been integral in the realization of a Homestake DUSEL and the project's success to date.

New Homestake DUSEL and SDSTA Hires

Dr. Jose Alonso



Dr. Jose Alonso is now the Laboratory Director for the Sanford Underground Science and Engineering Laboratory at Homestake. He will serve as chief executive with responsibility for the startup and overall operation of the Sanford Laboratory. The underground laboratory will host multidisciplinary science research experiments at various levels down to the 4,850-foot level of the former Homestake gold mine.

Dr. Alonso is a physicist with experience in establishing new laboratories and operating large user facilities. He began work at Lawrence Berkeley National Laboratory in 1972, where he participated in heavy element work and the management of large accelerator facilities, including the Bevalac, a large accelerator facility with an extensive international user community. In 1994 he served on a three-man senior management team for the Spallation Neutron Source. He earned a Ph.D. in Nuclear Physics from M.I.T. in 1967 and was a co-discoverer of Element 106, Seaborgium.

Tom Regan

Tom Regan was hired as Operations Safety Officer for the Sanford Underground Science and Engineering Laboratory at Homestake. Tom will inspect and make recommendations dealing with the environmental, health, and safety conditions related to mine re-entry, water pumping and treatment, infrastructure needs of experiments, and surface building renovation. He will also be providing information, training, and technical assistance to employers and visitors to the Sanford Laboratory on

the issues of public health, environmental protection, and workplace safety.

Tom Regan has been a safety consultant to the Authority since 2004 and Safety Director to Homestake Mining Company, where he worked in various capacities for 38 years. He is certified as Mine Safety and Health Administration (MSHA) trainer and serves on the board of Black Hills Safety Association, as well as the Lawrence County Emergency Planning Committee.

Todd Seaman

Todd Seaman, an engineer for the past 23 years with South Dakota Department of Transportation (DOT), has been hired as Director for Contract Management at the Sanford Laboratory. Todd Seaman will be responsible for developing and administering contracts for the laboratory, as well as for surface building renovations. A civil engineering graduate of the South Dakota School of Mines and Technology, Todd has worked for the South Dakota DOT since 1984 in various engineering and supervisory capacities. In his most recent position as Rapid City Region Engineer for DOT, he has been responsible for preparing and monitoring the Rapid City Region's \$90 million annual operating, equipment and construction budgets.

William (Jack) Stratton

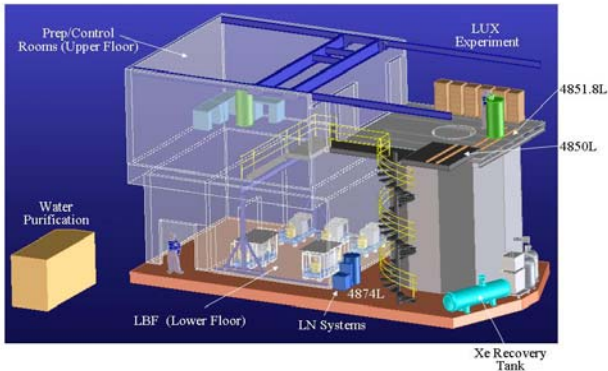
William "Jack" Stratton began work November 26 as Project Administrator charged with providing oversight of shaft re-entry work, working on a daily basis with Dynatec. William Stratton worked for Homestake Mining Company for 31 years, beginning as a cager (elevator operator) and then as a shaftman doing weekly inspections and maintenance, as a shaft supervisor and eventually as shaft foreman. For twenty of those years he was in charge of the four main shafts: the Ross, Yates #4 and #6. He scheduled time and manpower to provide safe movement of personnel, as well as mined ore to the surface.

Stratton, who also owned and operated a business in Spearfish, South Dakota, earned a Bachelor of Science degree in business with an emphasis in accounting from Black Hills State University.

Homestake DUSEL and Sanford Laboratory Newsletter

December 2007

Davis Lab & EIP Experiments



The figure above shows the conceptual design of the LUX Experiment and a Low Background counting Facility (LBF) within the Davis Lab on the 4850 level. The liquid xenon detector will be located at the center of a six meter diameter by six meter tall water tank. The upper floor of the adjacent building will be used as an assembly and preparation area for the LUX experiment as well as a control room. The lower floor will become a low background counting facility.

Planning continues on locating other experiments such as Majorana during the Early Implementation Program on the 4850 level.

Washington Town Meeting

Over 200 scientists and many federal officials gathered in Washington, D.C. for the DUSEL Town Meeting on November 2-4, 2007. An open meeting at the National Academy of Science on the first day gave DUSEL scientists and proponents the opportunity to express support for DUSEL to interested federal officials. During the following two-day scientific workshop, participants started the process to conceptualize and baseline the Initial Suite of Experiments (ISE) and to help define the scientific case for DUSEL. The workshop provided a venue for federal officials to obtain feedback from the scientific community on the proposed process for defining the ISE before drafting the full solicitation, to be posted in early 2008. Meeting information, posted slides and white papers can be accessed from http://cosmology.berkeley.edu/DUSEL/Town_meeting_DC07.

The list of distinguished speakers at the open meeting included SD Governor Mike Rounds, SD Representative Stephanie Herseth-Sandlin, SD Senator John Thune, and Matt Varilek representing SD Senator Tim Johnson, all of whom spoke of the very supportive and enthusiastic atmosphere in the

political and academic communities of South Dakota. The roundtable discussion with Governor Rounds towards the end of the day was a particularly inspirational high point in the opinion of many attendees. Governor Rounds spoke of a long, very positive history of relationships between the State of South Dakota and the Homestake mine, including one year in which the mine operators voluntarily increased their tax contributions when an agricultural disaster threatened very low tax revenues from farmers. He also described the pheasant hunt during which Mr. Sanford graciously offered to donate \$70M towards the development of the lab and an education and outreach center. Governor Rounds pleaded with the scientists and federal officials present to bring the "spark" of scientific excitement to the children of South Dakota.

Many officials from the NSF, the DOE, and other agencies were present to give presentations and participate in round table discussions. NSF officials, Jack Lightbody, Deputy Assistant Director, Mathematical and Physical Sciences, Joseph Dehmer, Director, Division of Physics, and Jonathan Kotcher, Program Officer, described the Major Research Equipment and Facilities Construction process and progress with DUSEL. In order to stay on schedule to begin construction in early FY11, the DUSEL preliminary design would have to be put before the National Science Board in spring 2009. The NSF representatives explained that DUSEL is the highest priority in the NSF Division of Physics. Naturally, other divisions may have different priorities. DUSEL is certainly not a done-deal, and will require a cutting-edge Initial Suite of Experiments in addition to substantial sustained support from the scientific community. They stressed that there will be "zero tolerance" for budget overruns, and that staying on schedule is a major concern. DOE representatives present included Dennis Kovar, Acting Associate Director, Office of High Energy Physics and Gene Henry, Physics Research Division Director. They expressed strong support for underground science and were supportive of the NSF's efforts to create DUSEL.

During the scientific workshop held Nov. 3-4, attendees broke into discipline oriented working groups to begin to conceptualize the multiple experiment programs for the DUSEL ISE. The meeting format encouraged several rounds of active working group discussions, with time in between to hold plenary round table discussions with NSF, other officials and the DUSEL management teams to clarify the process and process requirements. Quickly the conclusion was reached that the original

Homestake DUSEL and Sanford Laboratory Newsletter December 2007

hope of NSF officials to have a fully resource-loaded work breakdown structure, cost, schedule, and risk assessment and management plan for each component of the ISE in time for the National Science Board review in late 2008 was very optimistic. With construction scheduled to begin in 2011, and customized laboratory space not available for a year or two after that, in many subfields the ISE represents the next experimental generation, for which the optimal technology and detailed plans depend on the outcome of current international experimental efforts. The different disciplines are exploring a variety of approaches to mitigate the time challenge. Proposals for the different experimental programs are required to give sufficient detail to give confidence that their science goals can be achieved while staying within their funding profiles.

With this in mind, the working groups began to assemble whitepapers describing their experiment programs for the ISE. From this effort, a baseline for the ISE was initiated. Three areas of "flagship science" were identified: neutrinoless double-beta decay searches, dark matter searches, and biological experiments on "dark life". The neutrinoless double-beta decay program makes a strong case for experiments in two isotopes, ^{76}Ge and ^{136}Xe , deploying on the order of 1 ton of active mass. The goal for the dark matter program includes at least two experiments with sensitivity to WIMP cross sections below $10^{-46} \text{ cm}^2/\text{nucleon}$. This field in particular is rapidly advancing with a broad range of detector technologies currently ready for deployment; the conceptual design for the DUSEL ISE depends to a large extent on the outcome of the current generation. The biological experiments include deep boreholes to 16,200 ft below the surface, as well as a series of other experiments, such as bioassays in pristine fracture zones. The Dark Life effort will help address questions about what forms of life exist in environmental extremes, the interaction between microbial and chemical environments, and just how deep life can be found. The neutrinoless double beta decay will probe questions of neutrino mass and whether the neutrino is its own antiparticle. Dark matter experiments will search for direct evidence of the unknown ~20% of the matter of the universe.

A number of other fundamental scientific ventures were discussed and proposed. Earth science and engineering proposed "Transparent Earth" experiments to test earth modeling and imaging techniques in four dimensions (space and time) on length scales never before attempted. They

proposed fracture experiments and coupled-processes (thermal, chemical, hydrological, pressure and biological studies), as well as large cavity engineering R&D efforts. In physics, a strong case was made for an underground accelerator to measure reactions near the Gamow peak. These reactions are essential for understanding nucleosynthesis. Low energy solar/geoneutrino experiments and supernova neutrino searches were deemed an important contribution to the ISE. A program to build a megaton detector for proton decay and long-baseline neutrino oscillation studies was also cited as a strong candidate for the ISE. Strong synergisms with geoengineering efforts were noted. Science with even a single large cavity could begin as part of DUSEL's ISE.

In addition to the discipline-specific experimental programs, a second series of working groups convened to discuss cross-cutting issues that affect many efforts lab-wide. A group interested in low radioactivity materials identified the need for low background counting and assay, and clean materials fabrication at DUSEL. These services will also require staff for operation and integration with the experimental programs, and coordination with other entities (such as ILIAS in Europe). Another group identified ~15 science topics which did not fit into any specific scientific discipline but are compelling enough to warrant further investigation for inclusion in the ISE. In some cases these involve Homestake-specific opportunities. A passionate theory working group recommended setting up a local theory group dedicated to DUSEL-related topics, for example neutrinoless double-beta decay matrix elements and proton decay half-life predictions from different GUTs models. The theory group strongly advocated establishing a series of workshops and summer schools focused on DUSEL science goals.

The entire suite of exceptional experiments discussed at the Town Meeting was roughly estimated to be on the order of \$500M. Many of these experiments are highlighted in the Deep Science report. This takes into account not only the NSF's MREFC, but could also include contributions from other U.S. and international entities, and other organizations such as DOE, NASA, USGS, DHS, DOD, EPA, MSHA, USDA, NIH, etc. NSF officials stressed that there will be several opportunities to downselect at the PDR and FDR stages of the project, but that there will also be additional on-ramps into the DUSEL and the ISE.

A series of workshops have been scheduled in Lead, SD for April 21-28, 2008 with the purpose of

Homestake DUSEL and Sanford Laboratory Newsletter December 2007

further defining the ISE. Additionally, a Center for Underground Science is being set up initially in Berkeley to help facilitate planning and communication as the working groups prepare for the PDR. It is expected that the Center will open in early 2009.

Homestake in the News

Rapid City Journal October 17, 2007

<http://www.rapidcityjournal.com/articles/2007/10/17/news/top/doc471594d4bc43e964815300.txt>

Argus Leader October 16, 2007

<http://www.argusleader.com/apps/pbcs.dll/article?AID=/20071016/NEWS/71016049>

Rapid City Journal October 24, 2007

<http://www.rapidcityjournal.com/articles/2007/10/23/news/local/doc471eba5029a97934403442.txt>

Rapid City Journal October 31, 2007

<http://www.rapidcityjournal.com/articles/2007/10/31/news/local/doc4729512591d54358126799.txt>

Associated Press November 4, 2007

<http://www.rapidcityjournal.com/articles/2007/11/04/news/top/doc472e7a44f34f3573975651.txt>

Rapid City Journal November 17, 2007

<http://www.rapidcityjournal.com/articles/2007/11/17/news/local/doc473dc9543f480558258469.txt>

Rapid City Journal November 17, 2007

<http://www.rapidcityjournal.com/articles/2007/11/17/news/local/doc473e631f9348e705427695.txt>

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Information about underground science workshops, conferences, experiments and job opportunities should be sent to djacobs@lbl.gov.