Response to Panel Review of Proposal 0528025: DUSEL-Cascades:

Site Suitability

Availability of space for facilities: All surface facilities will be constructed on the Peshastin Mill site, which borders both Highway 2 and the BNSF railroad, and is close to hotels in Peshastin and Leavenworth. The Port of Chelan, the owner and the County's economic development agency, has offered the site to the UW. Also, the Peshastin Water District is willing to supply water for both the surface and underground campuses. The project architect favors placing both the Science Campus and Visitor Center on the Peshastin site, because of economies from shared common spaces, such as the cafeteria and auditorium. (Mark Urdahl, Port Executive Director, is available to confirm site availability: 509-663-5159.)

Costs*:* We hope the Panel has evaluated **three** cost differentials between sites: **construction, laboratory operations, and experiment construction**. *Because the 2003 NSF panel did not evaluate laboratory operations and experimental costs, many in the high-energy physics community rejected the report's cost conclusions.* S-1 also emphasized operations costs. DUSEL-Cascades costs compare as follows:

- ***Construction costs for access****:* As detailed below, Cascades requires less tunneling than other sites to reach the deep laboratory location. This lowers costs and time-to-depth.
- ***Operations utility costs****:* Because of its very low power costs ($0.016/kW-hr), Cascades enjoys a typical 40-year utility advantage over other sites of **$120M**. (This assumes an average power of 5MW and a national-average cost of $0.084/kW-hr. Costs for competing sites range up to $0.14/kW-hr.)
- ***Operations manpower costs****:* Horizontal-access facilities have much lower manpower costs for operations/maintenance than vertical facilities like Homestake: published Cascade and Homestake manpower requirements (24/7 operations) are 21 and 57 FTEs, respectively (after Homestake hoist modernization). The 40-year cost differential is **$114M** in current-year dollars ($79K/loaded FTE/y).
- ***Experimental construction costs****:* Drive-in access through clean tunnels is a major cost saver – by many estimates, vertical access through a mining environment cost the SNO group about 100 person-years – 50% of the 4-year delay. *The integrated effect over many experiments may be the dominant cost difference between sites*. San Jacinto and Cascades have the most efficient access.

Such a cost/benefit analysis argues for a **purpose-built, horizontal-access facility**, engineered for efficient 24/7 access, power use, and maintenance/operations, meeting S-1 safety and 30-year-site-stability goals.

To compare **construction access requirements**, we have compiled the following table of tunneling needs:

Site	*Depth (mwe)*	*Rock (est. density)*	*Tunnel length (km)*	*Grade*	*Δ(depth) (ft)*
Cascades	6540	Granitic (2.9)	**4.9 (TBM)**	-8%	+1280
San Jacinto	7060	Granitic (2.9)	7.5 (TBM)	+0.5%	-120
Henderson	5640	Gran. porphyry (2.5)	7.5	-9%	+2165
Kimballton	5830	Limestone (2.55)	16.1* (TBM)	-10%*	+5300
Soudan	7120	Greenstone (2.85)	17.5 (TBM)	-14%	+8200

(*As Kimballton did not give a gradient, we chose -10%, which then determines the tunnel length.) While every site must provide dual access to depth, some do so with two tunnels, while others provide one plus a shaft. Thus a uniform comparison is the single-tunnel length. Δ(depth) is the incremental depth obtained by downgrade tunneling to meet DUSEL S-1 depth requirements.

The Cascades site has the shortest tunnel length. The two flat or nearly flat (Kimballton) sites have long tunnels, with lengths depending on the chosen gradient. San Jacinto has the advantage of a positive gradient (0.5%), but some drawbacks because the proposed alignment cannot be fully explored. Henderson's 7.5 km of tunneling is an internal ramp: to reach their ramp entrance one uses the mine hoist and ramps to the 7065 ft level. The access is considerably more complicated than the table suggests. One could combine such a table with appropriate costs/meter of tunneling to determine access costs, then follow with an assessment of the resulting quality of the access, to estimate associated experimental costs.

One proposed deep site does not appear on the table because its cost-of-access issues are different. In the 2003 Homestake Reference Design the cost of hoist/shaft improvements to provide a modest hoist footprint of 11 ft by 12 ft (not the S-1 6.1m-container standard) to the 7400-ft level totaled $50M. The current proposal estimates dewatering at $50M, and the mechanical systems for the #4 and #6 shafts must be replaced to restore access below 4850 ft. These are some of the costs for re-establishing Homestake access.

Frontier-Kemper (F-K) made the DUSEL-Cascades TBM cost estimate. The access costs assume an average advance rate of 22.5m/day, and include tunnel support, sealing, drainage, and concrete floors, but exclude haulage (costed separately in our proposal). The F-K estimate for the 6.0-m-diameter tunnel is $9.1K/m. The two access tunnels thus total $90M. The TBM will reach the lab site in approximately 220 days: laboratory excavation can then begin. Thus access is fast, with all boring completed in 475 days. F-K costing assumed that the deep rock at Cashmere would prove to be as competent as the granodiorite at Pioneer Tunnel: F-K was given foot-by-foot maps of Pioneer Tunnel support, geology, and hydrology.

The Panel termed Cascades costs as ***"extremely expensive."*** It would be helpful to us if the Panel could provide its analysis leading to this conclusion, perhaps following an outline like that given above, including the operations costs. ***Because of Panel construction cost concerns, we have now posted, behind the Ref. 8 WBS, the full set of project cost sheets, showing 5-yr project construction/operations NSF costs of $300M, a figure below some NSF estimates for this project.*** The sheets include room excavation, mechanical, electrical, safety, and communications costs. In the case of access, we checked F-K estimates against a comparison set of about 30 TBM projects, some quite similar to Cascades, e.g., the Nancy Creek Tunnel [at-bid project cost (2002) of $7.88K/meter – a 5.63m, 12.5 km long tunnel, through good quality granite with three significant shear zones, concrete lined and modestly supported, but at flat grade]. Four nationally known engineers re-examined our costs this week, with Panel comments in hand, and concluded our $90M access cost is credible, given our rock-quality assumptions.

Cost uncertainties: However, we agree it is fair to assign ***at this point in the evaluation a reasonable uncertainty*** to excavation costs for the Cascades site. The F-K rock-quality assumption was deemed plausible because of the Cashmere surface geology (more uniform than above the Pioneer Tunnel) and the general consistency of construction records among all seven previously excavated batholith tunnels. F-K believes it took into reasonable account the complications and uncertainties posed by our -8% gradient.

But this assumption must be validated by a comprehensive program of exploration. The S-2 proposal described year-one exploration. ***The full three-year program, including the deep holes to the laboratory site, is detailed in the Refs. 1,8. We hope the Panel recognizes the extent of the proposed exploration program.*** We understand both the cost of this program and the limited capacity of the NSF to support exploration: the UW is prepared to make a *substantial investment to complete exploration* in a timely way.

Rock disposal: The Panel report refers to environmental problems with spoil disposal. Both the US Forest Service and Goodfellow Construction have expressed interest in all of our rock. Both have storage pits and crushers in the area, well beyond the required capacity, and fully permitted. The rock is an excellent mix for USFS local quarry gravel because the latter is too rich in "fines." The rock is very low in sulfides.

The one environmental issue apparent to us, trucking, has been re-evaluated in the economic analysis work recently commissioned by the Port and UW. The facts: The truck route is entirely over County and State roads. Both entities *strongly* support DUSEL-Cascades. The DUSEL traffic averages 44 trucks/day for 2.6 years, comparable to that generated by the nearby County gravel pit (30 trucks/day). Current traffic counts on the haul route are 3149, 2685, and 1062 vehicles/day. Thus DUSEL will increase traffic by 1.4-4.1%, depending on the location along the road. The economic consultants will label the impact as not significant. Several mitigation options will be examined during the environmental review process.

Schedule: Our schedule calls for completion of exploration/analysis by 1/08 and pre-construction permitting by 6/08. The NSF advice (M. Turner) conveyed to proposers by the S-1 leader (see Bernard Sadoulet's 3/04/05 posted DUSEL.org talk) is that FY09 is "the most optimistic DUSEL starting date." This appears to conflict with the FY08 date that the Panel has been given. Our exploration and permitting schedules were predicated on an FY09 start, and would need to be re-examined for an earlier start.

Local support, opposition: Local decision-makers for DUSEL-Cascades are (1) the ***State of Washington*** (e.g., CTED and the Dept. of Ecology) and (2) ***Chelan County***, including the Port Authority, the Chelan County PUD, and the Peshastin Water District. All have been extremely supportive of DUSEL-Cascades (see posted letters on the web site). These two groups will form the project's local government partners in the next phase. In addition, two groups may participate during the public environmental review process: (3) ***state-wide environmental and recreational groups*** and (4) ***Chelan County residents***.

Group (3), typically the most effective large-project opponents, includes the Sierra Club, the Wilderness Society, National Audubon, the Mountaineers, and several Land Conservancies. They have met regularly with us for the past 18 months, and recently suggested a partnership to advance their goals and DUSEL: partial funding by the UW for acquisition of private inholdings near our portal, as mitigation for our use, and UW advocacy with the County for this proposal. We intend to accept. (Doug Walker, Board Chair of REI, noted environmentalist, and discussion leader, is available to discuss the plan: 206 664-2514.)

Most of group (4) either supports the project or would like the project to go through technical studies and environmental review to establish its suitability. *We stress that all of the established groups that have taken a position* – chambers, educational and business groups, and the Port – *have supported DUSEL-Cascades*. Chelan County has a strongly conservative, pro-development history. One group – the Icicle Valley Protection Society (IVPC) – has formed to oppose DUSEL. It is a single-purpose group composed primarily of Leavenworth residents living near Icicle Creek Road. IVPC operates a web site and a kiosk on Icicle Creek Road, where the group lobbies any visitor who stops to write the NSF and UW to oppose the project. The group has become increasingly extreme in the past few months, charging that DUSEL will harbor radioactive waste, Level III biohazards, etc. The group has approximately 30 core members and perhaps 50 others that attend some meetings. In part because of the misinformation coming from IVPC, a second group, Citizens for Science and the Environment, has recently formed. This pro-DUSEL group, which believes it represents the majority of Leavenworth citizens as well as the 96% of County residents who live outside of Leavenworth, is focused on science and education advocacy and on supporting the established environmental review process.

Permitting and timescales: Our plans provide three years for the SEPA/NEPA/permitting process. This was based on advise from the US Forest Service, which stated the process could require up to three years. We included a complete timetable and map of the permitting process in our S-2 proposal (Ref. 5).

Washington State is regarded as a national model in SEPA/NEPA and permitting. Its highly structured process delineates specific timelines for public input and appeals. The State's most controversial, reviewed, and litigated projects include the Port of Seattle's Third Runway, Seahawk Stadium, the Mariner's Safeco Field, King County wastewater treatment facilities expansion, and the three-county Puget Sound light rail. The Third Runway was the largest and most litigated SEPA/NEPA case in the State's history, involving vigorous opposition by city governments, new project-related environmental legislation by the State, massive public opposition, and an urban excavation 25 times larger than DUSEL. Environmental review, permitting, and litigation was concluded in five years. We believe our three-year estimate for DUSEL-Cascades is consistent with the State's track record for permitting similar projects.

Communications and the NSF: The UW has a detailed plan for continued public outreach including a lecture series (beginning with talks by Lawrence Krauss, Warren Buck, Paula Heron, Lucy Fortson), a regular set of radio and newspaper columns, and the establishment of a DUSEL Office in Leavenworth. The UW has decided to hire a highly capable public relations firm to work with local government and the community, so that project scientists can focus on an engineering proposal once an S-2 decision is made.

The opposition NIMBY group has become increasingly strident in an attempt to prevent the established process of public review from commencing. We do not see a role for input from such a group in S-2 proposal review – especially when the group's views are at variance with the conclusions of the recently completed public process, conducted by the State and Chelan County, and expressed unanimously by the Port's elected commissioners in their resolution. As the NSF told one of our Senators, when she inquired about submitting a supporting letter, unsolicited input is not appropriate for or relevant to the S-2 process.