

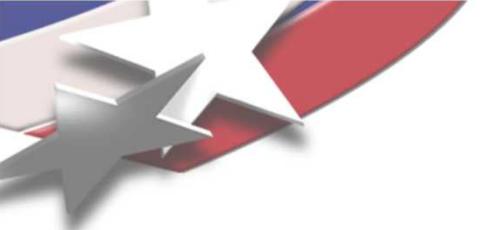


Response to April 2007 Engineering Sciences External Panel Review

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Summary Feedback

- The ERP felt that the **research presented was of world-class quality**. The ERP saw outstanding scientists throughout the course of the review and found that numerous presentations demonstrated a high level of innovation.
- The ERP found that the ESRF is focused on problems of **critical importance to Sandia and the nation**. **Relevance to mission** was seen for both individual presentations and the entirety of the portfolio as presented. The ERP expresses its concern, however, that **Engineering Sciences (ES) may be hamstrung by any future decreases in access to high performance computing**. Addressed in Director overview.
- The ERP found that **ESRF research is well-managed**. Strategic direction is appropriate, the portfolio is balanced, and appropriate processes are in place. The ERP believes that the quality of management is validated by the high morale exhibited by the Technical Staff.
- The ERP stresses the immediate need to incorporate uncertainty quantification into the ES culture. Illustrated in W76-1 qualification presentation.
- The ESRF is to be commended for its contributions to drive broad national interest in modeling and simulation. The group must continue to make progress in terms of applying computational modeling within its core customer base – i.e., Sandia's nuclear weapons (NW) system and component designers. Addressed in discussion with Panel, SAND read ahead. Paulsen committee.
- The ESRF may benefit from additional strategic high-quality academic partnerships. Addressed in Director overview, ES strategic plan.
- In regards to the issue of hiring foreign nationals, the ERP was unanimous in wanting management to have the flexibility to make decisions appropriate to circumstances. There are clearly practical barriers to incorporating foreign nationals as active members of the ESRF community, and the ERP is not in a position to evaluate the inherent tradeoffs and make a specific recommendation. The ERP can say with confidence that maintaining a world-class research organization with only US citizens will be a major challenge. Addressed in Director overview.





Suggestions for Future ERP Meetings



- The format of the dinner meeting (i.e., limited attendance and open conversation) was very productive – the ERP encourages continuation of this format in future years. [See Agenda](#).
- The lunch session with staff was extremely helpful. It may be even more helpful if it is moved to breakfast (or if a second session is added, i.e., roundtables at both breakfast and lunch). ERP members would like to spend more time with the ESRF staff. [See Agenda](#).
- The theme overviews by Level 1 Managers need to be structured to show how the portfolio is being managed. ERP members want to know about milestones and gaps: essentially, the game plan. ERP members should not hear summaries of ensuing technical talks; instead, they should hear about the entirety of the portfolio, and how the sampled areas (i.e., those being presented in detail) fit into the portfolio. [See Agenda](#).
- A round-table with program managers (i.e., ES' internal customers) could be helpful in giving the ERP a customer perspective. [Not addressed](#).
- The ERP would like to see a greater variety of presenters from ESRF's technical staff. The staff is obviously strong and deep, and the ERP would like a greater breadth of interaction. [See Agenda](#).
- The ERP would like to see more explicit evidence of the requirements for and use of HPC in the various presentations. [See discuss in ES Strategic Plan](#).
- Technical talks need to include more white space – fewer slides, fewer words, and more time for questions. [See Agenda](#).
- The ERP appreciates the opportunity to contribute its time and expertise to Sandia's ESRF, and understands that the span of the review requires ERP member's undivided attention. However, the ERP would like to suggest adding a break before the dinner session to allow ERP members to attend to voicemail and email. [See Agenda](#).

How relevant is the research to Sandia's mission?



1. The ESRF is working on problems of critical importance to Sandia and the nation. The ESRF showed clear and compelling evidence of the linkages between individual technical projects and future program needs. It appears to the ERP that there is an appropriate balance between short and long term research as presented. This is a significant improvement from previous sessions, when the ERP felt that greater emphasis was needed on high-risk and early-stage “discovery” research.
2. In addition, the ERP notes that some of the problems (e.g., predictive electrical response) are not otherwise being addressed by more than a small number of groups; in these cases where the community is small, Sandia's research efforts are all the more relevant. ES management is working other organizations to address issues of critical mass and collaborations. Addressed in overview.
3. The ERP does note that the ESRF should ensure that this balance is maintained as mission priorities change over time. The anticipated larger role of non-NW sponsors may require ES to do more outside of its traditional focus area. Will be addressed in overview.
4. A concern of the ERP is the extent to which Sandia maintains access to high performance computing. This concern is expressed in relation to the current operating environment, but also with an eye to pending decisions on consolidation by the NNSA Advanced Simulation and Computing (ASC) program. The ERP feels strongly that Sandia must maintain a robust computing capability; anything short of this will impair Sandia's future ability to fulfill its mission. The ERP's collective experience is that to do so in an off-site manner is likely to be detrimental to the ability of Sandians to perform science. High-end computing and predictive modeling are so closely intertwined that it is seems likely that to do one without the other will put Sandia and the programs that rely on its world-class engineering capabilities at a disadvantage. To be addressed in overview.
5. Finally, the ERP notes that the relevance to mission will be increased by the extent to which computational simulation is fully embedded in the NW product engineering lifecycle. ESRF research is contributing to this important goal appropriately. Panel discussion and read-aheads to address this.



How well is the research managed?



- As noted above, the ERP feels that ESRF activities show world-class quality and are well-tied to the mission. High-quality, mission-led research is *prima fascia* evidence of outstanding ESRF management.
- The ERP felt that research is well-managed in various specific aspects.
- The ESRF is focusing on clearly identified research themes, and has determined paths to success (though the path could, in some cases, be better articulated).
- The ERP felt that the ESRF includes an appropriate balance of funding allocated bottoms-up (i.e., Laboratory Directed Research and Development funding) and top-down (i.e., tech base and campaign funding). In terms of the top-down decisions, it appears to the ERP that sound judgment was used in determining investments. In terms of the Laboratory Directed Research and Development (LDRD) funding, the process followed by the Research Foundation was conducive to strong and relevant activities.
- An additional validation of the quality of management was the extremely high morale exhibited by the technical staff. ERP members had numerous unmediated interactions with staff (including a set of hour-long lunchtime roundtables, and the poster session). The technical staff is very enthusiastic. The opportunity to do high-quality research is the driver; ERP members continually heard about this as the factor in drawing talent to Sandia. Management (especially Level 1 line managers) appears to deliberately – and effectively – protect technical staff from bureaucracy and non-technical concerns. This approach does not come without a cost, of course: **the role of Line Manager at Sandia is clearly a very challenging position, and the morale of the Level 1 Managers is somewhat impacted by the uncertainty in budgetary issues and in the related mission goals.** A topic for the lunch meeting with the panel.
- In short, the technical staff appears to be provided with an environment conducive to innovative research.





Incorporating Uncertainty

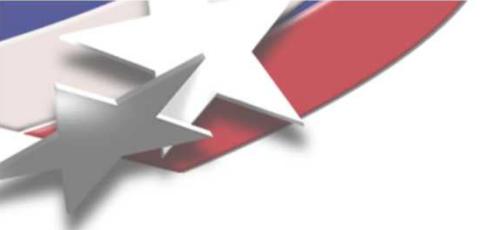
- The presentation on W76-1 ISL was a tour de force in the use of simulation and the quantification of uncertainty. The ERP commends Sandia on this work. It solved a significant problem, and in doing so provided a validation of the strategy embraced by the ESRF over the last decade. In fact, several ERP members noted that this work might be of broad interest as a case study on the power of and the “right way” to do engineering (although the ERP also notes that the nature of the work may make this difficult and/or undesirable).
- **That said, the ERP raises the question of whether statistics / uncertainty quantification have been inculcated in the ES culture. We hope to show you improvement in this area in our strategic plans and presentations.**



Translating Modeling/Simulation Leadership into Design Activity



1. As the issue becomes a national and international trend, it is important that Sandia redouble its focus on ensuring connectedness to the Sandia mission. In particular, the ERP wishes to emphasize the importance of making progress incorporating ESRF techniques into the front end of the design cycle. Read ahead's – ESRF discussions.
2. The W-76 ISL presentation raised a question in this respect: could the need for the ESRF “save” have been avoided? ES was brought in near the conclusion of the design phase. ES provided its customer with an elegant computational simulation-based answer to a problem that was simply not feasible to address experimentally. However, the real goal for ES is to use modeling and simulation to *avoid* these sorts of issues – and the very need for the ESRF to provide a “save” on the shock/lock issue illuminates the point that modeling still has much progress to make in terms of inclusion early in the design/build process. The “save” also re-illustrates the need for high-end HPC to model at the NW level, not just at the component level. Obviously ESRF management is well aware of this point. **However, the ERP notes that it hopes it will see discussions in future sessions which trace how this activity is included at the start of the design cycle. The ESRF needs to ensure that it is in the business of preventing fires, not just extinguishing them. This will be part of our panel session. See Sand report on design and COMP sym.**



Partnerships



- As noted earlier in the report, the ERP has high confidence in ESRF technical capability. While in general the ERP saw evidence of good connectivity with academia, it appeared to the ERP that there were areas where Sandia could benefit from additional strategic partnerships, specifically with top-tier researchers. ERP members would like to express their willingness to share particular suggestions as requested by the ESRF. **Will be addressed in Ratzel/Carling overview.**
- There was evidence of impact of research on industry, both from technical presentations and from the experiences of individual ERP members from industry. To the extent that ES wishes to increase its activities with industry partners, the National Institute for Nano Engineering (NINE) appears to be a very attractive vehicle (as evidenced by companies – including Corning and 3M – that are already participating, as well as by the attractiveness of the value proposition). The ESRF should be commended for its role in leading this effort.
- **Addressed in overview**



Predictive Electrical Response

Theme



- The ERP was unsure what to make of the contributions of the electrical theme. On one hand, the group is doing significant work to meet the Sandia mission and broader national needs. Moreover, it is work that very few others are (capable of) doing. On the other hand, it appears to the ERP that the group may still lack critical mass. The ERP saw only a limited number of relevant presentations, and therefore cautions that its assessment should not be taken as definitive. The ERP also lacks the nuanced view of ESRF requirements to make a specific recommendation on how to proceed. However, the ERP does identify the issue as a topic for ESRF management to consider.
- ESRF leadership is beginning to address political and stewardship issues around the EE/EM area and be will addressed during overview.



"The Best and the Brightest"



- We still struggle with the issues around foreign nationals.
- Second, the ERP acknowledges the complexity of the issue.
- Nearly all of ES-relevant facilities in New Mexico are in a Technical Area. Moving outside the fence would mean losing physical proximity to the NW system designers, which would in turn detract from the ESRF strategic goal of encouraging early use of modeling and simulation within the engineering design process.
- Routine matters of staff deployment will become more complicated with foreign nationals as a significant part of the group. The ESRF budget is dominated by NW support activities, and finding work elements suitable for foreign nationals will be an administrative burden. Also, some of ES' brightest moments (e.g., the shock/unlock analysis) appear to have been borne of a capability for responsiveness to NW stockpile issues. This sort of fast-response will undoubtedly become more challenging if there are numerous foreign nationals in key technical positions. **Status quo**
- The question was also raised as to what extent export control constraints would preclude use of foreign nationals even if the classification issues could be managed. **We are able manage this situation for the most part.**
- The ERP is not in a position to evaluate these issues and the inherent tradeoffs in flexibility and effectiveness. But the ERP is unanimous in wanting management to have the flexibility to make decisions appropriate to circumstances, and reiterates the underlying point that Sandia and the ESRF will be extremely challenged to maintain a world-leading position on the basis of purely US-citizen talent. **Agreed.**