CREST PROGRAM RESPONSE to the FINAL REPORT
For
FY 2010 NSF COMMITTEE OF VISITOR (COV) REVIEW

PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

A.1 Questions about the quality and effectiveness of the program's use of merit review process.

1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?

COV Comments:

The review methods are appropriate and include mostly panel but also some ad hoc reviews. The COV noted as many as nine reviews in certain panel reviews. In most instances, the reviewers are panelists with the majority from MSIs. We found that outside ad hoc reviewers from R1 universities have been asked to provide expert ad hoc reviews on the intellectual merit and commend this very good practice.

Supplementary awards had fewer reviews although the lower number seems appropriate.

Review methods look good yet not without challenges in obtaining qualified reviewers. The method for how the program identifies reviewers may be worth revisiting. We found that subprojects have been completed by mail. Is a telecom to go through these reviews also included? The discussion provides a significant element of the value.

Questions: Why did supplemental requests go up in 2009 as indicated on slide 20 in the CREST program presentation to the COV? Does this support better flexibility than a higher base budget?

Site visits seem to have peaked in 2008, dropped in 2009, and may be very low in 2010 depending on when development of slide 18 in the COV presentation occurred. Is value emerging from the site visits?

Program Response:

The support of the COV for CREST to have the highest quality review process is appreciated.

Training: The idea of a teleconference among the ad hoc reviewers and the Program Officers is intriguing, despite a number of practical obstacles. The Program Officers will investigate whether such an approach has been used for any other large proposal review processes at NSF. In addition, the Program Officers will seek ways to enhance the integration of a high quality ad hoc review process, addressing the Intellectual Merit and Broader Impacts of the Subprojects (for CREST) and the Research Thrusts (for HBCU-RISE).

Supplemental Requests: We believe that the number of supplemental funding requests in the Partnership Supplement category of the CREST solicitation has increased primarily due to the increased familiarity of the CREST Centers with this opportunity as well as the increased sophistication of the CREST investigators in generating productive partnerships. The $100K limitation serves to promote a focused partnership development over a short period of time, consistent with the traditional goals of NSF supplemental funding awards. The commitment of $1M per year from the program emphasizes a relatively high success rate, as well.

Site Visits: The HRD Division and the Foundation as a whole regard comprehensive site visits (whether at the award institution or at NSF) as a critical element of continuous quality improvement for these large

centers. One reason for moving to a two Program Officer arrangement for CREST was the desire to enhance such visits. The lack of overlap in the transition between the previous CREST Program Officer and the current Program Officers indeed led to a shortfall in an appropriate site visit process during FY2010. However, this is being actively addressed for FY2011 and beyond. The tentative plan of action is as follows:

- Individual visits to newly awarded CREST centers, as well as HBCU-RISE institutions, within the first year of the award.
- Panel visits or reverse site visits for CREST centers in the third or the fourth year of an award.
- Opportunistic visits of Program Officers to award institutions as schedules permit to interact with External Advisory Committees or to participate in special activities such as workshops, symposia, etc.

2. Are both merit review criteria addressed (a) In individual reviews? (b) In panel summaries? (c) In Program Officer review analyses?

COV Comments:

In reviewing sample proposals the COV found that individual reviews, panel summaries, and Program Officer review analysis addressed both review criteria. Our review of a declined proposal as well as awarded proposals showed equal attention to both criteria in the reviews, panel summary, and Program Officer review.

The quality of panel summaries seems inconsistent. In some cases these summaries appear weak in the renewals and lack specific details that would help the investigator improve the program. We feel it would be worth spending more time assisting the lead investigators; a very good program could become excellent with such support. Initial reviews seem quite effective for recommended programs and include not just strengths but also weaknesses to be addressed. In many cases, the declined proposal received specific advice for how to improve the program. This follow-up step is an example of a useful review.

Program Response:

CREST staff provides orientation and training for panel reviewers by webinar before every review panel takes place. The two merit review criteria are explicitly discussed in the webinar, with guiding questions presented on what to consider in addressing intellectual merit and in broader impacts in the proposal.

We will examine ways to improve our training material to help our reviewers further to address the merit review criteria more substantially than providing only descriptive information. For example, we will consider including in the training materials excerpts of sample reviews of write-ups that were good and not good as examples in addressing intellectual merit and broader impacts and summary statements. In addition, we will look at creating and providing as a handout, a template with guiding questions to which the reviewer should respond in writing his/her merit review comments for the proposal being reviewed.

3. Do the individual reviewers provide substantive comments to explain their assessment of the proposals?

COV Comments:

Although the quality of individual reviews varies, the COV discovered a generally high quality of review with substantial comments to explain decisions. In some instances, even a declined proposal that was poorly written and executed, nonetheless received a thorough review by the panel. Also noteworthy are the MSI reviews which are favorable in their quality and detail compared to reviews from panelists or ad

hoc reviewers from R1 institutions.

Most reviewers did an excellent job. They sometimes included suggestions for how to improve the proposal, even though several proposals lacked this step, including those where the proposal received a funding renewal. In a capability building program, it is particularly important to use the opportunity of proposal feedback to help the individual investigators improve. Feedback that explicitly requires a strong section which explains to investigators how this might be done would significantly benefit the program.

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4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)?

COV Comments:

The panel summaries generally provide rationale for the panel consensus. However, in evaluating panel summaries for a winning proposal compared to a declined proposal, the detail in the rationale provided for the decision was markedly higher for the winning proposal. This difference in specificity does not seem to be systematic when compared to the summary of another declined proposal, which was quite specific.

Sometimes the summary review includes diverse opinions without indicating the specific reason for selecting a given perspective. In these cases it is difficult to distinguish between a funded and a non-funded proposal based only on the summary, and we had to examine the reviews. We found an example of diverse opinions in the summary without a resolving rationale. This jacket also highlights a concern that the review analysis included the statement “lacks innovative and original” research while still recommending the funding. The review provided no explanation of why “lacks innovative and original” research was not necessary, as might be the case in certain situations more focused on capability building.

Program Response:

The Program Officers (POs) agree fully that the Review Analysis (which remains internal to NSF) and the PO Comments (provided to the PIs) must provide a clear rationale for the recommendation to fund or to decline. Weaknesses cited within the reviews must be evaluated relative to strengths cited in the same or other reviews. Often the panel discussion will serve to clarify these differences, and then the Panel Summary as well as the Review Analysis and PO Comments must reflect this discussion. We will continue to be diligent in avoiding the example scenario discovered by the COV.

5. Does the documentation in the jacket provide the rationale for the award/decline decision? (Note: Documentation in jacket usually includes context statement, individual reviews, panel summary (if

applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.)

COV Comments:

The complete jacket documentation is thorough and provides ample rationale for the decision. While the Program Officer's review analysis recycles some comments made in the panel summary, the Program Officer also provides additional information relevant to the decision, such as the downgrading of the "E" given by a non-expert reviewer. The panel reviews, panel summaries, and program officer review analyses were by far the most important contributors to the rationale used to make the decision. These analyses are thorough, balanced, and address both intellectual merit and broader impacts.

Although information in the jacket generally supported the decision, no information appeared to explain divergent panel summary wording or the opinion of a specific reviewer.

Program Response:

It is important for the Review Analysis to be complete in this regard. Certainly, an "E" rating in a review that provides minimal substantiation may be annotated in the POs review analysis. Likewise, a "G" or "F" rating that cites important strengths of a proposal may carry more positive weight during the panel discussion.

8. Additional comments on the quality and effectiveness of the program's use of merit review process.

COV Comments:

While the process seems to be effective, the COV would like to see evidence of how the reviews actually do assist the investigators in building their own capability to write good proposals. Ideally the process of the review builds better investigators. Has this information been captured anywhere? Would it be possible to provide specific small capability building grants to investigators who seem to have an idea with great scientific merit, but who lack the writing expertise to sell their ideas?

Program Response:

The Program Officers welcome the opportunity to meet with PIs of declined proposals, at their request, to help them improve future proposals to CREST or to other NSF funding opportunities. At least four such interactions have already occurred in the Fall of 2010, based on the FY2010 review process. Typically, a group of investigators from the institution having been declined would meet for about an hour with the Program Officers to discuss ways to improve their proposal. In addition, the Program Officers conducted webinars for potential PIs who have submitted Letters of Intent provide an additional opportunity to provide suggestions for improved proposals.

A.2 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space provided.

1. Did the program make use of reviewers having appropriate expertise and/or qualifications?

COV Comments:

Without a doubt the program has made use of a wide set of reviewers with appropriate qualifications and backgrounds to review the CREST program. In addition to assembling panels with diverse backgrounds, the program has also used ad hoc reviewers with specific expertise that may not be represented in the panel.

We noted difficulty in determining whether the reviewers truly have the right kinds of expertise for a given proposal. Our suggestion is to add a self-assessment for reviewers that include such elements as

scientific expertise or special institutional knowledge depending on the kind of program undergoing analysis. Also, bringing in non-voting junior members of faculties or graduate schools would provide a mentoring opportunity that would aid in capability building while simultaneously assisting NSF in finding qualified reviewers. Finally, could the CREST program take advantage of the new Ph.D.s graduating from it to assess the programs by providing some form of evaluation one or two years post-graduation? That would help us better understand the individual impact.

Program Response:

During the selection process for both ad hoc and panel reviewers, the Program Officers use a variety of mechanisms to determine the level and appropriateness of expertise. This includes requesting a CV from a potential reviewer, assessment of the web site for a reviewer (easily accomplished for university faculty), or even obtaining recommendations from colleagues. We also provided to potential ad hoc reviewers the titles of the subprojects, to ensure that the reviewer was comfortable as well with the match and would agree to conduct an effective review. Panelists were invited both for their scientific expertise relative to the subjects of the proposals and for their understanding of issues surrounding the operation of a large center, knowledge of issues in minority-serving institutions (MSIs), appreciation for general issues of broadening participation of underrepresented groups, and expertise in integrating research and education. Although, not every panelist has strengths in all areas; it is expected that complementary expertise will strengthen the panel discussion as a whole.

The idea of developing a reviewer mentoring program (via an observing or analogous status) is intriguing. It should be recognized that being only a short time in one's professional career is not a disqualification for service as a panelist or reviewer. We seek a diversity of panelists, including of course, women and minority participants, individuals from MSIs and from research intensive institutions, as well as individuals who are at an early stage of their careers as well as at senior positions.

The final suggestion of this section lies outside the proposal review process and relates to the impact of the CREST award to a given institution. Tracking graduates from a program during the early stages of their careers, whether they are Bachelor's, Master's, Doctoral, or Post-Doctoral participants, would certainly be a useful indicator of program impact.

An important additional element of the CREST and HBCU-RISE awards is the expected development of individual faculty and institutional research capacity. There are a number of performance measures associated with institutional and faculty development and with student involvement, which are contained in the annual reporting process and in the annual data assessment by the CREST program contractor ("CRESTWeb").

Because there are variety of institution types involved in CREST and HBCU-RISE (not all are doctoral-degree granting institutions, for example), uniform performance measures for the impact on the students (and post docs) that experience the program might be difficult to establish. However, we will investigate how this might be accomplished. Certainly, this subject should be part of formal site visits and reverse site visits.

2. Did the program use reviewers balanced with respect to characteristics such as geography, type of institution, and underrepresented groups? (Note: Demographic data is self-reported, with only about 25% of reviewers reporting this information.)

COV Comments:

The number of reviewers from underrepresented groups has been about 20% in 2008 and 2009. This

number seems somewhat low to the COV given that the CREST program focuses on MSIs. Every state in the union appears on the reviewer list, with larger states proportionally represented. The types of institutions represented also seem appropriate. About 50% of the reviewers are from peer MS and Ph.D. institutions, and about 20% are from research-intensive Ph.D. institutions.

The COV would need to see more about the underlying demographics being sought. Is the goal to increase participation in the review panels also? What about increased participation from industry and FFRDCs? We suggest that you include any appropriate tables in your report.

Program Response:

It is the policy of the National Science Foundation and especially HRD to include scientists, engineers, and educators from underrepresented populations in review panels and among ad hoc reviewers. We emphasize the participation of women and minority panel members and ad hoc reviewers. The FY2010 panelists included approximately 50% women and minority participants. Although data from previous years are not immediately available, careful documentation, when possible based on reviewer self-documentation of demographic or ethnic background, will be archived for future use.

4. Additional comments on reviewer selection.

COV Comments:

In general it seems hard to mitigate the problem of having "the same" pool of reviewers. We suggest finding a way to balance the quality of reviews with mentoring possible proposal writers. Perhaps periodically holding proposal reviews on the west coast or in the South would help diversify the participant pool. While this has never been NSF policy, it seems like a reasonable thing to consider and might help with reviewer bias. Note that disadvantaged or smaller institutions may also find it a hardship to be without a faculty member for the time invested in traveling to DC to participate. In these cases, we recommend scheduling some reviews "off season" as well as in alternate locations so as not to overlap with the academic year.

Program Response:

These are constructive recommendations. We will consider the impact of holding panel reviews in other geographical locations. There are issues associated with this, including technical support for the panel. It has not been the experience of the Program Officers that panelists declined to participate because of the geographical distance associated with traveling to Arlington. The recommendation to consider academic year calendars in scheduling review panels is important. However, academic year calendars are not uniform, and the need to complete the review and recommendation process within the confines of the NSF annual financial calendar is a significant constraint. It has been our experience that panelists are eager to participate in NSF review panels and only decline when they have been overburdened by other responsibilities or have individual time conflicts (not necessarily associated with academic year calendars).

A.3 Questions concerning the resulting portfolio of awards under review. Provide comments in the space below the question. Discuss areas of concern in the space provided.

4. Does the program portfolio have an appropriate balance of:
   - Innovative/potentially transformative projects?

COV Comments:

Since we are not sure whether a specific target has been set, this determination is hard to make.

Most of the program portfolios have an appropriate balance of potentially transformative projects. However, we recommend multiple site visits to determine how the grant balances resources to align with the existing institutional resources that enable such transformation.

Program Response:

The recommendation of multiple site visits will be seriously considered for integration into our site visit schedule. This is being actively addressed for FY2011 and beyond.

8. Does the program portfolio have an appropriate balance of:
   - Geographical distribution of Principal Investigators?

COV Comments:

The geographical distribution appears to match the need distribution except for the western states. It would be useful to see an overlay of principal investigator locale with "need" locale – whether this be by EPSCoR status, average income, or location of target institutions.

The COV slides map out the distribution of the current portfolio and, in general, the distribution of awards is as expected with one exception. We were surprised to note that the state of California has only one award. Is this consistent with the number of HSIs in the state? It appears not. In general the geographical distribution does match the need distribution in the western states.

We suggest that you develop an overlay of principal investigator locale with "need" locale to facilitate evaluation by EPSCoR status, average income, or location of target institutions.

Program Response:

There is an important distinction between the self-adopted definition of an Hispanic-serving institution (HSI) (25% student population) and the requirements for a Minority-serving institution (MSI) (50% student population), as stipulated in the CREST solicitation. Therefore, many HSIs are not eligible for CREST, including most universities in California. The HRD is working to develop programs that address the needs of HSI across the many southwestern states that have significant numbers of Hispanic students but do not qualify as a MSI. We note that the current portfolio includes seven universities whose student minority populations are largely Hispanic and one other with a significant population of Hispanic students.

With respect to EPSCoR co-funding of awards, we are constrained by the regulations regarding that support. Fortunately, the CREST program has been successful in obtaining 50% co-funding (first year) for about one award per year over the last few years.

The Program Officers will continue to reach out to potential eligible HSIs that are nearing 50% total minority student enrollment to encourage participation in CREST. For example, we participated in the

recent SACNAS and MAES conferences in Fall 2010; and we have had interactions with representatives of HSI on several occasions.

9. Does the program portfolio have an appropriate balance of:
   - Institutional types?

COV Comments:

We found that most of the institutions in the jacket list and those depicted in the slideshow are traditionally structured graduate universities. In what seems to be a missed opportunity, CREST does not appear to have many four-year undergraduate research institutions participating. The earlier an intervention is made, the more likely it is to be a success. Adding incentive to collaborate with researchers in underserved institutions at the four-year level may be worth considering.

CREST awards go predominately to MS institutions with small Ph.D. programs and non-research intensive Ph.D. granting institutions. The data indicate that 66 of the 79 PIs are from these classes of institutions, which are appropriate and expected numbers from this program. Most of the institutions appear to be traditionally structured graduate universities.

Program Response:

One of the key goals of the CREST program is to build institutional capacity at MSIs to conduct scholarly research and to educate graduate students. Such a goal must be consistent with the institutional mission. There is no prohibition of undergraduate institutions from receiving a CREST award, but establishing a research framework appropriate for a CREST award may pose a significant challenge for a predominantly undergraduate university. Several CREST institutions emphasize master's education with students moving to doctoral programs at other universities, and the review panels have been very supportive of this type of arrangement.

Nonetheless, it may be appropriate for the Program Officers to emphasize a partnership among MSIs, such that one or more of them might be predominantly undergraduate universities, or even community colleges (especially, for example, Tribal Colleges). Currently, NSF does not propose specific partnerships nor provide special preferences to any institution or group of institutions in preparing a proposal.

10. Does the program portfolio have an appropriate balance:
    - Across disciplines and sub disciplines of the activity?

COV Comments:

The current CREST portfolio represents general disciplinary areas that follow along the lines of those areas receiving funding from other science and engineering programs. Some issues need attention:

- First, a disproportionate number of awards go to the nanotechnology area, even though most of these are legacy awards. We did note two 2009 awards that are nano awards.
- Second, the Bio area has too few awards, a surprising discovery that seems out of balance with national trends in research.
- Third, the representation of engineering disciplines is not as high as one would expect — what is the underlying reason for this?
- Fourth, there are no new centers in the energy area. Perhaps this development is to come, and we would encourage it since energy is the fastest growing large research area in the world, not just in the U.S.

Program Response:

The Program Officers appreciate and share this legitimate concern. The current portfolio reflects the areas of submission of proposals and the review process. It seems that developments in materials science and nanotechnology have been more successful at many HBCUs as well as other minority institutions. We note that five CREST awards are in areas of ecology, having a significant biological component and indirect connection to energy (via climate change effects). We also note that five CREST awards are in areas of computational science. Three CREST non-ecology awards contain a significant biotechnology component, as do four HBCU-RISE awards. Two current CREST awards have significant energy technology components, with both of those involving engineering departments directly. One other CREST is led by an engineering department, albeit in a computational area.

The Program Officers will continue to emphasize a diversity of project areas and opportunity for engineering programs with MSI's within the CREST and HBCU-RISE framework.

11. Does the program portfolio have appropriate participation of underrepresented groups?

COV Comments:

Approximately 40% of the awards have minority participation. This percentage seems consistent with the available pool of potential PIs or co-PIs. It appears that female participation spiked, then dropped, significantly. Is the reason known? Minority involvement picked up over the same period, though not to the same extent. In general the participation of minority and female PIs seems adequate and consistent with the available pool of faculty in these areas.

One issue arises here: Are the CREST collaborations taking advantage of the pool of minority and female PIs in non MSI schools? Tapping the MSI schools certainly enlarges the available pool, especially of mentors.

Program Response:

This is an excellent recommendation, and we will offer such suggestions to enhance CREST collaborations.

A.4 Management of the program under review. Please comment on:

1. Management of the program.

COV Comments:

The 2009 management plan is succinct and seems effective based on the outcomes of CREST. We noted specific concerns.

The mention of generating a constant 1/3 set of "fresh eyes" for reviewers is appropriate and good. Experienced reviewers and new reviewers are valuable for different reasons. However, the COV did not observe an explicit plan to increase the diversity of the reviewer pool, and that is a concern since it was an issue that was raised by the 2007 COV. Although individual Program Officers may be engaged in this, the COV would like to see an NSF-wide initiative for supporting the need for diversity and increasing the reviewer pool. Is this a crosscutting issue? Would NSF support a requirement that investigators/ institutions that receive funds participate in the review process?

Our concerns about the proposal development workshops: Are the workshops increasing the caliber of the written proposals and encouraging more successful first time proposal writers? Who attends them –

are they the target audience?

We did not see discussion of the staff workload in the 2009 or earlier management plans, although the COV was briefed on the increase in program managers from one to two.

Program Response:

The Program Officers, as well as the HRD Division, are committed to a diverse pool of reviewers, in terms of "repeat" panelists and "fresh eyes" into the program. In FY2010, there were a significant number of new panelists to the CREST program, although a number of panelists had served on other NSF panels. We do not believe that a requirement that PIs serve on panels is necessary, as current PIs are generally quite willing, subject to consideration of demands on their time, to serve as NSF reviewers.

The Program Officers have conducted webinars for PIs who have submitted Letters of Intent. No specific assessment of the effectiveness of these webinars in generating higher quality proposals has been conducted, although the nearly unanimous response from the participants has been that they are extremely useful. Unfortunately, the number of CREST proposals is probably too low to obtain statistically relevant data concerning first time proposal writers. However, other divisions at NSF have conducted more extensive proposal writing workshops via online venues, and there may be data from those workshops.

The Program Officers do not at this time see a concern with program workload, especially now that two POs are actively involved.

2. Responsiveness of the program to emerging research and education opportunities.

COV Comments:

As previously noted, an apparent lag exists between the research concentrations represented by CREST awards and national funding trends. One example is the large number of nanotechnology based centers and the absence of centers with bio/nano or energy focus. The program would be able to address this lag if the CREST proposal teams were coupled more effectively with PIs from major R1 institutions that are more likely to be keeping up with the very latest research trends. We temper this comment, of course, with the stage of development of the MSI in research participation. As MSIs grow and mature in their research capabilities, we encourage them to "catch up" with the R1 community with respect to working in the most current research areas, as opposed to doing incremental research in areas that have been exhausted.

Program Response:

The first part of this comment was addressed in Item A.3.10. We believe that the areas suggested by the COV are covered within the portfolio, although possibly in non-obvious ways.

The second component is the suggestion that collaborations be encouraged between minority institutions and R1 Universities, in a semi-mentoring approach. This is a good suggestion, and can be implemented under existing guidelines: It is allowable for a minority institution to provide up to 25% of the total award as a subcontract to a second institution. If the second institution is an R1 University, and appropriate safeguards are in place to create a truly nurturing/mentoring relationship, then this could be a method to implement fruitful collaborations. There are several CREST-eligible minority institutions that are afraid to devote the resources and prepare a CREST proposal, because they feel that they lack the **"critical research activity mass"** that will empower them to prepare a competitive CREST proposal. In such cases, collaboration with an R1 University that will be a subcontractor for 25% of the total award will potentially result in a strong mentoring collaboration and strong CREST proposal. Encouragement of

such **"immature for CREST submissions"** universities to foster collaborations with R1 Universities in CREST submissions may be a possible strategy to build their capacity. However, the Program Officers are seriously limited in the extent to which they can promote specific partnerships.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

COV Comments:

The COV found it difficult to determine from the management plan what process was used to prioritize areas of research supported by CREST centers. Nevertheless, the diversity in the portfolio seems reasonable, and perhaps the institutions deserve credit for keeping up with emerging trends. The COV, in general, did not see in the management plan an explicit process for deciding on the research areas that are to receive priority, perhaps a useful exercise that would benefit the yearly planning cycle.

Program Response:

This topic was addressed in the response to Item A.3.10. Certainly, the Program Officers can consider diversity of topics within the portfolio as an element in deciding between two highly competitive awards, only one of which will be recommended for an award. In addition, over the next year, the Program Officers will explore strategies better to reach out to a more diverse potential population of investigators, with the recognition that only one CREST and one HBCU-RISE award may be active at any institution at any time.

PART B. RESULTS OF NSF INVESTMENTS

The NSF mission is to:

- promote the progress of science;
- advance national health, prosperity, and welfare; and
- secure the national defense.

To fulfill this mission, NSF has identified four strategic outcome goals: Discovery, Learning, Research Infrastructure, and Stewardship, although the COV does not review accomplishments related to Stewardship.

B. Please provide comments on the activity as it relates to NSF's Strategic Outcome Goals. Provide examples of outcomes ("highlights") as appropriate. Examples should reference the NSF award number, the Principal Investigator(s) names, and their institutions.

B.1 OUTCOME GOAL for Discovery: "*Foster research that will advance the frontier of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering.*"

COV Comments:

Many strong developments have evolved, especially in the nanotech centers. The number of Ph.D.s granted is excellent, as is the number of patents sought. These developments show a path from science into the workplace/industry. The number of papers (evidence) is quite respectable particularly when the context is within a university that historically may not have had a strong history of scientific achievement. The case for the importance of the results could be made even stronger if they are used more effectively in communicating the program success.

Although the program encourages breakthrough projects, it may be helpful if the awardees are

encouraged to partner with the U.S. National Labs on projects and also use their facilities. Breakthrough projects that will advance the frontiers do not come easily. Their attainment is possible after many years of sustained work which makes a strong case for partnering and working with National or Industrial Labs.

Basic research is not enough in order to be transformative in the modern world. We propose that you more strongly address and encourage the transition from research ideas to useful technology in CREST. Especially encourage minorities to participate in order to create industries in the institutions' states.

Program Response:

To communicate the program more effectively, we plan to strongly suggest that a) each CREST and HBCU-RISE Center develop and maintain over time its own website; b) each CREST Center initiate a local conference to inform the local and state community of the successes. Development of mechanisms to "advertise" the successes of the CREST program across the Foundation and throughout the scientific community will be explored with the Directorate leadership and with the Office of Legislative and Public Affairs, as appropriate. The Program Officers will support and will further encourage partnerships with National Laboratories and with industry. The funding mechanism of "CREST Partnership Supplements" will continue to be offered as a potential vehicle for such collaborations. A plan for Technology Transfer as part of a CREST or HBCU-RISE proposal will be promoted where appropriate.

B.2 OUTCOME GOAL for Learning: "*Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens.*"

COV Comments:

The CREST program could require institutions with a large number of underrepresented students to collaborate with K-12 schools/school districts or even the institutions' departments of education for the development of workshops for teachers, advanced field/laboratory experiments for gifted middle and high school students, and to provide opportunities through the CREST funded programs for team teaching between the faculty researcher and the science teacher. As the outcome goal is to cultivate an inclusive science and engineering workforce, opportunities to expose larger numbers of underrepresented K-12 students to a variety of occupations in science and engineering could significantly impact the number of students entering STEM fields as well as encourage university STEM researchers to explore innovative ways to reach this population.

We recommend that you encourage the centers of excellence to develop programs for middle and high school future engineers and scientists. This strategy will help them think about developing new digital and arts science academy curriculum for K-12.

We did not specifically note an emphasis on the K-12 or undergraduate support based on the awards presented, at least not from the standpoint of partnering institutions. However, CREST has clearly advanced the production of Ph.D.s and MS, and provided the opportunity for them to publish. These advances are of critical importance to our next generation workforce.

Program Response:

Integration of research and education is a key element of CREST and RISE proposals. This includes, of course, outreach activities that extend beyond the university environment. Every CREST Center includes a significant outreach component. Outreach at the K-12 and undergraduate levels will be encouraged. However, we recognize that the most important element of a CREST Center or a RISE award is the development of research capacity and scholarly achievement within the Minority Serving Institution.

B.3 OUTCOME GOAL for Research Infrastructure: "*Build the nation's research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure and experimental tools."*

COV Comments:

We believe that the CREST program should strategically enable institutions to build their own capabilities, while weighing the advantages of improving access of institutions to national centers of specialized infrastructure, such as national micro and nano fabrication centers and foundries. Again, we recommend this as a key goal for a well-thought out strategic plan in the overall management plan. If one does not already exist, we suggest performing an assessment to create a map of the existing institutional infrastructure at MSIs to help guide the program funding directed at laboratory development.

Most of the proposals do not include ways of sharing infrastructure which the COV encourages. An example we note is the fabrication of MEMS in Brook Haven Labs. Every school does not have to have a large center for infrastructure but if the design of CREST is to increase the number of students, CREST Centers must have resources to build infrastructures sufficient to allow the institution to participate in competitive research. In addition, we encourage CREST Centers to collaborate with research institutions and organizations such as national laboratories that have unique resources. We recommend that the institutions develop and maintain sustainable infrastructures that in turn will sustain the research.

The CREST program as currently designed tends to favor those institutions that already have significant infrastructure to conduct STEM research. Building research infrastructure at HBCUs in particular is one of the most critical needs for those institutions. However, we found only one proposal that requested funds for a large piece of equipment and it was declined.

Program Response:

Encouragement of CREST and RISE proposers to establish collaborations with national laboratories and with other institutions having unique facilities can be included in the program solicitation. CREST Centers are already stipulated to serve as a resource for local communities, other institutions, and so forth. There is no prohibition of a CREST Center requesting acquisition of experimental or computational facilities appropriate for the proposed activities. That few have done so may reflect on the desire of the institutions to devote resources to faculty and student support and to educational development and to outreach. We will remind review panels to give careful consideration to proposals requesting equipment support, so that lack of facilities does not exclude a priori from a favorable panel recommendation.

CREST COV COMMENTS

C.1a Please comment on any program areas in need of improvement or gaps (if any) within program areas.

COV Comments:

Across the Portfolio

CREST offers a ripe opportunity to train students for the professoriate in addition to the AGEP program. It is recommended that there be a closer and more explicit link between these two programs (CREST and AGEP), citing the business of research as a necessary skill for future faculty.

Program Response:

The Program Officers for both CREST and AGEP appreciate this observation, which supports our own views. We will continue to investigate ways in which closer alliance between the two programs can be

facilitated.

C.1b Please comment on any program areas in need of improvement or gaps (if any) within program areas.

COV Comments:

Program-Specific

It is important that CREST Centers receive sufficient resources to build sustainable infrastructures and participate in competitive research and that they are encouraged to collaborate with research institutions and organizations, such as national laboratories, that have unique resources. The building and sharing of infrastructure and research networks needs to be improved to increase project sustainability and encourage the development of useful innovations for society.

- A positive example of this is the collaborative work led by Brook Haven National Laboratory that resulted in the fabrication of microelectromechanical systems (MEMS).

NSF should recruit and support the participation of new faculty in review panels. "Mock review" opportunities can be offered to give Ph.D. candidates a sense of what can be expected on an NSF review panel and encourage their future participation.

Program Response:

The suggestion to invite Ph.D. candidates to participate in CREST review panels as observers is intriguing. We already welcome young faculty to active membership in review panels across the Foundation. CREST will continue to seek a diversity of age groups among panel participants. However, we will discuss the efficacy of inviting observers to panels with the Division leadership and the NSF Policy Office.

C.2a Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

COV Comments:

Across the Portfolio

How robust are the Directorate's databases that track demographics and other data on the programs' target populations? Is the Directorate's use of money and performance evaluated with respect to those numbers?

Program Response:

The Division of Science Resources Statistics[1] (SRS) is the federal statistical agency within the NSF that manages the Scientist and Engineers Statistical Data Systems (SESTAT). National data on Science and Engineering education (beginning from the bachelor degree level) and employment, work activities, and demographic characteristics are collected in SESTAT. SRS produces the "Science and Engineering Indicators Report" and the "Women, Minorities, and Persons With Disabilities in Science and Engineering Report" from which data on underrepresented minority and groups in the STEM population targeted by the Division of Human Resource Development (HRD) can be extracted. Additionally, CREST has a program-specific monitoring system that allows for the annual review of project performance.

C.2b Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

[1] Now renamed the National Center for Science and Engineering Statistics

COV Comments:

Program-Specific

Strengthen CREST participation in California, Arizona, and New Mexico.

Program Response:

Many institutions in California, Arizona, and New Mexico have significant Hispanic student enrollment but do not qualify as Minority Serving Institutions, which is a CREST eligibility requirement. There is an important distinction between the self-adopted definition of an Hispanic serving institution (HSI) (25% student population) and the requirements for a Minority-serving institution (MSI) (50% student population), as stipulated in the CREST solicitation.

Therefore, many HSIs are not eligible for CREST, including most universities in California. The HRD is working to develop programs that address the needs of HSI across the many southwestern states that have significant numbers of Hispanic students but do not qualify as MSI. We note that the current portfolio includes universities whose student minority populations are largely Hispanic.

C.2c Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

COV Comments:

Program-Specific

Infrastructure sustainability is an important objective of all centers that should be evaluated after CREST participation ceases to measure the need for an "infrastructure renewal" program.

Program Response:

The CREST Program now has enough "graduates" that an effort may be made to obtain this information. The current summative evaluation that has been initiated with an outside contractor to the Foundation will be investigating several awards that have completed a full 10 year cycle. The results of this evaluation should provide guidance as to how the program may be improved to assure the sustainability of the research infrastructure at MSI.

C.2d Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

COV Comments:

Program-Specific

Stronger post-award assessment is needed and evaluation plans should reflect both short- and long-term impacts; for example, is the program still around after the funding is gone; what happens when the program ends, were the goals integrated within the institution, and was there lasting change?

Program Response:

The current external summative program evaluation is designed specifically to address these issues. Nonetheless, the Program Offices will discuss ways in which these issues may be assessed on a regular basis.

C.3 Across the Portfolio

C.3 Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

COV Comments:

Program-Specific

Strengthen and enhance mentoring to increase the competitiveness of Ph.D. students as research leaders and increase their understanding of the business of research (i.e. proposal writing, conference attendance, publication).

To take full advantage of their size and established relationships with MSIs, ERC and MSERC Centers should mentor/partner with CREST Centers. To encourage these partnerships, NSF could make the mentorship a formal requirement and condition of ERC and MSERC funding. Each center could retain autonomy, but collaboration is expected and assessed as part of a joint review based on shared publications and jointly mentored students.

Program Response:

We agree that broader mentoring of graduate students should be an essential feature of CREST and RISE awards. We will take steps to strengthen the annual solicitation in this regard.

We agree that large research programs such as STC, ERC funded through the NSF research directorates would be strengthened by developing partnerships with MSIs. Establishing formal conditions for such partnerships is beyond the purview of the CREST program; however, HRD will share the recommendation with senior leadership for further consideration.

C.4 Across the Portfolio

C.4 Please provide comments on any other issues the COV feels are relevant.

COV Comments:

Program-Specific

To better integrate research and education the CREST program could require CREST-sponsored institutions to collaborate with K-12 schools. This could be in the form of teacher professional development, advanced field/laboratory experiments for gifted middle and high school students, team teaching between the faculty researcher and the science teacher, etc.

The program might want to consider informal learning organizations such as museums for further interface. To ensure a strong pipeline from K-12 through CREST, a comprehensive outreach effort should also include components designed for home schooling and/or informal learning organizations.

Stronger and wider outreach to agencies beyond participating universities is necessary to increase inter-agency and inter-institutional collaboration.

Program Response:

The CREST solicitation contains the following language concerning outreach activities: "…. the projects will promote synergy between education and research; develop outreach activities for pre-college students, K-12 educators, and the general public; and serve as a model for research scholarship throughout the institution." We believe that the specific nature of these activities should be appropriate for the institution and the participants, as well as the area of the research activities. Progress in these areas is evaluated specifically as part of the review process and as part of award monitoring, such as site visits and reverse site visits.

Establishing stronger inter-agency collaboration for support of research activities at MSIs is an NSF priority, which is being pursued at a number of levels. The Program Officers for CREST and the HRD Division leadership are fully supportive of these thrusts.

One example of interagency collaboration is in the implementation of a Memorandum of Understanding (MOU) with the Department of Energy. The Division collaborates with DoE to provide opportunities to participate in cutting edge research at the Nation's laboratories to promote the development of human resources in science, technology, engineering, and mathematics. The opportunity supported with supplemental funding from NSF is primarily for undergraduate students for which the CREST program is a participant. The partnership also poses an excellent model for other such collaborations.

C.5a NSF would appreciate your comments on how to improve the COV review process, format and report template.

COV Comments:

Across the Portfolio

Provide systematic training in the steps to be used in extracting programmatic data.

The off-site processes allowed the COV to concentrate on the specifics of the program and helped the group cover the materials and come to agreement more quickly.

The links and PDFs embedded in the PowerPoint presentations increased accessibility to the materials.

In a bundled COV, it would have been nice to touch base with the other programs prior to the cross-talk discussion. Being isolated from each group limited the potential benefits of a more diverse pool of ideas.

It is difficult to reconcile the concerns put forward by individual sub-panels into a single document. Some recommendations/concerns may be diluted by other sub-panel observations.

Sub-panels may have experienced an unequal emphasis in preparation for the COV, which led to logistical problems.

Program Response:

We appreciate the compliments as well as the guidance and will strive to ensure that the administrative processes noted will be considered and concerns addressed.

C.5b NSF would appreciate your comments on how to improve the COV review process, format and report template.

COV Comments:

Program-Specific

The quality and content of the electronic documents was commendable. Kudos due for all the effort behind the review – the electronic linkage of documents, ease of use, the jacket system – all of it was extremely well done. Having a technical writer was also extremely helpful.

The webinar could have been more useful. We suggest a more systematic explanation of the steps it takes to complete this process (e.g., a "COV for Dummies" to make this a success). It would be helpful to have two collaborative meetings. One to brief the COV on the steps needed to conduct a successful COV

seminar and another to conduct the actual COV review. The schedule for this COV was not convenient for West Coast participants. Provide every reviewer with background information on each program before the cross-talk dialogue because not everyone reviewing had enough background on the other programs.
Program Response: The first two items above concern the COV process as a whole. The third item is duly noted and will be addressed in the future. The fourth item suggests an appropriate expansion of pre-COV preparation across all programs. The CREST Program Officers fully concur with this suggestion.

SIGNATURE BLOCK:

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For the CREST COV
James Renick
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