Charge Letter

“By this letter, I am charging the ASCAC to assemble a sub-committee to examine the effectiveness and impact of the CSGF, as compared to other educational activities, and the quality and breadth of the program over the past decade. The sub-committee should take into account the unique qualifications and skills of computational scientists and their role in the public and private sectors. It should also address the role of women and under-represented minorities, the projected need for trained computational scientists in the DOE laboratories and for continued US leadership in the computational sciences.”
Distilled Charges

• Address the **projected need** for trained computational scientists in the DOE laboratories and for continued US leadership in computational science.

• Examine the **effectiveness and impact** of the CSGF.

• Comment on the **quality and breadth** of the program over the past decade.

• Address the participation of **women and minorities** in the program.

• Compare to other **educational programs**.
Committee Process

• Information from ASCAR and Krell Institute

• Interviews at CSGF Annual Conference July, 22
  (Dona Crawford, Jeff Hittinger, Bill Tang)
  – Jim Corones, Jeana Gingery, and Mary Ann Leung of Krell
  – Barb Helland of DOE-SC and Thuc Hoang of NNSA

• Teleconference July 7, Email Discussions
Projected Need

• Supported by Recent Reports

• Supported by Personal Experience
Projected Need

Reports Cited


• Joseph, E; Conway, S; Wu, J; IDC Special Study for DOE: HPC Talent and Skill Set Issues Impacting HPC Data Centers, December 2010.

Projected Need  Selected Quotes

• “DOE, NSF and other agencies should consider creating fellowship programs to train graduate students and postdocs in HPC modeling and simulation, and expanding the Presidential Early Career Awards in Science and Engineering (PECASE) program in this area.” (Council on Competitiveness)

• “At one laboratory, there is an ongoing hiring requirement for 30 computational scientists.” (DLC)
Projected Need: Conclusions

The Subcommittee has concluded that the need for well-trained computational scientists in government laboratories and in industry will far exceed the supply for the foreseeable future. This is especially true in the DOE laboratories. We conclude that the need for programs like the CSGF will increase over the next decade.
Projected Need

Recommendation:

*The Subcommittee recommends that the Office of Science continue to view stimulation of the computational science workforce as important to its mission.*
Effectiveness and Impact

Based on

• Effective Educational Process

• Impact
  – Alumni Outcomes
  – Impact on DOE
  – Broader Impact
Effective Educational Process

Program features

• Program of Study
• Practicum
• Annual CSGF Conference
• Alumni Outreach
Effective Educational Process

Program of Study

• Students required to propose a plan of study
• Plan must include the right mix of courses
  – Domain Science
  – Applied Math
  – Computer Science
• Treated as a contract
Effective Educational Process

Practicum

• Students spend at least one summer working in a DOE Laboratory.
• Additional practicum are encouraged
• Exposes student to Labs and real problems
• Establishes a network
• Gives Labs opportunity to evaluate students
Effective Educational Process

Annual CSGF Conference

• Required to present a poster
• Last required to give talk
• Teaches communication skills
• Develops network of Fellows
Effective Educational Process

Alumni Outreach

- Encouraged to mentor current Fellow practicum
- Invited to CSGF Annual Conference
- Receive CSGF Literature (DEIXIS)
Impact

Alumni Outcomes

• Graduation Rates:
  – Between 2001-2006, 96%

• Current positions
  – All but 1 out 102 in technical positions (01-09)
  – Academic, Industry, Government Labs
  – 27 Employed at some point in DOE Labs
Alumni Current Positions

- Industry: 24%
- Academic - Postdoc: 25%
- Academic - Faculty: 12%
- Academic - Research Scientist: 5%
- Government Lab - Staff: 19%
- Government Lab - Postdoc: 13%
- Other: 2%
- Industry: 24%
Current Positions: Academic

Current Positions: Industrial

Microsoft, Google,
Shell, Exxon Mobil,
Seagate, Amyris Biotechnologies,
Dataspora, British Petroleum,
AREVA, Intellisis

Several Alumni have started new companies
Alumni at DOE Laboratories

**ANL**
- Jeff Hammond, Post Doc
- Stefan Wild, Post Doc
- Hal Finkel*

**Bettis**
- Stephen Vinay III

**LANL**
- Joshua Coe, Post Doc
- Ethan Coon, Post Doc
- William Daughton
- Jeff Drocco, Post Doc*
- Timothy Germann
- Aric Hagberg
- Nathaniel Morgan
- Sam Schofield
- Allan Wollaber

**LBNL**
- Jarrod Chapman, Post Doc
- Daniel Martin
- Anubhav Jain*

**LLNL**
- Teresa Bailey
- Thomas Epperly
- Brian Gunney
- Jeff Hittinger
- Matthew McNenley
- Elsie Simpson Pierce
- Brandon Wood

**NREL**
- Christina Payne, Post Doc

**ORNL**
- Mark Berrill, Wigner Fellow
- Kristine Cochran
- Gregory Davidson
- Steven Hamilton
- Judith Hill
- Richard Mills
- Matthew Norman
- Matt Reuter*

**PNNL**
- Christopher Gesh
- Kevin Glass
- Glenn Hammond
- Christopher Oehman

**Sandia-CA**
- Aron Cummings, Post Doc
- Alex Lindblad
- Michael Veilleux, Post Doc

**Sandia-NM**
- Nathan Crane
- Heath Hanshaw
- James Morrow
- Elijah Newren, Post Doc
- Laura Painton Swiler
- Michael Wolf, Post Doc
- David Rogers, Post Doc

* Starting in 2011
Alumni who have left DOE labs

**Ames**
- Heather Netzloff, Post Doc - > School

**ANL**
- Jaydeep Bardhan, Post Doc - > Rush Medical Center

**LANL**
- Eric Held, LANL/ORISE Fusion Fellow -> Utah State
- William Humphrey, Staff member -> NumeriX, LLC
- Mario Trujillo, Post Doc -> Penn State
- Scott Zoldi, Post Doc -> FairIsaac
- Dan Horner, Post Doc - > Center for Naval Analysis
- Charles Zeeb - > Deceased

**LBNL**
- Mary Dunlap, Post Doc -> University of Vermont
- Richard Propp, Post Doc -> Oracle
- Scott Stanley, Post Doc -> Hewlett-Packard

**LLNL**
- Allison Baker, Staff Member

**ORNL**
- Asegun Henry, Post Doc -> Northwestern

**PNNL**
- Collin Wick, Post-doc -> Louisiana Tech

**Sandia – CA**
- Edwin Blosch, Post-doc -> CFD-FASTRAN
- Shilpa Talwar, Staff member -> Intel
- Obioma Uche, Post-doc -> University of Virginia, Charlottesville

**Sandia – NM**
- Marcus Martin, Staff member -> Useful Bias (his own company)
- David Ropp, Post Doc -> SAIC
- Peter Wyckoff, Post Doc, -> Ohio Supercomputing Center
- Ahmed Ismail, Staff member - > RWTH Aachen University
Effectiveness and Impact

Subcommittee concludes that the DOE CSGF is an exceptionally effective program that has had a significant impact on the national Computational Science infrastructure.

As indication of direct benefit to the DOE, a large percentage of Fellows spend a portion of their early career in the DOE laboratories and an even larger portion continue interaction with the DOE laboratories as they pursue their careers in academia and industry.
Effectiveness and Impact

In light of the effectiveness and impact of this program and in the context of the growing projected need, the Subcommittee has concluded that funding for this program is not only well spent, but that additional funding should be provided.

Recommendation: the Subcommittee recommends that the funding for this program be put on a path to double over the next 5 years.
## Budget History

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Budget in $M
Quality and Breadth

Quality
• Quality of Applicants and Awardees
• Selection Process
• Management of Fellowships

Breadth
• Applicants and Awardees by Field
• Outcomes
## Applicants GRE Scores

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Selection Process

• Outreach
• Screening Committee
  – Triage on applications:
    • Noncompetitive
    • Competitive
    • Top tier
• Selection Committee
  Complicated selection process
Applications are split amongst four teams

ROUND ONE: FIRST ROUND APPLICATION REVIEW

TEAM A
Applications are reviewed by three subteams.
A1 A2 A3 A4

TEAM B
Applications are reviewed by three subteams.
B1 B2 B3 B4

TEAM C
Applications are reviewed by three subteams.
C1 C2 C3 C4

TEAM D
Applications are reviewed by three subteams.
D1 D2 D3 D4

Team chooses 1/2 to forward to next round

DEADLINE FOR FIRST REVIEW: FEBRUARY 25, 2011

ROUND TWO: SECOND ROUND APPLICATION REVIEW

TEAM A
Team A switches applications with Team B

TEAM B
Team B switches applications with Team A

TEAM C
Team C switches applications with Team D

TEAM D
Team D switches applications with Team C

Team A reads Team B applications

Team B reads Team A applications

Team C reads Team D applications

Team D reads Team C applications

DEADLINE FOR SECOND REVIEW: MARCH 21, 2011

ROUND THREE: MEETING MARCH 21-23, 2011, NEW YORK

TEAM AB
Team A & Team B Combine

TEAM CD
Team C & Team D Combine

AB
CD
ROUND THREE: MEETING MARCH 21-23, 2011, NEW YORK (CONTINUED)

TEAM AB

Team AB chooses \( \frac{1}{2} \) of applications to go forward to next round

Team AB exchanges applications with Team CD

Team AB reads Team CD’s applications

TEAM CD

Team CD chooses \( \frac{1}{2} \) of applications to go forward to next round

Team CD exchanges applications with Team AB

Team CD reads Team AB’s applications

ROUND FOUR (FINAL ROUND): MEETING MARCH 24, 2011, NEW YORK

TEAM ABCD

Team AB & CD Combine

Remaining 45-50 applications are reviewed by Team ABCD
Selection Process

• Quality of the selection process depends on the quality of the participants

• Committees consist of accomplished computational scientist from a broad range of application areas
# Selection Committee

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## Steering Committee

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Selection Criteria

• Criteria not clearly documented
• Definition in application

“Computational science” involves the innovative and essential use of high-performance computation, and/or the development of high-performance computational technologies, to advance knowledge or capabilities in a scientific or engineering discipline.
Selection Process

Questions

• How does one weigh the application of existing technologies to advance science versus the development of new methods and techniques in this pursuit?
• Is there any preference for simulation over more data-centric scientific discovery, i.e., data mining and informatics?
• Is the goal to encourage non-computational scientists to enter into the field of scientific computing or to reward outstanding applicants already in the field?
Selection Criteria

• Kept intentionally vague
• Allows program to grow “organically”
• Sets few boundaries and relies on carefully chosen screening and selection committee
• Annual discussion to set priorities
Selection Criteria

Krell’s interpretation based on program history and current grant proposal

• Fellowship proposal must be application driven
• Interpreted to mean application specific
• Excludes enabling science
Omission and Opportunity

• Excludes important part of the computational science endeavor.
• Krell (Jim Corones) aware of this omission and has advocated for a new program to include enabling sciences.
• ASCR proposed Fellowship Programs in Applied Math and High Performance Computing in FY10 and FY11 at $2M.
Conclusions

• Quality of the Fellows is exceptional.
• Quality of the management is exceptional.

• Program covers a broad range of scientific disciplines.
• Should be expanded to cover enabling sciences.
Recommendation

The Subcommittee recommends that the focus of the program be expanded to include enabling sciences, either through modification of the current program mandate or through the introduction of separate programs.
Women and Minorities

Based on

• Voluntary Data

• Outreach efforts
2002 – 2011 Applicants by Gender

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2002 – 2011 Awardees by Gender

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2002 – 2011 Awardees by Minority

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<th>Non-minority Awardees</th>
<th>Minority Awardees</th>
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</table>
Women

CSGF Data 2001-2010
• Applicants 26%
• Awardees 29%

SIAM statistics (Courtesy Jim Crowley)
• Non-student members 13%
• Student members 22%

Recent PhD (2009-2010)
• Math 31.4%
• Computer Science 18.8%
Minority

CSGF Self-reported Data (2001-2010)
• Applicants  26%
• Awardees  19%

No available data
Outreach Activities

Krell Staff attend conferences, booths handouts, plenary talks

- Women in Engineering Program Advocates Network (WEPAN),
- Association Minority Engineering Program Advocate (NAMEPA),
- Society of Women Engineers,
- Society for the Advancement of Chicanos and Native Americans in Science (SACNAS),
- Grace Hopper Conference Celebrating Women in Computing,
- Richard Tapia Celebration of Diversity in Computing Conference,
- SCxy Broader Engagement Program.
Outreach Activities

Mail printed material
• Diversity Careers,
• Association of Women in Science,
• Association of Women in Mathematics

Email material
• Women in Engineering,
• Systers
• Self-identified individuals
Conclusions

The Subcommittee feels that these efforts are commendable and no doubt lead to a higher participation of women and minorities than otherwise.

**Recommendation:** The Subcommittee commends the Krell Institute on its efforts in this area and recommends that it continue these efforts.
Other Educational Programs

• NSF GRFP

Other Programs

• DOD National Defense Science and Engineering Graduate Fellowship
• NASA Graduate Student Research Programs
• EPA STAR Graduate Fellowship
• USDA National Needs Graduate Fellowship
• NIH NRSA for Individual Pre-doctoral Fellowships
### NSF GRFP

#### Awards Given

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<tr>
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</table>

No data available on number focused on Computational Science
Conclusions

The Subcommittee believes that the CSGF is unique in its focus on Computational Science. It provides features that other Graduate research Fellowships do not, such as the Plan of Study, the Practicum, the Annual CSGF Conference and efforts to keep alumni engaged. In this regard, the CSGF is an exceptional program that produces interdisciplinary scientists uniquely qualified to address current and future computational science challenges.
Recommendation:
The Subcommittee concludes that this is a unique educational program with features the DOE can best provide and recommends that the DOE continue stewardship of the program.