

## **INCITE Proposal Preparation Instructions**

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### **2013 INCITE Call for Proposal: Important information for Authors**

Average awards per project for calendar year (CY) 2013 are expected to range between 50 million to 100 million core hours, but could be as much as several hundred million core hours. Project requests for time below 10 million hours for science and engineering simulations may be redirected to another program.

The new and upgraded systems: an IBM Blue Gene/Q, “Mira” and a Cray XK6, “Titan” will be allocated in CY 2013. The IBM Blue Gene/P, “Intrepid” will also be allocated. **Please closely examine the descriptions and expectations for allocable hours and system availability.**

Access to the new systems is very limited from April – June, 2012 but some time may be available for computational readiness runs (for example, to generate benchmarking data). Contact the relevant center to determine whether you might be able to run on a subset of the new systems for this purpose.

Revised instructions for the 2013 INCITE Call for Proposals include the following.

- Section 2.c.ii: Updated Job Characterizations including guidelines about ensemble runs.
- Section 2.c.v: Development Plans for Next-Generation Systems was previously for multi-year requests. It is now requested for all submittals.
- Section 3: Personnel Justification and Management Plan: Authors are requested to provide a management plan outlining the project’s organizational and decision-making bodies. This is requested for all proposals but is especially relevant for large collaborative efforts.

Please see the INCITE Overview and Policies for a description of the INCITE program, mission, basis for award decisions, etc. See also <http://www.doeleadershipcomputing.org/faqs/>, “Presentations” for a current webinar slide set on INCITE Proposal Writing. This webinar includes many best practices and suggestions for authors to develop proposals.

The questions posed to INCITE reviewers to assess proposals and renewals are posted as links on the proposal web form (log in is required to access the proposal form).

**Anticipated changes for future calls for proposals:** The INCITE program plans to implement in the 2014 INCITE Call for Proposals a request for any publications resulting from INCITE awards of research to the project team for work related to the proposal under consideration. Only those publications that include an appropriate acknowledgement to INCITE may be included. See the FAQs for the acknowledgement statements.

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Prior to submission, it is strongly recommended that proposers review their proposals to ensure that they comply with the proposal guidelines established below. These guidelines will be used to assist in the review of proposals. Templates for all sections are available. **The INCITE program reserves the right to return without review any proposal that does not comply with the proposal guidelines.**

The proposal must be clear, readily legible, and conform to the following requirements:

1. Each section of the proposal must be paginated. Footers should be used for paginating all files. Also, headers should be used to indicate title of the proposal and the lead PI.
2. Proposal titles may not exceed 80 characters in length.
3. Use one of the following typefaces identified below: Arial or Times New Roman (font size 12). A font size of less than 12 points may be used for mathematical formulas or equations, figure, table, or diagram captions and when using a symbol font to insert Greek letters or special characters. PIs are cautioned, however, that the text must still be readable.
4. Margins must be at least an inch in all directions. These requirements apply to all sections of a proposal, including supplementary documentation.
5. Proposals should be prepared using single line spacing. The proposal elements should not exceed the specified page count limits.
6. References may be either gathered at the end of the narrative or at the end of each major section of the narrative. References are included in the total page count.

Adherence to type size and spacing requirements also is necessary to ensure that no proposer will have an unfair advantage, by using smaller type or spacing to provide more text in the proposal.

The total file size should be limited to 5MB.

----- Guidance Continued -----

## Proposal Contents

1. **Project Executive Summary (1 page):** This should include an executive summary that accurately describes the proposed research and the high-impact scientific or technical advances you will realize with the proposed INCITE allocation. Industry organizations should also summarize the potential economic or strategic business impact of the proposed research.
2. **Project Narrative: The narrative should not exceed 15 pages. Section limits are given below.** Visual materials, such as charts, graphs, pictures, etc will be included in the 15 page limitation. URLs that provide information related to the proposal should not be included in the proposal. **The 15 page limitation will be strictly enforced.** The Project Narrative should address the following points:
  - a. **Significance of Research:** Explain what advances you expect to be enabled by an INCITE award that justifies an allocation of petascale resources (e.g. anticipated impact on community paradigms, valuable insights into or solving a long-standing challenge, etc). Place the proposed research in the context of competing work in your discipline or business. List any previous INCITE award(s) received and discuss the relationship to the work proposed here. Please also list any previous Discretionary award(s) at the Argonne or Oak Ridge leadership computing facilities. **This section, including references, should not exceed four (4) pages.**
  - b. **Research Objectives and Milestones:** Describe the proposed research, including its goals, milestones and the theoretical and computational methods it employs. The information should be sufficient for peer review in your area of research and also appropriate for general scientific review comparing your proposal with proposals in other disciplines. Goals and milestones should articulate simulation and developmental objectives and be sufficiently detailed to assess the progress of the project for each year of any allocation granted. It is especially important that in the research proposal, authors provide clear connections between the project's overarching milestones, the planned production simulations, and the compute time expected to be required for these simulations. **This section, including references, should not exceed six (6) pages.**
  - c. **Computational Readiness:** This section, including references, should not exceed five (5) pages.
    - i. **Approach:** Provide
      1. a description of the underlying mathematical formulation (e.g., ODE, PDE),
      2. particular libraries required by your production and analysis software, the algorithms and numerical techniques employed (e.g., finite element, iterative solver), programming languages, and other software used,

3. the parallel programming model(s) used (e.g., MPI, OpenMP, Pthreads), and
  4. a description of project workflow including the role that analysis and visualization plays in the project's discovery process; identify where the analysis will be done and any potential bottlenecks in the analysis process.
- ii. **Job Characterization:** Applicants must present evidence that their proposed production simulations can make effective use of a significant fraction, in most cases 20% or more, of the HPC systems requested. Production jobs using <20% of the computer may experience significant throughput limitations. Parameter sweeps, ensembles, design evaluations, and other statistical methods that require large numbers of discrete or loosely coupled simulations can be considered capability-class campaigns if the volume of work is so large that time-to-solution is an untenable pacing issue and if a software workflow solution (e.g., pre- and post-processing scripts that automate run management and analysis) is provided to facilitate this volume of work. Applicants planning to execute ensemble jobs are advised to review the Frequently Asked Question "Can I meet the computationally intensive criterion by loosely coupling my jobs?" [https://hpc.science.doe.gov/allocations/incite/faq.do#faq\\_13](https://hpc.science.doe.gov/allocations/incite/faq.do#faq_13). In your descriptions below state how the jobs are tied to each of your project's goals. For the simulations you plan to carry out during production runs, provide
1. a description of what jobs are going to be run; relate these to the research/development objectives given above,
  2. a description of processor/core utilization for large runs (e.g. 10,000 hour run with 100 cores, or ten 10 hour runs with 10,000 cores, for a 1,000,000 hour allocation), and
  3. a clear, detailed explanation as to how you calculated the requested number of processor hours.
- iii. **Parallel Performance:** Provide direct evidence, including *supporting quantitative data*, for your production application's parallel performance. Data for related – but not intended production – application codes is undesirable. Data should reflect performance for the intended research simulations. Performance benchmarking should reflect all I/O requirements of your application. Parallel performance data in either strong or weak scaling mode *must* be provided. Explain how the strong or weak scaling applies to the proposed work. Weak scaling behaviors are probed by holding per-node computational work constant (e.g., the size of the mesh on a processor is held constant) as the total problem size grows with processor count. Strong scaling behaviors are probed by holding the total problem size constant as the processor count grows, thereby decreasing the per-processor computational work. Supporting quantitative data should be provided in either tabular or graphical form, or both; also a

speedup curve should be supplied for strong scaling examples. Where appropriate, characterize the production application's single-node performance (ex. percent of peak).

NOTE: If the supporting quantitative data is not available for your application, you may apply for a start-up account at one of the centers to conduct performance studies. Applications for start-up accounts are available at:

ANL: [www.alcf.anl.gov/resource-guides/getting-started-directors-discretionary](http://www.alcf.anl.gov/resource-guides/getting-started-directors-discretionary)

ORNL: [www.olcf.ornl.gov/support/getting-started/olcf-director-discretion-project-application](http://www.olcf.ornl.gov/support/getting-started/olcf-director-discretion-project-application)

An example of the kind of parallel performance data sought can be found at the end of this document. Without this data, application readiness cannot be adequately ascertained and hence awarding this INCITE allocation request will be placed in jeopardy.

- iv. **Developmental Work:** If the performance data indicates less than 50% parallel efficiency on less than twenty percent of the requested system, please delineate the path forward for achieving greater performance on much larger scale simulations with the requested INCITE resources. If the production application scales (i.e. parallel speedup remains greater than 1) to less than 20% of the requested resource, or, if you propose to use part of an INCITE allocation to further enhance scaling and overall performance, outline the development plans and any desired support from the center. Describe what, if any, development work has been carried out to date, especially on the architecture of the requested resource.
- v. **Development Plans for Next-Generation Systems.** Proposal authors should provide a development plan articulating a strategy for running effectively on the new and upgraded HPC systems at the ALCF and OLCF. See the system descriptions provided at the call for proposals web site (<http://hpc.science.doe.gov/>). We recognize that researchers may not have access to, or experience with, the new hardware architecture, however, authors should give thought to the LCF future systems and indicate whether they have committed resources to prepare to maximize node-level parallelism. Areas to consider for discussion here include the following.
  1. Experiments or developments to make use of hardware multi-threading on a core and multiple cores per node
  2. Experiments or developments to expose vector or streaming parallelism through, e.g. CUDA, OpenCL, OpenMP, Pthreads, compiler directives, etc.

3. General design to improve data locality and memory hierarchy usage
  - vi. **Workflow Patterns:** Provide an estimate for the percentage of project time you will spend on development (porting, performance analysis) computing and other non-production runs. Describe your anticipated usage patterns for each year of the requested award, for example
    - Production jobs at a steady state throughout the year;
    - Development work at the beginning of the year, with periods [specified] of intense production work, or
    - Development work at the beginning of the year, with production work after mid-year.
  - vii. **I/O:** Please discuss the I/O requirements for the proposed simulation jobs. Highlight any exceptional I/O needs.
    1. Restart I/O. Describe your I/O requirements for program restart. Include a list of the types of files you write out for program restarts, i.e. MPI/IO, raw binary, serial from all processors, HDF5, etc. and the following quantitative information: how much restart data you write out, or percentage of memory image occupied by the executing application, how many processors write-out restart data; how much memory your job takes per processor; the size of a single restart dump, maximum percentage of total execution time acceptable to read/write restart data, etc.
    2. Analysis I/O: describe your I/O requirements for analysis. Include a list of the types of files you write out for analysis (i.e. HDF5, NetCDF, PHDF5, PnedtCDF; size of analysis dump, amount and type of data read into analysis program, etc.), number of jobs needed on-hand to do analysis,
    3. Workflow I/O. How much I/O do you need per job? Do you have any exceptional I/O needs?
  - viii. **Data Storage:** The LCF reserves the right to request that data be transferred to another location following the project's completion. To assist the INCITE program in identifying potential long-term storage solutions, please comments on the anticipated cumulative size of stored data at the end of the requested award (e.g. one-, two-, or three years) and any challenges in relocating this data.
3. **Personnel Justification and Management Plan:** A personnel justification and management plan should be included in the proposal and detail what personnel are already in place, including a description of their roles on the project. If applicable, details should be provided on personnel that would be hired on the project in the future and the responsibilities of any new personnel. The INCITE program welcomes proposals from individual PIs or teams of collaborators. In order to more effectively interface with projects during the period of production simulations (e.g. post-award), the INCITE

program will require at the time of proposal submittal a management plan that includes a description of the project's leadership team and how decisions are made to allocate time to individuals or, for proposals with multiple collaborating teams, subgroups within the project. A statement should be included describing the focus of each individual/subgroup and their relationship to the overarching scientific or engineering goal of the INCITE submittal. The management plan must clearly define points of contact in the project who will provide, as needed, updates on the status of the work including publications, awards, and highlights of accomplishments. For some projects this will be the PI. For larger collaborations, subgroup or task leads may also be designated. In addition to facilitating interactions between the INCITE program, the centers, and the project team during production, the management plan will also be integral in the review and renewal process. Successful proposals will include a management plan that conveys to reviewers the interrelationship between subgroups and how the sum of the parts will lead to scientific discovery or engineering solutions that comprise the overarching goal of the project. Proposals that include both capability and capacity type computing elements must clearly articulate how the latter is required for successful delivery of leadership-class solutions. (Does not count toward the 15-page limit).

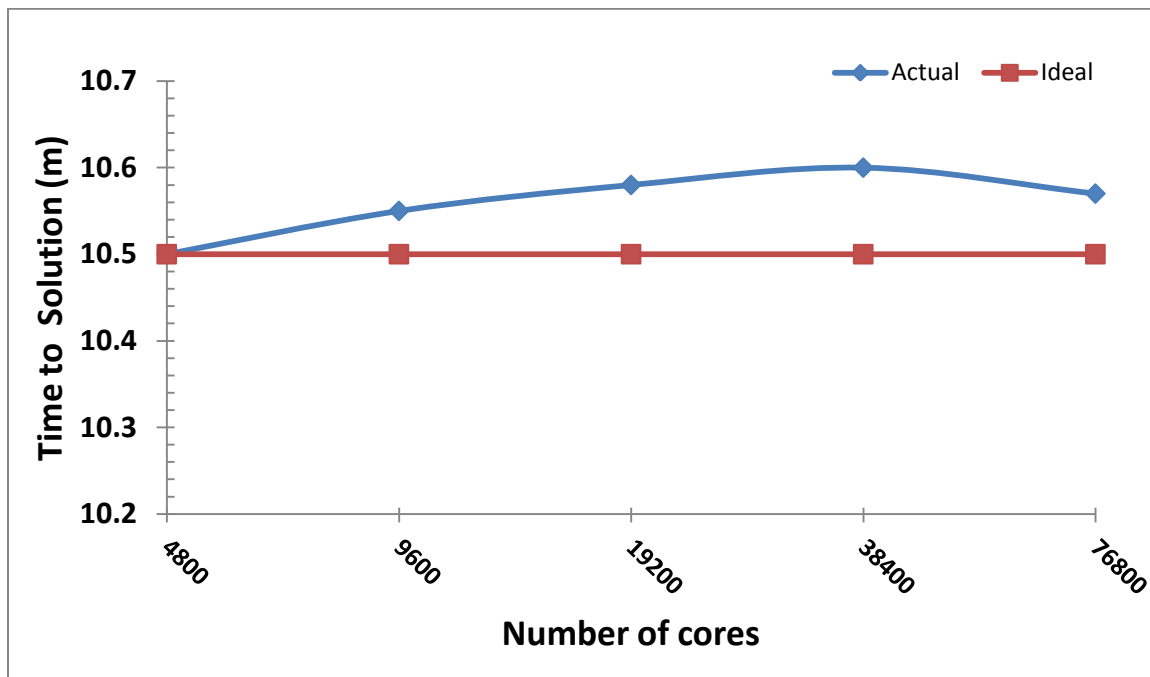
4. **Milestone Table:** New proposals must be accompanied by a summary table of planned milestones, listed for each year of the proposed work. Milestones should be clearly articulated and appropriate for the size and length of the requested award (e.g. large requests should have sufficient milestones to allow reviewers to assess the planned project workflow). Multi-year projects undergo an annual review and will be provided this table to update with project accomplishments. Any future modification to the project scope and milestones will be tracked in part through the milestone table. Reviewers of new proposals and renewals are specifically asked by the INCITE program about the milestones: the clarity and reasonableness of those in projects being considered for awards, and milestone achievements in projects being considered for renewal. It is important to spend sufficient time to clearly articulate the scientific and technical (e.g. development) milestones for each year of the proposed work.

**NOTE:** No Letters of Collaboration or Letters of Support will be accepted with the proposal. Current and Pending Support document is not required for this solicitation.

An example of the kind of parallel performance data sought is given in the following examples:

**Weak Scaling Example:**

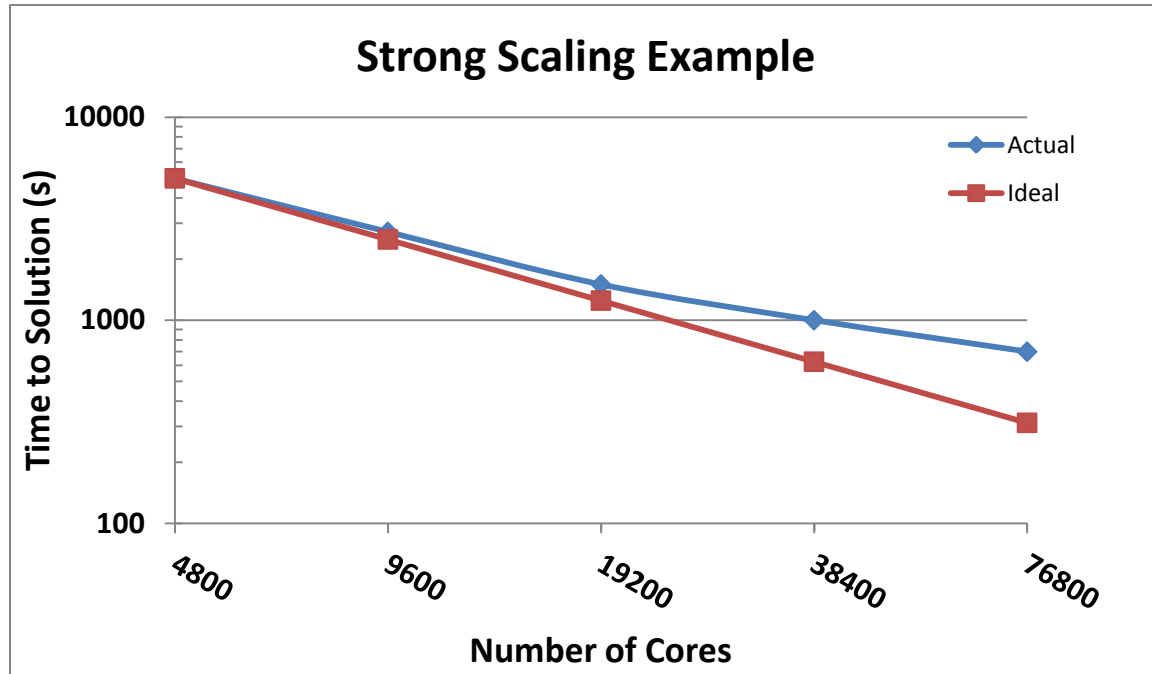
nProc	Time to Solution	Ideal
4800	10.50	10.50
9600	10.55	10.50
19200	10.58	10.50
38400	10.60	10.50
76800	10.57	10.50





### Strong Scaling Example:

nProc	Time to Solution	Ideal
4800	5000.00	5000.00
9600	2725.00	2500.00
19200	1500.00	1250.00
38400	1000.00	625.00
76800	700.00	312.5



### Strong Scaling Speed Up Example:

nProc	Speedup	Ideal
4800	4800.00	4800.00
9600	8807.34	9600.00
19200	16000.00	19200.00
38400	24000.00	38400.00
76800	34285.71	76800.00

