

**Program Announcement
To DOE National Laboratories**

LAB 11-583

**Office of Science
Office of Fusion Energy Sciences
Jointly with
The National Nuclear Security Administration, Defense Programs
Office of Stockpile Stewardship**

High Energy Density Laboratory Plasmas

**GENERAL INQUIRES ABOUT THIS PROGRAM ANNOUNCEMENT SHOULD BE
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SUMMARY:

The Fusion Energy Sciences (FES) program of the Office of Science (SC) and the Office of Stockpile Stewardship of the Defense Programs (DP) of the National Nuclear Security Administration (NNSA), both of the U.S. Department of Energy (DOE), jointly announce their interests in receiving proposals for new awards and renewals for research in the SC-NNSA Joint

Program in High-Energy-Density Laboratory Plasmas (HEDLP). All DOE National Laboratories planning to submit proposals for new or renewal funding in Fiscal Year 2012 should submit in response to this Program Announcement.

The specific areas of interest are:

1. High-Energy-Density Hydrodynamics
2. Radiation-Dominated Dynamics and Material Properties
3. Magnetized High-Energy-Density Plasma Physics
4. Nonlinear Optics of Plasmas and Laser-Plasma Interactions
5. Relativistic High-Energy-Density Plasmas and Intense Beam Physics
6. Warm Dense Matter
7. Diagnostics for HEDLP
8. Community Development Activities

More specific information on each area of interest is outlined in the general and program specific supplementary information provided below.

Letter of Intent (LOI).

LOI DUE DATE: September 30, 2011

A LOI is STRONGLY ENCOURAGED and should be submitted by September 30, 2011. It is important that the submission be in a single PDF file. The LOI should clearly indicate the research area or areas identified in the **SUPPLEMENTARY INFORMATION** section to which the proposal is responding. The LOI should be submitted electronically by E-mail to John.Sauter@science.doe.gov, with a copy to Ann.Satsangi@science.doe.gov, Sean.Finnegan@science.doe.gov, Keith.LeChien@nnsa.doe.gov and Kirk.Levedahl@nnsa.doe.gov. Please include “**Letter of Intent for LAB 11-583**” in the subject line.

The purpose of the LOI is to help in planning the review and the selection of potential reviewers for the proposal. For this purpose, the LOI must include: (1) identification of relevant research areas of interest from among those identified in this FOA, (2) one-page abstract of the proposed research; (3) list of names and institutional affiliations of all Principal Investigators, key investigators, collaborators, or consultants; (4) for each funded PI, a list of collaborative co-investigators including co-authors of past 48 months, co-editors of past 24 months, graduate and postdoctoral advisors/advisees, and close associations. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the Principal Investigator interacted on a regular basis while the research was being done. For proposed investigations requiring access to experimental user facilities, confirmation of communication with the facility’s point-of-contact should be indicated in the LOI. Collaborations should submit a single LOI clearly indicating the collaboration and all PI’s and institutions involved, and list a primary point of contact/Lead PI for the research activity.

PROPOSAL DUE DATE:

Formal proposals submitted in response to this LAB Program Announcement must be submitted from the Laboratory to the site office through Searchable FWP no later than **Thursday, November 3, 2011, 11:59 PM Eastern Time** to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2012. **Each proposal should be in a single PDF file. The first few pages of the PDF should be the Field Work Proposal followed in the same PDF by the full technical proposal.** You are encouraged to transmit your proposal well before the deadline. PROPOSALS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.

Have your LAB administrator submit the entire LAB proposal and FWP via Searchable FWP (<https://www.osti.gov/fwp>). If you have questions about who your LAB administrator is or how to use Searchable FWP, please contact the Searchable FWP Support Center.

SUPPLEMENTARY INFORMATION:

Descriptions of the Research Programs and the Proposals Solicited under this Announcement.

High-energy-density laboratory plasma (HEDLP) physics is the study of ionized matter at extremely high density and temperature, specifically when matter is heated and compressed to a point that the stored energy in the matter reaches approximately 100 billion Joules per cubic meter (the energy density of a hydrogen molecule). This corresponds to a pressure of approximately 1 million atmospheres or 1 Mbar. Systems in which free electrons play a significant role in the dynamics and for which the underlying assumptions and methods of traditional ideal-plasma theory and standard condensed matter theory do not apply (e.g., Warm Dense Matter (WDM) at temperatures of a few eV) can have pressures as low as 0.1 Mbar and are also considered high-energy-density plasmas [R. P. Drake, Phys. Plasmas 16, 055501 (2009)].

Proposals on high-energy-density science are sought by this FOA that address the recommendations of the 2003 report *Frontiers in High Energy Density Physics The X Games of Contemporary Science*, the intentions of the 2007 *Report of the Interagency Task Force on high-energy-density physics*, and the research needs identified by the 2009 Research Needs Workshop (ReNeW) on high-energy-density laboratory physics. Proposed research efforts can include experimental, theoretical, and/or computational science. Proposals integrating experiments, theory, and simulation are encouraged. Specifically, proposals are sought in the following subfields and cross-cutting areas of HEDLP, as described in the Report of the ReNeW in HEDLP, with additional scope indicated specifically below:

1. High-Energy-Density Hydrodynamics

Specific areas of interest include, but are not limited to, turbulent mixing, probing properties of high-energy-density (HED) matter through hydrodynamics, solid-state hydrodynamics at high pressures, new hydrodynamic instabilities, and hydrodynamic scaling.

2. Radiation-Dominated Dynamics and Material Properties

Specific areas of interest include, but are not limited to, radiative shocks, radiation waves and radiation transport, radiative cooling, opacities and equation of state, radiative instabilities, and radiation pressure.

3. Magnetized High-Energy-Density Plasma Physics

Specific areas of interest include, but are not limited to, basic properties of magnetized HED plasmas, coupled dynamics and atomic kinetics, phase transitions in the presence of high magnetic fields and current densities, ultra high magnetic fields and their measurements, radiation-dominated HED dynamo, and radiation-dominated reconnection.

4. Nonlinear Optics of Plasmas and Laser-Plasma Interactions

Specific areas of interest include, but are not limited to, the interplay between coherent radiation and nonlinear states in HED plasmas, nonlinear-wave-particle interactions, multiple coexisting instabilities, broadband radiation in plasma, and quantum phenomena in plasmas.

5. Relativistic HED Plasmas and Intense Beam Physics

Specific areas of interest include, but are not limited to, relativistic laser and beam propagation, relativistic laser-solid interaction, ultrahigh energy density plasmas at the quantum electrodynamic (QED) limit, relativistic thermal plasmas, and relativistic shocks.

6. Warm Dense Matter

Specific areas of interest include, but are not limited to, phase transitions in and around the WDM regime, comprehensive theory connecting different WDM regimes, equation of state dependence on formation history, transport properties of warm dense matter, and quark-gluon plasma similarities to warm dense matter.

7. Diagnostics for HEDLP

Proposals will be considered for the development of advanced diagnostic instruments, methods and experimental techniques, as discussed in the ReNeW report, to be developed at the home institution or on intermediate scale HED facilities, and that would, if the research is fruitful, have potential applications on large scale facilities e.g. the National Ignition Facility (NIF), the Z-machine at the Sandia National Laboratories, the Matter under Extreme Conditions Instrument (MECI) at the Stanford Linear Accelerator Center.

8. Community Development Activities

Proposals will be accepted for community-development activities, especially in the areas associated with the LINAC Coherent Light Source Materials under Extreme Conditions Instrument experimental end station at the Stanford Linear Accelerator Center (LCLS-MECI), the Neutralized Drift Compression Experiment upgrade (NDCX-II) at the Lawrence Berkeley National Laboratory, and the National Ignition Facility at the Lawrence Livermore

National Laboratory. Examples of community-development activities may include partial support for coordinating a series of workshops, a multi-institutional, broad-impact research effort in HEDLP science, a community-accessible platform for data sharing, and user-oriented support.

An initial review will check that the proposal is responsive to the objectives of the Announcement and not duplicative of programmatic work, in addition to checking for eligibility, completeness and mandatory requirements. Proposals which satisfy the initial review criteria will be subjected to formal merit review (see below: Office of Science Guide for Preparation of Scientific/Technical Proposals to be Submitted by National Laboratories/1. Evaluation Criteria).

References

Frontiers in High Energy Density Physics: The X Games of Contemporary Science, 2003 (http://www.nap.edu/catalog.php?record_id=10544)

Office of Science and Technology Policy (OSTP), *Report of the Interagency Task Force on High Energy Density Physics* (Chairs: C. Keane, D. Kovar), National Science and Technology Council, Committee on Science, Interagency Working Group on the Physics of the Universe. (http://www.whitehouse.gov/sites/default/files/microsites/ostp/report_of_the_interagency_task_force_on_high_energy_density_physics.pdf).

Report of the 2009 Workshop on Basic Research Needs for High-Energy-Density Laboratory Physics, Chairs: Robert Rosner and David Hammer. (http://science.energy.gov/~media/fes/pdf/workshop-reports/Hedlp_brn_workshop_report_oct_2010.pdf)

Collaboration

Collaborative research projects that require more than one institution are welcome *if the added value is absolutely clear and compelling*. Proposals involving a multi-institution collaborative team will be scrutinized. Those without an obvious collaborative imperative or clear benefit from the collaboration are discouraged and will be declined. Listing collaborators external to the principal investigator's institution that are not absolutely essential will be regarded as a negative factor. Listing co-investigators and collaborators who do not draw salary and support from the proposed budget is discouraged.

All proposals being submitted as part of a multi-institutional collaboration (e.g. Lab-Lab, Lab-Univ.) must have the same title, clearly indicate they are part of a proposed collaboration, contain a common description of the overall research project, contain scientific or technological justification for treating the proposal as part of a collaboration, include Letters of Coordination from the collaborative partners, and identify a lead principal investigator for the entire collaboration. Each proposal, participating in collaboration, must have a distinct scope of work, budget for their institution, and a qualified principal investigator, who is responsible for the

research effort being performed at his or her institution. Multi-institutional collaborative proposals will be reviewed as a single project and subsequently awarded or declined as a single project.

Additional Information

In selecting proposals for funding, priority will be given to proposals that can produce experimental results within three years after grant initiation. Theoretical research will be accepted for consideration if it is related to, or supports, a laboratory experiment or nature observations. Preferred proposals in this category would typically have a performance period of three years. For important information on the format of the proposal, please see below: **Office of Science Guide for Preparation of Scientific/Technical Proposals to be Submitted by DOE National Laboratories** (3 to 3.4).

PROGRAM FUNDING:

Awards (typically single-investigator projects) are expected to be made for a period of two or three years at a funding level appropriate for the proposed scope, with out-year support contingent on the availability of appropriated funds and satisfactory progress. Total funding up to \$14,000,000 annually is expected to be available to support the DOE National Laboratory and non-DOE laboratory Awards, subject to appropriation of funds by Congress. DOE is under no obligation to pay for any costs associated with the preparation or submission of a proposal. DOE reserves the right to fund, in whole or in part, any, all, or none of the proposals submitted in response to this Announcement.

The Joint Program reserves the right to make zero awards, or fewer awards than would be possible at the \$14,000,000 grand-total level, if an insufficient number of proposals are judged to be of suitable scientific quality or of sufficient relevance to the programs described in Part I. The cost effectiveness of the proposal will be considered when comparing proposals with differing funding requirements. A single award or multiple awards may be made depending on the number and quality of the proposals that are received and favorably reviewed. If multiple awards are made, it is anticipated that award sizes may range from \$50,000 per year to \$1,000,000 per year, typically less than \$300,000 per year. Proposals for greater than \$500,000 per year need to justify a budget that is much larger than the average award. Proposals for larger than \$2,000,000 per year are unlikely to be successful. Programmatic relevance is a factor in evaluating all proposals.

The instructions and format described should be followed. You must reference Program Announcement LAB 11-583 on all submissions and inquiries about this program.

OFFICE OF SCIENCE
GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS
TO BE SUBMITTED BY NATIONAL LABORATORIES

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this Program Announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Initial Review Criteria.

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for the award; (2) the information required by the FOA has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the Announcement, and (5) the proposed project is not duplicative of programmatic work. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

2. Merit Review Criteria.

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria, listed in descending order of. Included with each criterion are the detailed questions that will be asked of the reviewers.

1. Scientific and/or Technical Merit of the Project

- Discuss and assess the likelihood that the research being proposed will be deemed important in the relevant field of science (one or more of the preferred research areas identified in Part I). Comment on the potential impact of the expected findings outside its primary field.
- Does the application articulate the scientific objectives and/or the scientific issues of the proposed research in terms of an achievable plan? Comment on the competence of the investigators, the institutionally available infrastructure, and proposed resources in terms of achieving this plan.
- What is the likelihood that the specific project will lead to fundamental advances or discovery in its field within the proposed project period? Compare the anticipated scientific benefit of the proposed research for the proposed project period to that associated with past projects of the investigators or of peer investigators.

2. Appropriateness of the Proposed Method or Approach

- Is the proposed research approach sound and innovative?
- To what extent does the applicant recognize significant potential problems and consider alternative strategies?
- Comment on the effectiveness of the proposed research effort in addressing the scientific issues and/or objectives of the proposed research.

3. Competency of Applicant's Personnel and Adequacy of Proposed Resources

- How well qualified are the applicant's personnel to carry out the proposed research? (If appropriate, please comment on the scientific reputation and quality of recent research by the principal investigators and other key personnel.)
- Please comment on the applicant's research environment and resources.
- Does the proposed work take advantage of unique facilities and capabilities and/or make good use of collaborative arrangements?

4. Reasonableness and Appropriateness of the Proposed Budget

- Are the proposed budget and staffing levels adequate to carry out the proposed research?

For renewal applications, the reviewers will also be asked to answer the following question:

Performance under the Existing Award

- Assess the progress the applicants made toward the research goals during the most recent performance period (last funding cycle) and the impact of the research in the relevant area of science.
- To the extent possible within his or her available means, has the applicant disseminated the results of his or her research through publications in peer-reviewed journals, meeting and conference presentations, workshops, or other appropriate means?
- If appropriate, has the applicant attempted to compare experimental results against theoretical predictions?

Other Appropriate Factors

- Could the proposed research make a significant contribution to another field?
- Is there potential for spin-offs?
- If applicable, please comment on the educational benefits of the proposed activity.
- What are the overall strengths and weaknesses of the application?

SC and NNSA will also consider, as part of the evaluation, other available advice or information as well as program policy factors such as ensuring a programmatically appropriate balance within the program areas, coupling to theory and computational efforts, and quality of previous performance. Selection of applications for award will be based upon

the findings of the technical evaluations, the importance and relevance of the proposed research to the SC and NNSA's missions in high energy density laboratory plasmas, and funding availability. Funding under this Announcement is limited to supporting research activities based in the U.S., though subcontracts with an international dimension are welcome. Limited funding for collaborators outside the U.S. may be allowed with appropriate justification.

3. Summary of Proposal Contents

- Field Work Proposal (FWP) Format (Reference DOE Order 412.1A) (DOE ONLY)
- Proposal Cover Page
- Table of Contents
- Budget (DOE Form 4620.1) and Budget Explanation
- Abstract (one page)
- Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel - 25-page limit)
- Literature Cited
- Biographical Sketch(es)
- Description of Facilities and Resources
- Other Support of Investigator(s)
- Appendix (optional)

3.1 Submission Instructions

Have your LAB administrator submit the entire LAB proposal and FWP via Searchable FWP (<https://www.osti.gov/fwp>). If you have questions about who your LAB administrator is or how to use Searchable FWP, please contact the Searchable FWP Support Center.

FOR FURTHER INFORMATION CONTACT:

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4. Detailed Contents of the Proposal

Adherence to type size and line spacing requirements is necessary for several reasons. No researcher should have the advantage, or by using small type, of providing more text in his or her proposal. Small type may also make it difficult for reviewers to read the proposal. Proposals must have 1-inch margins at the top, bottom, and on each side. Type sizes must be at least 11 point. Line spacing is at the discretion of the researcher but there must be no more than 6 lines per vertical inch of text. Pages should be standard 8 1/2" x 11" (or metric A4, i.e., 210 mm x 297 mm).

4.1 Field Work Proposal Format (Reference DOE Order 412.1A) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

4.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project
SC Program Announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI
Name of official signing for laboratory*
Title of official
Fax number of official
Telephone of official
Electronic mail address of official
Requested funding for each year; total request
Use of human subjects in proposed project:
 If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.
Use of vertebrate animals in proposed project:
 If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.
Signature of PI, date of signature
Signature of official, date of signature*

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

4.3 Table of Contents

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages, and do not use suffices, such as 5a, 5b.

4.4 Budget and Budget Explanation

A detailed budget is required for the entire project period and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information*. Modifications

of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

* Form 4620.1 is available at web site: <http://www.science.doe.gov/grants/budgetform.pdf>

4.5 Abstract

Summarize the proposal in one page. Give the project objectives (in broad scientific terms), the approach to be used, and what the research is intended to accomplish. State the hypotheses to be tested (if any). At the top of the abstract give the lead DOE national Laboratory, project title, names of all the investigators and their institutions, and contact information for the principal investigator, including e-mail address.

4.6 Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel).

The narrative comprises the research plan for the project and is limited to **25 pages (maximum)**. It should contain enough background material in the Introduction, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project, and should indicate which project personnel will be responsible for which activities. It is important that the 25-page technical information section provide a complete description of the proposed work, because reviewers are not obliged to read the Appendices. Proposals exceeding these page limits may be rejected without review or the first 20 pages may be reviewed without regard to the remainder

The page count of 25 does not include the Face Page and Budget Pages, the Title Page, the biographical material and publication information, or any Appendices. However, it is important that the 25-page technical information section provide a complete description of the proposed work, since reviewers are not obliged to read the Appendices.

Background and Recent Accomplishments

- 0 Background – explanation of the importance and relevance of the proposed work.
- 0 Recent Accomplishments – this subsection is mandatory for renewal proposals and should summarize the proposed work and the actual progress

made during the previous funding period.

Proposed Research and Tasks

In addition to the technical description of the proposed work and tasks, include a discussion of the following:

- 0 Impact of the proposed research on other fields of science, if appropriate.
- 0 Project schedule, milestones, and deliverables.

If any portion of the project is to be done in **collaboration** with another institution (or institutions), provide information on the institution(s) and what part of the project it will carry out. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation," "Biographical Sketches," and "Description of Facilities and Resources."

4.7 Literature Cited

Give full bibliographic entries for each publication cited in the narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Principal investigators should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal.

4.8 Biographical Sketches

This information is required for senior personnel at the institution submitting the proposal and at all subcontracting institutions (if any). The biographical sketch is limited to a maximum of two pages for each investigator and must include:

Education and Training. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

Research and Professional Experience. Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than five professional and scholarly activities related to the effort proposed.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information must also be provided in each biographical sketch.

Collaborators and Co-editors: A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been, collaborators or co-authors with the investigator on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of the proposal. Also, include those individuals who are currently or have been co-editors of a special issue of a journal, compendium, or conference

proceedings during the 24 months preceding the submission of the proposal. Finally, list any individuals who are not listed in the previous categories with whom you are discussing future collaborations. If there are no collaborators or co-editors to report, this should be so indicated.

Graduate and Postdoctoral Advisors and Advisees: A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations. A list of the names of the individual's graduate students and postdoctoral associates during the past five years, and their current organizational affiliations.

4.9 Description of Facilities and Resources

Facilities to be used for the conduct of the proposed research should be briefly described. Indicate the pertinent capabilities of the institution, including support facilities (such as machine shops), that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution (if any).

4.10 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial, or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort (months per year or percentage of the year) devoted to the project.

4.11 Appendix

Information not easily accessible to a reviewer may be included in an appendix, but **do not use the appendix to circumvent the page limitations of the proposal**. Reviewers are not required to consider information in an appendix, and reviewers may not have time to read extensive appendix materials with the same care they would use with the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts accepted for publication, abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

5. Detailed Instructions for the Budget

(DOE Form 4620.1 "Budget Page" may be used).

5.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Applicants should list the number of

postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

5.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$50,000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

5.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

5.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

5.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

5.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.