Proposed Research for the ARIES Team for 1999-2000

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Virtual Laboratory for Technology Meeting

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Proposed topics have been developed under the Virtual Laboratory for Technology framework and discussion with physics and technology program leaders*

- Role of Fusion in a Sustainable Energy Strategy
  (in support of IIASA Study) (10% of effort)
- Advanced ARIES-RS (25% of effort)
- Neutron Source (60% of effort)
- Support for on-going examination of fusion systems as producers of hydrogen (5% of effort)

- Stellarator Power Plant (If additional resources become available)

* Assumes President’s budget allocations
Strategic Studies of the Role of Fusion in a Sustainable Energy Strategy Initiative

• There is a need to make a case for fusion energy in the context of a sustainable global energy future.

• Study should be done by an independent organization, recognized worldwide as experts in the global strategic modeling.

• It would be most helpful if such a study is requested by or has the support of all ITER partners

• International Institute for Advanced Systems Analysis (IIASA) is an organization of choice for this study.
International Institute for Advanced Systems Analysis (IIASA) -- Background

- IIASA was created during the Cold War for “scientists of East and West to work together on problems that plagued all advanced nations.”

- IIASA charter, as a multinational organization, was signed in 1972 in London. Its headquarters is in Vienna.

- IIASA is supported by national members organizations (from Europe, including former Soviet republics, Japan, and U.S.)

- IIASA has done a fusion/fission-breeder comparison study

- IIASA current director is Gordon MacDonald

- For more information see http://www.iiasa.ac.at/
Strategic Studies of the Role of Fusion in a Sustainable Energy Strategy Initiative

- Bob Conn has contacted Gordon MacDonald.
- MacDonald has shown interest in a fusion study.
- A draft statement of work is prepared. Pending OFES comments, it will be sent to IIASA for MacDonald’s feedback.
- IIASA has its own internal funding. Therefore, only modest resources would be required by IIASA for this study.
- ARIES Team will compile and provide the necessary information for IIASA study.
- July ITER council meeting at Vienna is a good time to visit IIASA.
Advanced ARIES-RS

- ARIES-RS is the vision for the advanced tokamak program and is used to plan R&D directions.

- ITER EDA will concentrate on developing lower-cost options using advanced modes to achieve a higher performance.

- Focus of the program on advanced tokamaks has resulted in major progress which will be continued in the next few years.

- A re-visit of ARIES-RS is warranted to assess “how good” advanced tokamaks can be using higher performance physics and technology.

- This effort will provide timely information to the program and compliment the ITER low-cost options activity.
Neutron Source Study -- Rationale

• Scoping studies have indicated that fusion neutron sources may lead to attractive, near term products for the fusion program, leading to new clients and to additional resources for fusion development.

• An integrated conceptual design is warranted at this time to produce a technically credible argument for non-electric application of fusion.

• Such study will provide the necessary information to help OFES and FESAC decide on giving non-electric application of fusion a visible role in the program direction.
Neutron Source Study -- First Phase

- Define what fusion should deliver to be competitive in these markets:
  - Technical requirements of fusion neutron sources (e.g., flux, fluence, availability, cost, competition potential)
  - Extrapolation from present data base
  - Cost, RAMI, and safety & environmental issues

- Concurrently, consider the potential tokamak and alternatives to fulfill role of a fusion neutron source.

- Technical requirements and time-scale/cost of the competition will be used to choose one or two concepts for further study.

- This phase to take about 6 to 9 months.
**Neutron Source Study -- Second Phase**

- Depending on the results of the first phase, one or two studies will be launched. For example:

  1) A low neutron flux and a low neutron fluence device (small extrapolation from present technology) and

  2) A high neutron flux and a high neutron fluence device (larger extrapolation)

- This division differentiates between application and between the time needed to develop a concept. It is quite possible that the first device would be the precursor to the second device.

- This phase will take about 15 to 18 months.
Stellarator Power Plant Study

• Major worldwide stellarator program with two proof-of-performance stellarator experiments, LHD and W7X.

• Five years ago, SPPS study by the ARIES Team provided the impetuous for advanced compact stellarators. SPPS represents a factor of two improvement over conventional stellarators. SPPS was a “part time” study aiming at identifying the potential of advanced stellarator.

• Considerable progress has been made in advanced stellarators which may lead to more attractive stellarator power plants.
Stellarator Power Plant Study

• An stellarator power plant study is warranted when a proof-of-principle, advanced stellarator program is launched in U.S. Such a study will help guide the experimental R&D.

• If a proof-of-principle stellarator program is launched in US and if additional resources (beyond President’s budget levels) are provided, a low-level effort can be initiated in coordination with the physics community.

• During the next two years, this effort will provide preliminary feedback to the stellarator community. In addition, it will set the ground work for a detailed stellarator study after the neutron source study.