

Proposed Research for the ARIES Team for 1999-2000

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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 impetus 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.**