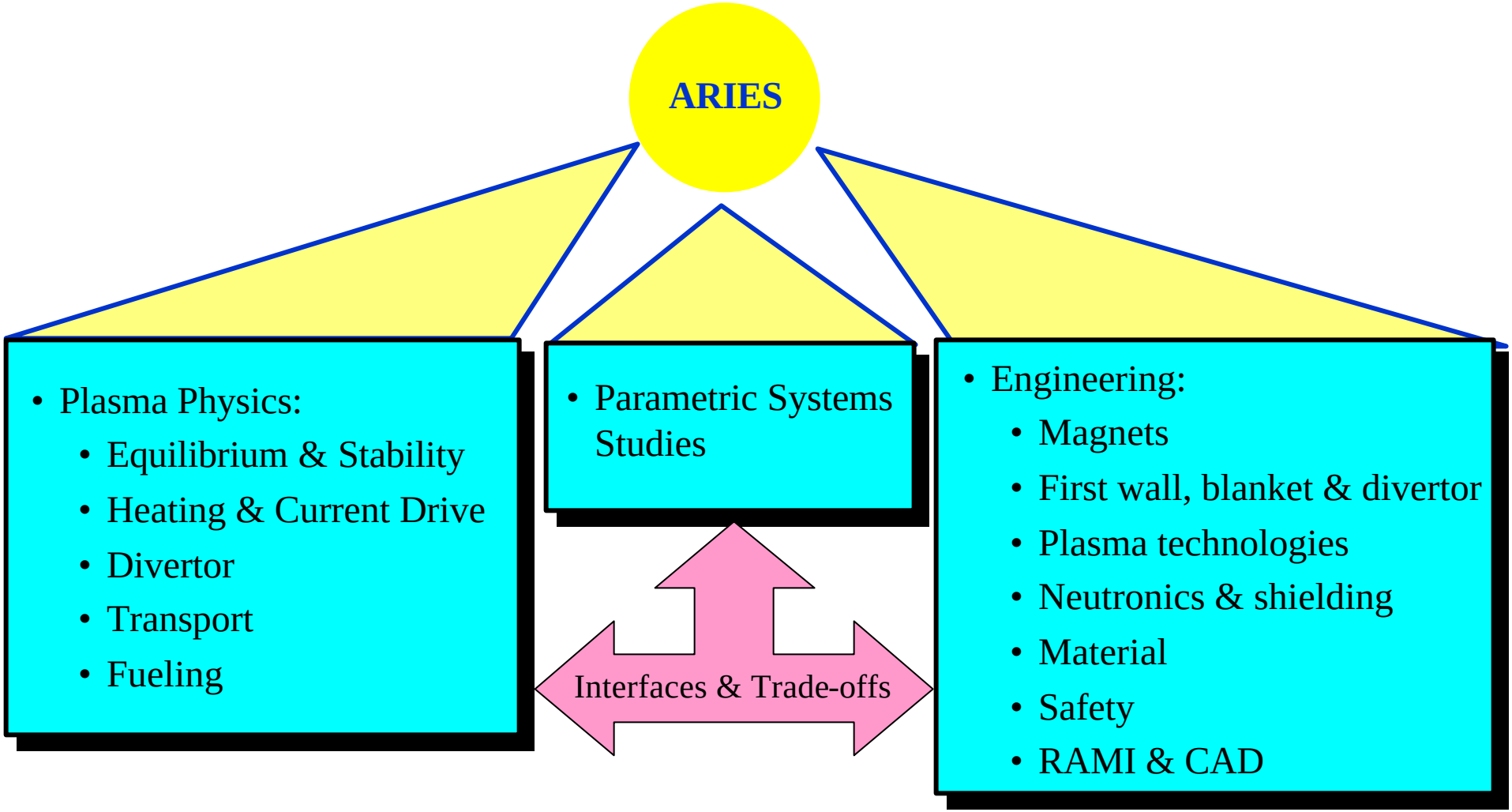
Summary and Closing Remarks

Farrokh Najmabadi
University of California San Diego

Presentation to:
ARIES Program Peer Review
August 18, 2000
UC San Diego

Electronic copy: http://aries.ucsd.edu/najmabadi/TALKS/
ARIES Web Site: http:/aries.ucsd.edu/ARIES

Detailed and in-depth analysis is necessary to make scientific progress and impact the R&D program



- Many areas of research were not covered today.

I: Quality and Innovation

- **Validity and effectiveness of scientific methods and approaches**
  - ➢ Research includes detailed analysis of high-leverage systems.
  - ➢ An environment is created for fusion scientists to investigate fusion systems together. Team members bring in the latest information from R&D programs. State-of-art analysis, innovation, and high-leverage issues are readily transferred back to the R&D program.
  - ➢ ARIES work is referenced and used by other scientists in the program.
- **Effectiveness in use of state-of-the-art analytical and experimental tools**
  - ➢ We use the latest code/models developed by the physics & technology community and extend these models to power plant relevant regimes.
  - ➢ Experimental results are continuously incorporated.
  - ➢ Good connection with R&D communities exists.

I: Quality and Innovation

- **Degree of creativity, originality, and uniqueness in addressing scientific issues and technical problems**

  ➢ Many concepts have been introduced which were taken up by the R&D program, *e.g.*, advanced tokamak regimes, SiC/SiC materials, advanced self-cooled blankets.

  ➢ Impact of latest development in other scientific fields on fusion systems are evaluated.

  ➢ Because we draw from expertise of the national program, we are unique in the world in the ability to provide a fully integrated analysis of power plant options including plasma physics, fusion technology, economics, safety, etc.

- **Quality and completeness of documenting/reporting technical approaches and obtained results**

  ➢ 230 Publications, presentations in every major conference, town meeting & workshops, extensive Web site.

II: Resourcefulness in resource management

- **Resourcefulness in seeking out and adapting available research resources (personnel, access, etc.) both domestically and internationally**
  - ARIES research is viewed as a resource by national and international R&D communities.
  - ARIES Program receives voluntary contribution from R&D programs.
  - Team utilizes the best expertise in US in each technical area.
- **Progress toward addressing scientific issues & resolving technical problems**
  - Each ARIES design provide new insights and help focus R&D.
  - Progression of ARIES research underlines continuing innovation and resolution of technical issues.
- **Effectiveness of teaming domestically and internationally for information transfer and synergistic problem-solving**
  - A US national team
  - Collaboration with programs in EU and Japan
  - We hosted many long-term visitors from EU and Japan (all paid by their home institutions).
  - Current proposal of collaboration between US and EU in power plant studies.

III: Relevance and Impact

- **Relevance of the research and development (R&D) to the scientific goals of the program element**
  - ARIES Research focuses the R&D directions toward high-leverage areas (see support letters of J. Sheffield and VLT PAC).
- **Influence of results obtained to progress in fusion energy sciences research**
  - TPX and KSTAR experimental regimes named after ARIES-I and –II.
  - Focused stellarator research on compact stellarators.
  - Introduction of SiC composites as a high-performance material
  - Many others (see F. Najmabadi overview presentation).
- **Contributions to strengthening the scientific foundations of the U.S. fusion program**
  - Innovative solutions to many systems , *e.g.*, TF coils, H&CD, blanket, ...
  - Extending models and tools to power plant conditions and environment.

III: Relevance and Impact

- **Influence on other program elements of both the domestic and international fusion programs**
  - Large impact on the R&D program (this is a major part of ARIES mission).
- **Contributions to and impact on other scientific and technical fields**
  - Materials science (*e.g.*, participation by MER and SEP in SiC/SiC mtg.)
  - Heat transfer (*e.g.*, external programs funded on porous media & ERV's)
  - rf systems (*e.g.*, co-hosting of RF2001)
  - Power conversion systems (*e.g.*, NERI proposals on ultra-high efficiency)
- **Educational benefits of R&D work, such as effectiveness of attracting and training students to become future fusion scientists and engineers**
  - About 2/3 of resources is allocated to universities this year.
  - Seven students were supported last year.

III: The scientific and technical excellence

- **Recognition of R&D results and performers by peers, scientific communities, and professional societies**
  - ARIES designs are goals of R&D programs (DIII-D, FIRE, …)
  - ARIES research is referenced extensively in the literature
  - Invited papers and presentations in many conferences and symposia
- **Publication of R&D results in peer-reviewed journals**
  - See list of 230 publications
- **Use of R&D results in fusion programs, domestically and internationally**
  - ARIES designs are goals of R&D programs (DIII-D, FIRE, …)
  - TPX and KSTAR experimental regimes names after ARIES-I and –II.
  - European and Japanese visions of fusion power has become progressively closer to ARIES visions.

The National Advanced Design Program Is a High-Leverage Research Effort

- **High Quality of Science:** Detailed and in-depth analysis is necessary to make scientific progress.
- **High-Leverage Research:** Integrated design & analysis beyond current experiments identifies key R&D Issues.
- **Community input and consensus:** An environment is created for fusion scientists to investigate fusion systems together. Team members bring in the latest information from R&D program. State-of-art analysis, innovation, and high-leverage issues are readily transferred back to the R&D program.
- **Interaction with other disciplines:** Impact of latest development in other scientific fields on fusion systems are evaluated.
- **Impact on Education:** Approximately 2/3 of the research is performed by universities (UCSD, U. Wisc., RPI, MIT). Seven students were supported by this activity last year.
- **A high-leverage niche on the international fusion program.** It is recognized internationally as a credible driving force towards an attractive end product and influences world-wide fusion research.