UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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DATE: 4/14/00

TO: Richard Attiyeh, Vice Chancellor for Research

FROM: Forman Williams, Director, CECR

SUBJECT: Change of Name from Center for Energy and Combustion Research to Center for Energy Research

We request that the name of the Center for Energy and Combustion Research (CECR) be changed to the Center for Energy Research (CER). This name change reflects the merger of the activities of the current CECR group with the activities of the Fusion Energy Research Program (FERP). We expect that the merger of these two programs into one ORU will foster greatly increased interdisciplinary interactions among UC San Diego faculty, research staff and students and that this will provide a new vehicle for developing future additional dimensions of energy research, including energy policy research. I will remain as Director of the ORU. The enclosed updated version of the proposal for a name change amplifies this request.

CC: R. Conn
J. Luco
J. Lasheras

Proposal

for a Name Change*

of an

Established Organized Research Unit

The Center for Energy and Combustion Research

to become

The Center for Energy Research

University of California, San Diego
April 14, 2000

*Reference: Article IX of UCSD ORU Policies and Procedures (draft, 4/12/99)

1.0 Background and Rationale

It is proposed to change the name of the present UCSD Center for Energy and Combustion Research (CECR) to the Center for Energy Research (CER), while simultaneously broadening its scope and increasing the range and interdisciplinary nature of its research programs. This change, in a sense, returns the CECR to its original intent as proposed by Professor S. Penner in 1973. The emphasis on combustion research of the CECR (beginning in 1986) was appropriate as it reflected the primary interest of its Director, Professor F. Williams, and associated faculty. More recently, however, interest has developed in other fields of energy, particularly fusion energy research, and a significant program has developed on campus in this area over the past six years. Thus, the proposal is: to reestablish the CER to encompass the activities of the existing CECR; to add faculty and staff from the UCSD Fusion Energy Research Program (FERP); and to provide a vehicle for developing other dimensions of energy research, including energy policy research, in the future.

2.0 Objective and Goals

The overall objective of the Center for Energy Research remains the same as its original intent and remains consistent with the mission of the CECR. The objective is to provide an academic research unit for interdisciplinary interactions among UC San Diego faculty, research staff and students aimed at promoting and coordinating energy research and education. The goals of the CER are complementary to academic departments of instruction and research with an emphasis on bridging the various disciplines related to energy research on the campus. The specific goals of the CER are:

- To provide an inter-departmental coordinating function for energy research groups and projects at UC San Diego.
- To enhance the prospects of extramural research funding involving inter-departmental and multi-disciplinary collaborations in energy research.
- To promote the visibility of energy topics in undergraduate and graduate programs at UC San Diego.
- To provide a mechanism for interacting with other institutions involved in energy research with particular attention to potential industrial partners.
- To promote the visibility of energy research at UC San Diego to potential sponsors and funding agencies.

3.0 Areas of Research

The CER will be engaged in research in energy and energy-related areas. The initial focus will be in two areas: combustion research and fusion energy research. It is also intended to nurture activities involving policy analysis and interactions of integrated models of energy requirements and usage, climate change, air pollution, economic impacts and international consequences.

Since its origin, the Center has focused on basic problems in finding new sources of energy and the social, environmental, economic and political consequences of energy consumption. Studies range from investigations into the fundamental nature of energy to practical applications in energy conservation and production, as well as pollution control. There are investigations related to the safe exploitation of nuclear energy and to reduction of emissions of greenhouse gases in combustion processes. Studies are in progress concerning minimization of emissions of soot and oxides of nitrogen from flames of both gaseous and liquid fuels, including sprays in Diesel and gas-turbine engines, as well as systems employing natural gas and coal. There are also investigations of pulse-detonation engines and the stability of combustion chambers for propulsion applications, for example, applying the strong CER expertise in fluid mechanics, reacting flows and turbulent combustion. In addition, there are fundamental studies in microgravity combustion science, involving droplet-burning experiments in Spacelab and in other NASA facilities.

CER brings together faculty, researchers and students from across a broad range of disciplines: applied mathematics, physics, chemistry, oceanography, meteorology and economics, as well as mechanical, nuclear, aerospace, civil and chemical engineering. At present, the vast majority of faculty, research staff and students comes from the Department of Mechanical & Aerospace Engineering (MAE); the Department of Electrical & Computer Engineering (ECE); the Programs in Chemical Engineering; and the Graduate Program in Materials Science. Experimental, analytical and computational research methods are used to study chemical and physical aspects of combustion and fusion phenomena. Collaborative study of problems using all three of these basic methods is a particular goal of the Center.

Examples of ongoing research in combustion-related areas are projects in mitigation of combustion-generated air pollution, propellant combustion and combustion instability, control of initiation and propagation of detonations in pulse-detonation engines, incineration of toxic and non-toxic waste materials, and finding replacements for halogen-containing fire suppressants to reduce ozone depletion. On the applications side, CER addresses important societal problems such as the efficient use and production of energy, the design and propulsion of airborne and waterborne vehicles, water quality and reclamation technology, aspects of materials processing, including self-propagating high-temperature synthesis, and practical uses of catalysis.

Fusion-energy-related research areas of the CER also cover a broad spectrum of fundamental to applied topics. One principal thrust is plasma-materials interactions and the development of plasma-facing components. The PISCES laboratory contains unique plasma devices to fully simulate the plasma edge condition of large fusion facilities. These on-campus facilities are augmented with several national and international collaborations where UC San Diego researchers have access to large-scale, state-of-the-art fusion test facilities. Research topics include fundamental studies of plasma turbulence, plasma edge physics, diagnostic development and

studies of disruption phenomena. The experimental effort is complemented by a strong modeling capability, in part in association with the plasma theory studies in the Physics Department.

Related areas of CER-based research are investigations into the physics and chemistry of plasma-aided nano-scale manufacturing. This work focuses on experimentation and supporting theoretical work using plasmas for the production of multi-layer semiconductor integrated circuits, for the formation and manipulation of nanometer-scale clusters and related dusty-plasma physics issues. Plasmas enable engineers to produce features that are only a few thousand atoms wide in a cost-effective manner. The production of these microscopic features depends upon plasma density and temperature as well as neutral-gas chemistry and the energy at which plasma particles bombard the chip surface. Currently the plasma chemistry is strongly controlled by the plasma density and temperature, limiting the flexibility of the plasma manufacturing steps. Research is underway, motivated by results from magnetic fusion research, to develop and study techniques that might provide the semiconductor manufacturing engineer with independent control over the plasma density and temperature, plasma bombarding energy and neutral-gas chemistry. Interest is also growing in the formation and manipulation of so-called "nano-phase" materials in which atomic clusters of novel material combinations are formed, manipulated and deposited to form materials with new mechanical, electrical and/or optical properties. Plasma-based nano-phase material synthesis brings together the disciplines of aerosol physics, materials science and plasma physics and may represent a new research thrust area for CER-affiliated faculty, staff and students.

Another thrust of fusion research is national leadership of advanced design and systems analysis of fusion power concepts. Various fusion concepts are carefully evaluated to assess their commercial power-plant potential for both electrical and non-electrical applications, determine critical R&D issues and provide guidance to the national fusion research program. This activity provides the capability to pursue integrated and comprehensive physics and engineering design, including modeling and systems analysis to provide a complete perspective. Research activities are also underway to investigate critical issues for inertial fusion chambers and to study the fundamental interactions of very-short-pulse, but very intense energy beams with materials.

The CER will also be the host for the Department of Energy's (DOE) Virtual Laboratory for Technology (VLT) for Fusion Energy Sciences. This is a national endeavor which is responsible for coordinating all fusion technology and materials activities in the U.S. – an enterprise that includes many universities, national laboratories, and industries. The VLT is responsible for coordinating national activities of the DOE which have an annual budget of about $35M. Dr. Charles C. Baker serves as the VLT Director.

4.0 Center Members

Center members of the CER will include the present membership of the CECR plus several members with interest from fusion-related research. Please see Table 1.

Members (M) and Affiliates (A) of the Center for Energy Research

Charles Baker	(M)	Adjunct Professor/MAE
David Benson	(A)	Professor/MAE
José Boedo	(M)	Research Scientist/MAE
Robert Cattolica	(M)	Professor/MAE
Leo Chousal	(M)	Senior Development Engineer/FERP
Robert Conn	(M)	Dean, Professor/MAE
Russ Doerner	(M)	Associate Research Engineer/ECE
Alvin Gordon	(M)	Adjunct Professor/MAE
Arthur Grossman	(M)	Associate Development Engineer/FERP
Rolondo Hernandez	(M)	Associate Development Engineer/FERP
Sergei Krasheninnikov	(M)	Professor/MAE
Juan Lasheras	(A)	Professor/MAE
Shui-Chi Li	(M)	Assistant Research Engineer/MAE
Paul Libby	(M)	Professor Emeritus/MAE
Stan Luckhardt	(M)	Research Scientist, Lecturer/MAE
Kurt Lund	(M)	Assistant Research Engineer/MAE
T. K. Mau	(M)	Research Scientist/ECE
Marc Meyers	(A)	Professor/MAE
David Miller	(A)	Professor/MAE
Ronald Miller	(M)	Project Scientist/MAE
Rick Moyer	(M)	Research Scientist/MAE
Farrokh Najmabadi	(M)	Professor/ECE
Vitale Nesterenko	(A)	Professor/MAE
Keiko Nomura	(A)	Assistant Professor/MAE
Stanford Penner	(M)	Professor Emeritus/MAE
René Raffray	(M)	Specialist/MAE
Sutanu Sarkar	(A)	Associate Professor/MAE
Ray Seraydarian	(M)	Associate Development Engineer/FERP
K. Seshadri	(M)	Professor/MAE
Massoud Simnad	(M)	Adjunct Professor/MAE
Daniel Sze	(M)	Assistant Project Scientist/MAE
Mark Tillack	(M)	Research Scientist/MAE
George Tynan	(M)	Assistant Professor/MAE
Xueren Wang	(M)	Staff Research Associate/FERP
Dennis Whyte	(M)	Associate Research Scientist/MAE
Forman Williams	(M)	Professor/MAE
Jun Zhang	(M)	Staff Research Associate/ FERP

Table 1.

5.0 Organization

5.1 Director and Deputy Director

Professor Forman A. Williams of MAE, who is currently Director of the CECR, will be the Director of the Center for Energy Research. Dr. Charles C. Baker, Adjunct Professor of MAE and Director of FERP, will be the Deputy Director of the CER. The CER will initially have two divisions: Combustion Research headed by Professor Williams and Fusion Energy Research headed by Dr. Baker. Each division will also have associate heads as determined by the Director and Deputy Director (see Fig. 1).

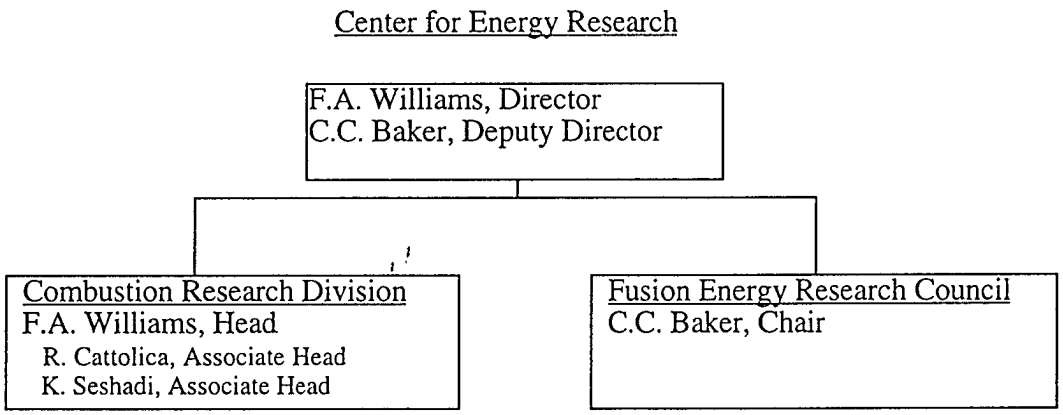

Figure 1.

5.2 Committees

The CER may establish an internal Executive Committee consisting of faculty and senior research staff of the Center and chaired by a senior faculty member who is neither the Director nor Deputy Director of the CER.

The CER will also have an Advisory Committee including members of the Center as well as campus members outside the Center and possibly outside the University. The Advisory Committee will meet at least annually.

6.0 Resource Projections

6.1 Faculty, Research Staff and Graduate Students

At present, the proposed Center for Energy Research will include 19 faculty, emeritus, and adjunct faculty (members and affiliates), 14 research staff, and 17 graduate students.

6.2 Anticipated Sources of Funding

The total value of 36 ongoing grants and contracts for the CECR and FERP, which will now become the CER, is approximately $30M. The annual spending rate for the current fiscal year is approximately $5.8M. The substantial scope of activities represented by these grants and contracts requires an effective overall administration including the services of the Director and Deputy Director; grant, contract and budget control; and administrative support.

6.3 Space Needs

The CER will be housed in EBU-II in the space currently occupied by the CECR (and currently assigned to CECR) and by FERP (currently provided by the MAE Department).