

**ANNUAL REPORT OF THE CENTER  
FOR ENERGY RESEARCH**

University of California, San Diego

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## 1. SUMMARY OF MAJOR ACTIVITIES

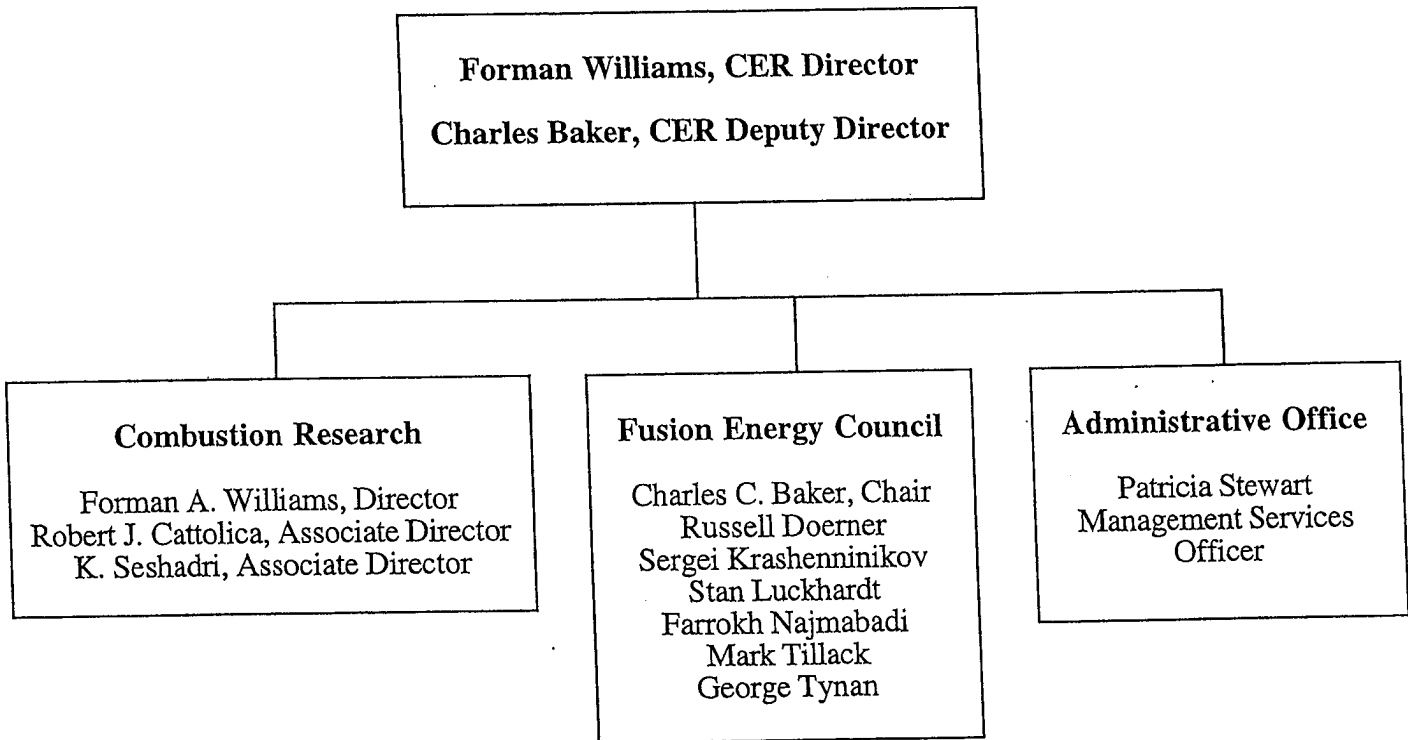
Studies were performed of energy problems in California, oil prices and the US strategic petroleum reserve, economic aspects of energy needs, long-term energy resources, and needs in moving towards a hydrogen economy. S.S. Penner, the original CER founder, was the major contributor to these studies. A CER newsletter was initiated, both web-based and in hard copy, disseminating this and other information generated in CER. In addition, CER hosted a number of US and foreign visitors in fusion, combustion and other energy areas and sponsored many lecture and seminars on topics related to these areas, as well as training graduate students. Among the outreach activities were displays and demonstrations on fusion energy at meetings of the American Physical Society. A meeting of the Western States Section of the Combustion Institute was hosted at UCSD, and international meetings in both the fusion and combustion areas were arranged and chaired by CER researchers.

CER activities in fusion energy and plasma science during this reporting period encompass a wide variety of leading research. The projects include plasma-material research using the PISCES experimental facility, participation in plasma confinement experiments at several institutions (e.g. General Atomics and the Princeton Plasma Physics Laboratory), development of plasma theory and models, national leadership of the study of advanced fusion power systems, experimental study of laser-matter interactions and national leadership of the U.S. Department of Energy's Virtual Laboratory for Technology. The fusion-related activities represent one of the largest and most diverse set of research efforts among universities in the U.S. The research activities include both magnetic and inertial fusion concepts, basic plasma science and technology and fundamental engineering science needed for fusion energy systems.

CER activities in combustion during this reporting period include research related to both propulsion and clean and efficient use of fossil fuels. A large project on pulse detonation engines was brought to fruition by demonstrating how such engines can best be designed and controlled and what chemistry needs to be addressed in initiating detonations in such engines. Advances were made in a number of microgravity combustion studies with NASA support, notably concerning droplet combustion and discovery of spiral flames. Chemical-kinetic characterization of ignition and extinction of combustion of both model and practical fuels was achieved. These various lines of research were supported by NASA, DOD and NSF. A website was established to make the San Diego chemical-kinetic mechanism for combustion readily available to the broad scientific community.

## 2. ORGANIZATION

The CER leadership is summarized in the following organization chart. Besides the administrative office that keeps the organization running smoothly, there is a fusion research council and a combustion research group. The members of these jointly discuss future directions and plan for future thrusts. They also consult with external advisors on an informal basis to evaluate past performance and possible new directions.



### 3. PERSONNEL

#### A. FACULTY

Faculty Members (active participation on a day-to-day basis)

Yousef Bahadori  
Adjunct Associate Professor of Mechanical and Aerospace Engineering  
PhD Engineering Physics

Charles C. Baker – Deputy Director  
Adjunct Professor of Mechanical and Aerospace Engineering  
PhD Nuclear Engineering

Robert J. Cattolica  
Professor of Engineering Physics  
PhD Engineering Physics

Alvin S. Gordon  
Adjunct Professor of Engineering Chemistry  
PhD Chemistry

Sergei Krashenninikov  
Professor of Mechanical and Aerospace Engineering  
PhD Physics and Mathematics

Paul A. Libby  
Professor Emeritus of Fluid Mechanics  
PhD Aeronautical Engineering

Farrokh Najmabadi  
Professor of Electrical Engineering and Computer Science  
PhD Nuclear Engineering

Stanford S. Penner  
Professor Emeritus of Engineering Physics  
PhD Physical Chemistry

Norbert Peters  
Adjunct Professor of Mechanical Engineering  
PhD Mechanical Engineering

K. Seshadri  
Professor of Chemical Engineering and Fluid Mechanics  
PhD Engineering Science

George R. Tynan  
Associate Professor of Mechanical and Aerospace Engineering  
PhD Engineering

Forman A. Williams - Director  
Professor of Engineering Physics and Combustion  
PhD Engineering Science

Affiliated Faculty Members (regular faculty who participate in some CER projects)

T. Bewley  
Assistant Professor of Mechanical and Aerospace Engineering  
PhD Mechanical Engineering

C. Caulfield  
Associate Professor of Environmental Engineering  
PhD Fluid Mechanics

M. Krstic  
Professor of Mechanical and Aerospace Engineering  
PhD Electrical Engineering

J.C. Lasheras  
Professor of Fluid Mechanics  
PhD Mechanical and Aerospace Engineering

P. Linden  
Blasker Professor of Environmental Science and Engineering  
PhD Applied Mathematics

D.R. Miller  
Professor of Chemical Engineering  
PhD Chemical Engineering

M. Meyers  
Professor of Materials Science  
PhD Physical Metallurgy

V.F. Nesterenko  
PhD Physics  
Professor of Materials Science

K. Nomura  
Associate Professor of Mechanical Engineering  
PhD Mechanical Engineering

S. Sarkar  
Professor of Fluid Mechanics  
PhD Mechanical Engineering

## B. STUDENTS

### GRADUATE STUDENTS

NAME	DATES	DEGREE
Advisor: S. Krasheninnikov		
Carlos Estrada-Mila	2001 - present	
Boris Frolov	2002 - present	
Guanghui Yu	2001 - present	
Advisor: S. Luckhardt		
Laizhong Cai	2001 - present	
Lina Li	2000 - present	
Andreas Liebscher	1997-2001	MS 1997
Zheng Yun	2002 - present	
Advisor: F. Najmabadi		
Sophia Chen	2001 - present	
Beau O'Shay	2001 - present	
Advisor: M.S. Tillack		
Dustin Blair	1996 - present	MS 1998
Brian Christensen	2002 - present	
Advisor: G. Tynan		
Michael Burin	1998 - present	
Larson Lindholm	2000-2002	MS 2002
Linh Pham	2002 - present	
Masahi Shimada	2000 - present	
Kurt Taylor	1999 - present	
Advisor: F.A. Williams		
Malissa Ackerman	1997 - present	
Craig Eastwood	1997 - 2002	PhD 2002
Tetsuo Hiraiwa	1997 - present	
Edward Olano	1998 - 2001	
Maria Petrova	2001 - present	
Li Qiao	2001 - 2002	
Frederick Redell	1999 - 2000	MS 2000
Priyank Saxena	2002 - present	
Tsutomo Shimizu	2002 - present	
Balachandar Varatharajan	1997 - 2001	PhD 2001
Christopher Varga	1997 - 2002	PhD 2002

## POST-GRADUATE RESEARCHERS

NAME	DATES
Advisor: M.S. Tillack	
C. V. Bindhu	2001-present
A. C. Gaeris	2001-present
S. S. Harilal	2001-present
Advisor: G. Tynan	
Neal Crocker	2001-present
Advisor: F.A. Williams	
Bala Varatharajan	2001 - 2002
Alexander Telengator	2000 - present



## C. RESEARCH PERSONNEL

Ghassan Antar  
Assistant Research Scientist  
PhD Physics

Matthew Baldwin  
Assistant Research Scientist  
PhD Physics and Materials Science

Jose Boedo  
Research Scientist  
PhD Physics

Russ Doerner  
Associate Research Scientist  
PhD Electrical Engineering

Zoran Dragojlovich  
Assistant Research Scientist  
PhD Mechanical Engineering

Sergei Galkin  
Assistant Research Scientist  
PhD Applied Mathematics

Douglas Gray  
Associate Development Engineer  
PhD Nuclear Engineering

Arthur Grossman  
Senior Development Engineer  
PhD Physics

Eric Hollmann  
Assistant Research Scientist  
PhD Physics

Sastry Indrakanti  
Staff Research Associate  
PhD Metallurgical Engineering and Materials Science

Shui-Chi Li  
Associate Research Scientist  
PhD Mechanical and Aerospace Engineering

Andreas Liebscher  
Staff Research Associate  
MS Physics

Stan Luckhardt  
Research Scientist  
PhD Physics

Kurt O. Lund  
Associate Research Scientist  
PhD Engineering Science

T. K. Mau  
Research Scientist  
PhD Electrical Engineering

Rick Moyer  
Research Scientist  
PhD Physics

Alexander Pigarov  
Assistant Research Scientist  
PhD Physics

John Pulsifer  
Assistant Development Engineer  
MS Engineering Sciences

Rene Raffray  
Research Scientist  
PhD Mechanical Engineering

Dimity Rudakov  
Assistant Project Scientist  
PhD Physics

Reinhard Seiser  
Assistant Project Scientist  
PhD Technical Sciences

Dai-Kai Sze  
Visiting Research Scientist  
PhD Chemical Engineering

Mark Tillack  
Research Scientist  
PhD Nuclear Engineering

Xueren Wang  
Assistant Development Engineer  
MS Physics

Mofreh Zaghloul  
Assistant Development Engineer  
PhD Physics

**D. ENGINEERING AND TECHNICAL STAFF**

Leo Chousal  
Senior Development Engineer  
B.S. Mechanical Engineering

Justin Delemus  
Assistant EH&S Specialist  
B.A. Physical Sciences

Rolando Hernandez  
Associate Development Engineer  
B.S. Electrical Engineering

Tyler Lynch  
Junior Development Engineer  
A.A. Automechanics

Glenn Mounce  
Development Technician

Maggie Qu  
Programmer Analyst  
M.S. Physics, M.S. Science Education

Ray Seraydarian  
Associate Development Engineer  
M.S. Engineering Physics

Bruce Thomas  
Assistant Development Engineer

**E. ADMINISTRATIVE PERSONNEL**

Nancy Bastian	Administrative Specialist	Fund Manager & Asst. to the Director
Claudia Hennessy	_Assistant III	Asst. to the Deputy Director
Ruth Lingo	Administrative Analyst	Financial Manager
Mary Olivarria	_Assistant III	Administrative Assistant
Patricia Stewart	Senior Administrative Analyst	Business Officer
Phyllis Voigts	Administrative Specialist	Contract and Grant Specialist
TBA	_Assistant II	Personnel Assistant

#### 4. PUBLICATIONS (2000 - 2002)

1. G. Antar, "Visible Light Scattering Measurements of Turbulence Small Scales," *Review of Scientific Instruments* 71, 113 (2000).
2. G. Wang, G. Antar, P. Devynck, "The Hurst Exponent and the Long-time Correlation," *Physics of Plasmas* 7, 1181 (2000).
3. G. Y. Antar, P. Devynck, G. D. Wang, Response to "Comments on the 'Hurst Exponent and Long Time Correlation'", *Physics of Plasmas* 7, 5269 (2000).
4. G. T. Hoang, C. Bourdelle, X. Garbet, G. Antar, R. V. Budny, T. Aniel, V. Basiuk, A. Bécoulet, P. Devynck, J. Lasalle, G. Martin, F. Saint-Laurent, "Internal Transport Barrier with Ion-Cyclotron-Resonance Minority Heating on Tore Supra," *Physical Review Letters* 84, 4593 (2000).
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- Divertor Simulator (NAGDIS-II),” *Physics of Plasmas* 8, 3314 (2001).
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  50. M. Hollmann and A. Yu. Pigarov, “Measurement and Modeling of Molecular Ion Concentrations in a Hydrogen Reflex-arc Discharge,” *Physics of Plasmas* 9, 4330 (2002).
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## 5. VISITORS AND SEMINARS

### A. VISITING RESEARCHERS AND SCHOLARS

CER participants interact extensively abroad on energy and combustion issues. There is continuing joint research with investigators at various universities, research institutions and industries abroad and within this country. Renowned scientists from throughout the United States and abroad, specializing in energy, fusion, fission and combustion research, regularly visit UCSD and participate in CER programs through formal lectures, research activities and informal discussions. Visitors from 2001 and 2002 include:

VISITOR	AFFILIATION
Merete Bing-Jacobsen	Norwegian Institute of Technology
Nils P. Basse	Niels Bohr Institute, Copenhagen, Denmark
K.N.C. Bray	Cambridge University, Cambridge, England
Michel Champion	ENSMA, Futuroscope, France
Paul Clavin	CNRS - Universités d'Aix-Marseilles, Marseilles, France
Marcos Vera Coello	Universidad Politécnica de Madrid, Madrid, Spain
Bruno Coppi	Massachusetts Institute of Technology
Jill Dahlburg	General Atomics
Ben Eastlund	Novatron, Inc., San Diego
Junichi Furukawa	Tokyo Metropolitan College of Technology
Miguel Hermanns	Universidad Politécnica de Madrid, Madrid, Spain
Yoshi Hirooka	National Institute for Fusion Energy Science, Japan
Stefan Humer	Vienna University of Technology, Austria
Emil Hopfinger	Institut de Mécanique de Grenoble, Grenoble, France
Marianne Jensen	Norwegian Institute of Technology
Ryoichi Kurihara	JAERI Naka Fusion Research Establishment
Amable Liñán	Universidad Politécnica de Madrid, Madrid, Spain
Noriyasu Ohno	Nagoya University, Nagoya, Japan
Wolfgang Payer	Vienna University of Technology, Austria
Matt Peterson	Univ. of California, Washington DC office
Heinz Pitsch	RWTH Aachen, Aachen, Germany
Paul Ronney	University of Southern California

VISITOR	AFFILIATION
Takuya Saito	STA, Japan
Klaus Schmid	Max Planck Insitut-für Plasmaphysik, Garching, Germany
Tatiana Soboleva	Universidad Autonoma, Mexico
Al Sweedler	San Diego State University & San Diego Regional Energy Office
Bill Tang	Princeton Plasma Physics Laboratory
Kimitoshi Tanoue	Oita University, Oita, Japan
Kazutoshi Tokunaga	Kyushu University, Japan
Jorg Winter	Bochum University, Germany
Vlidiimir Zimont	CRS4, Italy and TsAGI, Russia

## B. SEMINARS

CER sponsors a general series of seminars and public lectures in its areas of activities. A listing of these seminars is given in the following table.

SEMINAR SPEAKER	DATE	TOPIC
Mofreh Ramadan Zaghloul	July 24, 2000	"Physics of Nonideal Plasmas with Application to Electrothermal-Plasma Devices"
Vladimir Zimont	August 14, 2000	"Kolmogorov Methodology and Turbulent Premixed Combustion Modeling at Large Re and Da Numbers"
Amable Liñán	August 16, 2000	"Flame Flashback and Propagation of Premixed Flames near a Wall"
Paul Ronney	August 21, 2000	"Combustion in Microscale Heat-Recirculating Burners"
K.N.C. Bray	August 23, 2000	"Use of DNS Data to Test a Flamelet Model for Pressure Fluctuation Covariances in Premixed Turbulent Combustion"
Paul Clavin	August 25, 2000	"Gallopings Detonations Close to the C.J. Regime"
Forman A. Williams	August 28, 2000	"Chemical Effects in Counterflow Hydrocarbon Flame Structures"
Boris Khripunov	October 4, 2000	"Recent Experiments on Divertor Simulator, Lenta."
Chung Wu	November 9, 2000	"Hydrogen in Lithium and Its Separation from Liquid Lithium"
Hutch Neilson	November 20, 2000	"Compact Stellarator Research"
Mike Zarnstorff	February 6, 2001	"Compact Stellarators and the NCSX Project"
John Sethian	February 23, 2001	"KrF Lasers for Inertial Fusion Energy"
Roger Bohn	March 8, 2001	"California's Electricity Mess: Past and Future"
Robert Bitmead	April 18, 2001	"A Skeptical Introduction to Combustion Instability Modeling"
Zoran Dragojlovic	April 30, 2001	"Control of Convergence in a Computational Fluid Dynamics Algorithm Using Fuzzy Logic"



SEMINAR SPEAKER	DATE	TOPIC
Al Sweedler	May 18, 2001	"Energy Issues in the U.S.-Mexican Binational Region: Focus on California – Baja California"
Stewart Zweben	July 31, 2001	"Edge Turbulence Measurements in the C-MOD and NSTX Tokamaks"
K.N.C. Bray	August 13, 2001	"Vorticity in Unsteady Premixed Flames"
Emil Hopfinger	August 14, 2001	"Liquid Jet Breakup and Atomization by a High Velocity Gas Stream"
Mujid S. Kazimi	August 14, 2001	"Reinventing Nuclear Energy"
Paul Clavin	August 16, 2001	"Diamond Patterns in Cellular Fronts of Overdriven Detonations"
Amable Liñán	August 20, 2001	"Laminar Mixing in Diluted and Undiluted Fuel Jets Upstream from Lifted Diffusion Flames"
Marcos Vera Coello	August 24, 2001	"The Interaction of Vortices with Counterflow Reacting Layers"
Paul Ronney	August 27, 2001	"Premixed Flame Ignition by Corona Discharges"
Michael Shats	November 6, 2001	"Turbulence, Transport & Electric Field Studies on the H-1 Helimak"
Valery Godyak	March 22, 2002	"Nonlinear Effects in Inductive Discharges"

## 6. CONTRIBUTION TO UNDERGRADUATE AND GRADUATE TEACHING PROGRAMS

In addition to other teaching activities, CER personnel participated in teaching the following courses that are directly related to CER disciplines:

### MAE 118A. Energy: Non-Nuclear Energy Technologies (4)

Oil recovery from tar sands and oil shale. Coal production, gasification, liquefaction. The hydrogen economy. Energy storage systems. Techniques for direct energy conversion. Solar energy utilization. Energy from windmills. Tidal and wave energy utilization. Hydroelectric power generation. Hydrothermal energy. Geothermal energy from hot rocks. Electrical power production, transmission, and distribution.

### MAE118B. Energy: Nuclear Energy Technologies (4)

A brief survey of energy demands and resources. Available nuclear energy, background in atomic and nuclear physics; fission and fusion processes, physics of fission reactions-engineering aspects-safety and environmental effects, fusion-including laser fusion and magnetic confinement, and nuclear power economics.

### MAE 118C. Introduction to Fusion Science and Technologies (4)

Overview of basic fusion processes, high-temperature plasma characteristics, and fusion power plant features. Reaction rates and energy balance for burning fusion plasmas. Survey of the enabling technologies for practical fusion and related applications outside of fusion, such as plasma-material interactions, plasma heating, high heat flux engineering, superconductivity, advanced materials, and nuclear technology.

### MAE 211. Introduction to Combustion (4)

Fundamental aspects of flows of reactive gases, with emphasis on processes of combustion, including the relevant thermodynamics, chemical kinetics, fluid mechanics, and transport processes. Topics may include deflagrations, detonations, diffusion flames, ignition, extinction, and propellant combustion.

### MAE 213. Mechanics of Propulsion (4)

Fluid mechanics, thermodynamics, and combustion processes involved in propulsion of aircraft and rockets by air-breathing engines, and solid and liquid propellant rocket engines; characteristics and matching of engine components; diffusers, compressors, combustors, turbines, pumps, nozzles.

### MAE 220A. Physics of Gases (4)

Thermodynamics of gases for use in gasdynamics. Derivation of thermodynamic functions from statistical mechanics. Applications of classical and quantum statistical mechanics to chemical, thermal, and radiative properties of gases. Equilibrium and nonequilibrium radiation, chemical equilibrium, and elements of chemical kinetics. Laser and reacting-flow applications.

### MAE 220B. Physical Gasdynamics (4)

Velocity distribution functions, the Boltzmann equation, moment equations and the Navier-Stokes equations. The dynamics of molecular collisions. The Chapman-Enskog expansion and transport coefficients: shear and bulk viscosity, heat conduction, molecular and thermal diffusion. Linearizations about equilibrium: applications to acoustics and supersonic flows with relaxation.

## **7. FINANCIAL SUPPORT**

The following table summarizes the financial support of CER, listing the projects, funding agencies and funding levels. Nearly all of the support is extramural, most either directly or indirectly from the federal government, the majority of that from the Department of Energy (DOE). The annual budget has increased from about 9M to about 12M during the reporting period.

**UCSD**  
**Center for Energy Research**  
**Grant Funding**  
 (Based on UC Fiscal year 7/01-6/02)

Index Nbr		Funding Source	PI	POP	ANNUAL AWARD		
					Annual Direct Award	Indirect Costs	2001/2002 Funding
NRG5262	19900A	19900	Williams	7/1/01-6/30/02	97,042		97,042
FER0002	62092A	RECHARGE LAB	Luckhardt/Doerner	7/1/01-6/30/02	633,021		633,021
ENG0838	66838A	CONFERENCE	Baker	7/1/01-6/30/02	146,565		146,565
FER8890 & FERDISR	31855A	DOE	Luckhardt, Moyer, Boedo	11/1/94 - 10/31/02	969,664	14,384	984,048
FER0067 & FER0213	09596A & 80213A	UC SMART	Tynan	9/1/00-8/31/01	92,998	63,087	156,084
FER0201 & FER8100	09596A & 80213A	UCSMART	Tynan	1/26/01-1/25/02	103,017	32,226	135,243
FER1889	31889A	DOE	Tynan	9/1/99-8/31/02	116,698	33,526	150,224
FER1858	31858A	DOE	Conn, Luckhardt, Doerner	1/1/95 - 10/31/02	1,409,598	1,172,099	2,581,697
NRG1663	41663A	Archimedes	Tynan	3/1/02-No End date	48,000	2,000	50,000
FER1895	31895A	DOE	Boedo, Moyer	8/15/00-8/14/02	197,984	30,892	228,876
FER1894	31894A	DOE	Krashennnikov	1/1/00-12/31/02	367,161	170,805	537,966
FER1885	31885A	DOE	Boedo	5/1/99 - 4/30/02	197,472	16,083	213,554
FER8646	78646A	GA	Krashennnikov	1/1/02-12/31/02	45,818	22,778	68,596
NRG8452	78452A	GA	Krashennnikov	5/6/02-3/6/03	13,782	7,167	20,949
NRG8189	81089A	BOEING	Doerner	10/9/01-10/8/02	32,895	17,105	50,000
NRG8659	78659A	Univ of Texas, Austin	Luckhardt	9/01/00-12/31/03	32,895	17,105	50,000
ENG7864	78640A	ORNL/Bechtel/Lo	Baker	2/15/99 - 9/30/02	838,732	171,460	1,010,192
FER8647	78647A	UT-Battelle	Grossman	4/1/00-9/30/02	31,224	16,210	47,434
FER8655	78655A	GA	Luckhardt/Whyte	11/1/01-10/31/02	73,790	19,185	92,975
FER0020	56584A	TSI	Tillack	N/A	1,780		1,780
FER3159	31859A	DOE	Najmabadi, Tillack	12/1/94-12/31/02	947,823	445,670	1,393,493
FER1883	31883A	DOE	Mau, Najmabadi	3/15/99-3/14/05	52,066	27,101	79,167
FER1886	31886A	DOE	Tillack, Najmabadi	7/15/99-3/14/05	260,667	118,620	379,287
FER8651	78651A	PPI	Raffray, Tillack	10/11/00-6/5/02	39,619	12,874	52,493
NRG2704	27047A	NRL	Najmabadi, Tillack, Raffray	3/21/01-3/20/03	436,459	163,541	600,000
NRG7007	27007A	Naval	Najmabadi	3/20/01-3/19/02	527,875	146,656	674,531
NRG8434	78434A	NRL	TILLACK	4/15/01-4/14/02	34,353	17,863	52,216
FER8652	78652A	GA	TILLACK	10/9/00-10/31/01	24,484	6,366	30,850
NRG8451	78451A	GA	Tillack, Raffray	11/1/01-3/6/03	69,210	35,989	105,199
NRG2250	22505A	AFOSR	Williams	11/1/01 - 7/31/03	121,120	67,090	188,210
NRG2832	28321A	NASA	Williams	12/1/02 - 11/30/03	6,445	3,352	9,797
NRG1447	21447A	NSF	Williams	4/1/02 - 3/31/05	171,761	68,239	240,000
NRG3251	32514A	NSF	Williams	7/1/00 - 12/31/02	5,401	-	5,401
NRG2872	32872A	NASA	Williams	6/11/02 - 1/3/03	88,058	45,177	133,235
NRG2892	32892A	NASA	Williams	12/14/01 - 12/13/02	157,811	76,663	234,474
NRG3289	32897A	NASA	Williams	3/29/02 - 1/13/03	23,907	7,545	31,452
NRG0001	39426A	UC Presidents Office	Williams	7/1/01 - 6/30/03	87,052		87,052
NRG0010	69750A	Vice Chancellor	Williams	open	43,507		43,507
NRGCHN1	19900A	Chancellor	Williams	open	30,965		30,965
NRG4028	43130A	UC Foundation	Williams	1/7/91 - open	32		32
NRG0007	56281A	Sundstrand Power Systems	Williams	9/10/98 - open	5,952		5,952
NRG0863	40863A	Various Doners	Williams	7/31/00 - open	480		480
NRG1427	31427A	ARO	Seshadri	8/01/02 - 3/31/03	122,411	37,199	159,610
NRG3253	32534A	NSF	Seshadri	8/1/99 - 7/31/03	105,877	36,599	142,476
NRG0051	45151A	Energy Science Lab	Lund	1/1/99 - open	636		636
<b>TOTALS</b>					<b>8,814,105</b>	<b>3,122,656</b>	<b>11,936,761</b>

**UCSD**  
**Center for Energy Research**  
**Grant Funding**

(Based on UC Fiscal year 7/00-6/01)

Index Nbr	Fund	Funding Source	PI	POP	ANNUAL AWARD		
					Annual Direct Award	Indirect Costs	2002/03 Funding
NRG5262	19900A	19900	Williams	7/1/00-6/30/01	90,639		90,639
FER0002	62092A	RECHARGE LAB	Luckhardt/Doerner	7/1/00-6/30/01	472,113		472,113
ENG0838	66838A	CONFERENCE	Baker	7/1/00-6/30/01	None		None
FER8655	78655A	GA	Luckhardt, Whyte	2/1/97 - 10/31/02	48,425	12,590	61,015
FER8890 & FER0152	31855A	DOE	Luckhardt, Moyer, Boedo	11/1/94 - 10/31/02	583,888	303,621	887,509
FER0067 & FER0213	09596A & 80213A	UCSMART	Tynan	9/1/00-8/31/01	74,293	16,529	90,822
FER0201 & FER8100	09596A & 81003A	UCSMART	Tynan	1/26/01-1/25/03	81,000	16,089	97,089
FER1858	31858A	DOE	Conn, Luckhardt, Doerner	1/1/95 - 10/31/02	1,257,920	879,081	2,137,001
FER1895	31895A	DOE	Boedo, Moyer	8/15/00-8/14/03	346,720	22,614	369,334
FER1894	31894A	DOE	Krashennnikov	1/1/00-12/31/03	346,720	161,249	507,969
FER1885	31885A	DOE	Boedo	5/1/99 - 4/30/03	191,909	14,447	206,356
FER8647	78647A	UT-BATTELLE	Grossman	4/1/00-9/30/02	34,035	17,560	51,595
FER1889	31889A	DOE	Tynan	9/1/99-8/31/02	242,349	13,557	255,906
FER8646	78646A	GA	Krashennnikov	1/1/00-12/31/02	45,079	22,235	67,314
ENG7864	78640A	ORNL/Bechtel/Lochheed	Baker	2/15/99 - 9/30/02	841,364	134,337	975,702
FER0020	56584A	TSI	Tillack	N/A	2,481		2,481
FER3159	31859A	DOE	Najmabadi, Tillack	12/1/94-12/31/02	978,343	432,995	1,411,338
FER1883	31883A	DOE	Mau, Najmabadi	3/15/99-3/14/05	51,826	26,814	78,639
NRG7007	27007A	Naval	Najmabadi	3/20/01-3/19/02	230,677	69,323	300,000
FER8652	78652A	DOE	Tillack	10/9/00-9/30/01	69,320	18,023	87,343
FER1886	31886A	DOE	Tillack, Najmabadi	7/15/99-3/14/05	331,928	140,397	472,325
NRG8434	78434A	NRL	TILLACK	4/15/01-4/14/02	-	-	-
FER8651	78651A	PPI	Raffray, Tillack	10/11/00-6/5/02	70,977	29,023	100,000
NRG2250	22505A	AFOSR	Williams	11/1/01 - 7/31/03	92,823	52,083	144,905
NRG2832	28321A	NASA	Williams	12/1/02 - 11/30/03	6,513	3,387	9,900
NRG3251	32514A	NSF	Williams	7/1/00 - 12/31/02	12,050	-	12,050
NRG2872	32872A	NASA	Williams	6/11/02 - 1/3/03	50,963	42,345	93,307
NRG2892	32892A	NASA	Williams	12/14/01 - 12/13/02	139,553	65,673	205,226
NRG3289	32897A	NASA	Williams	3/29/02 - 1/13/03	17,998	4,881	22,879
NRG0001	39426A	UC Presidents Office	Williams	7/1/01 - 6/30/03	122,662		122,662
NRG0010	69750A	Vice Chancellor	Williams	open	8,643		8,643
NRGCHN1	19900A	Chancellor	Williams	open	4,945		4,945
NRG4028	43130A	UC Foundation	Williams	1/7/91 - open	1,573		1,573
NRG0007	56281A	Sundstrand Power Systems	Williams	9/10/98 - open	5,822		5,822
NRG0863	40863A	Various Doners	Williams	7/31/00 - open	500		500
NRG1427	31427A	ARO	Seshadri	8/01/02 - 3/31/03	124,896	43,310	168,206
NRG3253	32534A	NSF	Seshadri	8/1/99 - 7/31/03	154,760	60,201	214,961
NRG0051	45151A	Energy Science Lab	Lund	1/1/99 - open	656		656
				<b>TOTAL</b>	<b>6,573,609</b>	<b>2,602,363</b>	<b>9,175,972</b>

**8. EXPENDITURE BREAKDOWN**

The following table provides a breakdown of expenditures.

**UCSD  
Center for Energy Research  
Grant Funding**  
(Based on UC Fiscal year 7/01-6/02)

Index Nbr		Funding Source	PI	POP	ANNUAL EXPENSES			Total
					Admin Cost	Research Cost	Other Specific Uses	
NRG5262	19900A	19900	Williams	7/1/01-6/30/02	102,181		10,657	112,839
FER0002	62092A	RECHARGE LAB	Luckhardt/Doerner	7/1/01-6/30/02		688,008		688,008
ENG0838	66838A	CONFERENCE	Baker	7/1/01-6/30/02			123,467	123,467
FER8890 & FERDISR	31855A	DOE	Luckhardt, Moyer, Boedo	11/1/94 - 10/31/02	20,807	656,729		677,536
FER0067 & FER0213	09596A & 80213A	UC SMART	Tynan	9/1/00-8/31/01	2,128	74,110		76,238
FER0201 & FER8100	09596A & 80213A	UCSMART	Tynan	1/26/01-1/25/02	2,759	173,672		176,431
FER1889	31889A	DOE	Tynan	9/1/99-8/31/02	5,937	138,749		144,686
FER1858	31858A	DOE	Conn, Luckhardt, Doerner	1/1/95 - 10/31/02	70,151	1,953,027		2,023,178
NRG1663	41663A	Archimedes	Tynan	3/1/02-No End date	-	36,215		36,215
FER1895	31895A	DOE	Boedo, Moyer	8/15/00-8/14/02	9,438	214,796		224,234
FER1894	31894A	DOE	Krashennnikov	1/1/00-12/31/02	12,788	285,579		298,367
FER1885	31885A	DOE	Boedo	5/1/99 - 4/30/02	4,734	67,018		71,752
FER8646	78646A	GA	Krashennnikov	1/1/02-12/31/02	0	44,050		44,050
NRG8452	78452A	GA	Krashennnikov	5/6/02-3/6/03	0	0	0	0
NRG8189	81089A	BOEING	Doerner	10/9/01-10/8/02	0	20,334		20,334
NRG8659	78659A	Univ of Texas, Austin	Luckhardt	9/01/00-12/31/03	0	642		642
ENG7864	78640A	ORNL/Bechtel/Lockhead	Baker	2/15/99 - 9/30/02	93,337		451,244	544,581
FER8647	78647A	UT-Battelle	Grossman	4/1/00-9/30/02		46,914		46,914
FER8655	78655A	GA	Luckhardt/Whyte	11/1/01-10/31/02	3,417	80,411		83,828
FER0020	56584A	TSI	Tillack	N/A		172		172
FER3159	31859A	DOE	Najmabadi, Tillack	12/1/94-12/31/02		713,014		713,014
FER1883	31883A	DOE	Mau, Najmabadi	3/15/99-3/14/05		36,570		36,570
FER1886	31886A	DOE	Tillack, Najmabadi	7/15/99-3/14/05	4,372	265,315		269,686
FER8651	78651A	PPI	Raffray, Tillack	10/1/00-6/5/02		52,479		52,479
NRG2704	27047A	NRL	Najmabadi, Tillack, Raffray	3/21/01-3/20/03		185,503		185,503
NRG7007	27007A	Naval	Najmabadi	3/20/01-3/19/02	20,557	704,499		725,056
NRG8434	78434A	NRL	TILLACK	4/15/01-4/14/02	2,188	50,842		53,030
FER8652	78652A	GA	TILLACK	10/9/00-10/31/01		30,850		30,850
NRG8451	78451A	GA	Tillack, Raffray	11/1/01-3/6/03		47,627		47,627
NRG2250	22505A	AFOSR	Williams	11/1/01 - 7/31/03		73,896		73,896
NRG2832	28321A	NASA	Williams	12/1/02 - 11/30/03		7,157		7,157
NRG1447	21447A	NSF	Williams	4/1/02 - 3/31/05				0
NRG3251	32514A	NSF	Williams	7/1/00 - 12/31/02		2,545		2,545
NRG2872	32872A	NASA	Williams	6/11/02 - 1/3/03		101,766		101,766
NRG2892	32892A	NASA	Williams	12/14/01 - 12/13/02		104,889		104,889
NRG3289	32897A	NASA	Williams	3/29/02 - 1/13/03		26,703		26,703
NRG0001	39426A	UC Presidents Office	Williams	7/1/01 - 6/30/03		12,346		12,346
NRG0010	69750A	Vice Chancellor	Williams	open		7,861		7,861
NRGCHN1	19900A	Chancellor	Williams	open		6,101		6,101
NRG4028	43130A	UC Foundation	Williams	1/7/91 - open		16		16
NRG0007	56281A	Sundstrand Power Systems	Williams	9/10/98 - open		240		240
NRG0863	40863A	Various Doners	Williams	7/31/00 - open				0
NRG1427	31427A	ARO	Seshadri	8/01/02 - 3/31/03		81,163		81,163
NRG3253	32534A	NSF	Seshadri	8/1/99 - 7/31/03		43,690		43,690
NRG0051	45151A	Energy Science Lab	Lund	1/1/99 - open		129		129
<b>TOTALS</b>					<b>354,794</b>	<b>7,035,627</b>	<b>585,368</b>	<b>7,975,789</b>

**UCSD  
Center for Energy Research  
Grant Funding**

(Based on UC Fiscal year 7/00-6/01)

Index Nbr	Fund	Funding Source	PI	POP	ANNUAL EXPENSES			Total
					Admin Cost	Research Cost	Other Specific Uses	
NRG5262	19900A	19900	Williams	7/1/00-6/30/01	71,896		11,884	83,779
FER0002	62092A	RECHARGE LAB	Luckhardt/Doerner	7/1/00-6/30/01		435,655		435,655
ENG0838	66838A	CONFERENCE	Baker	7/1/00-6/30/01			1,962	1,962
FER8655	78655A	GA	Luckhardt, Whyte	2/1/97 - 10/31/02	522	28,889		29,411
FER8890 & FERDISP	31855A	DOE	Luckhardt, Moyer, Boedo	11/1/94 - 10/31/02	20,667	470,794		491,461
FER0067 & FER0213	09596A & 80213A	UCSMART	Tynan	9/1/00-8/31/01	2,637	73,482		76,119
FER0201 & FER8100	09596A & 81003A	UCSMART	Tynan	1/26/01-1/25/03	44	13,984		14,028
FER1858	31858A	DOE	Conn, Luckhardt, Doerner	1/1/95 - 10/31/02	58,603	1,296,536		1,355,139
FER1895	31895A	DOE	Boedo, Moyer	8/15/00-8/14/03	6,437	134,021		140,458
FER1894	31894A	DOE	Krasheninnikov	1/1/00-12/31/03	9,230	266,920		276,150
FER1885	31885A	DOE	Boedo	5/1/99 - 4/30/03	4,468	38,334		42,802
FER8647	78647A	UT-BATTELLE	Grossman	4/1/00-9/30/02		34,161		34,161
FER1889	31889A	DOE	Tynan	9/1/99-8/31/02	4,861	220,464		225,325
FER8646	78646A	GA	Krasheninnikov	1/1/00-12/31/02	-	48,718		48,718
ENG7864	78640A	ORNL/Bechtel/Lockheed	Baker	2/15/99 - 9/30/02	91,879		603,631	695,510
FER0020	56584A	TSI	Tillack	N/A		701		701
FER3159	31859A	DOE	Najmabadi, Tillack	12/1/94-12/31/02	37,103	813,082		850,185
FER1883	31883A	DOE	Mau, Najmabadi	3/15/99-3/14/05		49,472		49,472
NRG7007	27007A	Naval	Najmabadi	3/20/01-3/19/02	5,544	89,924		95,468
FER8652	78652A	DOE	Tillack	10/9/00-9/30/01	1,851	36,742		38,593
FER1886	31886A	DOE	Tillack, Najmabadi	7/15/99-3/14/05		313,038		313,038
NRG8434	78434A	NRL	TILLACK	4/15/01-4/14/02	2,188	10,436		12,624
FER8651	78651A	PPI	Raffray, Tillack	10/11/00-6/5/02		47,507		47,507
NRG2250	22505A	AFOSR	Williams	11/1/01 - 7/31/03		46,789		46,789
NRG2832	28321A	NASA	Williams	12/1/02 - 11/30/03		103		103
NRG3251	32514A	NSF	Williams	7/1/00 - 12/31/02		6,649		6,649
NRG2872	32872A	NASA	Williams	6/11/02 - 1/3/03		2,980		2,980
NRG2892	32892A	NASA	Williams	12/14/01 - 12/13/02		69,652		69,652
NRG3289	32897A	NASA	Williams	3/29/02 - 1/13/03		17		17
NRG0001	39426A	UC Presidents Office	Williams	7/1/01 - 6/30/03		35,611		35,611
NRG0010	69750A	Vice Chancellor	Williams	open		0	0	0
NRGCHN1	19900A	Chancellor	Williams	open		0	0	0
NRG4028	43130A	UC Foundation	Williams	1/7/91 - open		1,541		1,541
NRG0007	56281A	Sundstrand Power Systems	Williams	9/10/98 - open		130		130
NRG0863	40863A	Various Doners	Williams	7/31/00 - open		480		480
NRG1427	31427A	ARO	Seshadri	8/01/02 - 3/31/03		48,596		48,596
NRG3253	32534A	NSF	Seshadri	8/1/99 - 7/31/03		72,485		72,485
NRG0051	45151A	Energy Science Lab	Lund	1/1/99 - open		20		20
				<b>TOTAL</b>	<b>246,034</b>	<b>4,272,254</b>	<b>603,631</b>	<b>5,121,918</b>



## 9. FACILITIES AND SPACE

CER is housed entirely in Engineering Building Unit II, (EBU2), which is also occupied by much of the Department of Mechanical and Aerospace Engineering (MAE) and some of the Department of Electrical and Computer Engineering (ECE). Much of the space occupied by CER is formally listed as belonging to MAE, and some to ECE. Laboratory space, which contains extensive experimental facilities, totals about 10,000 sq. ft. and comprises rooms B12, B14, B16, B17, B28 and B29, the last two of which are often listed as MAE space. All office and other space is located in parts of the third, fourth and fifth floors of EBU2.

The space for all offices is allocated per University guidelines: Faculty and senior research staff are given their own office, junior research scientists and engineers and postdoctoral students are housed two per office, and graduate students are housed three per office.

Professors and Emeriti who are members of the CER Combustion Research Program have their own office in EBU2. These offices are rooms 555, 556, 557, 558, 559, 560 and 562. These faculty house their graduate students, research scientists, staff and visitors in EBU2 rooms 556, 561, 562, 563 and 564. Laboratory space (some of which provides desk and office space for laboratory personnel) for the Combustion Research Program is located in rooms B12, B14, B16 and B17. All of the space of the Combustion Research Program is listed as belonging to CER but is administered cooperatively with MAE.

Professors who are members of the CER Fusion Energy Research Program and the Virtual Laboratory for Technology also have their own offices in EBU2. These offices are rooms L-309, 474, 464, and 457B. They have offices for their graduate students, research scientists and staff and visitors in EBU2 rooms 366, 357, 358, 359, 360, 361, 362, 363, 364, 365, 455, 456, 457, 457A, 458, 458A, 460, 465, 474, 475, all provided by MAE, with the exception of L-309, which is space provided by ECE. Laboratory space (some of which houses desks and office space for laboratory engineers and technicians) for the Fusion Energy Research Program is located in rooms: B12, B28, and B29. The Fusion Energy Program has a conference room that also houses its library, located in room 479.

CER administration space, occupied by financial and secretarial staff, is located in rooms 554, 565, 566 and L-309. The library of the Combustion Research Program also is housed in room 565.

There is presently no unoccupied space in the allotment given to the CER, and two additional senior scientists and four additional graduate students are expected before the end of the year. An allocation of more space for scientists and students is necessary for the effective operation of the CER in the future. In addition, proposals have been submitted for external funding of new research that would require extensive additional laboratory space. Consideration is being given to looking off campus for this space.

## **1. FUTURE DIRECTIONS AND NEEDS**

CER intends to expand and improve its internationally recognized programs in combustion research and fusion energy. New thrusts planned in the combustion area pertain to environmental improvement through better knowledge of mechanisms of pollutant production in flames and through identification of surrogate fuels that can increase understanding of combustion mechanisms needed for enhancing efficiency. New thrusts planned in the fusion area pertain to achieving greater knowledge of laser-material interactions for improving prospects of inertial confinement and advancing knowledge of injection and boundary interactions for increasing purity and lifetime in magnetic confinement. Besides these plans for existing areas of research in CER, it is intended to explore possibilities for expanding activities into new directions, including alternative energy options and energy assessment.

To pursue these new directions in an effective manner, there is need for more collaboration with other departments and faculty and especially for more support from the campus. CER itself is in need of additional space for its research and its personnel, as well as additional core support for manpower, notably in the financial (accounting) and human-resources areas. The urgent needs for campus funding of support personnel could be achieved by increasing the ratio of campus support to external overhead brought in by CER (more than \$3M this year), up to values that are comparable with those of other ORUs. The space needs hopefully will be helped by freeing space in EBU2 when the new engineering building is occupied.