FOREWORD

This document describes the long-range plan for the DIII–D National Program which is updated annually and forms the background for the DIII–D annual experiment plan and the budget submittals to the U.S. Department of Energy.

The DIII–D long range program plan supports the Fusion Energy Sciences Program mission of advancing fusion science and fusion technology; to establish the knowledge base for an economically attractive energy source for the nation and the world. The unique capabilities of DIII–D are used in an innovative program of understanding and demonstrating the potential of tokamak improvement. This program plan strongly emphasizes the study of fusion plasma physics (stability, transport, wave/particle interactions and plasma wall interactions) in an integrated manner that aids in developing understanding of other toroidal magnetic concepts.

The integrated goal of this research program is to demonstrate good high-beta plasma confinement utilizing rf current drive and particle control to sustain and optimize the bootstrap-driven non-inductive advanced tokamak configuration. Success in DIII–D will provide the database for an improved tokamak (steady state, low-disruptivity, and compact) that would help speed the commercialization of magnetic fusion energy.

This program is carried out with extensive national collaboration at the flexible DIII–D tokamak facility. Principal among GA's collaborators are the on-going cooperative efforts with the Japan Atomic Energy Research Institute (JAERI), the Lawrence Livermore National Laboratory (LLNL), Oak Ridge National Laboratory (ORNL), Princeton Plasma Physics Laboratory (PPPL), University of California at Los Angeles and San Diego (UCLA and UCSD), and Sandia National Laboratory (SNL). On-site university collaborators include: Columbia University; Massachusetts Institute of Technology (MIT); the University of Maryland, the University of California at San Diego and Los Angeles, and University of California at Irvine; University of Texas; University of Wisconsin; and Hampton University. In addition, the DIII–D program continues to provide facilities for training graduate students and post doctoral fellows. Foreign laboratory groups involved in cooperative programs on DIII–D include the Joint European Tokamak (JET); Culham Laboratory; Max-Planck-Institute für Plasmaphysik, Garching; Institute for Plasmaphysics KFA, Jülich; Centre d'Etudes Nucleaires de Cadarache; Kurchatov Institute of Atomic Energy, Moscow; Troitsk Institute for Development of Thermonuclear Research; Korean Basic Science Institute; and Korean Advanced Institute of Science and Technology. In addition to hosting scientists to

participate in DIII–D experiments, DIII–D scientists participate in experiments at other laboratories.

The DIII–D program plan was developed as an outgrowth of feedback and input received on the draft plan developed by the DIII–D Executive Committee that was discussed at the DIII–D National Workshop attended by approximately 180 scientists on July 8-10, 1997. Following the National workshop the DIII–D Executive Committee developed a further prioritized program that was reviewed by the DIII–D Program Advisory Committee on February 3–4, 1998. With subsequent changes, GA submitted a five-year proposal which was peer reviewed on June 2–4, 1998. With appropriate modifications, this became the DIII–D Long Range Plan.

The year 2002 DIII–D Long Range Plan follows closely the 2001 version but incorporates input resulting from the FESAC Panel Report on Priorities and Balance of August 18–21, 1999, the Integrated Program Planning activities (2000), and the National Research Council Assessment of the DOE Office of Fusion Energy Sciences Program. The Year 2002 plan was reviewed with the DIII–D Program Advisory Committee on December 5–7, 2001.

To carry out research described in this plan requires the support of the national research team, facility operations, and facility upgrades. The overall DIII–D funding for GA and collaborative institutions in FY01 is $50.7M (Science $21.7M, Facility Operations $27.5M, and Capital and Upgrades $1.5M).

Upgrades of DIII–D are underway to move toward the particle control and current profile control to enable DIII–D to carry out the intermediate pulse length research on the Advanced Tokamak called for in the recent FESAC document on five year goals for fusion research. Those upgrades are nearing completion as indicated by the table below. This Long Range Plan assumes that as these facility upgrades are completed, needed funding will be provided for a full implementation of the current profile control systems and other facility modernization and refurbishment projects. Further increases in future funding would allow increased facility operating time for deeper scientific investigations and to increase the number of experiments being carried out. Overall, this Long Range Plan enables the Fusion Energy Sciences Program to obtain maximum scientific productivity from the DIII–D Program.

January 2000 Upgrade Plan ($M)

Subsystem	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	Total
Radiative Divertor	–	–	–	1.2	2.1	1.5	0.6	1.6	0.3	–	–	7.3
ICRF Power Upgrade	0.3	2.4	5.0	0.2	0.3	–	–	–	–	–	–	8.2
ECRF Power Upgrade	–	–	0.1	2.0	0.9	0.4	0.6	2.4	4.5	0.8	–	11.7
Total	0.3	2.4	5.1	3.4	3.3	1.9	1.2	4.0	4.8	0.8	–	27.2
Later Upgrades												TBD

In summary, this DIII–D program is aligned with the 1999 FESAC recommendation for priority emphasis on developing fusion science understanding and demonstrating tokamak improvement aimed at steady-state reduced-disruptivity high power density tokamak operation. Advanced tokamak results provide confidence that the DIII–D program objective (to carry out an integrated long-pulse demonstration of a well-confined high-beta plasma with noninductive current drive) can be carried out in an advanced tokamak operating mode which reduces the plasma current needed, and is attractive for future tokamak steady-state operation.