

AGREEMENT ON A COLLABORATIVE PARTICLE CONTROL PROGRAM
BETWEEN THE UNITED STATES DEPARTMENT OF ENERGY AND
THE JOINT EUROPEAN TORUS (JET) JOINT UNDERTAKING

Whereas an Agreement for Cooperation Between the European Atomic Energy Community and the United States Department of Energy in the Field of Controlled Thermonuclear Research (hereinafter referred to as the "DOE-EURATOM Fusion Agreement") was concluded on December 15, 1986 with the objective to help maintain and intensify cooperation and collaboration in magnetic fusion research and development,

Whereas the Council of the European Communities on May 30, 1978 established the Joint European Torus (JET) Joint Undertaking, whose aim is to construct, operate, and exploit, as part of the Community Fusion Program, a large torus facility of the tokamak-type in order to extend the parameter range applicable to controlled thermonuclear fusion experiments up to conditions close to those needed in a thermonuclear reactor,

Whereas Article III, paragraph 2 of the DOE-EURATOM Fusion Agreement provides for arrangements to be made between DOE and the JET Joint Undertaking,

Whereas the JET Joint Undertaking is within the framework of the EURATOM Fusion Programme of the European Atomic Energy Community (hereinafter referred to as "EURATOM"),

Whereas the United States Department of Energy (hereinafter referred to as "DOE") and the JET Joint Undertaking (hereinafter referred to as "JET"), each having capabilities which can assist the other in their effort to advance the status of research and development of magnetic fusion energy as a potential energy source, desire to work together, as part of a DOE-JET cooperation on fusion research and development, in a collaborative program of mutual interest and equitable benefit on particle control,

Therefore, DOE and JET (hereinafter referred to as the "Participants") agree to a Collaborative Particle Control Program as follows:

ARTICLE 1

Objective

- 1.1 The objectives of the Collaborative Particle Control Program are to:
- (1) control the plasma profiles in the JET device in order to optimize plasma confinement under conditions of ohmic and additional, i.e., auxiliary, heating,
 - (2) develop the components and materials needed to control the plasma profiles and the neutral particle and impurity flux into the plasma, and
 - (3) study the plasma-materials interactions necessary to control the plasma and particle profiles.

- 1.2 The Collaborative Particle Control Program shall be executed by the Participants under the DOE-EURATOM Fusion Agreement.
- 1.3 This Agreement is not intended to diminish or duplicate any existing Agreements between DOE and EURATOM or multilateral agreements to which DOE and EURATOM are Parties.

ARTICLE 2

The Collaborative Particle Control Program

- 2.1 The Collaborative Particle Control Program shall consist of:
 - (1) joint plasma confinement and plasma technology experiments on the JET device,
 - (2) joint plasma confinement and plasma technology experiments in laboratories in the United States operated by DOE or its contractors,
 - (3) experiments on plasma-materials interactions and high heat flux materials and components in laboratories in the United States operated by DOE or its contractors,
 - (4) detailed design, thermal analysis and testing of high heat flux components for the JET pumped limiter, and
 - (5) manufacture of parts for the pumped limiter, if JET obtains approval from its authorities to proceed.

The experiments on the JET device shall include, but are not limited to, experiments to determine the effect of particle control on plasma performance for the different operating modes of JET including x-point divertor operation and assessments of the performance of high heat flux components and materials. These experiments may include a pumped limiter, wallpumping, and, if mutually agreed, beryllium tiles and coatings.

- 2.2 To support the Collaborative Particle Control Program described in paragraph 2.1, DOE shall be responsible for:
 - 2.2.1 providing a team of scientists and engineers from the DOE programs to participate in the joint experiments on the JET device;
 - 2.2.2 modifying present wallpumping experiments with graphite and beryllium at Sandia National Laboratories, Livermore (SNLL) to include temperature control, local heating effects, including evaluation of hot spots and tritium effects using the Tritium Plasma Experiment;

- 2.2.3 performing work at Sandia National Laboratories, Albuquerque (SNLA) on heat transfer and thermal fatigue tests in graphite, beryllium, beryllium coating on graphite, and porous beryllium materials to support the design of the JET pumped limiter, and heatload tests on beryllium coated graphite;
 - 2.2.4 performing at SNLA thermal analysis of the pumped limiter head sufficient to complete a detailed design of the graphite high heat flux components of the pumped limiter, thermal fatigue testing of the limiter blade (including connections with the inconel structure), assessments of the eddy current forces and the effects of plasma disruptions;
 - 2.2.5 defining diagnostics for the limiter by SNLA; and
 - 2.2.6 based both on approval by JET of the detailed design and on a formal JET commitment to proceed with hardware fabrication, producing at SNLA the high heat flux, i.e., graphite, components of the pumped limiter, interconnections to the inconel structure, and mutually agreed limiter diagnostics.
- 2.3 To support the Collaborative Particle Control Program described in paragraph 2.1, JET shall be responsible for:
- 2.3.1 providing access to the JET device for the mutually agreed experiments which are approved by the JET Director. This access shall include provision of mutually agreed plasma and device diagnostics for adequate analysis of results and a plasma with mutually agreed plasma conditions;
 - 2.3.2 providing a team of scientists and engineers to work with the DOE team in the joint experiments on the JET device;
 - 2.3.3 providing specimens and samples to SNLA and SNLL for the plasma materials interaction and high heat flux experiments to be done in the United States;
 - 2.3.4 providing SNLA with conceptual design drawings of the pumped limiter which have been approved by the appropriate JET authorities; and
 - 2.3.5 based both on approval by JET of the detailed design and on formal commitment to proceed with hardware fabrication, providing all equipment necessary for interface with the JET device and the components for the pumped limiter not produced by SNLA.
- 2.4 To support the Collaborative Particle Control Program described in paragraph 2.1, DOE and JET shall jointly be responsible for:
- 2.4.1 performing joint work on other high heat flux issues such as the development and testing of actively cooled divertor and limiter elements with low-z materials; and

- 2.4.2 developing on a timely basis the Work Plan for the Collaborative Particle Control Program which shall include plans for experiments and tests identified in paragraphs 2.2, 2.3 and sub-paragraph 2.4.1 in addition to other activities.

ARTICLE 3

Other Terms and Conditions

- 3.1 Neither JET nor DOE shall be bound to fabricate its share of the pumped limiter unless the following conditions are met:
- (1) JET receives approval to proceed from appropriate authorities,
 - (2) JET is provided with a firm cost estimate from DOE based on the SNLA detailed design, and
 - (3) DOE and JET agree to proceed with fabrication on the basis of the SNLA estimate.
- 3.2 DOE shall be responsible for the costs to support work directly related to applications on the JET device as part of the Collaborative Particle Control Program which is designated by DOE as part of its base program. JET shall be responsible for the incremental costs to support work associated with JET-specific work done in the United States which is beyond the scope of the DOE base program. The JET-specific work for the design of the pumped limiter to be carried out in the US outside the DOE base program and the related costs to be borne by JET are detailed in Appendix I. JET and DOE shall agree on a suitable method of payment prior to the start of work at SNLA on the pumped limiter detailed design.
- 3.3 As the effort proposed under this Agreement will provide substantial benefit to the DOE, DOE Office of Fusion Energy shall request an exception under DOE Orders 2100.10 and 2110.1 to the Department's full cost recovery policy.
- 3.4 The estimated target date for delivery to JET of the high heat flux components for the pumped limiter provided by SNLA is 21 months after receipt of the approval conceptual design from JET. Commissioning of the pumped limiter is expected to begin in July 1990.

ARTICLE 4

Management

- 4.1 Each Participant shall designate a Program Coordinator who shall be responsible for the technical and managerial oversight of that Participant's portion of the Collaborative Particle Control Program. The Program Coordinators shall also be responsible for jointly developing the Work Plan for the collaboration, presenting that Plan to their respective authorities for approval, managing the implementation of the approved

Plan, and reporting the results of the work to the Coordinating Committee established under the DOE-EURATOM Fusion Agreement and as requested by their respective authorities.

- 4.2 The Program Coordinators shall also be responsible for the periodic review of the technical context in which the Collaborative Particle Control Program is undertaken. If that technical context undergoes significant changes affecting the purpose, direction, priority, and/or scope of the collaboration, then the Program Coordinators shall inform the DOE-EURATOM Coordinating Committee and seek appropriate guidance.
- 4.3 The experiments performed on the JET device as part of the Collaborative Particle Control Program shall be conducted within the program proposed by the JET Topic Groups. The Topic Group is part of and subordinate to the JET Experimental Committee which advises the JET Director on the overall experimental plan for the JET device. Where feasible and desirable, these activities shall be coordinated with other DOE-JET joint programs.
- 4.4 When the experimental phase of operations with the pumped limiter at the JET device commences under this Agreement, JET shall establish a Topic Group for this work. Each Participant shall appoint an on-site co-leader for this Topic Group. For representation on the JET Experimental Committee these co-leaders shall serve on a rotating basis for a mutually agreed term. The co-leaders shall be responsible for developing a Joint Experimental Plan and proposing to the JET Director the execution of that Plan at the JET Experimental Committee.
- 4.5 Scientists, engineers, and technicians on assignment from JET to the United States under this Agreement shall be invited to participate in all internal meetings of the host group concerning the planning of collaborative activities insofar as these planning meetings are related to the Collaborative Particle Control Program. Personnel from the United States assigned to the JET device site shall have similar access to meetings at that site.

ARTICLE 5

5.1 The Parties support the widest possible dissemination of information provided or exchanged under this Agreement, subject to the need to protect proprietary information exchanged hereunder, and to the provisions of Article 8 of this Agreement. Each Party shall have the right to use, disclose, publish, or disseminate such information for any and all purposes whatsoever, subject to sub-paragraph 7.2 below, Article 8, and Article 10.

5.2 Use of Proprietary Information

Definitions as used in this Agreement:

- i) The term "information" means scientific or technical data, results or methods of research and development, and any other information intended to be provided or exchanged under this Agreement.

- ii) The term "proprietary information" means information developed prior to or outside this agreement which contains trade secrets or commercial or financial information which is privileged or confidential, and may only include such information which:
 - a) has been held in confidence by its owner;
 - b) is of a type which is customarily held in confidence by its owner;
 - c) has not been transmitted by the transmitting Party to other entities (including the receiving Party) except on the basis that it be held in confidence; and
 - d) is not otherwise available to the receiving Party from another source without restriction on its further dissemination.

5.3 Procedures

- i) A Party receiving proprietary information pursuant to this Agreement shall respect the privileged nature thereof. Any document which contains proprietary information shall be clearly marked with the following (or substantially similar) restrictive legend:

"This document contains proprietary information furnished in confidence under the Agreement between the United States Department of Energy and the European Atomic Energy Community (EURATOM) of _____ and shall not be disseminated outside these organizations, their contractors, and the concerned departments and agencies of the Governments of the United States and EURATOM without prior approval of _____

This notice shall be marked on any reproduction, hereof, in whole or in part. These limitations shall automatically terminate when this information is disclosed by the owner without restriction."

- ii) Proprietary information received in confidence under this Agreement may be disseminated by the receiving Party to:
 - a) persons within or employed by the receiving Party, and other concerned Government departments and Government agencies in the country of the receiving Party; and
 - b) prime or subcontractors of the receiving Party located within the geographical limits of the receiving Party's nation, for use only within the framework of their contracts with the receiving Party in work relating to the subject matter of the proprietary information;

provided, that any proprietary information so disseminated shall be pursuant to an agreement of confidentiality and shall be marked with a restrictive legend substantially identical to that appearing in section 3(i) above.

iii) With the prior written consent of the Party providing proprietary information under this Agreement, the receiving Party may disseminate such proprietary information more widely than otherwise permitted in the foregoing subsection (ii). The Parties shall cooperate with each other in developing procedures for requesting and obtaining prior written consent for such wider dissemination, and each Party shall grant such approval to the extent permitted by its national policies, regulations and laws.

5.4 Each Party shall exercise its best efforts to ensure that proprietary information received by it under this Agreement shall be controlled as provided herein. If one of the Parties becomes aware that it will be, or may reasonably be expected to become, unable to meet the non-dissemination provisions of this Article, it shall immediately inform the other Party. The Parties shall thereafter consult to define an appropriate course of action.

5.5 Information arising from seminars and other meetings arranged under this Agreement and information arising from the attachments of staff shall be treated by the Parties according to the principles specified in this Article; provided, however, no proprietary information orally communicated shall be subject to the limited disclosure requirements of this Agreement unless the individual communicating such information places the recipient on notice as to the proprietary character of the information communicated.

ARTICLE 6

Information transmitted by one Party to the other Party under this Agreement shall be accurate to the best knowledge and belief of the transmitting Party, but the transmitting Party does not warrant the suitability of the information transmitted for any particular use or application by the receiving Party or by any third Party. Information developed jointly by the Parties shall be accurate to the best knowledge and belief of both Parties. Neither Party warrants the accuracy of the jointly developed information or its suitability for any particular use or application by either Party or by any third Party.

ARTICLE 7

7.1 With respect to any invention or discovery made or conceived in the course of or under this Agreement:

- a. If made or conceived by personnel of one party (the Assigning Party) or its contractors while assigned to the other Party (the Receiving Party) or its contractors in connection with exchanges of scientists, engineers or other specialists, the Receiving Party shall acquire all rights, title and interest in and to any such invention or discovery in all countries, subject to a non-exclusive, irrevocable, royalty-free license in all such countries to the Assigning Party, with the right of the Assigning Party to grant sublicenses under such invention or discovery and any patent application, patent or other protection relating thereto.

- b. If made or conceived by a Party or its contractors as a direct result of employing information which has been communicated to it under this Agreement by another Party or its contractors or communicated during seminars or other joint meetings, the Party making the invention shall acquire all rights, title and interest in and to such inventions or discoveries in all countries, subject to a grant to the other Party of a royalty-free, non-exclusive, irrevocable license, with the right of the other Party to grant sublicenses, in and to any such invention or discovery and any patent application, patent or other protection relating thereto, in all countries.
- c. With regard to exchange of samples, materials, instruments, and components for joint testing, the Receiving Party shall have the same rights as the Receiving Party as set forth in paragraph a. above, and the Assigning Party shall have the same rights as the Assigning Party as set forth in paragraph a. above.
- d. With regard to other specific forms of cooperation, the Parties shall provide for the appropriate distribution of rights to inventions or discoveries resulting from such cooperation, in accordance with the arrangements foreseen in Article III, paragraph 2 of this Agreement.

7.2 Each Party shall, without prejudice to any rights of inventors or authors under its national laws, take all necessary steps to provide the cooperation from its inventors or authors required to carry out the provisions of this Article and Articles VI and IX. Each Party shall assume the responsibility to pay awards and compensation required to be paid to its own nationals according to its own laws.

ARTICLE 8

Copyrights of the Parties or of cooperating organizations and persons shall be accorded treatment consistent with internationally recognized standards of protection. As to copyrights on materials which constitute "information" as defined in paragraph 2(i) of Article 5, owned or controlled by a Party, that Party shall make efforts to grant to the other Party a license to reproduce copyrighted materials.

ARTICLE 9

Articles V, X, XI, XII, XIII, XIV, AND XVI of the DOE-EURATOM Fusion Agreement are hereby incorporated by reference.

ARTICLE 10

10.1 The U.S. team can output onto tape data generated in joint US-JET pumped limiter and reference shots and can transport these data to the U.S. for analysis. These data, however, remain the property of EURATOM and should be protected accordingly from third party access.

10.2 Papers based on theoretical and experimental information arising from investigations under this Agreement must be approved by both Participants before being sent to a publisher. Such publications shall normally be issued in the form of joint reports by the individuals who contributed to the investigations and will be handled in accordance with Articles 3 and 5 herein. Each Participant shall have equal access to data developed from the collaborative Particle Control Program. These publications are to be clearly marked with the following caption: "This work has been performed under a collaboration agreement between the JET Joint Undertaking and the U.S. Department of Energy." Other publications that make use of the unpublished results of the collaborative Particle Control Program should make reference to this collaborative Particle Control Program in an acknowledgment.

ARTICLE 11

11.1 This Agreement shall enter into force upon signature and shall continue in force for an initial period through December 31, 1991 or the end of the JET project, whichever comes first. The Agreement may be amended or extended by written agreement of each of the Participants as long as the DOE-EURATOM Fusion Agreement is in force.

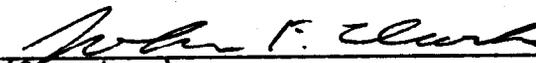
11.2 If necessary, this Agreement may be terminated at any time at the discretion of either Participant upon one year advance notification in writing by the Participant asking to terminate the Agreement. Such termination shall be without prejudice to the rights that may have accrued under this Agreement to either Participant up to the date of the termination.

11.3 In the event that, during the period of this Agreement, the nature of either Participant's magnetic fusion program should change substantially, whether this be by substantial expansion, reduction or transformation, or by amalgamation of major elements with the magnetic fusion program of a third Participant, either Participant shall have the right to request revisions in the scope and terms of this Agreement.

Done in duplicate at Washington, DC this 14th day of April 1988.

FOR THE UNITED STATES
DEPARTMENT OF ENERGY

FOR THE JOINT EUROPEAN TORUS
JOINT UNDERTAKING


(Signature)


(Signature)

John F. Clarke
(Printed Name)

P. H. Rebut
(Printed Name)

Associate Director
for Fusion Energy
(Title)

Director of JET,
Joint Undertaking
(Title)

Appendix I

JET-Specific Work for the Development and Design
of the Pumped Limiter

1. Activities to be carried out:

The following JET-specific activities will be executed by SNLA for the development and design of the pumped limiter under the "Collaborative Particle Control Program Between the United States Department of Energy and the Joint European Torus":

- Study of brazing pyrolytic graphite to Inconel
- Computer modelling of pumped limiter head
- Thermal fatigue tests of materials and components
- Mechanical tests
- Design of limiter head

2. Costs:

The total costs of proceeding with design, research and development of the pumped limiter head under the Agreement will be fixed at \$220.000 which will not include DOE overhead. It is expected that the work will be executed during the U.S. financial year 1988.