

INTERNATIONAL ENERGY AGENCY

**IMPLEMENTING AGREEMENT  
FOR A PROGRAMME OF RESEARCH  
AND DEVELOPMENT ON HIGH TEMPERATURE  
MATERIALS FOR AUTOMOTIVE ENGINES**

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The Contracting Parties

CONSIDERING that the Contracting Parties, being either governments of International Energy Agency ("Agency") countries, governments of other countries invited by the Governing Board of the Agency to be Contracting Parties, international organizations or parties designated by their respective governments, wish to take part in the establishment and operation of a Programme of Research and Development on High Temperature Materials for Automotive Engines (the "Programme") as provided in this Agreement;

CONSIDERING that the Contracting Parties which are governments of Agency Countries and the governments of Agency countries which have designated Contracting Parties (referred to collectively as the "Governments") have agreed in Article 41 of the Agreement on an International Energy Program (the "I.E.P. Agreement") to undertake national programmes in the areas set out in Article 42 of the I.E.P. Agreement, including energy research and development, and have referred in Chapter IV of the Long-Term Co-operation Programme, adopted by the Governing Board on 30th January, 1976, to the establishment of programmes in new energy research and development areas and that the development of high temperature materials for automotive engines would aid the Agency Participating Countries in meeting their energy objectives;

CONSIDERING that in the Governing Board of the Agency on 30th March, 1979, the Governments approved the Programme as a special activity under Article 65 of the I.E.P. Agreement;

CONSIDERING that the Agency has recognized the establishment of the Programme as an important component of international co-operation in the field of energy research and development;

HAVE AGREED as follows:

## Article 1

### OBJECTIVES

(a) *Scope of Activity.* The Programme to be carried out by the Contracting Parties within the framework of this Agreement shall consist of co-operative research, development, demonstrations and exchanges of information, personnel, materials and instrumentation regarding high temperature materials for automotive engines (including cars, trucks and buses).

(b) *Method of Implementation.* The Contracting Parties shall implement the Programme by undertaking one or more tasks (the "Task" or "Tasks") each of which will be open to participation by two or more Contracting Parties as provided in Article 2 hereof. The Contracting Parties which participate in a particular Task are, for the purposes of that Task, referred to in this Agreement as "Participants".

(c) *Task Co-ordination and Co-operation.* The Contracting Parties shall co-operate in co-ordinating the work of the various Tasks and shall endeavour, on the basis of an appropriate sharing of burdens and benefits, to encourage co-operation among Participants engaged in the various Tasks with the objective of advancing the research and development activities of all Contracting Parties in the field of high temperature materials for automotive engines.

## Article 2

### IDENTIFICATION AND INITIATION OF TASKS

(a) *Identification.* The Tasks undertaken by Participants are identified in the Annexes to this Agreement. At the time of signing this Agreement, each Contracting Party shall confirm its intention to participate in one or more Tasks by giving the Executive Director of the Agency a Notice of Participation in the relevant Annex or Annexes and the Operating Agent for each Task shall give the Executive Director of the Agency a Notice of Acceptance of the Task Annex. Thereafter, each Task shall be carried out in accordance with the procedures set forth in Articles 2 to 11 hereof, unless otherwise specifically provided in the applicable Annex.

(b) *Initiation of Additional Tasks.* Additional Tasks may be initiated by any Contracting Party according to the following procedure:

- (1) A Contracting Party wishing to initiate a new Task shall present to one or more Contracting Parties for approval a draft Annex, similar in form to the Annexes attached hereto, containing a description of the scope of work and conditions of the Task proposed to be performed;
- (2) Whenever two or more Contracting Parties agree to undertake a new Task, they shall submit the draft Annex for approval by the Executive

Committee pursuant to Article 3 (e) (2) hereof; the approved draft Annex shall become part of this Agreement; Notice of Participation in the Task by Contracting Parties and acceptance by the Operating Agent shall be communicated to the Executive Director in the manner provided in paragraph (a) above;

- (3) In carrying out the various Tasks, Participants shall co-ordinate their activities in order to avoid duplication of activities.

### *Article 3*

#### THE EXECUTIVE COMMITTEE

(a) *Supervisory Control.* Control of the Programme shall be vested in the Executive Committee constituted under this Article.

(b) *Membership.* The Executive Committee shall consist of one member designated by each Contracting Party; each Contracting Party shall also designate an alternate member to serve on the Executive Committee in the event that its designated member is unable to do so.

(c) *Responsibilities.* The Executive Committee shall:

- (1) Adopt for each year, acting by unanimity, the Programme of Work, and Budget if foreseen, for each Task, together with an indicative Programme of Work and Budget for the following two years; the Executive Committee may, as required, make adjustments within the framework of the Programme of Work and Budget;
- (2) Make such rules and regulations as may be required for the sound management of the Tasks, including financial rules as provided in Article 6 hereof;
- (3) Carry out the other functions conferred upon it by this Agreement and the Annexes hereto; and
- (4) Consider any matters submitted to it by any of the Operating Agents or by any Contracting Party.

(d) *Procedure.* The Executive Committee shall carry out its responsibilities in accordance with the following procedures:

- (1) The Executive Committee shall each year elect a Chairman and one or more Vice-Chairmen;
- (2) The Executive Committee may establish such subsidiary bodies and rules of procedure as are required for its proper functioning. A representative

of the Agency and a representative of each Operating Agent (in its capacity as such) may attend meetings of the Executive Committee and its subsidiary bodies in an advisory capacity;

- (3) The Executive Committee shall meet in regular session twice each year; a special meeting shall be convened upon the request of any Contracting Party which can demonstrate the need therefor;
- (4) Meetings of the Executive Committee shall be held at such time and in such office or offices as may be designated by the Committee;
- (5) At least twenty-eight days before each meeting of the Executive Committee, notice of the time, place and purpose of the meeting shall be given to each Contracting Party and to other persons or entities entitled to attend the meeting; notice need not be given to any person or entity otherwise entitled thereto if notice is waived before or after the meeting;
- (6) The quorum for the transaction of business in meetings of the Executive Committee shall be one-half of the members plus one (less any resulting fraction) provided that any action relating to a particular Task shall require a quorum as aforesaid of members or alternate members designated by the Participants in that Task.

(e) *Voting.*

- (1) When the Executive Committee adopts a decision or recommendation for or concerning a particular Task, the Executive Committee shall act:
  - (i) When unanimity is required under this Agreement: by agreement of those members or alternate members which were designated by the Participants in that Task and which are present and voting;
  - (ii) When no express voting provision is made in this Agreement: by majority vote of those members or alternate members which were designated by the Participants in that Task and which are present and voting.
- (2) In all other cases in which this Agreement expressly requires the Executive Committee to act by unanimity, this shall require the agreement of each member or alternate member present and voting, and in respect of all other decisions and recommendations for which no express voting provision is made in this Agreement, the Executive Committee shall act by a majority vote of the members or alternate members present and voting. If a government has designated more than one Contracting Party to this Agreement, those Contracting Parties may cast only one vote under this paragraph.
- (3) The decisions and recommendations referred to in sub-paragraphs (1) and (2) above may, with the agreement of each member or alternate member entitled to act thereon, be made by mail, telex or cable without

the necessity for calling a meeting. Such action shall be taken by unanimity or majority of such members as in a meeting. The Chairman of the Executive Committee shall ensure that all members are informed of each decision or recommendation made pursuant to this subparagraph.

(f) *Reports.* The Executive Committee shall, at least annually, provide the Agency with periodic reports on the progress of the Programme.

#### *Article 4*

### THE OPERATING AGENTS

(a) *Designation.* Participants shall designate in the relevant Annex an Operating Agent for each Task. References in this Agreement to the Operating Agent shall apply to each Operating Agent in respect of the Task for which it is responsible.

(b) *Scope of Authority to Act on Behalf of Participants.* Subject to the provisions of the applicable Annex:

- (1) All legal acts required to carry out each Task shall be performed on behalf of the Participants by the Operating Agent for the Task;
- (2) The Operating Agent shall hold, for the benefit of the Participants, the legal title to all property rights which may accrue to or be acquired for the Task.

The Operating Agent shall operate the Task under its supervision and responsibility, subject to this Agreement, in accordance with the law of the country of the Operating Agent.

(c) *Reimbursement of Costs.* The Executive Committee may provide that expenses and costs incurred by an Operating Agent in acting as such pursuant to this Agreement shall be reimbursed to the Operating Agent from funds made available by the Participants pursuant to Article 6 hereof.

(d) *Replacement.* Should the Executive Committee wish to replace an Operating Agent with another government or entity, the Executive Committee may, acting by unanimity and with the consent of such government or entity, replace the initial Operating Agent. References in this Agreement to the "Operating Agent" shall include any government or entity appointed to replace the original Operating Agent under this paragraph.

(e) *Resignation.* An Operating Agent shall have the right to resign at any time, by giving six months written notice to that effect to the Executive Committee, provided that:

- (1) A Participant, or entity designated by a Participant, is at such time willing to assume the duties and obligations of the Operating Agent and so notifies the Executive Committee and the other Participants to that



effect, in writing, not less than three months in advance of the effective date of such resignation; and

- (2) Such Participant or entity is approved by the Executive Committee, acting by unanimity.

(f) *Accounting.* An Operating Agent which is replaced or which resigns as Operating Agent shall provide the Executive Committee with an accounting of any monies and other assets which it may have collected or acquired for the Task in the course of carrying out its responsibilities as Operating Agent.

(g) *Transfer of Rights.* In the event that another Operating Agent is appointed under paragraph (d) or (e) above, the Operating Agent shall transfer to such replacement Operating Agent any property rights which it may hold on behalf of the Task.

(h) *Information and Reports.* Each Operating Agent shall furnish to the Executive Committee such information concerning the Task as the Committee may request and shall each year submit, not later than two months after the end of the financial year, a report on the status of the Task.

## Article 5

### ADMINISTRATION AND STAFF

(a) *Administration of Tasks.* Each Operating Agent shall be responsible to the Executive Committee for implementing its designated Task in accordance with this Agreement, the applicable Task Annex, and the decisions of the Executive Committee.

(b) *Staff.* It shall be the responsibility of the Operating Agent to retain such staff as may be required to carry out its designated Task in accordance with rules determined by the Executive Committee. The Operating Agent may also, as required, utilize the services of personnel employed by other Participants (or organizations or other entities designated by Contracting Parties) and made available to the Operating Agent by secondment or otherwise. Such personnel shall be remunerated by their respective employers and shall, except as provided in this Article, be subject to their employers' conditions of service. The Contracting Parties shall be entitled to claim the appropriate cost of such remuneration or to receive an appropriate credit for such cost as part of the Budget of the Task, in accordance with Article 6 (f) (6) hereof.

## Article 6

### FINANCE

(a) *Individual Obligations.* Each Contracting Party shall bear the costs it incurs in carrying out this Agreement, including the costs of formulating or transmitting reports

and of reimbursing its employees for travel and other per diem expenses incurred in connection with work carried out on the respective Tasks, unless provision is made for such costs to be reimbursed from common funds as provided in paragraph (g) below.

(b) *Common Financial Obligations.* Participants wishing to share the costs of a particular Task shall agree in the appropriate Task Annex to do so. The apportionment of contributions to such costs (whether in the form of cash, services rendered, intellectual property or the supply of materials) and the use of such contributions shall be governed by the regulations and decisions made pursuant to this Article by the Executive Committee.

(c) *Financial Rules, Expenditure.* The Executive Committee, acting by unanimity, may make such regulations as are required for the sound financial management of each Task including, where necessary:

- (1) Establishment of budgetary and procurement procedures to be used by the Operating Agent in making payments from any common funds which may be maintained by Participants for the account of the Task or in making contracts on behalf of the Participants;
- (2) Establishment of minimum levels of expenditure for which Executive Committee approval shall be required, including expenditure involving payment of monies to the Operating Agent for other than routine salary and administrative expenses previously approved by the Executive Committee in the budget process.

In the expenditure of common funds the Operating Agent shall take into account the necessity of ensuring a fair distribution of such expenditure in the Participants' countries, where this is fully compatible with the most efficient technical and financial management of the Task.

(d) *Crediting of Income to Budget.* Any income which accrues from a Task shall be credited to the Budget of that Task.

(e) *Accounting.* The system of accounts employed by the Operating Agent shall be in accordance with accounting principles generally accepted in the country of the Operating Agent and consistently applied.

(f) *Programme of Work and Budget, Keeping of Accounts.* Should Participants agree to maintain common funds for the payment of obligations under a Programme of Work and Budget of the Task, the following provisions shall be applicable unless the Executive Committee, acting by unanimity, decides otherwise:

- (1) The financial year of the Task shall correspond to the financial year of the Operating Agent;
- (2) The Operating Agent shall each year prepare and submit to the Executive Committee for approval a draft Programme of Work and Budget, together with an indicative programme of work and budget for the following two years, not later than three months before the beginning of each financial year;

- (3) The Operating Agent shall maintain complete, separate financial records which shall clearly account for all funds and property coming into the custody or possession of the Operating Agent in connection with the Task;
- (4) Not later than three months after the close of each financial year the Operating Agent shall submit to auditors selected by the Executive Committee for audit the annual accounts maintained for the Task; upon completion of the annual audit, the Operating Agent shall present the accounts together with the auditors' report to the Executive Committee for approval;
- (5) All books of account and records maintained by the Operating Agent shall be preserved for at least three years from the date of termination of the Task;
- (6) Where provided in the relevant Annex, a Participant supplying services, materials or intellectual property to the Task shall be entitled to a credit, determined by the Executive Committee, acting by unanimity, against its contribution (or to compensation, if the value of such services, materials or intellectual property exceeds the amount of the Participant's contribution); such credits for services of staff shall be calculated on an agreed scale approved by the Executive Committee and include all payroll-related costs.

(g) *Contribution to Common Funds.* Should Participants agree to establish common funds under the annual Programme of Work and Budget for a Task, any financial contributions due from Participants in a Task shall be paid to the Operating Agent in the currency of the country of the Operating Agent at such times and upon such other conditions as the Executive Committee, acting by unanimity, shall determine, provided however that:

- (1) Contributions received by the Operating Agent shall be used solely in accordance with the Programme of Work and Budget for the Task;
- (2) The Operating Agent shall be under no obligation to carry out any work on the Task until contributions amounting to at least fifty per cent (in cash terms) of the total due at any one time have been received.

(h) *Ancillary Services.* Ancillary services may, as agreed between the Executive Committee and the Operating Agent, be provided by that Operating Agent for the operation of a Task and the costs of such services, including overheads connected therewith, may be met from budgeted funds of that Task.

(i) *Taxes.* The Operating Agent shall pay all taxes and similar impositions (other than taxes on income) imposed by national or local governments and incurred by it in connection with a Task, as expenditure incurred in the operation of that Task under the Budget; the Operating Agent shall, however, endeavour to obtain all possible exemptions from such taxes.

(j) *Audit.* Each Participant shall have the right, at its sole cost, to audit the accounts of any work in a Task for which common funds are maintained, on the following terms:

- (1) The Operating Agent shall provide the other Participants with an opportunity to participate in such audits on a cost-shared basis;
- (2) Accounts and records relating to activities of the Operating Agent other than those conducted for the Task shall be excluded from such audit, but if the Participant concerned requires verification of charges to the Budget representing services rendered to the Task by the Operating Agent, it may at its own cost request and obtain an audit certificate in this respect from the auditors of the Operating Agent;
- (3) Not more than one such audit shall be required in any financial year;
- (4) Any such audit shall be carried out by not more than three representatives of the Participants.

#### *Article 7*

### INFORMATION AND INTELLECTUAL PROPERTY

It is expected that for each Task agreed to pursuant to this Agreement, the applicable Annex will contain information and intellectual property provisions. The General Guidelines Concerning Information and Intellectual Property, approved by the Governing Board of the Agency on 21st November, 1975, shall be taken into account in developing such provisions.

#### *Article 8*

### LEGAL RESPONSIBILITY AND INSURANCE

(a) *Liability of Operating Agent.* The Operating Agent shall use all reasonable skill and care in carrying out its duties under this Agreement in accordance with all applicable laws and regulations. Except as otherwise provided in this Article, the cost of all damage to property, and all expenses associated with claims, actions and other costs arising from work undertaken with common funds for a Task shall be charged to the Budget of that Task; such costs and expenses arising from other work undertaken for a Task shall be charged to the Budget of that Task if the Task Annex so provides or the Executive Committee, acting by unanimity, so decides.

(b) *Insurance.* The Operating Agent shall propose to the Executive Committee all necessary liability, fire and other insurance, and shall carry such insurance as the

Executive Committee may direct. The cost of obtaining and maintaining insurance shall be charged to the Budget of the Task.

(c) *Indemnification of Contracting Parties.* The Operating Agent shall be liable, in its capacity as such, to indemnify Participants against the cost of any damage to property and all legal liabilities, actions, claims, costs and expenses connected therewith to the extent that they:

- (1) Result from the failure of the Operating Agent to maintain such insurance as it may be required to maintain under paragraph (b) above; or
- (2) Result from the gross negligence or wilful misconduct of any officers or employees of the Operating Agent in carrying out their duties under this Agreement.

## *Article 9*

### LEGISLATIVE PROVISIONS

(a) *Accomplishment of Formalities.* Each Participant shall request the appropriate authorities of its country (or its Member States in the case of an international organization) to use their best endeavours, within the framework of applicable legislation, to facilitate the accomplishment of formalities involved in the movement of persons, the importation of materials and equipment and the transfer of currency which shall be required to conduct the Task in which it is engaged.

(b) *Applicable Laws.* In carrying out this Agreement and its Annexes, the Contracting Parties shall be subject to the appropriation of funds by the appropriate governmental authority, where necessary, and to the constitution, laws and regulations applicable to the respective Contracting Parties, including, but not limited to, laws establishing prohibitions upon the payment of commissions, percentages, brokerage or contingent fees to persons retained to solicit governmental contracts and upon any share of such contracts accruing to governmental officials.

(c) *Decisions of Agency Governing Board.* Participants in the various Tasks shall take account, as appropriate, of the Guiding Principles for Co-operation in the Field of Energy Research and Development, and any modification thereof, as well as other decisions of the Governing Board of the Agency in that field. The termination of the Guiding Principles shall not affect this Agreement, which shall remain in force in accordance with the terms hereof.

(d) *Settlement of Disputes.* Any dispute among the Contracting Parties concerning the interpretation or the application of this Agreement which is not settled by negotiation or other agreed mode of settlement shall be referred to a tribunal of three arbitrators to be chosen by the Contracting Parties concerned who shall also choose the Chairman of the tribunal. Should the Contracting Parties concerned fail to agree upon

the composition of the tribunal or the selection of its Chairman, the President of the International Court of Justice shall, at the request of any of the Contracting Parties concerned, exercise those responsibilities. The tribunal shall decide any such dispute by reference to the terms of this Agreement and any applicable laws and regulations, and its decision on a question of fact shall be final and binding on the Contracting Parties concerned. Operating Agents which are not Contracting Parties shall be regarded as Contracting Parties for the purpose of this paragraph.

#### *Article 10*

### ADMISSION AND WITHDRAWAL OF CONTRACTING PARTIES

(a) *Admission of New Contracting Parties: Agency Countries.* Upon the invitation of the Executive Committee, acting by unanimity, admission to this Agreement shall be open to the government of any Agency Participating Country (or a national agency, public organization, private corporation, company or other entity designated by such government), which signs or accedes to this Agreement, accepts the rights and obligations of a Contracting Party, and is accepted for participation in at least one Task by the Participants in that Task, acting by unanimity. Such admission of a Contracting Party shall become effective upon the signature of this Agreement by the new Contracting Party or its accession thereto and its giving Notice of Participation in one or more Annexes and the adoption of any consequential amendments thereto.

(b) *Admission of New Contracting Parties: Other OECD Countries.* The government of any Member of the Organisation for Economic Co-operation and Development which does not participate in the Agency may, on the proposal of the Executive Committee, acting by unanimity, be invited by the Governing Board of the Agency to become a Contracting Party to this Agreement (or to designate a national agency, public organization, private corporation, company or other entity to do so), under the conditions stated in paragraph (a) above.

(c) *Participation by the European Communities.* The European Communities may participate in this Agreement in accordance with arrangements to be made by the Executive Committee, acting by unanimity.

(d) *Admission of New Participants in Tasks.* Any Contracting Party may, with the agreement of the Participants in a Task, acting by unanimity, become a Participant in that Task. Such participation shall become effective upon the Contracting Party's giving the Executive Director of the Agency a Notice of Participation in the appropriate Task Annex and the adoption of consequential amendments thereto.

(e) *Contributions.* The Executive Committee may require, as a condition to admission to participation, that the new Contracting Party or new Participant shall contribute (in the form of cash, services or materials) an appropriate proportion of the prior budget expenditure of any Task in which it participates.

(f) *Replacement of Contracting Parties.* With the agreement of the Executive

Committee, acting by unanimity, and upon the request of a government, a Contracting Party designated by that government may be replaced by another party. In the event of such replacement, the replacement party shall assume the rights and obligations of a Contracting Party as provided in paragraph (a) above and in accordance with the procedure provided therein.

(g) *Withdrawal.* Any Contracting Party may withdraw from this Agreement or from any Task either with the agreement of the Executive Committee, acting by unanimity, or by giving twelve months written Notice of Withdrawal to the Executive Director of the Agency, such Notice to be given not less than one year after the date hereof. The withdrawal of a Contracting Party under this paragraph shall not affect the rights and obligations of the other Contracting Parties; except that, where the other Contracting Parties have contributed to common funds for a Task, their proportionate shares in the Task Budget shall be adjusted to take account of such withdrawal.

(h) *Changes of Status of Contracting Party.* A Contracting Party other than a government or an international organization shall forthwith notify the Executive Committee of any significant change in its status or ownership, or of its becoming bankrupt or entering into liquidation. The Executive Committee shall determine whether any such change in status of a Contracting Party significantly affects the interests of the other Contracting Parties; if the Executive Committee so determines, then, unless the Executive Committee, acting upon the unanimous decision of the other Contracting Parties, otherwise agrees:

- (1) That Contracting Party shall be deemed to have withdrawn from the Agreement under paragraph (g) above on a date to be fixed by the Executive Committee; and
- (2) The Executive Committee shall invite the government which designated that Contracting Party to designate, within a period of three months of the withdrawal of that Contracting Party, a different entity to become a Contracting Party; if approved by the Executive Committee, acting by unanimity, such entity shall become a Contracting Party with effect from the date on which it signs or accedes to this Agreement and gives the Executive Director of the Agency a Notice of Participation in one or more Annexes.

(i) *Failure to Fulfil Contractual Obligations.* Any Contracting Party which fails to fulfil its obligations under this Agreement within sixty days after its receipt of notice specifying the nature of such failure and invoking this paragraph, may be deemed by the Executive Committee, acting by unanimity, to have withdrawn from this Agreement.

## *Article 11*

### FINAL PROVISIONS

(a) *Term of Agreement.* This Agreement shall remain in force for an initial period of three years from the date hereof, and shall continue in force thereafter unless and until the Executive Committee, acting by unanimity, decides on its termination.

(b) *Legal Relationship of Contracting Parties and Participants.* Nothing in this Agreement shall be regarded as constituting a partnership between any of the Contracting Parties or Participants.

(c) *Termination.* Upon termination of this Agreement, or any Annex to this Agreement, the Executive Committee, acting by unanimity, shall arrange for the liquidation of the assets of the Task or Tasks. In the event of such liquidation, the Executive Committee shall, so far as practicable, distribute the assets of the Task, or the proceeds therefrom, in proportion to the contributions which the Participants have made from the beginning of the operation of the Task, and for that purpose shall take into account the contributions and any outstanding obligations of former Contracting Parties. Disputes with a former Contracting Party about the proportion allocated to it under this paragraph shall be settled under Article 9 (d) hereof, for which purpose a former Contracting Party shall be regarded as a Contracting Party.

(d) *Amendment.* This Agreement may be amended at any time by the Executive Committee, acting by unanimity, and any Annex to this Agreement may be amended at any time by the Executive Committee, acting by unanimity of the Participants in the Task to which the Annex refers. Such amendments shall come into force in a manner determined by the Executive Committee, acting under the voting rule applicable to the decision to adopt the amendment.

(e) *Deposit.* The original of this Agreement shall be deposited with the Executive Director of the Agency and a certified copy thereof shall be furnished to each Contracting Party. A copy of this Agreement shall be furnished to each Agency Participating Country, to each Member country of the Organisation for Economic Co-operation and Development and to the European Communities.

Done in Paris, this 22nd day of May, 1979.



For the DEUTSCHE FORSCHUNGS- UND  
VERSUCHSANSTALT FÜR LUFT- UND  
RAUMFAHRT e.V.  
(designated by the Government of Germany):

W. BUNK  
V. KRIES

For the DEPARTMENT OF ENERGY  
for and on behalf of the  
Government of the United States of America:

HARRY E. BERGOLD

## *Annex 1*

### CERAMICS FOR AUTOMOTIVE GAS TURBINE ENGINES

#### 1. *Background*

The Federal Ministry for Research and Technology (BMFT) of Germany is supporting a ceramic components programme for vehicular gas turbines that is similar in scope and funding to part of the United States Department of Energy (DOE) advanced automotive heat engine development programme devoted to gas turbine ceramic components. Both programmes have been operating for several years. The BMFT programme is being conducted by the Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt e.V. (DFVLR).

#### 2. *Objectives*

The objective of this Annex is to carry out technical studies related to high temperature structural ceramics for automotive (including cars, trucks and buses) gas turbine engine applications, with emphasis on materials and component technology. The Participants wish to avoid unnecessary duplication of research efforts and to accelerate the achievement of the objectives of their research and development programmes.

#### 3. *Means*

The scope of the work to be accomplished by the Participants is set out in the following Subtasks:

##### *Subtask 1: Technical Information Exchange*

The objective of this Subtask is to achieve a balanced exchange of technical information between the Participants on ceramics for automotive gas turbine engines. Such an exchange shall include the following activities:

##### *(a) Periodic exchanges of reports, studies and software packages, as follows:*

The United States Participant will contribute:

- (1) Semi-annual DOE Highway Vehicle Systems Contractor Co-ordination Meeting Reports;
- (2) Semi-annual and annual reports and other significant findings of the organizations participating in the DOE Advanced Automotive Heat Engine Systems Development Project in the area of ceramic materials and components for gas turbine engines. The specific reports to be exchanged will be set forth in a document to be submitted by the United States Participant to the Operating Agent within thirty days after approval of this Annex.

The German Participant will contribute:

Semi-annual and annual reports of the organizations participating in the DFVLR Ceramic Components for Vehicular Gas Turbines Programme. The specific reports to be exchanged will be set forth in a document to be submitted by the German Participant to the Operating Agent within thirty days after approval of this Annex.

- (b) *Joint technical meetings;*
- (c) *Reciprocal invitations to workshops and conferences; and*
- (d) *Reciprocal visits to research facilities.*

*Subtask 2: Investigation of Ceramic Materials' Properties*

The objective of this Subtask is to investigate mechanical properties of ceramic materials applicable to automotive gas turbines. The activities to be undertaken by the Participants shall include:

- (a) *Baseline Data on Selected Ceramic Materials.* Each Participant shall provide pre-existing non-proprietary baseline physical and mechanical property data on the following materials potentially suitable for economic engine applications:

The German Participant will provide data on:

- (1) Degussa, injection molded, reaction bonded silicon nitride (RBSN);
- (2) Feldmühle AG, injection molded, RBSN;

The United States Participant will provide data on:

- (1) Sintered alpha silicon carbide (SiC);
- (2) RBSN (approximately 2.85 g/cm<sup>3</sup> density).

The data provided shall include a complete description of test methods used. The Executive Committee, acting by unanimity, may change the materials selected.

- (b) *Acceptable test bars.* Each Participant shall provide bend-test bars of the materials selected by that Participant under paragraph (a) to the other Participants. At least 100 bend-test bars of each material shall be provided to each Participant. The Operating Agent shall prepare, in consultation with the Participants, the specification for the test bars (dimensions, surface finish, etc.), and shall submit it to the Executive Committee for approval prior to proceeding with the test bar exchange.
- (c) *Property measurement.* Each Participant shall measure the flexure strength of the materials which they select and which are provided to them by other Participants pursuant to paragraph (b). The Participants, by mutual

agreement, may use exchanged test bars in other tests including long-time gas turbine exposure tests. Test plans shall be as agreed to with the Operating Agent and within the limitations of each Participant's testing facilities.

- (d) *Data analysis.* Data analysis by each Participant shall include statistical methods, fracture analysis, and other observations made during the course of investigation.
- (e) *Reporting.* The Operating Agent, in consultation with all Participants, shall set up a format for reporting the test results in paragraphs (b) through (d) above. As soon as available, the Participants shall exchange the test data in the adopted format. The Operating Agent shall prepare a final report integrating all the test data.

#### *Subtask 3: Exchange of Life Estimate Techniques and Results for Critical Components*

The activities under this Subtask shall include:

- (a) *Exchange of information.* The Participants shall exchange information on techniques used to predict fast fracture, static fatigue (slow crack growth) and creep life of critical engine components, including but not limited to, ceramic turbine wheels.
- (b) *Testing of analytical techniques.* The Participants shall test the analytical techniques described in paragraph (a) against experimental data to be provided by the German Participant on a one piece integrally bladed turbine wheel design fabricated from Norton hot pressed silicon nitride (NC-132) and Annawerk hot pressed silicon nitride (HPSN). The data provided by the German Participant shall include sufficient hot spin and engine rig test results to allow statistical interpretation of the data.
- (c) *Exchange of material property data.* The Participants will exchange material property data on Norton NC-132 and Annawerk—HPSN, including slow crack growth, flexural rate testing, and tensile tests. The United States Participant shall test Annawerk—HPSN to supplement its NC-132 data.
- (d) *Exchange of results.* The Participants shall exchange the results of the life prediction analysis obtained in paragraph (b) above, in reports to be prepared by each.
- (e) *Final Report.* The Operating Agent shall prepare a final report summarizing the results of the above activities.

#### *Subtask 4: Nondestructive Evaluation of Ceramic Materials*

The objective of this Subtask is to compare available non-proprietary techniques used for Nondestructive Evaluation (NDE). To achieve this objective, the Participants shall undertake the following activities:

- (a) *Provision of "seeded defects" reference standard specimens.* The United States Participant shall provide the other Participants with "seeded defects" reference standard specimens and the results of X-ray, ultrasonic and other conventional NDE testing conducted on these specimens.
- (b) *Comparison of results.* Each of the Participants shall subject these specimens to NDE, shall compare its results with those provided by the United States Participant and shall prepare a final report demonstrating the results of these comparisons.

#### 4. *Time Schedule*

This Annex shall remain in force until 31st December, 1980. It shall continue in force thereafter unless and until the Executive Committee, acting by unanimity, decides on its termination.

#### 5. *Responsibilities of the Operating Agent*

In addition to the responsibilities stated in *Subtasks 2 and 3* above, the Operating Agent shall prepare annual Subtask progress reports and a final report, containing the status and results of each Subtask and suggestions for future work. The Operating Agent shall also be responsible for the overall management of the Annex and for implementing the decisions of the Executive Committee.

#### 6. *Funding*

Each Participant will bear all costs it incurs in carrying out the Task, including costs of materials, testing, transport, reporting and travel expenses of representatives.

#### 7. *Operating Agent*

The United States Department of Energy.

#### 8. *Information and Intellectual Property*

- (a) *Executive Committee's Powers.* The publication, distribution, handling, protection and ownership of information and intellectual property arising from activities conducted under this Annex shall be determined by the Executive Committee, acting by unanimity, in conformity with this Annex.
- (b) *Right to Publish.* Subject only to patents and copyright restrictions of this Annex, the Participants shall have the right to publish all information arising from the Programme except proprietary information but they shall not publish it with a view to profit, except as agreed by the Executive Committee, acting by unanimity.
- (c) *Proprietary Information.* The Participants shall take all necessary measures in accordance with this Annex, the laws of their respective countries and international law to protect proprietary information. For the purposes of this Annex, proprietary information shall mean information

of a confidential nature such as trade secrets and know-how (for example, computer programmes, design procedures and techniques, chemical composition of materials, or manufacturing methods, processes, or treatments) which is appropriately marked, provided such information:

- (1) Is not generally known or publicly available from other sources;
- (2) Has not previously been made available by the owner to others without obligation concerning its confidentiality; and
- (3) Is not already in the possession of the recipient Participants without obligation concerning its confidentiality.

It shall be the responsibility of each Participant supplying proprietary information to identify the information as such and to ensure that it is appropriately marked.

- (d) *Production of Relevant Information by Governments.* The Operating Agent should encourage the governments of all Agency Participating Countries to make available or to identify to the Operating Agent all published or otherwise freely available information known to them that is relevant to the Task. The Participants should notify the Operating Agent of all pre-existing information, and information developed independently of the Task known to them which is relevant to the Task and which can be made available to the Task without contractual or legal limitations.
- (e) *Reports on Programme Work.* Reports containing arising information and pre-existing information necessary for and used in the Task, including proprietary information, shall be provided to each Participant by the Participant performing the Task. It shall be the responsibility of each Participant to identify information which qualifies as proprietary information under this Annex and ensure it is appropriately marked. The Operating Agent shall provide summary reports of work performed under this Annex and results thereof (arising information), excluding proprietary information, to the Executive Committee.
- (f) *Licensing of Proprietary Information.* Each Participant agrees to license all pre-existing proprietary information necessary for and used in its work in the Task and which it solely owns or controls to the Participants, their governments, and the nationals of their respective countries designated by them royalty-free for research, development and demonstration purposes (non-commercial uses) in the field of high temperature ceramic materials for automotive gas turbine engines. Each Participant agrees to license all arising proprietary information to the Participants, their governments, and the nationals of their respective countries designated by them:
  - (1) Royalty-free for use in their country only; and
  - (2) On reasonable terms and conditions for use in all other countries.

Each Participant agrees to license all such arising proprietary information to all Agency Participating Countries on reasonable terms and conditions for use in their own country in order to meet their energy needs.

- (g) *Licensing of Patents Needed for Task.* Patents solely owned or controlled by a Participant which are needed for use in the Task shall be licensed to the Task Participant for use in the Task only at no cost to such Participant. If such patents are partially owned or controlled by a Participant, then efforts shall be made by the Participant to reduce or eliminate as possible the benefits that might accrue to it.
- (h) *Arising Inventions.* Inventions made or conceived in the course of or under the Task (arising inventions) shall be owned in all countries by the inventing Participant. Information regarding inventions on which patent protection is to be obtained by the Participant shall not be published or publicly disclosed by the other Participants until a patent application has been filed, provided, however, that this restriction on publication or disclosure shall not extend beyond six months from the date of receipt of such information. It shall be the responsibility of the inventing Participant to appropriately mark reports which disclose inventions that have not been appropriately protected by the filing of a patent application.
- (i) *Licensing of Inventions.* Each Participant agrees to license all arising inventions to the Participants, their governments and the nationals of their respective countries designated by them:
  - (1) Royalty-free for use in their country only; and
  - (2) On reasonable terms and conditions for use in all other countries.

Each Participant agrees to license all such arising inventions to all Agency Participating Countries on reasonable terms and conditions for use in their own country in order to meet their energy needs.

- (j) *Copyright.* The Operating Agent or each Participant for its own part of the Task results may take appropriate measures necessary to protect copyrightable material generated under the Task. Copyrights obtained shall be the property of that Participant or the Operating Agent for the benefit of the Participants, provided, however, that the Participants may reproduce and distribute such material, but shall not publish it with a view to profit.
- (k) *Inventors and Authors.* Each Participant shall, without prejudice to any rights of inventors or authors under its national laws, take all necessary steps to provide the co-operation from its authors and inventors required to carry out the provisions of this Annex. Each Participant will assume the responsibility to pay awards or compensation required to be paid to its employees according to the laws of its country.

- (l) *Determination of "National"*. The Participants may establish guidelines to determine what constitutes a "national" of a Participant.

9. *Participants*

The Contracting Parties which are Participants in this Task are the following:

The Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt e.V.  
(DFVLR) (Germany),

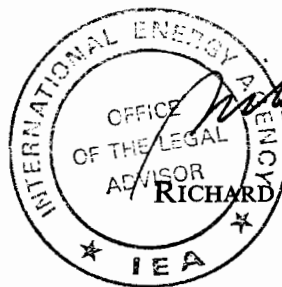
The United States Department of Energy.



The Legal Advisor of the International Energy Agency hereby certifies that the present copy conforms to the original text deposited with the Executive Director of the International Energy Agency.

Paris, *24th April, 1980*

THE LEGAL ADVISOR:



*Richard F. Scott*  
RICHARD F. SCOTT