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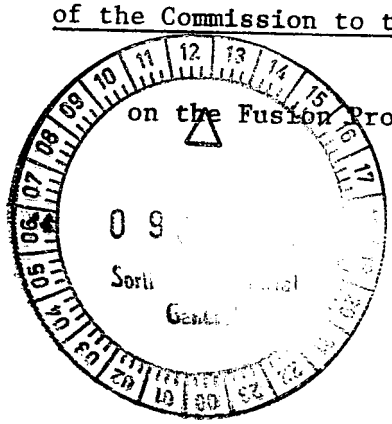
Communication

of the Commission to the Council

on the Fusion Programme



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1. Introduction

In its proposal for a Fusion Programme 1985 to 1989[1] the Commission estimated the expenditure commitments necessary for the implementation at 790 MioECU.[2]

In its decision[3] adopting the Fusion Programme 1985 to 1989 the Council reduced this amount by 100 MioECU to 690 MioECU. Contrary to previous decisions on the Fusion Programme, the Council abstained from making a breakdown of the allocation between the General Programme and JET and within the various components of the General Programme.

The Commission stated[4] at the Council Decision "that it will initiate forthwith, in consultation with the CCFP and the JET Council, the elaboration of a breakdown of the 1985-1989 allocation (690 MioECU) between the various programme components, as well as an analysis of the consequences of such a funding level. The Commission will communicate to the Council this breakdown and the result of the analysis as soon as they are available, and at the latest by the end of 1985."

In implementing this statement the Commission, after consultation with the CCFP and the JET Council, presents hereinafter to the Council

- a breakdown of the 1985-1989 allocation between the various programme components (Part 2 of this document),
- an analysis of the consequences of such a funding level (Part 3 of this document).

The analysis with regard to JET also contains some preliminary information about the need to prolong the duration of this project.

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(1) Document COM(84) 271 final of 18 May 1984.

(2) Throughout this document all figures relate to the research and training programme in the field of controlled thermonuclear fusion exclusive of the fusion activities of the Joint Research Center.

(3) Council Decision 85/201/Euratom of 12 March 1985.

(4) Council document 5260/85, Annex II "Statements for the Council Minutes".

In view of the presentation of a new framework programme for the period 1987 to 1991, which the Commission announced in its communication "Implementation of the Commission's Memorandum 'towards a European technological Community'"(5), the Commission stresses here the following points:

Within this framework programme fusion will be an important objective. The long-term potential of fusion, namely to open a new way of power generation, friendly to the environment and using practically inexhaustible fuel, remains a valid and strong argument to vigorously continue its development. Fusion might contribute one day to reduce the economic, ecological and political vulnerability of Europe.

The scientific and technical achievements of the European programme place Europe in the forefront of world-wide fusion research. JET is the leading fusion experiment in the world, which achieved its initial objectives for the ohmic heating phase on time and in budget and hence made formidable progress towards the demonstration of the scientific feasibility of fusion. The European medium-size machines in operation have contributed in a powerful way to the progress of fusion and the future success of JET, e.g. by discovering the regime of high plasma confinement, by developing plasma heating systems, etc., and more can be expected from those under construction. Europe is also leading in research on stellarators and reversed field pinches, alternative configurations to the Tokamak. JET and these devices are by themselves a demonstration of European high technology, with spin-offs (in particular in the fields of super-conducting magnet technology, robotics, radiofrequency and high power microwave tubes), to the benefit of other branches of science and of European industry.

Fusion is the programme in Europe with an absolute Community character: all fusion activities of the Member States and in the JRC are integrated into one, "The European Programme". This Programme has attracted the important fusion R&D activities of two non-member States, Sweden and Switzerland, now fully associated with it; and it

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(5) COM(85) 530 final.

makes Europe an appealing partner for international cooperation, both in bilateral frames (Canada, Japan, United States) and in multinational organisations (OECD, IAEA). It is worthwhile to note that the expenditure of the European programme is comparable to that of Japan and inferior to that of the US magnetic fusion programme. Moreover, this programme is achieved with a comparatively small rate of financial participation of the Community. An efficient management allows for common planning of the national activities and their steering by Community institutions; for the active exchange of staff between European laboratories (mobility) and for the setting up of the JET Joint Undertaking and of the NET Agreement to operate the NET-Team.

Therefore, by virtue of its important objectives, its excellent record, its technological interest and its Community character, fusion continues to be one of the most important R&D programmes sponsored by the Commission. As already anticipated by the Commission, in order to maintain the momentum of the programme and to account for the increase of Community R&D activities due to the joining of the new member States in 1986, as well as to the mounting involvement of industry, the funding level indicated in the Commission's proposal for the programme 1985/89 should be restored in real terms.

2. Breakdown of the allocation to the Fusion Programme 1985 to 1989

2.1 Article 2 of Council Decision 85/201/Euratom reads:

"The funds estimated as being necessary for the execution of the programme amount to 690 million ECU, including expenditure on a workforce of 270 staff and the unused amounts from the previous programme."

2.2 By the present communication the Commission informs the Council that the amounts and figures mentioned in that decision are broken down between the General Programme and JET as follows:

- **funds estimated necessary:**

. General Programme (budget item 7310):	360 MioECU
. JET (budget item 7311):	330 MioECU
Total	690 MioECU(6)

- amounts unused from previous programme, included in the funds estimated necessary:

. General Programme:	46.9 MioECU
. JET:	73.1 MioECU
Total	120.0 MioECU

- Staff:

. General Programme:	105	officials and other servants
. JET	165	staff within the meaning of Article 2(a) of the conditions of employment of other servants of the European Communities
Total	270	

- Without prejudice to the Commission's responsibility for the implementation of the Fusion Programme, the amount of 360 MioECU earmarked for the General Programme, may be indicatively

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(6) The 360 MioECU for the General Programme are exclusive of, and the 330 MioECU for JET are inclusive of, Third States contributions. Both budget items (7310 and 7311) show these contributions separately.

broken down as follows:

	MioECU
. NET	13
. Technology	80
. Physics	245
. Mobility and Management	22
Total of General Programme	360

3. Analysis of the consequences of a funding level of 690 MECU for 1985-89

3.1 General Considerations

The evolution of the programme, particularly during the last 5 years, required increasing R&D resources in order to make significant progress in JET and in the General Programme. While this necessity was recognized by the Council and is reflected in the budget 1982-86, as compared to the (real term) budget of the previous programme period, the figures for 1985-89 do not correspond to this trend (see table below). With an inflation of about 19% from 1982 to 1985 the 690 MioECU represent a reduction of about 50 MioECU in real terms at 1985 values when compared to 620 MioECU for 1982-1986.

The budget for the Fusion Programme in the last 3 programme periods following decisions of the Council.

MioECU	1979-83	1982-86	1985-89
JET	195.0	319	330(7)
General Programme	190.5	301	360(7)
Total	385.5	620	690

(7) breakdown by the Commission in the present document.

The breakdown of 690 MECU as shown in Part 2 of this document is intended to protect the JET programme from irreversible damage as a consequence of the overall budget reduction, since JET is an indispensable source of information on the medium term and distant scientific needs of fusion. However, as will be explained in paragraph 3.2, 330 MECU for JET are not sufficient to achieve its approved aims.

As for the General Programme, the expansion initiated following the recommendations of the independent European Fusion Review Panel and the decision of the Council on the 1982-86 programme, and consisting mainly of the construction of medium-size machines for plasma confinement and heating and of the implementation of the NET-Technology programme, cannot be financed from 360 MECU. On the other hand, neither can the construction of those machines be stopped halfway to their completion, nor can the NET-Technology programme be abandoned without, at the same time, abandoning the present strategy with NET as focus of the fusion programme. The breakdown for the General Programme at the end of Part 2 of this document does not resolve this dilemma: it is an attempt to maintain all elements of the ongoing programme; however, as the comments line by line will show, the funds are not sufficient to cover these activities.

The following table compares the breakdown of the 690 MECU to the original proposal totalling 790 MECU, and to the December 1984 compromise of the Presidency (750 MECU).

Comparative breakdown of the funds
allocated to the Fusion Programme 1985-1989

	Original proposal (790)	December 84 compromise (750)	Council decision (690)	Cuts relative to proposal
JET	347	337	330	17 (5%)
NET	23 for 3 yrs	23 for 4 yrs	13 for 3 yrs	10 (43%)
Technology	120	100	80	40 (33%)
Physics	278	268	245	33 (12%)
Management + mobility	22 not including fellowships	22 including fellowships	22 including fellowships	0 (7%) (8)
Total general programme	443	413	360	83 (19%)
GRAND TOTAL	790	750	690	100 (13%)

3.2 JET at the reduced funding level of 330 MECU

Within this sum, it seems possible to steer the Project so that no irreversible damage is made to the presently foreseen scientific programme and planning up to early 1987. However, in order to achieve the aims of the Project as defined when it was approved in 1978 (e.g. to approach as closely as possible the conditions needed in a reactor by making the best possible use of the capabilities of

(8) fellowships account for 1.5 MioECU

the device), it will be necessary to add some supplementary equipment. This will require more time and more funds than hitherto envisaged, but without increasing the present level of annual expenditure.

Thus the JET Council initiated discussions on the extension of the statutory lifetime of the JET Joint Undertaking ending the 31st May 1990. At present it seems likely that the device will have to be in operation up to the end of 1992 in order to achieve its aims and to make the best use of the new equipments to be installed. The JET Council will pronounce itself on a precise date and on the corresponding amendment of the JET Statutes in time for the Commission to submit it for approval to the Council (Art. 50 of the EURATOM-Treaty) together with the next programme revision.

3.3 The General Programme at the reduced funding level of 360 MECU

- NET: In accordance with the March 1985 Council decision, the NET activity will be slowed down postponing its major milestones by about 2 years, i.e. adopting now, as a working hypothesis, 1989/90 as a date for the decision on the detailed design, and 1993 for the decision on the construction of NET. These dates fit the new time schedule for JET and allow for more evidence on the plasma performance to be gathered from the medium-size machines (on the assumption that the schedules for these are maintained). It should be noted that the budget of 13 MECU includes only the expenses for running the NET Team and for the contracts to the Associations in support of NET. Industrial contracts in direct support to NET (6 MioECU as foreseen in the NET Agreement) are included in the Technology budget.

- Technology: Like NET, the Technology programme will be slowed down so as to match the new NET-milestones. However, in order to squeeze the budget down to 80 MECU, it would be necessary in addition

  (i) to cut the NET-oriented part of the programme to the bone so that it may become too meagre to base on it the

envisaged decisions and the development in industry of the advanced technologies essential to the feasibility of the project; and

(ii) to reduce the long-term (DEMO-oriented) part, such as research into materials promising a long life and/or low activation of the first wall, evaluation of the environmental impact of fusion, and possibly other generic research items, which are not bound to the time schedule of NET.

Both are considered incompatible with the overall programme strategy and therefore the Commission will not resort to these measures during the first two years, expecting that at the next revision enough funds will be made available to avoid a disruption of the Technology programme.

- Physics: The funds required for this part of the programme (which covers all aspects of physics and engineering of plasma heating and confinement) can be calculated very precisely because the investments are well known since all medium-size machines are presently under construction, because there are clear estimates of the support required by JET and NET, and because the Associations are working with a well-defined staff. Even under the most severe streamlining, the amount of 245 MioECU is not sufficient to carry out the programme in the Associations. The only possible response to this level of funding, short of destroying the European character of the programme, would be to temporarily halt the construction or even the operation of the medium-size devices, with irreversible damage to the programme. The financial artifice of reducing the Commission's participation (e.g. by reducing the rate or failing to compensate for inflation) would equally lead to a halt because national budgets would not make up for the deficit. Here again the Commission will not implement such measures during the first two years, expecting to make up for the difference in the funding at the next programme revision.

- Management and Mobility: Due to increasing cooperation between the fusion laboratories the mobility fund could be exhausted before the end of the five years period.

4. Conclusions

The Commission has analysed the consequences on the fusion programme of the reduced 1985-89 allocation of 690 MioECU. Given the momentum gained since 1979, the enormous scientific potential of JET, and the commitment of the European fusion laboratories to build and operate several specialized medium-size machines and to devote a sizeable effort to NET and Technology, the restrictive measures that would need to be imposed if this allocation were not to be revised would strongly damage the European fusion programme as a whole.

As already announced at the programme decision - and noted by the Council - the Commission intends, in the first two years 1985 and 1986, to run the programme at the financial level as indicated in the programme proposal. As to the years after 1986, the Commission expects that the revision aimed at a new programme 1987 to 1991, to which the Council committed itself in the decision of 12 March 1985, will provide the Community resources for the continuation of the programme without major disruption.

Opinion of the CCFP

on the Communication of the Commission to the Council on the Fusion Programme concerning the breakdown of the 1985-1989 allocation

The CCFP, which already expressed on January 24, 1985, its Opinion on the implications of the Conclusions of the Council Meeting of 19 Dec. 1984 concerning the Community Fusion Programme, makes the following statements:

- The structure and content of the European Fusion Programme make it a model for other possible efforts of Europe in Science and Technology; it is the most successful Community programme in research and technology.

- The structure of the fusion programme is that it is driven by the relevant national institutions coordinated by the Commission within the system of Associations. The fusion programme has an absolute Community character: all fusion activities of the Member States (plus Sweden and Switzerland) and in the JRC are integrated into one, "The European Programme", and this is achieved with a comparatively small financial participation of the Community. The research programmes of the Associations provide the necessary width, and together with JET, the guidance for the European programme. The Associations have together launched a joint undertaking, JET, in order to equip themselves with a large device which goes beyond the capability of any individual Association; a possible next joint undertaking is NET. This structure is thought to be well adapted to the future, when the role of the presently physics-oriented Associations will be eventually taken over by technology-oriented national institutions and later by industry.

- The content of the fusion programme is prepared by the fusion community through the peer group review system operated by the CCFP and, for JET, by the JET Council. The scientific and technical achievements of the European programme place Europe in the forefront of world-wide fusion research. JET is the leading fusion experiment in the world, which already in its first two years of operation has made formidable progress towards demonstration of the scientific feasibility of fusion. The European medium-size machines contribute in a powerful way to the progress of fusion and to the future success of JET, e.g. by discovering the regime of high-plasma confinement or developing plasma heating systems. In addition to helping to steer JET and the future main-line programme directed towards NET, the devices existing in the Associations and those under construction will have to provide more results. They will investigate confinement under high-field conditions, plasma technology and superconducting magnet technology. They also investigate different systems of confinement (stellarator, reversed field pinch) to provide alternative solutions - or better solutions - for the power reactor.

- The European Fusion Programme has been successfully managed. It has been able to concentrate on the most promising line, the toroidal magnetic confinement, and within this approach to maintain the necessary width.

- The European Fusion Programme has efficiently built a true scientific and technical community of large and small laboratories, readily capable to welcome new comers, and directed towards a common goal. The mobility of scientists between the various laboratories has reached a remarkable level. It is that closely interwoven European network which is at stake if the funding level is not to be improved.

- In order to exploit the full potential of JET for the benefit of the whole fusion programme directed towards NET, the JET Undertaking should be prolonged beyond the date presently foreseen. The JET Council has made a recommendation to the Commission that the steps for prolongation should be initiated. The CCFP endorses these recommendations. These recommendations require that the JET commitment budget should continue at about the present annual level.

- Finally, it is well to remember that fusion has already a large high technology content. JET and the other plasma devices and the NET-oriented component development are such a demonstration of high technology. In this context the European industry has played an important role which is expected to grow in the case of NET. Fusion Technology includes areas of wider interest to other branches of science and technology and to industry such as superconductivity, robotics, ultra high vacuum, plasma engineering, sensor technology, highly resistant materials, high power and high frequency tubes, high power beams, tritium technology. We observe that, at the present time, many of these technologies are under intensive discussion, in quite a different context.

The CCFP concludes that it can only note the break-down presented by the Commission because it recognizes that 330 MioECU are insufficient for the success of JET and that 360 MioECU are equally inadequate for the success of the general programme. The CCFP endorses and supports the analysis of the consequences of such a low level of funding which is reported in Chapters 2 and 3 of the Commission paper.