



COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 03.12.1997  
COM(97) 629 final

97/0349 (SYN)

Proposal for a  
**COUNCIL DIRECTIVE**  
on the limitation of the emission of oxides of nitrogen  
from civil subsonic jet aeroplanes

(presented by the Commission)

## EXPLANATORY MEMORANDUM

### I. Justification

#### 1.1 Background

The Commission has produced a number of Communications to the Council pertinent to the current proposal. These Communications are the result of work carried out by different Directorates-General and include: the Communication from the Commission to the Council: "The European Aircraft Industry: first assessment and possible Community actions"<sup>1</sup>, which highlighted emissions as being one of the major environmental factors likely to impinge on capacity and air traffic growth in Europe. The Communication to the Council "The Green Paper on the Impact of Transport on the Environment: A Community strategy for *sustainable mobility*"<sup>2</sup> which was followed by the second Communication on "The Future Development of the Common Transport Policy: A global approach to the construction of a Community framework for sustainable mobility"<sup>3</sup>, both dealt with the problem of the environmental impact of air transport and the second Communication specifically cites the proposal on aircraft emissions as an urgent measure to be taken in the short term. As mentioned above, the 5th Environment Action Programme calls for a reduction in NOx emissions.

The 5th Environment Action Programme<sup>4</sup> specifically mentions Community action on NOx emissions from aircraft. The Council approved the general approach of this Action Programme in their Resolution 83/C 138/01 of 1 February 1993<sup>5</sup>. Furthermore, the Council, in reply to Written Question No 654/73 put by Members of the European Parliament on the subject of aeroplane noise, stated that "the environment programme of the European Communities provides for mounting a campaign against environmental and noise pollution caused by aeroplanes".

In recognition of the environmental concerns relating to aircraft emissions and the political pressure to reduce these emissions, the Aeronautics Task Force has identified aircraft engine emission reduction (including NOx) as a critical consideration for the commercial viability of future aircraft.

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<sup>1</sup> COM(92) 164 final, 29.4.1992.

<sup>2</sup> COM(92) 46 final, 20.2.1992.

<sup>3</sup> COM(92) 494 final, 2.12.1992.

<sup>4</sup> COM(92) 23 final, 30.6.1992, pp. 42 and 46.

<sup>5</sup> OJ C 138, 17.5.1993, p. 1.

## 1.2 Background

### 1.2.1 Environmental effects of NO<sub>x</sub> emissions from aircraft

Our knowledge concerning the effects of aircraft emissions on atmospheric chemistry continues to develop. The European Community's Environment and Climate programme through research projects (e.g. AERONOX) and scientific assessments has contributed significantly to our understanding and the research effort continues within the 3rd and 4th framework programmes. According to the recent European scientific assessment on the atmospheric effects of aircraft emissions, despite a number of uncertainties, it is clear that there are environmental impacts associated with aircraft emissions, especially of NO<sub>x</sub>, particularly in relation to ozone formation in the upper atmosphere.

Aircraft produce most of their NO<sub>x</sub> emissions at the climb and cruise phases of flight. 14% of the emissions are released in the boundary layer (the lowest 1 km of the atmosphere) where they contribute to regional pollution. The remaining 86% are emitted in the free troposphere and lower stratosphere where they have a global effect. In the upper troposphere (~9-12 km) NO<sub>x</sub> emissions contribute to ozone formation, which in turn contributes to radiative forcing of climate (global warming). In the upper troposphere ozone production and destruction is a natural process and is in dynamic equilibrium: lightning produced NO<sub>x</sub>, of which there is a significant amount, is part of that equilibrium. Excess ozone is only formed when extra NO<sub>x</sub> is introduced outside the natural process. In the lower stratosphere research emphasis was given to the impact of potential supersonic aircraft. However, currently emitted NO<sub>x</sub> interfere with catalysis cycles of ozone, making the size of the ozone perturbation dependent on other factors like background levels of trace gases, sulfate aerosols and polar stratospheric clouds.

Although aircraft produce only around 3% of man-made NO<sub>x</sub>, they are the only direct source in the upper troposphere and lower stratosphere. This is where the production process of ozone is at its most efficient and the change in radiative forcing most pronounced. **It follows that aircraft emissions of NO<sub>x</sub> have a disproportionate effect on ozone formation and thereby on climate change as compared with terrestrial sources.**

**In the absence of further action, NO<sub>x</sub> emissions will increase significantly.**

When assessing the potential threat to the environment associated with aircraft emissions, one must also take account of the projected increase in air transport. **According to current forecasts, air transport activity will increase by around 6% per annum leading to a doubling of aircraft movements by 2010. Clearly, if no action is taken, NO<sub>x</sub> emissions will increase at the same rate with all the potential risks that this constitutes for the environment.** In 1996 at a major conference on "Global Atmospheric Effects of Aviation"<sup>6</sup>, it was concluded in relation to NO<sub>x</sub> emissions that *"there is still a need for technology improvements - even to stand still at a constant NO<sub>x</sub> level"*.

<sup>6</sup>

This symposium was jointly organized by the Association of European Research Establishments in Aeronautics, the European Commission, the Intergovernmental Panel on Climate Change, the International Civil Aviation Organization, the National Aeronautics and Space Administration (US), the National Oceanic and Atmospheric Administration (US), the United Nations Environment Programme and the World Meteorological Organization.

## **The technical possibilities**

Many of the new aircraft engines manufactured today not only respect the existing ICAO standard (itself a 20% reduction as compared with the original Annex 16 Volume 2 limit established in 1986) but significantly out perform it. **The majority of these new engines achieve NOx emission levels which represent an improvement of 15-20% as compared to the existing ICAO standard.** In 1996, some airlines introduced into service aero engines equipped with new types of combustors offering significant potential for further NOx reductions. Research is continuing into the development of more fuel efficient and less polluting engines and it is reasonable to expect that further advances in emission reduction will be developed although no technological breakthroughs are expected in the short term. An additional benefit of Council Directive 92/14/EEC which prohibits the operation of certain types of aircraft due to noise is that the replacement aircraft ordered by European air carriers will, in most cases, already comply with the limits set out in the proposal.

### **In summary**

1. There is convincing scientific evidence that NOx emissions from aircraft in the upper troposphere contribute indirectly to radiative forcing. It is hoped that on-going research will allow the importance of this contribution to be quantified.
2. In the absence of any remedial measures, NOx emissions from aircraft will increase significantly in line with air transport activity.
3. The majority of modern aircraft engines already achieve NOx emission levels which are significantly better than existing standards.

### **In conclusion**

**While awaiting the further insights which scientific research will allow into the precise impact of aircraft emissions on atmospheric chemistry and in recognition of the precautionary approach which is required under the Treaty, it is appropriate to tighten emission standards in line with the emission performance of modern engines. Such a measure will slow down the rate of increase in NOx emissions from aircraft and will also encourage manufacturers to exploit and continue the development of less-polluting technologies.**

#### **1.3 The international dimension - ICAO and the outcome of the CAEP/3 meeting**

Given the international nature of air transport, it is appropriate that many of the technical issues covering the operation of aircraft are agreed at a global level. The International Civil Aviation Organization (ICAO) is the international body charged with these responsibilities. Within ICAO, it is the Committee on Aviation Environmental Protection (CAEP) which is responsible for dealing with issues such as noise and NOx emissions. The existing international standards for NOx emissions were established by ICAO in 1991 on the basis of the recommendation of the Second Meeting of the Committee on Aviation Environmental Protection (CAEP/2). It was the intention that the ICAO standards would be revised again in 1996 and for this purpose a third meeting of the Committee on Aviation Environmental Protection (CAEP/3) was held in Montreal in December 1995.

In preparation for CAEP/3 the Commission produced a Joint Staff Working Paper which *inter alia* contained suggested revisions for the NOx standard. At the CAEP/3 meeting in December 1995, the revisions presented by France in a working paper were accepted by CAEP and formed part of the CAEP Recommendations (Recommendation 2/3)<sup>7</sup>. The effect of the Recommendation would be to further limit NOx emissions from aero engines by just over 16%. The arguments behind the recommended increase supported by CAEP, included:

- *"It responds to environmental concerns until such time as the results of scientific assessments of the effect of NOx produced by aircraft on the atmosphere can provide guidance;*
- *it can be achieved with existing technology and is therefore in alignment with previous proposals by CAEP for increases in stringency;*
- *the costs should be modest and production of existing engines will not be affected until 2007"*<sup>8</sup>.

Also, when deciding the level of stringency CAEP members took into account the aim of ICAO standards, essentially to ensure that the best available technology is incorporated into engines rather than setting future goals.

The recommendation from CAEP/3 were put forward to ICAO. In the past, the recommendations from the Committee have been endorsed and there was every reason to expect that the CAEP/3 Recommendation on emissions would be similarly approved. Unfortunately, for various reasons, ICAO has been unable to implement the Recommendation from CAEP/3 concerning NOx emissions.

The Commission considers it highly regrettable that ICAO has been unable to implement the CAEP/3 Recommendation. The Commission would much prefer to see international solutions to problems of this nature and ICAO is clearly the body where an agreement should be found. However, having followed the lengthy preparatory process to a successful completion at CAEP/3, the Commission now sees the Community's policy objectives with regard to aircraft NOx emissions being frustrated. It is the view of all the Commission services involved in the CAEP process that without Community action, an international solution incorporating the CAEP/3 Recommendations is unlikely in the foreseeable future.

What the Commission is therefore proposing is to take the recommendation from CAEP/3 in relation to NOx emissions and to introduce this tighter emission standard into the Community aircraft fleet in the form of a non-addition rule. A non-addition rule is the form in which previous ICAO standards on noise have been introduced into the Community fleet. A non-addition rule applies only to aircraft on the registers of the Community Member. Since such a rule does not affect the operation within and into Community airports of existing

<sup>7</sup> The voting on the CAEP/3 NOx Recommendation was 10 in favour and 4 against. Those members in favour were: Australia, Brazil, Germany, France, Netherlands, Italy, Spain, Switzerland, Sweden and the United Kingdom. Those against were: Canada, Poland, Russia and the United States. Japan abstained.

<sup>8</sup> Extracted from the report of the third meeting of CAEP, ICAO Doc 9675, CAEP/3.

aircraft which do not comply with the more stringent standard, it is expected to have limited impact on the financial situation of air carriers including those established in developing nations. In addition, the rule is non-discriminatory in nature.

The Commission will communicate this proposal to the President of ICAO. Furthermore, if ICAO were to envisage within a reasonable time-limit the adoption of an increase in stringency of aircraft engine NOx emissions, which is technically feasible and offers a similar level of environmental benefit, then the Commission is, obviously, prepared to review its position and to cooperate with ICAO towards the achievement of an internationally agreed standard.

The present proposal is the CAEP/3 Recommendation as adopted, in the form of a non-addition rule.

## **2. The Commission's proposal**

The proposal applies the CAEP/3 recommended NOx reduction limits. This would lower the permitted NOx emissions levels in the ICAO certification standard by just over 16%. Taken together with the 20% reduction from the CAEP/2 meeting it would mean that an overall reduction of 33% had been achieved against the original standard which came into force in 1986.

As recommended by the appropriate technical group, and accepted by the CAEP/3 meeting, it was agreed that there were particular problems facing manufacturers of small, low-thrust aero engines. Pointing out that these engines have specific technical problems in achieving reduced emissions, it questioned whether the newest emission reduction concepts - as applied to medium and large engines could be applied to them. Consequently, in line with the CAEP/3 decision, the Commission's proposal sets out a two-tier increase in stringency, one for engines with a maximum rated thrust of more than 89.0 kN and a less severe regime for those engines with a maximum rated thrust of more than 26.7 kN but not more than 89.0 kN. Aircraft with a maximum rated thrust of less than 26.7 kN were not covered by the CAEP/3 recommendations and are therefore not covered by the proposal.

The present proposal would apply the CAEP/3 Recommendation as a non-addition rule. Non-addition in this context means restricting the type of aircraft a Member State may add to their civil air register. Council Regulation (EEC) No 2407/92 ensures that this non-addition rule cannot be circumvented by means of leasing operations. It does not affect the choice of aircraft as, apart from the fact that most production engines already meet the proposal, aircraft are commonly offered with a choice of engines by different manufacturers. It is an entirely Community orientated regulation in that it does not affect third countries either through registration or operational restrictions. The European Union has previously used this method of achieving environmental benefit in aviation for aircraft noise (Council Directive 89/629/EEC) whilst other countries have adopted a similar approach, an example being the United States in its "Stage 2" Phase Out of aircraft noise regulation.

**As part of a joint effort to improve aviation environment protection, the European Civil Aviation Conference's environmental working group agreed that ECAC should adopt a recommendation similar in scope to the Commission's proposal. This would apply the same limit values across all of Europe.**

### **3. Costs, benefits and effectiveness**

Studies undertaken by the Commission and, independently, as well as work by the Economic Analysis subgroup (EASG) of CAEP have concluded that it is not possible to use conventional cost/benefit analysis for NOx emissions. However, the documentation presented by the EASG to the CAEP/3 meeting constitutes the only internationally reviewed source of data concerning the costs and emission benefits associated with increasing the stringency of ICAO NOx emissions standards for aircraft. In addition, it should be noted that the inflated figures produced by EASG for the impact on the existing fleet were strongly contested. It is, however, a criteria for CAEP recommendations that they should be technically feasible, economically reasonable and environmentally beneficial.

The data presented at CAEP/3 were calculated on the basis of projections for the entire world fleet. On the basis of a 10% increase in stringency applied to new engine models as from 2000 and existing engines as from 2008, it was calculated that the increase in cost to the Industry would be in the order of US \$ 130 to 210 million per annum (discounted present values expressed in 1993 US dollars). For a 20% increase in stringency, the figures were calculated as US \$ 420 to 470 million per annum. It should be noted that the aircraft that gave rise to the major portion of these projected costs will shortly cease production and these costs will not therefore be incurred.

To put these figures in context, the operating profits of international services of IATA member airlines in 1994 were reported as US \$ 5.3 billion. Seen from another perspective and as the Commission concluded in its presentation to CAEP/3:

*"If it was assumed that all the costs were passed on to the airline passenger, in the most severe option, average fares would need to rise by less than 1 per cent. This increase, of course, would take effect over a number of years"* (CAEP/3 -WP/74).

With respect to emissions, CAEP/3 was only presented with data concerning the emission reduction benefit associated with the impact on new aircraft: the 10% increase in stringency was predicted to reduce NOx emissions 1.2% by 2015 as compared to what they would have been without the measure. An increase in stringency of 20% was similarly predicted to give an emission reduction benefit of 2.8% as compared to the reference case. It was accepted that "the full extent of benefits was not realized until beyond that date" (Working Group 3 (Emissions), Final Report to CAEP).

With regard to the effect of the measure on existing aircraft, EASG did consider cost estimates associated with the early retirement of aircraft as a direct result of an increase in the stringency of the NOx emission standard. However, no estimate was offered to CAEP/3 concerning the emission reduction benefits which would be associated with this early retirement. In the absence of figures relating to both costs and benefits, it is not possible to draw conclusions concerning the existing fleet.

As mentioned above (in Section 1.3.), the standard is within the reach of existing technologies, it does not require major investment by engine manufacturers and the costs "should be modest". During consultation with those parts of the manufacturing industry thought to be most affected by the proposals, there was agreement that the level set out in the proposal was technically attainable and at reasonable cost.

Since the CAEP/3 meeting in 1995, engine manufacturers have continued to make substantial advances in NOx control. Some aero engines that were considered by the EASG report to incur heavy costs in meeting the new limit have in fact already been modified and are now substantially below this limit. In the same way, aircraft that would have been the subject of expensive modification or re-engining are no longer in production. The effect in both cases is to significantly diminish the already "modest" costs.

The proposal is complemented by the actions launched by the Commission in its White Paper "Freeing Europe's Airspace", adopted in March 1996 and the recommendation for a Council Decision authorizing the Commission to start negotiations with a view to establishing Community membership of EUROCONTROL. These initiatives aim at improving the efficiency of Air Traffic Management, which will also help to reduce emissions from aircraft. This work is being supported by on-going research in the context of the 4th Action Programme.

Finally, it must be borne in mind that the proposal does not affect aircraft already on the fleets of European air carriers nor does it affect the sale, lease or transfer of these aircraft between carriers in different Member States or to carriers outside the Community.

#### **4. Subsidiarity**

In making its proposal, the Commission has also considered its compatibility with the principle of subsidiarity by addressing the following questions:

- (a) *What are the objectives of the proposal in relation to the obligations of the Community and what is the Community dimension of the problem?*

The Communication on "The Future Development of the Common Transport Policy: A global approach to the construction of a Community framework for sustainable mobility", dealt with the problem of NOx emissions from aircraft and specifically cites the proposal on aircraft emissions as an urgent measure to be taken in the short term. In the same way, the 5th Environment Action Programme calls for a reduction in NOx emissions.

- (b) *Does competence for the planned activities lie solely with the Community or is it shared with the Member States?*

The envisaged action relates to an area of shared competence between the Community and the Member States.



- (c) *What is the most efficient solution taking into account the resources of the Community and the Member States ?*

In view of the Internal Market dimension of air transport, the most efficient solution is the setting up of common requirements at Community level. Until agreement can be reached within ICAO, this will ensure a harmonized application of a technical standard throughout the Community and avoid distortion resulting from the introduction of varying national legislation.

- (d) *What added value does the Community action provide and what are the costs of no action?*

The action aims at preventing the addition of non-complying aircraft to the civil air registers of Member States. The effect of the action will be to limit to a certain degree the impact of NOx emissions from aircraft on climate change. In the absence of action at Community level, air carriers may be faced with a multitude of local uncoordinated restrictions and charges.

- (e) *What kind of action is at the disposal of the Community?*

In order to provide an effective and coordinated action, it is necessary to introduce legal measures in the form of a Directive or a Regulation.

- (f) *Is a uniform regulation necessary or is it sufficient to draft a directive which outlines the general objective while leaving the execution to the Member States?*

Given that the core of the proposal is based upon a recommendation from ICAO's competent committee for aviation environmental standards, a Directive is considered sufficient.

Accordingly, the Commission reached the conclusion that its proposal is consistent with the principle of subsidiarity.

## **5. Results of consultation with affected partners**

### **5.1 Introduction**

All major partners in the aviation industry were consulted.

### **5.2 Consultation with manufacturers**

In preparation for the abovementioned CAEP/3 meeting in December 1995, the Commission met with European aero engine manufacturers. As a result, there was an agreement on a level that offered a significant environmental improvement at a reasonable cost and within the technical ability of the manufacturers. This level was the basis for the Joint Staff Working Paper circulated prior to CAEP/3, the CAEP/3 Recommendation and the present proposal.

### **5.3 Consultation with airlines**

The Commission presented the initial draft of the aircraft NOx proposal to the relevant committee of the Association of European Airlines and has met with individual airlines since then. The main point made by airlines was that, although the proposal is for a non-addition rule, i.e. adding aircraft to the fleet, any new rule would depress the secondhand value of their existing fleet.

Although it is not possible to quantify the financial impact of such a non-addition rule on air carriers, the measure is expected to have a limited financial effect for the following reasons:

- the proposed measure is a non-addition rule and does not affect the operation within and into the Community of existing aircraft which do not comply with the new NOx standard;
- most European air carriers already operate, have ordered or intend to order aircraft which comply with the new standard.

In addition, the Commission believes that the impact on the residual value of aircraft which do not comply with the new standard will be minimal since the proposal will only affect a limited number of aircraft/engine types. The same argument was raised during the CAEP/3 discussions where it was noted that "*the argument about the existing fleet value could be raised whenever an increase in stringency was suggested and sooner or later would have to be disregarded*".

The Commission considers that it was unreasonable to expect European citizens to accept the continued growth of the air transport industry if this growth outstrips environmental standards.

### **5.4 Consultation with airports**

The main point of contact for the Commission was with the Airports Council International (ACI) and its representatives on the various CAEP working groups. The ACI had, on numerous occasions, called for stricter standards and, like the Commission, deplored the lack of international action. The ACI has, through Resolutions passed at its General Assemblies, called for a similar reduction to that contained in this proposal.

## **6. Legal basis**

The legal basis for the proposal is Article 84(2) of the Treaty. This Article is deemed appropriate as the proposal concerns the operation of transport facilities and follows the precedence of using the same Article for environmental action dealing with aircraft noise.

### **6.1 Provisions of the proposal**

**Article 1** defines the scope of the proposal.

**Article 2** establishes the dates of application of the proposal and sets out the formulae to be used when computing the oxides of nitrogen emissions levels in accordance with the procedures of Part III, Chapter 2 of Volume II of Annex 16 to the Convention on International Civil Aviation, second edition (July 1993).

**Article 3** commits the Commission to report to the Council on developments during the life of the proposal. This will include the evolution of scientific appreciation of the problem of NOx emissions at cruise altitudes as well as the testing and use of aero engines with advanced combustors which came into airline service in 1996.

The remaining Articles are standard Articles dealing with the introduction of the proposal by Member States.

The Community will need to ensure that the measures eventually adopted are compatible with commitments which have been made in the context of the international trade obligations and in particular within the framework of the WTO.

Proposal for a  
**COUNCIL DIRECTIVE**  
on the limitation of the emission of oxides of nitrogen  
from civil subsonic jet aeroplanes

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 84(2) thereof,

Having regard to the proposal from the Commission<sup>9</sup>,

Having regard to the opinion of the Economic and Social Committee<sup>10</sup>,

Acting in accordance with the procedure referred to in Article 189c of the Treaty in cooperation with the European Parliament<sup>11</sup>,

Whereas the Commission Communication "The European Aircraft Industry: First Assessment and Possible Community Action"<sup>12</sup>, approved by the Council, shows clearly the need to resolve environmental problems which limit the future growth of the aviation industry;

Whereas the Commission Communication "The Green Paper on the Impact of Transport on the Environment: a Community strategy for *sustainable mobility*"<sup>13</sup> stresses the growing concern about emissions of oxides of nitrogen (NOx) at high altitude; whereas the Commission Communication on "The Future Development of the Common Transport Policy: a global approach to the construction of a Community framework for sustainable mobility"<sup>14</sup> clearly indicates the need to set progressively stricter standards for gaseous emissions for the different transport sectors and, more specifically, includes in its action programme more stringent standards for NOx emissions from aeroplanes;

Whereas the application of emission standards to civil subsonic jet aeroplanes has significant consequences for the provision of air transport services, in particular where such standards impose restrictions on the type of aeroplane that may be operated by air carriers and encourage investment in the latest and least polluting aeroplanes available;

Whereas the European Community programme of policy and action in relation to the environment and sustainable development<sup>15</sup> shows clearly the importance of the problem of air pollution and, in particular, the need to take action to protect the atmosphere;

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<sup>11</sup>

Opinion of the European Parliament of ... (OJ C ...), Council Common Position of ... (OJ C ...), and Decision of the European Parliament of ... (OJ C ...).

<sup>12</sup>

COM(92) 164 final, 29.4.1992.

<sup>13</sup>

COM(92) 46 final, 20.2.1992.

<sup>14</sup>

COM(92) 494 final, 2.12.1992.

<sup>15</sup>

OJ C 138, 17.5.1993, p. 5.

Whereas NOx emitted by aircraft in the upper troposphere are implicated in the formation of ozone; whereas ozone in the upper troposphere contributes to the greenhouse effect; whereas research is continuing in order to quantify and describe more precisely the impact of NOx emissions from aeroplanes on stratospheric ozone and climate;

Whereas air traffic activity is forecast to double by 2010; whereas, in the absence of stricter controls, NOx emissions will increase in parallel with this increased activity;

Whereas the majority of modern aeroplane engines can already achieve significant improvements in NOx emissions;

Whereas the precautionary principle requires that while awaiting further scientific data concerning the effects of NOx emissions from aeroplanes, the rate of increase of such emissions should be reduced by introducing standards which are consistent with the performance of new technologies while not imposing excessive costs;

Whereas, in November 1993, the International Civil Aviation Organization (ICAO) amended its standard applicable to the gaseous emissions from civil aeroplanes, Part III, Chapter 2, Volume II of Annex 16 to the Convention on International Civil Aviation, second edition (July 1993), to include a 20% reduction in the regulatory level for NOx; whereas that reduction does not take account of either forecast traffic growth or technical capability;

Whereas, in December 1995, the third meeting of the ICAO Committee on Aviation Environmental Protection (CAEP/3) recommended, on the basis of the available scientific and technical information, a tightening of the NOx emission standard by a further 16%, in order to provide, in the context of increasing air traffic, adequate environmental protection;

Whereas, in the absence of action at the international level, it is appropriate and justified for the Community to introduce measures to reduce NOx emission, in line with those recommended by CAEP/3, in so far as those measures do not create unnecessary obstacles to international trade; whereas more stringent emission standards should accordingly be introduced in the Community by means of a non-addition rule which will not affect air carriers based in third countries,

**HAS ADOPTED THIS DIRECTIVE:**

#### **Article 1**

The objective of this Directive is to lay down rules to restrict future registration in the Member States of certain civil subsonic jet aeroplanes in order to reduce the overall level of NOx emissions.

## **Article 2**

Member States shall ensure that civil subsonic jet aeroplanes fitted with engines of a type or model number of which the date of manufacture of the first individual production model is after 31 December 1999 or for which the date of manufacture of the individual engine is after 31 December 2007 shall not be added to their registers unless those engines are of a type having NO<sub>x</sub> emission levels, measured and computed in accordance with the procedures of Part III, Chapter 2, Volume II of Annex 16 to the Convention on International Civil Aviation, second edition, (July 1993), no greater than a regulatory level determined in accordance with the formulae set out in the Annex to this Directive.

## **Article 3**

No later than four years following the implementation of this Directive, the Commission shall submit to the Council a report on the results of studies presently underway and an evaluation of the development of NO<sub>x</sub> emissions from aeroplanes.

## **Article 4**

1. Member States shall adopt and publish, before 30 June 1999, the provisions necessary to comply with this Directive. They shall forthwith inform the Commission thereof. They shall apply these provisions with effect from 31 December 1999.

When Member States adopt these provisions, these shall contain a reference to this Directive or shall be accompanied by such reference at the time of their official publication. The procedure for such reference shall be adopted by Member States.

2. Member States shall communicate to the Commission the text of the provisions of national law which they adopt in the field covered by this Directive.

## **Article 5**

Member States shall lay down the system of penalties for breaching the national provisions adopted pursuant to this Directive and shall take all the measures necessary to ensure that those penalties are applied. The penalties thus provided for shall be effective, proportionate and dissuasive. Member States shall notify the relevant provisions to the Commission not later than the date specified in Article 4 and shall notify any subsequent changes as soon as possible.

## **Article 6**

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities*.

**Article 7**

**This Directive is addressed to the Member States.**

**Done at Brussels,**

**For the Council  
The President**

**Formulae for determining the regulatory levels referred to in Article 2**

1. For engines with a maximum rated thrust of more than 89.0 kN:

$$D_p/F_{oo} = 19 + 1.6 \pi_{oo}$$

2. For engines with a maximum rated thrust of more than 26.7 kN but not more than 89.0 kN:

$$D_p/F_{oo} = 37.572 + 1.6 \pi_{oo} - 0.2087 F_{oo}$$

where  $D_p$  represents the mass of any gaseous pollutant emitted during the reference emissions landing and take-off cycle;

where  $F_{oo}$  represents the rated output;

where  $\pi_{oo}$  represents the reference pressure ratio.

The above symbols are defined in Part I, Chapter 1, Volume II of Annex 16 to the Convention on International Civil Aviation, second edition (July 1993).



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