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# An emerging strategy of general aviation noise reduction

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ABSTRACT
**The following pages offer the reader a review of Dutch General Aviation Noise Reduction Policy and its context. At first, the general outline of the Dutch Government's strategy in General Aviation Noise Reduction is presented - as it currently emerging. Subsequently, the main elements of this strategy are considered more closely. The reader will learn that General Aviation Noise Reduction is a policy-in-the-making that is to be 'internalized' by both operators and users of small airfields.**

## Summary

The following pages offer the reader a review of Dutch General Aviation Noise Reduction Policy and its context. At first, the general outline of the Dutch Government's strategy in General Aviation Noise Reduction is presented - as it is currently emerging. Subsequently, the main elements of this strategy are considered more closely. The reader will learn that General Aviation Noise Reduction is a policy-in-the-making that is to be 'internalized' by both operators and users of small airfields.

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# 1 Introduction

The following pages offer the reader a review of Dutch General Aviation Noise Reduction Policy and its context. At first, the general outline of the Dutch Government's strategy in General Aviation Noise Reduction is presented - as it is currently emerging. Subsequently, the main elements of this strategy are considered more closely. The reader will learn that General Aviation Noise Reduction is a policy-in-the-making that is to be 'internalized' by both operators and users of small airfields.

## 2 The strategy

By the year 2000, the General Aviation sector in The Netherlands is expected to attain noise reduction to a specified level in designated zones around small airfields. This goal is imposed on the sector by Decree of 27 December 1990. This is part of a public policy whose main elements are shown in figure 1. One of these elements is the effort to create a quieter fleet of general aviation aircraft. Another element is to turn the use of airspace over and around small airfields into less of a nuisance. The third and critical element of the strategy, from the public administrator's point of view, is to hold the general aviation sector responsible for such changes in the quality of the fleet and the use it makes of airspace and airfields as are necessary to reach the target set for 1 January 2000. That is to say that the public policy outlined here, is essentially a 'meta policy' aiming at the 'internalization' of its goals by the sector, i.e. operators of small airfields and of aircraft using these airfields.

## 3 Making a quieter fleet

The making of a quieter fleet depends both on what is technically feasible and on what is economically and strategically sensible for aircraft operators.

Technologically, general aviation has been stagnant for quite a number of years. The economic recession of the early eighties and a change in product liability legislation led to the collapse of the world's largest market for general aviation aircraft, that of the USA. A number of manufacturers, including market leader Cessna Aircraft Company altogether suspended the production of small aircraft. Whereas the small aircraft industry realised an output of 17,800 units in 1978, barely 800 small aircraft were produced in 1994. Consequently, the steady stream of technical innovations that is a feature of the rest of the aircraft industry has been largely absent in the branch catering for general aviation, for approximately a decade and a half. This industrial drama has presumably contributed to the ageing of the world's fleet of general aviation aircraft. Of the Dutch fleet of 600 piston-engined small aircraft, e.g., 80% is older than 15 years. The average age of these aircraft is 13 years.

In 1994 the U.S. government adopted a revitalization scheme for General Aviation, including an adaptation of product liability regulation and a technological research programme, "Advanced General Aviation Transport Experiments" (AGATE). This is expected to stimulate the introduction of several new technologies into the production of airframes and propulsion systems for general aviation. These include:

- Application of new materials (composites).
- Improved propeller design.
- 'Anti noise' devices.
- Exhaust silencers.

All these new technologies have considerable noise reduction potential. Their potential varies however in respect of costs, the term in which it can be realised, the extent to which it is experimentally confirmed and the extent to which it will reduce noise generation. Their effect in terms of noise reduction will, moreover, vary with the type of aircraft to which they will be applied. Hence, the contribution to noise reduction of efforts to create a quieter fleet through technological innovation will only be discussed in the most general of terms.

The application of new materials will enable manufacturers to make lighter airframes and to realize aerodynamical improvements in airframe design. At least one type of aircraft with an airframe made entirely out of composite material, is certified and flying. Lighter and

aerodynamically improved aircraft need less power for the same performance. Less power generated, means less noise produced. At the current rate of renewal of the general aviation fleet of aircraft, however, a noticeable contribution of lighter and aerodynamically improved airframes to noise reduction must be considered a long term perspective.

New materials also enable manufacturers to acoustically optimize propeller design. Experimental results suggest that reduction of noise levels produced per aircraft of up to 8 dB(A) are possible through replacement of current standard propellers by quieter and more efficient ones. Replacement of propellers on existing aircraft is relatively simple. Such replacement nevertheless requires a measure of 'tuning' of engine and airframe to propeller that calls for renewed certification of the aircraft.

Experiments have proven that it is possible to attenuate the farfield noise by applying 'anti noise' control methods. The principle is that noise from the primary source (the propeller) is destructively interfering with noise from the secondary source (the exhaust). This technique is applicable to both newly produced and used aircraft.

Last but not least, mandatory use of exhaust silencers is expected to significantly reduce engine noise of both new propulsion systems and systems already in use.

Although a gradual replacement of the existing fleet of aircraft by new, acoustically optimized designs will certainly have its effects on noise levels produced by general aviation, the best perspective for the short and medium term is offered by adaptation and modification of types of aircraft already in use.
A national government's policy instruments to stimulate such a development are scarce and limited in scope. Within the European context, certification has become a matter of policy of the Joint Aviation Authorities. Anti-discriminatory clauses in EU regulation largely prohibit a national government to introduce regulation to the effect of barring noisy foreign aircraft from using small airfields on its territory. Therefore, most of the burden of stimulating aircraft owners to upgrade their planes will have to be borne by local airport authorities.

The operator of an airfield has two instruments at his disposal to stimulate users to acoustically upgrade the aircraft that use the airfield. One is differentiation of airport charges and the other is persuasion.

The fares that are currently charged for the use of small airfields are low, relative to the hourly operating costs of an aircraft. These fares would therefore have to be rather significantly raised if differentiation between charges for quiet and noisy aircraft is to be an effective stimulant for aircraft operators. Airfield operators will be reluctant to put such significant raises into effect

unilaterally, for fear of losing traffic to competing airfields. Therefore, to be successful, this instrument will probably have to be jointly wielded by airfield operators. A precondition for differentially charging noisy and quiet aircraft is the introduction of an 'environmental hall mark' for general aviation aircraft, such as has been introduced in Germany.

Persuasion may be an effective complementary instrument for the airfield operator to use in a concerted effort to create a quieter fleet, depending on the type of 'population' of users of the airfield and the nature of his relationship to them. Such populations differ in size and composition. They range from tens of commercial and 'private-for-leisure' aircraft operators to one commercial operator that also owns the airfield and a dozen private plane owners. Among the commercial operators are companies specializing in offering services such as instruction, spraying of agricultural areas or advertisement and multifunctional operators that offer their planes for use in various missions. The airfield operator and its users may appear as a closely-knit community in some cases, or constituting a functional network only, in other cases. Ways, means and effectiveness of persuasion as an instrument of policy of the airfield operator will vary accordingly.

## 4 Reducing the nuisance of small airport use

The use of an airfield and its surrounding airspace offers a number of actionable features for an effort to reduce nuisance caused. These can also be categorized into adaptations that offer a longer, or medium to short term perspective on nuisance reduction.

One of these features is, of course, the total volume of traffic. Obviously, the more frequent operations at an airport are, the more noise is generated. Perhaps somewhat less obviously, a large traffic volume also implies a large nuisance reduction potential. This potential can be tapped through action on other characteristics of an airport's utilization pattern.

The second feature is the dominant flight pattern of traffic using the airfield. Most of the traffic around small airfields consists of so called circular flights, originating from and destined for the same airfield: instruction flights, recreational flights, flights for agricultural and advertising purposes. A small portion of traffic consists of overland, point-to-point flights, such as "taxi-" or other business flights. Airfield operators indicate that circular flights cause relatively more nuisance than point-to-point traffic.

A third feature of airport use with an obvious nuisance reduction potential is traffic volume per category of aircraft - producing more or less noise. For the purpose of computing noise levels produced by General Aviation, the Dutch Government distinguishes between a number of categories of types of aircraft.
These three features of an airfield's utilization are found to depend on the composition of an airfield's population of users. This would mean that their actionability is a matter of the longer term and would require a sustained strategy on the part of the airfield's operator to effect a change in the composition of the group of aircraft operators using the airfield. All three airfield operators interviewed for the study professed to be engaged in a strategy aiming at enlarging the share of point-to-point business traffic in its total traffic volume. Part of this strategy invariably is the upgrading of facilities the airfield offers to its users. The noise reduction potential of a strategy concentrating on these actionable features differs with each airfield's actual pattern of utilization. These patterns appear to vary considerably.
Three other actionable aspects of an airfield's utilization are:

- The spread of traffic over the hours of the day and the days of the week. Some hours of the day and some days of the week are deemed more vulnerable for noise than others.
- Route structures.
- Pilots' abidance by rules and procedures of start and approach.

Little is as yet known of what motivates aircraft operators to use their aircraft on particular times of the day or week. Therefore, one can only speculate as to the extent to which the spread of

traffic over the day or week is in fact actionable, by what means action can be taken and whether this is to be considered a matter of longer or shorter term planning. Potential effect and feasibility of changing route structures varies with the situational and administrative context of the airfield, including the complexity of the environmental planning structure in which it is embedded. Pilots' abidance by rules and procedures appears to be the most actionable of features in the short term. This requires a mix of actions, ranging from the installation of better route markings, education of pilots to intensified monitoring and policing. In addition, all three airport operators interviewed devoted considerable time and effort to communication with the surrounding community.

## 5 Holding the sector responsible

To date, 'Holding The Sector Responsible' is the most elaborated element of the strategy. Criteria for evaluation have been developed and summarized. A computing method has been developed and legally prescribed for computing the noise level in a certain area. Most of the actionable features that were described in the previous sections, are valued and integrated as elements in this computing method. The unit has been called 'BKL'. Most airfields have been assigned a 'noise zone', limiting the area in which a level of noise of 50 BKL is allowed. As of January 1, 2000 this level must have been reduced to 47 BKL. A system of monitoring and enforcement has yet to be developed.

A structure for accounting for and deliberation on use made and planned of airfields is being created. Committees have been installed by the Minister of Transport, composed of representatives of the Directorate General of Civil Aviation and the Directorate General for Environmental Protection from central government, representatives of local governments, the surrounding community, the airfield operator, users and other stakeholders. The airfield operator is held to submit an annual 'Utilization Plan' of the airport, through these Committees to the Minister of Transport. Reporting stations of the provincial government, or at the airport itself, register complaints from members of the surrounding community. Registered complaints will presumably be the main touchstone in assessing the 'Utilization Plan'.

## 6 Conclusion

The strategy of General Aviation Noise Reduction that is currently emerging in The Netherlands and the outlines of which have been described, appears to have its strengths and weaknesses. The main strength is the local variation in policy that it tolerates. This is fine, because of the considerable variation in local situation and costeffectiveness of policy instruments which the results of our exploratory study indicate.

Where the system is working, it has prompted some airfield operators to draw up 'Environmental Policy Plans' incorporating some of the actionable features described above and some organizational development.

A weakness of the system is the leverage, or rather, the lack of it, that airfield operators have on users. For the moment, persuasion is what airfield operators mostly have to rely on for prompting aircraft operators and pilots to work on noise reduction. Threatening with the ultimate sanction for not complying with the designated zone shutdown of the airport - and confrontation with stakeholders currently seem to be the strongest arguments that the airfield operator can use. This and other weaknesses are not beyond repair, however. They do call for a supportive policy agenda on the national and suprational levels of government and the intermediary level of associations of airport operators, users and pilots.