

Fly Neighborly Guide

produced by the **Helicopter Association International** Fly Neighborly Committee

Preface

This is the third edition of the Helicopter Association International (HAI) *Fly Neighborly Guide*. The initial guide was issued in 1981 and again with a change to the title page in 1983. A second edition was issued in 1993. This guide is based on the second edition and was edited and revised by Charles Cox and Dr. John Leverton on behalf of the HAI Fly Neighborly Committee.

The Fly Neighborly Program is a voluntary noise abatement program developed by the HAI Fly Neighborly Committee. The program is designed to be implemented worldwide by large and small individual helicopter operators. This program applies to all types of civil, military and governmental helicopter operations.

Fly Neighborly Noise Abatement procedures for specific helicopter models are available on the HAI Web site www.rotor.com.

Additional pilot training information, discussion of helicopter noise sources, noise propagation and general information on how to operate helicopters to minimize the noise impact is also available on an associated interactive Noise Abatement Training CD developed for pilots by the HAI Manufacturers Committee. Copies of this CD can be obtained from HAI .

| | | |
|----------|--|------------|
| | Preface | i |
| | List of Figures | iii |
| | Foreword | iv |
| 1 | General Information | 1 |
| | 1.1 Background | 1 |
| | 1.2 Objectives | 1 |
| | 1.3 About This Guide | 1 |
| | 1.4 Purpose | 1 |
| | 1.5 Organization | 1 |
| | 1.6 Administration | 2 |
| 2 | Helicopter Sound Generation | 3 |
| | 2.1 The Source of the Sound | 3 |
| | 2.2 Impact of Operations | 4 |
| 3 | General Guidelines for Noise Abatement Operations | 7 |
| | 3.1 Flyover Height | 7 |
| | 3.2 FAA Guidance - VFR Flight Near Noise Sensitive Areas | 8 |
| | 3.3 Flyover Speed | 9 |
| 4 | How to Operate Helicopters Quietly | 10 |
| | 4.1 General | 10 |
| | 4.2 Ground Operations | 10 |
| | 4.3 Hover / Hover Taxi / Ground Taxi | 10 |
| | 4.4 Takeoff and Climb (Departure) | 10 |
| | 4.5 Enroute and Cruise Flyover | 10 |
| | 4.6 Turns (Maneuvers) | 11 |
| | 4.7 Descent/Approach and Landing | 11 |
| | 4.7.1 Small/light helicopters | 11 |
| | 4.8 Other Factors to be Considered | 14 |
| 5 | Pilot Training | 15 |
| | 5.1 Scope | 15 |
| | 5.2 Basic Guidelines for Pilot Training | 15 |
| 6 | Operator Program | 16 |
| | 6.1 Introduction | 16 |
| | 6.2 Company Policy | 16 |
| | 6.2 Implement Guidelines | 17 |
| 7 | Managing Public Acceptance | 18 |
| | 7.1 Scope | 18 |
| | 7.2 Media Support | 18 |
| | 7.3 Public Relations | 18 |
| | 7.4 Preventing and Responding to Complaints | 19 |
| 8 | Fly Neighborly Program—What Can be Achieved? | 22 |
| | Appendix 1 | 23 |
| | Appendix 2 | 26 |
| | Appendix 3 | 27 |
| | Glossary | 28 |

| | |
|---|----|
| Figure 1 | |
| High-Noise Flight Operations – Small/Light Helicopter | 5 |
| Figure 2 | |
| High-Noise Flight Operations – Medium/Heavy Helicopters | 5 |
| Figure 3 | |
| High-Noise Maneuvers – Medium Helicopters | 6 |
| Figure 4 | |
| Fly Higher Chart | 8 |
| Figure 5 | |
| Noise Abatement Approach Techniques for Small/Light Helicopters | 12 |
| Figure 6 | |
| Noise Abatement Approach Technique for Medium and Heavy Helicopters . . . | 13 |
| Figure 7 | |
| Ground Noise Exposure Footprint | 13 |
| Figure 8 | |
| Relationship between Noise Exposure and Annoyance | 20 |
| Figure A1 | |
| Relationship between Sound Level and Helicopter Weight | 23 |
| Table A1 | |
| Illustrative Noises | 24 |
| Figure A2 | |
| Comparison of Sounds | 25 |

Foreword

In the late 1970s, concern was being expressed about helicopter noise by the general public and national authorities in a number of nations, including the USA. As a result, a number of Helicopter Association International (HAI) committees, including the Heliport and Airways Committee (now known as the Heliports Committee), started to research how this concern should be addressed. At the same time, the International Civil Aviation Organization (ICAO), with active support of the United States Federal Aviation Administration (FAA) and most European nations, established a working group to develop helicopter noise certification standards. In addition, the FAA issued a Notice of Proposed Rulemaking (NPRM) outlining proposed noise certification procedures and limits.

The industry, and HAI in particular, felt that a better approach would be for the industry to develop voluntary guidelines to control the noise impact by operational means. After a number of FAA/industry meetings, the FAA, in the fall of 1981, agreed to withdraw its initial NPRM related to helicopter noise certification while additional technical data were acquired. This was done with the understanding that the helicopter industry would develop new technology - creating quieter, more advanced equipment, and implement a voluntary noise abatement program. This resulted in the establishment of the HAI Fly Neighborly Program based on an earlier program developed by Bell Helicopter Textron.

ICAO initially issued international noise standards in 1981, as a part of the International Standards and Recommended Practices, "Environmental Protection," Annex 16 to the Convention on International Civil Aviation. These were not adopted by many nations before they were relaxed in 1985. Since that time, the standards have been amended a number of times. The FAA subsequently issued helicopter noise certification standards in 1988. These have been revised over the years. They are defined in 14 CFR Part 36. The Fly Neighborly Program offers the technical information necessary for helicopter operators to fly both current and new advanced helicopters as quietly as practical, and to make helicopter operations compatible with nearly all land uses. The program also discusses how to communicate to the public the gains from using such procedures. In addition, the program provides general information related to helicopter noise and public acceptance.

1 General Information

1.1 Background

HAI's Heliports and Airways Committee (HAC) originally organized the Fly Neighborly Program through its Fly Neighborly Steering Committee. This committee was composed of members of HAI and governmental representatives, including the FAA, members of the military and other associations. Officially launched by HAI in February 1982, the program gained U.S. and international acceptance. Subsequently, the work related to the Fly Neighborly Program was considered sufficiently important by HAI that a separate Fly Neighborly Committee was formed to promote the program and ensure that the *Fly Neighborly Guide* and associated material are updated as appropriate.

In the U.S., the program has gained the full support of helicopter operators, regional associations, manufacturers, pilots and communities throughout the country. Federal, state and local government agencies have embraced the program, and taken an active part in sponsoring Fly Neighborly presentations in conjunction with safety seminars and other activities. Worldwide, the helicopter industry and its related communities are kept informed on the Fly Neighborly Program. Companion programs have been developed in a number of countries including Germany, France, and the United Kingdom.

1.2 Objectives

The Fly Neighborly Program addresses noise abatement and public acceptance objectives with guidelines in the following areas:

- pilot and operator awareness
- pilot training and education
- flight operations planning
- public acceptance and safety
- sensitivity to the concerns of the community

1.3 About This Guide

The *Fly Neighborly Guide* is published under the auspices of HAI to promote helicopter noise abatement operations. It addresses general issues only and is, by no means, comprehensive.

1.4 Purpose

These guidelines are intended to assist pilots, operators, managers, and designated Fly Neighborly officers to establish an effective Fly Neighborly Program. The concepts and flight operations outlined, herein, must be further tailored to suit local needs, and to ensure local or regional organizations cooperate to develop a strong, well-organized and disciplined approach to achieving Fly Neighborly objectives.

1.5 Organization

This guide is divided into seven main sections. Section One covers general information. Section Two addresses helicopter sound generation. Section Three gives guidance for noise abatement operations. Section Four discusses how to operate helicopters quietly. Section Five covers pilot training. Section Six describes the operator program which provides a broad outline of the possible actions helicopter operators can take, including

flight operations planning. Section Seven deals with community concerns and issues of public acceptance and Section Eight answers the question of what the Fly Neighborly Program can achieve. Three appendices present a comparison of sounds, the Advisory Circular (AC) 91.36D, and an example of a public heliport noise abatement program. In addition, a glossary is provided to help define the acronyms used or referred to in this Guide.

1.6 Administration

HAI solicits new ideas, comments, and recommendations to improve the program. HAI's Fly Neighborly, Safety and Heliport Committees are focal points for the development of new technical material in their respective areas. Additional guides can be obtained from HAI.

The Fly Neighborly Committee monitors the Fly Neighborly Program, and distributes new information to participants. Individuals, operators, or agencies desiring additional information should contact the HAI Fly Neighborly Program staff liaison at:

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2 Helicopter Sound Generation

2.1 The Source of the Sound

The external sound produced by a helicopter is made up of acoustical sources from the main rotor, the anti-torque system (tail rotor), the engine(s), and drive systems. For turbine-powered helicopters, the main rotor and anti-torque system dominate the acoustical signature. Engine and gearing noise are generally of significance only when up close to the helicopter. The same is true for piston-powered helicopters, although muffling of the engine is usually necessary.

The most noticeable acoustical characteristic of all helicopters is the modulation of sound by the relatively slow-turning main rotor. This modulation attracts attention, much as a flashing light is more conspicuous than a steady one. The resulting modulated sound can become impulsive in character and is referred to as BVI (Blade Vortex Interaction Noise), *blade slap*, or more generally, as *impulsive noise*. In some flight conditions, the main rotor noise can become quite impulsive in character (*blade slap*, or more generally *impulsive noise*), which can increase the annoyance of the helicopter to people on the ground.

Impulsive noise occurs during high-speed forward flight as a result of blade thickness and compressible-flow on the advancing blade. This latter source causes the blade's airloads to fluctuate rapidly. These fluctuations result in impulsive noise with shock waves that can propagate forward. High tip-speed rotor designs flown at high airspeeds are the worst offenders.

At lower airspeeds, and typically during a descent, rotor impulsive noise can occur when a blade intersects its own vortex system or that of another blade. This type of noise is referred to as Blade Slap or (BVI) noise. When this happens, the blade experiences locally high velocities and rapid angle-of-attack changes. This tends to produce a sound that is loud and very annoying in character.

There are three basic types of anti-torque systems used in current helicopters: the conventional open tail rotor, the ducted tail rotor/fan (e.g., the Fenestron), and the Coanda-effect/ blown-air system (e.g., the NOTAR). Each system has its own unique acoustical characteristics. The conventional open tail rotor generates a fluctuating low pitch whine or drone. The ducted tail rotor/fan produces a high pitch, sometimes fluctuating shrill. The blown-air, directional-vane system generates a broadband, 'compressed-air' hissing.

The noise of both the open tail rotor and the ducted tail rotor/fan increases with airspeed and in high-rate climbs and turns. Interaction between the main rotor and either type of anti-torque system can, and often, exacerbates the anti-torque system's sound output. In addition, the proximity of the vertical fin and tail boom influences the sound output of an open tail rotor. Somewhat similarly, the presence of vanes/stators and support struts, plus inflow/outflow turbulence, exacerbate the sound output of ducted tail rotor/fan systems. Turbulent flows off the pylon and fuselage also tend to increase the level and the sound fluctuations of both these types of anti-torque systems.

The Fenestron has some advantages over an open rotor at distance since it generates a higher frequency sound, which is more easily attenuated by the atmosphere. On many helicopters, the main source of noise heard at distance, particularly if a high tip-speed tail rotor is used, is associated with the tail rotor blade thickness. 'Quiet open tail rotors' tend, therefore, to use lower tip speeds, thinner blade sections and, to provide adequate thrust, an increase in the number of blades.

With regard to the noise generated, the NOTAR has advantages in many respects because it is independent of the increase associated with the other two types of anti-torque systems. The NOTAR is, however, only available at the current time on designs manufactured by one company.

The general relationship between sound level and helicopter weight, and a comparison of the sound generated by a helicopter and other common noise sources are given in Appendix 1.

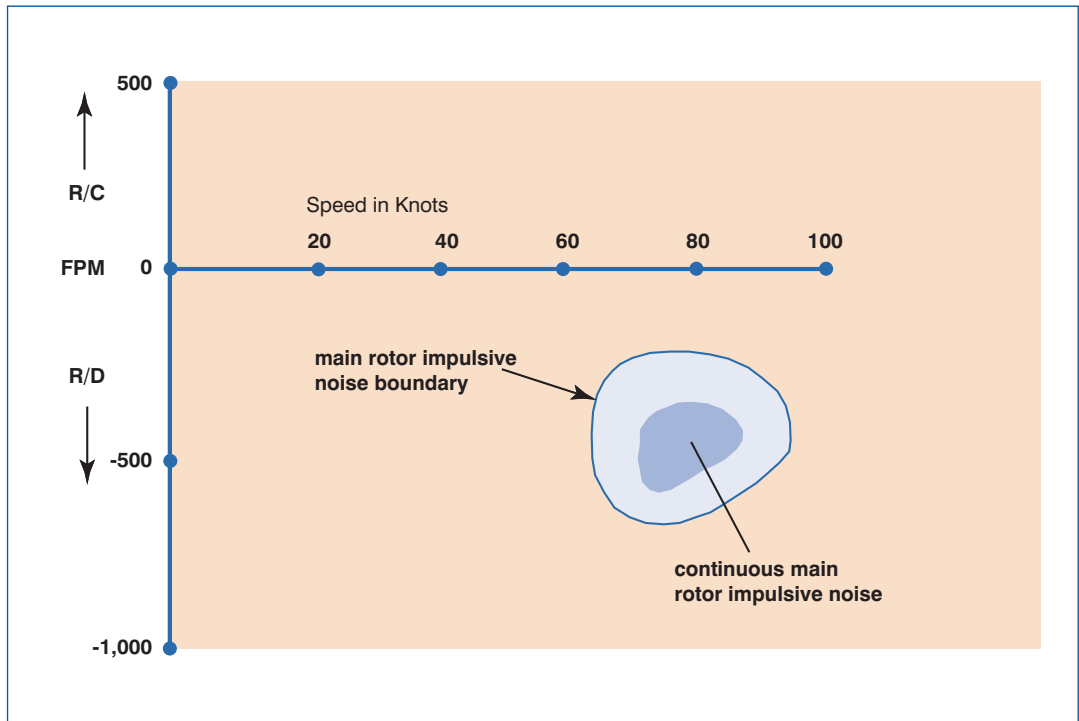
2.2 Impact of Operations

For a typical small/light helicopter, the most annoying noise mechanism impulsive noise (BVI) occurs during partial power descents and in sharp/high-rate turns. For a typical medium or large/heavy helicopter, they can occur in low-speed level flight, during partial power descents, and in sharp/high-rate turns. Figures 1, 2 and 3 show the flight conditions under which you can expect main rotor impulsive noise to occur.

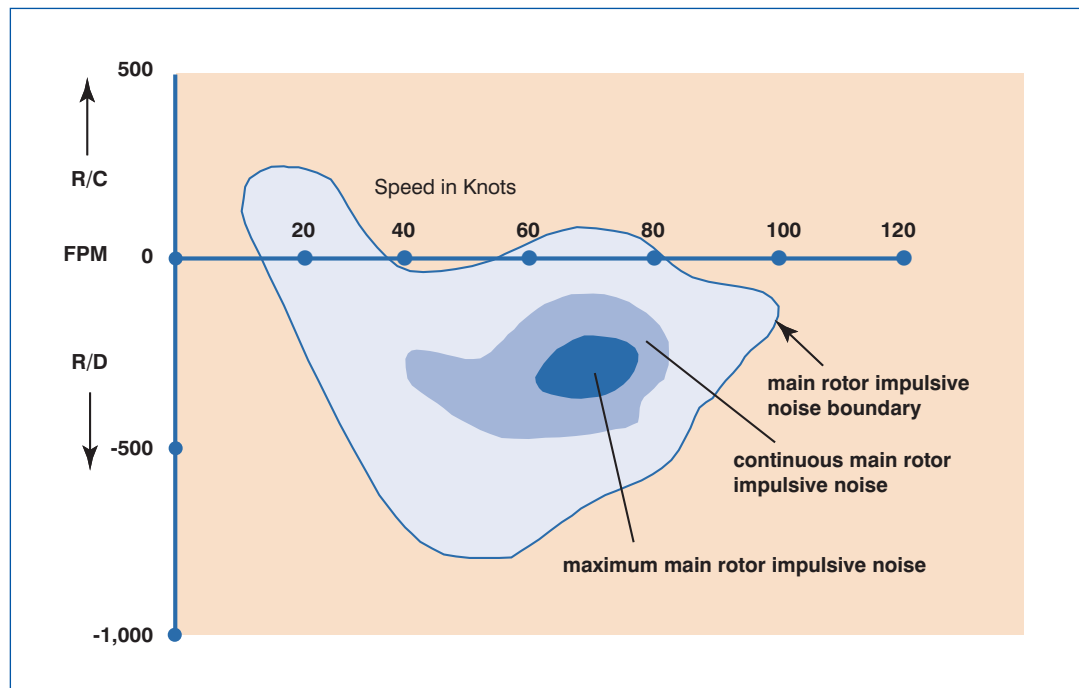
The impulsive noise boundary for your particular helicopter may be somewhat larger than that shown in Figures 1 and 2 because the main rotor may generate impulsiveness intermittently when it encounters wind gusts, or during a rapid transition from one flight condition to another. Although the sound produced at these descent rates is not extremely loud to crewmembers inside the helicopter, they can, in most cases, recognize it and, thereby, define the impulsive noise boundaries for their particular helicopter. However, in some cases, the impulsive BVI noise cannot be detected in the cockpit. Of course, people on the ground hear impulsive noise grow more intense as the helicopter descends.

Figure 1

High-Noise Flight
Operations – Small/
Light Helicopter

**Figure 2**

High-Noise Flight
Operations – Medium/
Heavy Helicopters

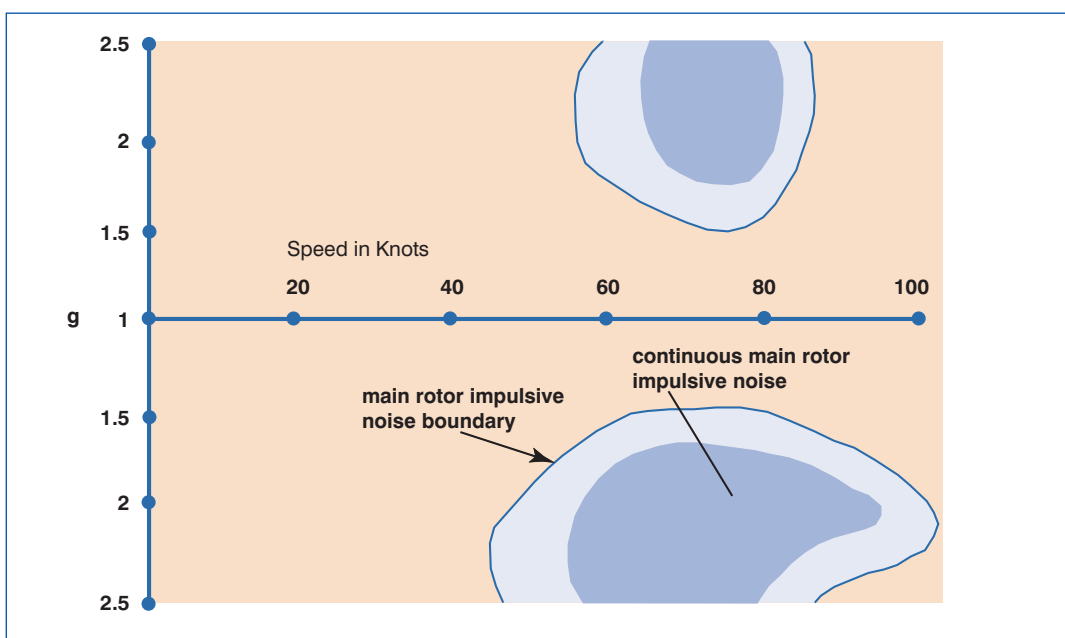


Main rotor impulsive noise also occurs during maneuvers (i.e. in constant speed turns, if turn rates are too high. Here, the main rotor blade and wake interact in much the same manner as in partial power descents. As Figure 3 shows, for a medium helicopter with

a two-bladed main rotor, main rotor impulsive noise occurs in turns that exceed 1.5g, with airspeeds between 50 and 90 knots in a left turn, and between 40 and 100 knots in a right turn. There is little difference in the intensity of the noise in right or left turns once the 'critical g' is reached. The crew can normally hear this impulsiveness. These characteristics also generally apply to other helicopters. Unfortunately, specific information on the increase in the level of impulsive noise, in terms of 'g' or bank angle, is not generally available.

Figure 3

High-Noise
Maneuvers –
Medium
Helicopters



In addition to the general characteristics discussed above, it should be noted that the various sound sources exhibit specific directivity characteristics. These are not discussed in detail in this document, but it is worth noting that, in general, the main rotor sound is focused towards the front and on the advancing blade side of the helicopter. The tail rotor noise is similarly focused forward and it is also radiated downward under the helicopter. As a result, the sound – in particular from the main rotor impulsive sources – is generally detected well in advance of the helicopter flying over. Fortunately, these aspects are normally taken into account when noise abatement procedures are developed by the manufacturer. Even so, they should not be ignored when planning flight operations.

3 General Guidelines for Noise Abatement Operations

This section offers a number of noise abatement techniques for use in daily operations. A few general guidelines are given below.

- Avoid noise-sensitive areas altogether, when possible. Follow:
 - high ambient noise routes such as highways, or
 - unpopulated routes such as waterways.

If it is necessary to fly near noise-sensitive areas:

- maintain an altitude as high as possible in line with the HAI *Fly Higher Chart* (Fig. 4)
- fly normal cruising speed or slower
- observe low-noise speed and descent recommendations
- avoid sharp maneuvers
- use steep takeoff and descent profiles, and
- vary the route, since repetition contributes to annoyance

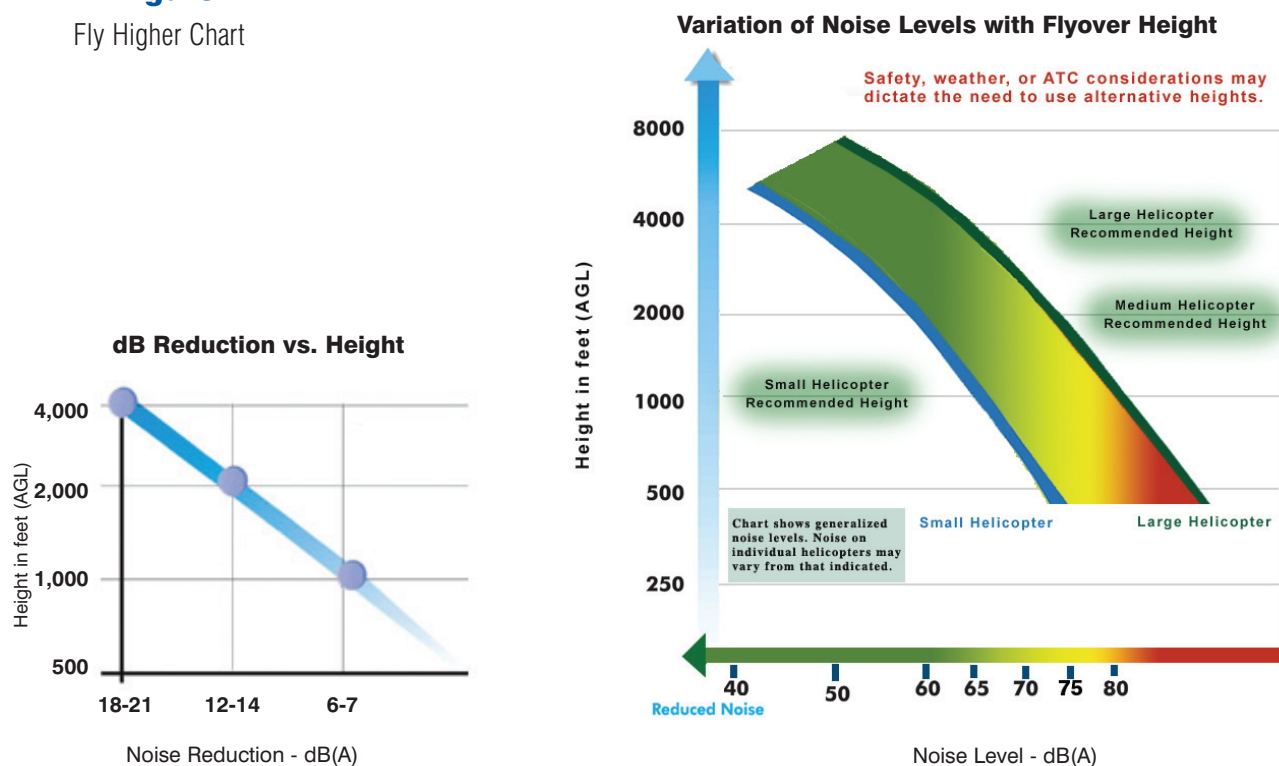
Flights conducted over roads (particularly interstates), railways and rivers in noise-sensitive areas are less likely to generate complaints than routes that acoustically and visually intrude on peoples' privacy, such as those that cross, or can be heard from, residential backyards.

3.1 Flyover Height

Maintaining an altitude as high as possible above the ground and flying at airspeeds consistent with minimum noise output, flight safety and ATC constraints is essential. Height and distance have a major impact on the noise level observed under the helicopter, as illustrated in the HAI *Fly Higher Chart*, shown in Figure 4. It shows the relationship of flyover height and noise exposure at ground level for different-sized helicopters. A doubling of height or distance reduces the level by six to seven dB(A). If the height/distance is increased by a factor of three, the maximum level is decreased by approximately 10 dB(A), which is equivalent to reducing the loudness by half. The chart can be used to decide what height should be flown so that the helicopter's noise output is compatible with community noise exposure criteria. For example, to be compatible with the generally accepted criterion of 65 dB(A) max for flyover of noise-sensitive areas, light/small helicopters should fly at altitudes no less than 1,000 feet AGL. For medium helicopters, the recommended height is 2,000 feet AGL, and, for heavy/large helicopters, 4,000 ft AGL.

Figure 4

Fly Higher Chart



3.2 FAA Guidance - VFR Flight Near Noise Sensitive Areas

The FAA has published guidance when flying near noise-sensitive areas for a number of years. It was updated in 2004 and issued as Advisory Circular AC91.36D. A copy of this document is reproduced in Appendix 2. This voluntary practice recommends:

- the avoidance of flights over noise sensitive areas, if practical.
- When not possible, pilots flying VFR flights over noise-sensitive areas should make every effort to fly at not less than 2,000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of FAR 91.79, Minimum Safe Altitudes.

Typical of noise-sensitive areas in this Advisory Circular are defined as: outdoor assemblies of persons, churches, hospitals, schools, nursing homes, residential areas designated as noise-sensitive by airports or by an airport noise compatibility plan or program, and National Park Areas (including Parks, Forest, Primitive Areas, Wilderness Areas, Recreation Areas, National Seashores, National Monuments, National Lakeshores, and National Wildlife Refuge and Range Areas). It is also recommended that, during departure from, or arrival at an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitudes near noise sensitive areas. It should be mentioned, however, that such procedures should not apply where it would conflict with ATC clearances or instructions, or where an altitude of less than 2,000 feet is considered necessary by a pilot in order to adequately exercise his or her primary responsibility for safe flight.

It should be noted that FAA guidance recommends a height of 2,000 ft AGL be used for general over flight of noise-sensitive areas. This is somewhat different than the guidance developed by HAI's Fly Neighborly Committee, discussed previously and illustrated in Figure 4, which recommends 1,000 ft for small helicopters. For medium helicopters, HAI recommends 2,000 ft, the same as the FAA, but for large helicopters, HAI recommends 4,000 ft. Although FAA guidance should be followed when practical, HAI considers use of the heights in Figure 4 will ensure acceptable noise disturbance to persons on the ground.

3.3 Flyover Speed

The airspeed of the helicopter has an important effect on both noise exposure impact and the impulsive character of your helicopter. Generally, it is best to fly at, or somewhat below, normal cruise speeds when over-flying noise-sensitive areas. Airspeeds above normal cruise can dramatically increase your helicopter's noise levels and the impulsive character to the extent that, even if you maintain the suggested minimum flight altitudes, your over-flight is no longer compatible with generally accepted noise exposure criteria.

4 How to Operate Helicopters Quietly

In this section, general information is presented on how to fly a helicopter more quietly. Such information applies to the operation of all helicopters. The flight techniques given in this section are also general in nature and vary somewhat according to the actual helicopter being flown. Manufacturers have developed recommended noise abatement procedures for specific models and, when available, these should be followed. The information on HAI's Web site, www.rotor.com, represents data currently available from the manufacturers. As new data becomes available, HAI will periodically update the Web site. In some cases, the noise abatement information is also available in the specific *Rotorcraft Flight Manual*. When noise abatement information is not available for a specific helicopter model, the flight techniques in the following sections should be followed. This information is also helpful to supplement the information supplied by a manufacturer.

4.1 General

Increasing the distance/separation from noise-sensitive areas is the most effective means of noise abatement.

4.2 Ground Operations

Although startup and shutdown procedures are relatively quiet and are usually shielded from noise-sensitive areas, it is good practice to reduce the amount of time spent on the ground with the rotor turning. This reduces the noise exposure to ground handling crews and heliport/airport personnel.

Minimize the duration of warm-up or cool-down periods (typically two to three minutes, although, on some engines it can be as short as 30 seconds). Do not idle at the heliport for extended periods of time.

When feasible, park with the rotors running with the nose of the helicopter directed into the wind to minimize noise. If the wind speed is above 5 knots, avoid parking with the nose 15 degrees or more from the approaching wind. This will minimize tail rotor noise.

4.3 Hover / Hover Taxi /Ground Taxi

When hover turning, make the turn in the direction of the main rotor rotation. This minimizes the anti-torque thrust required and, therefore, minimizes the level of noise generated by the anti-torque system. Keep the turn rate to as low as practical.

4.4 Takeoff and Climb (Departure)

Takeoffs are reasonably quiet operations, but you can limit the total ground area exposed to helicopter sound by using a high rate-of-climb and making a smooth transition to forward flight. The departure route should be over areas that are least sensitive to noise.

4.5 Enroute and Cruise Flyover

- Fly at least at the heights recommended in the *Fly Higher Chart* (Figure 4).
- Fly at the highest practical altitude when approaching metropolitan areas.

- Select a route into the landing area over the least populated area.
- Follow major thoroughfares or railway tracks.
- Avoid flying low over residential and other densely populated areas.
- If flight over noise-sensitive areas is necessary, maintain a low to moderate air-speed.
- Select the final approach route with due regard to the type of neighborhood surrounding the landing area, and the neighborhood's sensitivity to noise. Assess this sensitivity beforehand for each landing area. Some guidelines are:
 - Keep the landing area between the helicopter and the most noise-sensitive building or area on approach.
 - If the landing area is surrounded by noise-sensitive areas, approach using the recommended noise abatement approach procedure or at the steepest practical glideslope.
 - Avoid flying directly over hospitals, nursing homes, schools, and other highly noise-sensitive facilities.

4.6 Turns (Maneuvers)

As a general rule, avoid rapid, 'high g'/high bank angle turns. When the flight operation requires turns, perform control movements smoothly.

4.7 Descent/Approach and Landing

The approach techniques presented below are designed to avoid the impulsive (BVI) noise generated by the main rotor. These techniques typically use a glideslope that is a few degrees steeper than a normal approach. In addition to avoiding high BVI regimes, steep approaches ensure a greater height over the noise-sensitive area. Once the transition from cruise to the approach glideslope has been made, the airspeed and rate of descent can be 'tailored' to fit local conditions, avoid unsafe regimes, and still guarantee minimum noise.

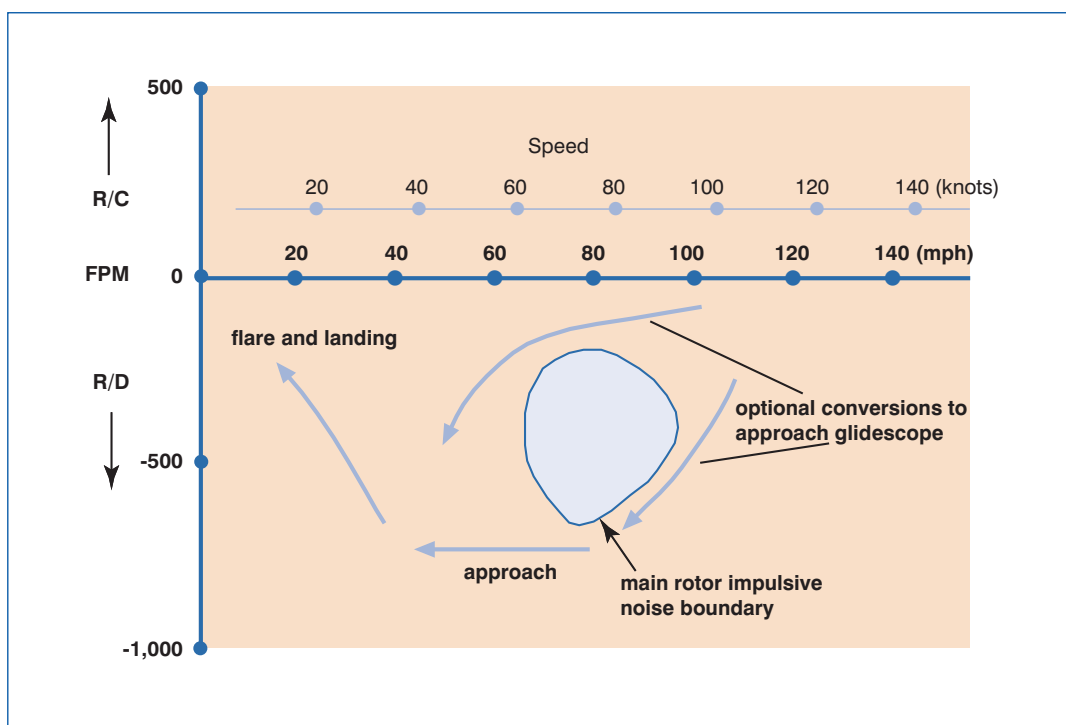
4.7.1 Small/light helicopters

Follow one of the noise abatement flight techniques given below and illustrated in Figure 5.

- When commencing approach, first establish a rate-of-descent of at least 500 fpm, then reduce airspeed while increasing the rate-of-descent to 700-800 fpm.
 - Hold the rate-of-descent to less than 200 fpm while reducing airspeed to 50-60 knots/60-70 mph, then increase the rate-of-descent to 700-800 fpm.
- At a convenient airspeed between 45 and 60 knots/50-70 mph, set up an approach glideslope while maintaining the 700-800 fpm or greater rate-of-descent.
- Increase the rate-of-descent if main rotor BVI noise is heard, or if a steeper glideslope is required.
- Just prior to the 'flare,' reduce the airspeed below 50 knots/60 mph before decreasing the rate-of descent.
- Execute a normal flare and landing, decreasing the rate-of-descent and airspeed appropriately.

Figure 5

Noise Abatement
Approach Techniques
for Small/Light
Helicopters



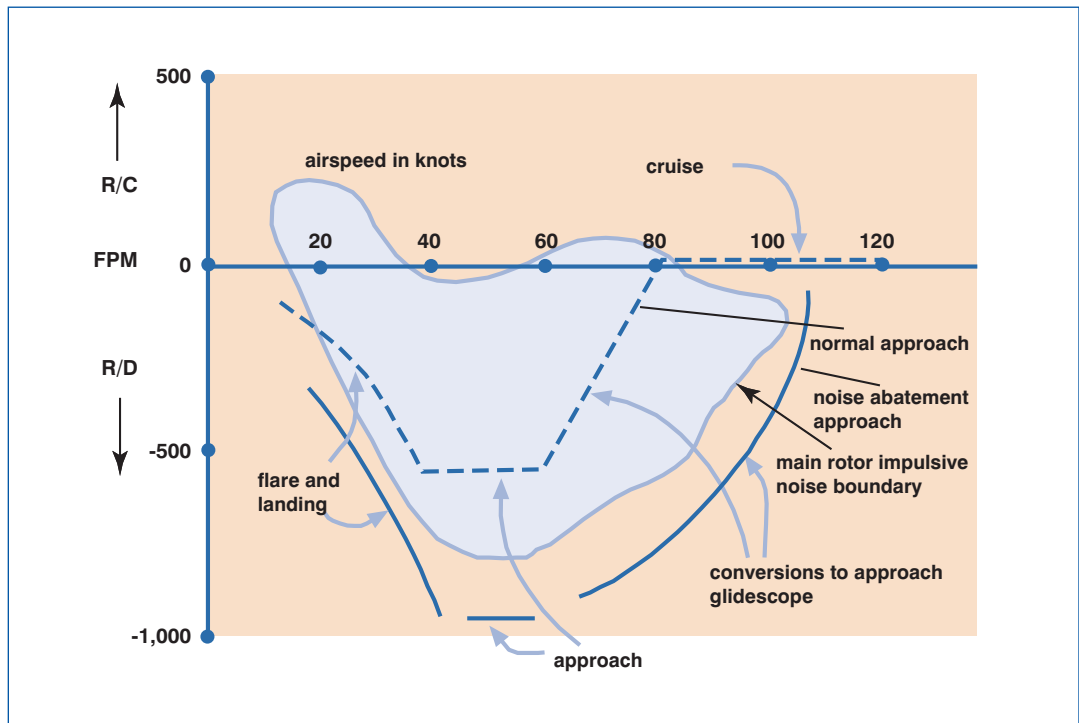
4.7.2 Medium and heavy helicopters.

Follow the noise abatement flight technique given below and illustrated in Figure 6.

- When commencing approach, begin descent at a rate of at least 200 fpm before reducing airspeed, then reduce airspeed while increasing the rate of descent to 800-1000 fpm.
- At a convenient airspeed between 50 and 80 knots, set up an approach glideslope while maintaining the 800-1000 fpm rate of descent.
- Increase the rate-of-descent if main rotor BVI noise is heard, or a steeper glideslope is required.
- Just prior to the approach to the 'flare,' reduce the airspeed to below 50 knots before decreasing the rate-of-descent.
- Execute a normal flare and landing, decreasing the rate of descent and airspeed appropriately.

Figure 6

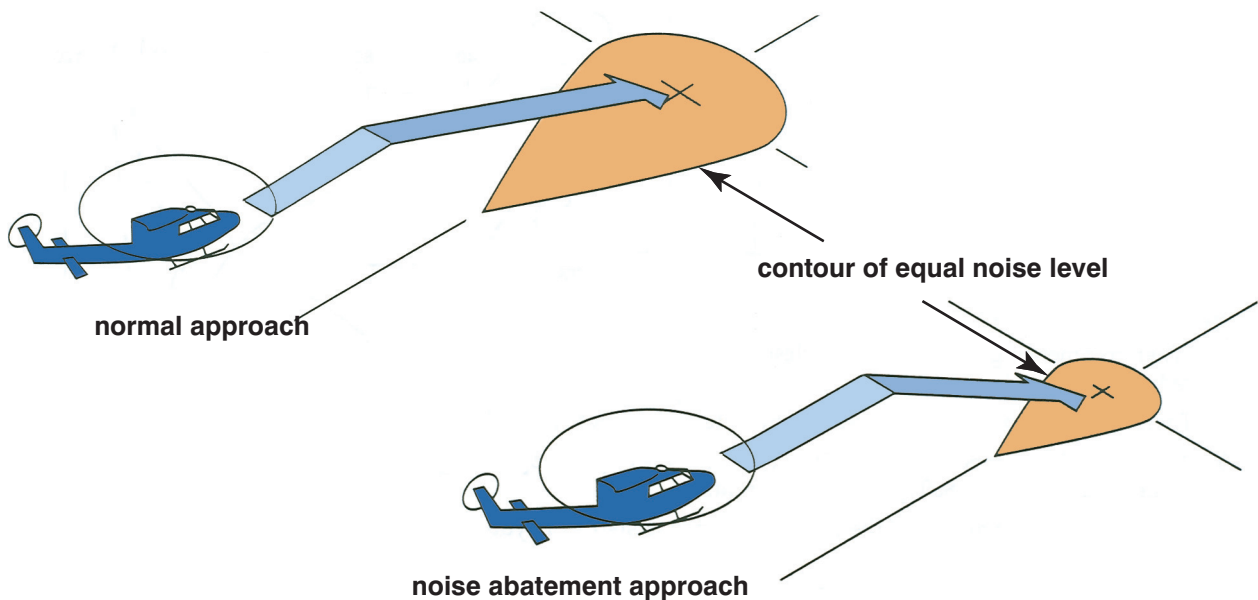
Noise Abatement
Approach Technique
for Medium and
Heavy Helicopters



The noise abatement flight techniques discussed above for small/light and medium helicopters reduce the ground area exposed to a given noise level by as much as 80 percent. Figure 7 illustrates the potential noise benefits when compared to a normal approach.

Figure 7

Ground Noise
Exposure Footprint



4.8 Other Factors to be Considered

It is important to mention that the sound environment on the ground and weather have much to do with how offensive helicopter sound is judged. The background noise of residential areas reaches its lowest level between late evening and early morning. In warm weather, people are apt to be relaxing outdoors in the evening and on weekends. At these times, they are most conscious and resentful of noise intrusion. Therefore, flight over or near residential areas should be avoided, if possible.

Although the weather cannot be controlled, it may be possible to adapt the planned flight schedule to take advantage of meteorological conditions to help minimize noise. The two weather factors most useful in this respect are wind and temperature. They are helpful because they affect the propagation of sound, and vary throughout the day, in a more or less predictable manner.

Wind carries sound in the direction towards which it is blowing, and it makes a background noise of its own that, in high winds, tends to reduce the intrusion of helicopter sound. In inland areas, surface winds are generally stronger during the day, reaching a maximum in mid-afternoon and weaker at night. In coastal regions, land and sea breezes give a different diurnal pattern, beginning to blow shortly after sunrise (sea breeze) and sunset (land breeze). These winds can be used to increase the acceptability of the helicopter by flying downwind of densely populated areas and by scheduling the majority of flights after noon near especially noise-sensitive areas.

Temperature has two effects upon sound. One is the tendency of warm air to be more turbulent than cold air, and, therefore, to disperse sound and decrease its nuisance effect. The other is temperature gradient - the change in temperature with altitude. The normal gradient is negative: temperature decreases with altitude. A negative gradient reaches a maximum in the late morning or just after noon, and is more intense during summer months. This means that it is of some value to schedule flights to and from noise-sensitive areas during the warmer parts of the day. Also, lower temperatures lead to higher advancing main rotor and tail rotor tip speeds which increase the magnitude of the impulsive noise.

At certain times, however, there may be an inversion in the atmosphere - a layer of air from a few hundred to a few thousand feet thick in which the temperature increases with altitude. The inversion reverses the normal curvature of sound propagation, turning an abnormally high portion of the sound energy back toward the ground. The most severe inversions usually occur at night and in the early morning. These, then, are times when the sound of the helicopter will have the most adverse effect upon people on the ground.

In terms of helicopter noise, the worst possible combination of atmospheric conditions is a windless, cold, overcast morning. At such times, it is important that even more emphasis is placed on using noise abatement procedures.

NOTE: *The noise abatement flight techniques described above and detailed on the HAI Web site permit flight crews to fly helicopters in the quietest manner possible. They are to be construed as advisory guidelines only. If flying according to these noise abatement flight techniques conflicts with operating the aircraft in a safe manner, then all safety-related procedures take precedence.*

5 Pilot Training

The basic scope of the recommended pilot training program and an outline of the requirements for such a program are outlined in this section. The information embodied in other sections of the Guide is also relevant. In addition, HAI has issued an interactive Noise Abatement Training CD for Pilots which covers all the aspects a pilot should be aware of. This CD, developed by the HAI Manufacturers Committee, and initially issued in 2006, is available from HAI. It is recommended that this CD be used as a part of any pilot noise abatement training program.

5.1 Scope

The scope of a pilot training program should include:

- initial and recurrent flight training for pilots
- preparing and distributing recommended noise abatement procedures
- organizing and holding operator and manufacturer seminars
- providing environmental and supervisory personnel training courses.

5.2 Basic Guidelines for Pilot Training

Public acceptance for helicopter operations can be obtained in several ways. One is noise abatement. Crew training to ensure that pilots are fully familiar with the noise abatement procedures is, therefore, vital. The following guidelines for noise abatement training are suggested:

- Select training teams for ground and flight training, usually two or three people who have extensive metropolitan operations experience.
- Standardize presentations.
- Maintain complete files of all persons trained.
- Circulate comment sheets at all meetings or training sessions, and stress that all suggestions, ideas and comments will be taken into consideration.
- Make the necessary changes in training and publications that result from the feedback.
- Maintain an open-door policy to all participants, flight crews and the public.
- Determine the effect of this training on the public. Has it been positive or negative?
- Record all complaints and include all relevant details, such as the time, date, location, altitude, and weather.
- Follow up with proficiency training every six months. Emphasize the importance of public contacts, and the necessity of good community relations.
- Expand the guidelines given in this document to cover local needs.

6 Operator Program

When operating a helicopter in a new area, a new spectrum of sound is added to the usual noise environment. If that area is a municipality, thousands of people will hear the new sounds and know a helicopter is operating. How they react depends not only on the noise you generate but upon physical, economic, and psychological factors. One thing is certain: they will react strongly, adversely, and actively if the sound is too irritating, if it represents something that seems to threaten their safety and well-being, or if they cannot see how the noisemaker (the helicopter) benefits them. Although it is up to operators to educate the public about the safety and usefulness of the helicopter, pilots can make the public less hostile to the helicopter (and to the operator's arguments about its safety and community service) by flying in such a way as to make the sound of the aircraft as non-intrusive as possible.

6.1 Introduction

The Fly Neighborly Program attacks the problem of helicopter noise on three fronts: pilot training, flight operations planning, and public education and acceptance. These three areas are interrelated. Planning flight operations with an eye to noise abatement can have a major positive impact on both the pilot training program and public acceptance.

The information presented in this section provides only a broad outline of the possible actions helicopter operators can take. Operators are encouraged to expand this outline by applying knowledge of their own geographical area of operations, the nature of their businesses, and the local climate of opinion with regard to helicopter operations.

6.2 Company Policy

Implement a company policy aimed at reducing the sound levels produced by the operation of your aircraft or other equipment. As part of this policy, implement a broad-based complaint prevention program. Such a voluntary program is necessary to preclude the eventual implementation of restrictive and mandatory federal, state or local laws, regulations, or ordinances.

To formulate this policy, identify and evaluate current and anticipated problems. To assure its acceptance and success, make your commitment to your policy clear, in order to generate such change as may be necessary in the attitudes of pilots and other personnel. In order for company policy to have any meaning, companies should formulate and implement specific guidelines.

6.2.1 Formulate Guidelines

Guidelines are intended to assist flight crews and flight operations personnel to formulate responsible mission profiles without infringing on operational reality. They are not, however, provided as a substitute for good judgment on the part of the pilot. They must also not conflict with federal aviation regulations, air traffic control instructions, or aircraft operating limitations. The noise abatement procedures outlined by these guide-

lines should be used when consistent with prudent and necessary mission requirements. The safe conduct of flight and ground operations remains the primary responsibility.

- Enroute operations:
 - Maintain a height above the ground consistent with the HAI *Fly Higher Chart* (see Figure 4), or higher, when possible. Complaints are significantly reduced when operating above these altitudes. The reverse is also true.
 - Vary routes in order to disperse the aircraft sound.
- Heliport (Terminal) operations:
 - Restrict hours or frequency of operations as appropriate. Minimize early or late flights, especially on holidays and weekends.
 - Limit ground idling in noise-sensitive areas.
 - Minimize flashing landing lights in residential areas at night.
- Establish procedures for each sensitive route or terminal.
- Provide flight crews with noise abatement procedures for each model of aircraft.

6.2.2 Implement Guidelines

- Publish all guidelines and procedures in a flight operations manual or similar document.
- Train flight crews and flight operations personnel as appropriate:
 - Educate regarding basic attitudes in ground school.
 - Train in noise abatement procedures for each model of aircraft to be flown.
 - Emphasize awareness and recognition of sensitive routes and terminals.
 - Establish a requirement that noise abatement procedures must be considered in recurrent company flight checks.
- Assign responsibility and authority for the company program to an appropriate person.

6.2.3 Review and Revise

- Establish periodic reviews of company policy and programs to respond to changes in the regulatory climate or operational conditions.
- Revise your policy and programs as necessary.

7 Managing Public Acceptance

7.1 Scope

The scope of the public acceptance program includes:

- engendering media support
- promoting positive public relations
- enacting a program to prevent or resolve complaints from the public

7.2 Media Support

The purposes of engendering media support are to:

- develop favorable and active helicopter-related media coverage
- provide valid information concerning helicopter operations as necessary

Media sometimes concerned with news of helicopter-related activities include general circulation newspapers, television and radio news, trade journals, and the magazines or newsletters of international, national, state, and regional helicopter associations.

To engender awareness and support in these media, a number of actions can be taken:

- Provide press releases to trade journals and local newspaper, radio, and television news editors concerning any Fly Neighborly seminars that may be sponsored by the local helicopter operator association.
- Support a continuing campaign with the trade journals to keep the rotary-wing community aware of the Fly Neighborly Program.
- Support a continuing campaign with the general press to make the public aware of the Fly Neighborly Program, and the benefits of helicopter transport.
- Stage demonstrations and press conferences addressing specific local issues such as heliports, high-rise evacuation, police services, search and rescue services, emergency medical evacuation, fire-fighting, and the benefits of helicopter transportation to the general public.

7.3 Public Relations

The purposes of engaging in public relations activities are to:

- Develop awareness in the community of the benefits of helicopter transportation
- Develop awareness of the Fly Neighborly Program
- Develop support for the voluntary Fly Neighborly Program, as administered by the helicopter community, in lieu of governmental regulation

In order of their general importance and effectiveness, public relations activities can be undertaken in conjunction with:

- governmental agencies concerned with aviation such as federal, state, or local agencies, the FAA, or state aeronautics commissions
- other governmental agencies not particularly concerned with aviation, such as regional planning commissions, economic development commissions, the National League of Cities, or the U.S. Council of Mayors

- local civic and professional organizations such as Rotary or Kiwanis Clubs, the National Association of Aviation Officials, the Airport Operators Council International, or the National Fire Protection Association. Provide speakers for their local meetings. Solicit their sponsorship of heliports based on the Fly Neighborly Program as a civic project to promote public service.
- nongovernmental economic development agencies such as chambers of commerce, regional economic development councils, or merchant associations. Demonstrate to economic development agencies how helicopter transportation benefits the community, and present data to show the economic viability of helicopter transportation.
- direct public contact
- environmental organizations such as Greenpeace, the Sierra Club, or federal or state environmental protection agencies. Provide information. Do not immediately assume they are hostile to the planned operations. Instead, emphasize the positive environmental aspects of helicopter operations, such as the fact that they are involved in search and rescue operations for hikers or workers injured in remote areas, and that they provide access to such areas without the need to pave over ground for landing strips.

Public relations can be improved by influencing government agencies concerned with aviation in the following ways:

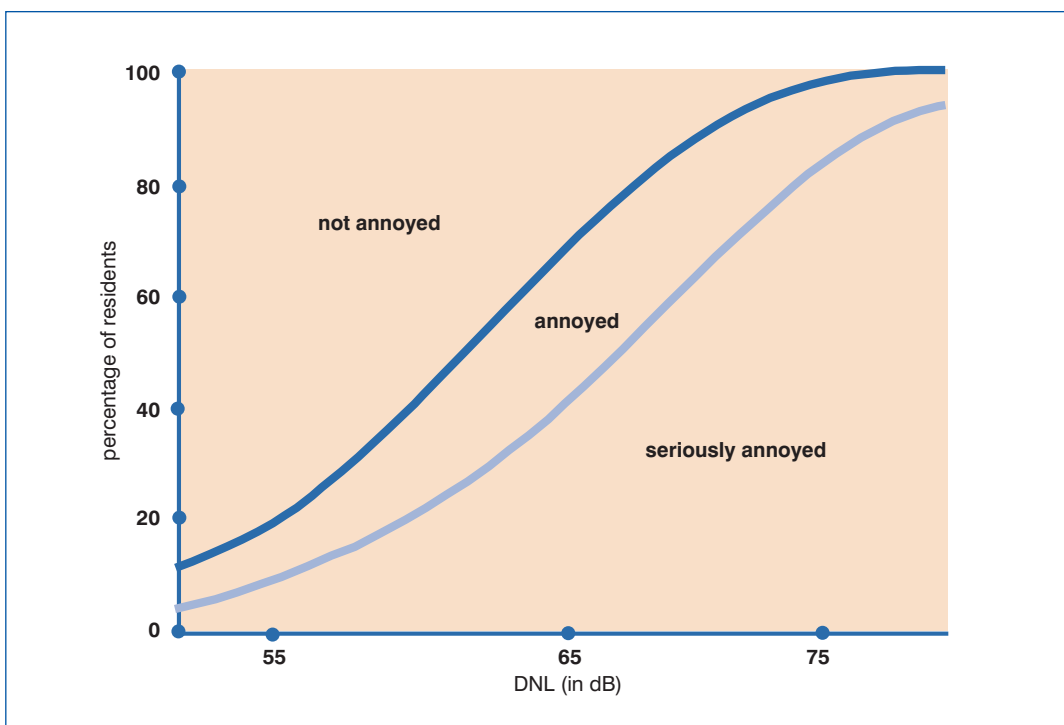
- Participate in public hearings
- Provide professional testimony as appropriate
- Conduct flight demonstrations
- Conduct one-on-one campaigns
- Submit petitions and letters

7.4 Preventing and Responding to Complaints

Helicopter operations are undeniably noisy, and this guide is concerned with a program designed to minimize the problem. Figure 8 shows the relationship between the amount of noise people are exposed to, and how annoyed they are likely to get. In the figure, the amount of noise exposure is expressed as DNL (day-night sound level).

Figure 8

Relationship between
Noise Exposure and
Annoyance



7.4.1 Complaint Prevention

A significant number of noise-related complaints can be prevented in the first place, given a certain degree of sensitivity, foresight, and commitment. Prevent complaints by assessing the environmental compatibility of potential landing facilities. Select those most suitable from a safety, operational, and environmental point of view.

Implement a public acceptance program.

- When contemplating site licensing, identify, contact, and try to influence potential sources of opposition before the hearing.
- Initiate or support presentations, seminars, or displays to educate the public about the value of helicopter transport.

Educate customers about noise abatement procedures, in order to prevent or minimize conflicts between their expectations and company policy.

Coordinate operations personnel and flight crews, so that flights that would unnecessarily violate company policy are not assigned.

7.4.2 Handling Noise Complaints

Although earlier sections of this guide offer information concerning noise abatement techniques, it is unlikely all noise complaints can be avoided. Since some complaints are inevitable, how they are handled is also important to the success of the Fly Neighborly Program.

The resulting problem is not simple. A helicopter can annoy people simply by being over, or too near, certain noise-sensitive areas. If someone calls the FAA, or a state agency, and offers routine information such as the aircraft registration number, colors,

or type, it is likely that he or she will be told the aircraft was not in violation of any regulation, and that, therefore, nothing can be done. The result can be an angry, frustrated member of the community who will probably not be particularly supportive of any current or future helicopter or heliport related issue.

The helicopter user community has a real interest in assuring all complaints are appropriately addressed. Conventional channels for complaints are demonstrably insufficient. Therefore, a number of regional helicopter associations have started to operate their own complaint lines. These lines offer state, federal and local agencies another option when they receive complaint calls about legal and proper operations. The agencies can pass the complaint along to the regional association, or provide the complainant with the telephone number of the complaint line.

Such programs offer a number of benefits:

- Regional associations can often identify an aircraft with much less information than other agencies require.
- Associations can ensure that each issue is addressed and, when possible, satisfy the complainant.

When a complaint is received, how should it be addressed?

- The most effective way to deal with the complaint is to contact the complaining party personally. When you do, avoid being defensive, argumentative, or opinionated. Sincerely try to understand the other person's point of view, and avoid hostile confrontations. Sometimes merely listening politely can improve the situation.
- Furthermore, evaluate the problem thoroughly, and follow through. Was the pilot aware of the problem? Was there something the pilot could have done to avoid it? Is it likely to recur? Contact the pilot or the operator to determine the facts. Consult this guide, and other sources of noise abatement information, to determine how to improve the situation.
- Finally, respond to the caller. Tell him or her what has been learned, and what is being done to prevent the situation from recurring.

Of course, the best way to handle complaints is to avoid them in the first place. If a problem with a certain operation can be anticipated, contact the likely complainant, or members of the public to be impacted, before the operation begins. Explain to him or her, the purpose, timing, and duration of the operation, and its likely impact upon the area. People like to feel they have some control over their lives. Often, just a simple courtesy call in the beginning can save hours of trouble and nuisance later.

An example is given in Appendix 3 of a noise abatement program established at a heliport in a downtown area. The noise abatement program that was put into effect to solve the situation is described.

8 Fly Neighborly Program— What Can be Achieved?

The Fly Neighborly Program outlined in this guide, together with the information on HAI's Noise Abatement Training CD for Pilots, and use of the noise abatement procedures which are available on HAI's Web site, provide the basis for lowering the noise generated by helicopters in day-to-day operations. In addition, the noise abatement procedures offer a way of reducing the impulsive noise characteristic of helicopters which occur during normal operations and often cause complaints. By adopting and following the Fly Neighborly Program, a high level of public acceptance can be obtained.

It should also be noted that current public acceptance of helicopters is, in general, poor and, unless the program outlined in this guide is adopted, further international, national, and local regulations will be enacted to limit helicopter operations. Therefore, HAI strongly recommends that its members introduce a Fly Neighborly Program as outlined in this guide.

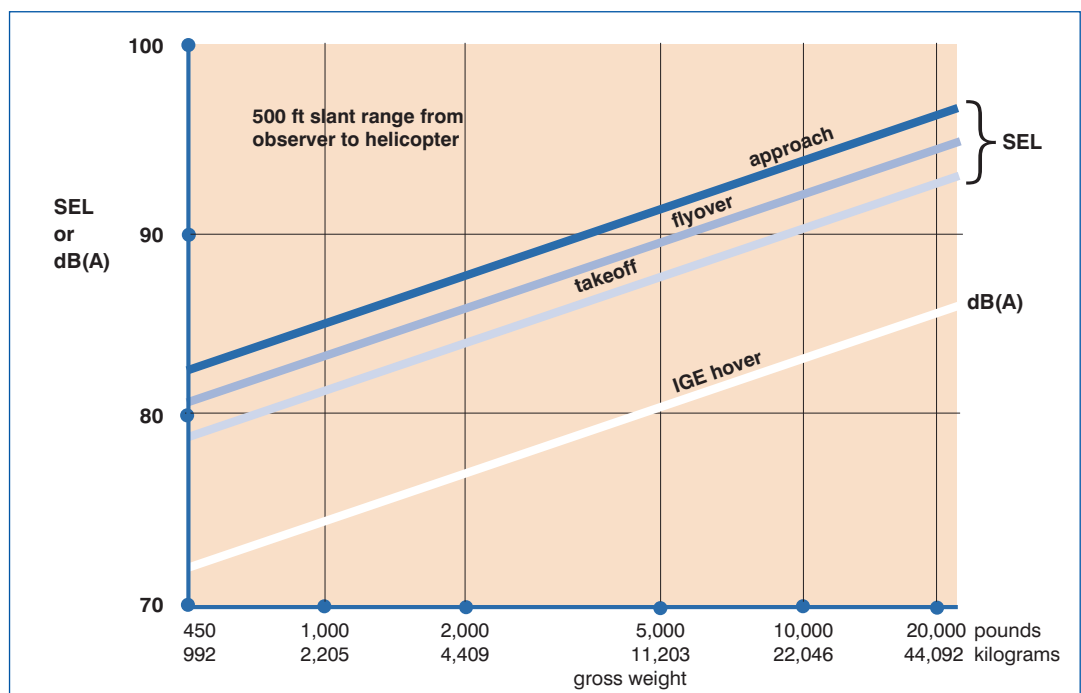
If the procedures given in this guide are followed, public acceptance will be improved and the rotorcraft segment of the aviation industry will be able to flourish and grow, without being restricted by the burden of new noise regulations and operational restrictions.

Sound Comparisons

The general relationship between sound level and helicopter weight is shown in Figure A1 reproduced from the HAI Helicopter Noise Prediction Method. Smaller helicopters are generally quieter than larger ones and sound levels tend to increase approximately three decibels per doubling of helicopter weight.

Figure A1

Relationship between
Sound Level and
Helicopter Weight



What do these sound levels mean? Table A1 provides sound levels for illustrative noise sources heard both outdoors and indoors. Human judgment of the relative loudness (relative to a reference level of 70 dB(A)) of different sound levels is also given.

Table A1

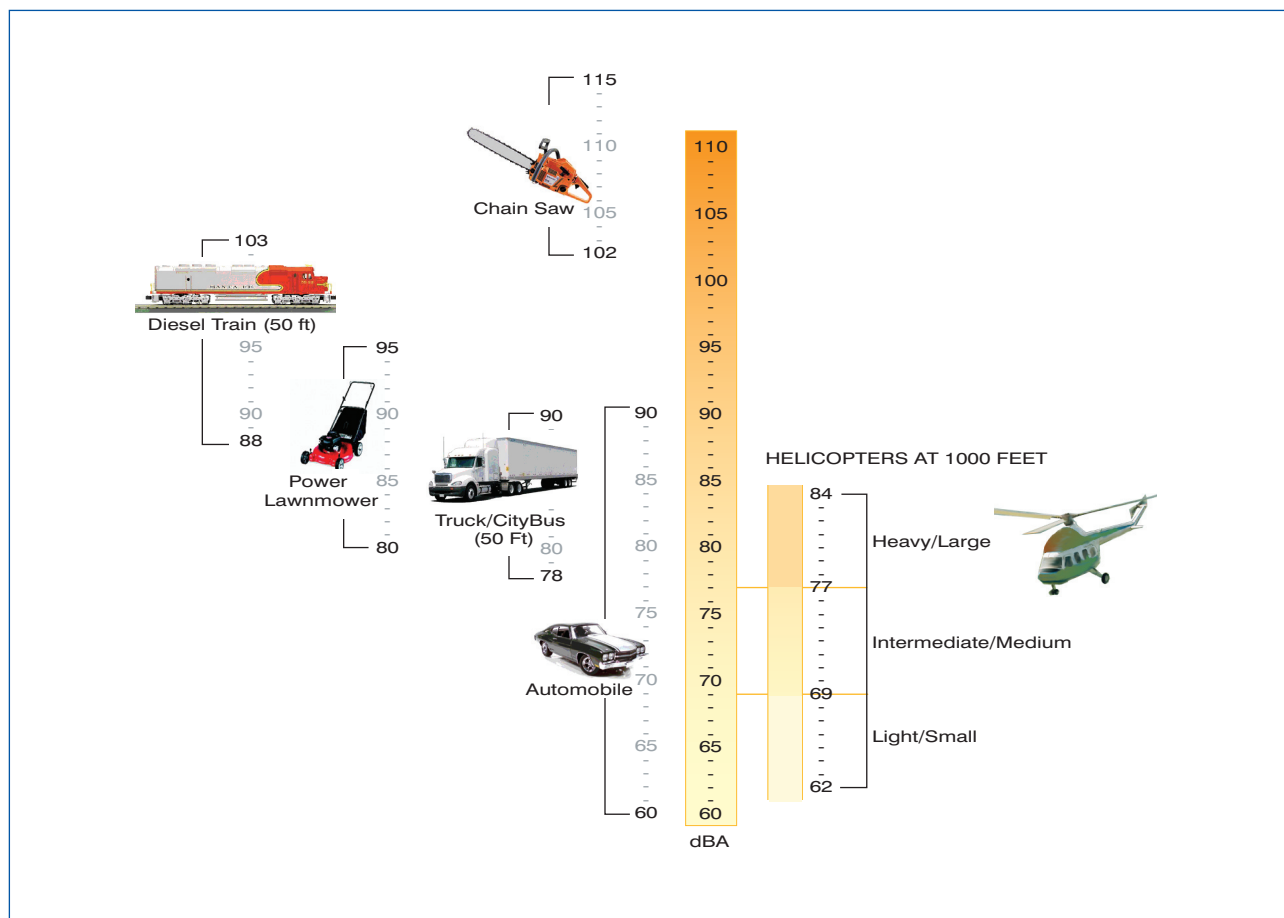
Illustrative Noises

| dB(A) | Overall Level | Community (Outdoors) | Home or Industry (Indoors) | Human Judgment of Loudness |
|-------|----------------------|---|--|----------------------------|
| 130 | uncomfortably loud | military jet takeoff from aircraft carrier at 50ft (130) | | |
| 120 | | | Oxygen Torch (121) | 120dB(A) 32 times as loud |
| 110 | very loud | turbofan aircraft takeoff at 200ft (118) | riveting machine (110) rock-and-roll band (108-114) | 110 dB(A) 16 times as loud |
| 100 | | Jet flyover at 1,000 ft (103) | | 100dB(A) 8 times as loud |
| 90 | | Power mower (95) | newspaper press (97) | 90dB(A) 4 times as loud |
| 80 | moderately loud | car wash at 20 ft (89) diesel truck at 40mph at 50ft (84) high urban ambient sound (80) | food blender (88) milling machine (85) garbage disposal (80) | 80dB(A) twice as loud |
| 70 | | car at 65mph at 25ft (77) | living room music (76) TV audio, vacuum cleaner (70) | 70dB(A)[reference] |
| 60 | | A/C unit at 100ft (60) | electric typewriter at 10ft (64) dishwasher (rinse) at 10ft (60) conversation (60) | 60dB(A) half as loud |
| 50 | quiet | large transformer at 100ft (50) | | 50 dB(A) 1/4 as loud |
| 40 | | bird calls (44) lower limit of urban ambient sound (40) | | 40dB(A) 1/8 as loud |
| 10 | just audible | | | |
| 0 | threshold of hearing | | | |

Figure A2 provides some basis for comparing helicopter sound levels to other familiar sounds. Comparisons are made at representative distances from each sound source.

Figure A2

Comparison of
Sounds



The sound level is, however, only one of the aspects to be considered since the character of the sound - or the impulsive character of the sound - can be equally important. Fortunately, the impulsive character of the sound, as well as the actual level, can be controlled by using noise abatement procedures.

FAA Advisory Circular AC 91.36D

Date: September 17, 2004 AC No: 91-36D

Subject: VISUAL FLIGHT RULES (VFR) FLIGHT NEAR NOISE-SENSITIVE AREAS

Initiated by: ATO-R

1. **PURPOSE.** This Advisory Circular (AC) encourages pilots making VFR flights near noisesensitive areas to fly at altitudes higher than the minimum permitted by regulation and on flight paths that will reduce aircraft noise in such areas.
 2. **EFFECTIVE DATE.** This advisory circular is effective on September 17, 2004.
 3. **CANCELLATION.** Advisory Circular 91-36C, Visual Flight Rules (VFR) Flight Near Noise Sensitive Areas, dated October 19, 1984, is cancelled.
 4. **AUTHORITY.** The FAA has authority to formulate policy regarding use of the navigable airspace (Title 49 United States Code, Section 40103).
 5. **EXPLANATION OF CHANGES.** This AC has been updated to include a definition of “noisesensitive” area and add references to Public Law 100-91; the FAA Noise Policy for Management of Airspace Over Federally Managed Lands, dated November 1996; and the National Parks Air Tour Management Act of 2000, with other minor wording changes.
 6. **BACKGROUND.**
 - a. Excessive aircraft noise can result in annoyance, inconvenience, or interference with the uses and enjoyment of property, and can adversely affect wildlife. It is particularly undesirable in areas where it interferes with normal activities associated with the area’s use, including residential, educational, health, and religious structures and sites, and parks, recreational areas (including areas with wilderness characteristics), wildlife refuges, and cultural and historical sites where a quiet setting is a generally recognized feature or attribute. Moreover, the FAA recognizes that there are locations in National Parks and other federally managed areas that have unique noise-sensitive values. The Noise Policy for Management of Airspace Over Federally Managed Areas, issued November 8, 1996, states that it is the policy of the FAA in its management of the navigable airspace over these locations to exercise leadership in achieving an appropriate balance between efficiency, technological practicability, and environmental concerns, while maintaining the highest level of safety.
 - b. The Federal Aviation Administration (FAA) receives complaints concerning low flying aircraft over noise sensitive areas such as National Parks, National Wildlife Refuges, Waterfowl Production Areas and Wilderness Areas. Congress addressed aircraft flights over Grand Canyon National Park in Public Law 100-91 and commercial air tour operations over other units of the National Park System (and tribal lands within or abutting such units) in the National Parks Air Tour Management Act of 2000.
 - c. Increased emphasis on improving the quality of the environment requires a continuing effort to provide relief and protection from low flying aircraft noise.
 - d. Potential noise impacts to noise-sensitive areas from low altitude aircraft flights can also be addressed through application of the voluntary practices set forth in this AC. Adherence to these practices is a practical indication of pilot concern for the environment, which will build support for aviation and alleviate the need for any additional statutory or regulatory actions.
 7. **DEFINITION.** For the purposes of this AC, an area is “noise-sensitive” if noise interferes with normal activities associated with the area’s use. Examples of noise-sensitive areas include residential, educational, health, and religious structures and sites, and parks, recreational areas (including areas with wilderness characteristics), wildlife refuges, and cultural and historical sites where a quiet setting is a generally recognized feature or attribute.
 8. **VOLUNTARY PRACTICES.**
 - a. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.
 - b. Pilots operating noise producing aircraft (fixed-wing, rotary-wing and hot air balloons) over noisesensitive areas should make every effort to fly not less than 2,000 feet above ground level (AGL), weather permitting. For the purpose of this AC, the ground level of noise-sensitive areas is defined to include the highest terrain within 2,000 feet AGL laterally of the route of flight, or the uppermost rim of a canyon or valley. The intent of the 2,000 feet AGL recommendation is to reduce potential interference with wildlife and complaints of noise disturbances caused by low flying aircraft over noise-sensitive areas.
 - c. Departure from or arrival to an airport, climb after take-off, and descent for landing should be made so as to avoid prolonged flight at low altitudes near noise-sensitive areas.
 - d. This advisory does not apply where it would conflict with Federal Aviation Regulations, air traffic control clearances or instructions, or where an altitude of less than 2,000 feet AGL is considered necessary by a pilot to operate safely.
 9. **COOPERATIVE ACTIONS.** Aircraft operators, aviation associations, airport managers, and others are asked to assist in voluntary compliance with this AC by publicizing it and distributing information regarding known noise-sensitive areas.
- Signed

Sabra W. Kaulia

The Portland Public Heliport Noise Abatement Program

In 1989, the city of Portland, Oregon and the Northwest Rotorcraft Association decided to build a heliport to provide direct air access to downtown Portland. During hearings to approve the facility, concern was expressed about the resulting noise increase in the area surrounding the heliport. In response to this concern, the following noise abatement program was put into effect:

Noise Abatement

Pilots are requested to utilize the following noise abatement procedures, whenever possible. Of course, it is the pilot's responsibility on each flight to determine the actual piloting techniques necessary to maintain safe flight operations.

1. *Flight Paths:* Maintain approach and departure paths over rivers and freeways. Avoid residential neighborhoods, the McCormick Pier Apartments, the convention center towers, and the piers for the Steel Bridge. Approach and depart over the Morrison, Broadway, and Grand Avenue bridges. [A map is provided with those features marked.]
2. *Steep Departure:* Depart at Vy (best rate of climb) when possible.
3. *Steep Approach:* Use steep approach angle when possible (PLASI is set for a 10° approach).
4. *Night Operations:* Avoid night approach from the north, as it passes near the McCormick Pier Apartments.
5. *Minimize Ground Operations:* Minimize the duration of warm-up or cool-down periods (typically two to three minutes). Do not idle at the heliport for prolonged periods.
6. *Avoid High Noise Regime:* Most helicopters have a high noise regime near a descent profile of 70 knots at 300 fpm. Pilots can avoid descending through this area by initiating the descent at a higher speed than normal.
7. *Gradual and Smooth Control Inputs:* Gradual and smooth control inputs result in reduced noise impact.
8. *Avoid Steep Turns:* Avoidance of steep turns result in reduced noise impact.
9. *Enroute Altitude:* Whenever possible, maintain 2,000 feet above ground level over residential neighborhoods and other noise-sensitive properties, as per FAA AC 91-36 "VFR Flight Near Noise-Sensitive Areas."
10. *Fly Neighborly:* Refer to the HAI Fly Neighborly Program for additional information on how to minimize helicopter noise impact.

Citizen concerns about helicopter noise emanating from the Portland Heliport should be brought to the attention of the Northwest Rotorcraft Association by calling 503-286-0927. All noise complaint calls will be logged. If the caller can identify the helicopter involved, follow-up calls will be made to the involved helicopter pilot and then back to the concerned citizen.

The Bureau of General Services maintains a Portland Heliport Noise Abatement Committee. When noise issues at the heliport cannot be easily resolved, the committee will be convened to assist in the resolution process, and the logs reviewed for pertinent information.

As concerns noise abatement of helicopter traffic in other parts of the city, it is noted that the Port of Portland has developed a plan of preferred helicopter flight routes for use in the greater Portland metropolitan area, especially as concerns helicopter traffic to and from Portland International Airport and Portland Hillsboro Airport. This program has been very successful and the heliport is still operating today.

The acronyms used in this Guide are defined below.

AGL Above Ground Level

BVI Blade-Vortex Interaction

dB Decibels, the basic unit for measuring the level of sounds.

dB(A) A-weighted sound level. A sound pressure level that has been weighted to approximate human hearing response to sound of different frequencies. Weighted sound pressure levels, such as the “A” weighting, are currently used for noise certification of light helicopters and small propeller-driven aircraft. In FAA Advisory Circular 36-3C, they are used as the basis for airport access restrictions that discriminate solely on the basis of noise level.

DNL Day-night sound level. A single-number measure of community noise exposure (expressed in the unit Ldn), introduced to help predict the effects on a population of the average long-term exposure to environmental noise. It is based on the equivalent sound level (Leq), but corrects for night-time noise intrusion. A ten-decibel correction is applied to noises heard between 10 P.M. and 7 A.M. to account for the increased annoyance of noises heard at night.

DNL uses the same energy equivalent concept as Leq. The specified time integration period is 24 hours. For assessing long-term exposure, the yearly average DNL is the specified metric in the FAA 14 CFR Part 150 noise compatibility planning process.

EPNL Effective perceived noise level. A measure of complex aircraft noise, expressed in decibels, that approximates human annoyance responses. It corrects for the duration of the noise event and the presence of audible pure tones and discrete frequencies such as the whine of a jet aircraft. The EPNL is used by the FAA as the noise certification metric for large transport and turbojet airplanes, as well as for helicopters.

fpm Feet per minute. A measure of speed used for the rate-of-climb or rate-of-descent of an aircraft.

KIAS Knots indicated airspeed. A measure of the speed of an aircraft.
[1 knot = 1.69 ft/sec = 101.3 ft/min = 1.15 mile/hour]

Leq Equivalent sound level expressed in decibels. The energy average noise level (usually A-weighted) integrated over some specified time. The purpose of Leq is to provide a single-number measure of noise level averaged over a specific period of time. When use for assessing community noise, Leq is normally defined over a 16 or 24 hour period.

mph Miles per hour. A measure of speed. [1 mph = 0.87 Knots]

PNL Perceived noise level. A rating of noisiness used in assessing aircraft noise, expressed in decibels. PNL is computed from sound pressure levels measured in octave or one-third octave frequency bands. An increase of ten decibels in PNL is equivalent to doubling the perceived noisiness. Currently, this measure is used by the FAA and foreign governmental agencies in the noise certification process for all turbojet-powered aircraft, and large propeller-driven transports.

R/C Rate of climb. The speed at which an aircraft is ascending.

R/D Rate of descent. The speed at which an aircraft is descending.

RPM Rotor revolutions per minute. The rotational speed at which an aircraft rotor is turning.

SEL Sound exposure level. A measure, expressed in decibels, of the effect of duration and magnitude for a single event. In typical aircraft noise model calculations, SEL is used in computing aircraft acoustical contribution to the equivalent sound level (Leq) and the day-night sound level (DNL).

Fly Neighborly Guide

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