

## Grand Canyon Working Group Glossary of Terms/Acronyms

### **A-Weighting**

See “Weighting.”

### **Acoustics**

The science of sound.

### **Acoustic Zone**

Areas with similar vegetation, terrain, animals, and weather likely have similar acoustic characteristics, including sound sources and sound attenuation characteristics. These areas are referred to as “acoustic zones” and may be helpful in describing acoustic conditions in areas with similar characteristics.

### **Ambient Sound Conditions**

Many different soundscapes occur in national parks. In some areas, natural sounds predominate, while in others, both natural and non-natural sounds occur. In order to understand and management soundscapes, ambient conditions for different soundscapes need to be acoustically described. Definitions of common ambient sound conditions are provided below.

#### **Ambient Sound, Existing.**

All sounds in a given area (includes all natural and non-natural sounds).

#### **Ambient Sound, Natural.**

All natural sounds in a given area, excluding all non-natural sounds. Natural ambient sound is considered synonymous with the term “natural quiet,” although natural ambient sound is more appropriate because nature is often not quiet.

### **Amplitude**

The instantaneous magnitude of an oscillating quantity such as sound pressure. The peak amplitude is the maximum value.

### **Attenuation**

The reduction of sound intensity by various means (e.g., air, humidity and porous materials).

### **Area of Audibility**

The area within which a specific sound or sounds is audible.

### **Audibility**

Audibility is the ability of humans and animals with normal hearing to hear a given sound. Audibility is affected by the hearing ability of the individual, other simultaneous interfering sounds or stimuli, and by the frequency content and amplitude of the sound.

**Audiogram**

A graph showing hearing acuity as a function of frequency and amplitude.

**Commercial Aviation**

The commercial sector of the aviation industry that consists of air carriers providing transportation for hire for passengers and cargo in domestic and international service. Commercial aviation includes air carriers that operate large passenger or cargo jets and regional/commuter/charter carriers operating smaller aircraft.

**Cooperating Agency**

An agency or tribal government that has jurisdiction by law or has special expertise with respect to an environmental issue and cooperatively works with the lead agency to prepare an environmental impact statement.

**Decibel (dB)**

A logarithmic measure of any measured physical quantity and commonly used in the measurement of sound. The decibel provides the possibility of representing a large span of signal levels in a simple manner as opposed to using the basic unit Pascal. The difference between the sound pressure for silence versus a loud sound is a factor of 1,000,000:1 or more, therefore it is less cumbersome to use a small range of equivalent values: 0 to 130 decibels.

Doubling of Sound Pressure = 6 dB

Doubling of Sound Power = 3 dB

Doubling of Perceived Sound Level = 10 dB (approximately)

**Detectability**

Noise that can be detected by a human on the ground who is actively listening. This is the measure of whether aircraft noise is audible in backcountry areas of Grand Canyon National Park.

**Energy Equivalent Sound Level ( $L_{eq}$ )**

The level of a constant sound over a specific time period that has the same sound energy as the actual (unsteady) sound over the same period.

**Environmental Impact Statement (EIS)**

A detailed written analysis of the potential environmental impacts of a proposed Federal action or decision that would significantly affect the environment, consistent with the requirements of the National Environmental Policy Act of 1969.

**Events per Hour**

The number of times a non-natural sound source is heard, on average, in one hour (this may be specific to a particular human-caused sound or to all human-caused sounds).

**Federal Interagency Committee on Aviation Noise (FICAN)**

A committee formed in 1993 to provide forums for discussion of public and private sector proposals on aviation noise and to identify and encourage needed research. All Federal agencies concerned with aviation noise are represented on the committee, including the Department of Defense (Air Force, Army, Navy), Department of Interior (NPS), Department of Transportation (FAA), Environmental Protection Agency, National Aeronautics and Space Administration, and Department of Housing and Urban Development.

**Frequency**

The number of times per second that the sine wave of sound repeats itself. It can be expressed in cycles per second, or Hertz (Hz). Frequency equals Speed of Sound / Wavelength.

**GCNP Quiet Aircraft Technology**

Reasonably achievable noise requirements for commercial air tour aircraft operating in Grand Canyon National Park to be considered as employing quiet technology. These requirements and the identification of aircraft that meet them are in a final rule published by FAA in the Federal Register on March 29, 2005.

**General Aviation**

The private sector of the aviation industry that consists of privately owned and operated aircraft that are not for hire. Aircraft size and range vary widely from small single engine aircraft to large jet aircraft.

**Hearing Range (human)**

An average healthy young person can hear frequencies from approximately 20 Hz to 20000 Hz, and sound pressure levels from 0 dB to 130 dB or more (threshold of pain).

**Human-caused Sound**

Any sound that is attributable to a human source. This term may be used interchangeably with “non-natural,” “human-made,” “man-caused,” or “man-made” sound.

**Infrasound**

Frequencies below 20 Hz. Humans perceive frequencies below about 20 Hz as pressure rather than sound.

**Instrument Flight Rules (IFR)**

Rules governing the conduct of flight using instruments and air traffic services to avoid obstacles, terrain, and other air traffic.

**Integrated Noise Model Version 6.2 (INM 6.2)**

FAA’s computer model for calculating aircraft noise. Version 6.2 of INM includes the capability to calculate aircraft audibility.

**Intensity**

The sound energy flow through a unit area in a unit time.

**Joint Lead Agency**

An agency that jointly supervises the preparation of an environmental impact statement with another agency.

**Loudness**

The subjective judgment of intensity of a sound by humans. Loudness depends upon the sound pressure and frequency of the stimulus.

**Masking**

The process by which the threshold of audibility for a sound is raised by the presence of another (masking) sound. A masking sound is one that renders inaudible or unintelligible another sound that is also present.

**National Environmental Policy Act (NEPA)**

Legislation that establishes a national policy for the environment and that requires the preparation of an environmental impact statement for major Federal actions significantly affecting the environment.

**National Parks Overflights Advisory Group (NPOAG)**

An advisory group of representatives of FAA, NPS, general aviation, air tour operators, environmental concerns, and Indian tribes established by the Air Tour Management Act of 2000 to provide continuing advice and counsel with respect to commercial air tour operations over and near national parks.

**Natural Quiet**

All natural sounds in a given area, excluding all non-natural sounds. See Ambient Sound, Natural.

**Noise**

Traditionally, noise has been defined as unwanted, undesired, or unpleasant sound. This makes noise a subjective term. Sounds that may be unwanted and undesired by some may be wanted and desirable by others. The appropriateness of any sound in a given area of a park will depend on a variety of factors, including the management objectives of that area.

**Noise Contours**

Continuous lines on a map connecting all points of the same noise exposure level.

**Noise Floor**

The lowest amplitude measurable by sound monitoring equipment. Most commercially available sound level meters and microphones can detect sound levels down to about 15 to 20 dBA; however, there are microphones capable of measuring sound levels below 0 dBA.

**Noise-Free Interval**

The length of time during which only natural sounds are audible.

**Notice of Proposed Rulemaking (NPRM)**

A draft of a proposed rule for public input and comment. Under the Administrative Procedures Act, in most cases before a Federal agency may adopt a final rule, the agency must publish in the Federal Register a draft rule and seek public comment. An NPRM contains a preamble that describes the rule and its purpose, commenting information and deadlines, and the text of the proposed rule.

**Noticeability**

Noise that can be noticed by a human on the ground who is not necessarily actively listening. This is the measure of whether aircraft noise is audible in developed areas of Grand Canyon National Park.

**Octave Band, One-Third**

A frequency band whose cutoff frequencies have a ratio of 2 to the one-third (approximately 1.26). One-third octave bands reflect reasonably the ability of humans to differentiate tones.

**Peak Day**

The day of the highest amount of aircraft activity. Modeling aircraft noise based on the peak day of activity should assure that substantial restoration of natural quiet is achieved on any given day.

**Percent Exceedence ( $L_x$ )**

These metrics are the sound levels ( $L$ ), in decibels, exceeded  $x$  percent of the time. The  $L_{50}$  value represents the sound level exceeded 50 percent of the measurement period.  $L_{50}$  is the same as the median. The  $L_{90}$  value represents the sound level exceeded 90 percent of the time during the measurement period.

**Signal-to-Noise Ratio (SNR)**

The ratio between the amplitude of a signal (meaningful information) and the amplitude of background noise. Because many signals have a very wide dynamic range, SNRs are often expressed in terms of the logarithmic decibel scale.

**Sound**

A wave motion in air, water, or other media. It is the rapid oscillatory compressional changes in a medium that propagate to distant points. It is characterized by changes in density, pressure, motion, and temperature as well as other physical properties. Not all rapid changes in the medium are sound (wind distortion on a microphone diaphragm).

**Soundscape**

Soundscape refers to the total acoustic environment associated with a given area. In a national park setting, soundscapes can be composed primarily of natural sounds, or they can be composed of both natural and non-natural sounds.

**Sound Exposure Level (SEL)**

The total sound energy of an actual sound calculated for a specific time period. SEL is usually expressed using a time period of one second. This metric is useful in comparing two sounds that differ in amplitude and duration. A very long, very low level sound may have the same 1-second SEL as a very short, very loud sound.

**Sound Level**

Generally, sound level refers to the *weighted* sound pressure level obtained by frequency weighting, usually A- or C-weighted.

**Sound Pressure**

Fluctuations in air pressure caused by the presence of sound waves. Sound pressure is the instantaneous difference between the actual pressure produced by a sound wave and the average barometric pressure at a given point in space. Sound pressure is measured in Pascals (Pa), Newtons per square meter, which is the metric equivalent of pounds per square inch.

**Sound Pressure Level (SPL)**

The logarithmic form of sound pressure. It is also expressed by attachment of the word decibel to the number.

**Sound Speed**

The speed of sound in air is about 344 m/sec (1,130 ft/sec or 770 mph) at 70° F at sea level. It substantially varies depending on temperature and type of medium.

**Special Federal Aviation Regulation (SFAR)**

A regulation adopted by FAA for unique and specific situations. SFARS generally have expiration dates that can be extended. SFAR 50-2 is the rule which created a Special Flight Rules Area (SFRA) over the Grand Canyon.

**Special Flight Rules Area (SFRA)**

A portion of airspace, with both vertical and lateral dimensions, wherein special operational rules and restrictions apply. The Grand Canyon SFRA overlies Grand Canyon National Park and surrounding lands. It extends vertically to 18,000 feet above sea level.

**Spectrum (Frequency Spectrum)**

The amplitude of sound at various frequencies. It is given by a set of numbers that describe the amplitude at each frequency or band of frequencies.

**Substantial Restoration of Natural Quiet**

A legislatively mandated requirement associated with recommendations by the Secretary of the Interior with respect to aircraft noise at Grand Canyon National Park. Substantial restoration of natural quiet has been further clarified by NPS as the achievement of natural quiet (i.e., no aircraft audible) in 50 percent or more of the park for 75-100 percent of any given day.

**Time Above Natural Ambient**

The amount of time that sound levels from non-natural sounds are greater than sound levels of natural sound levels.

**Time Audible**

The amount of time that various sound sources are audible to animals, including humans, with normal hearing (hearing ability varies among animals).

**Ultrasound**

Sounds of a frequency higher than 20,000 Hz.

**Visual Flight Rules (VFR)**

Rules pilots may operate under in appropriate airspace when weather meets certain criteria allowing ample visual ability to see and avoid other aircraft, obstacles, and terrain.

**Wavelength**

Wavelength is the distance a wave travels in the time it takes to complete one cycle. A wavelength can be measured between successive peaks or between any two corresponding points on the cycle.  $\text{Wavelength (ft)} = \text{Speed of Sound (ft)} / \text{Frequency (Hz)}$ .

**Weighting**

Adjustment of sound level data to achieve a desired measurement. A-Weighting is used to account for changes in human hearing sensitivity as a function of frequency. The A-weighting network de-emphasizes the high (6.3 kHz and above) and low (below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an effort to simulate the relative response of human hearing. C-Weighting is linear over the mid frequency range from 200 Hz to 1.6 kHz, and de-emphasizes the low (below 200 Hz) and high (above 1.6 kHz) frequencies.

**Windscreen**

A porous device used to cover the microphone of a sound level measurement system. Windscreens are designed to minimize the effects of wind disturbance on the sound levels being measured while minimizing the attenuation (<0.5 dB) of the signal. When using windscreens that attenuate sound levels >0.5 dB, the amount of attenuation for each one-third octave band must be known and corrections applied.

**Acronyms**

dB	decibel
EIS	Environmental Impact Statement
FICAN	Federal Interagency Committee on Aviation Noise
INM 6.2	Integrated Noise Model Version 6.2
IFR	Instrument Flight Rules
NEPA	National Environmental Policy Act
NPOAG	National Parks Overflights Advisory Group
NPRM	Notice of Proposed Rulemaking
SFAR	Special Federal Aviation Regulation
SFRA	Special Flight Rules Area
VFR	Visual Flight Rules