Sound Control Manual (4/99)

This manual is organized into five chapters:

1) Personnel

2) Equipment

3) Location

4) Operation

5) Anomalies

Philosophy-Sound control is not a popular subject with drivers or officials, so why does it exist?

* The GCR requires it.
* If we do not set our house in order, some day the local sheriff will show up with a sound meter - or perhaps even a cease and desist injunction.

In simple terms, the choice is: not "racing with sound control" -or - "racing without sound control"; the choice is really "racing with sound control" - or = "not racing at all".

* Many times we hear the lament: Why do we need sound control "way out here"? Alternate question: If we do not have any sound control "way out here" what will happen when a local competitor travels to a venue where sound control is enforced? For instance: Laguna Seca, Portland, Waterford Hills, Bridgehampton.

Chapter 1) - PERSONNEL 1.1)

TRAINING Day One

1.) Review GCR rules, SCCA Sound Manual and the meter Manual.
2.) Demonstrate how and where the Sound Level Meter is set up to take readings, specifically identifying switch settings.
3.) Demonstrate Battery Check and Field Calibration procedures.
4.) Review criteria for site selection.
5.) Identify requirements for separation between adjacent race vehicles for valid readings. Technically, the sound level should drop 6 dB between closely following vehicles.
6.) Identify the "Action Zone" for separation between closely following racecars to ensure valid readings.
7.) Discuss procedures for reporting sound violations over the Land Line or over the Radio Net.
8.) Trainee observe sound crew: in action.
9.) Allow trainee to listen to communications net via a listen only headset, if possible.
10.) With an experienced sound crewman reading the sound meter to ensure valid, accurate readings, have the trainee record sound readings during non critical sessions where violations are unlikely. The instructor should monitor the trainee extremely closely -alert for any potential error:
   * Right dB - Wrong Car
   * Legible handwriting (Is that a "one" or a "seven"?
   * Transposed car numbers
   * Emphasize: If not absolutely certain - DO NOT RECORD!!
0.) Ultimately entrust the trainee with the sound meter to measure the vehicle sound levels during non critical sessions. The sound chief should be especially watchful to ensure validity and correctness.
1.) Explain procedures for licensing and the requirements and procedures for license upgrades.

1.2) TRAINING Day Two

1.) Repeat, but have trainee do the setup of the microphone stand, meter settings, and perform the Field Calibration.
2.) Under extremely close supervision, let the trainee begin operating, but not making communication link calls yet.
3.) Absolutely most important, the Chief of Sound is totally responsible for the performance of his crew. Whenever trainees are operating in any capacity, the chief should be actively supervising.

1.3) LICENSING

1.) Log Book - First day of training
2.) Regional License -If the trainee returns for the second day
3.) Divisional License - When the trainee is able to set up the station and operate for the weekend without any assistance.
4.) National License - If the sound control crewman is willing to discuss sound problems with irate drivers, local enforcement agencies, and/or concerned Stewards. This is a protective measure; the crewman may be quite willing to operate the station, but the abusive environment of a confrontation will would not be acceptable.

Chapter 2) - EQUIPMENT

2.1) SOUND LEVEL METER - The American National Standards Institute has established the specifications and requirements for sound level (deciBel) meters. Various state and federal regulations and the Society of Automotive Engineers all mandate the use of a meter meeting or exceeding ANSI 51.4 (1971) - type 2 or type 2A.

The A weighting frequency response setting on the sound meter is universally designated for vehicle passby measurements. This A weighting is specified at 34 discrete frequencies from 10 Hertz to 20 kiloHertz. ANSI specifies the tolerance for matching this curve for the various types of sound meter. Typically, a type 2 meter will cost about as much as a set of racing tires. Beware. Hobby shops sell very cheap sound meters which do not meet any accuracy specifications. The microphone for a sound meter is mechanically designed for its intended application. To this end, there are three distinct physical designs:

* Free Field * Diffuse Field * Pressure Field

For passby measurements, the proper unit is a Free Field microphone. Aim it directly at the target.

2.2) FIELD CALIBRATOR - The manufacturers of precision sound meters (as specified by ANSI) also sell field calibration equipment specifically matched to their line of microphones. This calibrator is a relatively simple device consisting of: battery - precision oscillator - miniature speaker - and a carefully designed coupling air space between the loudspeaker and the microphone. The sound generated within this coupler is thus terminated within this tightly controlled "loading volume". Variation in this coupling volume from design can lead to calibration inaccuracies; this is why it is essential to fully insert the microphone into the calibrator. Because of this critical coupling volume, it is unlikely that calibrating a hobby shop meter with a precision calibrator will result in acceptable accuracy. Typically, the calibrator generates a specified sound level at a specific frequency.

2.2.1) Annual Lab Recertification - Both the sound meter and its field calibrator (and your extension cable, if possible) shall be returned to a testing laboratory which has their equipment traceable back to the National Institute for Standards and Testing (formerly the National Bureau of Standards). This annual checkup will verify that the meters performance across the frequency band remains within ANSI specifications. The calibrator is also certified to be producing the proper frequency and sound level. If the calibrator is off, guess what that does to your sound readings.

2.3) TAPE MEASURE - A tape measure of at least 25 feet shall be available to verify the microphone location.

2.4) THERMOMETER - Since drivers and officials will frequently want to know why sound readings may vary, recording the ambient temperature (and humidity) will help them to better predict sound levels in the future. See also the April 1997 issue of Sports Car, page 30.

2.5) BAROMETER - Similarly, recording barometric pressure will help competitors cope with sound control. It is desirable to always use the same barometer and never attempt to adjust the instrument, as this will give the maximum stability. The absolute value of the pressure is not especially critical, but the relative change is paramount.

Chapter 3) -LOCATION

Probably the single most important task that the sound control crew will ever attempt is the selection of the sound control site. In order that the site achieve stability day - to - day, the microphone must be located in the same place every time. In order for the site to achieve credibility, the site must be sufficiently free of geographic effects which might affect the sound readings adversely. These guidelines for selection and subsequent certification are designed to ensure that the site will be beyond meaningful challenge.

3.1) SITE SELECTION GUIDELINES

3.1.1) Consistent line - The entry to a slow turn is fairly well defined, especially if braking and even down shifting are required. A full throttle apex is another opportunity. The racing line at the exit of a turn is usually fairly well defined simply because the drivers will most likely try to carry too much speed thru the turn and are at risk for falling off the track. Unfortunately, they may not get to full throttle until farther down track.

3.1.2) Outside Edge - It is preferred, but not mandatory, that the sound station be located on the outside of the track surface.

3.1.3) Propagation paths - Sound propagation is influenced by the ground texture and composition; it is desirable to minimize the effects of these potential variables by selecting the microphone location such that the majority of the sound path is over asphalt (for uniformity and repeatability). Consistently hard earth is a reasonable alternative. Soft earth or grassy fields may contribute an undesirable variability; this variability could reduce the apparent sound level of the racecars.

3.1.4) Line of Sight - The monitoring station should allow the operator a reasonably clear view of approaching traffic so as to enable timely identification of car numbers as well as anticipate inseparable traffic groups.

3.1.5) Full Throttle - It is mandatory that the measurements be taken while the vehicles are at full throttle. Part throttle readings may make the competitor happy "this" weekend, but the next venue will annoy him when they take true readings and he is penalized.

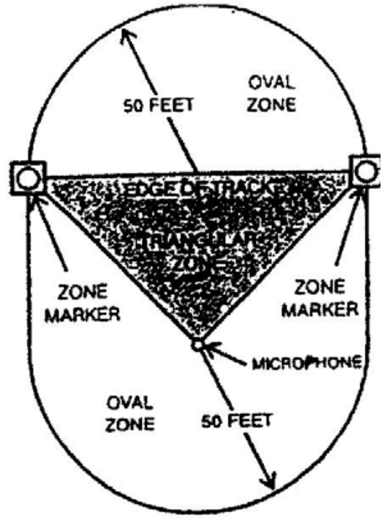
3.1.6) Shift Points - Inevitably, some vehicles will have their shift points within the measurement zone, but try to avoid the area where the majority of the louder cars are shifting.

3.1.7) Safe - Above all, the operator(s) must be safe. The operator cannot be constantly aware of potentially inbound vehicles or dangerous debris. The operator should probably be safely remote from the microphone, using 25 or even 50-foot extension cables. Secondarily, the microphone should also be reasonably safe from impact; the microphone is unusually expensive.

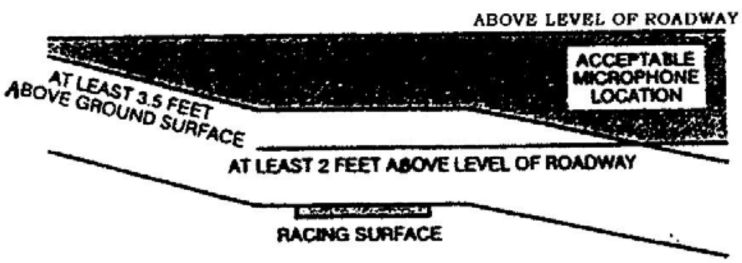
3.1.8) Comfortable - Monitoring sound demands considerable concentration. It is desirable to provide a seated, shaded work place for the operator. Safe, comfortable alternatives would be a permanent shelter or a parked automobile.

3.2) SITE CERTIFICATION - The site certification process shall document the location of the sound station on a track diagram which clearly identifies the approximate location with respect to nearby turns and flag stations. The document shall identify any nearby objects (concrete walls, railings, fences, tire walls, structures, etcetera) as discussed above. Include any objects (photos are desirable) of concern. Note the two examples (Figures 3.2) -1 & -2). Distances to all features should be included. If the location appears acceptable, the National Administrator shall provisionally approve the location. Final approval will await evaluation of the site certificate and analysis of the site calibration data. The National Administrator or his designee shall reviews the diagrams and photos for acceptability (A process similar to vehicle homologation). This acceptance will confirm that the geographic surroundings do not have a significant effect upon the sound readings.
Figure 3.1) -1 identifies the oval zone and the triangular zone is used by various agencies in describing apparent anomalies that are and are not acceptable within the measurement site. Section 3.2) outlines the process for acceptability of a sound station. The Site Certification report will identify any of the following items for evaluation by the National Administrator.

Figure 3.2 -1 Microphone Area Terminology



Site selection



Microphone location

SOUND CONTROL STATION CORNER
STATION 9 HEARTLAND PARK, TOPEKA

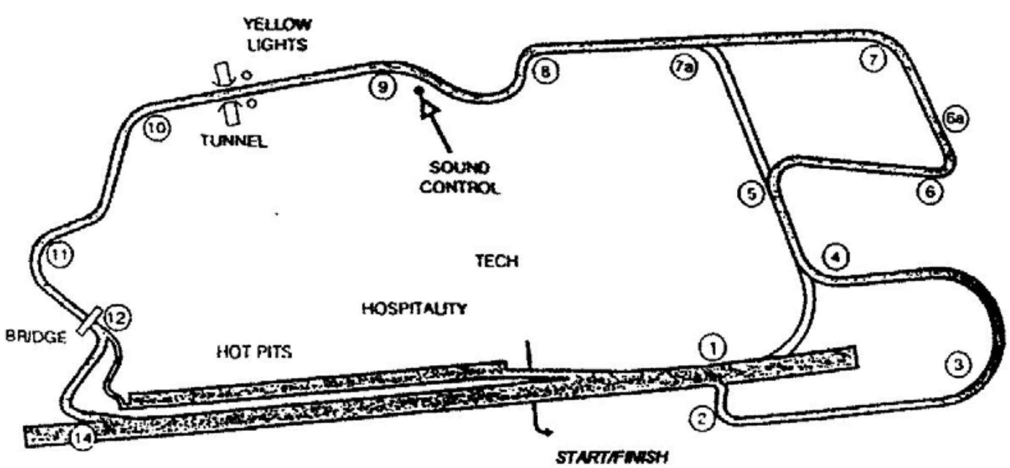
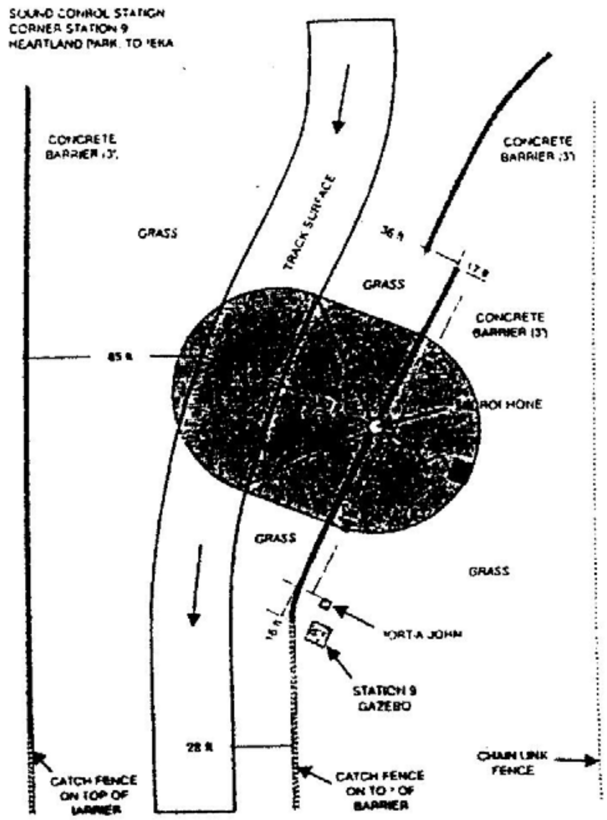


Figure 3.2) -2b Typical Site Certification Diagrams



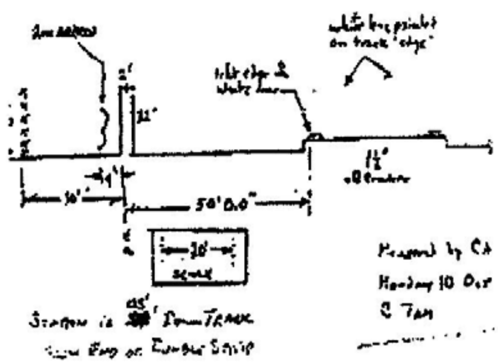


Figure 3.2) -3 Typical "Flat Terrain" diagram

As a rule of thumb, if possible, we want to avoid sound reflections or sound masking near the measurement site. Try to avoid "facing walls" beyond and close to the target vehicle. Ask if these items are closer to the target than the microphone. Small walls in the vicinity may be tolerable - subject to acceptance of the Site Certification. One particularly gross violation of these guidelines occurred at a temporary street circuit where the microphone was 50 feet back from a high concrete retaining wall (perhaps 3 to 4 feet high) and the microphone was placed immediately in front of a two story cinder block building. There appeared to be no line of sight between the microphone and the racecar, and the adjacent wall caused extraordinary reflections.

* Acceptable objects inside the "OVAL ZONE"
  - -Small cylindrical objects (fire hydrants, telephone poles)
  - -Rural Mailboxes
  - -Curbs with vertical height less than one foot -Small bushes, shrubs, hedges
  - -Traffic railings
  - - Low Armco
  - - Solid concrete barriers (must be approved)
  - - Some barrier configurations may be acceptable

* Acceptable inside the "OVAL ZONE", but outside the "TRIANGULAR ZONE" -Any uniformly sloping surface less than 45 degrees from level
  - -Any object on the far side of the vehicle path not exceeding three feet in width, regardless of height and not slanting toward the roadway
  - -Any vertical surface, such as a billboard or with its lowest edge higher than 15 feet above the road surface

On flat terrain, the microphone should be placed nominally 3 to 4 feet above the local surface. If the terrain varies between the microphone and the racing surface; the most important criteria concerns the sound pathway. There are two distinct paths between the microphone and the target:

* The uninterrupted direct line of sight
* The uninterrupted reflected path off the racing surface between the target and the microphone.

Any specific concerns shall be noted in the Site Certification drawings and shall be addressed by the National Administrator in his evaluation. Figure 3.2) -3 shows a typical "flat terrain" diagram. Final approval will not occur until sufficient sound data sheets have been analyzed to ensure that the sound station is correctly located. Figure 3.2) -2 shows typical track diagrams. This requires sufficient annotation or inclusion of entry list information to identify racing classes with uniform sound signatures:

*SRF *F/Ford *F/Continental *F/Mazda *FVee *F500.

3.3) CALIBRATION

Because the GCR directs that the microphone be located 50 feet from the edge of the track (or the artificial markers indicating the track edge), the actual range to the average racing line can be considerably greater. For example, if the racing line happens to be along the opposite side of the track and the track is 35 feet wide - the recorded sound level could be considerably lower, Under these conditions, the driver may feel that he is safely under the limit by a few dB - until he travels to another track where his line is only 50 feet to the microphone. The following calibration procedures will attempt to develop driver advisories.

3.3.1) Site Calibration - Trackside, if the racing line is NOT 50 feet from the microphone.

1.) The sound crew observes the path of the racecars during several sessions to define the approximate racing line.

2.) Mark the approximate near side of the passing racecars using racers tape (NOT paint). If possible, place shorter tapes ten feet either side of the master tape to designate near side and far side.

3.) The sound crew now confirms their choice for the location of the master tape. If manpower is available, the crew might record tallies of cars passing "beyond", "right on", or "inside" the master tape.

4.) When the master tape's location has been confirmed to the crew's satisfaction, it is desirable to assemble other witnesses to confirm or adjust the tape location. Use the Stewards of the Meet, if possible.

5.) The sound crew and the witnesses shall then measure the distance of the master tape to the edge of the track and the distance from the master tape to the permanent microphone location. This report shall also note any potential reflective objects that are closer to the racing vehicles than the microphone.

6.) A special Sound Station Report supplement shall be generated for submission with the sound data sheets for the formal race report. Include the "certified" measurements - a track map showing the general location of the station - and a detailed cross sectional layout of the microphone station, racing surface, and nearby walls fences and other features within a couple of hundred feet of the site.

7.) At this point, it should be emphasized that some means of permanently marking the microphone position be made; since any relocation invites the inevitable racer's rebuttal: "I didn't change anything, you changed!"

If painted marks or stakes are not possible or permanent, the site certification document should include tape-measured distances from 2 or more permanent marks or features. For instance, Grattan has planted a concrete pad to permanently locate their microphone.

3.3.2) Site Calibration - Remote The National Administrator shall analyze the data and publish the average sound level reduction caused by target ranges greater than 50 feet. For example, the original Road Atlanta station had a charity of 4 dB, The current Laguna Seca station is exactly 50 feet from the racing line and has zero charity.

Chapter 4) - OPERATION 4.1)

SETUP

* Use a microphone stand similar to one you might see at a stage show to position the microphone. This type of stand is robust and not likely to suffer in gusty winds. Unfortunately, it is bulky and heavy, so it is a bit difficult to transport.

* A camera tripod is another choice, but it is more likely to get blown over. One sound crew uses a 1-gallon plastic anti-freeze jug filled with water as a ballast weight to secure their tripod.

* There should be some method to permanently locate the microphone in exactly the same place each day, otherwise it is possible that differences in the positioning could lead to unwanted variability in your readings. If a permanent marker is not possible or allowed, record a set of measured distances using more remote reference points.

* When you perform the field calibration, be sure to have the microphone connected to the meter with the cable in place.

* Position your zone markers (as detailed in paragraph 4.3) near the edge of the track 50 feet either side of the microphone line.

4.2) DATA SHEETS

It is necessary to include details-of the event on each of your data sheets in case stewards want to review a competitor’s performance. The data sheet should be able to stand on its own without the need to review several pages to get a complete picture.

4.2.1) Legibility - Ensure that your sound report does not create more questions than it answers. If there is a protest, your attendance at the hearings should not be required just to interpret your own handwriting. To this end, are you using a sharp pointed pen? or a stubby blunt pencil? Are your ones and sevens distinctly different? Are your sixes, eights, and nines sufficiently unique? Let us hope that you do not find yourself unable to read your own handwriting!

4.2.2) Content- Most regions have evolved their own unique preprinted forms. Most of these forms are reasonably complete, but in some cases, there is room for some improvement. The following information must be recorded on each sound sheet; the following required items can be divided into three categories:

* Event specific "E”
* Run Group specific "R"
* Session specific "S"

E Track - SARRC is a series, not a track, "March Madness" is an event Event -School - Regional - National - Enduro - SARRC etcetera Date - Day - Month - Year
Limit - What is the sound limit?
Site - Where is the sound station? "Exit, turn 3, driver's left"

R Group - Run group 1? 2? but also "Big bore""ITS. ITA, ITB. ITC" Class - At least once during the event, identify the class of each car, most specifically those classes identified for site calibration: SRF - FIF - F/C - FIM - FVee - F/500

S Session - Practice - Qualifying - Warm up - Race
Meteorological - Temperature and Barometric pressure, if available. Also indicate any adverse conditions: Raining, wet, etc.
Time - Time of start/end of session
Calibration - Time of field calibration
Crew - Name of meter reader - Name of Recorder

4.2.3) Structure of Data Sheets - Each chief of sound has usually used his own initiative to form his own sound data sheets. Occasionally, he might copy or even use forms used by nearby regions. There are really three distinctive styles:

* First Lap Random sequence
* Entry list Sequence
* Zero - to - 99 Sequence

1.) The First Lap Random Sequence is typical of a sounder's first efforts, especially if there has been NO prior experience. NO training, NO supervision. The sound report is usually written on a sheet of lined binder paper. The sounder, standing trackside, spots a car coming out of the pit lane and writes down the car number - dash - sound reading. This continues for the first lap and then things begin to get a bit tedious. The sequence of car numbers begins to shuffle as cars pass each other and new cars emerge. The sounder then is obliged to do a number search as each new reading is taken, which begins to get very time consuming. Eventually, the sounder will give up, which is unfortunate, since those first readings will probably not be representative of the ultimate levels. Also, some regions apparently have a policy to only take a single reading on each car without bothering to verify their sound levels. These early lap readings only provide a false sense of security.

2.) The Entry List Sequence is occasionally the next step in the evolution. With the evolution of sound control in 1985, the Atlanta Region started using the Entry list Sequence format. The format utilized a legal size sheet with space for three sessions: Practice - Qualifying - Race. When the Runoffs sound crew arrived, they retained the format. The Runoffs policy has been to post the readings after each session, which required that the entry list had to be transcribed for each session - each day.

3.) An alternate evolutionary step resulted into the "Zero to 99" worksheet which took care of the early entries as well as the late entries. After a few tries, the Runoffs crew changed to this format.

4.) San Francisco Region developed a very sophisticated version of the Entry list Sequence. Ten days before the event, the club office would mail a copy of the entry list to the sound chief. In an earlier format, the chief would manually transcribe Car Number, Car Class, and Car Color onto a set of sheets. Since trackside records would usually require more than one sheet for each run group, this would require hand transcription by the crew during the event. In any case, No Shows and Late Entries remained a problem. In a later version, the sound chief would enter the entry list into his personal computer and get preprinted sheets for each group. Since many regions' offices routinely develop their entry lists onto a diskette for delivery to the Chief Registrar, the ultimate step would have been semi automated sound sheet preparation.

4.3) RECORDING PROCESS

As cars approach the sound station, the crew should determine if the approaching car is sufficiently separated from nearby cars so that the sound reading will be valid.

4.3.1) Separation - If two cars are too close together, each individual car's sound level will contaminate the reading for the other. Federal guidelines and Highway Patrol procedures require that the sound level must drop significantly between closely following targets. Actually monitoring the moment-to-moment reading to verify this separation is not an easy task, especially with the more convenient meters with digital displays. To reduce the influence of nearby targets, the chief of sound shall establish a sound zone at the station. The sound chief shall place some form of marker 50 feet up track from the microphone line and 50 feet down track. If two cars are within this 100-foot zone, it is not very likely that either sound reading will be valid. As the sound crew gains experience, they will develop a feel for adequate separation. Use of this 100-foot zone is primarily as a training aid.

4.3.2) Ambient - For a valid measurement, the ambient sound level should be at least 10 dB below the sound level of the target. Nearby public address speakers are usually the main problems.

4.3.3) Number of Readings - A single reading will not be very representative of the car's sound level. The driver may be just warming up; he may be cooling his tires; he may still be learning the track. One region's sound sheet has spaces for three readings; another region tries to get six readings for each car. Multiple readings allow the crew to minimize operator errors such a misread meter, or a misread car number. There may actually be two cars on course with the same car number. Once the driver settles down, you should begin to see several readings cluster into a tight group.

Chapter 5) - VARIABLES

Officials and competitors tend to get upset if all the readings on a particular car are not identical to within a tenth of a dB! This is usually expressed as: "Why is sound control so inconsistent?" Actually, the proper question could be better phrased: "Why are sound readings so inconsistent?" Here are a few of the bigger contributors.

5.1) EDGE OF TRACK- There is a huge potential variability caused by the actual distance between the race car and the microphone; The GCR mandates 50 feet from the edge or artificial edge of the racing surface. Thus a sound station halfway down a 50-foot wide straight will face a variability of up to 6 dB. It is interesting to note that California highway enforcement measures to the vehicle path. Oregon and Illinois state laws for racing sound control mandates 50 feet to the racing line. SCCA is different.

5.2) ATMOSPHERIC - Data taken since 1980 has provided rather robust evidence of the effects of meteorological conditions upon vehicle sound levels. Fundamentally: "Dense air makes more horsepower; Dense air makes more sound". Several of the SCCA classes stipulate essentially equal engines, either by sealed spec engines or blueprinted stock engines. These engines appear to be reliable standard sound sources.
Nominal sensitivities:

* Approximately 1/3 dB for every 10 degrees Fahrenheit
* Approximately 2 dB for every inch of Mercury – barometric

Note that barometric pressure does not change linearly with altitude. A very rough approximation at low altitudes is around 0.8" in 1000 feet.

When recording atmospheric conditions use the same instruments. Your equipment may not be scrupulously accurate, but we should be specifically interested in relative changes. Barometers usually have an adjusting screw on the back. NEVER diddle! Glue it! Tape it over! Any change to this adjustment will destroy any chance of maintaining the relative relationship. Do not be confused by newspaper or TV weather reports as these figures are generally corrected to sea level. Figure 5.2) -1 can be used to predict the meteorological influence on sound levels.

Note that the figure does not predict the dB change, engines are affected differently by atmospheric conditions; The figure estimates a "score". A bigger score will probably mean higher sound levels.

Figure 5.2) -1 Meteorological Influence   [Insert chart]

5.3) RPM - When asked if the sound level varies with engine speed, the answer is best stated: "Yes - No - and Maybe"

Back in the eighties, the camshaft engineer at Iskendarian phoned to discuss an upcoming test on various V8 camshafts and mufflers - could I bring along a sound meter? The theory was that some degree of sound reduction might be possible by varying the exhaust cam timing from their normal design. Depending on the particular combination of camshaft and muffler, there were cases where the sound level remained constant - fell with increased speed - rose with increased speed - and one case where it rose, leveled off, and finally dropped. IRL Aurora, please take note!

5.4) PHYSICAL - Why are sound readings so inconsistent? Let us consider the question in terms of the time frame involved.

* Same day, Lap-to-Lap
  Driver resolve - Consistent throttle - Consistent line

* Same day, Session-to-Session
  Add: Air Temperature - Track Condition - Absolute Humidity See Sports Car issue April 1997, page 30.

* Same event, Day to Day
  Same thoughts-Changes to induction system (air filter?)

* Same track, Event-to-Event
  Add: Deteriorating muffler packing - Same meter location - Same region or different sound meter, or crew - Has the meter ever been recertified or different meter

* Same competitor, Different Track
  Now add: Altitude - "50 feet from edge of track"

Another area of inconsistent data concerns the lap times recorded by the crew; why are they so inconsistent? Driver's lines improving? Driver's resolve getting better? Analysis of individual sound readings of competitors at the annual Runoffs shows an interesting increasing trend as the fight for better lap times progresses.

To put a focus on this variability, we might consider a curve which plots "inconsistency" versus "Resolve" or "Talent".

As an extreme case in point, at the 1997 Laguna Seca CART weekend, one of the FIA World Sports Challenge GT1 Porsches was in attendance to do some set up testing with Hans Stuck driving.

The testing consisted of a sequence of seven test laps - then 20 minutes in the pits - then seven more laps. On one of those seven lap runs, the sound readings were:

106.8 -106.8 -106.9 - 106.8 -106.9 -106.8 -106.9

Note: ALL readings within 0.1 dB!

Do we call that inconsistent? Another case was included in the '97 Sports Car article. Sound readings during qualifying for Juan Fangio III in the '97 Toyota GTP at a Laguna Seca IMSA event: not quite as perfect as Stuck's, but equally impressive.

5.5) TECHNICAL SEMINAR

Most people have great difficulty understanding the deciBel. Most of the numbers that we deal with in life are LINEAR- Changes to "linear" are personally meaningful to us: A $10.00 raise -15 more horsepower - - 2 seconds faster.

There are some numbers that we encounter where the size of those numbers boggles the mind; we are regularly confronted with "millions" and even "billions". To the racer, $1000 is still a rather large number, but it becomes more understandable when we compare the number to the cost of a set of racing tires. On the other hand, there are dollar values that are so huge that few people have any comprehension of their magnitude. The US Congress recently approved the 1999 national budget for half a Trillion dollars! How many people can even tell how many zeroes are there in a trillion?

There are even some numeric measurements that are so far BEYOND boggle that it goes totally beyond comprehension, the astronomer uses an equally incomprehensible yardstick called 'light years". The engineer turns to logarithms:

* Earthquake intensity is measured on a LOGARITHMIC scale; We folk in California have no problem with Richters
* The deciBel is a LOGARITHMIC measurement.

The range of sound magnitude from absolute quiet up to the sound levels of a 4-rotor Mazda would boggle a seismologist.

When you talk deciBel to a steward or a driver, try this little comparison: Divide the deciBel by twenty - - - and call it a Richter.

5.6) MULTIPLE CARS

The measurement procedure mandates that any readings taken on a competitor be recorded only when the cars are sufficiently separated. To give you a feel for the influence of closely spaced cars will have upon one another:

	or	
2 cars @ 100 = 103.01 dB	2 cars @ 90 = 93.01 dB	(a 3.01 upper)
3 cars @ 100 = 104.77 dB	3 cars @ 90 = 94.77 dB	(a 4.77 upper)
4 cars @ 100 = 106.02 dB	4 cars @ 90 = 96.02 dB	(a 6.02 upper)

Some sound crews will let the meter run untouched on the first race lap when the cars are much too dose to read separately. A pack reading under the sound limit will probably mean few, if any, violations will be recorded later. A pack reading several dB over the limit will probably mean problems.

5.7) DIFFERENT DISTANCES

The theoretical rate at which the sound level decreases with range is 6.01 dB every time the distance doubles. Technically, this is called the "Lapse Rate". Thus a 100 dB car at 50 feet will drop to 94 dB at 100 feet, 88 dB at 200 feet, and 82 dB at 400 feet, etc. This lapse rate will generally hold over solid, unobstructed ground. The rate of decay is faster over soft ground or foliage. Eventually the racing sounds will merge with the local ambient level. At this point, the sound meter may not detect the racing sounds - but the neighbor's ear will still be able to hear us. Weather conditions such as wind and temperature inversions can also affect the long distance lapse rate. Our main concern with this lapse rate is the effect upon cars on the far side of the racing surface (since we are mandated to be 50 feet from this side). Note that the states of Oregon, California and Illinois mandate SO feet from the vehicle path; same thing for the Society of Automotive Engineers test procedures.

Range	dB	Delta	-or-	Range	dB	Delta
50'	100	-0		50'	100.0	-0
56’1”	99	-1		60'	98.4	-1.6
63'0"	98	-2		70'	97.1	-2.9
70'7"	97	-3		80'	95.9	-4.1
79'2"	96	-4		90'	94.9	-5.1
88'11"	95	-5		100'	94.0	-6.0
100'	94	-6				