



HEAVENS GATE AUDIO
intelligent audio solutions

A Look Behind

Sept. 2010



Basics

Technology sounds pretty pretentious. Therefore, we rather discuss here the basic principles for developing our products, so aficionados - like yourself - may easier understand why our products are as they are.

Heavens Gate Audio is not a typical audio cable manufacturer: While we are more business oriented, better organized and more advanced in measurement equipment than most of the other High-End audio cable manufacturers, we believe in physics rather than in marketing.

Planning Is Everything

If you want to make the best, you have to prepare it long time in advance. Sometimes, you even have to create new technologies, which is immensely expensive and extensive.

You can say we are slow. This is true! We do not accept to follow the market, issuing new products each time a new fancy idea gets in the mood. We prefer to follow a clear and pre-determined development path based on real technology development, trying to avoid sharp turns.

This protects our customers. They pay for having the best and would not understand if we had to change our position each morning...

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Welcome

You are welcome to learn more about the 'things' we are doing to make Heavens Gate Audio products the way they are. Please take your time. Enjoy a glass of wine, relax and think about every word as critical as you can. Some statements might be strange for you and if you have any question, please feel free to contact us any time! Enjoy...

Step 1 - Conductor Material

When we started to find the perfect conductor material for audio applications we took a closer look at the following materials:

Copper: a relatively cheap material, good conductivity, poor high-frequency resolution, delicate to mechanical resonances

Silver: the price for pure silver is about 100 times higher as for copper, excellent conductivity, very open and fast sound, poor bass control, extremely vulnerable to resonances, changes sound quality over the time

Gold: about 60 times the price of Gold, good bass and midrange resolution, very slow in transient, no high frequency details

Platinum: even more expensive than Gold, good attack, very short transient, no emotions and no "groove".

Palladium: half the price of Gold, no high frequency resolution, useless for audio applications

Carbon: we used pure carbon, silver plated carbon and metallized carbon. Carbon offers excellent resonance properties but also a very poor bandwidth resulting in a slow and muddy sound experience. For shielding a cable it is perfect.

Hydrargyrum: because this metal is liquid under normal room temperature, it has no own resonances. Perfect sound but due to its toxicity not applicable for audio applications.

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Step 1 - Conductor Material (continued)

Every material mentioned on the previous page has it's own sonic character but there is no material perfect in all aspects.

Some manufacturers are claiming that the use of high purity copper like 7N, 8N or even 9N is the way to go. We believe that pure copper is not good for the use in high-quality audio cables. One of the biggest problems of pure copper is the material fatigue because of the recrystallization process - even at room temperatures. Pure copper changes it's resonance behaviour over a period of 3-4 months dramatically resulting in a loss of high frequency resolution.

Pure silver is another way to go. This material offers a tight, clean and very detailed sound experience while it tends to compression and poor harmonics resulting in a harsh high frequency range.

Copper and silver are choosen because of their excellent conductivity. However, conductivity is not important! The following table shows the conductivity of various materials:

Silver:	$61,4 \cdot 10^6 \text{ A}/(\text{V} \cdot \text{m})$
Copper:	$59,1 \cdot 10^6 \text{ A}/(\text{V} \cdot \text{m})$
Gold:	$45,5 \cdot 10^6 \text{ A}/(\text{V} \cdot \text{m})$
Platinum:	$9,43 \cdot 10^6 \text{ A}/(\text{V} \cdot \text{m})$
Palladium:	$9,26 \cdot 10^6 \text{ A}/(\text{V} \cdot \text{m})$
Hydrargyrum:	$1,04 \cdot 10^6 \text{ A}/(\text{V} \cdot \text{m})$

We have build an interconnect cable consisting of 5mm teflon tubes filled with hydrargyrum (also known as quicksilver or mercury) and 5cm long tails of pure copper and silver at each end. The result was astonishing and the best we have ever achieved. However, this material is so dangerous, that it is not applicable for audio applications at all.

Look at the conductivity of hydrargyrum: it is - compared to other materials - the worst you can get. So, what does it make sounding so good???

Hydrargyrum is a liquid metal and it has no own resonance!

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Step 1 - Conductor Material (continued)

Resonance???

This is one of the things we really take care about at Heavens Gate Audio.

All Heavens Gate Audio products uses conductor materials that employ a mixture of silver, copper and gold to avoid a “sonic stamp” given by just one material.

It is the right mixture of materials that avoids these problems inherent in most other audio cables. Basically, we use AgCu3 (pure silver with 3% copper), AgAu3 (pure silver with 3% gold) and 4N silver (pure silver).

But how to avoid the problems of recrystallization? Most audio cables loses high-frequency resolution and harmonics over a period of time. A special soft annealing process for all our conductor materials was a first step into the right direction but still, the sound behaviour changed in the course of time.

We started to research the behaviour of magnetically treated conductor materials and this process is the only way to avoid the problems of recrystallization over many years. After the soft annealing process all conductor materials are magnetically treated for up to 3 weeks by being “stored” in an magnetic field of extremely high strength.

We also tried cryogenic treatments but the results have not been as good as the magnetically treatment. The positive effects of cryogenic treatments do not last long enough and after 3 - 4 weeks they are gone.

Insulation & Dielectrics

The best insulation would be a vacuum, which is not possible within an audio cable. Air or Helium is the second best choice, but putting our conductors into a Teflon tube filled with gas would make the final cable to big, as we are using up to eight conductors for an interconnect.

Therefore, we decided to use a Air-Foam-PFA. PFA is a fluoroplastic material similar to PTFE and FEP, but with even better dielectric properties.

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Step 2 - Construction

Flat cables with parallel members typically have the highest propagation speed and the widest bandwidth with some of them passing signals freely into the gigahertz region. Coaxial cables are also relatively high propagation speed, wide bandwidth designs. Flat and coaxial cables are the designs of choice for digital and radio frequency transmission.

When these extremely wide bandwidth cables are used for non-digital audio applications, they are particularly subject to noise infiltration along the entire length of the cable, much like an antenna.

Inductance and capacitance need to be controlled carefully in an audio cable. Too much or too little of either characteristic will provide undesirable results.

In lengths suitable for most home audio systems, these cables have too much bandwidth for audio applications and are particularly subject to noise infiltration. Another problem is the point at which these cables achieve electrical resonance; i.e., the point at which inductive reactance equals capacitive reactance.

To control the inductance and capacitance of our cable designs, we simply apply electrical and physical basic principals.

This might sound crude, but at Heavens Gate Audio it becomes a very complex story. Up to sixteen single conductors are put together by hand to form a unique wire-weave-pattern that controls the electrical behavior of the cable. This is one of the reasons why a Heavens Gate Audio product can never be changed in lengths once it is made.

A proprietary combination of Silver-Gold-Alloys and Silver-Copper-Alloys for the positive signal path and pure 4N Silver for the return is the result of countless hours of listening to various constructions. We believe that only a mix of various materials result in a detailed sound experience without any harshness.

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Step 3 - Shielding

You may not realize how much low-level noise is robbing your system of its potential. If the audio cables used in your music system are not shielded properly, every signal path is like an antenna to unwanted noise. All Heavens Gate Audio products reject noise!

Noise at any point in the signal chain inhibits the ability of your music system to reveal all the subtle nuances of tone, body and dimension that are encoded in your favorite music material. These subtle nuances are the critical elements that help us to suspend our belief that we are only listening to electronic signals. They are the critical elements that bring our listening experiences to life.

Using conductors and a cable design, that allows a very wide bandwidth and propagation speed, make an efficient shielding necessary.

Shielding, however, influences the capacitance and the inductance of an audio cable and it is absolutely necessary to design a perfect shield for any cable and any length.

The Active-Shield-Matrix invented by Heavens Gate Audio uses different shields to protect the audio signal against any source of noise, like electro-magnetically-interference (EMI), radio-frequency-interference (RFI) or electro-static-interference (ESI).

Most audio cable manufacturers use one or two shields to protect the signal carrying conductors. At Heavens Gate Audio we use up to eight shields while some of them are connected to signal the carrying conductors at exactly defined points.

Our goal was to create a shield that perfectly rejects high frequency noise, offers excellent mechanical damping properties, is flexible in order to avoid an unwanted stiffness of the final cable and does not affect the electrical parameters of the cable design.

For high frequencies the surface of the shielding material is more important than the center of the material itself and therefore we use a mixture of pure 4N Silver and silver palted Carbon - simple but very efficient.

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Step 4 - Connectors, parts and manufacture

To be continued...

Step 4 - Listening

To be continued...

Step 5 - Final words

To be continued...