CELEBRATING THE 100 YEAR ANNIVERSARY

DANISH LOUDSPEAKERS

100 years

1915 – 2015

THE HISTORY OF THE DANISH LOUDSPEAKER INVENTION AND INDUSTRY

FOREWORD

Hearing is often considered as one of the most important of the traditional five human senses that allows us to communicate, understand, and navigate the world. The invention of the loudspeaker by the Dane Peter Laurits Jensen and Edwin S. Pridham in 1915 was groundbreaking. This enabled humans to communicate and experience sound from a distance, and further sparked the development of the 20th century's most important technology products such as radios, telephones, and public address systems. 100 years later, the loudspeaker is still a ubiquitous element of sound reproduction systems and used in almost all sound technology products.

Denmark was an early adapter of this new technology with the start-up of many companies as well as the introduction of university programs to support the technological development and constant flow of talented people. The present book covers important inventions, contributions, and amusing anecdotes from the 100 years of loudspeaker history, and not least, the flourishing of the Danish loudspeaker industry.

Understanding the history is essential in order to prepare for the future, but it also helps us to form a strong identity. It is a fact that the Danish sound sector has been, and still is, very healthy and has a strong identity and excellent reputation worldwide. In a way, the anniversary of the loudspeaker is also the anniversary for everyone who works hard every day to keep-on transforming the sector and maintaining competitiveness. This is of course not an easy task. The fact that we live in the digital age, where data is one of the core assets, also have consequences for the sound sector: The loudspeaker has become a commodity and should be integrated in smart and unique products and services ready for the digital economy and customizable to individual user's needs. I believe that Denmark has the positions of strength to take up that challenge in a multi-disciplinary collaboration.

In 100 years from now, the loudspeaker will surely be radically different. However, I am convinced that there is still a need for people to perceive and interact with sound from all over the universe. It is my hope that the Danish sound sector is taking part in fulfilling this need.

Enjoy the reading!

Jan Larsen
Director of the Danish Sound Innovation Network

DANISH SOUND

The history of

Audiovector

Audiovector was founded in 1979 by Ole Klifoth - built on a vision to produce natural sounding loudspeakers for music lovers. The ideas of linear dynamics, linear phase, and low compression still form the backbone of Audiovector's design philosophy.

The history

In 1979, Ole Klifoth founded Audiovector and the vision for this new company was then, and still is, to produce natural sounding loudspeakers for music lovers. Ole Klifoth came from other parts of the hi-fi industry and started Audiovector, because as he says: "I could not find the speaker of my dreams, so I decided to build it myself."

As a new company, Audiovector enjoyed a successful start with the "Trapez" speaker, which was built according to Ole Klifoth's ideas about linear dynamics, linear phase and low compression. These ideas form the backbone of Audiovector's design philosophy. The history of Audiovector is described through its iconic products selection.

Iconic products

The list of iconic products from Audiovector is long. In the following, a few of the best and most forward pointing ones are highlighted.

The speaker, which started Audiovector, was the Trapez, which also stipulated the principles and dogmas, where after future Audiovector models have been engineered. In the Trapez, the Low Compression Concept was launched for the first time. This concept includes all areas, where compression and distortion needed to be dealt with: in tweeters, bass drivers, cabinets, cross-overs, and voice coils. The 6dB per octave linear phase cross-overs, pioneered in the Trapez - something other loudspeaker companies claimed would not work - is part of the LCC concept.

All the concepts used in Audiovector loudspeakers, have been developed in Denmark, the cradle of loudspeaker design.

The Trapez

In 1979 the Trapez - the brainchild of Chief Engineer Ole Klifoth - was first launched. For a long time he had been dreaming about the perfect speaker. A speaker with linear frequency response and linear phase response.

Three drivers (modified Scan-Speak and Dynaudio drivers from Denmark), were placed on a baffle sloping backwards in order to bring the acoustic centre of the drivers in phase, when the drivers were fed by a 6dB per octave cross over. The drivers themselves were all low compression types and the goal was to create a linear impulse response.

The exterior design of Trapez was designed by 5 times Danish award winning Industrial Designer, Lars Mathiesen, and sported all the modern Danish technologies of the golden age of Danish loudspeaker industry.

The Trapez sold more than 25,000 pairs during the next 10 years and was an instant success from day one.

The Audiovector 3

The need for slim and tall speakers inspired Ole Klifoth and Lars Mathiesen to develop the lop-sided Audiovector 3 model. Standing 1 metre tall and sporting two 6.5" drivers with polypropylene membranes and an aluminium version of Audiovector's 2406 low compression tweeter, they created the start of a very successful range of loudspeakers. Again, the focus was on low distortion, low compression, linear phase cross-overs and a minimum of standing waves. This had become the new Danish standard for loudspeakers.

The M-series

Introduced in 1996, the M-series was a truly modular series of speakers. One type of cabinets was used for several models. The series covered a total of five models before it was discontinued and followed by the S-series.

The M-series was also the first series to be upgradable. With the M-series Audiovector introduced the open back tweeter SEC system for the first time. The LCC concept, although originally invented in the days of Trapez, was expanded and put into system with the M-series.

The S 6/Si 6/SR 6 - Form Follows Function

Designed by Lars Mathiesen and Ole Klifoth with the goal of marrying function and modern Scandinavian/Danish design. The teardrop shaped cabinet allowed Audiovector to rethink the whole issue of internal damping.

Internal damping is often the source of huge production tolerances, which again is the source of poor product uniformity. Audiovector introduced new precision-cut foam materials, which was cut very thinly to fit into the teardrop shape that has no parallel sides and thus no internal standing waves. The company almost got rid of damping materials and their sound quality impairing consequence i.e. hysteresis distortion. "Fast as a reptile" was the headline of one magazine after testing the S 6 Avantgarde in 2001. The tweeter in this speaker was Audiovector's first Avantgarde AMT in an open SEC system.

The R 11 Arreté

In 2007, Ole Klifoth and designer Jacob Tryde decided to develop an Audiovector flagship speaker, which was intended to serve as Audiovector's in-house reference. Real music is of course the best reference, but the existence of an in-house faithful reference to benchmark all new Audiovector speakers against, was a long time wish of Audiovector's listening team.

Sporting two full midrange drivers on the front, a double Avantgarde AMT tweeter and eight long-throw bass drivers on the rear, the R 11 Arreté has the bass driver area of a 17-inch driver, but with a much faster response. In truth a grand speaker, able to reproduce the scale and drama of any musical genre, and doing this by using all the Danish technologies in Audiovector's toolbox. The first speakers to benefit from the new reference, were SR 6 models and later and recently SR 3/SR 1 models.

Facts

Company name
Audiovector

Head office
Copenhagen, Denmark

Established in year
1979

Established by
Ole Klifoth

Main audio product types
Passive and active loudspeakers for domestic use.

Main markets
Denmark, Russia, Sweden, Norway, Poland, Germany, Japan

Number of employees
9

Ole Klifoth, founder and owner of Audiovector has been engineering loudspeakers for more than 45 years. Audiovector is based on principles developed in Denmark by himself and others. In 2010 he launched the most expensive speaker from Denmark, his R 11 Arreté.

The S 3/Si/SR series
Inspired by the S 6-shape and the technology of the R 11 Arreté, the S 1's, and S 3's are scaled down versions using the same unique cabinet shape to create distortion-free dynamic performance. All the technologies from Ole Klifoth's Danish toolbox (6dB per octave cross-overs, low compression tweeters, SEC, SD-technology, resistive ports, 3-point fixing, no standing waves, etc.) are incorporated in these fine speakers.

The SR-series is Audiovector's best performing series of compact speakers to date. The SR 3 Avantgarde Arreté is a true example of an extremely compact high-end speaker. The SR-series was also the start of Audiovector's colour programme, which makes it possible to buy speakers in almost any colour.

Reviews
Through the years, all Audiovector models have received excellent reviews. These can be found on Audiovector's website.

Cutting-edge technology

This is Audiovector
As we know from the historical pages of this booklet, many of the important inventions in loudspeaker technology, have been developed in Denmark. Almost any loudspeaker today is using a double chamber treble driver in order to reduce compression and to obtain a linear impedance curve. This technology was invented and developed in Denmark. If we look at B&W's latest 800 series speakers, we will sees that its drivers are using SD technology. Invented in Denmark. And first order filters. Pioneered in Denmark.

The Audiovector speaker on the right is a very good example of a speaker loaded with Danish technology. Some of the technologies are invented by Audiovector, some by other Danish companies through the years. What they have in common, is that they are all Danish inventions. Space does not allow us to cover all the technical solutions, but the most important ones included in this Audiovector Jubilee model, and other models are:

- The double chamber treble driver was developed into an open back treble driver with even lower compression by Audiovecor in 1996 in tandem with the SEC system (Soundstage enhancement Concept) where intelligent use of the rear radiation from the membrane replaces the fight against ear radiation.
- In cooperation with Scan-Speak, Audiovector has pioneered the 3 layer sandwich membrane, which uses a combination of woven fibres and a light long fibre paper membrane.
- The Dynamic Feed Forward filter technology, which reduces coil resistance by a factor 2, was invented in 2004 by Audiovector in Denmark in order to get performance of the then new S-series closer to that of speakers with active electronic cross overs.
- The SD technology which reduces induction related distortion in speaker drivers, was invented in Denmark in the 1960'ties.
- The IUC upgrade concept, which is unique to Audiovector and which allows end users to upgrade their existing loudspeakers, is invented by Audiovector in 1996 in connection with the launch of the M-series modular speaker line.
- The NES concept, which reduces energy storage in the drivers of a loudspeaker, was introduced by Audiovecor in 2008 in connection with the launch of the Si-series speakers. Another Danish invention.
- The ARA room adaptation technology was developed in Denmark, too. ARA is a low-tech frequency domain solution to a complicated time domain problem.
- The Discreet Active technology, which is retrofittable in modern Audiovector speakers, or available as amplification for new active speakers, was developed for high end use in Denmark. It allows 24 bit/192 kHz transmission and upsampling.

Audiovector speakers build on an evolutionary process of ongoing improvements
The strategy of constant improvement of technologies and products, which are already notorious for their excellent sound quality and reliability, also serves to preserve the Audiovector sound–DNA. Something that characterizes all of Audiovector's loudspeakers from the smallest to the biggest one. From the very first product to the newest ones.

Many of the important inventions in loudspeaker technology, have been developed in Denmark

The speaker above the SR3 Avantgarde Arreté Jubilee 100 is celebrating the 100 years birthday of the loudspeaker as it was invented by Laurids Jensen. This speaker model is available in red and white, plus a couple of other color combinations and in limited numbers. 100 pairs, indiviually numbered, will be produced.

Home of the loudspeaker
Denmark is notorious for being a loudspeaker country. In the sixties and seventies, Danish companies manufactured more loudspeakers per capita than any other country in the world. The technologies invented in Denmark are numerous and many of these have since become industry standard.

Audiovector has developed and fine-tuned many of the technologies from the golden age of loudspeakers in the 1960s and added more technologies to improve loudspeaker performance. On the opposite page, there are descriptions of the technologies used on today's most advanced Audiovector models.

Precision tweeters
In 1984, Audiovector developed its own dome tweeter. The goal was to create a tweeter design with an excellent dynamic response, extremely low compression and very narrow production tolerances.

The result was the 2406 Low Compression dome tweeter launched in 1984.

Since 1984, Audiovector has built all its dome tweeters and Avantgarde Air Motion Transformers in-house.

Avantgarde tweeters
When Ole Klifoth discovered, that he could get a frequency response from 2 kHz-50 kHz from one of the same tweeters, it changed his view on treble performance. Before the Avantgarde tweeter - a carefully designed and tuned open back derivative of Dr. Oscar Heil's Air Motion Transformer - a dome tweeter was the best choice in performance and power handling. A tweeter for Audiovector's top-models was born and it was built in-house.

Proprietary bass/mid drivers incorporating the best of modern Danish technologies
In cooperation with Peerless and Scan-Speak a line of drivers with stunning dynamic performance was engineered, using a specially designed chassis with 3-point fixing to honour Audiovector's NES technology (No Energy Storage). Hysteresis distortion is avoided by using titanium voice coil formers and heat is efficiently lead away from the coils by black anodized pole pieces and diffusers. SD-copper caps keep inductance and distortion under control

The SEC system
The SEC (Soundstage Enhancement Concept) system is a treble system, which works together with open back, low compression tweeters. A rear firing port makes intelligent use of the rear radiation from the tweeter (instead of fighting it). The rear output is delayed and becomes a part of the room's reflections. It does not interfere with the direct sound from the tweeter.

SEC creates a much bigger soundstage and a better reproduction of detail with less distortion than conventional tweeter systems. This technology is subject to patent pending, and was first introduced in the Audiovector M-series in 1996.

The teardrop shaped cabinets
The teardrop shape combines beautiful design with a non-resonant environment inside the cabinet. This allows for a reduction in internal dampening materials to almost nothing. This means better dynamics, minimal loss, and very little hysteresis distortion. In short: a more immediate and dynamic performance.

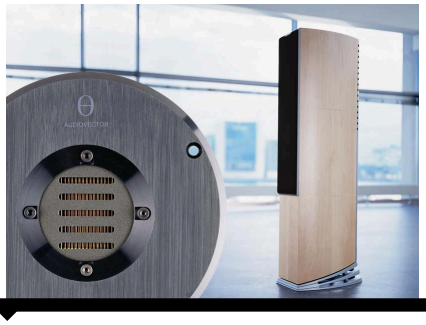
The IUC upgrade concept
Audiovector is unique in offering a logical upgrade path of its speakers, as all its existing loudspeaker models can be upgraded to a higher level, e.g. from Signature to Avantgarde Arreté or from a passive Super to an active Discreet Avantgarde model.

The fact that these upgrades are offered, has led to several unique elements: Firstly, people can buy Audiovector loudspeakers with reassurance because the product does not change and lose value overnight. Secondly, the product has a more environmental friendly profile than the use-and-throw-away products. This inspires a pride of ownership. It is estimated that more than 65 % of all speakers made by Audiovector, are still out there in the service of music. People keep them, quite simply.

The Low Compression concept
The Low Compression concept is a universal concept, which is reducing all types of compression: in drivers, voice coils, treble systems, cabinets internally, and cables.

This concept allows the parts of a speaker to last almost forever, because the

Timeline



1979
The Trapez was Audiovector's first speaker model in which Ole Klifoth's pioneering technologies were introduced. It enjoyed an immediate success and received outstanding reviews from the start.

1985
The Audiovector 3 with its lopsided front was another successful design by Ole Klifoth and Lars Mathiesen. It was followed by scaled down versions, as Audiovector 1 and 2 followed the same design concept.

1996
The Audiovector M-series was the first truly modular series and it marked the introduction of the IUC upgrade concept. The M-series was also the introduction of the SEC treble system with No-Compression tweeters.

1996
The IUC upgrade concept is introduced. Any Audiovector from the M-series can be upgraded to a higher level. Later they were upgraded to Mi level and later again to Mi-SE level.

1998
The Avantgarde AMT open back tweeter is born. Perfect for the SEC concept and with a range from 2 kHz–50 kHz. It represented ultra-low distortion in combination with a very fast transient response.

2001
The S 6 marked the introduction of the famous teardrop shape, with its total lack of standing waves. A beautiful looking design combining form and function to perfection.

heat build-up is vastly reduced. It allows Audiovector's speakers to sound more free, more dynamic, and more powerful than many competing products.

NES – No Energy Storage
The mechanics of loudspeakers is often a neglected area. Audiovector has developed a 3-point fixing method, which isolates the drivers from the weight of the cabinet, thus creating less overhang and less coloration.

Discreet
Almost all Audiovector speakers are available in Discreet versions with no passive cross-over inside. Instead there are 3 digital amplifiers with an even harmonics distortion profile similar to that of tube amplifiers and Class A amplifiers.

A powerful (NASA engineered) DSP chip takes care of the linear phase electronic crossover, power distribution and distortion management. The signal is transmitted from a hub to the speakers in 24 bit/192 kHz quality. The hub accepts inputs from digital and analogue sources and has a built-in automatic subwoofer sensing cross-over.

The hub accepts wireless BT signals directly, Wi-Fi, hi-res, airplay signals (the three latter through an external port). It accepts optical and digital signals and has a built-in high quality A-D converter for analogue sources.

In other words, you can make a full-blown system, with a hub, a pair of Audiovector Discreet speakers, and the source of your choice.

Future focus

The future of Audiovector is in high–end luxury loudspeakers - passive as wells as active. An Audiovector speaker will also in the future be based on Audiovector's trusted acoustic and mechanical principles – which is subject to their constant process of evolutionary improvement based on scrupulous listening tests.

For Audiovector's passive and active Discreet speakers, the mechanical and acoustical basis is the most important part of the speaker.

Luxury high-end
Audiovector will continue to focus on producing luxury high-end products in either passive versions or active Discreet versions - using advanced acoustical shapes, specially designed and precision machined bolts and screws, high quality build, and attention to detail.

The ongoing evolution

It is the plan to keep on evolving Audiovector loudspeakers in order to achieve even better performance in the future. This is expected to happen using new and better materials, new technologies (some of which will be developed by Audiovector's own design and engineering team), new understandings of human perception of sound quality, and new discoveries in hearing psychology.

Passive and active
Audiovector believes that there always will be enthusiasts, who worship the best possible sound quality. People who want to partner their Audiovector speakers with the best amplifiers and sources.

It is also believes that many music lovers will choose active Discreet speakers, which they can stream to in any available format. Although it will be possible to stream in the highest available resolution at any given time, availability of music will be extremely important. This is why Audiovector embraces everything from Bluetooth to 24 bit 192 kHz hi-res.

Because of the active Discreet speakers which are fully active and digital (with an analogue sound), passive Audiovector speakers will be inspired by the low loss sound transmission in the active speakers with their electronic cross-overs and multiple amplifiers. Just as the active Discreet speakers have been inspired by their passive siblings there will be an ongoing cross–inspiration, which will result in constant improving speaker models.

Audiovector's in-house reference
The fact that any new speaker model from Audiovector are measured against and compared to the Audiovector R 11 Arreté, bodes well for the future. The real reference, of course is live music, which is why Audiovector's listening team are frequent concert attendants. The aim of Audiovector is to bring the concert hall into people's homes. ■

2004
The S-series is born out of inspiration from the S 6-shape. With floorstanders, stand-mounts, centre speakers, and subwoofers it is a complete range for both stereo and surround sound.

2008
The Avantgarde AMT tweeter is lifted to a higher level. Faster transient response, more linear frequency response, and lower distortion result in a cleaner yet clearer sound.

2010
The R 11 Arreté is released - the most expensive Danish loudspeaker to date. Initially intended to be used as an in-house reference, soon after the speaker catches the interest of music lovers.

2011
The S 6 evolved into SR 6 (via Si 6). It was soon regarded as a true reference speaker. It has an isobaric bass system in combination with a 2.5 way upper bass/midrange/treble system.

2012
Audiovector active Discreet is introduced. Multiple "green" ultra-high damping factor PWM digital amplifiers with analogue sound driven by DSP derived "electronic" cross-overs with linear phase Bessel filters.

2014
The SR-series is introduced: Audiovector's best performing compact speaker to date. New treble drivers, low loss cross-overs, NES 3-point fixing and multiple colours, are just a few of the highlights.