act c60

White Paper

**Wilson Benesch loudspeakers have always been distinctively different.
Unique in every detail each design is visually stunning. Incorporating the most advanced materials known to man.
They reject convention and through innovation
define the future.
The Wilson Benesch sound has captured the imagination of music connoisseurs throughout the world.**

The Future is carbon

Introduction

As loudspeaker design in general continues down the well trodden cul-de-sac, at Wilson Benesch we would like to sit back and dwell for a moment on the achievements of the last twenty years, achievements that place us in a very strong position as we look to the future. If our history describes anything it is a desire to bring something new to the world. This desire, in tandem with our passion for music, has led to the development of completely new ways of reproducing sound. It is a design heritage and development foundation that will lead to even more significant developments in the future.

Wilson Benesch has one focus and one direction, high performance audio design. Wilson Benesch is today a highly developed, small volume, high performance manufacturing company. This capability provides significant benefits, not least of which is the capacity for evolutionary design and refinement of all our own components with all but a few exceptions. Our steadfast commitment to re-investment continues today. Building upon our success and adding to the considerable design and manufacturing plant that is fully integrated into the research and development objectives of the future, creating an exciting and dynamic work environment. Contained under one roof, lies the capacity to design and manufacture to the most exacting tolerances in a broad range of metals and advanced aerospace materials. It is a capability that is unique in the world of audio design. It is the foundation for even greater achievements in the future.

Outside the company Wilson Benesch can also be seen to have a long history of collaboration. Rolls Royce engineers, world leaders in developments in chemistry and experts in many other fields, have made their special contribution towards technologies that you will not find in any other loudspeaker design. The most recent collaboration is with the Advanced Manufacturing Research Centre that will provide access to technologies and equipment from tomorrow's world. The Advanced Manufacturing Research Centre is a major development that has come out of collaboration between the giants Rolls Royce, Boeing Aerospace and Sheffield University. Part of their remit is to work in partnership with local high technology companies assisting them in ways that were impossible previously in pursuit of design and making things better. This will allow us to enhance the technological capability of the company without the huge investments that would be beyond even the largest audio companies.

In a similar way we can also point to the funding that we have attracted in the form of grants from both the UK and Europe. Once again we stand alone in being able to make this claim and we are delighted to announce that we have just won our third major research and development grant. June 2008 saw the start of an eighteen-month pure research project with a £146,000 commitment that will pursue innovative solutions to analogue replay. The Mondrian project signals our dedication to finding revolutionary, not just evolutionary solutions to design problems, all too often accepted as being unavoidable and insurmountable.
To aspire towards the concept of perfection in any design requires the best possible components. The drive unit is one of the most important and we recognised this at a very early stage, which is why we sought substantial financial support to invent our own technologies and manufacturing systems.

Such crucial design elements cannot be left to other companies to decide. From a blank sheet we have totally redesigned the main dynamic drive unit and created alternative answers to the generation of bass and mid bass reproduction.

With the assistance of European and Government funding, our pure research allowed us to take the best known technologies, and combine them with the exotic to produce the Tactic, the Isobaric Tactic and more recently the W.B. One (Wide Bandwidth One) drive unit. In loudspeaker design, precision tuning rests upon control over each and every component. Through the application of new materials technologies, the application of fundamental engineering principles and innovative design, our cabinet architecture and materials technology is technically superior to any competing product on the market according to any scientific criteria. C60 draws a new line that defines the next evolutionary step in the A.C.T. dynasty, a design heritage that is as unique as the company behind its design.

Twenty Years of Innovation...

2009 is the 20th anniversary year for Wilson Benesch. Two decades building a heritage of applying the most advanced technologies in pursuit of measurable improvements in performance. Passionate product development, that rejects convention. Tied with massive investment in pure research and development, it has resulted in documented progress and patented solutions,that define completely original avenues for future development in sound reproduction.

The A.C.T. C60 Limited Edition is not only a celebration of our first 20 years but also a celebration of evolutionary design. Building upon the strengths of its predecessors, but with the benefit of the most advanced materials technologies and components only just available.

The A.C.T. design has evolved over more than fifteen years. It is in every way a world class product that has been designed for agility, speed and spirit. Every detail can be seen to have been drawn from the best technology available at this moment in time. Moreover, the A.C.T. C60 will form part of the companies 20th Anniversary Celebration in 2009 providing as it does the perfect addition to the companies Wide Bandwidth Series that began with Trinity.

The A.C.T. C60 is a pure thoroughbred. It is comprised of unique technologies that have been created and manufactured by high precision machinery, before being meticulously assembled by hand. These elements have been fine tuned over fifteen years to reach this level of excellence. The State of The Art materials technology is superior in performance to all alternatives according to all scientific criteria. Significantly, all this has been achieved without compromising any of the timeless, quintessentially classic forms that are as sublimely beautiful today as they were in 1995. The A.C.T. loudspeaker is the product design that moved an industry forward by ending the reign of the wooden box.

The Wilson Benesch A.C.T. product line can claim to have stood the test of time like no other.
With the A.C.T. C60 heritage moves forward to the 21st century.

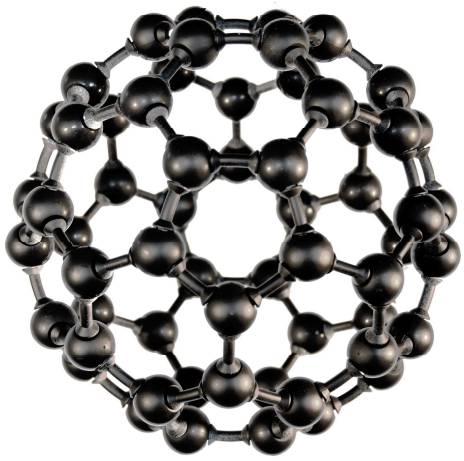
The A.C.T. C60

2008 saw the Inaugural Singapore Night Grand Prix. Coinciding, as it did, with the launch of the A.C.T. C60, we celebrated the event in style at the race track in the International Convention Centre on Raffles Boulevard. 61 Laps celebrated with 61 exclusive pairs of the finest loudspeakers (Wilson Benesch retains Lap No 1).

The C60 Limited Edition, utilises up to three times the carbon content of previous Wilson Benesch models to improve the already superior capabilities of the A.C.T. monocoque. A carbon fibre top provides a highly diffusive top piece forming an impenetrable sound barrier, due to polycrete internal mass loading. Poly alloy internal structural elements, enhanced by critical mass damping and laminated facets, help to complete the monumentally stiff none resonant casework, that allows the specially crafted drive units to operate at their optimum.

As a result of the success of this event, there may well be further product launches in Singapore in the future. The Singapore night race provided an ideal backdrop to the launch of a loudspeaker that shares much in common with F1 materials technology. The C60 nomenclature is not derived from the number of racing laps, but from materials technology that is now being pioneered by Wilson Benesch.

There are 60 atoms of carbon in the *"Bucky ball"* the name ascribed by Noble prize winner Sir Harry Kroto. Within his description of the net shape created by 60 carbon atoms, that form one of the most perfect geometrical structures known to man, Kroto drew upon his knowledge of the work of the influential architect and inventor Buckminster Fuller, who patented the use of net shapes in architecture. Arguably, this is one of the most important findings of the 20th century. It is also the foundation for work on Nanotubes, which are elongated buckyballs that provide huge potential for improvements in almost every technology.



Wide Bandwidth

New challenges new opportunities, a new genre in loudspeaker design – Wide Bandwidth: The capacity to recreate the actual event relies upon a number of fundamental design objectives. Bandwidth is one of the most important concerns.

Why should this be? At its most simple, it should be reproduced because the artists through their instruments create this energy. In fact many instruments produce sound that extends well beyond 20KHz and up to 100KHz. To ignore the importance of wide bandwidth, is to accept a compressed version of the recording. In order to even attempt to recreate this energy, new technologies must be invented. The laws of physics dictate that you cannot push the limits of the dynamic drive unit without severe penalties. Wilson Benesch invented the Torus to address the low frequency band. For the Ultrasonic band we adopted a patented technology from Murata of Japan, the sphere. The Sphere pulses with a step response time that is significantly superior to any alternative technologies. This capability is endowed with the capacity to recreate the most subtle transient information, that is quintessentially important to sound reproduction above 20 KHz.

W.B. (Wide Bandwidth) One

The latest drive unit the "W.B. One" incorporates a number of important details that have been painstakingly researched and developed within the companies C.N.C. manufacturing cell. The drive unit takes advantage of the latest Nd.Fe.B magnetic material to deliver more magnetic flux, providing for a more powerful motor system, but significantly one that does not obstruct the anti-phase energy projected from the back of the cone. The new motor assembly was modified to handle the increase in flux, without any major increase in size. All the profiles retain the same curved forms, so as to cause the least turbulence in air moving behind the diaphragm. The length of the magnetic aperture has also been increased in order to increase the length of coil submerged in flux. This increase enables greater control and a more responsive reaction to the all-important transient.
The net result sees a 3dB improvement in sound pressure levels and significant improvements in signal to noise ratios. Dynamics are almost electrostatic in character, but with real slam that is only possible with the most dynamic compression and rarefaction of air. The most obvious characteristic is the freedom of delivery, isolating and defining the instruments in a sound field that extends beyond the confines of the enclosure.

Superior Performance

To its credit Wilson Benesch has remained with what is fundamentally the same tweeter for over a decade, whilst our contemporaries have promoted new designs.
In our assessment these designs have all paid a high price to achieve the extra bandwidth, that has been sought after in the form of uncontrolled ultrasonic resonant energy. Where we differ, is in the argument that this energy is perceptible, and its hard, fatiguing and unnatural character of sound is not acceptable.

In sharp contrast to hard dome solutions, the Wilson Benesch soft dome is highly controlled, well damped and free of uncontrolled structural resonance. It is common knowledge that all materials possess a resonant signature. Woven, relatively soft multi material structures exhibit several orders of magnitude less violent resonant signatures than hard single material designs. Made from carbon, beryllium or whichever metal, all these Single material structures resonate in a very uncontrolled way.

The argument that this resonance is above 20,000 Hertz, thus beyond the threshold of hearing and so unimportant, is completely erroneous. When ignored, the resulting sound is typically fatiguing and characterised by sounding hard and synthetic. In contrast the Wilson Benesch tweeter works exceedingly well within its limitations from 5,000 to 20,000 hertz. In contrast to hard domes, the signature is often characterised as being sweet, natural or accurate. So although there might be many devices that provide a few thousand hertz extension beyond our tweeter, we would argue that the price of this is too high. The distortions and loss of damping are simply unacceptable.

This Ultrasonic Generator is the third element in the journey towards high definition sound reproduction. It provides the consumer with a real alternative to the "one tweeter does all" approach. As with the Sub woofer, Wilson Benesch chose the alternative path in its research and development to overcome traditionally accept problems. Such methods take longer to bring to fruition, but the result can justifiably be described as innovative and effective in pursuit of its goals. The Sphere has been designed to function with the greatest accuracy. It only begins to function at the point where many would claim that humans cannot perceive sound any longer, at 20,000Hz. It continues in a controlled way up to 100,000Hz, well beyond that of all other tweeters. This band of sound is clearly perceptible. Like the Torus, it integrates perfectly with the Tactic drive unit. Like the Torus it opens up a new dimension in sound reproduction.

With these extended bandwidth products Wilson Benesch are proving it isn't solely what the human body hears, but also what it perceives, that adds to the listening pleasure and the experience as a whole. This consensus has defined the development of our latest products, but most importantly, will also help focus and determine the path our design and research of loudspeakers will move in the future. Moving away from the rigid limits of 20Hz to 20,000KHz is pioneering work, and although we have made great strides with these new products being the result, we feel there is still much development to be done by ourselves and by the field of science in general.

Summary

The most advanced drive unit technology in the form of the Wilson Benesch One is coupled with the ground breaking Sphere, Ultrasonic Generator, equipping the C60 to produce not only the deepest most physical bass but also the sweetest highs, crisp and clear all the way up to 100kHz.

All drivers are rear mounted and principle high frequency components are mechanically clamped to inhibit resonance. The simplest of hand made point to point soldered filter elements, guarantee the least possible level of phase distortion. Precision tuning of the tweeter output, enables precise matching of loudspeaker to system components without additional circuits.

Torus

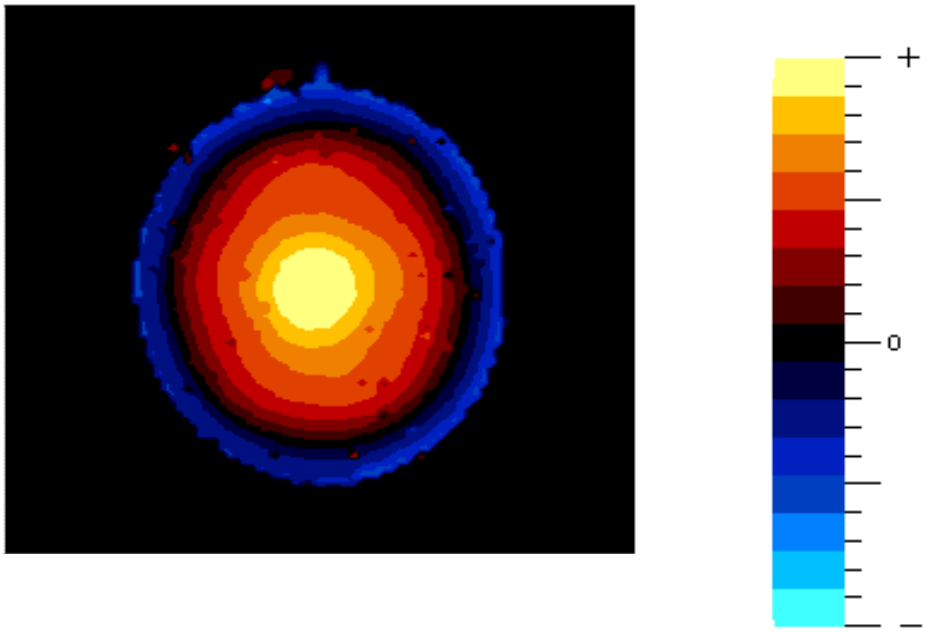
Though more than able to provide the ultimate wide bandwidth sound the C60, can benefit from the Torus Infrasonic sound for the lowest registers. When installed correctly with a stagger tuned Torus system the A.C.T. C60 is capable of delivering the nearest thing to the live event.

The Torus can be seen as an intellectual stepping-stone, demonstrating important technical advantages that will always compare favourably with large, slow and heavily damped woofer based designs. The listening experience is the test. It can be seen that the Torus provides the perfect partner to the super fast, linear phase, Wilson Benesch loudspeakers.

WILSON BENESCH
SPHERE
ULTRASONIC GENERATOR
WHITE PAPER
MAY 2007

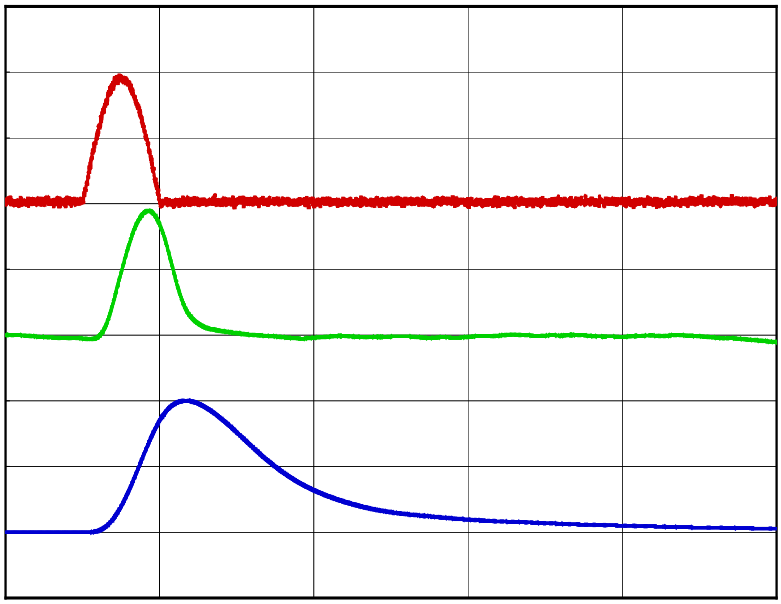
The Sphere is a key element of the ACT C60, the latest loudspeaker design from Wilson Benesch. The integration of the Sphere with the soft dome tweeter and Tactic II drive unit provides for an unprecedented level of performance. This white paper provides technical information about how the Sphere works as part of this important development.

The location of the Sphere with reference to the tweeter was found to be an important parameter in the performance of the Sphere. In order to avoid structural compromise and provide the closest positioning, a precision machined, alloy baffle has been developed. This rigid member affords the ideal mounting and launch vehicle for this extremely responsive device. The Sphere is housed in carbon fibre. This structure is then clamped in a compressive way to the primary baffle. These important details ensure that each unit delivers the maximum possible performance.



The image above is a laser vibrometer analysis, showing the expansion and contraction of the sphere. In contrast with conventional dynamic drive units, its reaction times are almost instantaneous. With reference to the graph below it is possible to see a comparative analysis of the impulse response.

The laser vibrometer measurement describes the dynamic response of the Sphere (green) and a conventional drive unit (blue) to a given impulse (red).



This exciting new technology takes its name from the gold plated ceramic element that produces the sound and is protected by patents.

The defining characteristic of this device is the way that it enhances the whole bandwidth of sound, much the same as the Torus. It is characterised by dramatic improvements in sound stage, greater fidelity of sound in all instruments and an air around each artist that was previously absent. The net result is a greater degree of reality. When the Sphere is combined with the Torus the increase in information is considerable and redefines the limits of sound reproduction. The unanimous perception is a performance that is more easy to enjoy because it is that much more life like.

The ceramic sphere diaphragm has a resonant frequency (f0) that is higher than its working frequency range. This virtue enables the fastest response capabilty (stop-to-go and go-to-stop). Conventional dynamic tweeters suffer from a lower resonant frequency and a major consequence is the lack of control and inability to respond as accurately. In sharp contrast the Sphere provides extremely accurate tracking of the original input signal. Extremely low levels of distortion are produced during this reproduction. The perceived benefits are delicate, highly realistic, and rich sound reproduction across the whole audible bandwidth. There is no harshness or high levels of uncontrolled resonance artifacts as in the case of devices attempting to work outside their limits.

The Wilson Benesch tweeter functions between 5kHz and 18kHz. At 19kHz the Sphere takes up the batten, producing accurate, ultra-high frequency from 19kHz to 100kHz. The importance of this additional information cannot be under estimated. It has always been well beyond the scope of conventional tweeters. The benefits are considerable, enabling for the first time access to crucial information available from high performance Vinyl, SACD and DVD formats that was previously impossible.

It is known that human hearing is capable of perceiving signal delays in sound up to 1 / 10000 second. Notably, the Sphere not only compensates for these delays in the higher frequencies but also in frequencies reproduced by the Tactic II. So in addition to the huge amount of information contributed by the Sphere it is also capable of assisting the function of the other drivers. The combined effect is a wide bandwidth transient response that is extremely faithful to the original signal.

The ACT 60 exhibits a completely new character of sound, characterised by accurate spatial information and ultra precise positioning of artists within the soundstage. This phenomenon is almost identical to the audible clues and additional information afforded by the Torus Infrasonic generator at the opposite, infrasonic end of the sound spectrum. Significantly, the combined result of ACT C60 and Torus is a quality of sound reproduction that is beyond what was previously possible. It can be accurately described as wide bandwidth, high definition sound. The sense of *"being there"* has never been more tangible.