

trinity

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

Trinity

This landmark design sets the agenda in the pursuit of high definition, wide bandwidth sound reproduction. Trinity can be used on its own or in combination with the Torus system to achieve the ultimate in terms of high quality, wide bandwidth, high definition sound. It pays homage to the capability of Vinyl source material as well as the greater bandwidth capability of SACD and DVD Audio formats.

The History behind the design

The greatest emphasis has always been placed upon the need for integration of dynamics within the transducers used in Wilson Benesch loudspeakers. To overlook this most critical concern is to ignore the incredible capabilities of the human ear. Without integration there is no illusion of one system, and the magic of recreating the event is lost before the stylus touches the vinyl. Only by convincing the ear that everything is in harmony can a successful attempt at recreating the original be made.

After the completion of the Tactic and Isobaric Tactic designs, Wilson Benesch committed to a long term development project to create new solutions for high quality sound generation in to ultra and infra sonic sound. The work was inspired in part by analogue playback systems that had always been capable of delivering broadband sound into infrasonic and ultrasonic regions. (see audio fidelity statement on 50 year old vinyl pressing of Louis Armstrong's Jelly Roll.)

In 2003 work began on the first element, the patent applied for Torus system. Three years later the remarkable success of the Torus endorsed the importance of this work. Four years later, we are delighted to announce the realisation of a completely new generation of loudspeaker design.

The latest chapter in Wilson Benesch design is a remarkable loudspeaker developed to cope with the dynamic forces of the very latest drive unit technologies. The comprehensive list of new technologies that can be found in Trinity are touched on below.

- 1. Cabinet. P.A.C.T. (Poly Alloy Carbon Technology) cabinet architecture.**
- 2. The Trinity of Drivers. (The first, second and third element.)**
- 3. Crossover**
- 4. Primary Baffle**
- 5. Sub Baffle**
- 6. Bracing**
- 7. Port Arrangement**
- 8. Stand**
- 9. Terminals**
- 10. Spikes**
- 11. Internal wire**
- 12. Absorbent material**

1. Cabinet

If a loudspeaker resonates it is no longer a transducer but an uninvited musical instrument. A key objective of all High definition loudspeaker designs should be to engineer out any potential uninvited musicians. In pursuit of this goal, Wilson Benesch has drawn upon the most advanced materials technology available in order to take full advantage of the performance envelope of the advanced drive units deployed in the design.

P.A.C.T. (Poly Alloy Carbon Technology) cabinet architecture

A wide variety of alloys have been selected to perform specific engineering tasks within the Trinity architecture. Combined with A.C.T. technology the result is the most advanced structure ever seen in a loudspeaker.

The same 12 K High Modulus multi axial woven Carbon fibre fabric that was developed for the Torus is now used in Trinity. One layer alone, deployed in the Torus cone eloquently demonstrates the awesome properties of this material. It copes with mass loads in excess of 100,000 its own mass. Of course in the loudspeaker monocoque it is just one part of the Advanced composite structure This structure provides massive improvements over and above the single layer. The 18 mm thick structure is a formidable barrier to resonant energy: think of Formula One cars colliding with concrete walls. In terms of stiffness, damping, low mass and therefore fitness for purpose, this advanced material is one part of the new structure that replaces the industry standard set by the previous Wilson Benesch designs. According to all physical criteria required of loudspeaker cabinets, no other material can match the physical properties of this technology.

2. The Trinity of Drive units

First element. The Tactic II Multi-role Drive unit

A solid principle at the core of all Wilson Benesch design has been the fundamental respect given to integration between drive units. In pursuit of this goal the Tactic multi role dynamic drive unit was created. This provided the ability to generate low frequency sound that is matched dynamically with the mid range drive unit. The clamshell Tactic Isobaric overcomes all the principle flaws of the large diaphragm designs commonly accepted by other designs. The rejection of large diaphragm drive units is a unique development path that sets Wilson Benesch apart from its contemporaries. Some of the principle flaws of the large woofer would include: the fact that they cannot integrate, they are incapable of matching the mid range unit dynamically, they provide a massive window for resonant energy to escape and of course the sound they create is quite different to the mid range driver that is typically made from different materials! It was this philosophical departure from convention that lead to the Torus design. Wilson Benesch has never and will never make a loudspeaker with drive units greater in size than the Tactic.

The latest version of the Tactic incorporates a number of small improvements as part of our on going development of the system. Tactic II drive unit takes advantage of the latest Nd.Fe.B magnetic material that delivers more magnetic flux, providing for a more powerful motor system.

To exploit the increase in flux, modifications to the adjacent conducting metalwork have been required. 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 front and back plates have been modified to enhance air venting, providing for more effective cooling and venting of air from the rear of the dust cap.

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 high compression and rarification of air. There is a noticeable freedom of delivery that allows music to image well beyond the confines of the enclosure.

The Second Element. The Wilson Benesch Tweeter

To its credit, Wilson Benesch has remained with, what is fundamentally the same tweeter for over a decade. This announcement fully endorses the unique development path that has been taken. Within its bandwidth, the Wilson Benesch tweeter delivers the finest quality reproduction with the least obvious compromise. In contrast to hard dome solutions, the Wilson Benesch soft dome is highly controlled well damped and free of un-controlled structural resonances. 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. These Single material structures be they made from carbon, beryllium or whatever metal all resonate in a very uncontrolled way. The argument that this resonance is above 20,000 Hertz beyond the threshold of hearing and so unimportant is completely erroneous. The Sphere lucidly demonstrates that this energy is perceptible and does have a significant effect when produced accurately. When ignored and un controlled the resulting sound is typical of so many designs of today often fatiguing and typically characterised by sounding hard and synthetic.

In contrast the Wilson Benesch tweeter works exceedingly well within its limitations from 5,000 to 18,000 hertz. In contrast to hard domes the signature is often characterised as being sweet, natural or accurate. So although today there might be many devices that provide a few thousand hertz extension beyond the Wilson Benesch tweeter we would argue that the price of securing this result is too high. The distortions and loss of damping are simply unacceptable.

The Third element. - The Sphere

In collaboration with Murata of Japan Wilson Benesch is proud to announce the realisation of The Sphere, 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. It takes longer but the result can be justifiably 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 18,000 Hertz. It continues in a controlled way up to 100,000 hertz 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.

- Further information can be found in The Sphere - White Paper attached to the bottom of this document.

3. Crossover

The best crossover, is no crossover. With no crossover you have no phase anomalies between voltage and current that are frequency dependent. Simplicity is the goal.

Within the stand of Trinity is a hand built crossover that is completely removed from the cabinet and encapsulated in sand in the main stand where structural borne energy will be at its lowest levels. Sand adds mass to the bass of the design assisting in stabilisation it is also recognised for its ability to absorb energy and so provides the ideal environment for the sensitive crossover elements.

4. Primary Baffle

The Baffle is the structural reference point for the launch of all energy from the drive units. Since we introduced the Alloy baffle in the A.C.T. One over a decade ago the recognition of this important facet has been widely recognised by other designers. High tensile bolts clamp this sub system to the Sub baffle. The baffle has become a sub system in itself, providing as it does a mounting structure for all three drivers that affords massive, highly damped, compressive clamping forces to reduce as much as possible spurious uncontrolled resonant artefacts in the drive units themselves. It's a little bit like clamping them in a vice. This method of retaining the drive units affords other benefits one of which is to remove clutter from the front baffle leaving a smooth elegantly machined surface.

The rigid 10mm alloy baffle is machined to exacting tolerances to provide the best possible launch platform for the three elements. Each drive unit is as close as physically possible to its adjacent drive unit

5. Sub Baffle

Displaced behind the Primary baffle and locked into the profile of the aluminium alloy side extrusions is the steel Sub Baffle. This is welded to the internal braces providing for a level of stiffness that is several orders of magnitude superior to any wood based designs. In itself this engineering solution exhibits a resonant frequency that is well above 7,000 hertz, so well outside the ears most sensitive sound band. However when married to adjacent dissimilar materials via lossy adhesives this energy is instantaneously converted to heat rather than sound. Simple but extremely effective.

6. Bracing

Bracing is the internal architecture of the loudspeaker. The quality of bracing is not simply a function of numbers however. The material chosen to provide the bracing is extremely important. This is why precision cut steel members are used in the Trinity. The braces act as a sound super conductor as well as a bracing structure. (Sound travels through steel at almost 15 times faster than through air at 5050 metres per second compared with 344 metres per second in air.) The objective of the brace is not simply to control resonance it is also seen as an energy conductor removing energy from the baffle and taking it away to lossy structures that convert this energy to heat. The other important benefit of steel is that the structure can be far smaller in size and so consume far less precious air volume. The Laser cut steel sub baffle and bracing that is welded throughout is quite simply the best solution available. The net result is a high precision super stiff structure that rapidly conducts resonant energy to the A.C.T. monocoque.

7. Port arrangement

In order to provide the main driver with the highest air volume possible and avoid any internal obstructions to air movement, the port have been externalised with two alloy turned tube structures firing down towards the ground through the carefully cut stand design. This arrangement affords the cabinet all of its precious air volume and directs bass energy from the ports down to the ground producing the most accurate method of enhancing low frequency output from the driver.

8. Stand

The stand is fabricated from precision ground steel alloys and extruded aluminium alloys. All the elements are bonded together and compressively clamped during fabrication. The net result is a low profile highly rigid design. This structure is then terminated into the multi alloy loudspeaker cabinet structure with 8mm high tensile bolts via Stainless steel stands. The direct connection from the steel internal bracing elements to the stand itself provides the best possible sink for resonant energy enabling it to be conducted to ground with the minimum effect upon the perceived sound.

9. Terminals

The termination of electrical signals is always accomplished by secure bolt fastners in any engineering application. For this simple reason Wilson Benesch manufactures its own copper alloy bolts before Rhodium plating them. A Wilson Benesch spanner provides the user with the confidence that once tightened the seal will be air tight and totally reliable. Bananas can be used also.

10. Spikes

The termination point of any speaker is the spike. Wilson Benesch spikes are the most formidable. Each rear spike can be easily adjusted to provide a rake angle on the attitude of the speaker. The 14mm threads are quite considerable and pay homage to the task that they must perform.

11. Internal wire

Wire technology has seen dramatic recognition over the last decade. The fundamentals remain the same however. Trinity takes advantage of the best materials available according to the task that it must achieve. These conductors are buried in sand for the large part in the main stand and are subsequently highly protected from the structural borne resonances within the system. Further protection is afforded in a different way within the main enclosure itself.

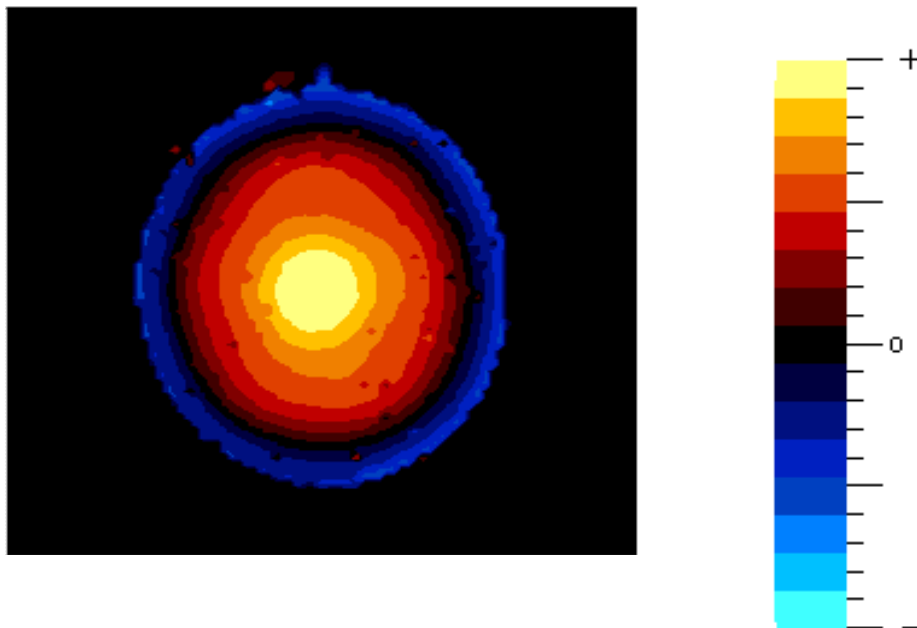
12. Absorbent materials

A lot of work has been carried out into the benefits and comparative merits of different absorbent materials. Three different materials are deployed in Trinity.

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SPHERE
ULTRASONIC GENERATOR
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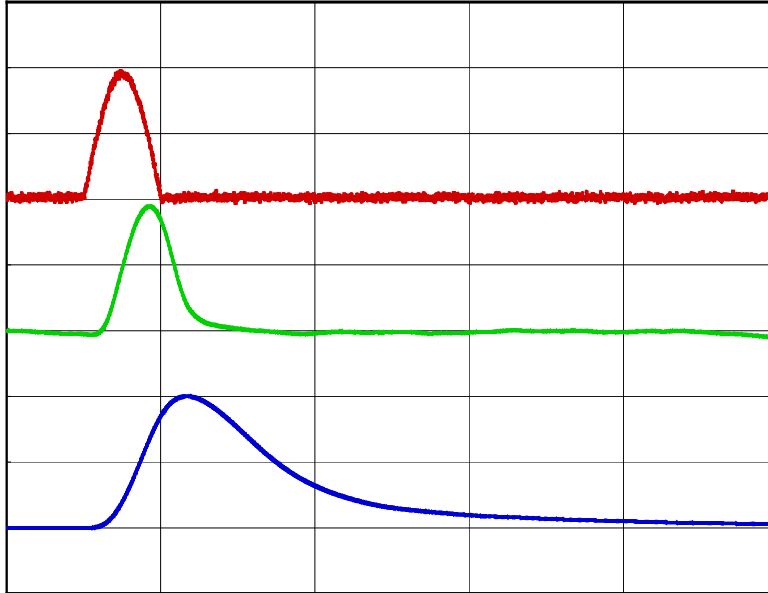
The Sphere is a key element of Trinity, the latest loudspeaker design from Wilson Benesch. The integration of the Sphere with the soft dome tweeter and Tactic II drive unit provides for an unprecedented level of performance. This white paper provides technical information about how the Sphere works as 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 (f_0) that is higher than its working frequency range. This virtue enables the fastest response capability (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.

Trinity, the first product to exploit this technology, is 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 Trinity 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.