

# SOPRA

\_\_\_\_\_ N°1 - N°2 ...



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# SOPRA

\_\_\_\_\_ N°1 - N°2 ...



Sopra incorporates 20 years of Utopia's technological heritage while satisfying the aesthetic requirement for a compact design



# Sopra

Innovation at Focal goes way beyond technology. Our obsession is with the end result: the delight of sound in all its harmonic richness; its purity and its precision in relation to the musical work. Moreover, we focus our efforts on our core skills - the speaker drive unit - in order to perfect our expertise and to accomplish our goals...

In 1995, the first Grande Utopia was conceived as a concept product, as a demonstrator, to confirm the contribution of new-technology speaker drivers to sound quality. Twenty years later, Utopia has become a major reference of world renown, praised for its incredible musicality.

This has enabled us to learn and progress by systematically associating each new technological innovation with its contributions in terms of audio quality. All these technological milestones, whether the cones (the "W" sandwich cone, the pure Beryllium dome) the magnetic circuits (the multiferrite magnet, the EM woofers or the IAL2 tweeters), the crossover (the [OCP+ circuit] or even

the cabinet (the Gamma Structure) all are inherent to our technological heritage. What's more, when advancements are feasible, we draw on our expertise from our heritage and to focus on the new performance we are able to provide.

The Sopra project is fully in line with this approach, with the additional aesthetic requirement for a compact design. Being extravagant by essence, this is something Utopia was never going to have. As you will see in this catalogue, Sopra benefits from several major technological breakthroughs. It is amazing to realise how it is possible to still make progress in the field of speaker driver technology. With the help of numerical analysis tools, to reveal the speaker driver's most intricate inner workings, we can push back the limits of sound reproduction in terms of purity, precision and harmonic richness... "*The Spirit of Sound*".



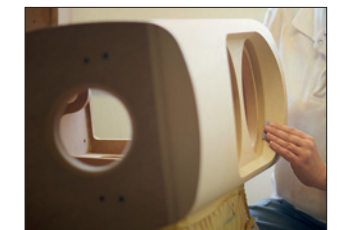
"W" sandwich cone



Pure Beryllium



OCP Crossover



Gamma Structure

Focal has been recognised for its unique expertise of the speaker by being awarded the Living Heritage Company label

# The Heritage of Speaker

## Made in France



Entreprise  
du Patrimoine  
Vivant  
  
L'excellence  
des savoir-faire  
français

The speaker is what's at the core of Focal's DNA, it's what the history of our business is built around: technology, mechanics and sophisticated materials. Focal's history is written every day by men and women whose unique expertise pushes back the limits of sound reproduction. We are proud to have succeeded in keeping our own manufacturing facilities, which was the only feasible way for us to continue innovating and developing our expertise and know-how. This has given us unique recognition, that of being awarded a Living Heritage Company label (Entreprise du Patrimoine Vivant).

All the optimisations we worked on for the transducers used in Sopra, using new numerical simulation software, in terms of magnetic circuits and suspension, would not have been possible without our own production facility. Indeed, hundreds of prototypes had to be made to come up with the right solutions.



New Sopra midrange drivers being assembled at our Ariane manufacturing facility. This facility based on lean manufacturing employs highly-qualified workers who have complete control over every step of the process.

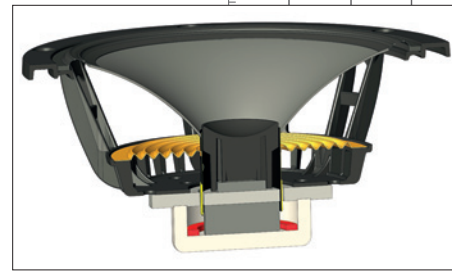
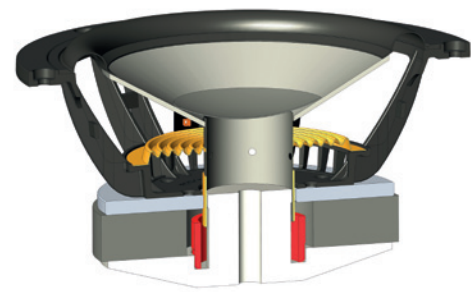
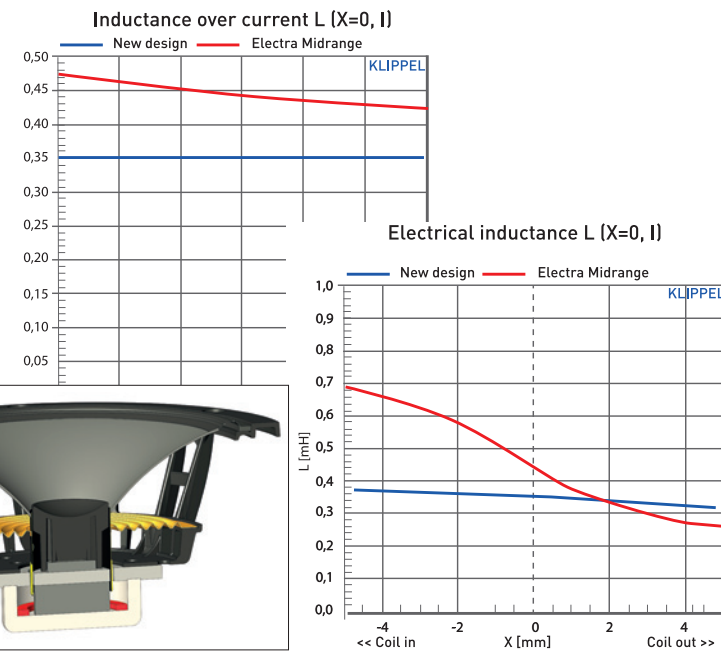
# NIC Neutral Inductance Circuit

## Stabilising the magnetic field

The precision and detail of audio reproduction depends on the stability of the magnetic field

Since the beginning, we have always had a great interest in the magnetic circuit, an essential aspect of a speaker drive unit. Over these last few years, after having pushed back the limits in electromagnetic technology with the Grande Utopia EM and the Stella Utopia EM, we recognised the fact that beyond the magnetic field intensity and its homogeneity within the gap, there was a dynamic aspect we had no control over. The magnetic field varies regardless of its intensity. Indeed, it is not stable because it is modulated by three factors: the movement of the voice coil (Lenz's law), the current passing through it (Foucault current) and the frequency. Consequently, the voice coil, the moving part, is in the magnetic field which becomes too variable, and this leads to loss of precision; like a picture taken with a camera which is shaking slightly. This is an obstacle to very high definition.

Research we began three years ago led to the development of simulation software which makes it possible to visualise these complex interactions. This paved the way for the development of an incredibly stable magnetic circuit. The solution lies in the Faraday ring a well-known technology which can be further developed thanks to modern simulation tools whose dimensions, materials and positioning we were able to optimise. This was inconceivable three years ago. The magnetic field is no longer affected by the position of the voice coil, by the amperage or the frequency of the current passing through it. This is a sign of very high definition.



In red, the Faraday ring on a Sopra n°2 woofer. Its material, dimensions and positioning have all been optimised thanks to our new simulation software. The result is a spectacular combination of efficiency and bass control, regardless of the position of the voice coil in the gap.

Effective measurement using the Klippel analyser for a 6" midrange speaker driver: the blue curve represents the new NIC (red ring in the cross section view), the red curve represents a conventional 6" midrange speaker driver with ferrite magnet. Above: the variation of inductance according to the current passing through the voice coil which varies according to the musical image. Complete stability of the NIC. Below: the variation of inductance according to the position of the voice coil in the gap. The result is spectacular.



Visual analogy of magnetic disturbance



Without a Faraday ring



With a conventional Faraday ring

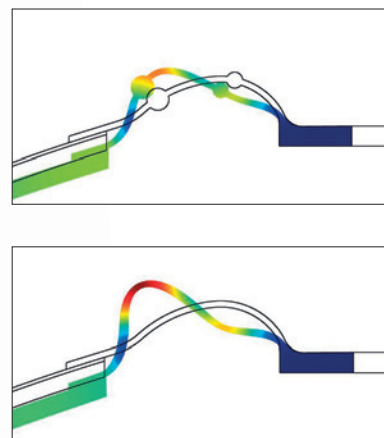


With Focal's Faraday ring

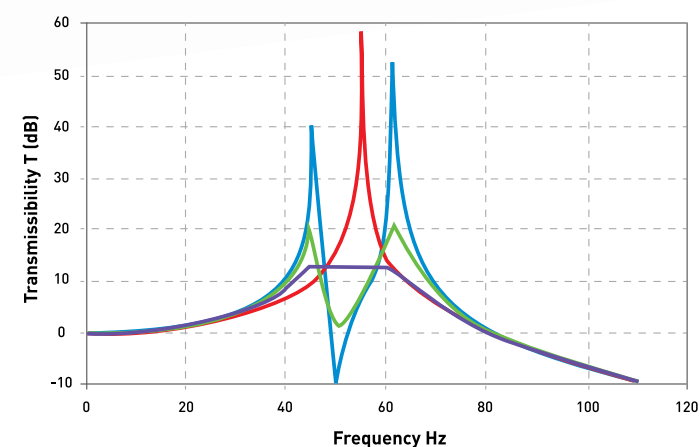
The variations related to the position of the voice coil and to the current passing through it in a conventional circuit results in blurring.

The Faraday ring is a well known technology which improves definition. However, this results in a loss in dynamics/contrast.

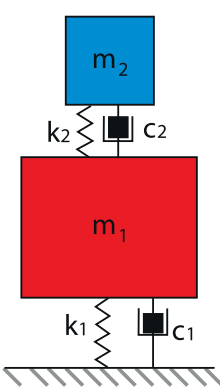
Our new simulation software enables us to combine the best of both worlds: very high definition and dynamics/contrast.



Our Tuned Mass Damper (TMD) consists of two tubular rings moulded onto the surround. This simple solution, perfected thanks to our new software, stabilises the dynamic behaviour of the surround according to resonance, thus avoiding deformation of the cone without afflicting the dynamics.



- without absorber
- with absorber, no damping
- with absorber, small damping
- with absorber, optimized damping



The graph on the left demonstrates the principle of the tuned mass damper. In red, an  $m_1/k_1$  system with very pronounced resonance. By adding a mass/spring system  $m_2/k_2$  (upper section of the diagram), there will be two resonance peaks, as represented by the blue curve. The drop or anti-resonance being previously based on the resonance of the main system, we get the green curve. Finally, by judiciously adding a damper, we obtain the purple curve. The resonance has almost disappeared!

## TMD Tuned Mass Damper

### The obsession with the midrange

The midrange register is no doubt the most complicated to control in a sound system. On the one hand, there must be a smooth transition with the bass. On the other hand, it must be tuned to the tweeter in terms of dispersion and acceleration. This determines the homogeneity of the timbre and spatialisation. Using a 6" (15 cm) woofer meets the first requirement, but meeting the second is where things get difficult, its coherence with the tweeter in terms of directivity. For the past 20 years, we have been working on mastering the "break up" (the frequency at which the cone becomes deformed, leading to distortion) of our 3<sup>rd</sup> generation "W" cones and on drastically reducing the resonance of the tweeter with the IAL 2.

Today, we can go even further thanks to the power of finite element analysis. Our teams have developed simulation software to visualise the dynamic behaviour of the suspension which connects the cone to the basket, thus revealing the performance issues requiring attention. All that was left to do was to conceive the equipment to solve those issues. The solutions already known for increasing the damping properties of the suspension all result in an increase of the mass which consequently alters definition.

**Sopra's midrange provides incredible realism thanks to its new magnetic circuit and TMD suspension**

Having eliminated the source of the distortion problems, we opted for exponentially shaped cones in order to increase frequency response, and consequently impulse response. Another reason for increasing definition.

The answer came from a technology used in earthquake-resistant skyscrapers and which is also used for the suspension on racing cars. This technology is called a "Tuned Mass Damper": an 40 applied to the speaker driver, the solution consists in simply two tubular rings on the suspension whose dimensions and position have been judiciously determined. This innovation is patented.



# IHL Infinite Horn Loading

## Getting the most out of the Beryllium tweeter



Our Beryllium tweeter features an incredibly light and extremely rigid dome. Its main limitation comes from the compression of air in the cavity behind it. To overcome this, the ideal would be to have a nearly infinite volume. The requirement for Sopra to be compact meant that as much of the cabinet as possible had to be used for the bass.

The requirement for Sopra to be compact meant we had to change the tweeter loading

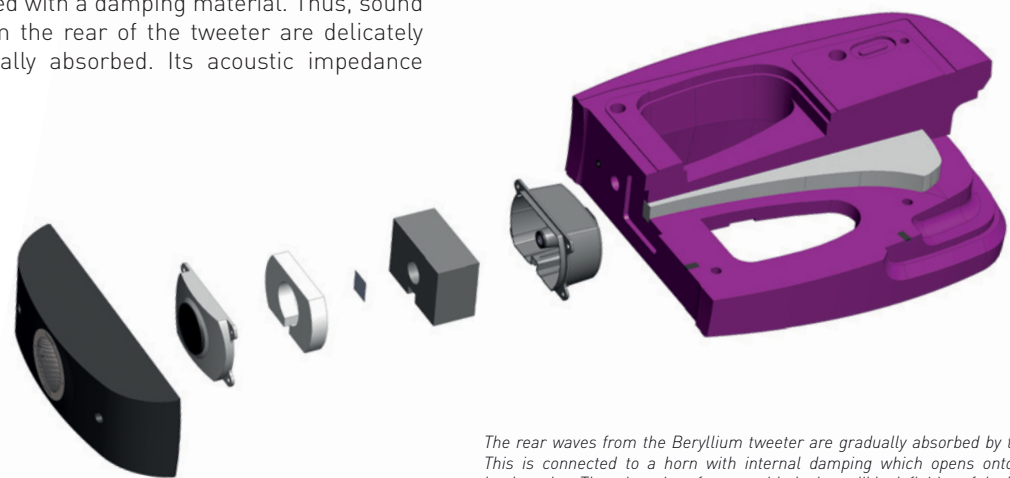
We had to explore other options for loading the tweeter, which led us to come up with the IHL system (Infinite Horn Loading). This system is patented.

The rear of the Beryllium tweeter is loaded via a small cavity which is connected to the exterior of the enclosure by a horn. The inside of the horn is filled with a damping material. Thus, sound waves from the rear of the tweeter are delicately and gradually absorbed. Its acoustic impedance

approaches zero so that no resistance alters the movement of the dome. This pushes definition to its maximum.

The advantage of this set-up is that this only slightly affects the cabinet's internal volume. Thus, we can get the most out of the woofers to enhance bass performance while having an ideally-positioned tweeter, and all this in a reasonably-sized cabinet.

Moreover, it was our duty to isolate the tweeter from any interference from vibrations. The injected polyurethane mono-bloc tweeter frame provides the optimal mass and damping in a reduced space.



*The rear waves from the Beryllium tweeter are gradually absorbed by the first chamber. This is connected to a horn with internal damping which opens onto the rear of the loudspeaker. There is no interference with the incredible definition of the Beryllium tweeter.*



# Design

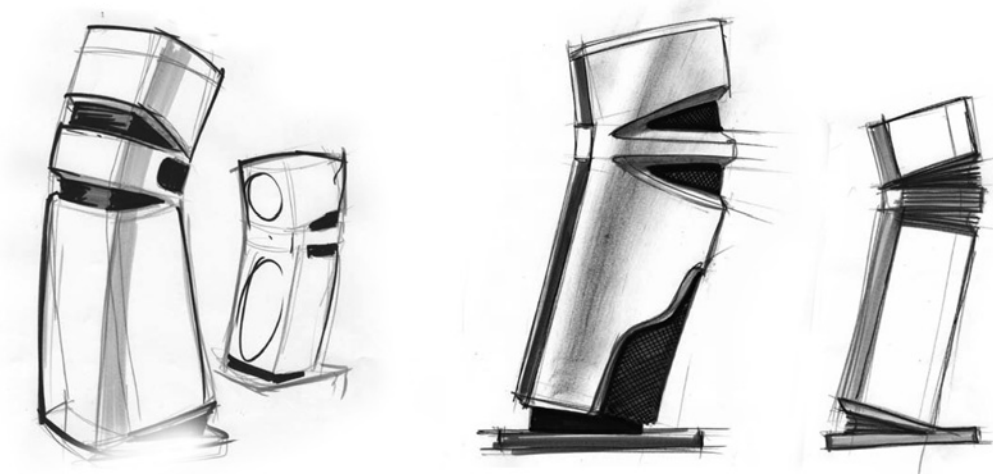
The primary goal in terms of design was to focus on the proportions which would enable us to satisfy the requirement for a compact design and reduced volumes while delivering very high performance bass. For obvious acoustic reasons, the height of the tweeter had to be at ear-level of a seated listener, the maximum being 1 metre, this means being beneath the midrange. This required 'Focus Time' alignment (where the audio sources are all at the same distance from the listener). This is particularly important for the biggest model of floorstanding loudspeaker which is equipped with two 8" (20 cm) woofers.

However, for this model, the size of lower section which would have been required wouldn't have made it compact enough. So we had to reach all the way up into the upper section for more volume,

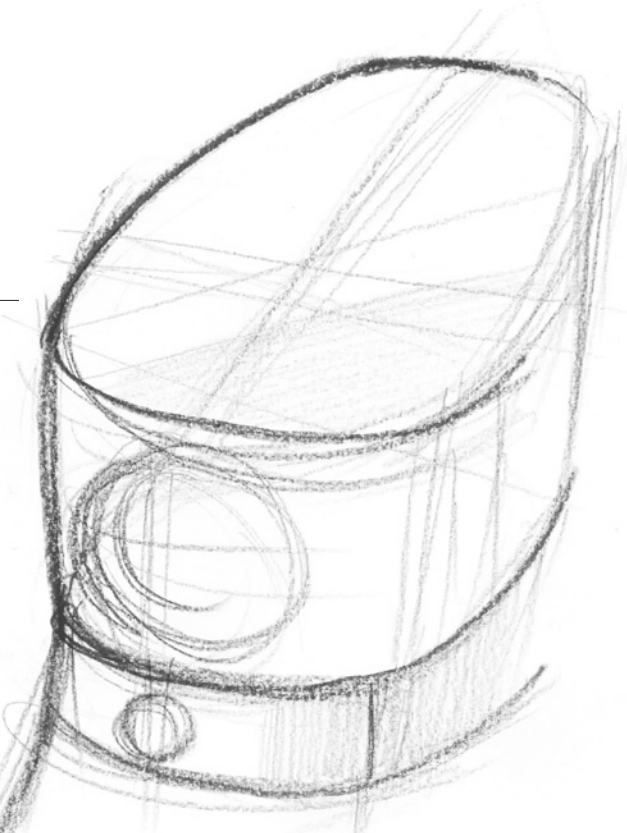
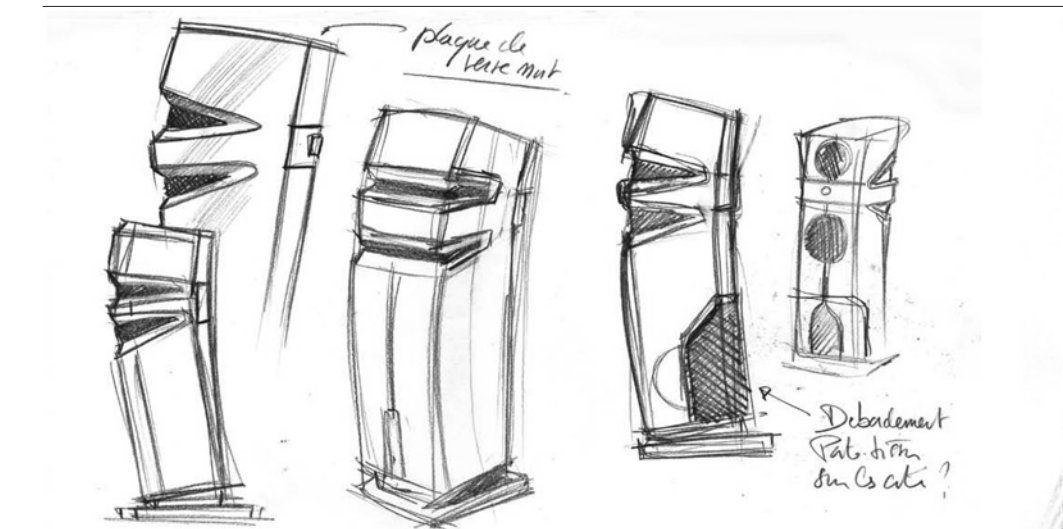
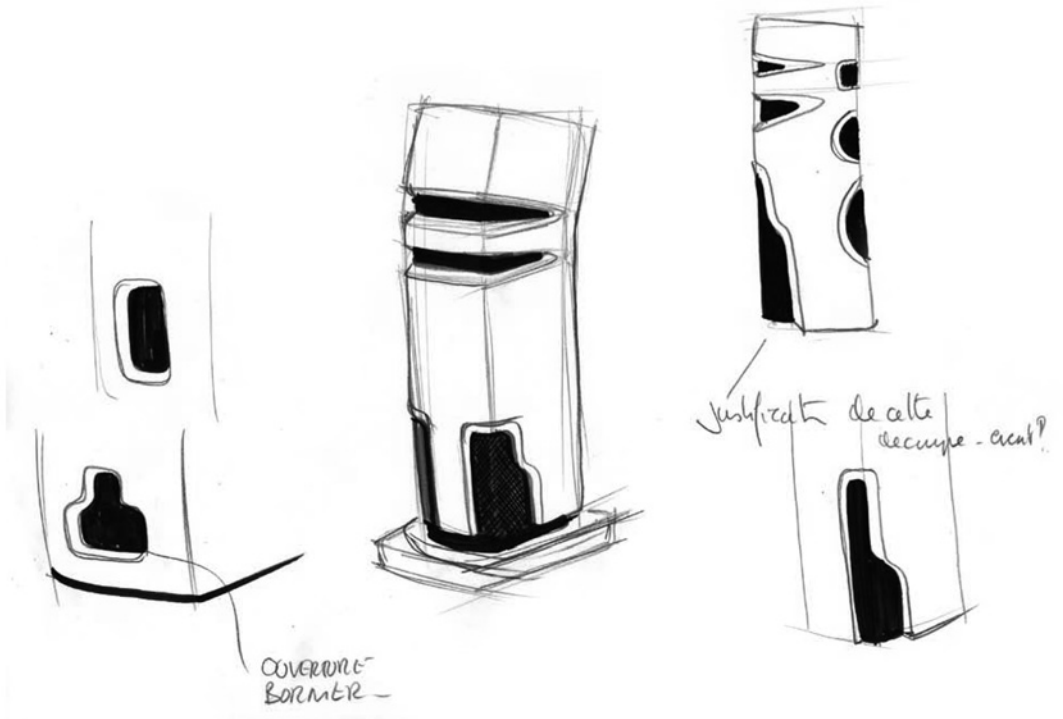


the midrange could do without the entire volume at the rear of the loudspeaker. We had to "cross" the tweeter section. The "IHL" system described previously was the solution, with two large openings where a maximum amount of volume could be used from the rear of the midrange.

The high-damping injected-polyurethane tweeter section isolates the tweeter from the vibrations coming from the bass and also protects the midrange. This section improves the overall rigidity of the enclosure in order to prevent any loss of precision. Finally, it is also what gives Soprano its unique design.



"The Soprano line is destined for the most passionate audiophiles. When expectations are so high, the design must provide solutions which go far beyond aesthetics and shape. This represents a great deal of work in terms of industrial design, which must serve acoustic experts and favour performance, whilst bringing together the qualities expected of an object which will be integrated into very elegant interiors and décors. Right from the drawing board, we wanted to emphasise the formal identity of Focal loudspeakers. A trapezoid section, a tweeter section with a strong identity, and cabinets placed at an angle which would ensure acoustic convergence (Focus Time). All these strengths which are inherent to the brand had to be emphasised by updating and even daring to reinvent new conventions, whilst keeping in line with the logic of the R&D departments technological advances. In this sense, Soprano reveals an exemplary 3-year collaboration between Focal's engineers and designers





... *Sopra's* very structure is articulated around the intermediate section, which, besides giving a very strong identity to the line, is a structural element which contributes to several technical solutions. This injected polyurethane component allows for the upper and lower cabinets to be inclined for the "Focus Time" (acoustic convergence of the channels).

It also provides the freedom necessary for the acoustic experts to achieve the desired enhancements for the treble (decompression, isolation of the tweeter section...). Finally, it optimises the use of space for the midrange whilst maintaining a compact design, and contributes to the very high rigidity of the structure as a whole.

Thus, the compactness and the harmony of the proportions of this line are the result of very advanced research. How was it possible to satisfy the requirements in terms of volumes necessary according to acoustics research, while keeping dimensions suitable for modern interiors?

Beyond 3D modelling, the many full-scale models and prototypes made it possible to refine the large volumes we were looking for, but keeping them balanced and easy to integrate.

Substantial efforts were made to give the front a tidy appearance, particularly around the speaker drivers, following on from the work on the *Aria* range. We wanted to celebrate and emphasise the core of Focal's expertise, in addition to ironing out any aspects which could afflict the acoustics or the appearance.

The flush cloth frames and the lacquered finishes allow for all sides of the loudspeaker to be the same, and right from the start of the project, we designed this line to allow for various combinations of colours and materials.

This was a real manufacturing challenge for our cabinet-making facility in Bourbon Lancy.

The mineral black, the brushed steel and the textured dark grey tones perfectly compliment the lacquered or bloodwood finishes.

The main theme of *Sopra* is deliberately uncluttered, though it still offers connoisseurs the opportunity to enjoy all the small details.

The grille with an incremental meshing motif protects the Beryllium tweeter and gives it a strong identity. This motif is repeated for sealing the curved back panel of the middle section.

The terminal board, the thumb nuts and the adjustable spikes have all been specially designed for *Sopra*, as have the few visible screws, all of which were manufactured by watchmaking experts.

Following on from *Utopia* and keeping in line with all Focal loudspeakers, the design of *Sopra* is the result of a very close collaboration between designers and engineers, a passionate quest aiming to conciliate complex constraints, experience, as well as sophisticated and innovative solutions, and all of this would have to be almost invisible, leading to something obvious, immediate simplicity for the pleasure and the purity of an unforgettable listening experience."

*Adrien Pineau*



Sopra n°2 "Carrara White" finish



With Alain Pineau, in charge of Sopra design: it soon became obvious, a powerful, compact and modern design.

## Mastering the cabinet



The 69mm sandwich-machined front panel uses the same principle as 'Gamma Structure' to provide inertia and damping. Its density gives it the inertia necessary to provide a stable mechanical reference for optimal definition.

The inside of the cabinet has no parallel side panels, and small Helmholtz resonators have been added to the lower section to prevent vertical standing waves. Sopra's cabinet was designed in our cabinet-making facility in Bourbon-Lancy using the same manufacturing process as for Utopia.

We chose glass as the material for the base of the loudspeaker to provide floor coupling, using spikes, which enabled the fastest propagation time possible, thus eliminating all halo effects in the bass.



# Sopra n°1

Compact and powerful, Sopra n°1 is a concentration of technological innovation. It features Neutral Inductance Circuits (NIC), Tuned Mass Damping surrounds (TMD) for the midrange woofer, and Infinite Horn Loading (IHL) of the tweeter. It is a true "demonstrator", corroborating the contribution of the new technologies implemented on Sopra.

First, the very low distortion gives it incredible clarity and very high definition combined with the spectacular spatialisation typical of bookshelf loudspeakers...

Beyond this attractive first impression, what's astonishing is the texture and smoothness of its sound. It provides a solid, "fleshy" sound with full and articulated bass. Precision is by no means artificial, nor is it limited to the treble. The overall coherence and harmonic richness gives the listener a surprising understanding of the music.

Ideal for small rooms up to 270ft<sup>2</sup> (25m<sup>2</sup>), Sopra n°1 is also ideal for spaces up to 550ft<sup>2</sup> (50m<sup>2</sup>). Providing high sensitivity and excellent power handling, Sopra n°1 is a true little monitor for the home.

Its special stand has been designed to expel interfering vibrations from the enclosure towards the floor to avoid any colouration. The steel frame inside the floorstander, coupled with the 0<sup>3/4</sup>" (19mm) thick glass base using four adjustable stainless steel spikes, provides very high transmission speeds. This is what guarantees an extremely sharp reproduction.



Sopra n°1 "Carrara White" finish



Sopra n°1 & Sopra n°2 "Carrara White" finish

# Sopra n°2

Sopra n°2 clearly inaugurates a new era for the "Premium High End" by taking into account new performance criteria. Compact, modern, a pure design, character... all these are essential factors to ensure perfect integration into your interior. Quite naturally, this orientation led to new requirements in terms of transducers due to the major innovations described in the previous pages.

Equipped with best midrange drivers ever developed by Focal, with the NIC and TMD technologies, Sopra n°2 pushes back the limits of sound reproduction in terms of transparency in a very compact enclosure. Indeed, unlike Utopia, which is extravagant by essence and where size is by no means a constraint, Sopra aims for maximal compactness to ensure easy integration into reasonably sized rooms.

The two 7" (18cm) woofers for the bass register equipped with natural inductance magnetic circuits benefit from a substantial volume thanks to the tweeter's IHL, allowing us to take full advantage of the cabinet's capacity. What's more, the cabinet's Gamma Structure with a 69mm front panel provides remarkable inertia considering such a size. Weighing 120 lbs (55kg), Sopra n°2 is by no means envious of its larger competitors... Thus weight and compactness are well balanced to provide impressive density and articulation.

This remarkable control of the bass makes Sopra n°2 even easier to integrate. It is perfectly at ease in rooms measuring up to 320ft<sup>2</sup> (30m<sup>2</sup>), and is even

ideal for larger rooms measuring up to 750ft<sup>2</sup> (70m<sup>2</sup>). The attention to amplifier quality and to the precision of positioning are essential for taking full advantage of Sopra n°2, the resolution being so high that holographic spatialisation requires such great care.

The purity of the timbre, the precision of the soundstage and the harmonic richness are sure to provide you with an intense emotional experience. Combining a compact design, a resolutely modern look and major innovations in terms of the transducers, Sopra n°2 clearly defines the new epitome of today's Premium loudspeakers.



Sopra n°2 "Carrara White" finish



Sopra n°2 "Electric Orange" finish



# Innovative features

## New Structure

- 1 > An original means of managing the space around the tweeter section to conciliate high-quality bass with a compact design

## Innovative patented transducers

- 1 > "IHL\*": a brand new tweeter configuration for an even more compact design
- 2 > "NIC\*" & "TMD" refined midrange, part of the DNA of Focal's sound
- 3 > "NIC\*": Impressive sound density and bass control

## Exceptional speaker drivers

- 4 > 35 years of continuous innovation "Made in France": W sandwich cones for the bass and midrange.
- 5 > Pure Beryllium for the treble  
Integrating all of Focal's most recent exclusive innovations NIC\*" & "TMD"

## The Codes of contemporary Premium quality

In terms of the choice of materials and finishes:

- 1 > Matt black polyurethane mono bloc tweeter section
- > Grilles with incremental meshing
- 6 > Glass surface and base
- > Lacquered cabinets

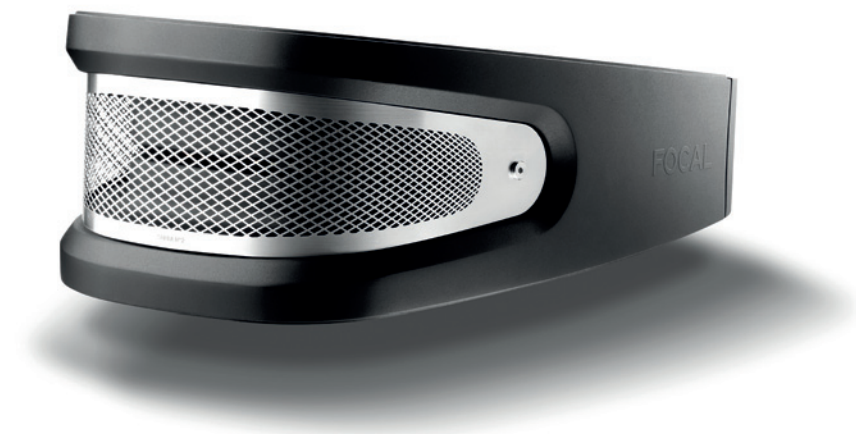
## 1 A strong identity

- > "Focus Time" built around the tweeter section, with its rear "IHL", aligns the audio sources in direction of the listener.

\*Patents Pending

## A modern statuary object

Harmoniously integrated technology. Simplicity and compactness have been combined for optimal integration into your interior.





**Sopra n° 2**

**Sopra n° 1**

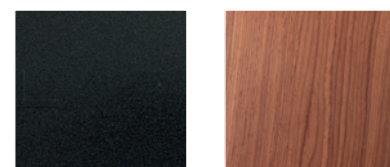
Type	Three-way Bass-reflex floor standing loudspeaker	Two-way Bass-reflex bookshelf loudspeaker
Speakers	Two 7" (18cm) "W" woofer 6 1/2" (16.5cm) "W" midrange with "TMD" suspension, "NIC" motor 1" (25mm) "IHL" Beryllium inverted dome tweeter	6 1/2" (16.5cm) "W" bass midrange with "TMD" suspension, "NIC" motor 1" (25mm) "IHL" Beryllium inverted dome tweeter
Frequency response [±3dB]	34Hz - 40kHz	45Hz - 40kHz
Low frequency point -6dB	28Hz	41Hz
Sensibility (2.83V/1m)	91dB	89dB
Nominal impedance	8 Ohms	8 Ohms
Minimum impedance	3,1 Ohms	3.9 Ohms
Crossover frequency	250Hz / 2 200Hz	2 200 Hz
Recommended amplifier power	40 - 300W	25 - 150W
Dimensions (HxWxD)	46 <sup>2732</sup> x14 <sup>332</sup> x21 <sup>1764</sup> " [1 190x358x540mm]	16 <sup>4764</sup> x10 <sup>6364</sup> x15 <sup>1932</sup> " [425x279x396mm]
Net Weight (unit)	12.2lbs - (55kg)	41.89lbs - (19kg) (stand: 40.78lb [18.5kg])

**Lacquered standard finishes (face + side panels)**



Carrara White    Black Lacquer    Imperial Red    Electric Orange

**Standard wood veneer finish**



Graphite Black (face)    Dogato Walnut (side panels)