



# Yamaha YSP-1 Digital Sound Projector: A Milestone in Home Theater History

The promise of a high performance, simple hook-up, one-box, surround-sound system fulfilled



by Patrick Hart of Audioholics.com

## Introduction

Years from now home theater enthusiasts may be reading whole articles on the available models within the Digital Sound Projector category. For the present though, there exists only the category-defining Yamaha YSP-1, a brilliant marriage of compact form with simply amazing multi-channel synthesis capability.

## What It Is, What It Is Not

The Yamaha YSP-1 is, quite simply, a *single-box, high performance home theater solution* which, by its very nature, integrates more easily into a typical home environment than any product that has come before.

To define it component-wise using standard audio categories, the YSP-1's internal sub-systems would break down roughly as follows:

- 1. It is an Audio Preamp/Processor which integrates with analog or digital video sources.** The YSP-1 hooks up to both digital and analog audio sources. Dolby Digital and DTS are built-in for movies while Dolby Pro Logic II and DTS Neo 6 can transform two-channel music into five channel surround. The number of inputs has been kept to a bare minimum but, as will be seen, they will support the most common configurations for which this unit will likely be used. This includes the capability to hook up to a DVD player, a cable or satellite receiver box (analog audio, digital video), an analog or digital TV and even analog audio from a VCR. Then there is the ever-present aux digital input which can be used for a digital cable TV, digital satellite TV or game console.
- 2. It has forty-two channels of digital amplification.** The YSP-1 has forty 2.5 watt digital amplifiers, each tied directly to its own 1.25" transducer within the array. There are also two 20-watt digital amplifiers which deliver power to two 4.5" mid-woofers.
- 3. The YSP-1 has a proprietary (1 Ltd) digital signal allocation and "beam steering" audio processor chip.** All of the transducers are used for ALL of the 5 different steered channels – they are NOT used as subsets; i.e. some for each beam only.
- 4. It is a button-push configurable two-channel, three channel, five-channel and three LCR channel + 2 channel surround-capable speaker system.** Forty-two transducers total; two 4.5" left

and right front mid-woofers on either side of the master array of 40 approximately 1.25" diameter drivers. The crossover frequency of the two 4.50" left-right mid-woofer drivers is switchable to 80Hz, 100Hz or 120Hz to match with an outboard subwoofer for which a low-level output is provided. The mid-woofers' handoff frequency to the 1.25" forty-driver array takes place at 350Hz (1000 Hz in Corner-location mode).

**5. It is the most decor-friendly, highest wife-acceptance-factor, true surround audio system ever designed.** With the debut of the Yamaha YSP-1, its product execution, from the quality of materials, to the stunningly elegant industrial design, marks a high-point for performance vs. value in a category-defining product.

## Design and Construction

At a suggested retail of \$1499 SRP the YSP-1's well chosen and expensive construction materials plus exemplary fit and finish set a benchmark for every subsequent product to emulate. My significant other immediately approved the classy, muted silver-gray perforated metal grille across the upper span of the unit's face. She loved the fact that in most room lighting, the 42 black drivers mounted on a flat-black background behind the grille make them invisible. The bottom front area sports a clear Plexiglas-over-high-gloss-black background running lengthwise across the entire device. The subtle dull-to-shiny blend of the grille versus the base was also highly regarded in my household.

Behind the plexiglas in the unit's bottom-center is a 4" x 1/2" flourescan dot-matrix display in a muted blue. This is my favorite choice of display technology and color as it is equally readable both in darkness and in most typical lighted room conditions. (The light level of this display is adjustable from 0 to -1 or -2 in the software. I found -2 worked equally well in darkness or daylight conditions.)

To the right along the bottom are four square, flat black tact-switch-style push buttons labeled Input, Volume - / + and Standby/On. To the Left along the bottom is a barely discernable Yamaha logo with "Digital Sound Projector YSP-1." A 0.2" wide x 6.25" high gloss black plastic end-cap finishes off both left and right sides of the perforated grille.

Moving around to the back, the unit's materials and quality of finish are every bit as



impressive. Presumably to contain EMI radiation that may be emitted from the digital amplifier chips, a double-layer steel chassis has been fabricated with overlapping seams. The outer black-oxide coated chassis sits atop an eight-tenths width plastic injection-molded base. On the YSP-1's top, two black-anodized aluminum extrusions form the upper cover. A plastic cap which has the Yamaha logo reverse-embossed is affixed at the top center to cover the seam of the two aluminum extrusions.

## The YSP-1 Remote

I'm big, really big on easy-to-use remotes. I'm just guessing here but I'd say Yamaha's YSP-1 engineering team must have taken several samples home for their wives and kids during development. The basic operations are simplicity in the extreme, and intelligently grouped along the remote's bottom 40% of real

## Review Summary

Overall Rating: 4.75/5

Value Rating: 5/5

MSRP: \$1499

## Manufacturer

Yamaha Electronics

## Pros

- Single-box, high performance, 42 digital amplifier, surround sound system
- Very easy, 30-minute hook-up; interconnects only.
- Dolby Digital 5.1 & DTS ES for movies, Dolby Pro Logic II & DTS Neo 6 for music
- Decor-friendly, highest partner-acceptance factor system
- Highly ergonomic, easy-to-use and integrate remote control
- Plays impressively loud and clean
- Quality construction, exemplary fit and finish
- Excellent value vs performance

## Cons

- Requires subwoofer for full-bandwidth movie sound
- Some non-re-EQ'ed DVDs can sound bright at high SPL
- Software set-up requires a learning curve

estate. The remote works within a pretty generous  $\pm 30^\circ$  window and at that  $30^\circ$  angle it's good for full functionality to about 20 feet.

There are some really clever ergonomic touches that are not apparent until you study the remote's layout a bit more closely. For example, the TV channel up-down buttons have been moved up and out of the most-used bottom sector. (Keep it on channel 3!)

Another brainy move was placing all the set-up routine buttons in a sort of "no-man's-land" center section around the ubiquitous Up-Down-Left-Right directional wheel with center Select button. This leaves a neatly divided and simple-to-use remote with most-used, single-push controls at the bottom.

At the top are secondary controls which the kids or grandparents would use less often once the movie or TV program is started. This is a remote I can remember easily and, for instance,



coach my fiancée's grandfather over the phone should he get in trouble. Just set it up once and you're home free.

Along the remote's bottom are the four available beam modes. Above the beam mode selection buttons are a soft-white TV input selector and four dark gray source selection buttons for TV, DVD, VCR and aux. The owner's manual suggests aux can be either a digital satellite tuner, digital cable or a game console.

The next section up from beam mode selection will be the most utilized. And it is here that the simple two-color button theme plus clever spacing ergonomics play such a subtle, yet vital roll. To the left in soft-white are the + and - TV Volume rocker-style buttons for the TV speakers. On the remote's right side the two + and - charcoal gray buttons simply called Volume. A soft-white TV Mute is in the center between these two rocker-style volume controls and matching charcoal gray Mute to quiet the YSP-1 is above that.

A single nit-pick: the remote control feature most of us Audioholics immediately look for... backlighting, is not included. Normally, in a product of this ambitious caliber I'd express disappointment. I'm guessing though that in most instances there'll be adequate lighting in the room anyway. So while I'll give the engineers a pass on this first version, at the same time I'd humbly request a fully backlit remote, (with the same great control layout please!) in your second generation Digital Sound Projector.



## Setting Up Yamaha's Digital Sound Projector

One of the most outstanding aspects of the YSP1's all-in-one design IS its all-in-one design. As long as you mount the Digital Sound Projector either above or below your video display all other room and imaginary speaker placement locations can be input into the unit's DSP.

Even after having an absolute ball with this system for the last two weeks I still laugh in dumbfounded amazement every time I try a new set-up. After working so many years carefully figuring out front and surround speaker placement in dozens of rooms, it's hard to describe the feeling of being able to simply plop a single box on top of my TV, hook-up five or six interconnects and having immersive home theater like I've never experienced - *all in less than 30 minutes.*

For basic hook-up to the TV, DVD, etc, the directions are well-written with clear, simple illustrations. Once all the hard-wiring is complete the on-screen set-up menu system will need to be utilized. Yamaha has anticipated that most people will not want to read too far into the set-up before they actually hear sound so the first Set Menu screen has only three choices: Memory, Easy Set-up and Manual Set-up.

A word of advice? Choose Easy Set-up and go through the two-minute, four-step program to get sound coming out of your magic box. It's simple. Select >

- **Room Type:** Square or rectangle? Got an L-shaped room? Choose rectangle.
- **Speaker Position:** Square has 4 choices including offset and corner. Rectangle has 8.
- **Room Size:** 3 general dimensions given. Pick the closest dimensions to your room.
- **Set-up Okay?** Say yes and input your first program into one of the three preset memories.

Sound comes out of the magic box. *Surround sound floating in space.* Center vocal sound that is up front, natural and clear. *The initial audio impact of the YSP-1 will likely be far different than you've ever experienced.* Enjoy the sound while you read about Manual Set-up...

Here are a couple of suggestions to bear in mind. When setting up, for instance, 3-Beam Mode (which I needed to use for my initial corner YSP-1/TV position) go through the



entire set-up in the order in which they are presented in the menu. Deviate from that order by jumping to the end of the menu to change a parameter and you may wind up changing a parameter further upstream. Also, if you take some hard measurements of your room and make a top-view sketch of your room beforehand, you'll have a much easier time getting your first manual set-up in the ballpark sound-wise.

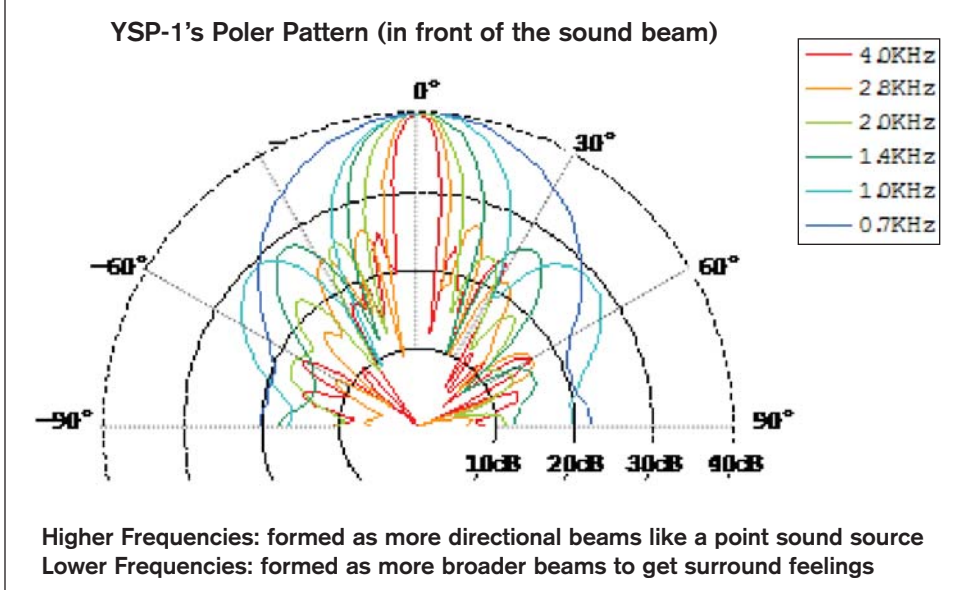
Once you've got that first program input into one of the three User program memories then you can go back through the exercise again and tweak your settings from there. I found that once I had the system performing well, I could navigate through the menu quickly. It was easy to go in, change one parameter in the whole menu, and put this new parameter template into another User memory. It was then simple to A-B the results while watching favorite movie

scenes. And rather than being the cumbersome chore this menu at first seemed, it became fun after the first week or so to continually make minor changes to see how the sound of a favorite scene would be changed.

## YSP-1 Digital Sound Projector Measurements

It was fairly easy to measure the YSP-1 outside in free air. For the 4.5" mid-woofer I did a close mic'ed measurement while the YSP-1 was pointing straight up. This gives a reflection-free curve with no curve-smoothing required. A digital filter cuts off the 4.5" mid-woofer sharply at 1000Hz. From this point I moved the microphone up to about 8" and over the left side of the 40 driver cluster. By setting the Mode to Stereo and adjusting the Tone Control to -3dB on the Treble I was able to achieve the curve below by splicing the frequency response of the cluster to the close-mic'ed response of the mid-woofer.

This type of smiley-curve response is most comfortable to hear when listening non-critically to music and will usually be perceived as more than adequate treble extension within the context of TV or movie viewing. Also, the bump at 6100Hz most probably corroborates well with frequencies beginning lower, at around 3KHz in throwing the "floating-in-space" sound portrait the YSP-1 is capable of rendering.



The caveat to the 6100Hz peak is that with movie music not specifically re-EQ'ed for DVD, instruments with lots of high frequency harmonic energy, like a tambourine, become immediately fatiguing. The same holds true for the CD and most music-only formats. As it is, the YSP-1's frequency response appears to have been specifically tailored to achieve maximum beam-throwing efficiency as is hinted by the inclusion of the multiple-frequency polar pattern chart contained in Yamaha's YSP-1 white paper.

## Listening Impressions

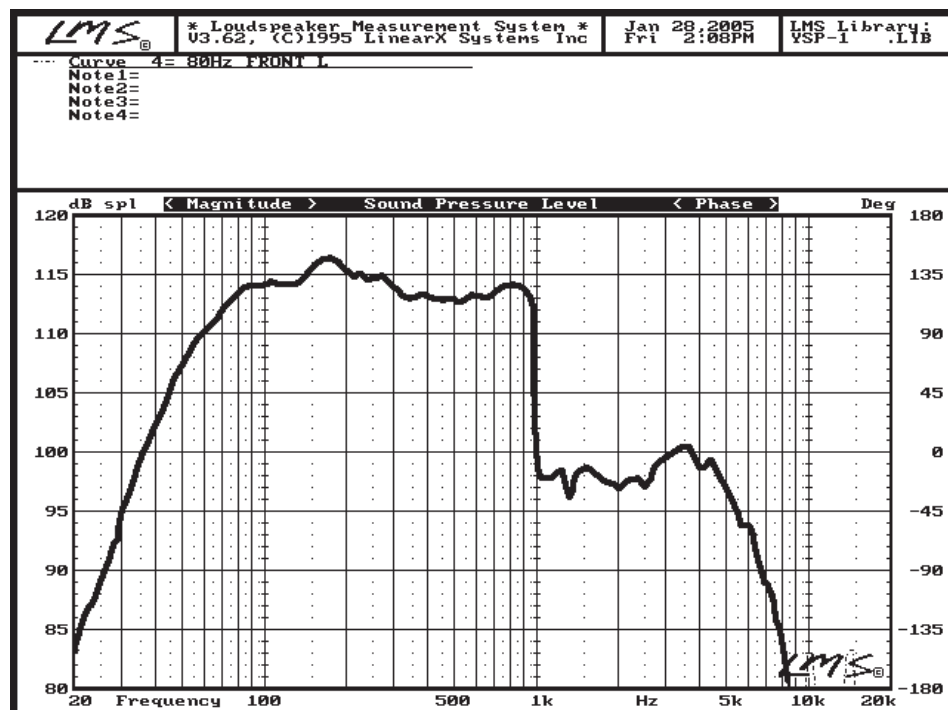
My open floor plan living room with corner placement is the space I used for most of my testing. The corner placement condition is the one which my comments have alluded to up to this point, so let's talk about the YSP-1's performance in this most sonically challenging situation...

After studying conceptual top-views of the different beam modes I concluded that my more open floor plan, with corner placement, was quite a bit larger than the largest room-choice given in the YSP-1's Easy Set-up menu. It seemed apparent that I'd be asking the YSP-1 to strut its stuff in an almost worst-case scenario.

By inputting and re-tweaking different Manual program settings for a couple of days I felt I had reached a point where I was getting close to the maximum performance out of Yamaha's Digital Sound Projector in my particular environment. So, what better way to wring out Yamaha's magic box than by renting the newly-released DTS 6.1 Special Edition version of 1986's Top Gun?

Using the 3 Beam Mode with my dual subs (one front, one rear) I set the YSP-1 level to -14dB as Top Gun's opening sequence with its tension-filled, slowly building musical score began to define, then expand the surround environment within my listening space.

I would describe the sound envelope of the YSP-1, operating from a corner into such a large space as a puffed-up trapezoid. This tall trapezoid runs front-to-back with the top, shorter base placed slightly *behind* the YSP-1



and bottom, longer base spread out quite a bit more way behind the listening area. This bloated trapezoid listening bubble might, with sources like Top Gun S.E. begin to approach a circle in a smaller listening space. For the most part though, the boundaries of the YSP-1's trapezoidal acoustic bubble handily trumped, in true 3-D spaciousness and realism, the "ideal" circle-of-surround-sound usually defined by actual surround speakers.

Listening to Top Gun's slowly building musical theme wherein new and more complex elements are added to Harold Faltermeyer's score every few bars, the adrenaline build-up from Yamaha's Digital Sound Projector splays sound out further and wider into the room as the SPL levels build naturally along with the score. When, at the music's crescendo, the F-14 jet hits full afterburner's on the carrier deck you feel the jet's explosive thrust slam you as the music transitions to the expansive, gut-thumping rhythm of "Danger Zone".

This scene was equally as exhilarating for my significant other who is usually screaming "Turn that down!" way before this point. That my fiancée could immediately enjoy such a scene, for the first time ever, is a tribute to the enhanced, palpable realism of the YSP-1's immersive and believable 3D soundstage.

Another reference-quality disc, *Standing in the Shadows of Motown*, was next in the rotation. This disc, like most music-centric DVDs, does not appear to have had its upper mid and treble frequency spectrum attenuated when the transfer was made to DVD. Cue up Chapter 5, the Joan Osborne rendition of Martha and the Vandellas' hit "Heat Wave" and you'll hear what I am describing.

With full orchestration by the Funk Brothers, the YSP-1 spews forth a soundstage which, though not as wide as would be the case if left-center-right speakers where at -30°, 0° and +30° angles, is far more realistic, exciting and convincing because of the YSP-1's 3D spatial capabilities. Close-up's of Joan's front-and-center vocal, do not command an expansive soundstage. Yet the realism of her voice is like all vocals I heard with Yamaha's magic box. It is clear, natural, open and nuanced. Her voice appears not to come from the speaker, but instead it is out-of-the-box real.

Turn to Disc Two from the *Standing in the Shadows of Motown* disc and listen to three jam sessions by some of the world's best musicians. These cuts sound like what you would experience if you carried the microphone around the room while next to the camera man. The ambience of this famous recording studio is stitched into the space of your listening room by the YSP-1. You

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hear the juxtaposition of the different musicians, the reverberations from those hallowed Motown walls. You hear it all! I'm talking about being immersed in the musical exhilaration of an event which only a lucky few ever experience. The YSP-1's three dimensional portrayal of this musical event is simply phenomenal.

Again though, when the camera moves to the Funk Brother's tambourine man, the front-and-center energy of his instrument so highlights the 3-6 kHz frequency region that the overall sound becomes grating and loses delineation. This segment is one of the many reasons why *Standing in the Shadows of Motown* is such a great reference disc. This scene in particular is torture in the extreme for even very high-end tweeters. It is infinitely harder for the YSP-1's much fuller range drivers to be expected to handle.

For the two movie examples just described, the average SPL levels, measured at the listening position (8 feet away), ranged between 95-98dB using the Radio Shack meter. At these very loud levels the YSP-1 remained very clean and unstrained sounding except on the most over-the-top interjections of sound such as when the F14's afterburners kicked in. At this instant it did appear that the YSP-1 went into hard clipping. But I must emphasize that this was the only instance when I could actually say yes, the unit is clipping.

For the rest of my listening it seemed as if the YSP-1 was playing impossibly loud and cleanly when producing its prodigious SPL output. So I would conclude that some very clever soft-clipping circuitry has been designed into these 10-channel digital chips. Better than I've yet heard from any moderate power digital amps up to this time.

Okay, any other nits? Yes, a couple:

The Yamaha YSP-1, in order to sound its best, must have a least one subwoofer to supply the required low frequency balance if you want to crank this puppy hard. In my set-up

I was using a 650-watt, sealed 10" and an 850-watt sealed 12". Both subs had been equalized in my listening space to within ±2dB from 20Hz to 100Hz. *It was only with this monstrous bass accompaniment that I was able push the YSP-1 hard enough SPL-wise to induce audible clipping.*

Second, in my open floor plan living room with corner placement, the YSP-1 cannot synthesize a fully round "sound bubble" like an actual set of -90° and +90° dipoles or bipoles can. This is almost an impossibility given that the sound-beam-throwing phenomena exploited by the YSP-1 depends on the ear-brain being able to *triangulate* a point of sound using the sound source and *both ears*. Once one ear is blocked by one's head, such as would be the case for a sound at ±90° from the 0° listening position the "full-round-surround" effect is much more difficult to synthesize.

The upshot of the preceding paragraph is that for the YSP-1's power and small driver size, sound "beams" can only be made so narrow and therefore project only a specific distance with a limited amount of power before the beam spreads out and loses both power and focus. The YSP-1 does, therefore, have the potential to perform even better in a smaller, rectangular room, mounted not in the corner but against one of the wall surfaces. I plan to follow up this first review with a further thoughts piece when I move the YSP-1 into my smaller, almost square home office. Stay tuned...

## Summing Up

The Yamaha YSP-1's Digital Sound Projection is totally different and much more immersive and believable than I've heard from anything less the most precisely placed and calibrated "traditional" circle-of-surround set-ups. It is more *real*; and truly three dimensional in its ability to convincingly envelop the listener.

Center channel dialog can be tuned within the software to portray an actor's natural



timbre without chesty upper bass frequency boost often heard with horizontal D'Appolito-style center channel speakers. Overdubbed voice insertions can more easily be detected within a movie scene because the voice will often exhibit the hooded mouth-too-close-to-the-microphone characteristic of a hastily added section of dialog. Conversely, a vocal recorded in the natural environment of the scene will be heard as such.

This natural, out-of-the-box effect is usually only heard from very flat-response loudspeakers which also have a very smooth polar response envelope. The YSP-1's center-channel articulation prowess, properly tuned, is among the most naturally detailed I've heard. (Dr. Hooley: *This is likely related to the almost spherical waves emitted by the centre channel when its focal length is set negative, e.g. to say --0.5 to -1.5m.*)

The naturalness of the YSP-1's center channel sound is carried through to all other channels in equal measure. That it may falter to an extent when trying to portray left-right information, widely splayed out within an overly large, corner placement environment serves only to outline one of the sole limitations of this marvelous machine. (Perhaps, a bit more tweaking could be done with respect to Image Location?)

The ease with which the YSP-1 can engulf the listener in a three-dimensional, immersive environment, especially with a very typical, acoustically live room is head-and-ears above most wall or ceiling-mounted surround speaker systems. Women notice this honest portrayal-of-naturalness difference immediately. Plus there are no ugly protuberances adorning their walls or sound attempting to be hidden within the walls. No ugly wires either.

That the YSP-1 easily and handily outperforms the popular cube systems in the same price ballpark isn't the point. Rather, Yamaha's Digital Sound Projector hopefully marks the first, almost perfectly executed volley in a new consumer electronics category - Digital Sound Projectors. Bravo!

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## Yamaha YSP-1 Digital Sound Projector Subjective Score Card

The scoring below is based on each speaker doing the duty it is designed for. The numbers are weighed heavily with respect to the individual cost of each unit, thus giving a rating equal to: **Performance x Price Factor/Value = Rating**

**Audioholics.com note:** The ratings indicated below are based on subjective listening and objective testing of the product in question. The rating scale is based on performance/value ratio. If you notice better performing speakers in future reviews that have lower numbers in certain areas, be aware that the value factor is most likely the culprit. Other Audioholics reviewers may rate speakers solely based on performance, and each reviewer has their own system for ratings.

### Audioholics Ratings Scale:

- 🏆🏆🏆🏆🏆 Outstanding (reserved for features or areas that exceed market norms)
- 🏆🏆🏆🏆 Above Average
- 🏆🏆🏆 Average
- 🏆🏆 Below average
- 🏆 Very poor

METRIC	RATING	COMMENTS
Build Quality	🏆🏆🏆🏆🏆	Superb, category-defining, very high-quality construction
Cosmetic Design; vs. genre	🏆🏆🏆🏆🏆	First-of-category; Timeless, understated elegance
Design Execution; fit & finish	🏆🏆🏆🏆🏆	Materials and colors beautifully integrated
System Hook-up	🏆🏆🏆🏆🏆	Simplest of all systems tested to date. Only 5 or 6 inter-connections!
Ease-of-Software-Set-up	🏆🏆🏆	Completely new set-up concepts, Owner's Manual barely adequate
Power; 20W x 2, 2.5W x 40	🏆🏆🏆🏆🏆	Perfectly matched to & shared among all drivers. Low THD, high SPLs
Subwoofer Bass; 20-120Hz	n/a	External subwoofer required
Satellite Bass; 80-200Hz	🏆🏆🏆🏆🏆	Good to 80Hz lower limit, excellent performance, sealed 4.5" mid-woofers
Midrange; 200-2000Hz	🏆🏆🏆🏆 3/4	Very good octave-to-octave spectral balance
Treble - 2-20KHz	🏆🏆🏆🏆	6.1KHz peak, required for beam throwing, degrades audio-only listening
Center Ch; vocal articulation	🏆🏆🏆🏆🏆	Excellent when properly EQ'ed per program w/treble & bass
Lft-Ctr-Rt; spectral balance	🏆🏆🏆🏆	Narrowed L-R image width w/corner location w/3 Beam+Stereo mode
Surround Immersion	🏆🏆🏆🏆🏆	3-D, floating-in-space effect. Trumps 2-D ±90° side monopoles & rears
Surround Specificity	🏆🏆🏆🏆 1/2	±90° "image-bubble" width not optimal in large room, corner location
Remote ergonomics	🏆🏆🏆🏆 3/4	Non-lit. Otherwise excellent layout
Remote functionality	🏆🏆🏆🏆 3/4	Integrates easily, works most functions of ancillary equipment (TV, DVD)
<b>Overall</b>	🏆🏆🏆🏆 3/4	
<b>Value</b>	🏆🏆🏆🏆🏆	

### Associated Test Equipment

HARDWARE	DESCRIPTION
Yamaha DVD-S1500	DVD-Audio/Video SACD player
Infinity Intermezzo 1.2S	850-watt (EIA Dynamic) subwoofer w/R.A.B.O.S.
Infinity CSW-10	650-watt (EIA Dynamic) subwoofer w/R.A.B.O.S.
Hand-made DH Labs interconnects	
LMS (Loudspeaker Measure System by Linear X)	Frequency response measurement system
Impact Acoustics XLR cable	50' XLR cable for LMS microphone



Yamaha YSP-1 Digital Sound Projector – MSRP: \$1499

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