Spread Spectrum Technologies, Inc. Trinaural Processor

Manufacturer: Spread Spectrum Technologies Inc., 716 N. G St. #2, Lompoc, CA 93436; 805/740-9902; sstinc@earthlink.net; www.ampzilla2000.com
Price: $1,500
Source: Manufacturer loan
Reviewer: David Rich

The name "James Bongiorno" may not be as familiar to audiophiles as it was in the '70s and early '80s. He has been out of circulation for a number years because of some serious medical problems that brought him to death's door more than once. He now appears to be completely healthy and is in charge of a company named Spread Spectrum Designs.

James is perhaps the most important innovator that high end audio has seen in the analog transistor era. He has been directly involved in almost every major breakthrough in power amplifier design. In his field of specialization he is one of the most creative electrical engineers on the planet. Bob Carver is the only other name that comes to mind at the moment. Bongiorno and Carver are both inflicted with some strange disease that mostly limits their vision to things audio. Both would no doubt be very rich if they had chosen to work in another area of the electronics industry. Indeed, the term "spread spectrum" is the enabling technology of 3G cell phones and wireless LANs. One can only imagine what would have happened to Bongiorno had he taken his company in the direction of wireless data systems. He could have done just this, because his expertise spans to RF design (he once designed a tuner called "Charlie" that contained many innovations in the front-end design that found their way into most high-end tuners later in the decade), but fortunately for us audiophiles, he applied his genius to things audio.

Early in his career, James worked at Marantz. He was contributing engineer with the Sid Smith as senior engineer in the project for the Marantz Model 15 Power Amplifier which was the first example of a topology that is virtually identical to most modern power amps. Some high-end designs have moved past this topology to a fully complementary one, which as it turns out was developed by James in 1973 (Scientific Audio Engineering 31B). Slightly later a higher-power version called Ampzilla was introduced by James as a kit design in *Popular Electronics.* Demand for both the kit and assembled unit created such demands on James's time that he was soon running is own company, GAS (The Great American Sound Co.), producing this 200-wpc unit and its baby brothers with cute names such as Son of Ampzilla (*first separate power amp I ever owned* -KWN). James also introduced preamps that incorporated the new balanced topology. Other innovations included the introduction of DC servo circuits (Theadra, 1975) and very low-noise phono preamps that did not need a pre-preamplifier stage.

Disagreement with partners resulted in James's departure from GAS. Soon another

Bongiorno company called Sumo was in business. It was here that the third-generation amplifier topology was hatched—the fully balanced topology. A 450-wpc monster balanced/complementary amplifier came out of this effort (Power, 1979). Other balanced amplifiers were produced by others, but problems keeping the amplifiers stable soon led others to abandon the topology despite the fact that it solves a whole series of technical problems associated with amplifiers with the speakers' output terminals referenced to ground. The reason Sumo was left standing alone with this topology is it is extraordinarily difficult to stabilize the DC and AC feedback networks.

Spread Spectrum Designs is now introducing a new set of preamp and power amps. I have seen the amps' schematics and they represent a fourth generation in power amplifier design. This design, like the third-generation Sumo design, is virtually impossible to copy by the "let's replace the yellow cap with a bigger red one" crowd. Only an analog engineer at the highest level could understand what is going on in this amplifier, let alone create the concepts to realize the design.

Now, I am not going to get into an argument on whether modern electronics (i.e. stuff copied from the Marantz 15 or Ampzilla) has a sound that cannot be attributed to measurable nonlinear operation or small frequency response errors at the speaker terminal. All I will say is that if you believe it can sound different even if they measure the same using traditional measurement methods, then the fourth-generation power amp should sound better than one that is developed from Bongiorno's first- or second-generation designs.

Luckily for me, this review is not about the new power amp or the soon-to-be-released preamp. I will leave that to others. Instead, in this review, I look at a whole new class of components. Bongiorno calls his new design a Trinaural processor. What it does is revectorize the composite stereo information into a three-channel signal. The extra channel drives a center-channel speaker.

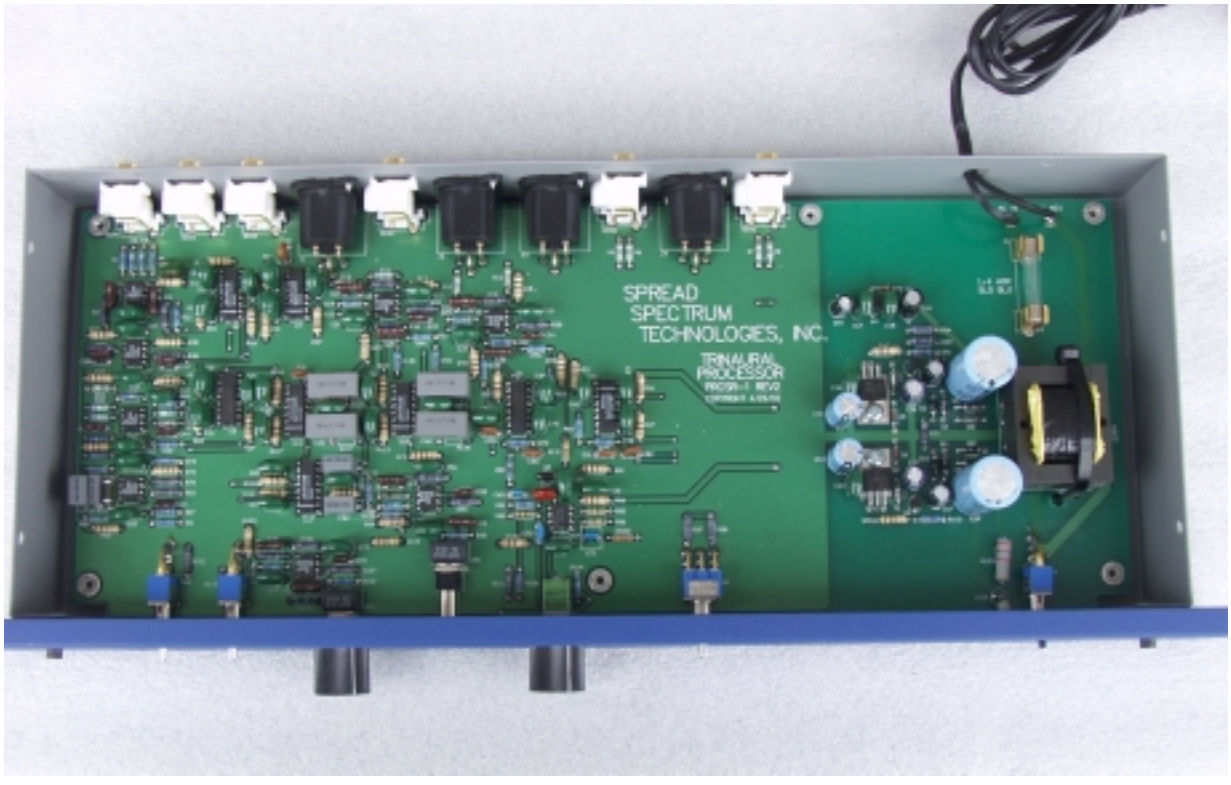
OK, what is this "revectorize" stuff? To understand what it is on the simplest level we first need to recall from my little red book of Hi-Fi that two-channel stereo creates a soundstage by varying the intensity of the left channel relative to the right channel. Thus, the left always has right-channel information and the right always has some left-channel info. In theory, when both speakers play the same thing at the same level (our little red book calls this "mono") you have a phantom center. You quickly find out this is only theoretical, however, if you run mono pink noise through your system.

Not only is the image not centered, but it is spread between the channels, the size of the space varying with tonality of the noise. This is the result of the room interacting with the two speakers in different fashions and your brain's ability to create a virtual center. How many times have you marveled at the beautiful sound stage of a recording only to find out you had the mono button pushed in? You got fooled because of the phenomena discussed above.

Let's now plop a center channel as part of a stereo system and put a mono signal through it (with some compensation for the level increase in the center relative to left and right) to get a REAL center. Now play the pink noise and it comes from the center. Alas, we still have a problem—the left channel still has right-channel signals present. Recall that we needed this to make the soundstage with two channels—but with three channels we now need to get rid of this crosstalk.

Consider panning a signal from left to right in an ideal left-center-right (LCR) system. The signal starts in the left channel and then the left reduces in level and the CENTER increase in level as the image moves form left to center. The right channel should be dead silent as we move from left to center, but it's not. Now as we move from right to center the left channel should stay dead, but it's not, and the center drops in level as the right channel comes up in level. At full right both the center and left produce no sound.

From the above it is clear that we have to remove any signal from the right channel that is attempting to make a virtual image LEFT of center. We need to do the same thing on the left channel for any signal that is encoded to be placed RIGHT of center. In high-tech terms, this is what we mean when we say we revectorize the two-channel signal into three channels. It is possible to extend the process to five channels (no joke—the latest 11.2 systems have 5 front speakers). But doing a two-channel to five-channel revectorization is very complex and may only be possible digitally. For now, we should be very happy that we have a piece of electronics that revectorizes from two channels to three channels. That is what the Trinaural processor does.



Please note that three channels is nothing new. When the big companies did the first stereo recordings they recorded and played back three channels. The end user, however, got only two channels, with the mix engineer trying to figure out what level to mix the center in. At the listener's end some companies proposed listening with three channels, but they only drove C with L+R, which as I explained above, is no good because L still contaminates R and R contaminates L.

If the Trinaural idea had been hatched in the '50s, any system worthy of being called Hi Fi would have been required to have three channels. Unfortunately, that never happened, and TM (tape monitor rooms where the pros did the editing and EQ) had the center channel removed and big 24-track tape recorders replaced the 3-channel recorders.

For the material originally recorded in three channels there have been endless arguments about what level the center channel should be mixed in at. One is left to wonder what magic is on those tapes if we could hear the center encoded on a DVD-A or SACD. I am told but have not actually seen in the flesh that some re issues of material on Everest have actually been issued in LCR with the surrounds silent. One hopes that Mercury and RCA sessions that exist of three channels will also be released this way, but the current state of the market makes any such release unlikely. Luckily, we now have the Trinaural processor to recreate the center on all our black vinyl and CDs, even when it did not exist in the original mix.

In addition to the Trinaural unit itself, all the schematics were made available to me. The build quality and innovation in the design of the electronics is consistent with the $1500 price. In fact, relative to what other small American electronics companies charge, it may well be a bargain. The innards are all made visible at http://www.ampzilla2000.com/Web_Processor.html so have no need to go into gory detail here.

ICs are used throughout the unit. It would be impossible to do this complex circuit with discrete components. I have always favored discrete component design for systems aiming for ultimate quality sound because of the flexibility such an approach offers. Bongiorno has been busy designing electrical test protocols that allow him to identify a few op amps that he claims (and I have no way to verify) match the performance of discrete circuits.

The op amps he has identified are not the most expensive units, which have the best measured performance by traditional methods, but neither are they the cheap TL071 and NJM 2068 op amps that makes up the vast majority of

the stuff you purchase at Best Buys and from your Ultra High end dealer. One has to wonder how anybody could say that very expensive high end stuff using these cheap op amps sounds better (as HP did in a recent issue of *TAS*), but this is a concept I have beaten to death in *The Audio Critic* and it has not had much traction with the true believers

The intellectual property involving the generation of the center channel in the Trinaural processor is unique and the presence of such IP alone could place the unit's price well above the cost of the construction. In this case no charge for the IP appears to have been added to the price. The IP is not protected (no utility patent on file) and could theoretically be reverse-engineered by someone competent in the field without taking the unit apart. It is important to understand that the simple explanation I gave of process to revectorize the composite stereo information to LCR is not complete—the actual IP in the unit applies more complex signal processing to take into second-order effects when the process is applied to real two-channel sources and is used in normal-size listening rooms.

The IP in the Trinaural processor could be implemented in a DSP-based AV receiver for considerably less than $1,500 retail, but questions would arise as to the sonic degradation that would result from DSP processing, at least among the audiophile community to which the unit is marketed. The Trinaural processor under review here is an all-analog system intended to be driven from audiophile-grade CD players and preamps in conjunction with audiophile-grade power amps and speakers. Outputs are single-ended or true balanced (no simple inverting opamp used to create a quasi-balanced output). Inputs are single-ended.The Trinaural processor also has a built-in subwoofer crossover centered at 80Hz. The low-pass filter (subwoofer) is "on" all the time; the "subwoofer switch" merely turns on the high-pass filters for the three front channels

To use the Trinaural processor you need a something that will act as a two-channel preamp to feed signals to the new gizmo. That can be an integrated amplifier or a receiver if it has line outputs after the volume control. If you do not have that you can (and James is going to kill me for this suggestion) pad down the speaker outputs to line level or use the headphone jack output. What you do with the three wires coming out of the processor is run them through any multi channel receiver with 5.1 analog input jacks for SACD players ($200 at Best Buys) You will be using only 3 of the 5 channels since you will be connecting only three speakers. In most cases when you put a receiver in 5.1 mode and leave it in that mode, you lose the front-end switching functions except for the volume control, so think of this $200 as a 3-channel power amp with lots other funny controls up front that you will not be using.

Now if you want to use the same system to listen to 3-channel Trinaural signals and 5-channel signals from DVD, SACDs, DVD-A, etc., you will have some very interesting setup issues. The most significant of these is you must place a center channel speaker that front of your video monitor. You need to move the video monitor to the left or the right of the center speaker. The issue is not negotiable. Lucky for me I do not do video and I find Trinaural processed CDs sound better than most multichannel SACDs and DVD-As.

The simplest path to a home theater/ Trinaural system is to have the AV receiver acting as the power amplifier in the Trinaural system. In home theater mode you use the AV receiver directly and bypass the preamplifier (or whatever component is being used for only it preamp function) that is switching the analog signals) You use the A/V receiver directly by connecting the AV receiver to the DVD player using a digital link. If you have SACD in your system, you will need to make sure the receiver you have supports two sets of 5.1 inputs. Things can get complex quickly when you want to use video switching and other AV advanced features. (You will need a six-year-old to help you to figure this out, because this becomes way too complex for a 40-something Ph.D. to understand…)

Although the Trinaural processor is designed to be used with the best available high-end components, I did the sensible thing and used the unit in a system with a total cost (exclusive of the processor) of less than $2,000. A Denon CD-R/ RW was the source for both analog and digital signals. Analog signals were routed to a Yamaha integrated amplifier used as a preamplifier only. The Yamaha was used to level-match the Trinaural processor output level to the direct digital signal paths used in the evaluation. The output of the preamp entered the Trinaural processor. The output of the Trinaural processor was routed to the 5.1 direct input of the AV receiver. The digital output of the Denon CD

player was also routed to the AV receiver using an SPDIF digital interconnect. Three AR 302 speakers where attached to the AV receiver. The speakers were deployed in an arch with L and R angled in. This is consistent with recommendations in the instruction manual for the Trinaural processor as well as for instructions for proper SACD/DVD-A playback.

Note that you will find your L and R speakers angled in more than you would do for a two-channel set up if you follow the instructions. Do not worry if you are changing your speaker deployment. I played with other speaker deployments for hours on end, including my favorite two channel placement for L and R, and in the end I found that those who have designed the LCR systems know where the speaker are supposed to go.

In my evaluation no subwoofer was used nor did I think one was needed if you are using full-range speakers to produce music rather than the sound of a car crash. Remember, you have three woofers playing now in three different places in the room. You can get to higher SPLs without stressing the speakers, and standing wave patterns may be smoothed out as result of deploying three speakers in three different places in the room relative to room boundaries.

The AV receiver was set for Dolby Pro Logic enhancement of the incoming digital stream. Rear-channel processing was disabled. The receiver allows remote switching between the direct inputs being sent from the Trinaural processor and the DSP based Dolby Pro Logic signals. This made comparison between the two methods of generating the center channel much easier. (Note that this is a sighted, not a blind test. I could not come up with a way to deploy my double-blind ABX comparator into this test environment although proper evaluation comparison of acoustical signals requires that a double-blind test must be run.)

The Trinaural signal was level-matched to the Dolby Pro Logic digital signal using pink noise. LR to center speaker levels were matched per instructions of the Trinaural processor using that unit's internal noise generator and center-channel level control. No level or distance correction was applied at the AV receiver because all sphJkers were identical and all speakers were placed at the same distance to the listener both on the horizontal and vertical planes.

A few notes about Trinaural processor setup before I get to the sound. First, for some unknown reason the switch on the Trinaural processor to optimize center channel level, using a Radio Shack sound level meter, does not have a lock position. The job of adjusting center level requires two people—one to hold the meter at the listener's chair and one to push on the darn switch and toggle back and forth. At least the second person can adjust the center level under the command of the person reading the sound level meters speeding up the iterative process of getting the center level correct.

Dramatic improvement in sound quality hass been observed by this reviewer in the past when moving from two-channel to three-channel Dolby Pro Logic sound reproduction. This improvement is only achieved for three IDENTICAL speakers deployed at the same vertical planes (i.e., no center-channel speakers on top of the TV set). Distances to the listening chair must be matched. L/R speakers must be angled towards the listener. LCR deployment requires the LC and LR to be spaced identically apart. C must be dead center to the listener. If correct speaker deployment is not followed it is impossible to image the speakers.

When things are set up properly, however, depth of sound is dramatically increased. The size of the soundstage is increased. Tonality of instruments becomes significantly closer to what is heard in a live performance. Given the wider soundstage (width and depth) and the decoupling of the sound from the speakers, inner parts of a large symphonic work that were not heard on two-channel reproduction are now made clear. Parts with complex unison orchestration are heard with the multiple instruments more easily identifiable. Dynamic range is enhanced. Clarity of vocal reproduction from solo to massed chorus is improved, with words more clearly understood. Harsh string sound and sibilance on vocal sections is reduced.

So, if Dolby Pro Logic is that good, is the Trinaural processor really better? Well, yesssssssssss.

Comparison of Dolby pro logic with the Trinaural processor showed the Trinaural processor to sound much cleaner than the Dolby process. Deployment of instruments in the soundstage appears to more varied. The Dolby process uses steering logic to ensure that center images appear only in the center (LR cut off). This is required for movie dialog, but the steering logic

affects musical reproduction negatively. On the other hand, the Trinaural processor presents a mono signal in all three channels, spreading the sound across the entire sound stage. This leakage of mono signals into L and R when using the Trinaural processor is an artifact of some of the second-order correction mechanisms applied in the Trinaural to mitigate effects of real rooms and real recordings. The L and R leakage effect is not noticeable on stereo recordings, where the center is very well defined using the Trinaural processor.

To restate, the best sound I got from Trinaural processor occurred when setup instructions for the Trinaural process are followed as closely as possible. In addition, high-quality matched speakers (preferably full-range three-way designs) are a far preferable way to go in comparison to three mini monitors and a sub. As I said above, three big speakers launching low frequency sound does wonders for standing wave patterns in a room. Also note that I found in my tests with the speakers I had available to me that using a different speaker in the center position than what you have in LR, even if it correctly placed in the horizontal and vertical plane, does not cut it.

OK—evaluation over. I can conclude the Trinaural processor represhWts the current state of the art in three-channel reproduction, and three-channel reproduction represents the first significant advance in sound reproduction since the introduction of the CD player.

I now put in a safe harbor statement before I move on to giving additional sonic impressions. The conclusion that Trinaural is the next best thing to the invention of the CD player may not be valid with non-optimal placement of the LCR speakers, such as the use of timbre-matched center-channel speakers on top of a TV set with the two other speakers aligned on the sides of the TV. For this reason, the Trinaural processor should purchased with a money-back guarantee to ensure it works in your system if you are not following ALL the rules.

I also need to disclose that I did not compare the Trinaural processor with the newer Dolby Pro Logic II music processor and DTS Neo 6 music processor (as well as some other less well known processors) since they were not available for this review. Please note that the IP used in the Trinaural processor is the result of years of work in an attempt to improve music reproduction by adding a properly placed center channel. No consideration to uses of the Trinaural processor in an AV environment was made in the development of the unit. This contrasts strongly with the design goals used at Dolby and DTS. I did not try the Trinaural processor with movies.

Nor did I attempt to evaluate the improvement achieved in the Dolby/DTS systems when two or three rear speakers are employed. The Trinaural processor has no rear-channel synthesis capability. The rationale for not evaluating the effect of rear channel synthesis in this review was that the development of the rear channel is a synthesis process with frequency tailoring (perhaps dynamic) and added signal delays (perhaps multiple) used as part of the process. In addition, extraction of rear-channel ambiance from a stereo mix is a guess made by the processor's use of a matrixing of the two-channel incoming signal with an attempt to develop a matrix that produces signals that appear uncorrelated to the events occurring in phase in both of the stereo channels (the hall ambiance). Dynaquad was the simplest form of this: the rear speakers were connected across the two front channel plus inputs. Out-of-phase signals went to the rear.

This is in contrast to converting LR to LCR. The procedure for doing this involves no synthesis or guessing techniques. Nor is any linear or non-linear signal conditioning used. Three-channel systems only improve the wave launch to the listener by creating a real (not virtual) center and by eliminating crosstalk between the L and R speakers.

When you go to a live music concert, all the sound appears to come from up front. Any ambience from the hall is not localized or apparent as you listen to the performance. The same cannot be said about most two-channel rear deployments. That is one reason the AV folks keep pushing the number of rear channels in AV systems up and up and up. I found that as long as you are close enough to a proper LCR speaker deployment the instruments sound as though they are in a concert hall. Move too far away from the speakers in a large room and it sounds like you are listening in the Academy of Music in Philadelphia. In such a listening environment, rear-channel ambiance may be required.

Your editor now wants me to give you some lovingly sculptured impressions of what the Trinaural processor does to the best-sounding CDs I have in the house. I have spent 3700 words

getting to this place so you would think I need another 3700 now to what the editor asks, but I do not. The reason for this is that Trinaural will take almost all the music you have in your house and make it better. Sometimes a little better and sometimes a lot better. The improvement happens all the time. The more you listen, the less you think "hi fi."

Occasionally, magic moments happen. Today it happened with the Chandos recording of Ottorino Respighi's *Concerto Gregoriano*. I had not heard this CD in a few years. What a wonderful piece this is! Think *The Lark Ascending* but with a greater range of emotions. For 33 minutes the violinist took me to a better place. It is type of intense experience you often get live, not through electronics. It is not the Trinaural processor that makes the magic. It has to be the right piece, in the right performance, at the right time, and you cannot always press replay and get it to happen all over again. Now the adventure goes on and in the next day or week you will find another disk you have not heard in years takes you to the magic place. Badly produced recordings unfortunately only sound a little less bad in Trinaural mode, so the free lunch goes only so far.

In the end what Trinaural does is lets you get back to being a music lover. The love of music is why I got into the hobby and I suspect the same for most of you. The things we have fought for all the years that drove us crazy with hi fi systems are gone reduced or eliminated depending on the recording. With Trinaural the speakers do not localize. Front-to-back depth is a very real thing. Woodwinds take on a size and character that one hears live but never in two channels. Brass glow with full tone but not the harsh edge. Violin sections really sound like sections, as you can hear the individual players, not some edgy blob that oozes from the center of speakers. With the Trinaural processor you can stop that part of your life that involved tweaking components, speaker placement, etc., and get on with what you really want to do – listen to music.

Soon you forget about all the cares and worries of an audiophile. Some CDs sound good and some sound better than good and a few still sound bad but you do not really care. Your whole CD collection is set before you. Pick a CD, any CD. Forget what you remember about the sound of the disc you picked. It is not going to sound like that now. In most cases it is going to sound good enough so you will listen to the music, not the sound.

Get the TV set out of the room. Put three full-sized speakers in the room in an arc around your listening chair. Go to Circuit City and get the required electronics and then send a check to Spread Spectrum Designs. Go forth and reconnect with the magic that you have created in your collection of recorded music. Be the music lover you were always meant to be.

-DR

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