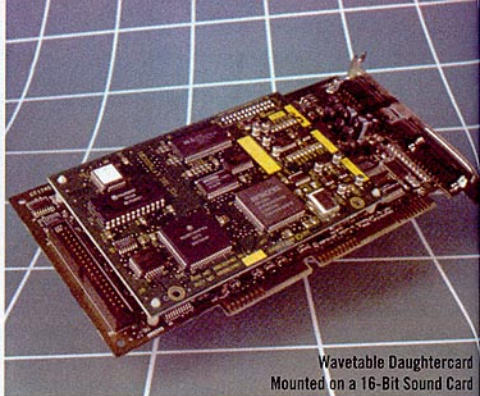


# In Search Of The Ultimate...



Wavetable Daughtercard  
Mounted on a 16-Bit Sound Card

Photo by John Kleinman

## Wavetable Daughtercard

*Eight Daughtercards Come Bearing A Generous Dowry Of General MIDI Sounds*

by Bobby Prince

**T**hink of your favorite song. What makes it your favorite? Chances are, part of the answer will be that it has some really cool lick by one of the artists performing on the recording. You look for that lick each time you listen to the song, and you never tire of hearing it.

Now put yourself in the composer's shoes at the time that the song was written. You have this idea in your mind and you want to express it the coolest way possible. You bring in the best soloist you know and, on the first take, magic occurs—there's this unbelievable riff at just the right place in the recording. So, you mix the recording down to a digital master. Listening to it is just like being there when it happened. From there you move the master to an audio CD. Yep, it's still just like being there. You want people without CD players to hear this great song too, so you record from the master to a cassette. Well, it's not like being there—

the riff lacks the sparkle and punch it had on the master. Without this sparkle and punch, the riff loses emotion and the whole point of the musical statement is lost. You release the cassette with trepidation, hoping that somehow the emotion will come through.

Until recently, composers of game music have felt like they were providing cassette quality music at best. This was because the only sound cards available used what is called "FM synthesis." With this type of music synthesis, the sounds of instruments are roughly approximated using waveforms created by the synthesizer chip. The resulting instrument sounds lack sparkle and punch over the broad range of instruments used in game music. But recently, composers have had a chance to deliver CD-quality audio through newer waveform synthesizers using a technique called "wavetable synthesis." Sound cards using this technology store the waveforms of real instruments on

a ROM chip. Since the card is making music using actual instrument sounds, not approximations, the sounds are more real and robust than FM synthesis.

What is a wavetable synthesizer daughtercard? It is a wavetable synth mounted on a printed circuit card. It plugs into a sound card that has a daughtercard connector. It allows the game player to have wavetable synthesized music, as well as the music that is available directly from the host sound card. So, if you have a sound card with an FM synthesizer and you install a wavetable daughtercard, you will have both FM synthesis and wavetable synthesis available for your game music. The daughtercard uses the sound card's mixer, amplifier and external connectors, so there are no cables and connectors to worry about; there is only the single connection between the daughtercard and sound card. In this article we'll compare seven different cards. But first, we'll have to know what we are comparing.

**DYNAMICS ARE EVERYTHING**

Most computer game music is composed and performed using a wavetable synthesizer. The game music data will generally sound OK on any wavetable synthesizer, but the sparkle and punch may get lost on some. The reason for this is the dynamics of a patch can vary greatly from card to card. What is a patch? A patch is a numbered "slot" that an instrument or set of instruments is placed into. "Patch" and "instrument," though many times used interchangeably, do not mean the same thing, as a patch can contain more than one instrument.

Dynamics are extremely important in enabling the delivery of sparkle and punch. To understand what this means, imagine a composer sitting at a computerized grand piano and performing a piano concerto. He uses every nuance of great technique to deliver the emotion he feels. His actual performance is recorded by a computer that has the capability of recording each piano key played, including the time each is played, how hard each key is hit, and how long the key is held down, among other things. At times during the performance the composer plays ten notes at a time, all of which the computer accurately records. After saving the computer file of his performance, the composer sends it to a computer game company which licenses it for an upcoming release.

The game company is very excited about the composition. They played it numerous times on their wavetable synthesis card, the same brand that the composer used. It sounds exactly like it did when the composer performed it. It sounds fantastic! Then, the music file is sent to another member of the game development team. This person happens to have a brand new Acme "Coyote" wavetable daughtercard (a fictitious device). When the music file is played on the Coyote, it sounds like notes are being hit late. When the music slows down, it sounds like notes cut off early. During faster portions of the composition with a lot of notes playing at once, it sounds like notes are getting bluntly cut off. Because proper grand piano dynamics were not built into the Coyote, the previously marvelous performance now sounds like junk. What is going on here?

The late notes are a result of the attack designed into the Coyote's piano patch. Playing a song using this patch is like playing the computerized grand piano with sponges on the tips of your fingers, making the music sound sluggish. On some of

# The Daughtercard Dictionary

Don't let the tech-speak fool and confuse you. Be on the look out for:

**Patches:** This is the term used for digitally recorded instrument and sound effects. All of the daughtercards reviewed have the General MIDI standard set of 128 patches. At this stage of computer game music, patches other than these default 128 are not used.

**Polyphony:** Polyphony is the number of notes a synth can play at one time—e.g. a standard piano has 88 note polyphony as it is capable of sounding all 88 keys at the same time. The amount of polyphony advertised can be very misleading. So can the terms used in connection with polyphony. "Voice" and "note" are most often used here. Voice is the more accurate term. You are a member of a six person choir. You are one voice out of six voices. The choir has six voice polyphony. Your choir does a lot of very modern music and most of the time each member of the choir sings a note different from the other members. But, sometimes two or more voices sing the same note. If the whole choir sings in unison, you would have six voices and only one note played. All of this terminology can be confusing. I know. Rest assured that all of the reviewed cards have sufficient polyphony for the foreseeable future in game music.

**16-Part Multi-Timbral:** Big deal. All daughtercards are capable of playing 16 different patches at once (one patch per each of the 16 MIDI channels).

**Megabytes of ROM:** ROM is the memory that stores the instrument data (sounds or waveforms) on a wavetable daughtercard. It must store data for at least 128 patches. So, the more ROM the better. Not necessarily so. The quality of the data is more important than the amount of data. Let your ears decide, not the number of MB of data.

**Digital Effects:** Note that these are not sound effects, they are enhancements to the sounds the card delivers. "Reverb" is an effect that makes the music sound like it is being played in a room or even a stadium or cavern. "Echo" is an effect that you hear when someone yells in a cave. Reverb is really a very fast echo. "Chorus" is a sometimes pleasant wavering effect that makes the affected patches sound fuller. To me, digital effects make a lot of difference. At

their default settings, most daughtercards with digital effects have a more "CD audio" sound than those without. In the near future there will probably be games that specifically support certain daughtercards. This specific support will certainly include "dabbling around with the digital effects."

**General MIDI Compatible:** General MIDI is a standard. All of these cards are General MIDI compatible (with the possible exception of the Media Vision Professional Wavetable Upgrade).

**Multiple Drum Sets:** Unless a game specifically supports a daughtercard (this means that there is a music data file particularly written for the card), the only drum set used by the composer will be the one the card defaults to on powerup. This is the only drum set of interest to the game player, as it is presently the only one used in computer games. The drum sounds available in the default set are standard from card to card as far as the name of the percussion instrument, but there are differences in the quality of the sounds and the tuning, attack speed, decay, etc.

**Number of Sampled Sounds:** Again, the important thing is not the amount but the quality.

**MT-32 Mode:** Because the MT-32 synthesizer (an FM synth) allowed a composer to design his own patch sounds, many games include MT-32 music that does not use the default MT-32 instrument set. Since the daughtercards with an MT-32 mode do not accept any customized instrument settings, they will not recreate the music properly in these types of games. If you have games that you know use the default MT-32 instrument set, this mode would be important for you.

**Volume and Panning:** As with General MIDI compatibility, don't worry about these terms. All reviewed cards have appropriate volume and panning (with the possible exception of the Media Vision card). Pan is the placement of individual patches within a stereo field. At any one time, a MIDI channel can only have one pan setting and one volume setting. These settings only affect the patch being played on that one channel. With 16 MIDI channels, there could be up to 16 different patches placed in up to 16 different locations in the stereo field (from extreme left and right to the very center).

the Coyote's patches the exact opposite is true and notes are attacked too quickly, making the music sound rushed.

The truncation of notes during slow parts of the composition is caused by the Coyote's piano patch not ringing as long as the composer's grand piano. No matter how hard one might bang out a part, the Coyote just cannot sustain the notes as long as a "real" piano would. On some of the Coyote's patches the exact opposite is true and the patch rings for much longer than the "real" instrument would.

The other problems can also be traced to limitations and problems in the implementation of the dynamics on the Coyote. If the composer had originally performed his masterpiece on the Coyote, he would have noticed these problems and would have changed his composition and playing technique to make up for the Coyote's limitations.

For you to hear exactly what the composer wrote and performed, you'd have to play his song on the same device he used. Since one cannot assume that every gamer has the same card, most game developers rely upon the sound programmer to come up with a driver for each type of synthesizer supported in the game. This allows one music file to sound acceptable on all supported sound cards. "Acceptable" in this instance can many times be likened to the cassette mentioned above. Even if the music is tweaked just for a particular synthesizer, that synth may not have the capability of producing the sparkle and punch that the composer wanted to get across.

#### HOW DO WE COMPARE?

To compare the sound quality of these cards, I used a "semihemidemi-scientific" method. I made up a list of 31 songs that used all but 15 of the 128 default patches available on each card. The songs were from actual computer games. I used the same computer, the same sound card, the same cables, and the same speakers for my comparison. The only thing changed for each listening test was the daughtercard. By synchronizing the test songs to a digital multitrack tape recorder, I recorded each daughtercard in stereo (using two tracks). This method had all of the cards playing the same thing at the same time on the tape so I could jump from one card to another card quickly to compare the sound. To listen to one sound card alone, all I had to do was turn up the volume on its tracks alone. In the electronics magazines, this is usually called "A/B testing." You have probably done this while comparing

speakers in a store. This method lessens the chances of forgetting one sound while listening to another.

Please note that I love all types of music, but I cannot be objective when it comes to what I like in sound. I don't know anyone who can. What I like may not ring true for you. So, I am going to make some subjective statements which are only true for me. Take them as *some evidence* that you can consider when you decide to buy a wavetable daughtercard. Buy what you like. As you know, no one can tell you what is "music to your ears."

#### AND THE RESULTS, PLEASE

Figure 1 shows the results of the listening tests. On some songs, more than one card was selected as best, meaning that there was a tie. "Acceptable" in this figure means that the "sparkle and punch" of a song came across on the card. The higher the score in "acceptable," the better the chance a card will consistently deliver a quality interpretation of a piece of music. The higher scores in the "best" column probably speak to the quality of the individual patches on a card. If a card was rated best on a song, it was also considered acceptable for that same song. And now, on to the individual cards...

#### ROLAND CONSUMER PRODUCTS GROUP

### Sound Canvas SCD-10 and SCD-15

You should note that the majority of game music composers use the SOUND CANVAS when composing/performing for game soundtracks. Is this because it is best? Maybe, maybe not. It was first and quickly became an unofficial standard. If one of the other cards had come first, it could possibly be the present unofficial standard. The SOUND CANVAS has excellent to very acceptable patch sounds throughout. Its dynamics (attacks, sustains, envelopes and such) are the standard for other cards to follow.

For game play, there is no difference between these two SOUND CANVAS cards.

For those of you who may want to experiment with MIDI and sequencing, pay the extra money for the SCD-15, which is the equivalent of the patches and digital effects on the much more expensive SC-55 SOUND CANVAS.

The first 1000 SCD-10's had problems working with a SOUND BLASTER AWE-32. This has been corrected and Roland will upgrade your SCD-10 free if you have this problem. The problem has no effect on the SCD-10 when used with sound cards other than the AWE-32.

#### ENSONIQ MULTIMEDIA PRODUCTS

### SoundscapeDB

The synth chip is the same on this card as on the SOUND GALAXY WAVE POWER, but that's where the similarities cease. For 1MB of ROM, the sounds on this card are exceptional. If the card had digital effects (reverb), it probably would have rated higher than its already impressive score (reverb can smooth out minor defects in patch sounds). Even at that, I do not recall missing digital effects when I listened to this card. While it doesn't have quite as many memorable/notable patches as the SOUND CANVAS, what it does have gets the job done. It does a great job of emulating the SOUND CANVAS' patch dynamics (attacks, sustains and envelopes).

#### CREATIVE LABS

### Wave Blaster

This was the product that started the whole daughtercard thing. It was the first card that hit the shelves and was great at

## The Prince Test Results (Figure 1)

Manufacturer/Name	Times Rated Best	Times Rated Acceptable
Roland Sound Canvas SCD-10	31	31
Roland Sound Canvas SCD-15	31	31
Ensoniq	18	28
Media Vision Professional Wavetable Upgrade	15	26
Turtle Beach Rio	4	21
ALR Wave Express Module	6	17
Artech Labs Sound Galaxy Wave Power	2	15
Creative Labs Wave Blaster	3	14

*These ratings reflect the subjective (expert) opinion of the author. Different ears have different tastes. So use these ratings as a rough guideline and be sure to listen to a card before a purchase.*

that time because there was nothing to compete with the product. Now there are compelling products like the Sound Canvas cards, which far exceed the WAVE BLASTER in sparkle and punch, and really give you more bang for your buck. In addition to being General MIDI compatible, these newer cards have effects like chorus and reverb which the WAVE BLASTER lacks. After listening to the other cards in this survey, it's apparent that the WAVE BLASTER patches just aren't as good as some of the more recent cards like Ensoniq's SOUNSCAPE DB. Creative Labs has mentioned that they have a new version of the WAVE BLASTER coming out, but they didn't have many more details at press time.

#### MEDIA VISION, INC.

### Professional Wavetable Upgrade

This card has many excellent patches. Panning was reversed, meaning that instruments placed to the left by the composer will sound like they were placed on the right. The drum channel (MIDI channel 10) would not respond to pan. This is required for General MIDI compatibility. Is this important? I didn't notice it until about the 15th song I listened to (I noticed that the drum set was backwards). One not familiar with patch pan placement on a particular song will never notice any of this, and it is not a significant problem for game music. This card

also did a great job of emulating the SOUND CANVAS' patch dynamics (attacks, sustains and envelopes).

#### TURTLE BEACH SYSTEMS

### Turtle Beach Rio

REVERB anyone? Wow, the default digital effects on this card are what studio engineers call "wet" (a monsoon?). You will have no doubt that this card has digital effects and that they are working from the first listening. This card would have rated higher in my tests if the default setting of the digital effects had been reduced. At times the effects caused patches to ring long after they should have stopped. There are some excellent patches here, and this card did an admirable job of emulating SOUND CANVAS patch dynamics.

#### ADVANCED LOGIC RESEARCH

### ALR Wave Express Module

This card had some beautiful patches. Since it includes Roland MT-32 and LAPC-1 compatible patches, I can see how the 6MB of data rated lower here than a card with 1MB of ROM. For beginning MIDI musicians who also want a game music card, this may be an excellent "one card fits all" decision. I didn't listen to the non General MIDI patches, but if the General MIDI string patch is an example of the quality, the rest of the super-orchestral patches should be exceptional. I'd like to

see this card with only high quality General MIDI patches (leaving off the MT-32 and LAPC-1 patches). With 6MB used for only 128 high quality patches, this could be a killer game music card.

#### AZTECH LABS, INC.

### Sound Galaxy Wave Power

The WAVE POWER and the ENSONIQ cards both use the Ensoniq Wavetable synth chip. So, why weren't the results of the listening tests the same? Remember that the ROM chip holds the instrument data, and the two cards have different instrument data. As you can see, there is a big difference in the results reflected in Figure 2. This difference supports the important fact that data quality is not reflected in ROM size.

#### EAR CANDY

Over the month preceding the writing of this article, I have had the pleasure of listening to music as the game music composers intended it. In all cases, I merely plugged a wavetable synthesizer daughtercard into a sound card that has a daughtercard connector. No muss, no fuss, no setting of IRQ, no switches, no drivers or TSRs—nothing. If the sound card is already set up properly, just plug and play. What a pleasure! The games that support daughtercards will most probably mention supporting "WAVE BLASTER or compatible" on the packaging. Many of the games will have "WAVE

## The Daughtercard Specs At A Glance

Manufacturer, Name (Synth Chip)	GM* Compatible	ROM	Polyphony	Effects	Length/Width/Depth (inches)**	Components Mounted***	Price
ALR Wave Express Module (Kurzeil)	Yes	6MB	32	Reverb	6 3/16 X 3 1/2 X <1/2	Toward sound card	\$349
Aztech Sound Galaxy Wave Power (Ensoniq)	Yes	2MB	32	None	5 1/2 X 3 1/2 X <3/4	Away from sound card	\$149
Creative Labs Wave Blaster (Emu)	Yes	4MB	32	None	5 1/2 X 3 1/2 X <1/2	Toward sound card	\$249
Soundscape DB (Ensoniq)	Yes	1MB	32	None	5 1/2 X 3 1/2 X <3/4	Away from sound card	\$129
Media Vision Professional Wavetable Upgrade (Korg)	Yes†	4MB	32	Reverb/Chorus	5 1/2 X 3 1/2 X <1/2	Toward sound card	\$199
Roland Sound Canvas SCD-10 (SCB-7 GM board)	Yes	4MB	28	Reverb/Chorus	5 1/2 X 3 1/2 X <1/2	Away from sound card	\$229
Roland Sound Canvas SCD-15 (SCB-55 board)	Yes	4MB	28	Reverb/Chorus	5 1/2 X 3 1/2 X <1/2	Away from sound card	\$299
Turtle Beach Rio (ICS Wavefront)	Yes	4MB	32	Reverb/Echo	5 1/2 X 3 1/2 X <1/2	Toward sound card	\$159

\*General MIDI

\*\*Approximate

\*\*\*Some daughter cards have components that face the sound card, often creating installation difficulties. If you purchase a card with components facing toward the sound card, special adapters may be required to mount the card properly. The ALR WAVE EXPRESS is the only daughter card that comes with such adapters.

†Except no pan Channel 10

BLASTER" or "General MIDI" in the music card selection menu. If your daughtercard is on the list, choose it. If it is not, don't fret—just choose "Wave Blaster" or General MIDI. It's that simple.

Well, almost that simple. When some of the daughtercards were installed, they came very close to physical contact with the card in the expansion slot next to the sound card. Some of the daughtercards have components that face the sound card and others have components that face away. The SOUND GALAXY in particular has a ROM chip that greatly increases the silhouette of the card. To mount it, I had to put my sound card in the slot that put the SOUND GALAXY away from other computer cards. While this posed no problems and worked just fine, it took longer. The ALR KURZWEIL EXPRESS came with an extender that would offset the daughtercard further from the sound card in case the daughtercard components were too close to the sound card. I didn't have to use the extender, but if I had, there would have been the same problem of not having room in an interior card slot.

When you go to buy a daughtercard, take your sound card with you to make sure that they will fit together without

metallic components touching. Don't assume that they will both fit into the slot you normally use for your sound card, either. While you are at the store, you might try fitting both the sound card and the daughtercard into a computer to see if they fit in a slot similar to the one you will use in your own computer. You might also try to get the store to allow you to listen to samples of the daughtercards available. Also, be careful when you buy a regular sound card. Be sure that you buy a sound card with a "WAVE BLASTER" compatible connector. This type of sound card does not require a WAVE BLASTER, but will work with any daughtercard mentioned in this article. Going this route will ensure that you can upgrade the synthesizer portion of your sound card with minimal effort.

#### THE FINAL NOTE

It is my sincere hope that the manufacturers of these cards will continue to improve/upgrade the patches and compatibility with regard to dynamics built into the patches. None of the composers with which I have spoken want cards that sound the same, but they do want cards that match patch dynamics.

The most beautiful patches can sound awful with improper dynamics. Even a live orchestra that does not follow the dynamics of a composition will sound bad.

It is good to see that there is some real competition here, and game players will benefit from this. Compared to FM synthesis, any of these cards is a major improvement, but there are some that are clearly better than others. Do not rely solely upon the information presented in this article. If you have access to one of the information services (CompuServe, Prodigy, AOL, etc.) or the Internet, look for the sound card discussion areas and see what many others have to recommend. Buy what you like—and do it soon so you can hear the sparkle, punch and CD audio quality of today's game music.

I would like to thank Margaret Prince, Rob Prince, and my fellow composers, Rob Wallace, George Sanger and Don Griffin for their help with this article.

*Bobby Prince is a composer and sound designer who has music and effects in many shareware and commercial games. You have heard his music (and sometimes his yells, grunts and groans) in such games as Wolfenstein and DOOM. You can write to him at his e-mail address: SDSV97A@prodigy.com.*

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