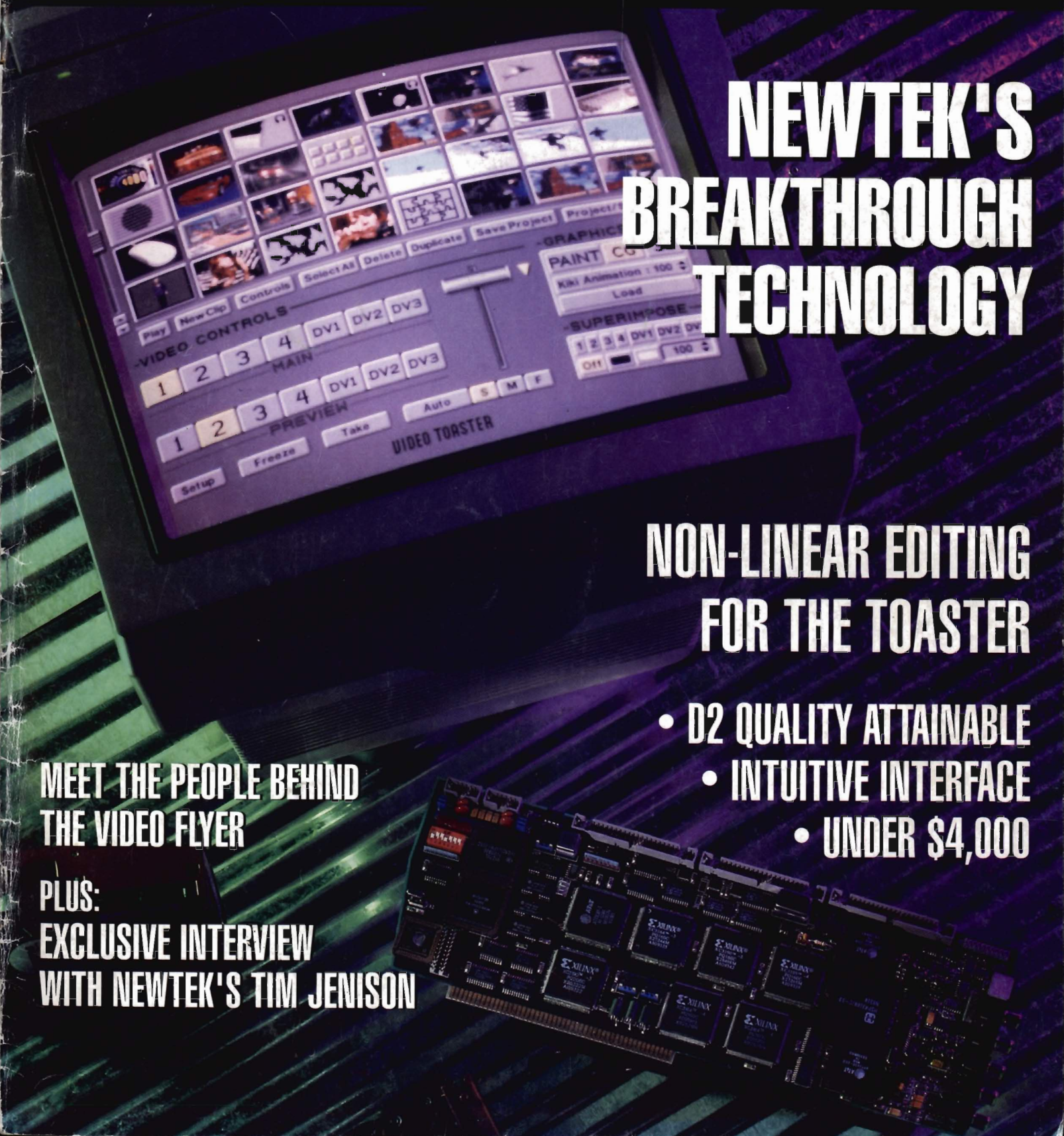
VIDEO TOASTER USER MAGAZINE NEWS COVERAGE

VTU SPECIAL REPORT



NEWTEK'S BREAKTHROUGH TECHNOLOGY

NON-LINEAR EDITING FOR THE TOASTER

- D2 QUALITY ATTAINABLE
- INTUITIVE INTERFACE
- UNDER $4,000

MEET THE PEOPLE BEHIND THE VIDEO FLYER

PLUS:
EXCLUSIVE INTERVIEW WITH NEWTEK'S TIM JENISON

Toaster Goes Non Linear

by Phil Kurz

NewTek ushers in the next wave of the personal video production revolution with its new low-cost, broadcast-quality Video Flyer.

As anyone who has used the NewTek Video Toaster knows, it's nearly the perfect low-cost video production tool. With exceptional video character generation and switching, creative digital video effects, an outstanding 3D animation program and an acceptable paint program, the Toaster has offered most of the features any video producer could possibly want.

However, the emphasis is on the word "most." As anyone who has tried to build an A/B-roll editing suite around a Video Toaster knows, the Toaster is far from a complete desktop video solution. Peripheral devices, such as time base correctors, edit controllers, videotape recorders and editing decks, a stable sync generator (or other sync source, such as a camera) and much more, must be combined into a video system, which operates in a highly precise way, to achieve an A/B-roll edit. (If you've never con-

structed such a system and doubt the complexity, simply review the first six parts of the recently completed "ABCs of Video" series of articles in *Video Toaster User*.)

As a result, what developed on the desktop to support the Video Toaster mirrored the traditional kludgy approach to video editing that dominated the field since the dawn of electronic post-production. In a sense, the shortcomings of the Toaster created a vacuum on the desktop that sucked in established video equipment makers and newcomers alike with solutions that for the most part adhered to the status quo. These products, while physically smaller and less expensive than their predecessors, pretty much mimicked what had come before.

However, with the introduction of the NewTek Video Flyer ($3,995) at the 1994 National Association of Broadcasters (NAB) convention in Las Vegas, the company has brought closure to desktop video production, completing with breakthrough technology the revolution that started with the Video Toaster.

The Video Flyer, a tapeless video editor, fulfills the vision NewTek president Tim Jenison had when he began development of the Video Toaster six years ago. "The Toaster was designed in 1987 as a complete desktop video system," he said. "That was the vision we had at a time when apparently no one else was interested. As we worked on the Toaster system, some parts were easier than others, and what we ended up shipping in 1990 was as much as we could get done at that point in time. But there was a piece missing. And that piece, which was in the original 1987 design, was a random-access, broadcast-quality, non-linear editing system."

With the Video Flyer, users will be able to edit video and audio for video without the complexity of an analog videotape-based system. Additionally, because NewTek designed its method of digital video compression with video production in mind, the tapeless editor is not hampered by many of the compression artifacts that plague other non-linear systems. As a result, when operating in its highest performance mode, the tapeless editor can deliver lossless compressed video that NewTek claims is as good as video played back from a D2 digital videotape player.

Compression Conundrum

The media used in the Video Flyer are computer magnetic hard disks. Unlike videotape, hard disks provide instant access to the data they store, which makes them ideal for non-linear video editing. However, this benefit isn't without penalty: Hard disks–even big ones–typically hold far less video than videotape.

Compounding the problem is video's voracious appetite for storage space. Typically, one second of uncompressed component digital video requires about 27MB of storage. At that rate, it's easy to see that even the largest computer hard disks would be unable to hold more than only a few minutes of video. Thus, for a non-linear video editor to be useful, the digitized video data must be compressed so that enough source footage can be stored to complete a project.

To date, various digital video compression algorithms have made their appearance in desktop video and multimedia products. JPEG (Joint Photographic Experts Group), MPEG (Motion Picture Experts Group), MPEG 2, Wavelet and some more exotic methods, such as fractal compression, have grabbed the spotlight as solutions for everything from HDTV transmission to multimedia, from satellite transmission to non-linear video editing.

NewTek chose not to base its non-linear design on these methods. "In doing our research," Jenison explained, "we discovered there was no magic bullet that could give you astounding compression ratios with no loss. When we started the project, our overriding goal was to build a product that was fully suitable for video production. Thus, we were only interested in compression that could sustain a broadcast-quality picture."

Video Flyer System Price

Product	List Price	No. Required
Video Flyer	$3,995	1
Micropolis 2217	$1,920	2*
Video Toaster 4000 card	$2,395	1
Opt'l NewTek TBC	not available	**
CD-ROM (Chinon 535)	$399.95	1
Amiga 4000	$3,699 ***	1
Amiga 4000T	not available	1****
Total (with two 1.7GB Micropolis drives)	$14,328.95	

* Two hard drives are required.

**A TBC is required; however, many users may have an existing TBC.

***Toaster 4000 list price as of May 17, 1993. Price based upon Commodore Amiga 68040-based 4000 with 6MB of RAM and no monitor.

**** Amiga 4000 Tower not yet available.

Thus, Adaptive Statistical Coding (ASC), NewTek's proprietary dynamic, user-variable compression algorithm, was born. The father of ASC is Kenbe Goertzen, NewTek's director of product development. Recognizing that discrete cosine transform (DCT) based algorithms, such as JPEG and MPEG, were incapable of delivering broadcast-quality video, Goertzen sought a solution that would take advantage of the signal characteristics of video in designing NewTek's compression algorithm.

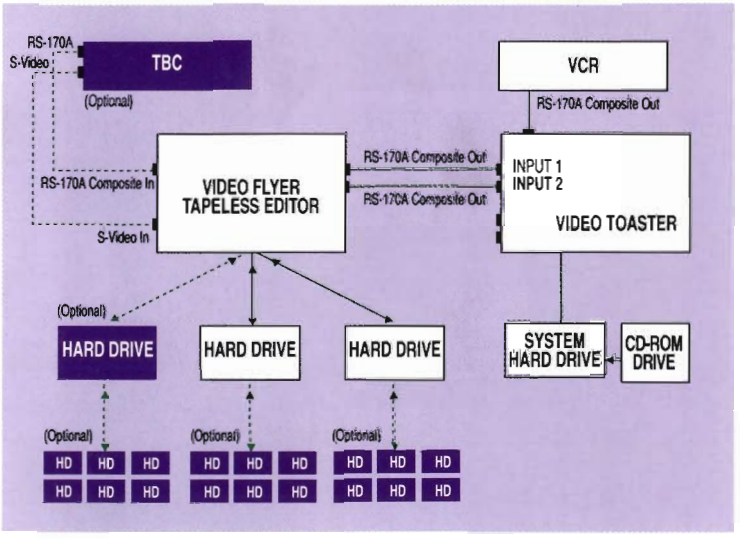
"ASC is based on some distinctive statistical aspects of the video signal, exploiting some mathematical regularities in a way that have not been done previously," said Goertzen.

"Although the device is capable of operating in a lossless mode, it will more often be used with some level of

lossy compression. When operated in extended play, low-data rate modes, our compression algorithm degrades the picture in a very graceful, almost organic way, by reducing the signal-to-noise ratio.

"Visually, the effect is similar to analog tape. In contrast, JPEG and MPEG tend to hallucinate block shape artifacts into the picture that our eyes are not accustomed to.

"Another feature built into our compression hardware is a noise-reduction function that can actually improve the appearance of video with high noise levels, such as scenes shot in low light with gain up."



The typical Video Flyer setup stores video onto two hard drives.

NewTek's compression algorithm also is dynamic, varying the amount of compression applied to frames of video based upon their signal characteristics. It also provides editors with the ability to vary the amount of compression that will be applied to any specific project. Typically, users desiring broadcast-quality performance will operate the tapeless editor at about 3MB of information per second. However, to emulate D2-quality video, the upper threshold of required information can be as high as 5MB per second. For some applications, such as multimedia authoring, 1MB per second may be suitable.

Thus, to accommodate one hour of full broadcast-quality compressed video requires about 10 gigabyte (GB) of hard-disk storage. Longer times can be handled by adding more drives.

NewTek defines the cut-off for broadcast-quality video from the tapeless editor as a video signal having a 50dB signal-to-noise ratio and a chrominance bandwidth of at least 1.5MHz.

Video Flyer users also have the option of running it in either absolute lossless or compressed lossless modes. While the data rates are greater for operation in these modes (typically 5MB per second for compressed lossless), this feature assures users concerned about maintaining the utmost quality that the data coming out of the NewTek non-linear editor is identical to the data going in.

Hardware and Setup

What makes the Toaster non-linear editor work is a single-video compression board that slips into any Amiga 2000, 3000 or 4000. The board accepts composite RS-170A video and S-Video (Hi8 and S-VHS) and two channels of stereo audio. It outputs two channels of RS-170A video that feed two of the Toaster's four video inputs and two channels of stereo audio.

In a typical non-linear editing configuration, the board will work in conjunction with two SCSI-2 magnetic hard drives in addition to the computer system's hard drive. However, there are three digital channels from the board, so up to 21 hard drives (seven per channel) can be added to the system for storage.

So far, one hard drive has been used with the system: the 3.5-inch Micropolis 1.7GB 2217AV drive. Other suitable drives from Micropolis, Quantum, Seagate and Fujitsu are expected soon.

These drives have been chosen because they do not thermally recalibrate (as do most hard drives), which can cause disastrous dropouts of video information in a non-linear editing system. They also have sustained data transfer rates that let them pull sufficient information off the drive quickly enough to maintain a broadcast-quality video image.

Once video and audio have entered the editor, the video is digitized, compressed and stored on a hard drive in real time. Audio is sampled at the CD rate of 44.1kHz and stored separately in an uncompressed fashion.

Video being played into the tapeless editor must have a stable time base. To accomplish that, users need only one TBC. They may choose to feed source video from a VCR with an internal time base corrector, through a stand-alone or board-based TBC, or through the new, optional TBC daughter card for the Video Flyer. Once the video is digitized, its time base remains stable and no longer requires time base correction.

Once the source material has been compressed and stored, it's ready to be edited. At this point, the Video Flyer decompresses a desired video clip and converts it into an analog video signal. This signal feeds one of the Toaster's video inputs. While this is happening, the editor decompresses and converts the next video segment and feeds it to another Toaster video input so that a Toaster Switcher wipe or dissolve can be added.

Additionally, all the other functions of the Toaster are available to the editor so that titles can be keyed over video, still store images can be added, or any of the other features can be used.

To the Toaster, the editor and hard disks act exactly like the source VTRs in a traditional A/B-roll editing system. However, to the user, the random-access ability of the hard disks is a big improvement over the constant searching, cueing, pre-rolling, playing and recording cycle of videotape machines in a typical video editing setup.

Once the desired video program has been created, the Toaster editor plays back the source video and audio material from the hard disks, triggers Toaster transitions, keys titles and does all the rest to play the completed pro-

gram through the Toaster. Users simply record the video program in one pass, eliminating the need for expensive edit recorders.

At first glance, it may seem that the conversions between the analog and digital domains would introduce artifacts into the system. However, the latest generation of A-to-D and D-to-A converters are so good that they have a negligible effect on the quality of the video, said Jenison.

"Merely going from A to D introduces such a slight degradation in the signal that you have a hard time measuring it in the signal," said Jenison. "Analog-to-digital converters do an excellent job. That wasn't always true in the past. In the very early days of digital TV boxes, those converters introduced a lot of artifacts, primarily contouring. These days, the process of going back and forth from analog to digital is so transparent that you cannot see any degradation."

The editor also provides for audio post-production. Its onboard digital signal processing (DSP) chip allows multichannel mixing of digitized audio material. Typically, the editor will be used in an audio-follow-video mode; however, the product also provides for more complex audio editing, including split edits.

Operating Software

One look at the new Toaster operating software tells veteran Video Toaster users that things definitely have changed. The new software comes on a CD-ROM, and while the primary change is the inclusion of an icon-based non-linear editor interface, it also sports updates to ToasterCG and LightWave.

The operating environment of the new Toaster software is analogous to a video storyboard. Traditionally, storyboards have provided a workspace on which individual frames of a program can be arranged left to right and top to bottom prior to going into the field to shoot. Each frame on the storyboard represents a key event or shot within the program. Through the new Toaster operating software, this approach has migrated to the post-production process.

The storyboard paradigm coupled with the high performance of the editor fundamentally changes how video is edited. In the Video Flyer, there is no need for traditional machine control operations. NewTek's Video Toaster tapeless editor controls the hard drives so that the desired video source plays at the appropriate time. Thus, from a control point of video, SMPTE time code is not required. The Video Flyer debuting at NAB does not support SMPTE time code. However, NewTek plans to add support for SMPTE time code to assist editors in important housekeeping chores. "The hardware is fully capable of reading SMPTE time code from incoming video and logging that information into the file," said Jenison. NewTek's president said this support should be helpful to editors desiring to log existing videotape footage.

The latest release of Toaster software establishes four operating modes from which Toaster users can work: Project/Files, Project/Switcher, Files/Files and Project. The Project/Files mode allows users to drag files, which are represented as individual croutons on the lower half of the interface screen, into a project on the top half of the screen. Among the file croutons that can be dragged into a project are video segments, Switcher transitions, CG pages and still stores. As the croutons are dragged into the project, they are arranged eight to a row with a theoretically limitless number of rows stacked horizontally down the screen. If it becomes necessary to insert a video segment or transition between two croutons already placed in the project, the crouton representing the new segment is simply dragged where the insert is required, and the project is expanded to accommodate the new clip.

"...the Toaster non-linear editing system appears to be unmatched."

A row of buttons in the Project/Files mode arranged between the project in the upper half of the screen and the files in the lower half allows users to modify their projects. For example, the Select All button lets users click on a series of croutons, which are then highlighted for easy identification. These croutons can then be moved to another location in the project or deleted. Users also can record video clips by clicking on a button in this row of controls and modify a control panel to set the duration of lower third CG keys, audio events, such as split edits, and framestores.

The Project mode is similar to the Project/Files mode, except it excludes the source files from the bottom half of the screen. This operating mode would be useful for projects in raw form that require the user to have a broader view of the project content and the ability to move and delete croutons. It also gives video presenters a broader view of their overall video and graphic content so that they can modify their presentations on the fly.

The Project/Switcher mode will be somewhat familiar to Toaster users. In the lower half of the interface, users have access to typical Video Toaster Switcher functions. However, the area of the current Switcher screen occupied by transitions now displays the storyboard croutons of a video project.

The Files/Files mode is a file requester that allows users to conduct basic housekeeping chores in a graphical environment. For example, by pointing and clicking with the mouse, users can copy fonts, textures and Switcher transitions from the system CD-ROM drive to the desired system hard drive.

The system operating software is a drastic, but logical, departure from what has come before. Just as the editor has brought a closure to desktop video hardware, the software too brings to fruition a desire to give first-time users and experts alike a simple, yet powerful way to build their video programs.

However, the simplicity of the storyboard analogy doesn't mean that the software lacks the powerful tools professional video editors require. The ability to trigger certain events, such as split edits and CG keys, at specific times can be set by opening control panels and entering the desired time values.

Back to the Future

NewTek's introduction of the Video Flyer promises to reignite the explosion that blasted through the video industry with the initial release of the Video Toaster. In the form of the Video Toaster tapeless editor, NewTek has shown that it understands what the personal video producer needs: an easy-to-use, broadcast-quality, non-linear editor at an affordable price.

On its own, the editor would be impressive. However, when coupled with the power of the Toaster's real-time video switcher transitions and effects, as well as LightWave, ToasterCG, ChromaFX and ToasterPaint, the Toaster non-linear editing system appears to be unmatched. Anyone who has ever waited for PhotoShop filter transitions to render will immediately recognize that.

Beyond its high quality and low price, Jenison is hoping that the editor's ease of use will bring to fruition the revolution the Toaster began in video production. He is seeking to offer an "Everyman" video product that's easy enough for anyone with a desire to communicate with video to use and powerful enough to satisfy the requirements of professional video producers.

"We think that while making a good television show requires many talents and skills in many areas," said Jenison, "that the electronic process of editing should not put barriers in people's way because it can be made simple.

"And that is what we have attempted to do. With our system, you still need talent and skill to make a good television show, but you won't need to spend three months learning how to become a technical director guru. We want that part of the problem to be transparent. We want that to just happen. We want you to think your show together."

VTU

The Father of the Video Flyer: Kenbe Goertzen

Kenbe Goertzen, NekTek's director of product development, led the hardware design of the company's new non-linear video editor, the Video Flyer.

What do guided missile test systems, the vision feedback robots on Ford Motors' production line, the control electronics and operating system for a specialized PostScript printer used in the magazine industry and the new Video Flyer from NewTek have in common? Kenbe Goertzen.

Goertzen, NewTek's director of product development, is the man behind these and several other powerful computer devices. His contributions to these products range from charting new territory in the design of multiprocessor computer architecture to developing unique operating systems to take advantage of the power of those computers.

Despite his many successful computer designs for the government, military and private industry, Goertzen may become best known for his pioneering work on the Video Flyer non-linear editor. He is responsible for the hardware design and development of NewTek's proprietary video compression algorithm, Adaptive Statistical Coding (ASC).

"The goal of ASC is to eliminate any visible evidence of image artifacts that plague other compression algorithms like JPEG and MPEG," said Goertzen. "An equally important goal with ASC is to maintain a signal-to-noise ratio that will be considered full-broadcast quality and competitive with high-quality digital videotape machines."

Goertzen, who joined NewTek two years ago, inherited the company's ongoing effort to develop a non-linear editor companion to the Video Toaster. With his direction and the support of company president Tim Jenison, NewTek's hardware and software research and development team made incremental advances until a major breakthrough developed in 1993.

By the beginning of 1994, NewTek had advanced beyond running computer simulations of what the ASC algorithm should do to compressing real video with prototype hardware running ASC. Early tests indicated that Goertzen's algorithm and software had delivered on the goals established for the Video Flyer at its inception: no compression artifacts, 50dB or greater signal-to-noise ratio and at least 1.5MHz chrominance bandwidth.

Since then, Goertzen and NewTek's team of hardware and software developers have been hard at work perfecting the hardware design, completing its low-level software code and implementing the Video Flyer's editing software. The final result is NewTek's NAB introduction of the Video Flyer.

But doesn't it seem unlikely that one man can succeed in developing a video compression engine that delivers broadcast-quality video where so many before have failed? Isn't it unusual that a single individual can come up with a system that outperforms compression standards that were designed by the greatest minds the photographic, video, computer and motion picture industries had to offer?

Goertzen humbly responds: "It's not necessarily such an astounding feat. It's just a different focus—a different goal. Our goal was to deliver broadcast-quality video. JPEG and MPEG were designed to do something else."

THE PERSONAL VIDEO PRODUCTION MAGAZINE

VIDEO TOASTER USER

COMING THIS FALL to SOUTHERN CALIFORNIA:

in cooperation with

NEWTEK INC.

Presents:

VIDEO TOASTER EXPO '94

You'll see NewTek's latest product, the Video Flyer non-linear editor. Plus, experience the wide range of third-party products and tools for video producers, 3D animators and Video Toaster users.

In addition, there will be a complete selection of classes on Toaster and video production and 3D animation. Please complete and return the form below to receive more information. See you at Video Toaster Expo '94!

☐ **Yes! I want more information about Video Toaster Expo '94!**

NAME: .....

COMPANY: .....

ADDRESS: .....

TELEPHONE: .....

FAX: .....

Send this form to:

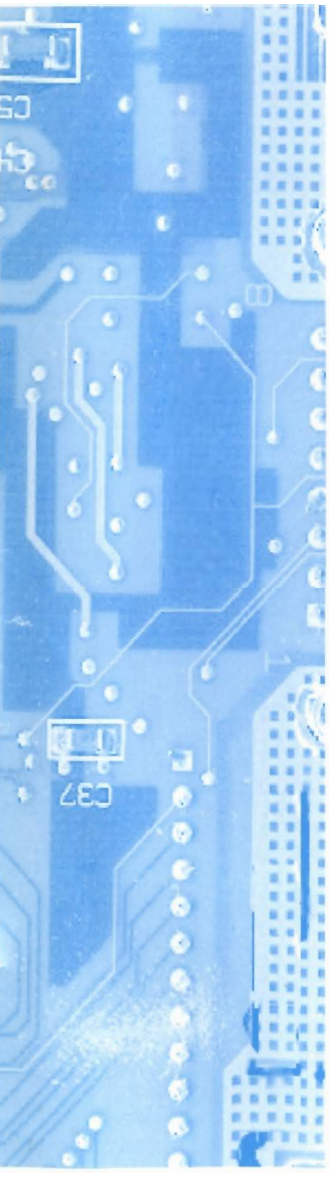
Avid Publications
273 N. Mathilda Ave.
Sunnyvale, CA 94086
or fax to: (408) 774-6783

Read future issues of *Video Toaster User* magazine for more details!

A Conversation with

Closing the Loop on the Desktop Video Revolution

Tim Jenison:



by Phil Kurz

Change is frequently an uncomfortable but necessary part of life, and NewTek has experienced its share of changes over the past few months.

The departure of company vice president Paul Montgomery and five other key employees has triggered a number of changes at the Topeka-based business. Under company president Tim Jenison's leadership, NewTek has embarked on a reorganization that has thrust some new and some familiar faces into positions of leadership and responsibility. Jenison seemed pleasantly surprised that the transition was as painless as it has been. The company has absorbed the initial shock of the split and rebounded with a clear assessment of where it is and where it is headed.

According to Jenison, NewTek is poised to bring the revolution in personal video production equipment and desktop video gear to fruition. At the National Association of Broadcasters (NAB) convention in Las Vegas, NewTek introduced the Video Flyer, a low-cost, broadcast-quality, non-linear video editing system.

At the core of this system is a NewTek-developed digital video compression engine that the company claims can deliver on-line, full broadcast-quality video for far less than competitive systems. Not unlike the Toaster's introduction in 1990, the unveiling of NewTek's non-linear system seems destined to send shockwaves through the video industry.

"Over the next year you are going to see NewTek delivering a lot of new products."

Intended to be coupled with the Video Toaster, NewTek's non-linear editor not only promises to deliver D2-quality video in its highest performance mode for a fraction of the cost of a digital videotape machine, but also real-time switcher transitions, digital effects, character generation, paint and all of the other staples Toaster users have come to expect. Thus, in a true sense the product brings to completion the Video Toaster system. It closes the loop on the desktop that to date has been filled by lower-cost, professional video decks, edit controllers, single frame animation recorders and the rest.

Jenison seemed confident that all video producers—from the broadcast ranks to the home hobbyist—would recognize the importance of this system, and that through it, NewTek has ignited another period of explosive growth in personal video production. Thus, the recent transition at NewTek seem to have foreshadowed the dramatic changes that the company once more is likely to cause throughout the entire video industry.

I met with Jenison on several occasions immediately following Montgomery's departure. While it was clear that Jenison will miss his close association with Montgomery, it was equally evident that NewTek's president had a firm grasp on the reigns of his company and an unobstructed view of where he wishes to steer it.

He clearly identified his destination as the personal video producer—the man or woman from every walk of life—who has a message to communicate with video but doesn't have a stack of money. According to Jenison, it is these people who will bring diversity to the content of future video productions and fill the emerging video channels with programming.

However, this diversity will wither unless personal video producers have access to affordable, high-quality tools, and that, according to Jenison, is what NewTek's new Video Flyer is all about.

Video Toaster User: *In the past you have said that NewTek's goal was to build a video production device easy enough for your mother to use. Is that still your vision for the direction of NewTek, or is the company headed elsewhere?*

Tim Jenison: Our stated goal at the beginning of the Video Toaster odyssey was to make television production accessible to anybody who wanted to use it, and the Toaster was the first step toward that goal. We haven't given up on that goal. That is exactly what we want to continue.

Desktop video has been estimated to be a $1 billion industry right now—in other words, Toasters and all of the ancillary equipment. Analysts are saying that is going to multiply many times over the next few years. Some of the reasons for this growth are the increase in demand for broadcast video with more cable channels, more satellite distribution and more high-tech ways of getting video into the home that are just around the corner. What doesn't change is that somebody has to make the video, and if there is a bottleneck in this whole new world of information, it is people making the video to feed that demand.

In corporations alone, there may be a tenfold increase in demand for video over what we had just a couple years ago. In the past in corporations, if you wanted to do a video you had to contract with a video producer outside, or you could try to set up a corporate video department. Very few corporations could afford it or knew how to do it.

Now if there is an interest in doing a video in a corporation, it is possible that you can set up a desktop video system and do it yourself. We think that there is an explosion about to happen in corporate video.

Another area is education. Since the Toaster shipped, we've heard from a lot of schools using Toasters and they say that the effect of the Toaster goes far beyond what you might expect. When this started, what I had in mind was that a teacher would produce tapes to use in the classroom, and that perhaps a mass communications course might have the students use the Toaster to learn about video production. But what's really happened is that some teachers are making tapes for their classrooms, but that's just a tiny, tiny percentage of what Toasters are being used for in schools.

I talked to a teacher in Dallas who said that the Toasters are being used in almost all aspects of their curriculum. He said that LightWave is being used to teach geometry, and the fine arts department is using the Toaster to train illustrators for the booming field of graphics for video. Now, if you want to be an illustrator, you have to go out and get a job. Where are the jobs? In video.

This teacher said that one thing is universal. The kids are immediately turned on by the power of desktop video. These kids grew up with television, but they have always been recipients of television, and he said the

lights just start going on when they see that they can get on the production end instead of being on the receiving end. As we make the Toaster even easier to use and less expensive, I see us going over a threshold where it just explodes. Right now it takes a pretty good budget and a certain amount of stick-to-it-tiveness and motivation to really get a Toaster system up and running. In the near future, we think that the new Toaster system is going to be that thing that puts us over that threshold—that for the first time, a layman can walk up to the Toaster and get a video production out of it without a lot of training or money.

It is hard to draw an exact parallel between desktop publishing and desktop video, but what really made desktop publishing take off was the ease of use of the Macintosh computer and the fact that you could get a Mac, a desktop publishing program and a laser printer for under $10,000. That's when all heck broke loose. People who never thought they wanted to be in the printing business got into it, and now we have seen an explosion in the number of magazines and all forms of printed communication.

A similar thing is clearly happening in video right now. What's been missing is that easy-to-use system in that price range, and that's what the new Toaster system is.

The direction of NewTek is to deliver on that promise. We've been working on it for a long time. We are not going to give up until we get it, and when we get it we will continue to improve it.

But we are also branching into a lot of related areas, and over the next year you are going to see NewTek delivering a lot of new products for a lot of new applications, but all related to easy-to-use personal video production.

VTU: *In the past, you have said that the Toaster as introduced was only half the solution. What is the other half?*
TJ: The Toaster was designed in 1987 as a complete desktop video system. That was the vision we had at a time when apparently no one else was interested. As we worked on the Toaster system, some parts were easier than other parts, and what we ended up shipping in 1990 was as much as we could get done at that point in time. But there was a piece missing. And that piece, which was in the original 1987 design, was a random-access, broadcast-quality, non-linear editing system.

That's what the original Toaster system was designed for, and the user interface was the key to making that accessible. Aside from broadcast quality, which is necessary for acceptance among professionals, the most important ingredient of this Toaster system is that you be able to use it casually. In other words, you don't have to be a full-time video professional to use the thing. You don't have to devote weeks to studying manuals and getting intensive training. You can use it for a few days, walk away from it for a week, come back, and you still know how to use it. Our goal is to make it so simple that you really wouldn't have to have a user's manual to make it work. And that involves a lot more design effort because you still have to provide the versatility to do the things the professional wants but at the same time you have to hide it from the initial user so that the most important parts of video production and the most common parts of video production are there on the surface and are intuitive. So that's been the hard work in designing the user interface.

The other hard part has been getting broadcast-quality video onto the hard disk for random-access editing. That has taken longer than we thought. We thought we could deliver it in 1990, and it was a tough problem, and we had to solve that problem on our own. Existing compression solutions couldn't get us the performance that we wanted. So, we had to design our own compression technique from the ground up with the goal that it please the most critical video engineer, that it pass test signals transparently and not degrade the video in any way. Not that our lowest end user required that, but to truly be video production gear, it had to meet those specifications.

Our premise with the Toaster system was that we meet or exceed the performance of the highest-quality recording formats in use. The Toaster has always had something to prove to the video production world—that we could meet those specs and in spite of its low cost, it could deliver high-quality video right along with the best of the boxes. So, being able to pass that muster was important for the success of the Toaster, and we think it is just as important for the Toaster editing system.

That is why we have put this emphasis on the broadcast-quality aspect of the Toaster recorder.

VTU: *Does your non-linear digital editing system use JPEG, MPEG, wavelet or other off-the-shelf video compression chips?*
TJ: No, we use a proprietary compression technique developed by NewTek.

VTU: *Why?*
TJ: When we began this non-linear editor several years ago, we looked at all of the available video compression techniques, and we have looked at all new techniques that have been developed since, and they all have certain problems.

One of the biggest problems when we began this project was cost. So we needed to find a compression technique that could be built into a low-cost product. At that time, JPEG and MPEG chips weren't available, but we looked at the scientific literature on image compression and that body of art goes back to the 1950s.

Back then, a lot of basic research was done by the military, the phone company and others on different types of digital compression and how effective they were versus image quality. And they went to great trouble to bring in groups of test subjects to quantify the visual degradation of various compression formats and ratios. So even without JPEG chips available, for example, it was possible to go into the scientific literature and see how ordinary people perceived images compressed at 4-to-1, 10-to-1 or 100-to-1 ratios. And even though JPEG as a standard hadn't yet been developed, the basic principle behind it, the dis-

crete cosine transform, had been well-researched.

In doing our research, we discovered there was no magic bullet that could give you astounding compression ratios with no loss. Our overriding goal has always been to build a product that was fully suitable for video production. Thus, we were only interested in compression that could sustain a broadcast-quality picture.

The emphasis in the development of MPEG to this date has been in achieving very low data rates, but allowing the picture to be degraded. So, even today, off-the-shelf compression solutions are not available to do the job at a reasonable cost.

"...a random-access, broadcast-quality non-linear editing system"

When we began this process, we decided that we had to come up with our own compression format that would allow us to get broadcast-quality video onto a computer hard drive. It is not an easy task, and it has taken us this long to deliver. But I think you will agree it has been worth the wait.

The picture quality is extremely transparent compared to other data compression techniques, and you will find that the suite of test signals that video engineers use to evaluate video equipment passes through our system cleanly and without computerish artifacts. This is very important in a piece of equipment that is used at the network level. But, of course, that benefit exists to all Toaster users across the spectrum, down to the video hobbyist.

While a video hobbyist does not typically have a Tektronix VM700 test unit, it's still important that video quality be maintained because any loss or degradation in the video is eventually seen by the final consumer.

VTU: *Is the compression ratio constant or dynamic?*
TJ: The compression ratio varies constantly depending upon the content of the video. In other words, it will use more data when there is more detail in the picture.

VTU: *Can you equate the image quality delivered by this product to that of existing videotape formats?*
TJ: There are several quality settings available that the user can choose. At the highest level, the quality is equivalent to D2 digital tape. The other settings range down to Super VHS quality.

VTU: *What data rates are required to support D2-like performance and other levels of image quality?*
TJ: So far, our tests indicate that the higher-quality modes, depending upon picture content, may average 4 to 5MB per second. We think most users will choose modes requiring about 2MB per second on average, and some applications may use as little as 1MB per second or less.

VTU: *Not only has quality been identified as being of the utmost importance, but you have said that ease of use was a major design consideration. Could you explain how that is reflected in the Video Toaster editor interface?*
TJ: We felt that back in 1987 when we started on this project that the Toaster control panel, the user interface, be friendly, intuitive and free of what we call computer complexity. In other words, it is a computer, but we didn't want to limit personal video production to people who were comfortable with computers. So, when you boot up the Toaster, it is a very palpable, tactile, almost physical machine on the screen; you can push the buttons with your mouse and it behaves like a video switcher that television people are accustomed to, and it does what they expect. We didn't want a lot of secret handshakes where you had to hold down three keys on the keyboard and drag down a sub directory to activate a particular function.

And compared to a lot of other products in the marketplace, the Toaster still stands out as something that is friendly and understandable. That philosophy also applies to our editor. We want it to be simple on the surface so when you walk up to this thing, you can make an educated guess about how it will work and that guess will be right.

VTU: *In the days when film dominated television post production, everyone edited by looking at the pictures—in other words, the frames of film. I see a lot of similarities between that style of editing and your editor's interface. Did you intend for that analogy to take place, and will that change the structure that required specialized technical knowledge?*
TJ: In the beginning of film, in the silent film days, virtually anyone could make movies and did. Editing those films was a pretty intuitive process. You found the frames you wanted, you took a pair of scissors, you stuck two pieces of film together, and you had an edit. Everyone understood that.

In those days, if you go back and look at the silent film—not much remains—there was an incredible amount of diversity. There was a lot of sort of what would now be called event videographers making feature films. They would grab a camera and run out to the scene of a burning building and in five or 10 minutes come up with a plot around this natural scenery. They would shoot a film of a burning building and a victim being rescued by a hero.

With the advent of sound, it suddenly got more complicated and expensive. But it was still fairly intuitive. You still stuck those pieces of film together, but now you had to deal with a parallel process—that of sticking the sound pieces together. But it was still understandable by a lot of people.

When video came along, they discovered that sticking two pieces of tape together just didn't work very well. So, we ended up with this rather bizarre technique of electronic editing, and nobody was really crazy about the way it worked. I mean, people probably would have preferred to fasten two pieces of tape together if that worked, but at

that point the editing process became more esoteric.

Editing video depended on these computerized edit controllers, and it was no longer as immediately tactile an experience. You were dealing with columns of numbers that made up the edit decision list. Videotape editors got used to this and became very proficient at this process, so much so that they could run rings around a film editor trying to put two pieces of tape together. But editing videotape was still something that needed a lot of training and experience to do properly. There is really no way that a client could walk into a post house and sit down in front of the editor and do any work himself. But that is exactly what we are trying to accomplish.

We are trying to make the entire editing process, including the special effects, character generation and even 3D animation, accessible to ordinary people, who have other things to do with their lives than climb the steep learning curve of professional video editing equipment.

VTU: *NewTek introduced the Toaster in late 1990, and now it's 1994. That's roughly 42 months since the last significant product introduction. Does this lengthy time span reflect a lack of R&D funding, and will NewTek accelerate its product development so that we begin seeing more regular product introductions?*

TJ: As a percentage, NewTek spends more on R&D than most companies. We think it is the key to our future, and since the Toaster shipped, we've been hard at work on a number of technologies for the future of desktop video.

NewTek is a company that doesn't ship a lot of products. Some companies will try anything in the marketplace and see if it flies. We try to focus on a small number of products that we know will be blockbusters. So in the process of doing that, we pour all our blood, sweat and tears into a very small number of projects.

Over the next year, you are going to see some of the results of that R&D. But many won't appear for two or three years. The kind of products we like are those that break new ground in technology and price/performance. We don't like to be in the position of selling me-too products. We like to hit them where they ain't.

Welcome to Alcatraz:
NewTek's R&D Prison

About 1,800 miles east of the "The Rock" in San Francisco Bay in a three-story office building overlooking the Kansas River sits a less well-known institution called Alcatraz. But you won't find any bird men or prison cells there.

This Alcatraz is situated on the edge of Topeka, Kan., and it houses NewTek's programmers, hardware engineers and content developers who only feel like they're incarcerated—at least that's how it seems when a new product like the Video Flyer, NewTek's new non-linear video editor, is under development.

The men of Alcatraz, according to NewTek insiders: (L-R) Kenbe Goertzen, Charles Steinkuehler, David Holt, Tim Jenison, Peter Tjeerdsma, Steve Kell, Marty Flickinger, Mung Hua Wang, and Arnie Cachelin.

"Traz," as it's fondly called by most NewTek insiders, is home to Arnie Cachelin, Marty Flickinger, Kenbe Goertzen, David Holt, Steve Kell, Charles Steinkuehler, Peter Tjeerdsma and Mung Hua Wang. They're the programmers and hardware engineers who made the concept of the Video Flyer a reality.

"When we were a year into the Toaster project," recalled company president Tim Jenison, "we realized that the programmers and engineers were getting dragged into all sorts of NewTek business that took away time from development of the Toaster.

"They all complained that no one would stay out of their area. NewTek is a very noisy and crazy place," Jenison said.

To appease the distracted developers, NewTek rented a storefront in downtown Topeka so they could work uninterrupted. Eventually, the grueling demands of programming the original Toaster meant that some would spend days at a time working in their offices. When a few brought cots into their offices, the similarity between the offices and prison cells became apparent. And to keep the general public from wandering in off the street, Traz programmers hung a sign in their storefront window that read, "Nuclear Waste Disposal Services."

"It was the kind of prison that allowed them to lock out the outside world," said Jenison.

"Not many people would bang on the window. They would walk down the sidewalk and veer away from the building."

NewTek has moved several times since those early Toaster days, but the company's research and development team has continued the Traz tradition of maintaining a separate identity from the rest of the company.

Now housed on the top story of NewTek's new headquarters, the Traz team remains cloistered away in its own domain. Although no cots or beds are evident, it's not uncommon to see the lights on in their offices well into the early morning hours. For the past several months, that midnight oil has been burned working on the Video Flyer.

"It can get crazy around here, the closer we get to the NAB (National Association of Broadcasters) convention," said Traz programmer Steve Kell prior to this year's convention. "But we can pull it off. We have in the past, and I'm confident that we'll do it again."

That's our product philosophy at NewTek, and that's what makes it such a fun business. Technology lets you do that—it's like clay that can be molded into any arbitrary sculpture. And once you have the final sculpture, it's mass production.

Microelectronics and designing silicon chips is almost like a printing process. The way they make integrated circuits is done by the thousands at once, and the technology is inherently cheap and gets cheaper every year. This makes it possible for us to bring the formerly expensive electronic systems to the masses at a price that anyone can afford.

"...the quality is equivalent to D2 digital tape."

VTU: *You said one of your product development philosophies is "hit them where they ain't." Where ain't they?*
TJ: They're not making a fully capable broadcast-quality non-linear editing system at a very low price, but more importantly, one that is so easy to use that a layman can walk up to the machine and operate it after a few minutes of training. That is our goal with our new system. The other systems I've seen have been pretty intimidating to a layman.

With our system, you still need talent and skill to make a good television show, but you won't need to spend three months learning how to become a technical director guru.

VTU: *Commodore U.S. is less than healthy. Several analysts have looked at their financial statements and wondered how they have kept the doors open. What steps have you taken to protect the Toaster, given its reliance on the Amiga and the status of Commodore in this country?*
TJ: Well, there is hardly any computer company these days that hasn't had financial scares, and Commodore is no exception. But it is not so scary that we are really afraid of losing the Amiga computer. Commodore has so many divisions that it's hard to tell which is in trouble and how much trouble they are in. But in Europe, they are doing quite well with some of their new machines.

In the U.S., clearly their day has passed as a mainstream personal computer. We never really depended upon it as a mainstream personal computer. At the time the Toaster was designed, the Amiga was the only system that was practical as a host for the Toaster because of its real-time multitasking operating system. The intimate coupling of the operating system to the video frame rate was perfect for the Toaster application and is still unsurpassed in those areas.

VTU: *Recently, NewTek vice president Paul Montgomery and five others, including two programmers, severed their ties to the company. What impact will their departure have on NewTek's ability to deliver products for the desktop video market?*
TJ: Their absence is being felt here. They are good friends, and it is like losing a couple members of the family. But it will not affect our ability to bring out new products. There are still more than 50 great people at NewTek to produce and promote these products.

The short-term problem is replacing them and making sure their jobs get done. Over the last two weeks, that's been my primary concern. The situation is under control now, and it looks like things are better than ever. There is some new talent in the company. It's like a breath of fresh air, and the people who were here hadn't been happy for a while. Unfortunately, it was dragging others down. That's gone, and there is a new gleam in NewTek's eye and an excitement and vitality. You can feel it in the air.

Our relationship with those people was long and pleasant, and it's sad to see that end. But change is good. They're going on with their lives, and we are getting on with ours, and that frustration is gone on both sides.

VTU: *In the past, third-party developers often have been surprised by NewTek product development. Do you now plan to keep your them better informed?*
TJ: That's one of the big changes taking place. We want to actively cultivate relationships with developers—something we haven't been real good at in the past. We haven't been good at disseminating information about the Toaster or guiding developers in directions we think they should go. There just has not been good communication with the world of Toaster developers.

And that is one of my challenges now in remaking NewTek's structure: to make sure that happens effectively. Also, with the advent of the new Toaster system, we have locked down a lot of the Toaster's internal structure that we knew had to change through the various versions—things that might break a third-party application. Now, we are in a position to document and guarantee the way things work in a Toaster. So in some cases, for the first time we are comfortable with sharing the innermost Toaster secrets with other developers.

VTU: *Is the recent announcement that NewTek and Prime Image will jointly pursue the PAL market an example of the increased communications between NewTek and third-party vendors?*
TJ: Yes. Since we started showing the Toaster in the late 1980s, the demand for the PAL Toaster has been as strong as the demand for an NTSC Toaster. The way the Toaster works made it difficult for us to make an equivalent PAL version, so for years we have been looking longingly at the PAL market.

When I first heard that Bill Hendershot (Prime Image president) was attempting to solve that problem, I was

skeptical because what he was proposing was a transcoding system that would transcode the PAL signal to NTSC, pass the NTSC through the Toaster and then transcode back to PAL.

Even if you do transcoding in an optimal way, there are motion artifacts, especially judder. And I thought that going through two conversions would make the result unusable for broadcasters. However, when I found out what (Hendershot) was really doing, I got very excited about it because with a clever frame interleaving technique, he solved the motion judder problem.

VTU: *What are some of the other products you might introduce to feed the desktop video and personal video production marketplaces?*

TJ: The technology in the Video Flyer is extremely powerful and has a lot of applications outside the Toaster. We are also working on the next generation Video Toaster and several other related products. The wonderful thing is that the technology that we are working with gets cheaper and better every single day. And one nice thing is that you can predict how much better and cheaper it is going to get. As we are designing products that are one and two years out, we can make accurate guesses about how much performance we can add and still keep this in the desktop video price range. It is very exciting because the kind of performance we can get in one or two years exceeds all of the high-end equipment that we have associated with six- and seven-figure equipment in the past.

So that is our goal: to bring that technology down to the desktop. That's one of the most exciting things I can imagine. Whatever we do at NewTek, it is going to be video, it's going to be graphics and it's going to be high-performance, but it is going to be low-cost. And to me that's what makes my job the best thing in the world.

VTU

Phil Kurz is Editor-in-Chief of Video Toaster User Magazine *and the co-author of* Mastering Toaster Technology, *a step-by-step guide to using and understanding the Video Toaster.*

Charles Steinkuehler: From Apprentice to Master

One of NewTek's first employees, 26-year-old Charles Steinkuehler has become a vital part of the company's research and development team.

He's the tall guy wearing the white lab coat in the NewTek Toaster 4000 promotional video. You know, the one with the white adhesive tape holding his glasses together at the bridge of his nose.

But don't mistake that nerdy on-camera character for the real Charles Steinkuehler. He's the 26-year-old hardware developer at NewTek who's regarded by many in the company to be somewhat of a genius. "Charles is the man who knows everything," said Christina Knighton, a NewTek co-worker. "He's a walking encyclopedia. It's quite frightening for a man of his youth."

So, it shouldn't be surprising that Steinkuehler is also the chief NewTek hardware guru who worked at the direction of Kenbe Goertzen, NewTek's director of product development, to build and breathe life into the Video Flyer.

For the past eight months, Steinkuehler has been assembling prototypes of the product, laying out printed circuit boards, writing all of the software that runs on the product's onboard processor and designing the device's front-end video processing subsystem. Such weighty responsibilities weren't always within his purview.

Steinkuehler was one of NewTek's first three employees, beginning his eight-year tenure with the company as a part-time DigiView assembler at the age of 18. His summer job with NewTek grew into a full-time position over the next few years as he made a transition from production and shipping manager to a technical assistant to company president Tim Jenison.

"I would talk to (Jenison) during the late nights when we would pour epoxy into the DigiView molds about how the DigiView software and hardware worked and how the color mapping worked," recalled Steinkuehler.

"Tim recognized that I was fairly bright and quick to pick up on things. Eventually, NewTek expanded, and I became a technician's assistant, which evolved into what I do now: full-blown research and development.

"I basically learned as I went in an apprenticeship-type program. If I needed to do something, and if Tim didn't have the time or didn't know the answer, I would be responsible for going out and figuring out how to do it on my own."

As a result of Jenison's tutelage and encouragement from Steinkuehler has become one of the primary movers behind the Video Flyer, NewTek's new non-linear video editor. Although his contributions to the development of the product have been significant, don't expect to see Steinkuehler taking any bows in public.

"I don't go to the trade shows very often," he said. "I don't often get to see the crowd's fanatical love for NewTek that I hear reports about."

However, if his labors bear the fruit that NewTek expects, Steinkuehler will have played a significant part in the development of the next wave in the personal video production revolution. And that's a far cry from the stereotypical panic-stricken, lab-coat-donning nerd he has portrayed in NewTek's promotional videos.

THE PERSONAL VIDEO PRODUCTION MAGAZINE

VIDEO TOASTER® USER

YOUR GUIDE TO THE ULTIMATE CREATIVE CHALLENGE

It's the magazine you've always needed to create the most stunning video productions from the world's top video experts.

For several years, VIDEO TOASTER USER has been guiding readers through the fascinating world of desktop video production. VIDEO TOASTER USER brings together all the secrets of the best talent in the business. It's your resource for making a statement, a lasting impression and your most creative video production to date.

VIDEO TOASTER USER is all you need to stay on top of the latest ideas, trends and products with articles geared toward both the beginner and the more advanced video producer. No matter what your level of expertise, VIDEO TOASTER USER will cover it. It's the kind of magazine you can learn from and get inspired by.

VIDEO TOASTER USER. Your Personal Video Production Magazine and your guide to the ultimate creative challenge.

Why be without it? Subscribe to VIDEO TOASTER USER today!

Call toll free to take advantage of the low subscription rate of only $36 for 12 issues:

VISA MasterCard **1-800-322-2843**