### Case 3:06-cv-00019-MHP Document 76-7 Filed 12/09/2006 Page 1 of 34

Apple Computer Inc. v. Burst.com, Inc.

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Acknowledgment is received. [_] been file	made of the claim for prior d in parent application Serial	ity under 35 U.S.C. 1	19. The certified copy has	[_] been received. [_] not been
Note the attached Ex	aminer's Amendment.		,	
Note the attached Ex Note the attached Ex	aminer Interview Summary R aminer's Statement of Reaso	ecord, PTOL-413.		•
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UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner Huy Nguyen

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 May 6, 1991

 Richard A. Lang
 ' hereby certify that this paper or fee is being deposited with the United States Postal Sarvice "Express Mail Post Office to Addresset" service under 37 CFR 1.10 on date indicated above and is addressed to the Commissions of Patents and Trademarks, Washington, D.C. 20231.

 CASE
 211

 SERIAL NO. 07/347,629
 William E. Hein

 FILED
 May 5, 1989

 SUBJECT
 AUDIO/VIDEO TRANSCEIVER APPARATUS INCLUDING COMPRESSION MEANS.

RANDOM ACCESS STORAGE MEANS, AND MICROWAVE TRANSCEIVER MEANS

THE COMMISSIONER OF PATENTS AND TRADEMARKS WASHINGTON, D.C. 20231

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#### INFORMATION DISCLOSURE STATEMENT

Pursuant to the provisions of 37 CFR 1.56, 1.97, and 1.98, as well as MPEP 609, applicant submits herewith a copy of U.S. Patent No. 4,506,387. Also enclosed is one sheet of Form PTO-1449 on which this reference is cited. This reference first came to applicant's attention on April 2, 1991, and was first discussed with applicant's undersigned attorney on April 9, 1991, following which applicant's attorney ordered the file history of this patent from the PTO and reviewed and discussed the subject matter thereof on several occasions with applicant and his technical associates before concluding on or about May 3, 1991, that the reference is material to the examination of the instant application. Therefore, applicant respectfully requests that the Examiner give consideration to this recently-discovered reference. A brief description of the relevance of the cited reference follows:

U.S. Patent No. 4,506,387 is directed to a programming-on-demand cable TV system in which a video program is divided into a number of segments and

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stored in a segmented memory in compressed digital form. The stored video segments are then converted from electrical data to optical data and simultaneously tranmsitted over a plurality of parallel fiber optic transmission lines to a data receiving station, which then reconverts the optical data back to the original electrical data.

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Respectfully submitted,

Richard A. Lang

By an

William E. Hein Patent Attorney #26,465.

APBU-00000239

May 6, 1991 (303) 667-6741 Loveland, Colorado

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UNITED STATES PATENT AND TRADEMARK OFFIC

ART UNIT 235

IN THE

Examiner H. Nguyen

Richard A.	Lang
CASE	211
SERIAL NO.	07/347,629
FILED	May 5, 1989
SUBJECT	AUDIO/VIDEO TRANSCEIVER APPARATUS INCLUDING COMPRESSION MEANS, RANDOM ACCESS STORAGE MEANS, AND MICROWAVE TRANSCEIVER MEANS

THE COMMISSIONER OF PATENTS AND TRADEMARKS WASHINGTON, D.C. 20231

SIR:

#### DRAWING TRANSMITTAL LETTER

In response to the drawing requirement set forth in form PTOL-37 mailed April 23, 1991, enclosed herewith for filing in the above-identified, allowed patent application (Issue Batch No. 097) are four (4) sheets of substitute formal drawings.

1

Respectfully submitted,

Richard A. Lang

By

William E. Hein Patent Attorney #26,465

July 22, 1991 (303) 667-6741 Loveland, Colorado

"Bapress Mail" mailing label number\_RB188719399 Date of Deposit \_\_\_\_\_ July 22, 199

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WILLIAM E. HEIN ATTORNEY AT LAW P.O. BOX 335

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### NOTICE OF PATENT EXPIRATION

According to the records of the Patent and Trademark Office, payment of the maintenance fee for the patents listed below has not been timely received prior to the end of the six-month grace period in accordance with 37 CFR 1.362(e). THE PATENT(S) LISTED BELOW HAS THEREFORE EXPIRED AS OF THE END OF THE GRACE PERIOD. 35 U.S.C. 41(b).

Expired patents may be reinstated in accordance with 37 CFR 1.378 if upon petition, the maintenance fee and the surcharge set forth in 37 CFR 1.20(m) are paid, AND THE DELAY IN PAYMENT OF THE MAINTENANCE FEE IS SHOWN TO THE SATISFACTION OF THE COMMISSIONER TO HAVE BEEN UNAVOIDABLE. -35 U.S.C. 41(c)(1).

IF THE COMMISSIONER ACCEPTS PAYMENT OF THE MAINTENANCE FEE UPON PETITION, THE PATENT SHALL BE CONSIDERED AS NOT HAVING EXPIRED, BUT WOULD BE SUBJECT TO THE INTERVENING RIGHTS AND CONDITIONS SET FORTH IN 35 U.S.C. 41(c)(2).

NOTICE OF THE EXPIRATION WILL BE PUBLISHED IN THE OFFICIAL GAZETTE.

PATENT NUMBER	U.S. SERIAL NUMBER	PATENT DATE	APPLICATION FILING DATE	EXPIRATION DATE	ATTORNEY DOCKET NUMBER
5057932	07347629	10/15/91	5/ 5/89	10/15/99	M914US

PTOL-441 MB441A

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PART B - FILE COPY

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JARAH MODI (602) 351-8110 Ji@brownho'

## BROWN & BAIN, P.A.

Attorneys at Law

### April 10, 2000 Burst.Com, Inc.

Dear Sir or Madam:

Enclosed for filing are the following documents:

- 1. Recordation Form Cover Sheet for Patents, with
  - a copy of the Name Change Certificate from the Secretary of State (i) of Delaware;
  - a check in the amount of \$360.00 as filing fee for same; and (ii)
  - a self-addressed, postage paid return postcard acknowledging receipt by the Patent and Trademark Office; (iii)
- 2. Petition to Accept Unintentionally Delayed Payment of Maintenance Fee in an Expired Patent (37 CFR 1.378(c)), and Statement Under 37 CFR 3.73(b), with
  - a check in the amount of \$2,590.00, and (i)
  - a self-addressed, postage paid return postcard acknowledging receipt by the Patent and Trademark Office. (ii)

Please direct all communications regarding this matter to the undersigned.

Sincerely Sarah Modi

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NOTE: If inform at (703)	ation or assistance is needed in 305-9282.	completing this form, please contac	t Petitions Information
Patent No.	5,057,932	Application Number <u>374,62</u>	9
Issue Date	October 15, 1991	Filing Date May 5, 1989	
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I hereby cer being depos postage as Box DAC, W	CERTIFICATE C tify that this paper (along with a sited with the United States Po first class mail in an envelope Vashington, D.C. 20231.	DF MAILING (37 CFR 1.8(a)) any paper referred to as being attac ostal Service on the date shown b addressed to the Assistant Comm	ched or enclosed) is below with sufficient issioner for Patents,
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2. LOSS OF ENTITLEMENT TO SMALL ENTITY ST	ATUS						
must be filed inpatent prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate pursuant to Section 1.19 of this part." From the wording of 37 CFR 1.28(a): notification of change of status (a) must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity. See also 37 CFR 1.366(f).							
$\square$ The status of this patent has changed from the	at of small entity to other than that of small entity.						
3. MAINTENANCE FEE (37 CFR 1.20(e)-(g))							
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Enclosed is a check for the sum of \$_2,590.	00the sum of \$ A duplicate						
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	ACCEPTED AND THE PATENT REINSTRIED. NOTE: 37 CFR 1.378(d) states: "Any pelition unde agent registered to practice before the Pate the assignee, or other party in Interest." $\frac{4/4}{00}$ Date	r this section must be signed by an attorney or ent and Trademark Office, or by the patentee, <u>2</u> <u>2</u> <u>2</u> <u>2</u> <u>2</u> <u>2</u> <u>2</u> <u>2</u> <u>2</u> <u>2</u>
	(419)       391-445!5         Telephone Number         ENCLOSURES:         X       Maintenance Fee payment         Small Entity Status Form         X       Surcharge	Edward H. Davis <u>General Counsel 6</u> Typed or printed name(s) Vice President, Strategic Alliances <u>burst com, inc</u> Address 500 Sansome St., Suite 503 San Francisco, CA 94111
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Application No./PatentNc.: 5,057,932	Filed/IssueDate: October 15, 1991
Audio/video transceiver app	Aratus including compression means, random
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Instant Video Technologies, Inc.	,a Corporation
(Name of Astignee) <sup>C</sup>	(Type of Assignee, e.g., corporation, pannership, university, government agency, etc.
states that it is:	
1 V the assignee of the entire right title and inte	erest: or
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in the patent application/patent identified above by v	irtue of either:
A. [3] An assignment from the Inventor(8) of the patter	it application/patentidentilled above. The assignment was recorded in
Patent and Trademark Office at Rcel_8321, F	-mme_0817, or for which a copy thereof is attached.
OR	
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must be submitted to Acalgnment Division in acco	rdance with 37 CFR Part 3, if the assignment is to be
recorded in the records of the PTO. See MPEP 30	)2-302.8]
The undersigned (whose bills is supplied below) is emp	owered to sign this statement on behalf of the assignce.
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#### UNITED STATES PATENT AND TRADEMARK OFFICE

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EDWARD H. DAVIS ALLIANCES BURST COM INC 500 SANSOME ST., SUITE 503 SAN FRANCISCO, CA 94111

In re Patent No. 5,057,932 Issue Date: October 15, 1991 Application No. 07/347,629 Filed: May 5, 1989 Patentee(s) Richard A. Lang Paper No. 19

## COPY MAILED

JUN 0 7 2000

SPECIAL PROGRAMS OFFICE DAC FOR PATENTS

ON PETITION

This is a decision on the petition under 37 CFR 1.378(c), filed April 10, 2000, to accept the delayed payment of a maintenance fee for the above-identified patent.

The petition is GRANTED.

The maintenance fee is hereby accepted and the above-identified patent is reinstated as of the mail date of this decision.

Petitioner will not receive future correspondence related to maintenance fees for the aboveidentified patent unless a "fee address" (see PTO/SB/47) is submitted for the above-identified patent.

Telephone inquiries concerning this decision should be directed to Wan Laymon at (703) 305-9282.

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APBU-00000257

Application No. 07/347,629

Page 2

The patent file is being forwarded to Files Repository.

Wan haymon

Wan Layrhon Petitions Examiner Office of Petitions Office of the Deputy Assistant Commissioner for Patent Policy and Projects **TECHNOLOGY UPDATE** 

Mass Memory

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Boulder, Colo.-based

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# Back to paper tape-digital paper conventional, rigid optical-storage media, can write data onto the surface of digital paper by burning in permanent minute in-dentations. The indentations, which reflect less light than surrounding unwritten

BY DAVID OWEN Development Executive, Data Storage Products ICI Imagedata WILMINGTON, DEL.

WILMINGTON, DEL. For applications demanding massive amounts of data, the storage found in 3½-inch, 100-Mbyte disk drives is no longer enough, and at 15 cents per megabyte, ngid optical WORM disks—a serious mem-ory contender—are still too expensive, However, a technology that shows signs of approaching these storage needs inexpen-sively is digical paper. Not really paper at all—but almost as inexpensive—digital paper is produced by sputtering a reflective layer onto a 25- to 75-micron Melinex polyester film sub-strate. The film is then coated with a dyne polymer layer and topped with a protective coating.

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polymer layer and topped with a protective coating. The dys polymer is designed to be reac-tive to 830 or 780-nm wavelength laser light, and the dye can be turned to suit the infrared wavelength of the writing laser. Thus, the same kinds of lasers used in



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102 February 13, 1989 Electronic Engineering Times

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op optical disk cartridge drives that would use the Laser-sensitive 'paper' Bernoulli princinle in con

junction with flexible optical disks from ICI

inction with flexible optical disks from ICI Imagedata. Preformatted by embossing during pro-duction and cut into disks, the "cookies" are housed in 5¼-inch removable car-tridges of a similar physical size and shape as the present Bosco 20-Mbyte magnetic cartridges. The cartridges slot into a half-height space in a standard personal com-puter storage console. Bosco's drive works by spinning the flexible optical disk close to the reading head with an air pressure differential be-tween the two sides of the disk. This ap-proach offers access time and data rates that are directly comparable to a Winches-ter hard disk, and it offers removability-the principal advantage of the floppy disk-but with a vaisly increased storage capacity and at a much lower cost.

ightweight, robust and flexible, digital paper promises to offer an effective storage life of 15 years.

More important, however, "head crash-es" and their disastrous consequences, so much a part of rigid disks, are no longer a problem because dust particles on the Bosco disk simply cause a temporary sepa-ration of the head and the rotating medium until they are spun harmlessly out of the way

way. The same thing applies to power inter-ruptions. Unlike Winchester technology, the media drops away from the head, not the head onto the media. The application of the Bernoulli principle to optical drives also offers dramatic im-

to optical drives also only driving and the provements over conventional rigid optical disk technology because the head and the rotating medium are held in stable close proximity by aerodynamics. As a result, the hulky focusing device used in rigid optical disks can be replaced by a lightweight, fixed-focus read/write head. Being able to up with a close dich bead ero dlewn the run with a closer disk-head gap allows the use of a wide-aperture, low-mass lens,

through which the laser can deliver more

for optical storage through which the laser can deliver more power to the optical medium, boosting the data transfer rate. Since the medium is very low in mass and is paper thin, it can be spun as a pair of disks in the same cartridge. Each disk is different than is a spun as a pair of disks in the same cartridge. Each disk is different than is a spun as a pair of disks in the same cartridge. Each disk is different than is a spun as a pair of disks in the same cartridge. Each disk is different than is a spun as a pair of disks in the same cartridge. Each disk is the on-line capacity over an equivalent rigid optical device. With access times and transfer rates comparable to today's rigid magnetic disks, the Bernoulli-type car-tridge demonstrates the very wide poten-tial of flexible optical disk systems. This technology, developed by ICI and Bosco and available for licensing, makes it possible to create drive with access times of better than 40 ms, a transfer rate of 1.5 Mbytes/s and a capacity of 1.5 Gbytes for-matted or 1.8 Gbytes unformatted. Most important, its media price is targeted at \$50 for a cartridge that, in some circum-tances, could provide enough data storage to see the user's hardware through to the end of its useful life. While certainly not a must for every PC user, this kind of data releation could be critical for a system used to back up a LAN in a law firm or to store patient records—such as X-rays and CAT scans— in a hospital material is also seen as ideal for reel-to-reel tape storage. A 2,400-foot reel of digit paper at half-inch tape size wound onto a 10½-inch spool—today's stan-drad format for reel-to-reel magnetic tape-would store 600 Gbytes of data. This is more than 4,000 times the capacity of a magnetic the same size, but with a cost of less than half a cent per megabyte. And, there are many applications for such storage. This reel-to-reel optical tape material would be well-suited for a bank that must maintain an expert system or store customer transaction records, or for sucer

store customer transaction records, or for a government agency system. An IBM 3400-compatible tape drive, an-nounced by Creo Electronics Corp., of Burnaby, B.C., boasts an average access time of about 28 seconds for a given byte of information on this tape. A worst-case search would take approximately 1 minute. With a corrected error rate of 10<sup>-12</sup>, the 2,400-foot tape would hold 1,000 Gbytes of data on a 12-inch reel.

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### SYSTEMS ARCHITECTURE

## Peripheral Storage: Who's Got What

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#### by Carl Warren, Contributing Editor

ystem platforms, regardless of architecture, have become powerful data processing engines. Like a racing car that gulps gallons of fuel by the second, these new systems gobble up and spit out data streams at unprecedented rates. To match the performance of these "data engines," storage devices such as Winchester disk drives, flexible disk drives, tape subsystems, semiconductors, and emerging optical storage units are offering equally impressive performance and capacity. Moreover, manufacturers of these storage devices can offer this capability at a fraction of the cost of devices available just five years ago.

The storage device has become the system core, and the latest crop of new storage announcements is stepping ahead in technology capability. For example, system designers can purchase Winchester disk technology in the 765-Mbyteplus range with under 20-msec average access times, tape drives that match virtually any capacity demand, and even erasable optical storage drives. Further, interfacing technology, due to the increased popularity of the Small Computer Systems Interface (SCSI), is rapidly becoming a commodity business (see Embedded SCSI Brings High Performance, Smarts to Smaller Drives, p. 62).

System manufacturers, however, demand more than capacity and performance. Indeed, the real impetus behind the burge oning storage market is cost/ performance per cubic inch. The goal: to inexpensively pack more storage solution

into the smallest amount of space, Even full-sized 5% "Winchester disk drives are staying true to this axiom.

The major performance providers-Control Data Corp. (Minncapolis, MN), Maxtor Corp. (San Jose, CA), and Micropolis Corp. (Chatsworth, CA)-offer fast 380-Mbyte and 765-Mbyte drives with average access times below 20 msec. Workstation vendors and host CPU makers are anatching up these drives.

Demand for the drives is helping to push the price per megabyte into the \$2 range; but so are innovative storage subsystem designs. One OEM array solution from Micropolis is the



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### SYSTEMSARL & CTURE

1604 (Figure 1). This storage array used a combination of four data drives and a parity drive (4 + 1 array). In addition to enhancing channel performance and increasing overall capacity, this combo also improves the transfer rate. For example, an array using disk drives with 10-MHz transfer rates produces an aggregate bandwidth of 40 MHz (3 Mbytes/sec).

Besides the benefit of a higher bandwidth, arrays fit more storage into smaller footprints. Thus, the overall cost/megabyte/ cubic inch is lessened. For example, a 3-Gbyte array built using the Micropolis 1580 series of 15-MHZ ESDI drives would fit into less than half the space required for a 1,2-Gbyte IBM 3380 subsystem, and consume one-third the power.

Although armys offer certain benefits, there is a price to pay. For example, the subsystem demands synchronized controllers, timing controls, and buffers to properly match the transfer rate to the host 1/O controller.

Interestingly, designers have been using ESDI drives to achieve high bandwidths. For the best system match, the drives are coupled to SCSI controllers, which increases the overall cost. The

### Packing more storage solution into a smaller space, at a lower cost, is the goal.

trend, however, is to move away from ESDI and instead go straight to SCSI. This is permissible since the emerging SCSI-II more than meets bandwidth requirements for high-performance systems. In addition, command overhead, once the bane of SCSI developers, has dropped from a 1-msec average to the nanosecond range.

Another company making use of the array concept, but as a fault-tolerant storage system, is Pacstor Inc. (Los Gatos, CA). The company's Integra series of subsystems uses Conner Peripherals' (San Jose, CA) 3½ " 100-Mbyte Winchesters to create arrays up to 1.2 Gbytes.

Besides using 3 ½ " Winchesters, the fault-tolerant aspects of the overall system make the Pacstor approach unique. The Integra system is an intelligent standalone unit that uses an Intel 80386 to control file access and data management. Pacstor uses SCSI to its fullest extent as a peripheral bus. Thus, drives can be easily removed or added without disturbing subsystem operation—a function of the disconnect/reconnect feature of SCSI.

Pactor has also developed proprietary file and error correction management that makes it possible to fully reconstruct a file should a disk drive malfunction. Pacstor pricing is between \$4000 and \$9000, depending on the configuration.

#### WORMing its Way in

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Write Once Read Many (WORM) optical technology, although not an overwhelming market giant, is proving useful in some niche segments. Ian Turner, vice-president of engineering at Laserdrive Ltd. (Santa Clana, CA), soes the technology as well suined to the imaging business. "Images take up lots of spece and usually need to be considered permanent," says Turner. To this



Figure 2: The Bernoutl Optical drive uses the ICI Digital Paper, mounted on a hob under a plate that guides the air flow, creating a filt effect. Thus, the media files rather than the head. The headhinedia interface as shown creates a Gimpling much like the prow of a bear plowing through water.

end, Laserdrive packages (in a 5 ¼ " form factor) 405 Mbytes per side of storage; a three-interleave Reed-Solomon error correction code (ECC) is implemented with the Neal Glover chip set from Scientific Microsystems Inc. (Mountain View, CA).

Since the Laserdrive 810 series of optical drives are write once, the company has implemented the management of write once protocol in the drive firmware. The upshot is that the host operating system doesn't require any specialized software.

Although WORMs are early to market, 514 "drives haven't really caught on. Moreover, they may be ignored in favor of emerging erasable optical.

emerging erasable optical. Verbatim first introduced a magneto optical erasable drive over four years ago, but Maxtor stands as today's market leader, with drives developed both in-house and with Sciko/Epson. And by this month, Maxtor should have made early shipments of its Fiji and Tahiti optical drives.

The Fiji I is a 3½ " drive with 160 Mbytes of removable storage and a 100-msec average access time. The Tahiti, on the other hand, is a 5¼ " optical drive that stores 600 Mbytes to 1 Gbyte of data, depending on the format. Maxtor adheres to the ANSI standard that speces 600 Mbytes, and offers an extended format for higher capacity. OEM pricing for the Tahiti is \$2500; \$1000 for Fiji. Erasable media will add about \$200 to the cost.

The technology used by Maxtor is called thermo magneto optical (TMO). This uses a medium, in this case built by Philips Dupont, that combines optical sensitivity with magnetic read/write characteristics. Here, a laser is used to heat a spot on the media until a bias field of about 250 Oc is achieved, causing a reorientation of the magnetic domain. The result is a written bit that can be sensed by the read/write head.

Although bits can be reoriented, there is no overwrite capability. Consequently, an erase pass must take place before a new bit is written. This might seem to slow operation. However, with careful integration, such as using buffers in combination with ast Winchester, the system impact should be negligible.

An interesting write once optical technology is being pursued by Jonnega Corp. (Roy, UT) in concert with the British firm ICI Electronica. ICI has developed an optical Digital Paper. The drive being developed by a subsidiary of Jonnega, Bernoulli Optical Systems Corp. (BOSCO) (Boulder, CO), is based on Bernoulli

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#### SYSTEMS ARCHITECTURE

principles whereby the media floats in relationship to the read/write head (Figure 2). The company claims the ability to store 1 Gbyte of data, with a 40-msec access time and a SCSI transfer rate of 1.5 Mbytes/sec.

The ICI Digital Paper (Figure 3) is a dye polymer infrared sensitive coating on a polyester-based substrate. The media has the look and feel of a wrapping paper, and since it is flexible, it can be used in rotating media, or tape drives. Developed by Creo Products, Inc. (Vancouver, Canada), the Creo drive stores up to 1 Toyte of data on a 12 "reel.

#### Half-Inch Upgrades

The half-inch tape is the only standard for interchange. IBM's 1/ " cartridge tape drive, the 3480, has been carried over to an easily handled cartridge. But third-party versions are few, and only one firm has emerged with a viable alternative to the high-end 3480. Working in a very open joint development effort with IBM, Cipher Data Products, Inc. (San Diego, CA) has fabricated the 3000i series of 14" drives. Designed for 8" and 54" form factors, the 3000i series drives store 320 Mbytes on a single 14" cartridge with 600" of tape.

This significant storage boost over IBM's 200-Mbyte capacity is achieved via the Multitrack Scrpentine Recording (MSR) format. A variation of the proposed Half Inch Tape Cartridge (Hi/TC) standard, this format permits scrpentine (continuous koop) recording on either two or four tracks on the 24 specified in MSR. This, too, denotes a significant step over IBM's 18-track format. However, IBM writes all 18 in a parallel fashion. The Cipher drive relies on a stepping mechanism to index over the track real estate.

The 3000 drives employ the standard  $\frac{1}{2}$  "tape cartridge used in the IBM drive, which is a chromium dioxide tape that is priced in the SS range in OEM quantities. Cipher reports 27,000 flux reversals/inch and ensures a 1 × 10-byte to 12-byte error rate.

## The Many Lives of Magnetic Tape Technology

by Joe Phillips, 3M Data Storage Products Div., St. Paul, MN

Agnetic tape technology refuses to die, despite periodic predictions of its demise at the hands of competitive products—first from magnetic disk drives as a primary storage medium, and, more recently, from technologies such as optical disk in removable storage applications. Half-Inch neel to-reel tape has survived and flourished by its adaptability to a variety of applications where cost per megabyte and data inferchange are the primary concerns.

megabyte and data Interchange are the primary concerns. The earliest data recording tape recorded information at 100 bits/inch. The technology has evolved to a 500-told increase: The current generation of deta storage tape products has boosted density beyond 50,000 bits/inch.

Today's mainstream magnetic tape technologies break down into four general categories: ¼" real-to-reel; ¼" data cartridge, both in standard-sized DC800 and the micro-sized DC2000 mki cartridges; ¼" single-reel certridges (e.g., IBM 3480 and DEC Compactipe media); and verious helical scan formats, including 8-mm and Digital Audio Tape (DAT). A possible fifth category having minor applications has developed for digital data cassette systems using a Philipstype cases and verious nonstandard ¼" cartridge designs.

Higher densities now being demonstrated with a helical scan format are the result of advenced taps formulations with greatly increased coercivities—up to 1450 cerated using metal particle taps on DAT cartridges. In comparison, ½" reel-to-reel taps has held the line at around 290 cerateds. A planned move to higher coercivity pigments for future ¼" data cartridge media will also offer higher areal recording densities; plans for a next-generation ¼" data cartridge product specify 40 tracks of data at a lineer recording density of 40,000 bits/Inch to achieve 1 Gbyte on a standard-size cartridge by 1990. These newsr ¼" data cartridges have moved coercivities to 900 cerateds.

With both product segments (helical and linear recording), as track and bit densities increase, vendors are becoming more concerned with accurate head positioning on these ever-smaller data tracks. Various types of serve positioning systems will be incorporated into these products to encure the required level of data integrity; sophisticated ECC will be included as well.

Although the venerable 9-track real-to-real systems have

Tratt Sec. 16.000 25 240 510/3 120 Finit Cartrido ilby: 165 Real to Re-\$250 9 Fento W 125 200 ilby fi Linity 10123480 35,000 10 120 200 Mayte a tiú 155 Deta DIV. B1000 100 Mate 321 13 122 inch -..... rtok

served as the dominant means of data interchange in mainframe and minicomputer applications for 25 years, most observers predict that within the next few years drives based on the IBM 3480 ¼" cartridge will become the most popular in the ½" tape arena. Storage Tek, Hitachi, Fujitsu, NEC, Cipher, and Aspen have all announced 3480 drives, ensuring this technology's use in the major data centers of the world.

Currently, 3480 cartridges are rated at 200 Mbytes/ transport using 18 parallel tracks having a linear recording density of 24,689 flux changes/inch for a bit density of 38,000 bits/nch. The media uses chromkun (Sodde based magnetic tape and thin-film read-write heads. Chrome tape has the potential to support much higher densities—over eight times the current level—and it is expected that IBM will soon upgrade the 3480 drive modules, at least doubling current capacity. In some proprietary drives based on the 3480 cartridge, storage capacities of up to 320 Mbytes are now being demonstrated.

The future of tape technology looks promiting. Much of the research linto magnetic tape coating and resulting developments can be shared both in commercial audio and video applications as well as data recording. The metal particle media, used for DAT drives is the same as that used for consumer audio recording. Moreover, research into ackenoed videotape formulations may possibly provide the answer for the next generation of high-coercivity tape used in data catricidge applications. With this synergistic research, it's a safe bet that continued technical improvements wit meter magnetic tape products strong competitors in the data clorege market welt into the next decade. delivers. card, it p function a small, t How? Ma like the s

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interface high-den interface function: convention

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(508) 481-3700\_ technical approaches usually gets in Color image translations are far easter after HSI conversion. For ex-ample, a purple image can be made into an orange one with just a single intensity changes in color require a single modification (three are needed on CGB brightness changes). In ordento achieve this real-time HSI comersion, one value must be divided by another at a 15-MHz rate. video data at rates up to 768 × 512 pixels, at 30-Hz video rates. Using HCMOS fabrication, each 68-pin Both chind can be used with an IBM PC-based RGB-to-HSI video board, the \$3,995 DT7821 (for prototyping. A \$995 software subrouting library, Aurora, allows customiing its the supply of proprietary circuit functions Diighlighted by the Z80 micropro-PLCC package draws under 140-mA rom a 5-V supply. OTTO II (HSI to RGB) chips handle cessor and Z8 microcontroller, into applicaopps are \$63 each in lots 1,000. RGB would reheway of rapid image analysis. Chips for real-time color comparisons ers S value change. RGB would r hree value translations. Si 122 zation of the chip's operation. 5 It's a new ball game in datacom control EL DIMES Feb B 89 Tssue 525 Bill O'B 6 06-0 com devices whose talents surpass anything The intensity portion of HSI represents yet seen. A cascade of products should fol-low this pioneer, based on a cell library three step intensity comparison. Indeed, the col-or data that tags along with RGB the monochromatic light intensity of an image region. Simple edge enhancements, shape comparison and other image-alteration schemes are made simpler with one-4 240 105 180 Blue HSI processing ⇮ Yellow 4 105 180 99 Solid State NEW PRODUCTS Color image processing comparison Saturation Intensity Hue The multiprotocol data peripheral can Once either a full video image frame (or select portions of it) are converted from RGB into calculated HSI values, any further inage manipulation becomes simpler and usually about three times faster. Still, over 16 million colors can be handled by the HSI technique. accommodate any conventional multiplexed 4 255 31 **RGB** processing tensity value comparisons. Yellow 4 143 143 ñ Green. Blue Red Continued from page 121 ecutive officer and president Ed Sack is HSI color processing allows engi-neers working with data from RGB video areas of chromatic interest. Once colors engineers have a greater latitude of data comparison opportunities (using HSI data cameras to more easily process specific are changed to their equivalent HSI values, lookup tables) than do traditional RGB in-RGB color video information in a allow developers of color scanners, inspection systems, frame grabbers ues. Using 8 bits for each primary light value, 24-bit color sources can be analyzed in the HSI domain. Mariboro, Mass. — Data Translastreamlined look-up table fashion, is The DT7910 and DT7911 allow translating the RGB video signals tion, developers of the first IBM PC peripheral board designed to handle offering two proprietary chips that real-time video color comparisons by produced by most color-image capture systems into easier-to-process nue-saturation-intensity (HSI) valand video signal processors to engi BY RICHARD DOHERTY neer rapid analysis systems.

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years in the making and on the design auto-The chip packs a fuller complement of functions than any of its ancestors: two haud-rate generators per channel, digital nuring the chip for a range of serial or non-multiplexed bus, serving as a serialco-parallel, parallel-to-serial converter/conroller. And software takes care of conficommunications applications.

> touting the IC as a candidate for semicon-Sack's point of view is hardly neutral, but the Z16C30 is undoubtedly a quantum leap

ductor "product of the year."

library. The toolset came from VLSI Tech-nology hnc. in a technology swap that returns product developments to VLSI. The evolution will continue at midyear, mation system that helped assemble that

when a single-channel USC will be offered

The company's traditionally strong posi-tion in datacom controllers also gives it a cations ekperience needed to capitalize on foundation of circuit functions and the appliits superintegration methodology. "CPUs get the press," admitted Hulme, tion-specific combinations.

APBU-00000262

pose datacom controllers run at around 2.5 Mbits/s, with some hitting 4 Mbits/s. The 21630\_also\_boasts\_174,000\_transistors\_

beyond the competition. Most general-pur-

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## Job's Next Machine Wins **Praise, Poses Questions**

#### BY THE INFOWORLD STAFF

SAN FRANCISCO - Steve Jobs' dream machine has finally arrived - sort of.

The wunderkind of Silicon Valley wowed the industry last week with the promise of a workstation that includes a 256megabyte read/write optical drive, a minimum of 8 megabytes of memory, a 17-inch megapixel monitor, and a new user interface he vows will

Next Interface to

## **SUsers Would** it Than Switch

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"The majority of my larger clients find that the current release of 1-2-3 meets the majority of their spreadsheet needs," said Richard Creeth, a consultant in Norwalk, Connecticut. But in organizations that haven't standardized with one product, competitive products are attractive. "A lot of people buying new

powers down the display, micro-

processor, drives, modem, and keyboard when the system is not

in use. The SLT/286 automati-

cally enters Standby mode when

it has been inactive for a user-

defined time period. Operation

is restored by pressing the Stand-

by button. An LED indicator and audible signal indicate low

See Compaq, Page 5

machines are taking a serious look at Excel," said Richard Silverston, senior systems support consultant with Arco, in Los Angeles, Especially with 80386 systems, many users are buying Excel rather than 1-2-3, See Lotus, Page 8

BHOENIX-

### Enhance IBM's Unix Environment BY NICK ARNETT

IBM's licensing of the Next Step interface from Next Inc. repre-sents a Unix strategy intended to complement, rather than threaten, its OS/2 Presentation Manager strategy, an IBM official said last week.

IBM and Next do not plan to develop the interface jointly, officials of each company said, IBM will, on its own, add color to its version, said William Filip, assistant general manager of

#### change the way people use computers.

But while the Next computer holds great promise, Jobs also said the \$6,500 machine won't be available until the second quarter of 1989, and then will be marketed solely to the higher education market.

Many analysts, developers, and academic buyers, while gen-erally impressed with the machine, are already looking for a lower-priced model. And many questioned when the company will provide a machine for the business market.

One explanation Jobs offered last week for targeting academia See Next, Page 93



Inc.'s 68030 Unix workstation.

APBU-00000263

AT DEADLINE

## **IBIM Says Presentation** Manager Is on Schedule

IBM will announce the availability of its Presentation Manager for OS/2 Standard Edition on October 31, according to sources. The company will make the announcement in New York, where a handful of software developers, including Microsoft Corp., Aldus Corp., and Micrografx Inc., are expected to demonstrate applications running under Presentation Manager.

Several sources said Microsoft was planning to show a version of



PAGE 93 :

OCTOBER 17, 1988

### Next

#### Continued From Page 1

was the opportunity he feels the machine has to broaden that market. "The key thing to note here is that although there are a lot of computers in higher edulot of computers in higher edu-catioa, they have not penetrated into the curriculum," Jobs said. "To develop courseware takes months and months, if not years. If we can allow people to write in two or three days what would have taken months, a lot more people will use computers. We want to be the first comput-er ta contribute to the curriculum."

Other aspects of the academ-Other aspects of the academ-ic market doubtlessly appealed to Jobs. A relatively small sales force can market new technol-ogy to universities, compared to the business market. Academic users are generally focused on developing their own applica-tions, meaning they will be less concerned with the lack of applications software for the new machine.

POSITIVE REACTION. Reaction to

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POSITIVE REACTION. Reaction to the machine from universities was generally positive. "They had very aggressive goals, tech-nologically, and I think they've reached them," said Kenneth King, a member of the Nex advisory board and president of Educom, the higher education computing consortium in Princeton, New Jersey. "It's unfortunate that the price is at the upper end of what universities generally spend for said." [Jobs has] been advised by his advisory board that he has to get it down to the \$3,000 level before students will buy it in significant numbers. It's the hopp of the advisory board that an entry-level machine emerge." "It clearly is a price break-

an entry-tevet intermediate emerges." "It clearly is a price break-through for all that it offers in one package," said it as Fuchs, vice president for computing and information technology at Princeton University, "But it's and information technology at Prinocton University. "But it's not going to be a machine that Princeton students are going to buy because students area"t pre-pared to spend more than \$2,500 to 33,000, We sel a tot of Macs and IBM PS/2 Model 30s. Even with an impact printer and word processing software, they are under \$2,500." "We want to see a machine

"We want to see a machine without the disk, where we cluster them all and run them off servers," Fuchs continued. 'Come second quarter I expect "Come second quarter l expect him to offer a more naked machine." Fuchs estimated that Princeton would order about 50 Next machines in the 1988-89 scademic year. "What excites me is the object-oriented environment and the opportunity for sharing critical components among uni-

and the opportunity for snarng critical components among uni-versities." Said Ron Danielson, director of information services at Santa Cara University. "It takes 100 to 1,000 hours for each hour of student contact

with the machine. If you want students to spend an hour in front of the machine, you have to spend at least 100 hours developing. The Interface Builder will cut down that time."

COSTLY MEDIA, Many developers, COSTLY MEDIA. Many developers, though impressed with the Next technology, are hoping for mar-kets beyond higher education and expressed amazement that Next expects applications to be distributed on optical disks that

distributed on optical disks that cost 550 each. "I wish they had said more about their distribution strate-gy," said Clinton Nagy, national sales manager for Adobe Sys-tems' Systems Division, "High-er education is not enough; I hope we'll be buying the Next machine at Businessland next year."

According to Dan'l Lewin According to Dan't Lewin, Next's vice president for sales and marketing, the company is looking at several options for software distribution, including having Next act as a distribution

having Next act as a distribution center for programs. Effect of the Next machine on the overall computer market is likely to be minimal in the near term, particularly in light of Job's own slow-growth business plan, which envisions the prodplan, which envisions the prod-uct in the hands of developers and universities for the next two years, "The impact will be nothing in the near term," said Michele Preston, an analyst with Salomon Brothers, "The only question right now is how it will affect Anole's position in the

affect Apple's position in the education market." "When the first generation of students using the Next comput-er graduate, they will take their machines with them into busi-ness." predicted Peter Tiege of Learner

ness," produced Peter Tiege of Infocorp, "The technology is wonder-ful, but the deal with IBM is the smartest, part," said Esther Dyson, oditor of Release 1.0, "The Next machine will get applications because of IBM, and IBM will lead the way right into the business market."

The Next Inc. introductions produced few surprises in the hardware offered but dramatic confirmation that a new price/ would performance plateau soon be reached. soon be reached. Claiming that "people don't want impact printers anymore," Next unveiled its 400-dpi laser printer, which works only with the Next CPU. The \$2,000 price for a Postscript-speaking laser printer scens phenomenal, cut-ting the present market price of even printer in balf will are

BY MARTIN MARSHALL

NEWS

such printers in half, until one considers that Postscript is not in the laser printer, it is in the CPU running Display Post-

The lase printer, this is not the CPU running Display Post-script. The image is created by the 68030 in a frame buffer in RAM, then an I/O processor effects the Direct Memory Ac-cess (DMA) transfer at a rate of 5 megabils per second without further burdening the CPU. The Postscript interpreter and asso-ciated RAM required in other Notscript printers do not exist in the Next laser printer. Only a single VLSI chip is required in the printer, which otherwise uses a Canon SX engine and downsized packaging that makes the printer 60 percent the size of other laser printers. The same architecture that allows the low-cost laser printer transfers without burdening the CPU also works to speed up

CPU also works to speed up other parts of the overall system processing, the company said. This makes optimum use of the 5-MIPS processing power of the 68030 CPU.

68030 CPU. Although Next is using Nubus protocols for the two expansion slots, its 25-MHz implementation will not be compatible with add-on prod-ucts for Mac II Nubus boards. Next would not say what add-on

Hardwarec Mandwared Motorola 68030 mkroproces-sor running at 25 MHz \*Motorola 68882 floating-point processor running at 25 MHz \*IO-MIS Motorola 56001 Digi-tal Signal Processor \$12.0046 mbersorie \*12 DHA channels \*25-MHz backplane using Nubus protocols "Two proprietary VLSI chips (In-tegrated Channel Processor and Optical Storage Processor) 256-megabyte read/write/eras able optical disc, 60- to 70-ms average access time, 4MB/sec burst transfer rate Built in Ethemet adapter \*17-inch monochrome gray-scale display, 1,120-by-832 res-olution, 2 bits per pixel \*Keyboard ..... \*2-button mou \*8 merabytes of RAM \*Three available expansion slots that can hold up to 3 more CPU boards "Mac-compatible" SCSI "Two "Mac-compatible" serial ports Ports Speaker and headphone Jack

Next Ups the Price/Performance Ante

Offers \$2,000 Postscript Laser; I/O Chip Transfers DMA at 5 MBPS

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**Standard Configuration of the Next Machine** 

boards are in preparation for the system, but it does plan to license its backplane technology that uses Nubus protocols to other companies. The digital signal processor

Software:.. j. • Sun's Network File System (NFS) Application development tools including Objective-C; GNU C compiler, debugger, and EMACS; and BSD 4.3 utilities •Next Step software environ-ment (includes Window Server, Workspace Manager, Application Kit; and Interface Builder) •Digital Ubrarian searching and Indexing tool Witte Now word processor • Mathématica -> Next SQL Database Server Allega CL. Common Lisp Jot personal datables Digital Library Options: 400 dol Postscript compatible aser printer and a set of the set nard disk \*16 megabytes of RAM - Carrier

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that is used for synthesizing sound someday also will be used to emulate a 9,600-bps modern, according to Next. The machine also has a 32-bit implementa-tion of Ethernet.

## Developers Eye Next, But Microsoft Abstains

#### BY PEGGY WATT

A fistful of software packages A fishin of software packages — including an object-oriented de-velopment program — will ship with the Next machine, and a respectable number of software developers are eyeing the system for future development for future deve

for future development. The new computer comes with Mach, a flavor of Unix developed at Carnegie-Mellon University and compatible with BSD 4.3; and Next Step, an object-oriented environment de-development development devel veloped by Stepstone Corp.

BUNDLES. Also being bundled with Next are Adobe Postscript, as both display and printer driver, T/Maker Write Now word processor, Mathematica from Wolfram Research Inc.; Franz Inc.'s Allegro Common Lisp; and Sybase SQL Server database technology. It also comes with Next's Sound & Music generation software and a Unix-Mail compatible graphical Mail program. Frame Te

Mail program, Frame Technology Corp., Cricket Software, Mark of the Unicorn Inc., and Faralion Computing also endorsed Next and promise applications; others said they are considering devel-opment, More than 500 development. More than 500 devel-opers signed up for a Next conference held the day after the product's announcement, said John Ison, Next's director of applications product marketing. Next is also bundling a Digi-tal Library comprised of Web-ster's Ninth New Collegiate Dic-tionant Webres' Collegiate

ster 3 Ninh New Collegiate Dic-tionary, Webster's Collegiate Thesaurus, the Oxford Dictio-nary of Quotations, and the Oxford Press' William Shake-speare: The Complete Works,

with Digital Librarian search and indexing tools. All Next documentation is also on-line.

ABSENT. Conspicuously absent ABSENT, Conspicuously absent from the supporters is Microsoft — first to endorse the new technology in Apple co-founder Steve Jobs' earlier innovation, the Macintosh, Microsoft Chair-man Bill Gates declared the Next machine's higher educa-tion moder too cambi und sold

rest machine's night cluster tion market too small and said he "decided not to put the cnergy into" development now. "We'd have to get the im-pression that it would sell in very, very big numbers, like a corporation coming in and tell-inger the development to the ing me they don't want to stick to a few standards any more," Gates said.

NEXT STEP. "We'd love to have Microsoft software on this ma-

chine," Jobs said. He expects applications will be speeded with the help of Next Step — also licensed by IBM for its RT and Intel-based systems.

and Intel-based systems. Software developers face such new challenges as distribut-ing programs on \$50 CDs in-stead of Noppy disks. Ashton-Tate is evaluating the Next machine, which would probably require entirely new products, said Terry Garnett, an Ashton-Tate vice president, "The environment he's done is od different in terms of multimeso different in terms of multime-dia that well have to go back and ask, what do users want in that environment?"

In a prepared statement, Lo-tus president Jim Manzi con-gratulated Jobs and his team, but fell short of announcing a version of 1-2-3 for the new machine.

INFOWORLD

1. 1.

# The ARRL Operating Manual

Robert J. Halprin, K1XA

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The American Radio Relay League Newington, CT USA 06111

# The Radio Amateur's Handbook

# Published by the AMERICAN RADIO RELAY LEAGUE

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Fig. 48 — This ATV sound-subcarrier generator (FM-A5) permits both voice and video to be transmitted. U1 is either a Motorola MC1458 CP1 or Raytheon RC4558DN operational amplifier.

In the completed installation a coaxial relay can be used for antenna switching. A set of auxiliary contacts on that relay should be used to switch power to the various modules for transmit and receive.

#### **FSTV** Station Identification

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As of June 15, 1983, the FCC discontinued the requirement for FSTV stations to identify by cw or voice, thus permitting FSTV stations to identify by video. Please note that this applies only to transmissions employing U.S. 525-line standards, legally "those which conform, at a minimum, to the monochrome transmission standards of Section 73.682(a)(6) through Section 73.682(a)(13), inclusive (with the exception of Section 73.682(a)(9)(iii) and Section 73.682(a) (9)(iv)." The FCC also requires that the characters be "readily legible." It follows that ATV operators should use an ordinary type style for identification and make their call signs cover enough of the screen to be readable even under weak-signal conditions.

#### SLOW-SCAN TELEVISION

Fast-scan TV signals take up more than 5 MHz of bandwidth. Since this is more kHz than in all the amateur bands below 6 meters, it is obvious that if we want to work TV-DX on the hf bands we will have to modify the TV signal a bit. Slow-scan TV (SSTV) is, just as its name implies, a TV signal with a very slow scan rate. While a regular fast-scan TV signal produces 30 frames per second, it takes eight seconds to send once SSTV frame. Thus, motion pictures are impossi-14-34 Chapter 14

Table 14				
Amateur Slow-Scan Standards				
· · ·	60-Hz Areas	50-Hz Areas		
Sweep Rates:		•		
Horizontal	15 Hz (60 Hz/4)	16 2/3 Hz 50 Hz/3)		
Vertical	B sec.	7.2 sec.		
No. of Scanning	•			
Lines	120	120		
Aspect Ratio	1:1	1:1		
Direction of Scan:				
Horizontal	Lt to Rt	Lt to Rt		
Venical	Top to Bot.	Top to Bot.		
Sync Pulse Durati	on:			
Horizontal	5 millisec.	5 millisec.		
Vertical	30 millisec.	30 millisec.		
Subcarrier Freg.:		-		
Sync	1200 Hz	1200 Hz		
Black	1500 Hz	1500 Hz		
White	2300 Hz	2300 Hz		
Reg. Trans.				
Bandwidth	1.0-2.5 kHz	1.0-2.5 kHz		

ble. (However, a form of image transmission called *medium-scan television* (MSTV) allows limited motion in a fairly inarrow bandwidth. Don Miller, W9NTP, and others are experimenting with MSTV on the 10-meter band under special temporary authority from FCC). If FSTV is analogous to watching home movies by radio, then SSTV resembles a photographic slide shown on the air. In addition, SSTV picture definition is four times coarser than fast-scan TV. Table 14 summarizes the video SSTV format used by amateurs. But these disadvantages are more than balanced by the fact that SSTV can be used in any amateur phone band above 3.5 MHz. Anyone you can work with



a good signal on ssb can be worked via slow scan. Many DX stations are now equipped for picture transmission, and more than one amateur has worked over 100 countries on SSTV1 The signal that comes out of an SSTV

The signal that comes out of an SSTV camera is a variable-frequency audio tone — high tones for bright areas and low tones for dark. To send SSTV over the air, you just feed this tone into the microphone jack of any ssb transmitter. (SSTV on double sideband a-m or fm is illegal on the hf bands.) To receive, a you tune in the signal on an ssb receiver and feed the audio into the SSTV monitor.

All you need to get started is an set station, a monitor (the slow-scan "TV" set") and a camera. You don't even need the camera if you already have a tape recorder.

Recent advances have led to the development of fast-scan converters. On receive,

such a device converts the incoming audio to a signal that is usable by a conventional fast-scan video monitor. Similarly, on transmit the converter changes the output of a fast-scan camera to a standard slowscan signal.

STV may be used by amateurs holding a General class license or above in their respective hf voice segments, and by Technician-class licensees or above in the voice bands above 50 MHz. The following SSTV operating frequencies have been recommended by A5 magazine:

75 meters — 3.990- 4.000 MHz 40 meters — 7.290- 7.300 MHz 20 meters — 14.340-14.350 MHz 15 meters — 21.440-21.450 MHz 10 meters — 28.990-29.000 MHz

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SSTV signals must be tuned in properly so the picture will come out with the proper rightness and the 1200-Hz synchronization pulses will be detected. If the signal is not "in sync," the picture will appear wildly skewed. The easiest way to tune SSTV is to wait for the transmitting operator to say something on voice and then tune him in while he is talking. With experience you may find you are able to zero in on an SSTV signal by listening to the sync pulses and by watching for proper synchronization on the screen. Many SSTV monitors are equipped with tuning aids of various kinds.

If you want to record slow-scan pictures off the air, there are two ways of doing it. One is to tape record the audio signal for playback later. The other is to take a picture of the image right from the SSTV screen. Polaroid cameras equipped with a close-up lens enable you to see the results shortly after the picture is ta....i. If you want to do this without darkening the room lights, you'll have to fabricate a light-tight hood to fit between the camera and the monitor screen.

On SSTV, FCC rules require that identification be made by voice or cw. Sending "This is WA8XYZ" on the screen is not sufficient. Most stations intersperse the pictures with comments anyway, so voice i-d is not much of a problem. Otherwise, SSTV operating procedures are quite similar to those used on ssb. As with RTTY, the station transmitter

As with RTTY, the station transmitter must be tuned for 100-percent duty cycle, since the SSTV emission is a constant tone. Only the frequency is changing.

For more information about amateur TV, see Amateur Television Magazine, c/o Mike Stone, WBØQCD, P.O. Box H, Lowden, IA 52255. A QST television bibliography is available for an s.a.s.e. from ARRL.

Lake

#### SLOW-SCAN TELEVISION

Nestled among the CW, phone and RTTY operators in the Amateur Radio bands is a sizable following of hams who regularly exchange still pictures in a matter of seconds virtually anywhere on earth. They are using a system called slow-scan television (SSTV), which was originally designed by an amateur in the early 1960s. Over the years, the amateur community has been continually refining and improving the quality of SSTV. Amateur success with SSTV during the past two decades has led to its application by the military and commercial users as a reliable long-range, narrow-bandwidth transmission system. The worldwide appeal of SSTV is manifested by the many DX stations that are now equipped for this type of picture transmission. Several amateurs have even worked over 100 DXCC countries on SSTV!

Just as the name implies, SSTV is the transmission of a picture by very slowly transmitting the picture elements, while a television monitor at the receiving end reproduces it in step. An SSTV signal is a variable frequency audio tone from 1500 Hz for black to 2300 Hz for white, with 1200 Hz used for synchronization pulses. Unlike fast-scan television, which uses 30 frames per second, a single SSTV frame takes at least eight to fill the screen. Additionally, the vertical resolution of SSTV is only 120 lines (or 128 for some digital systems) compared with 525 lines for fast-scan. (Some high-resolution experimental designs are operating with 256 lines.) These disadvantages are offset by the fact that SSTV requires less than 1/2000 of a fast-scan TV's bandwidth. Thus, the FCC permits it in any amateur phone band.

The basic SSTV format represents a trade off among bandwidth, picture rate and resolution. To achieve practical HF long-distance communications, the SSTV spectrum was designed to fit into a standard 3-kHz voice bandwidth through a reduction in picture resolution and frame rate. Thus, SSTV resolution is lower than FSTV and is displayed in the form of still pictures. A sample SSTV picture is shown in Fig 16-6.

In recent years, amateurs have been actively experimenting with various forms of video-processing techniques to provide limited motion and increased resolution. The greatest advancements are currently being made in the realm of color SSTV. Unfortunately, most of this work has been done independently from each other, resulting in a multitude of different SSTV color standards. Although the 120-line/8-s format is standard for black and white, newcomers to SSTV should be cautioned 'that color SSTV standards are in a state of flux which may severely limit interoperability. In the coming years, it is expected that the amateur community will adopt a single color format.

#### License Requirements and Operating Frequencies

In the HF bands, a General- or higher-class license is required to operate SSTV. Operation is restricted to the phone portion of the bands. At UHF and above, a Technician-class amateur license or higher is needed, although the vast majority of SSTV activity occurs in the HF bands. In the US, slowscan TV using double-sideband AM or FM on the HF bands is not permitted.

The common accepted SSTV calling frequencies are 3.845 MHz (Advanced), 7.171 MHz (Advanced), 14.230 MHz (General) and 28.680 MHz (General). Traditionally, 20 meters has been the most popular band for SSTV operations. A weekly international SSTV net is held each Saturday at 1800 UTC on 14.230 MHz. Many years ago, when SSTV was first authorized, the FCC recommended that

#### 16-6 Chapter 16



Fig 16-6-SSTV picture as seen on a standard TV set using a dividal scan converter.

SSTVers not spread out across the band even though it was legal to do so. A "gentlemen's agreement" has remained to this day that SSTVers operate as close as possible to the above calling frequencies to maintain the problem-free operation that has existed for nearly 20 years.

#### Identifying

On SSTV, the legal identification must be made by voice or CW. Sending "This is W9NTP" on the screen is not sufficient. Most stations intersperse the picture with comments anyway, so voice 1D is not much of a problem. Otherwise SSTV operating procedures are quite similar to those used on SSB.

#### Equipment

All you need to get started is an SSB station (or FM station for VHF/UHF), a monitor, scan converter and a video source. Like RTTY, SSTV is a 100%-duty-cycle transmission. Most sideband rigs will have to run considerably below their voice power ratings to avoid ruining the final amplifier or power supply. Early SSTV monitors used long-persistence CRTs much like classical radar displays. In a darkened environment, the image remained visible for a few seconds while the frame was completed. This type of reception is unusual today and has been replaced with digital scan converters which convert SSTV to FSTV to place a bright image on a conventional television monitor. Some of this older equipment is available almost for the asking and is a good way, on a temporary basis, to examine the SSTV mode without investing much money.

Motivated by the difficulty of observing SSTV pictures on the long-persistence CRTs, the scan converter is a result of recent advances in digital techniques. In receive mode, the device converts the incoming audio to a fast-scan video signal that is usable by a conventional fast-scan TV monitor. Similarly, on transmit the converter changes the fast-scan camera output to a standard slow-scan signal. A personal computer equipped with the proper software and interface makes a highly cost-effective slow-scan converter. Computers