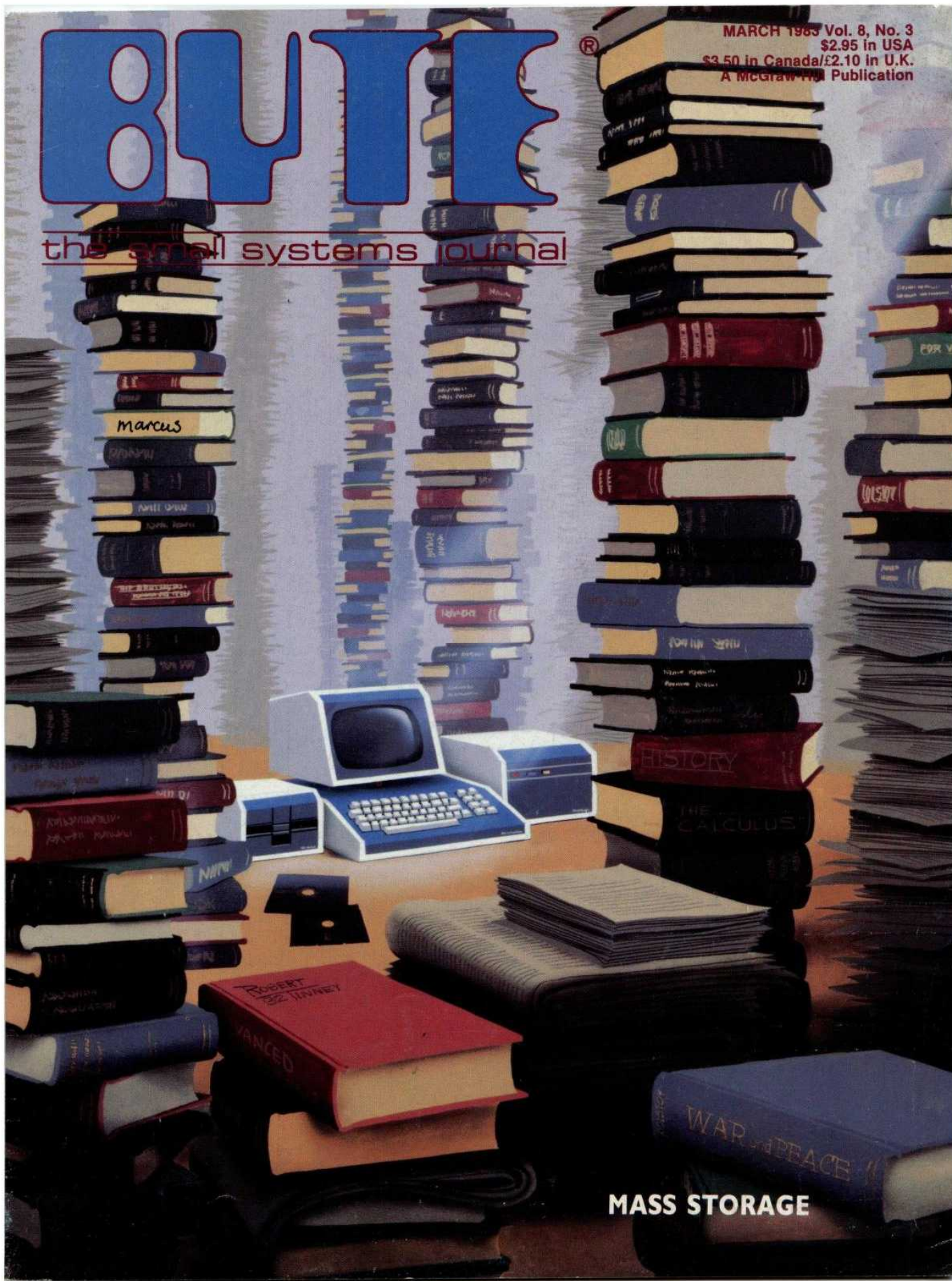


# BYTE

the small systems journal

MARCH 1983 Vol. 8, No. 3  
\$2.95 in USA  
\$3.50 in Canada/£2.10 in U.K.  
A McGraw-Hill Publication



MASS STORAGE

**DOCKET**  
**A L A R M**

Find authenticated court documents without watermarks at [docketalarm.com](http://docketalarm.com).



## Features

- 26** **Build the ECM-103, an Originate/Answer Modem** by Steve Ciarcia / The Texas Instruments TMS9953Z forms the heart of a Bell-103-compatible modem.
- 34** **The Enhanced VIC-20, Part 2: Adding a 3K-Byte Memory Board** by Joel Swank / Supplement the VIC-20's standard 5K bytes of RAM and eliminate those annoying "out-of-memory" messages.
- 44** **A User's View of COMDEX** by Jerry Pournelle / An impressionistic report of one of the largest gatherings of computer dealers and manufacturers.
- 56** **The Promise of Perpendicular Magnetic Recording** by Clark E. Johnson Jr. / As the Japanese seem to have realized already, PMR represents the next level of recording technology.
- 68** **New Developments in Floppy Disks** by Tom Moran / New advances in floppy-disk-drive technology spurs intense competition.
- 86** **Optical-Memory Media** by Edward Rothchild / Some background on how optical disks work, who makes them, and how much data they can hold.
- 110** **Will Removable Hard Disks Replace the Floppy?** by Larry Sarisky / Improved data-storage technologies may eventually eliminate floppy disks.
- 122** **The Winchester Odyssey, From Manufacturer to User** by Jim Toreson / A look at drives, OEMs, and the cost of doing business.
- 130** **Building a Hard-Disk Interface for an S-100 Bus System, Part 1: Introduction** by Andrew C. Cruce and Scott A. Alexander / The first in a series of articles on interfacing a Winchester disk drive to an S-100 bus CPM microcomputer.
- 152** **NAPLPS: A New Standard for Text and Graphics, Part 2: Basic Features** by Jim Fleming / How to encode text and simple graphics elements in a standard and efficient manner.
- 218** **User's Column: Sage in Bloom, Zeke II, CBIOS Traps, Language Debate Continues** by Jerry Pournelle / The consummate computer user tackles his new writing machine.
- 262** **A Faster Binary Search** by Dr. L. E. Larson / An important technique results in faster-running applications programs and shorter response times.
- 295** **Data Collection with a Microcomputer** by Dr. Mahlon G. Kelly / Using a TRS-80 Model I for environmental research saves time and money.
- 310** **Build This Memory, Part 1: How to Construct a Low-Cost Memory with 4116 Memory Devices** by Cameron Spitzer / Take advantage of the low price of the 4116-type memory.

- 331** **A Peek Into the IBM PC** by Tim Field / An assembly-language program enables an Epson printer to display all 256 characters used by the IBM PC.
- 389** **Keywords in a Fuzzy Context** by Thomas A. Smith / CBASIC programs for bibliographic search tell you the degree to which various articles meet your requirements.
- 418** **ROTERP: An Interpretive Language for Robot Control** by Gary Liming / High-level languages may help bridge the gap between artificial intelligence and the home experimenter's robot.
- 436** **Using SOUND Arguments for High-Precision RTTY** by Scott Persson / How to generate radioteletype audio frequencies from an Atari 800.
- 453** **Binary-Format Number Storage on the Apple II Disk** by David Eyes / A machine-language routine to read and write binary data to a text file.

## Reviews

- 190** MP/M II by Stephen Schmitt
- 247, 248, 251** **BYTE Game Grid: Project Nebula** by Keith Carlson; **Legionnaire** by Gregg Williams; **Omega Race for the VIC-20** by Stanley J. Wszola
- 256** **Quickcode** by Adam B. Green
- 282** **Hayes's Stack Smartmodem** by Norman C. McEntire

## Nucleus

- 6** Editorial: The Software Revolution: Where Will We Store All Those Programs?
- 14** Letters
- 22** BYTE's Bugs
- 307, 450** **Programming Quickies: Add Dimensions to Your BASIC; Computing Telescope Parameters with the OSI Superboard II**
- 380, 462** **System Notes: Circles and Ellipses on the Apple II; Adding a Trace to North Star BASIC**
- 474** Event Queue
- 478, 486** **BYTE's Bits**
- 484** Software Received
- 487** Ask BYTE
- 490** Books Received
- 491** Clubs and Newsletters
- 492** BYTELINES
- 497** What's New?
- 557** Unclassified Ads
- 558** BOMB, BOMB Results
- 559** Reader Service







**Managing Editor**

Mark Haas

**Technical Editors**

Gregg Williams, Senior Editor; Richard S. Shuford, Curtis P. Feigel, Arthur Little, Stanley Wszola, Pamela Clark, Richard Malloy; Phillip Lemmons, West Coast Editor; Steve Ciarcia, Mark Dahmke, Consulting Editors; Jon Swanson, Drafting Editor

**Copy Editors**

Beverly Cronin, Chief; Faith Hanson, Warren Williamson, Anthony J. Lockwood, Hilary Selby Poik, Elizabeth Kepner, Nancy Hayes, Cathryn Baskin, Tom McMillan; Margaret Cook, Junior Copy Editor

**Assistants**

Faith Kluntz, Beverly Jackson, Lisa Jo Steiner

**Production**

David R. Anderson, Assoc. Director; Patrice Scribner, Jan Muller, Virginia Reardon; Sherry McCarthy, Chief Typographer; Debi Fredericks, Donna Sweeney, Valerie Horn

**Advertising**

Deborah Porter, Supervisor; Marion Carlson, Rob Hannings, Vicki Reynolds, Cathy A. R. Drew, Lisa Wozmak; Patricia Akerley, Reader Service Coordinator; Wai Chiu Li, Advertising/Production Coordinator; Linda J. Sweeney

**Circulation**

Gregory Spitzfaden, Manager; Andrew Jackson, Asst. Manager; Agnes E. Perry, Barbara Varnum, Louise Menegus, Jennifer Price, Sheila A. Bamford; James Bingham, Dealer Sales; Deborah J. Cadwell, Asst; Linda Ryan

**Marketing Communications**

Horace T. Howland, Director; Wilbur S. Watson, Coordinator; Timothy W. Taussig, Graphic Arts Manager; Michele P. Verville, Research Manager

**Controller's Office**

Kenneth A. King, Asst. Controller; Mary E. Fluhr, Acct. & D/P Mgr.; Karen Burgess, Jeanne Cilley, Linda Fluhr, Vicki Bennett, L. Bradley Browne, Vern Rockwell

**Business Manager**

Daniel Rodrigues

**Traffic**

N. Scott Gagnon, Manager; Scott Jackson, Kathleen Reckart

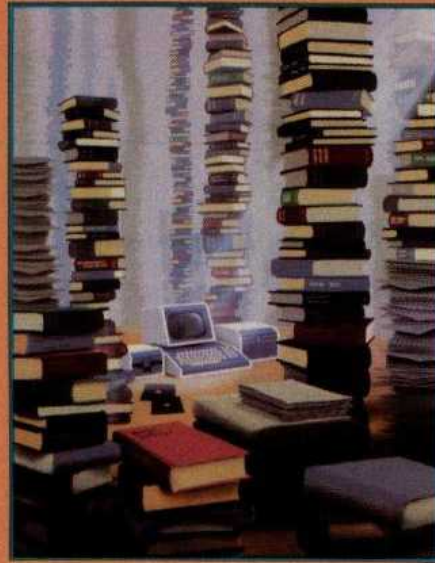
**Receptionist**

Jeanann Waters

**Publishers**

Virginia Londoner, Gordon R. Williamson; John E. Hayes, Associate Publisher; Cheryl A. Hurd, Publisher's Assistant

Officers of McGraw-Hill Publications Company: Paul F. McPherson, President; Executive Vice President: Gene W. Simpson; Senior Vice President-Editorial: Ralph R. Schulz; Vice Presidents: Kemp Anderson, Business Systems Development; Shel F. Asen, Manufacturing; Harry L. Brown, Special Markets; James E. Hackett, Controller; Eric B. Herr, Planning and Development; H. John Sweger, Jr., Marketing. Officers of the Corporation: Harold W. McGraw Jr., Chairman and Chief Executive Officer; Joseph L. Dionne, President and Chief



# In This Issue

Sophisticated new operating systems and multitasking software promise to alter significantly the way we use personal computers. Because of the large memory requirements of the new software, we're sure to see changes for the better in the nature of external storage devices. New technologies for mass storage will become even more critical as the software revolution continues to escalate. As Robert Tinney's cover suggests, personal computers will need a large quantity of high-speed mass storage to hold all the software and other data that we'll generate. Our theme articles address the latest developments in mass storage. Clark E. Johnson Jr. discusses "The Promise of Perpendicular Magnetic Recording," Tom Moran looks at "New Developments in Floppy Disks," Edward Rothchild writes about "Optical-Memory Media," Larry Sarisky explores the question "Will Removable Hard Disks Replace the Floppy?" Jim Toreson concentrates on "The Winchester Odyssey," and in the first of a three-part series Andrew C. Cruce and Scott A. Alexander discuss "Building a Hard-Disk Interface for an S-100 Bus System." Plus we have part 2 of "NAPLPS, A New Standard for Text and Graphics," the second installment in the VIC-20 series, "Adding a 3K-Byte Memory Board," a review of MP/IM II from Digital Research, and BYTE's Game Grid. Steve Ciarcia tells you how to "Build the ECM-103, an Original/Answer Modem," and more.

BYTE is published monthly by McGraw-Hill, Inc., with offices at 70 Main St. Peterborough NH 03458, phone (603) 924-9281. Office hours: Mon-Thur 8:30 AM - 4:30 PM, Friday 8:30 AM - Noon, Eastern Time. Address subscriptions, change of address, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, POB 590, Martinsville NJ 08836. Second class postage paid at Peterborough, N.H. 03458 and additional mailing offices. USPS Publication No. 528890 (ISSN 0360-5280). Postage Paid at Winnipeg, Manitoba. Registration number 9321. Subscriptions are \$21 for one year, \$38 for two years, and \$55 for three years in the USA and its possessions. In Canada and Mexico, \$23 for one year, \$42 for two years, \$61 for three years. \$53 for one year air delivery to Europe. \$37 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is \$2.95 in the USA and its possessions, \$3.50 in Canada and Mexico, \$4.50 in Europe, and \$5.00 elsewhere. Foreign subscriptions and sales should be remitted in United States funds drawn on a US bank. Printed in United States of America.

Address all editorial correspondence to the editor at BYTE, POB 372, Hancock NH 03449. Unacceptable manuscripts will be returned if accompanied by sufficient first class postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE. Entire contents copyright © 1983 by BYTE Publications Inc. All rights reserved. Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy any article herein for the base fee of \$1.00 per copy of the article or item plus 25 cents per page. Payment should be sent directly to the CCC, 21 Congress St, Salem MA 01970. Copying done for other than personal or internal reference use without the permission of McGraw-Hill is prohibited. Requests for special permission or bulk orders should be addressed to the publisher.

BYTE® is available in microform from University Microfilms International, 300 N Zeeb Rd, Dept PR, Ann Arbor MI 48106 USA or 18 Bedford Row, Dept PR, London WC1R 4EJ England.

Subscription questions or problems should be addressed to:

**BYTE Subscriber Service**





# Will Removable Hard Disks Replace the Floppy?

*Improved data-storage technologies may eventually eliminate floppy disks.*

---

Larry Sarisky  
Syquest Technology  
47923 Warm Springs Blvd.  
Fremont, CA 94539

---

The floppy-disk drive has been the method of choice for data storage for several years now. But like all de facto standards, its dominance is being challenged, in this case by the development of a new storage medium—the removable hard-disk cartridge.

The cartridge appears to offer all the advantages of the floppy disk as well as increased storage capacity and access speed. But before describing this new method of data storage, let's take a look at how and why floppy disks were developed.

When IBM introduced the System/360 computers, their low-level microcode programs were

stored in read-only memory (ROM). By the time the IBM 370 was developed, however, semiconductor technology had advanced so far that microcode storage could be implemented in semiconductor memory. This memory was volatile,

---

## **Newer microprocessors can make use of virtual storage only with the faster access speeds offered by hard disks.**

---

so a microcode loading-and-storage device was necessary. Magnetic tape was considered, but the need for loading diagnostic programs as well as microcode presented a problem. So in 1973, IBM developed a cheap disk

and drive that provided the random-access speed needed for diagnostic-program loading. This low-cost, flexible disk gave IBM an economical random-access program-loading device. And once such a device was available, it was easy to add a write capability for data storage. Semiconductor technology and the IBM 370 had set the stage for the floppy disk, the data-storage medium that helped launch the small-computer revolution.

The revolution, however, was spearheaded not by IBM but by independent manufacturers of floppy disks such as Shugart Associates and Memorex, who saw the value of low-cost, random-access storage for smaller computers. By 1975, 27 independent suppliers were producing 8-inch floppy-disk drives.

The new medium for storage offered potent advantages. As

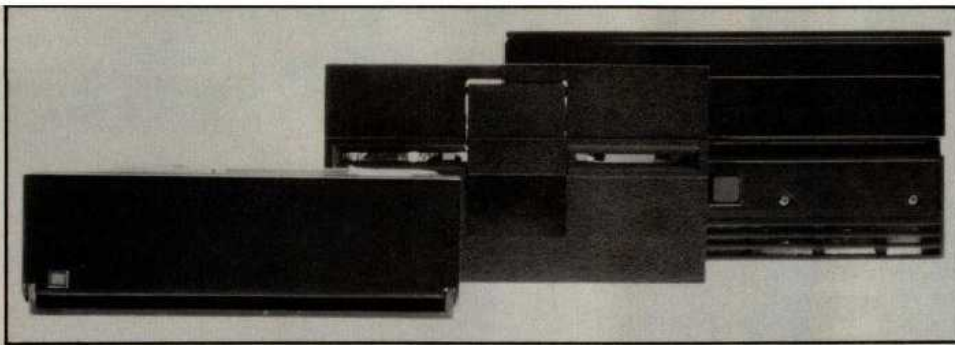
---

### **About the Author**

*Larry Sarisky is the vice-president of sales and marketing for Syquest Technology. He has more than 12 years' experience in marketing data-storage products.*

---





**Photo 1:** A size comparison of the 3.9-inch removable hard-disk cartridge drive with standard 5 1/4- and 8-inch floppy-disk drives. The cartridge drive is 1.625 by 4.8 by 8 inches.

*Business Week* reported in a May 17, 1976, article, "Each standard disk (floppy) has the data-storage capacity of 3000 punched cards. The disks are also reusable, easier to store and mail, and inexpensive." The article also predicted that "a new market segment is opening up thanks to the development of the cheapest of computers—the microprocessor or computer-on-a-chip."

As these prophetic words were

written, Shugart Associates was developing a lower-cost 5 1/4-inch flexible-disk drive. It was this drive that signaled the decline of cassette tape. The 5 1/4-inch floppy-disk drives and media cost less than comparable cassette-based storage. They offered an average access time of about half a second compared to the cassette's 20 seconds. And their error rate was two orders of magnitude better than that of cassettes.

### The Winchester Disk

While lower-cost 5 1/4-inch floppy disks gained most of the attention in 1976, Memorex saw another IBM-developed storage technology that could be used in small computers. Its Model 601 hard disk was the first small Winchester system to be available from a source other than IBM. By protecting the read/write heads and disk platters in a sealed environment, the Winchester could deliver higher data-storage capacities, faster access, and greater reliability at a lower cost per byte. While the 601's disk diameter was a hefty 14 inches, successive Winchester-technology disk drives reduced it to 8 inches and then 5 1/4 inches.

The history of disk storage has been a tale of increasing compactness. The first 14-inch Winchester-type drives paralleled established storage-module devices. The 8-inch Winchester followed the 8-inch floppy disk. The 5 1/4-inch drive was compatible in size with its corresponding

# It's not Magic, it's NEC.

## NEC distributors pull miracles out of a thimble.

NEC Spinwriters.™ Their supernatural reliability and versatility have made them the world's most popular letter-quality printers. Here are some of the miracles they can perform for you.

The Spinwriters' rapidly growing catalog of print thimbles give you incredible versatility. One NEC thimble can print in 35 different languages. Another has complete technical and mathematical symbols. Another a full scientific symbol font. The thimbles snap in and out in seconds. And they each last for more than 30 million impressions.

Of all printer companies, *only* NEC designs and manufactures its own comprehensive family of forms handlers. We've got eight of them, enough to handle any form you can conjure up. They're all user-



routine lubrication. Ever. With only 3 major spares, mean time to repair is only 15 minutes.

The NEC Spinwriters. Reliable, quiet, compact, flexible and easy to use. For more information on NEC Spinwriters, or to find out how to become an NEC distributor yourself, contact the authorized NEC distributor nearest you.

**DOCKET  
ALARM**

Find authenticated court documents without watermarks at [docketalarm.com](http://docketalarm.com).

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.