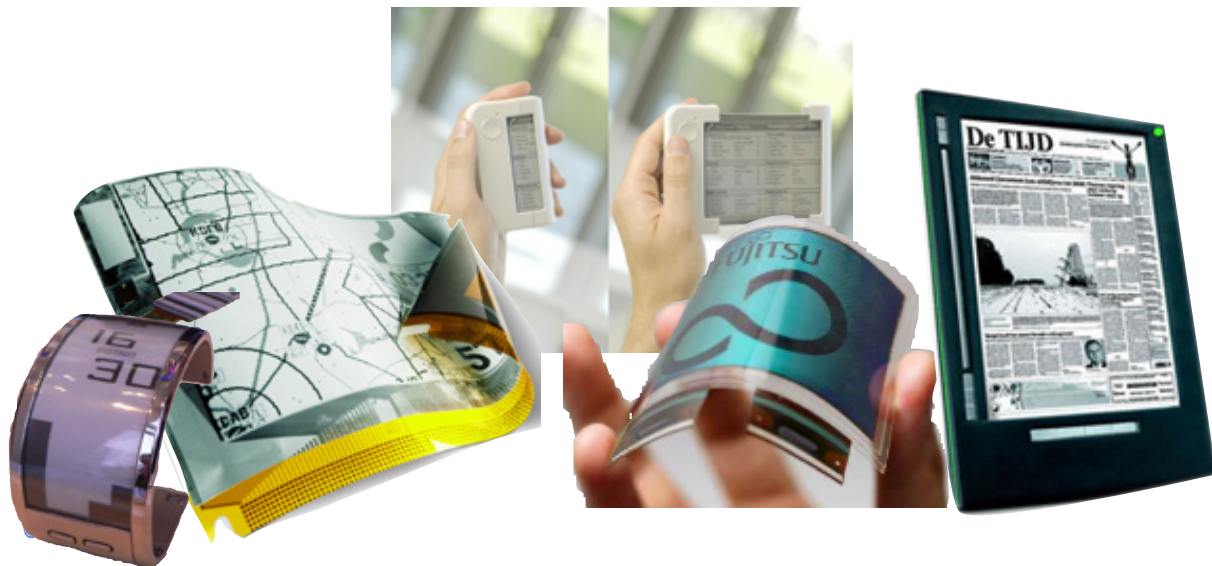


E-Paper Technology



*and Opportunities in Publishing,
Communications, and the Graphic Arts*

Outline and Proposal

May 3, 2006



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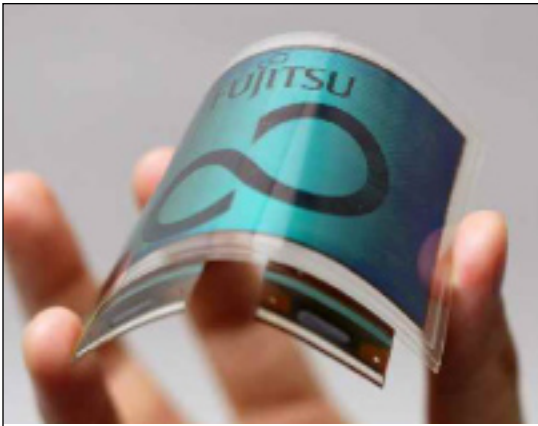
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INTRODUCTION

Strategies for Management, Inc. is pleased to announce a new multiclient research initiative, “E-Paper Technology, Opportunities and its Impact on Graphic Communications.” The project was initiated in November 2005 and was completed in May 2006. The report analyzes the emerging e-paper marketplace, as well as possible applications of e-paper technologies, with analysis and forecasts of e-paper’s potential impact on content creation, publishing, distribution, and printing industry volume.

Why Study “E-Paper?”

This past year, Sony, Samsung, Phillips, Fujitsu, and many others made important announcements about their initiatives in the development of “E-paper.” Fujitsu captured significant news coverage because its development



Fujitsu’s color e-paper, demonstrated in Summer 2005, opened the floodgates for a spate of new product and technology announcements.

included color capabilities, previously a major obstacle for widespread adoption, where others have created technologies for black-and-white only. In addition, this breakthrough does not require that the “paper” receive a constant electrical charge to maintain an image. Many companies have e-paper initiatives, and it should be assumed that not all of them have been made public. Among them are computer technology multinationals, paper companies, and venture-funded startups.

E-paper will impact many forms of media including magazines, newspapers, books, business

documents and reference materials. Even the way information is presented on the Internet will be affected. There is also potential competition with personal computers, TabletPCs, PDAs, and emerging applications for cellphones, iPods, and many other devices.

E-paper technologies can potentially change everything and anything that is printed. Recent reports indicate the capability of printing electronic images using traditional offset or gravure presses. This opens an immense range of possible applications, limited only by one’s imagination. Potentially, many “new” new media—before we’ve even had a chance to become used to them—could be rendered obsolete by e-paper, if not have

to adapt to e-paper's constraints and requirements. But at the very least, e-paper will play a significant role in the "media mix" of the near future.

A BRIEF HISTORY OF E-PAPER

E-paper has been a topic of interest among researchers, technologists, and futurists for decades. Among the most famous proponents has been the MIT Media Lab. They have been involved in many projects directly, or just providers of inspiration, for the consideration of the e-paper concept. One of the pioneering companies in the field of e-paper—E Ink—grew out of the MIT Media Lab. Other e-paper pioneers have included Xerox's Palo Alto Research Center (PARC), whose research in the 1970s and 80s has led to numerous elements of modern computing. Seiko has introduced a watch with an e-paper face. Phillips Electronics and Fujitsu announced e-paper breakthroughs in 2005. A company called iRex introduced an e-paper-based newspaper reader that is currently (as of May 2006) being market-tested in Belgium.



Seiko's e-paper watch

Early e-paper ideas from futurists....

- A sheet of e-paper the size of a broadsheet or tabloid newspaper, can access Wi-Fi hotspots—however those hotspots are provided (be they by today's wireless or broadband carriers)—and can provide the same form factor and portability as a print newspaper, yet be updated dynamically and automatically, bridging the gap between print and the Internet.
- In addition to constant connectivity, e-paper can be more portable than a laptop and easier to view than a PDA, solving two major barriers that have limited wider e-book adoption among other personal visual communications media.
- One sheet of e-paper connected to flash storage devices can access all of a reader's magazine subscriptions; advances in e-paper refresh rates can allow magazine (and newspaper) content to incorporate rich media content like audio, animation, video, etc.
- E-paper could very well be the "killer app" for e-books, as the new E Ink-based Sony Reader is launched in Summer 2006.

- Restaurant menus can be provided as e-paper, allowing restaurants to update items dynamically depending on availability and daily specials; clickable menu items can transmit data directly to the kitchen, allowing items to be ordered without the need to attract the attention of a server.
- E-paper maps and atlases can access any location from a small form-factor device—and be updated dynamically via MapQuest or Google Maps or GPS data; the U.S. Defense Department is already using a version of “e-maps”
- E-paper-based train, plane, or bus schedules can be updated dynamically, providing a convenience to passengers and the ability to navigate delays and travel disruptions.
- RFID-enabled e-paper tags can revolutionize inventory management and dynamic item pricing, as well as customer ordering; labels could have RFID embedded through its inks, creating an interesting convergence of these technologies.
- E-paper can also be as large as posters, providing large, flexible electronic displays, wallpaper, streaming media (what some might have called “TV” in another time), and other applications in signage.
- The incorporation of handwriting and voice recognition into e-paper can again revolutionize the forms business; if “the network is the computer,” then e-paper will require minimal requirements to be “smart” on its own, unlike PDAs in common use today. Microsoft’s Origami initiative, and Samsung’s first commercial deployment of the concept, is either a precursor to, or a potential replacement for, an e-paper-based tablet PC.
- E-paper that will adjust to ambient lighting conditions, allowing users to easily view content no matter what the reader’s physical circumstance, would provide yet another potential appeal compared to “p-paper.”



In April, 2006, the iRex iLiad e-paper newspaper reader went into market testing among readers of a Belgian news daily. American newspapers have also expressed interest in the technology.

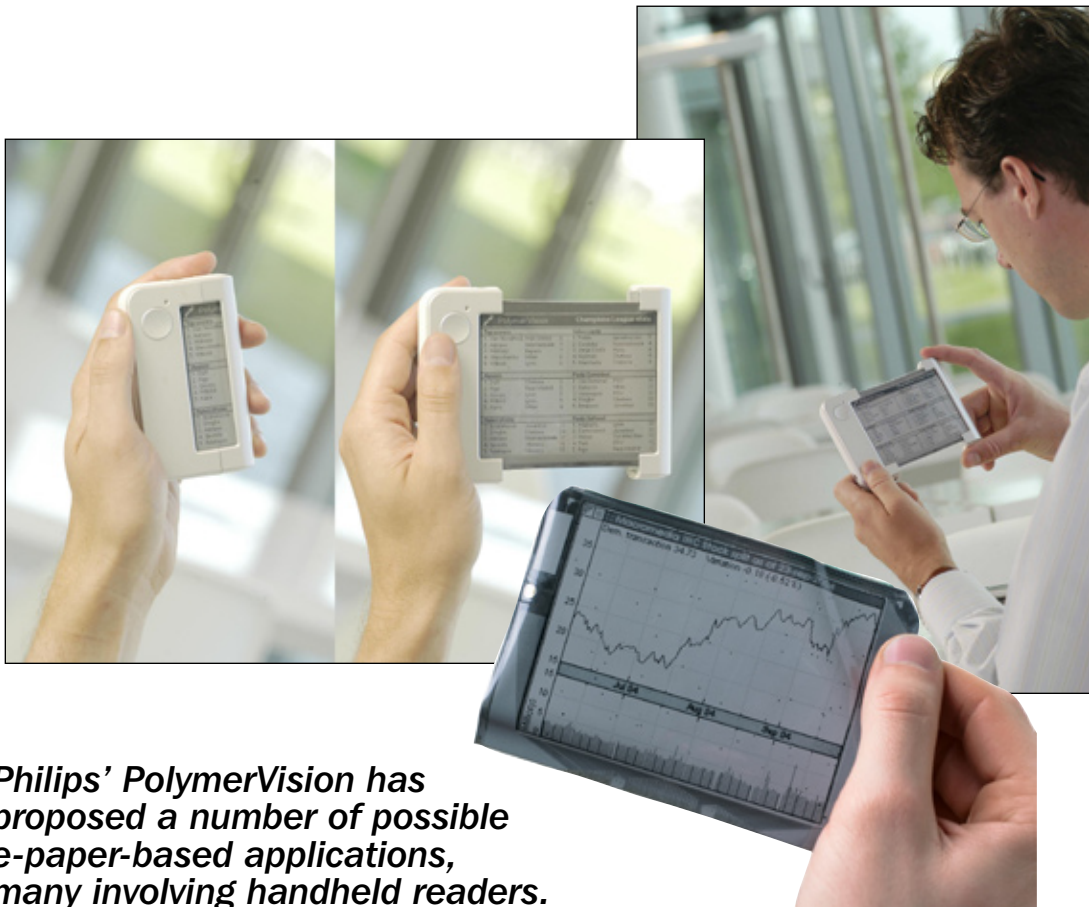
Most every technology is adopted in ways not envisioned by its original developers or creators. There is no reason to assume that e-paper will be any different. SFM consultants have brainstormed about what's not being reported, or publicly envisioned, and suggest market-moving applications to watch for—or to avoid.

WHAT IS E-PAPER?

The phrase “e-paper” has been used for years, and has been used to describe many things. Even the concept of viewing a newspaper on a computer screen has been referred to as “e-paper.” It certainly gets confusing.

What SFM is referring to are thin substrates—often referred to as “flexible displays”—that are able to display images that can be changed as they are fed data from some outside communications source. The possibilities for these technologies are seemingly endless, replacing paper, of course, but replacing current computer screens, PDAs, even cellphone displays. The idea of being freed from computer hardware and instead carrying a light, highly portable, flexible, foldable screen is getting closer to reality.

The rapid improvement in the reliability and availability of broadband



Philips' PolymerVision has proposed a number of possible e-paper-based applications, many involving handheld readers.

data and communications, especially wireless and cellular technologies, is setting the stage for ubiquitous and constant connectivity. These technologies are quite young in their product acceptance, but they have already had significant impact on publishing, advertising, and communications industries. Google has proposed providing free Wi-Fi access throughout San Francisco, and Earthlink has been selected to provide inexpensive Wi-Fi service throughout Philadelphia; imagine citizens armed with e-paper in those cities, able to access information they need at any time of their choosing, unfettered with bulky computer equipment.

In a related issue, industry legend Nicholas Negroponte of the MIT Media Lab has proposed and published specifications for a \$100 computer (with a battery charged by a manual crank, and loaded with free open-source software) for deployment to developing economies. The computer will have Wi-Fi capabilities. New, emerging economies will “skip” the paper era and can cross the threshold of the information age at a more rapid rate than most forecasters realize. This has already happened with other technologies—many developing nations skipped traditional landline-based telephone service and have gone straight to cellular telephony. There is no compelling reason why any nation has to “evolve” through legacy technologies in order to reach parity with what the First World has; whatever technology is available and economical for a nation when it “develops” will be adopted.

THE PURPOSE OF THIS PROJECT

The report will delve into these essential topics, adding sharp analysis, penetrating insights, and a skeptical eye:

- What is e-paper?
- What does e-paper do? What does it not do?
- What do people want e-paper to do?
- How far can e-paper go?
- What media are impacted the most, least and when?
- Who has e-paper now?
- How close are other introductions and applications?

Explore the Definitions of E-Paper

The report defines what “e-paper” is—and is not—exploring the different definitions as found in the marketplace (or even the “pre-marketplace”), among manufacturers and researchers, and creating a working definition.

Critically Assess E-Paper as a Disruptive Technology

There are already many competitors to e-paper. Existing computer screen manufacturers have their own approaches to make computer screens better, have lower cost, better energy consumption, to stave off competition of other technologies. It may be the case that supporters of e-paper may very well include display companies themselves.

In addition, the applications that might use e-paper to their advantage already have a place in the market. Adobe Acrobat, for example, is one of the greatest enablers of formatted portable information, being able to display documents on many devices. But even languages like XML are being used to ensure a diverse range of viewing devices against which e-paper must compete, or can assist in its adoption.

Apple is steadily expanding the applications of its iPod, which now contains and displays moving images. Cellphones include iPod capabilities, and video and other rich media content are increasingly being delivered to mobile phones. PDAs such as the Blackberry and Palm devices are regularly used to surf the Internet and to check e-mail. Wristwatches can play MP3 files and connect to computer USB ports. E-paper and ubiquitous broadband technologies may consolidate access to many of these capabilities.

How “smart” e-paper must be is an important question. If e-paper needs support of embedded computing power, then it’s just another kind of computer screen. If it requires “keyboarding,” even as small as one finds on a PDA or Blackberry, then it’s just another computer. If e-paper is as envisioned, a standalone display technology with just enough embedded software and connectivity technology built-in, then it creates a new class of display technology with the potential of changing all information markets.

The Companies and Technologies That Can Make E-Paper Possible

Numerous e-paper projects are underway. Which ones are close to market? How do they differ? How are they the same? This project will discuss the companies and wide range of technologies in play and review the rationales of why they are in the running and how they can be expected to be applied. What are the market enablers? What are the market barriers?

Every new technology has its enablers, the trends or coincident technologies that serve as a springboard for its market adoption, and disablers, the countertrends and competitors that hold it back.

Broadband, wireless, and cellular are all examples of technologies that will play a role in e-paper adoption. The growing shortage of employees because of the “baby bust,” the wealthiest, most educated market of retirees, and young people whose memory has always included an Internet, can be enablers of e-paper acceptance. Yet, there is a small, but growing backlash to the lifestyle of constant connectedness, and competitors to e-paper are already firmly entrenched and expanding, including PDAs, increasing applications for iPods, growing applications included in cellphones, and other technologies.

E-paper can also be combined with other technologies, such as voice activation of its features, or voice synthesis—such as being able to “speak” to documents for navigation, or have documents read themselves to you. In essence, e-papers become podcasts—or even portable televisions!

Why isn’t e-paper here today? Clearly there are many technological hurdles. Little is known of the costs of producing e-paper, how it may be sold, what forms it might take, and how long it may take for developers to scale up their production.

Rendering graphics, images, and text in the way content creators intended may present numerous layout, color management, and other issues to be resolved—dynamic reflow, XML, etc. E-paper may require content creators to support yet new formatting protocols and procedures in order for creators and their audiences to be satisfied with e-paper offerings.

Indeed, e-paper will not be resistant to competitive reaction should it succeed in gaining market acceptance, even in some niche applications. Competitors may improve, more benefits to users are identified, the technology becomes adapted in ways not originally intended by the developers, etc.

Among the reasons to encourage e-paper development have been concerns about the energy used in paper production and disposal issues around paper. An interesting report was released this year that found that current manifestations of e-newspapers may actually consume more energy than they save. Things are not always what they seem, and the SFM research team is always on the lookout for unintended consequences that could undermine a technology’s adoption.

Applications in Publishing, Printing, and Other Markets

How do these firms take advantage of the coming market for e-paper applications?

Being based in the printing and publishing businesses, SFM has special expertise to bring to the discussion of the impact of e-paper technologies to the content creation, publishing, and distribution business. SFM

researchers have been closely involved in, and have closely tracked, the emergence of the Internet as a significant publishing medium, and members of the research team have conducted some of the earliest market research on Internet design, development, publishing and impact on the reigning infrastructure.

What will the earliest applications be? What will follow close behind? These are top-of-mind issues for entrepreneurs who want to take advantage of the opportunities of market disruption that are likely to arise, and also of interest to those who need to treat the existing publishing paradigms as cash cows, squeezing as much profitability out of them as the market transitions to yet another format option.

How can companies prepare themselves for the multi-format future? Is it with a core of XML-compatible content, or will it be something else? Enhancements of existing tech? Something new?

Not every publishing format or content is adaptable to digital alternatives. After all, each medium has its own strengths and weaknesses. Will e-paper spawn yet another style or format of content creation in the pursuit of the elusive specifics of reader needs and expectations?

Who Has E-Paper Technology? Who *Should* Have It?

Companies leading the development of e-paper will be profiled, and, where available, contact information will be provided. The nature of the products being developed, and the likely applications, will be included in the profile.

Companies that in SFM's view should end up being players in the e-paper business, or being factors in the development, marketing, or applications of the technologies, will also be reviewed.

When Will E-Paper Be Commercialized?

A discussion of likely market scenarios and turning points will be an essential part of the report. Some e-paper products have already been targeted for release in 2006. What kind of reception will they get? What applications will they head to first? What will the market be in 2007? 2010? 2015?

WHAT ARE THE POSSIBLE IMPLICATIONS OF E-PAPER?

Print product	Current concerns	E-paper implications?
Magazines	Finding the right new media models; flat total circulation for industry overall; circulation measurement scandals	Creates yet more problems; change in frequency of publications, such as monthly to daily (or even more often), to accommodate space and limitations of e-paper format; do advertising models move more toward personalization and segmentation than they are now?; without overhead of printing and postage, are subscription-only models more viable? What becomes the distinguishing feature of a magazine vs. a newspaper?
Newspapers	Competition with new media, broadcast	e-newspapers published throughout the day,
Brochures, product information	Internet access	can be provided on-the-fly, updated as needed
Newspaper inserts	Declining newspaper circulation, less credibility of circulation data; distribution costs	e-paper creates a new market attractive to young readers;
Catalogs	Transition from hard-copy catalog to direct mail and e-commerce	Catalogers with retail outlets can enhance store signage with catalog content; e-paper creates yet another new method for catalogers to reach customers
Newsletters	Moving from print to paid-Internet access has been difficult with numerous “free” Internet sources	Opportunities for constant access to subscribers as they are less-bound to physical computers; more competition from other news and information sources
Folding cartons	Versioning for regional tastes, different brands, test marketing costs are high, especially for short run packaging	Products in “blank” cartons can be supplied to retailers and they can alter content according to their needs to stimulate sales; package design tests can occur in “real time”; consumers can switch languages, font size to accommodate their needs; addition of RFID can add inventory tracking and other fulfillment functions

What becomes of commercial printers? Who will distribute e-paper data? Publishers and content creators themselves? Can printers transition into content repositories, managing e-paper content distribution as they do now for hard copy? Or will new businesses emerge? Can printers gain a foothold in “printing” flexible display components on traditional substrates?

Will publishers be able to compete in an e-paper marketplace, where the barriers to entry are lower and the needed staff and infrastructure are likely to be less?

Who will verify the content of e-paper? That is, there are serious legal issues as to the reliability of information contained in e-paper documents. If packaging is always changing, how could one verify the information provided on packages at a particular place and time? Can e-paper content be “locked”? Is e-paper just an opportunity waiting to be hacked with its own version of computer viruses and worms?

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REPORT AVAILABILITY

The e-paper project began November 15, 2005 and was completed in May 2006. It is currently available for download at www.sfminc.com.

PAYMENT

Report Cost

The cost of this project is \$4975 per company.

Payment may be made by check, bank wire transfer, or credit card.

- Checks sent by post office should be addressed to Strategies for Management, Inc., PO Box 483, Harrisville, RI 02830.
- Checks sent by overnight service should be addressed to Strategies for Management, Inc., 42 Tall Timber Drive, Harrisville, RI 02830.
- Bank wire: please contact us at epaper@sfminc.com for transmittal details.
- Credit card purchase can be made at <http://store.yahoo.com/drjoe/reports.html>

FOR MORE INFORMATION

Please contact Project Manager Mr. Vince Naselli at 1-732-568-0316 or at epaper@sfminc.com.

SFM STUDY TEAM**Lead researchers****Dr. Joe Webb**

Dr. Webb has been one of the industry's best-known consultants. He now serves as an advisor to other industry consultants, speaks to industry associations, groups, and company events, and writes about the printing industry's future. His commentary, speeches, and lively Q&A sessions have been featured at industry trade events.

A 25+ year veteran of the graphic arts industries, was the developer of the influential TrendWatch information service, sold to Reed Business in 2000. Outside the graphic arts, Dr. Webb and business partner Jim Whittington have brought TrendWatch methodologies to the broadcast and entertainment/visual effects imaging markets.

Since January 2003, his "Fridays with Dr. Joe" column has become a popular feature on www.WhatTheyThink.com, as have his quarterly economic forecast Webinars, where he analyzes trends in the economy, technology, and the industry, and interprets what they mean for executives and their strategic decisions.

He is a Ph.D. graduate of the NYU Center for Graphic Communications Management and Technology (1987) and serves on the Center's Board of Advisors. He holds an MBA in Management Information Systems from Iona College (1981) and was a magna cum laude graduate in Managerial Sciences and Marketing from Manhattan College (1978), and was a member of the economics honor society. He has taught graduate and undergraduate courses in marketing, market research, quantitative analysis, business policy, and organizational behavior.

He started in the industry with Agfa's Graphic Systems Division (1978–1980) and was a marketing executive with Chemco Photoproducts (1981–1987). He also served the industry as chairman of the NPES Statistics Committee and was an active member of the GAMIS special industry group of Printing Industries of America.

Among his publications is "Dr. Joe's Almanac," a resource of more than 500 industry publications, Web sites, associations, and others. He has also written "Renewing the Print Industry: A Contrarian's Constructive Perspective."

Richard Romano

Since 2000, Richard Romano has been a writer and editor with TrendWatch Graphic Arts, contributing to the TrendWatch Graphic Arts *Printing, Design & Production, Publishing, and Internet Design & Development* survey reports, and has written more than two dozen Special Reports. He was also

writer/editor/analyst for all three of TWGA's extensive research studies, the TrendWatch Graphic Arts Installed Base/Market Share Benchmark Study, the GAMIS-commissioned "The Market for New Lithographic Presses in the Printing Industry," and the "Media Requirements Study: The TrendWatch Graphic Arts Perspective on How Media Buying Behaviors Are Changing In The Printing And Related Industries." He also functioned in a similar capacity for two extensive studies conducted by TWGA in conjunction with Library Journal, profiling trends in research spending for both public and academic libraries. He has also worked with *Publishers Weekly* on an extensive study of religious/spirituality book-buying trends.

Between 1995 and 2000, he has been a full-time or contributing editor to *Micro Publishing News*, a now-defunct newsmagazine for electronic designers and print buyers, as well as its then-sister publication *Digital Imaging*. In 1998, he became managing editor of *Digital Imaging* and, in 1999, managing editor of *Micro Publishing News*, for which he wrote news stories and feature articles on new graphic arts technologies.

He is the editor-in-chief of *The GATF Encyclopedia of Graphic Communications*, a compendium of 10,000 graphic arts terms published in 1997 by the Graphic Arts Technical Foundation. He is also the author or co-author of several books on graphics hardware and software, the most recent being *Special Edition Using Adobe Photoshop CS* (2003, Que Publishing).

He graduated from Syracuse University's Newhouse School of Public Communications in 1989 with a B.S. in English and Writing for Telecommunications, and, in 1993, received a Certificate in Multimedia Production from New York University.

Key Advisors

Bob Sacks

Bob Sacks is an industry veteran, having been involved in the printing/publishing industry since 1970. He has held positions of publisher, editor, director of manufacturing and distribution, senior sales manager (paper), circulator, chief of operations, pressman, cameraman, and developer of Web site companies, among other roles.

Mr. Sacks has held director/executive positions with *McCall's*, Time Inc, New York Times Magazine Group, International Paper, Ziff-Davis, CMP, and Bill Communications (VNU). He now serves as a consultant to the printing/publishing industry at large, and is president of The Precision Media Group. He is publisher and editor of a daily industry newsletter, "Heard on the Web," now in its 10th year of publication with a worldwide membership of over 8,750 industry leaders.

David Zwang

David Zwang is an industry consultant specializing in process analysis and strategic development. He has founded several prepress and printing operations, and has extensive background in offset, flexography, and gravure printing technologies, as well as prepress.

Mr. Zwang's recent work has included global data management solutions; book, magazine, and packaging publishing technologies and processes; remote production systems development; and color management and process collaboration systems.

Project Manager***Vince Naselli***

Vince Naselli has more than 20 years of professional experience in the graphic arts marketing industry. Before starting his private practice in 2004, Mr. Naselli was Director of TrendWatch Graphic Arts. He directed significant investments in the TrendWatch Graphic Arts business and expansion of its client services, building on the established TrendWatch Graphic Arts offerings.

Mr. Naselli recently completed studies of offshore printing with Dr. Webb. He has been a contributor to WhatTheyThink.com and other leading industry publications.

He has served as a past committee chairman of the Imaging & Prepress and Market Research subcommittees for the NPES market research program. He has also served as president and on the board of directors of GAMIS, the former research trade association of the Printing Industries of America.

Mr. Naselli speaks at numerous industry events about the trends in technology, business conditions, and the future of the imaging business. Some of the events he has participated in are Graph Expo, Executive Outlook, MacWorld CreativePro, and Connect, among others.

In previous professional roles, he served as Dealer Relations and Regional Sales Manager for Screen USA and was the Senior US Marketing Manager for Agfa of market research and competitive analysis and concurrently was the Senior U.S. Marketing Manager for Apogee responsible for PDF Workflow software and systems.

Mr. Naselli holds a Bachelor of Science degree in marketing and management from Kean University, New Jersey.

Specific to this project, Mr. Naselli's experience in competitive technology evaluations while at Agfa Graphic Systems, especially regarding project workflow systems, heading projects like the TWGA Benchmark study, and his experience working with dealer channels were important assets to the project.

While leading TrendWatch Graphic Arts, Mr. Naselli became fluent in the applications of e-commerce and electronic marketing in business-to-business marketing, both of which have had a significant impact on the demand for print.

Project Writer

Christopher R. Yeich

Mr. Yeich is a seasoned editorial professional with over 16 years of business journalism and publishing experience across a range of industries: automotive, energy, factory automation, food engineering, graphic arts, packaging and publishing. He has won several awards for business writing, and has overseen staffs of writers and editors at numerous top-tier publications within the business-to-business realm at Chilton Publishing Company and Reed Business Information. In addition to magazine operational oversight, feature writing, and editing, Yeich has crafted and directed myriad customized publishing initiatives, from highly-targeted multi-page magazine inserts to Web sites, electronic newsletters, and Show Daily newspapers produced live on the show floor of major national and international trade events. He holds a Bachelor of Arts degree in literature, writing, and psychology from West Chester University, West Chester, Pennsylvania. Yeich lives in New York City, where he serves as a writer, editor, and media/communications expert for several magazines, associations, and corporations.