

普通高等教育印刷工程类双语教材

# 印刷工程导论

PRINTING  
TECHNOLOGY

[美] ◎ 亚当斯 (J. Michael Adams)

◎ 多林 (Penny Ann Dolin)

英文版 · 第五版

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类双语教材

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## PRINTING TECHNOLOGY

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Printing Technology, Fifth Edition  
by  
J. Michael Adams and Penny Ann Dolin

*The fifth edition of Printing Technology  
is lovingly dedicated to the two individuals  
who provided the support and encouragement  
necessary to complete this revision,  
my husband and my daughter,  
Ron and Sage Ann Schneider.*

—Penny Ann Dolin

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# Preface

**Penny Ann Dolin**

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When *Printing Technology* was introduced in 1977, it was one of a new generation of books that dealt with printing as a technology, rather than as merely a process. The decade before had seen a revolution in the printing industry. Computer typesetting had become a commercial reality; presensitized litho plates had been introduced; offset printing had surpassed relief in percentage of sheets printed; web presses had grown in sophistication and acceptance. The first edition of *Printing Technology* covered the printing processes, but it also addressed the printing revolution and offered an introduction to the sophistication of printing.

We are still amazed by and appreciative of the reception of that first edition. Classroom teachers and their students reacted with enthusiasm. Instructors liked the combination of concepts with practice, and students liked the understandable language and contemporary illustrations. The second edition arrived in 1982, and the third came in 1988 as a result of the encouragement of many individuals who offered suggestions for improvement. The third edition was used at nearly every level of graphic arts education—in public, private, and industrial training—and found wide national and international acceptance.

The fourth edition of *Printing Technology* was published in 1996, and at that time the changes that the computer was bringing to the industry seemed revolutionary. It appeared that the computer had entered every aspect of printing, but it was hard to predict just how perva-

sive it would prove to be and how fast the changes would come.

## Preparation of the Fifth Edition

In the past five years the printing industry has continued to face a fundamental restructuring of how it produces its products and conducts its business. Entire job classifications such as pasteup and stripping, have either disappeared or are being rapidly phased out. The Internet has become a dominant force in every aspect of business, and customers producing printed material are also concurrently publishing their information to the World Wide Web. Printers are becoming information managers, with their products having to be repurposed for a variety of different output options. Digital workflows must be understood and embraced for those in the printing industry to stay competitive in the new millennium.

In this fifth edition the challenge has been to introduce technologies that are truly taking hold and proving effective and avoid those that appear with fanfare but fade away quickly. The sections on computer-to-plate and digital printing have been greatly expanded because they are in the process of becoming an integral part of the printing industry. There are estimates today that in just a few years the purchases of digital presses will outnumber those of conventional offset presses. The technologies involved in publishing to the Internet are reviewed as more and more printers are offering web design

and production services. New business models involving e-management and data collection have been introduced, and Internet addresses have been added to the list of resources in the Appendix.

The trend in the past decade has been toward consolidation and a blurring of boundaries between what was traditionally considered the purview of prepress and what was considered strictly the printer's domain. Many production components have moved downstream with more and more control residing with the content creator. This has resulted in a printing and publishing industry that is more collaborative in its production processes than it was just a few years ago.

The book is structured such that the reader will first review the historical and traditional processes, because they remain critical to an understanding of where we are today. Basic concepts of traditional prepress are reviewed, but a number of specific procedures have been omitted because they are no longer done, such as process camera work. Four entirely new chapters are devoted to understanding digital terminology and digital prepress concepts. Many chapters have been expanded to reflect changes that will continue to accelerate even as this book goes to press. But even with the myriad changes that are occurring in the graphic arts industry, much of what was contained in the fourth edition still has validity today. For the sound foundation that this classic book evidences throughout, I am completely indebted to the authors who created and continuously improved this book through four editions and the truly revolutionary changes that continue to transform the industry today.

## Major Changes and Additions

*Chapter 2:* Details regarding relief plates have been removed and letterpress specialty applications moved to chapter 17.

*Chapters 3, 4, and 6:* These chapters are the result of condensing former chapters that detailed traditional production techniques. Although the basic concepts remain, many specific step-by-step procedures have been removed.

*Chapter 5:* An expanded discussion of color theory and elimination of the step-by-step process of producing color separations in the traditional manner.

*Chapters 7 through 10:* Completely new chapters covering digital infrastructure terminology and concepts necessary to understand today's digital prepress technology (input, assembly, and output).

*Chapters 11, 14, and 15:* Expanded sections on automation of presses, including a discussion of the CIP3 standard, new developments in gravure and flexography, and a completely revised and expanded section on ink-jet and digital printing.

*Chapter 16:* A new section on ultraviolet-curing inks.

*Chapter 18:* An expanded discussion of automated data collection and estimating software, with a completely new section covering the new e-management models being adopted by the printing industry.

*Appendixes B and C:* Current industry resources have been added, along with information on health and safety issues.

In addition to these changes, new illustrations and photographs have been added throughout. Statistics and updated information have also been added where needed.

# Acknowledgments

As in previous editions, many individuals and organizations were critical to the success of the fifth edition of *Printing Technology*. I wish to especially thank the following Arizona State University students whose participation and contributions were invaluable: Daniel Burns, Paul Matthews, Jo Ramirez, and Jennifer Tweedy. In addition, the constant support and encouragement of my fellow faculty and my department chair, Dr. Thomas Schildgen, helped to provide focus and enthusiasm during the course of the revision.

This book would not have been possible without the numerous contributions from members of the graphics arts industry and trade and educational organizations. In particular, I would like to thank the Agfa Corporation for their generosity and willingness to provide resources for this edition. The following companies and organizations must also be recognized for the role they played in making the fifth edition of *Printing Technology* possible.

—Penny Ann Dolin

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# The Printing Industry

## Historical Background

It is possible to trace the origins of printing to the use of seals to “sign” official documents as early as 255 B.C., during the Han dynasty in

China. A ceramic stamp was pressed into a sheet of moist clay. When dry, the imprint served as a means of certifying the authenticity of the document. When paper was invented, around A.D. 105, the transition to the use of the seal with ink was a natural one.

Early documents and manuscripts were copied and recopied by hand. Frequent copying mistakes were made from one edition to the next; copies often differed significantly from the author’s original. Around A.D. 175, the Chinese began the practice of cutting the writings of important scholars into stone. The stones were placed in centers of learning, and students made “rubbings,” or copies, on paper from the carvings. The process was faster than hand copying, and all editions were identical to the first.

No one knows when the ideas of the seal and stone rubbings came together, but in China in A.D. 953, under the administration of Fêng Tao, a large-scale block-printing operation was set up to reproduce the Confucian classics. Block prints were generally made from slabs of hard, fine-grained wood that were carved to leave well-defined raised images. The raised portions of the block were inked, paper was laid over the block, and a pad was rubbed across the surface to transfer the ink to the paper.

During the Sung dynasty, around A.D. 1401, a common man named Pi Shêng invented movable type. Building on the ideas of block



**An early Chinese press.** The press was a low, flat table solid enough to hold the form in place. The Bettman Archives.



printing, Shêng cut individual characters into small pieces of clay. The clay was fired to make it hard, and the individual pieces were placed in an iron frame to create the printing form. Because the pieces did not fit together perfectly, they were embedded in a mixture of hot pine resin, wax, and paper ashes. When cold, all the pieces held together perfectly tight, and the form was inked and printed. Reheating the resin mixture loosened the pieces of type so they could be reused. Other materials, including wood, tin, copper, and bronze, were used for the same purpose.

The idea of movable type traveled to neighboring countries. In Korea, in A.D. 1403, King T'ajjong ordered that everything within his reach be printed in order to pass on the tradition of information contained in the works. Three hundred thousand pieces of bronze type were cast, and printing began. Less than fifty years later in Northern Germany, Johann Gutenberg worked a similar process, only using the Roman alphabet. His efforts earned him the title "father of printing." It is interesting to speculate whether Gutenberg learned of the process from visits to Asia.

## Objectives

After completing this chapter, you will be able to:

- Discuss the evolution of graphic symbols from prehistoric times to the modern alphabet of the present.
- List the major printing processes and describe the differences between them.
- List and describe the steps in the printing cycle.
- Rank the printing industry in terms of number of individual firms, number of employees, and value added.
- Describe the structure and purpose of each level of a small- to medium-sized printing company.
- Compare the kinds of services provided by the different types of printing businesses.
- Describe the different ways to enter, train, and advance in the printing industry.

## Introduction

Printing has been identified as the single most significant technological development in the history of the human species. Prior to the invention of printing all information and communication was transmitted verbally. Ideas survived as long as someone could remember the concept. Little information was retained unchanged for more than three generations. Folklore and legend formed the base for all cultures. Before printing it was very difficult

to communicate messages to a large number of people. The oral tradition was limited to small groups and the memory of the speaker.

Printing created the ability to record ideas so they could survive across many generations. It also allowed information to be communicated exactly to any number of people. Once ideas and information were made permanent and everyone had access to them, true science and technological development began.