

# PCB 101

# HANDBOOK

First Edition

A BOOK ABOUT PRINTED CIRCUIT BOARDS

Written by

**Dan Beaulieu and Robert Tarzwell**

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Cover photo of a 15 oz. heavy copper PCB by Robert Tarzwell

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## **The Authors**

Dan Beaulieu President: D.B.Management Group L.L.C.

Dan Beaulieu, has over 30 years experience in the printed circuit board industry. He is considered one of the industry's top marketing and sales experts, as well as perhaps the strongest and most focused strategist in the industry. He served as the top sales executive in three major printed circuit board fabrication companies; Maine Electronics, General Circuits and Automated Systems Inc. Mr. Beaulieu is also a well known, industry writer and columnist, writing sales and marketing columns in Circuitree, Printed Circuit Design and Manufacture, U.S. Tech and Printed Circuit News and PCB007.

He is a writer of feature articles about various board shops and how they perform in the industry. He is always available for working with clients on their marketing communications and image literature needs. Mr. Beaulieu has worked with numerous board shops including: Prototron Circuits, Hunter Technology, Rockwell Collins, Colonial Circuits, Sierra Proto Express, RBP Chemical, Taiyo-America and over 100 others.

His specialty is helping companies increase their sales with strategies and tactics, niche definition, marketing communication plans and managing, measuring and motivating sales forces. Having worked with independent sales reps for many years, Mr. Beaulieu is particularly well suited for helping companies develop successful and profitable relationships with their reps.

Mr. Beaulieu is particularly interested in and completely dedicated to helping board shops enhance their professional and technical image through sales and marketing. He feels that "Most companies in our industry have a sales and marketing executive who really spends 99.9% of his time on sales and .1% of his time on marketing. I consider it my job to fix that. Until we are completely dedicated to the concept of marketing ourselves, we will remain a second tier industry."

Robert Tarzwell, is semi-retired living in the Bahamas, consulting to the PCB business and spending his free time writing books, working on antique cars and deep sea fishing.

Robert started in printed circuit boards in 1964, part time and during the summers while attending Sheridan College in Canada, earning a degree in electronics and cinema photography. After college and a ten-year stint in television electronics and proto-type printed circuit manufacturing, he started a printed circuit, quick turn, manufacturing company. The printed circuit company specialized in high technology research and development. Robert learned how to manufacture many different types of high technology circuit boards including very fine lines below 1.5 mils and very heavy copper up to 40 oz.

Since selling his company in 2000, Robert has developed and transferred advanced printed circuit high technology to many companies. Robert has written hundreds of articles, spoken as keynote speaker and written 22 books on printed circuit technologies and car racing. Robert has 3 patent- pending applications in fine lines, high reliability and outer space printed circuits. Robert has now completed his five year contract with Sierra Proto Express, San Jose, Ca. and is able to transfer 20 advanced new products such as new bleeding edge, extreme circuits, high reliable electronics, heat sinking technology, low CTE technology, micro circuits and ultra fine lines to 8 micron, high voltage, heavy copper to 20 oz., impedance vias, three dimensional copper structures and silver ink HDI circuits.

Robert has invented high technology printed circuits for Delphi, Rockwell Collins, Boeing, NASA, Allied Signal and many more electronics companies. Robert also worked to advance the technology of HDI dielectric circuits through hybrid combinations with silver ink. Robert now spends his time writing PCB books and transferring advanced technologies to PCB shops.

### **Acknowledgments**

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## Introduction

For years now, we have been hearing about the demise of the printed circuit board. For as long as we can remember people have gloated about the fact that the circuit board has been on its way out that it would be replaced by newer technology; that within the next few years (whether they meant 1975, 1985 or 2015), we would see the last of the printed circuit board as we know it. You have to marvel at the logic of this kind of thinking, especially when viewed in perspective of a time line based on hindsight. For example, while people were predicting the demise of the PCB in the 70's, Digital's Ken Olsen was wondering why anyone but an engineer needed to own a computer. While Steve Jobs and Wozniak were busily founding Apple, proclaiming that there should be a computer in every home others were wondering, what for? What would a home maker do with a computer? At that time, those same naysayers were telling us that we'd better kiss the circuit board good-bye, adios, ciao. Later, after Al Gore "founded the internet" and Bill Gates told us it was only a passing fad, people were still proclaiming the death of the PCB! And some people never learned. Yes, there are still people today that say that the printed circuit board's days are numbered, that the PCB will disappear. To those people, we say this: word of the printed circuit board's demise has been greatly exaggerated. The PCB is very much alive and well.

In the sixties when the eulogies for PCBs began, the worldwide market for them was about a billion dollars. Today, as we finish this book, the PCB industry is expected to hit fifty billion dollars and printed circuit boards are everywhere. Look around you; check out your kitchen, your laundry room, your family room, your home theatre, your doctors', dentists' and ophthalmologists' offices, your hospital, your car, the mechanics shop, your phone, your computer, your I-Pad, your mp3 player, your scoreboards, your new LED lighting, your home security system, your country's security and defense and space systems and all of those products that have not even been thought up yet and tell us again how the circuit board is on its last legs and we're just getting started! The volume you are now holding is meant to be not just an introduction to the printed circuit board but more than that. We have included everything you'll need to have a good working knowledge of the printed circuit board including its history, its technology, old, current and a touch of the future.

We have included a chapter on the latest specifications and registrations for printed circuit boards, as well as a segment on how to design, buy and sell PCBs. Additionally, we have included an all new glossary which includes all of the printed circuit board terms and definitions for your PCB vocabulary.

So, whether you are an engineering student wanting to learn more about this technology or a new recruit into a company that buys PCBs or maybe, you are lucky enough to be working for a company that actually fabricates PCBs or maybe, you're a board designer who wants to learn more about the product you design or maybe, you're an investor looking to buy or sell a PCB company. Whatever your role, whatever your reason for wanting to learn more about printed circuit boards, you'll find what you need in this book.

Welcome to the world of the printed circuit board.

Dan Beaulieu

Robert Tarzwell



Robert Tarzwell



Dan Beaulieu

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*"Dan has been a significant help in achieving the growth objectives we have set for our company. His pleasant personality combined with his wealth of experience and background, have made Dan a welcome member of our team. I strongly recommend him to anyone who is seeking assistance in making improvements in the sales, marketing and management areas of their company".*

*Charles Hazen, General Manager, Milplex Circuit (Canada)*