

NO "e"

WILLIAM M. WOLF

NO “e”

NO “e”

William M. Wolf

Copyright © 2005 by William M. Wolf.

Library of Congress Number:		2004097677
ISBN:	Hardcover	1-4134-6846-2
	Softcover	1-4134-6845-4

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the copyright owner.

This book was printed in the United States of America.

To order additional copies of this book, contact:

Xlibris Corporation

1-888-795-4274

www.Xlibris.com

Orders@Xlibris.com

26205

CONTENTS

Foreword	9
Thanks	13
Dedication	15
Organization	17
Section 1.0: Computer	19
Section 2.0: Programming.....	21
2.1 Number Systems	21
2.2 Computer Instructions	23
2.3 Example of Programming	24
2.4 Conditional Transfer of Control	25
2.5 Bugs	25
2.6 Bug in Operation	26
2.7 Hardware versus Software	28
2.8 Approximations	28
2.9 Crossword Puzzles	28
2.10 Software Standards	30
2.11 Summation	31
Section 3.0: Early Years—1928-1939	32
3.1 “Boy, 4, Swallows Pin”	32
3.2 Buzzer	33
3.3 Groups of Tens.....	33
Section 4.0: The 1940s	35
4.1 First Celebrity.....	35
4.2 Piano Lessons	35
4.3 Hi-Y Cup	36
Section 5.0: The 1950s	38
5.1 Philadelphia.....	38
5.2 MIT	40
5.3 Cape Cod System	40
5.4 First Independent Contract	41

5.5 Nuclear Reactor Design	42
5.6 Humble Oil.....	43
5.7 Avco Everett Research Laboratory	45
5.8 Derivation of Mouse Tracking Principles	48
5.9 Pushbutton Dialing	49
5.10 Light Dimmer for Wall Switch	50
5.11 WWI Story—Apple Pie	51
5.12 Sheldon Best.....	51
5.13 Grace Hopper	52
5.14 Industrial Publications Corp.	54
5.15 Hooper Holmes	54
5.16 IBM Tactics	57
5.17 Federal Reserve Work	58
5.18 Flash Data Triangulation.....	59
5.19 Aqueduct	60
5.20 Pat McGovern	61
Section 6.0: The 1960s	63
6.1 Whirlwind Move	63
6.2 Ted Kennedy.....	67
6.3 Moving Madagascar	68
6.4 Boston Strangler	68
6.5 Magnetic Core Dispute.....	71
6.6 Hal Steward.....	74
6.7 Nasa Houston.....	75
6.8 A-OK in Seattle	78
6.9 Richard Buckminster Fuller	80
6.9.1 First Meeting	80
6.9.2 World Game.....	81
6.9.3 United Nations University.....	81
6.9.4 Typical Behavior	82
6.10 Concord Floor Covering.....	82
6.11 Smart Buildings	83
6.12 First Computer Graphics	84
6.13 Banking	84
6.14 Midwest Computer Service, Inc.	90
6.15 Life Magazine	92

6.16 Sale to EG&G	108
6.17 Association of Independent Software Companies	110
6.18 First Impressions	115
Section 7.0: The 1970s	117
7.1 Computer Facilities Management	117
7.2 Teheran Trip	120
7.3 First Software Specification	122
7.4 Edulogical Systems	123
7.5 Unemployment	124
7.6 Queen Elizabeth	125
7.7 Concord Computing	126
7.8 Wilbur Mills and Fannie Fox	129
7.9 A Curious Example of Luck	131
Section 8.0: The 1980s	134
8.1 The Personal Computer	134
8.2 PC Effects	136
8.2.1 Users	136
8.2.2 Programmers	136
8.2.3 Other Effects	136
8.3 Visicalc	137
8.4 PC Anywhere	138
8.5 Videodisc	138
8.6 Tsongas Versus Harvard	140
8.7 Colonel Comment	141
8.8 Sources of Wonderment	141
8.8.1 Drugs and Thugs	141
8.8.2 Pure Fantasy	142
Section 9.0: The 1990s	144
9.1 Wolfsort	144
9.2 Technology Capital Network	145
9.3 Slovenia	149
9.4 Tip O'Neill	150
9.5 Year 2000 Problem	151
9.5.1 Problem Definition	151
9.5.2 Solutions	152
9.5.3 New York Experience	153

Section 10.0: The 2000s	155
10.1 1:11-1/1/01	155
10.2 Letter to the Editor Re Chad	157
10.3 Letter to President Bush	160
Section 11.0: Business Commentary	164
11.1 Organization	164
11.2 Management Information Systems	166
11.3 Contract Monitoring.....	166
11.4 Marketing.....	168
11.5 Free Advice	169
11.6 Business Ethics	169
11.7 University of Maryland Lecture	170
11.7.1 Business Advice	171
11.7.2 Business Opportunities For The 90S.....	176
Section 12.0: Personal Commentary	178
12.1 Boring Life	178
12.2 Internal Revenue Service	179
12.3 Organized Religion	181
12.4 Jury Duty	183
12.5 Extra Mile	184
12.6 Who's Who	185
12.7 Humor.....	186
Section 13.0: Summary and Hope for the Future	189
13.1 Summary	189
13.2 Hope for the Future	190
13.2.1 Birth to Death Registry	190
13.2.2 Tracking and Location	190
13.2.3 Work at Home	191
13.2.4 Medical Applications	191
13.2.5 Space Travel	192
13.2.6 e-Commerce	192
Appendix: Companies Founded	193
Index	201

Foreword

We are all aware of the ubiquity of the digital computer in our everyday lives. One cannot pay taxes, make a plane reservation, purchase groceries using a credit card, nor draw cash out of an Automatic Teller Machine (ATM) without interfacing directly or indirectly with the computer. Yet behind all computers is the work of programmers—those persons whose minds and hands visualize, create and write the instructions that these computers execute.

The programmer is a man of mystery to the average person. We derisively call such people “nerds”. By highlighting their societal differences we defend our fear of what they can do. Yet a programmer, so impatient to code that he dropped out of his university in his junior year, is now the richest man in the world! And it took him only 27 years to achieve a wealth of \$52.5 billion! This founder of a software company called Microsoft, Bill Gates is not yet 50, married to one of his employees, and has his first child. Yet his accumulated wealth is greater than the Gross National Product of many countries. In recent years his personal foundation, the Gates Foundation, was established with a capital fund of \$23 billion, the largest amount of funding of any foundation in the world!

How did this happen? Is this a unique experience? Was this person lucky? Hardly, when one observes that the third richest man (at \$25.2B) in the U.S., Paul Allen, was also a programmer and co-founder of Microsoft; and so is the fourth, Larry Ellison (at \$23.5B), founder of another software company, Oracle. These numbers (presented as of 2001, a down year) vary with the times and the values in the stock market. Warren Buffett was the second man in the listing referred to at \$35B.

Who are these people called programmers and what sort of lives do they live? What do they really do? Where did they come

from, and where are they apt to be going in the future? Although pieces of this story have appeared in print from time to time the whole 50 year chronology of programming has not been documented from a programmer's viewpoint.

This work will chronicle the life of a not-your-ordinary programmer. It will be an autobiographical account of an MIT-trained programmer who was one of less than 50 in the whole world in 1952. There are reputedly 9 million programmers working today. It will cover a career that has included:

- * Work at MIT on the Cape Cod System—the first real time application of a digital computer—the prototype of our air defense system.
- * Programming for the design of the heat shield that permits safe re-entry of our astronauts and payloads from space into our earth's atmosphere.
- * Correcting the earth coordinates of Madagascar a distance of four football fields in latitude while reducing data from the moon—250,000 miles away.
- * Work with R.Buckminster Fuller on his concept of his World Game.
- * The building of a national computer programming and professional services company—Wolf Research & Development Corp.
- * The sale of this company to Edgerton, Germeshausen, & Grier.
- * Involvement in the start-up of fifty companies and non-profits—mostly computer based.
- * Resumption of a programming career at the age of 70—helping to address the Year 2000 (Y2K) computer programming problems.

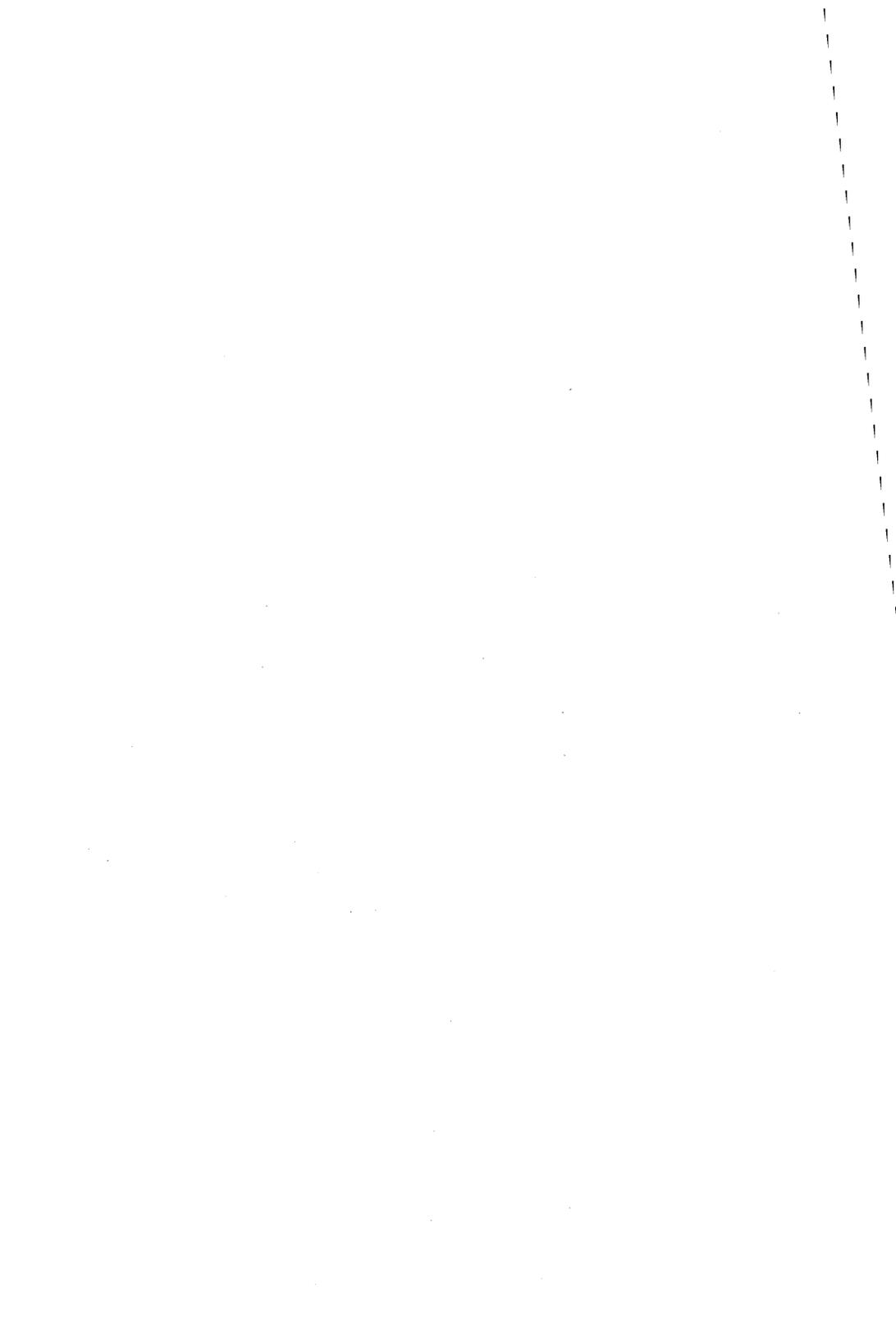
The story will include—

- * Never-before-published background of computer work associated with the solving of the Boston Strangler mystery.

- * What happens to a family and company when a 9 page spread in LIFE magazine features them.
- * The intimate involvement in and responsibility for the creation of the software business as we know it today.

On that last point, the author of this work was one of the Founders and the first President of the Association of Independent Software Companies—the first national computer software association which actively supported one of its members in an anti-trust suit against IBM. The end result was that IBM changed its policy and separated pricing between software and hardware. Prior to that time, the software was given away by IBM and other computer manufacturers as an adjunct to the sale of their hardware. The sale of software separately from hardware paved the way for the birth and growth of such firms as Lotus, Microsoft, Oracle, and others.

With respect to the title—Whenever a new person hears the name Wolf, over the phone or at the sign-in desk at a meeting, she or he invariably asks, "With or without the "e"? The response to which query is—No "e".

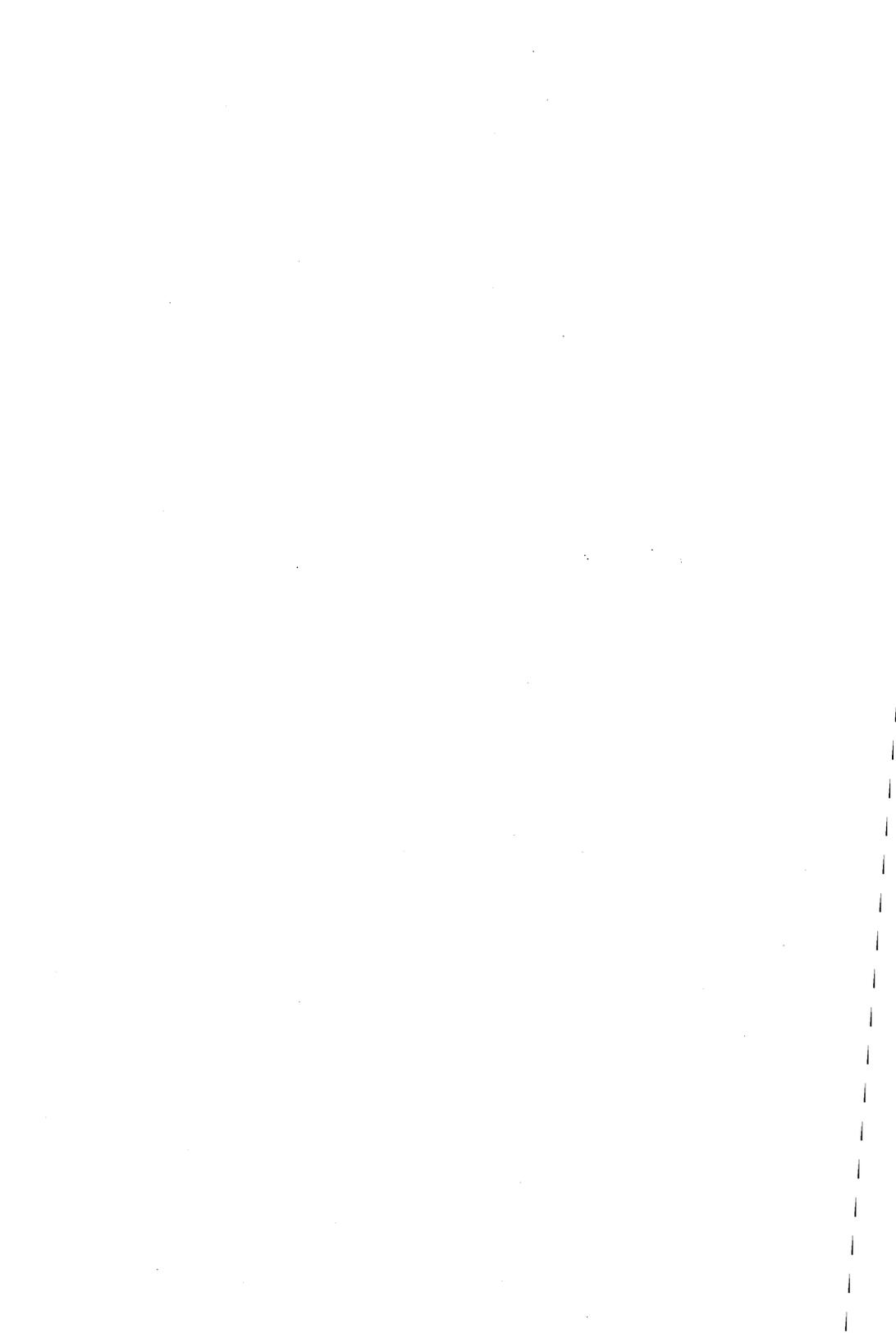


Thanks

Where to begin, then when to stop are the questions. Clearly I wouldn't be here without my parents. They faced overwhelming problems with courage and optimism. I am of course grateful for the lessons they taught me and my siblings.

Teachers and coaches were another source of training in techniques and life, for which I am most appreciative. My bosses and fellow workers from whom I learned what I know were all helpful in shaping my life. I also thank my doctors who have guided me and prolonged my sedentary life so that I could finish this work.

Today, I am most thankful for my family and friends from whom I gain and to whom I offer that most valuable of all things—unqualified and unquestioning love and support.



Dedication

This work is dedicated to all the spouses and partners of programmers who early on must face a cold and faceless fact—they share their loved one with another—the computer. If they are smart, they will accept this fact and learn to live with it. They will never ask—which do you prefer, the computer or me? If they are not smart, their relationship is doomed.

It is important to recognize that programming is a solo, non-participatory activity, not unlike composing music. One never encounters a symphony by Beethoven *and* Brahms. To often become so engrossed in programming that all outside activities are distractions to be avoided is the norm.

So, brave souls, please understand that we are not different—we are normal people with a selfish addiction to our profession that borders on a passion. Our love for you is not in any way diminished by our love for what we do. True love for these dual and strong forces in our lives can only co-exist if they are understanding of each other.



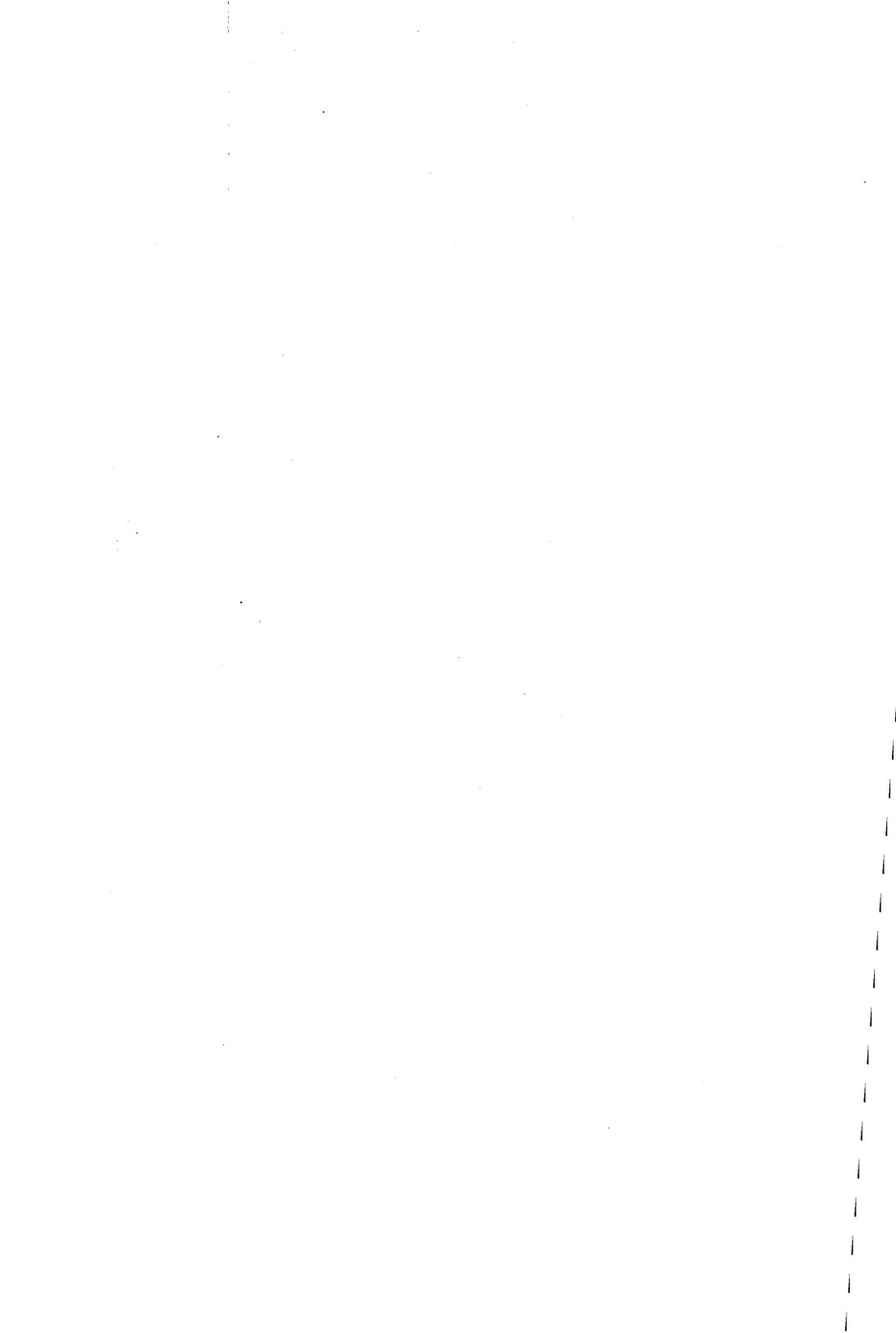
Organization

The text is organized in a relatively straightforward manner. After two sections about computers and programming, Sections 3 through 10 cover the decades of my life to date. Descriptions of events in each decade are at times chronological but mostly random. If I kept a lifetime journal I would be more accurate on dates, but looking back from the perspective of 75 years it is easier to remember things in terms of decades.

Speaking of remembering, I have tried hard to be accurate in this account but it wouldn't surprise me to have erred in recalling the dates and/or the people. This is as non-fictional as an autobiography can be without an undue amount of research.

I hope you enjoy my sharing these stories with you. My portal is always open for your thoughts and comments.

Try me at: [*wmmwolf@aol.com*](mailto:wmmwolf@aol.com)



Section 1.0

Computer

When the term computer is used in this work it shall mean an electronic, digital computer. This broad definition will include the whole spectrum from the multi-ton, several room sized machine of the 1950s down to today's personal data assistant (PDA) that we carry in our briefcase, pocket, or purse.

A computer, not unlike an adding machine, will add, subtract, multiply and divide. However, it will perform at the rate of millions of numbers per second. Intel's Pentium Pro operates at 440 MIPs (Millions of Instructions per Second).

Consider what this means in everyday terms. Let us assume that there are 150 million U.S. taxpayers and that it takes an average of 200 steps of addition or subtraction for the IRS to check the arithmetic of a single taxpayer's return. Thus, we see that

$$(150\text{M returns}) \times (200 \text{ steps/return}) \times (1 \text{ second per } 440\text{M steps}) = 68.2 \text{ secs.}$$

That is, about one minute to check the math of every taxpayer in the country! And that assumes only one desk top computer working that problem. It makes one wonder what the IRS does in its vast computer complex the rest of the year.

We used to say that the computer can do anything but press your trousers. However, there are many real-world problems that can not be expressed in mathematical terms and thus are difficult if not impossible to program. These are especially true where judgment is involved such as driving a car or picking stocks.

In recent years a number of technical people have been touting “artificial intelligence.” Ignoring the misnomer, a lot of government and venture capital money has been spent searching for a practical application that the market will buy. To date, the field has yet to justify the interest and investments. But the jury is still out and more money is bound to follow this hunt, lured by the potentially large payoffs.

Not since the Industrial Revolution brought the farmer into the factory has there been an invention which has fostered such dramatic changes on our society. And the number of programmers who instruct these computers to do their bidding has increased from about 50 when I started programming in 1952 to over 9 million today.

In conclusion, when someone asked me recently what age in history I would have preferred to live, I answered—the present.

- 1) What can be more exciting than helping to put a man on the moon?
- 2) What can be more illuminating and beneficial to mankind than being able to perform a CAT scan or MRI scan to actually perform a non-invasive look inside a person’s brain or other parts of their body?
- 3) What is more useful in business than being able to call Singapore from a portable phone in your car or backyard by the pool?

All of these gee-whiz technologies and more could not have been achieved without the computer. And, today, hardware and software companies are working toward implementing the introduction into our homes of the combination of equipment and programs which will result in interactive television.

Section 2.0

Programming

To understand programming it will be helpful to review and define some fundamental principles.

2.1 Number Systems

In the early days—circa 1950s—the large electronic computers employed relatively large tubes similar to ones you may have seen inside an old radio. In practice, it was more reliable to build circuits that depended upon whether or not current was flowing through a tube rather than the amount of current flowing. This “on” or “off” characteristic enabled the high speed of early computers but imposed a constraint on the users. Since there were only two states to work with, on or off, a user was forced to work with these two states, represented by a “one” or a “zero”. Thus a user of the computer was constrained to using the binary number system—a system comprised of only two digits—“1” and “0”. In the decimal system of everyday life we count from 0 to 9, using all of the 10 numbers, and then we start over, counting from 10 to 19. Either system is valid in counting things. Our decimal system stems from the fact that we are born with 10 fingers. There is a shoeless Peruvian tribe that has a number system based on 20.

It is possible, then to construct and employ a number system that is based upon any number of elements. In the early days of programming it was convenient to use the octal number system where there are eight numbers to work with, 0 through 7. The

reason for this is that three binary digits equal one octal digit. That is, each of a group of three binary digits can be contained in and are represented by one octal digit.

For example, let us count in the decimal and binary number systems and, while we're at it, in the octal number system—

DECIMAL		BINARY		OCTAL
0		0		0
1		1		1
2	then	10		2
3		11		3
4	then	100		4
5		101		5
6		110		6
7		111		7
8	then	1000	then	10
9		1001		11
then 10		1010		12
11		1011		13
12		1100		14
13		1101		15
14		1110		16
15		1111		17
16	then	10000	then	20

One of the first things an early 1950s vintage computer user had to learn was how to work with binary numbers. As a practical convenience, it was customary to group three binary digits at a time into the octal number system.

Early computers, MIT's Whirlwind I for example, contained circuitry for sixteen binary digits (or "bits") arranged in a so-called "word". A word was contained in a location known as a "register" which had an "address".

The bit contents of a word might look like this—

0	0 0 1	0 1 0	1 0 1	0 0 1	0 1 1
---	-------	-------	-------	-------	-------

The first digit was employed as a sign digit where "1" represented a minus and "0" represented a plus. In octal, the above number would be

+ 1 2 5 1 3 ; in decimal, + 5 4 4 1.

The 15 binary digits are capable of representing any decimal number up to 32,768. Larger numbers are represented by more than one word.

2.2 Computer Instructions

The 16-bit register can also be characterized as containing a computer instruction where the first five bits contain the code for a computer operation and the other 11 bits contain the address of the register germane to the operation.

Computer instructions are separated into the following major groupings—

INPUT / OUTPUT

These govern the operations of reading information in and out.

ARITHMETIC

Addition, subtraction, multiplication, and division.

TRANSFER OF CONTROL

These may be conditional or unconditional.

OTHERS

Including such functions as transfer to storage instructions.

A sequence of instructions is termed a "program" and a person who writes the program is called a "programmer".

I recall when I was a student at MIT and working in the Digital Computer Lab, I filled out a check-cashing application at the Stop & Shop and answered “programmer” in response to the “occupation” question. The young lady behind the counter said—“Oh, a programmer—what radio station do you work for?”

2.3 Example of Programming

It is the programmer’s job, skill, art or whatever one wants to call it—to write the instructions in the correct order so that the computer performs the desired function. For example, consider the steps one might take in writing a program to produce a bi-weekly payroll in a 24 person company.

STEP 1 INITIALIZE COUNTER	(set employee counter to zero)
STEP 2 READ IN DATA	(including rate and hours worked)
STEP 3 COMPUTE GROSS PAY	(multiply hours times pay rate)
STEP 4 COMPUTE DEDUCTIONS	(including FICA & state with-holdings, pension plan, others)
STEP 5 COMPUTE NET PAY	(gross pay minus deductions)
STEP 6 PRINT PAYCHECK	(including employee name & address, gross & net pay, deductions)
STEP 7 INDEX COUNTER	(add one to employee counter)
STEP 8 IS EMPLOYEE COUNTER = 24?	
If NO, Return to STEP 2	
If YES, Proceed to STEP 9	
STEP 9 EXIT	

Note in particular Step 8. Without this instruction we would have to write the same set of instruction 24 times—once for each employee. We term this type of instruction the “Conditional Transfer of Control”.

2.4 Conditional Transfer of Control

There is one type of instruction that dwarfs others in its importance. That is the “Conditional Transfer of Control”. To illustrate, as in the previous example, suppose we are writing a program to calculate each employee’s payroll. This program must multiply the hours worked by the employee’s hourly rate to get the total pay, then subtract the amounts to be withheld for income tax, social security, and other deductions. When we are all done and have the net pay we must then do the same thing for the next employee. Since the instructions are the same, if we set up a counter representing the number of employees to “0” at the outset and then add “1” to this counter after we have processed each employee’s data, we can test to see when this counter is “24” at which time we will have processed all of the employees. This capability allows us to only write the instructions once and then use them repeatedly for all the others. We test this counter each time and when it is “24”, we then branch off to another part of the program. This ability to test and branch off is enabled by the “Conditional Transfer of Control” instruction which allows us to set up logical trees and many other useful functions.

2.5 Bugs

It is common practice to write a program and then test it to get all the errors, or “bugs”, out. The term “bug” for programming error was coined by Grace Hopper. In the 1947, when she was working on Harvard’s Mark II relay computer, a moth got caught in between the contacts of a relay and caused the computer to malfunction. In the 1970s I read her notebook in which she had taped the unfortunate moth. It was on display in the reception

area of the Naval Weapons Research Laboratory at Dahlgren, Virginia. Thus, a correctly operating computer program is said to be one that is completely “debugged”. When Microsoft ships a release of one of its programs that still contains bugs (a not unusual circumstance) it makes the papers—at least the trade journals. It is common folklore in the computer business to never buy the first of anything—hardware or software since experience has proven that the first issue or model still contains bugs which must be eliminated before the computer or program can be trusted to perform accurately. To ameliorate this state of affairs it is customary to define an “alpha” test during which the manufacturer reputedly removes all the bugs; then the “beta” test whereby the program or equipment is used in a customer’s environment using real, not test, data. Bugs are found and eliminated at both levels and, further, when the equipment or software is in the market supposedly working. Caution and hesitation in adopting new computer applications are wise attitudes to employ unless one really needs the new products in one’s environment.

2.6 Bug in Operation

This example came in recently in an eMail from a friend in San Luis Obispo:

“TO ERR IS HUMAN, BUT . . . Sometimes all you can do is laugh. In March of 1992 a man living in Newton, Massachusetts received a bill on his as yet unused credit card stating that he owed \$0.00. He threw it away. In April he received another and tossed that one, too. The following month the credit card company sent him a nasty note stating they were going to cancel his card if he didn’t send them \$0.00. In retrospect, he probably should have let them do that. Instead he called the company and was informed that (are you ready for this?) the problem was the result of a computer error. They told him they’d take care of it. The following month he reasoned that, if other charges appeared on the card, then it would put an end to his ridiculous

predicament. Besides, they assured him the problem would be resolved. So he presented his card for a purchase. It was declined. Once again he called. He learned that the credit card had been cancelled for lack of payment. They apologized for (here it is again) another computer error and promised they would rectify the situation. The next day he got a bill for \$0.00 stating that payment was now overdue. Assuming that this bill was yet another mistake, he ignored it. But the following month he received yet another bill for \$0.00 stating that he had ten days to pay his account in full or the company would take necessary steps to recover the debt. He gave in. He mailed in a check for \$0.00. The computer duly processed it and returned a statement to the effect that his account was paid in full. A week later, the man's bank called him asking him why he wrote a check for \$0.00. He explained the problem at length. The bank replied that the \$0.00 check had caused their check processing software to fail. The bank could not now process ANY checks from ANY of their customers that day because the check for \$0.00 caused a computer crash. The following month the man received a letter from the credit card company claiming that his check had bounced, that he still owed \$0.00 and, unless payment was sent immediately, they would institute procedures to collect his debt. This man, who had been considering buying his wife a computer for her birthday, bought her a typewriter instead. Who said, “To err is human, but to really mess things up it takes a computer . . .”? Computers may not be the root of all evil, but some days I'm convinced they come close.”

Let us consider how a programming patch could eliminate this bug. In the part of the program that reads in the amount of payment to be processed, one could write the following test:

Is the amount = “\$0.00”?

If NO, continue processing

If YES, forget this person and process the next one.

Simple? Agreed, but this is what a programmer gets paid \$80,000 per year to find and fix.

2.7 Hardware versus Software

Computer hardware is the tangible “hard asset” assemblage of electronic equipment. Software refers to the collection of programs that instruct the hardware to function according to the design of the programmer. Software is intangible and represented by the information derived from some input medium—punched cards or key strokes. The term “versus” in the heading refers to the generations old debate when something goes wrong—is it the fault of the “hardware” or the “software”? Both are “debugged” over a period of time and usage.

2.8 Approximations

If we want to track a satellite’s trajectory or put a man on the moon we must solve the pertinent differential equations of motion. However, we only have the elementary arithmetic operations with which to work. Therefore, we must use approximations. Simply put, if we want to differentiate we use differences and if we want to integrate we use summations. In both cases the interval is very small so that the approximations mimic reality. We essentially return to Sir Isaac Newton’s definitions in his differential and integral calculus where he took differences at extremely tiny increments. Since we have the speed of the digital computers to work with we can use similar approximations. If we want to program trigonometric functions such as sine or cosine we program an approximation formula comprised of arithmetic operations.

2.9 Crossword Puzzles

Programming computers is a little like solving crossword puzzles—only easier. In programming, one knows all the words and arranges them into an array which will perform a given task.

In solving crossword puzzles, the words are unknown and clues are derived from determining the words in the opposite direction. I have always felt that if you like one you will like (and be good at) the other.

Speaking of crossword puzzles, one of my personals highs in recent years was the meeting on Cape Cod with Eugene Maleska—editor for many years of the New York Times crossword puzzles. He was the neighbor of friends from the Cambridge Boat Club with whom we were visiting. When they told us about their neighbor I expressed such interest that they took me over to meet him. Maleska greeted us in his office which looked more like a library—with several huge dictionaries all open to various pages. He was a typical New Yorker—in manner, speech, and dialect. I told him the story of what happened one Sunday morning during brunch at the Ritz in Boston. I was sitting there doing the New York Times puzzle with a friend when I excused myself and approached a man at another table, puzzle in hand. I asked him if he would help me with "57 across". The five letter solution was needed for "Isaac Stern's violin". The person I approached was Isaac Stern. After his initial surprise he was delighted to help and wrote in "Strad". He then autographed the puzzle for me—"Fiddler on the Hoof—Isaac Stern". The following Sunday I learned that the answer should have been "Amati" however I didn't have the heart to write and tell him. Gene Maleska was delighted to hear the story and countered with several of his own—including the time he composed a puzzle for Frank Sinatra. One of the things I learned from him is that when a puzzle author composes a puzzle he or she starts in the lower right hand corner and works up and out from there. This is the opposite of where most puzzle solvers start—namely, in the upper left corner—solving 1 across; 5 across; et cetera.

Some time ago I considered the idea of composing the puzzles automatically by computer. This is not a trivial task. It would require a very large memory to hold all the possible clues—the equivalent of Maleska's dictionaries. However, one could custom design a puzzle to fit an occasion such as a birthday, anniversary, etc. One would personalize the questions to the recipient with

names, vocations, pets, and other things that pertain to the person. Then the computer could build a puzzle around those personal facts. When thinking about it I asked a number of people what they would pay to have a custom puzzle written. My informal marketing survey revealed that it would have to be in the range of a birthday card with perhaps \$5 being the maximum. That discouraged me from pursuing the effort. I asked Gene Maleska if anyone was doing it and he said—“No, but it would be a good idea.” Neither Maleska nor Stern is with us today but they were both heroes to me in time past.

2.10 Software Standards

The only body that could have enforced anything resembling a software standard is our federal government. But historically the government has always avoided standardizing software to everyone's disappointment and at enormous and unnecessary cost to the country. The argument (fallacious, in my opinion) was that standardizing software would limit innovation.

When the government finally woke up to the fact that software development had grown to be much more costly than hardware development in military systems it was too late.

The government wrote a contract to develop a uniform standardized programming language named “Ada” in honor of the first programmer—Lady Ada Lovelace. She worked under the direction of Charles Babbage—the inventor of what some call the first computer, a mechanical sequence calculator.

The contract, curiously, was awarded to a French firm named Bull who took about two years to write the necessary software to interpret and execute the language's instructions. Today, the many allowed exceptions to Ada have doomed its use as a standardized universal language.

This lack of standardization in software is the most wasteful and unnecessary tragedy of the computer age. Can you imagine a world where each individual flashlight has a different sized battery? Or where bolts and nuts have different pitches to their threads; or

where each electrical appliance has a different sized plug and none of them fit the wall outlet?

Such was and is the world of computer software.

2.11 Summation

I hope I haven't totally confused you but I felt it was important to define the programming process so that the reader would have a better appreciation for what is involved. It is one of those things where if one understands the process one can feel comfortable with what to expect from it and see that it can be easy to work with. However, each detail, every punctuation mark, is important. It is difficult to comprehend, yet true, that a misplaced comma in a program written by a TRW programmer resulted in the destruction of an \$18 million satellite.

In a general sense, if we define a programmer as someone who tells the computer what to do, every computer user is performing programming when he/she uses the mouse to select the desired options for the computer. However, the programmers that we refer to in this work are those who write the programs in either machine language or some higher order language which enable the computer to obey our mouse or keyboard implemented instructions.

Programming can be a frustrating process but the frustration is balanced by the personal satisfaction that you get when your program works as it should. MIT's Sherry Turkle wrote that when you write a program you put part of yourself into it and thus you protect it like your child.

I have never felt that paternalistic but I, like a few before and many after, have felt the intense satisfaction of knowing that a good job has been done and that the results that come from your work are useful to the university, company or government agency who pays for your performance. It is one of those professions where you can't believe that you are being paid for having such a good and rewarding time.

Section 3.0

Early Years—1928-1939

Born the fourth child of John and Rose Wolf from Transylvania who immigrated to the US in 1917 for all the reasons folks did in those days, I grew up in Watertown, New York. My Father and Mother owned and operated a grocery store about 2.5 miles out of town on the road to Lake Ontario. We lived in the same structure as the store which meant that if we were sitting on the porch after hours and a neighbor came by to buy something we would open the store for them.

I inherited a natural flair for salesmanship. I can remember Mrs. Crowder and my mother having a good laugh at my expense. It seems as though she had come by looking for Ex-Lax, a popular laxative at the time. We were out of Ex-Lax but we did have a different brand called Feen-a-Mint. I tried to sell her the substitute by saying, "It works just as good."

My mother used to call us the three wonders. When we see a fellow walking down the street, we wonder if he is coming in. When he does, we wonder what he wants. When he tells us, we wonder where it is.

3.1 "Boy, 4, Swallows Pin"

That was the headline in the Watertown Daily Times of an article on the fact that I had swallowed an open safety pin. In a small town, that's big news. This is one of my earliest childhood memories. The sheet on my crib had come loose from the safety pin which was holding it in place. I had been laid down for my

afternoon nap and my Mother had headed for the bus on the corner to take her uptown shopping. I had seen my sisters put hairpins in their mouths while adjusting their hair and I thus put the pin in my mouth while I was adjusting the sheet. But the sheet wouldn't move—perhaps because I was lying on it. I remember lying on my back to rest and opening my mouth to swallow. I popped the pin. I can still remember feeling the pain in my back as the pin was stuck in my esophagus. My sitter called for my mother who came running back and they took me to the hospital where the doctors had to perform surgery to remove it from my stomach. I still have an ugly scar six inches long to remind me of the incident. Today, GE makes an instrument for closing the pin in the stomach and retrieving it.

3.2 Buzzer

One contribution that I remember making to our household was the rigging up of a buzzer for the front door in the store so that my mother would not go on a false alarm when she thought she heard someone enter the store while she was in the kitchen. I cut two strips of metal from a tin soup can and attached one to the door and the other to the door frame. I bent them so that they would rub against one another whenever the door was opened, completing a circuit actuating a door buzzer. I wired the metal strips to the buzzer in a serial circuit which also had a transformer to cut down the voltage from the standard household outlet. I didn't do batteries because I didn't want anyone worrying about when the batteries would go dead. This system worked so long as I can remember and was a real time and frustration saver.

3.3 Groups of Tens

In our store, my Father extended credit to people who would buy during the week and then, on payday, would come in and "settle up". We kept each person's account on a separate pad with a carbon sheet between the pages so that we and the customer

would each have a copy of what they spent. However, at “settle up” time we had to add all the numbers to get the total. I can remember devising a quick way to do this. I would separate out groups of numbers that added to ten and remember the number of groups of tens that there were. Then the remainder would be added to the groups of tens. For example, if the numbers (1940 prices) to be totaled were:

Doz. Eggs	\$ 1.53
1 lb baloney	2.15
1 peck of Potatoes	1.75
2 cans of Soup	1.18
Candy	<u>0.17</u>

I would start by scanning the rightmost column and observing that there were two groups of ten ($3+7$ and $5+5$). Adding the remaining 8 to the two groups of ten would give 28 as the total for the rightmost column. I would write down the 8 and carry over the 2. Then I would see that $7+1+1+1$ would make one group of ten. Then I would add the 5 to make it 15 and then remember to add the 2 from rightmost column carry over making it 17. I would write down the 7 in the middle column with 1 to carry. The final column would then be a total of $1+1+2+1 = 5$ plus the one carried over to make it 6. Thus the total would be \$6.75

In school I would always finish my arithmetic before the other members of my class. I had a teacher named Mrs. Lines who one day asked me to go to the front blackboard and illustrate my method for the rest of the class. I didn't see anything special about it. It seemed to me to be a natural short cut. She used to say that if there were an easier way to do something I would find it.

Section 4.0

The 1940s

I don't remember too much about the forties except that they were the war years with all the trauma that entailed for everyone. A few recollections follow.

4.1 First Celebrity

The first celebrity I ever met was Frank Leahy—then coach of Notre Dame. He succeeded Knute Rockne. Coach Leahy later went on to West Point where he coached such players as Doc Blanchard (fullback) and Glenn Davis (halfback). I was all of 13 years old and wore my confirmation suit to meet him. He stopped by the radio station—WWNY—where my older sister had her own radio program. Every Sunday night she played the piano for 1/2 hour. I have a picture of me taken with Coach Leahy with my eyes open wide. He looks bored.

4.2 Piano Lessons

I learned bartering early on when I observed my mother doing the laundry for our piano teacher. We couldn't afford the money for lessons but doing the laundry paid for lessons for my sisters and me. I remember picking up and delivering the laundry in my little red wagon. Both of my sisters progressed to graduate from the Julliard School of Music in New York City and thence became professional musicians.

4.3 Hi-Y Cup

From every graduating class in the Watertown High School there was selected one male to receive the Hi-Y cup as the most outstanding graduate. The year I graduated I was President of the Student Council, played center on the basketball team, was sports editor of the student paper—the OWL—et cetera. However, one of my good friends—Don Eberly—was also regarded favorably by the faculty for things that he had done. Therefore, a tie resulted, and we were both told that we would receive the cup. However, it was during World War II—1946—and all the metal had gone to war. We were told that we would actually receive the cups after the war. The last time I saw Don he was promoting National Service down in Washington. That was during the Eisenhower administration. Eleanor Roosevelt told him that he would never be able to sell it in a Republican administration.

After college, Don spent 2 hapless years in the Army as a private—an ill fate for an MIT Physics graduate. He was convinced that there should be an alternate to Selective Service—which he termed National Service—where young people could spend two years doing something worthwhile for the nation, instead of wasting time in the military. When Kennedy was elected he instituted the Peace Corps but this was not quite what Don had in mind. Clinton's National Service program was more like it—some 40 years later.

By the time 1996 arrived I decided that fifty years was long enough to wait so I wrote to the Principal of Watertown High school asked for my cup. Receiving no answer to my letter I wrote again in 1997 and sent my letter certified mail. One day a few weeks later I got a phone call from the Principal. He explained to me that the Hi-Y was disbanded some 10 years previously and asked if I was serious. I said, "Of course, 50 years is long enough to wait." He said, "OK, I'll look around the basement and see what we have."

About two months later the postman delivered a package from Watertown, New York. My excitement in opening the box plummeted to disappointment when I saw the cup. It was about

half the size of what I had remembered from my youth. My sister won the female equivalent before me. It was called the Mary Hays Memorial trophy and was a beautiful silver cup about 12 inches high on a black plastic base. What I got was a 6" high pewter cup on a square wooden base. The pewter was scaled and had variable colors. In the wooden base was inserted a removable brass plate on which was inscribed—

WILLIAM M. WOLF W.H.S. HI/YCLUB 1946

Note that the brass plate was not big enough to spell out Watertown High School. Also the name of the club was Hi-Y, not HI/Y. And it wasn't a club honor, it was a school honor which was named the Hi-Y Cup.

The lesson that I learned is summed up by the advice attributed to General Colin Powell—"Be careful what you ask for—you just might get it." Another lesson is the vivid difference between one's mental image and reality. Often when one anticipates a vacation or trip one imagines what it will be like. Part of the thrill of living is to enjoy the experience whether or not it corresponds to your expectation.

Section 5.0

The 1950s

5.1 Philadelphia

Following a B.S. in Physics from St. Lawrence University in 1950 and an M.S. in Mathematics from the University of New Hampshire in 1951, I was recruited to join the Fire Control Instrument Group at the Frankford Arsenal in Philadelphia, PA. As a mathematician working in the Operations Research section of this US Army laboratory my job was to solve by the method of least squares a set of equations for the design of an out-of-level computer. This analog computer would compensate for the fact that an artillery piece in the field rarely has a level platform from which to fire. The computer was designed to provide the corrections in aiming the weapon so that it would perform accurately in the tilted position.

Working with two assistants, the effort consumed many months using the hand-operated, electrically-powered Marchant calculator. Such a solution would take about a week to program and less than 15 minutes to solve on the Whirlwind I—the electronic digital computer that I later was to work on at MIT.

While in Philadelphia I took evening courses at the University of Pennsylvania in Theoretical Physics and Servomechanisms. I can recall visiting the ENIAC—the first modern computer built at the Moore School of Engineering. One of the engineers bragged to us—“We got it working for 20 minutes last week.”

In my Theoretical Physics class I had a fellow student named Paul Bothwell. None of us had a lot of money but Paul had a scheme that he was working. He had a friend at the Medical School who would allow him to donate his blood more frequently than the norm. So Paul would sell a pint of blood for \$18, buy a bottle of red wine for \$3 and pocket the difference. As the semester went along I got to worry about him because he kept getting whiter and whiter. I then lost track of him until he showed up in Massachusetts as a Vice President of a firm called 3C—short for Computer Controls Corporation. It was a company that Bill Wolfson and Ben Kessel and Paul had founded. It was sold to Honeywell and Paul did very well financially and I was happy for him—including my happiness that he was still alive! Then he disappeared from my radar screen. The next time I saw him he was broke. It turned out that he had turned his fortune over to a brokerage house and allowed them to put all of his stocks in 'street name' which allowed them to use them as collateral for the firm. I think the name of the company was McDonnell. They went into bankruptcy, out of business, and lost Paul's fortune. I haven't seen him since but when I do I suspect he will be well off.

After a year working in Philadelphia I had a career choice to make. I was offered the opportunity to go down to the University of Virginia to work on a PhD in Physics on a fellowship or up to the Massachusetts Institute of Technology (MIT) to work on a PhD while working as a programmer. I chose the latter course because I felt that if I were to get a PhD I would want it to be from MIT. I'm still waiting on that one. Through the years, I sometimes wondered what would have happened if I had gone South. I would probably have ended up teaching in some university somewhere—a cushy job but not all that exciting. So I packed up my new wife in a 1939 Ford coupe that I bought from my college buddy, Don Brady, who was studying Dentistry at the U. of Penn, and drove off to Cambridge, Mass.

5.2 MIT

In the Fall of 1952 I was introduced to the MIT (Massachusetts Institute of Technology) community and what a shock that was. I took a course in Theoretical Physics from Professor Robley Evans and I remember meeting over coffee with a couple of classmates. We were discussing a homework problem and one fellow started working the numbers on a napkin. He used the value for Planck's Constant in the formula. Can you imagine? Here is a guy who had memorized the numerical value of Planck's Constant! Recovering from my amazement, I immediately knew that I was in the big leagues.

On our first quiz my score was "18". The class average was "21". This was a far cry from my Dean's List scores I was used to pulling down. I persevered however and, in the one year that I was a full time grad student, got all "B"s in my courses which for me was outstanding.

5.3 Cape Cod System

To put bread on the table and pay the rent during the period 1952-1954 I worked as a programmer at the MIT Digital Computer Laboratory. The work was on a Lincoln Lab project called the Cape Cod System. The Whirlwind I computer was used as the first on-line, real-time application of the digital computer. There were less than 50 programmers working on this system. Ken Olsen and Harlan Anderson, founders of Digital Equipment Corp. (DEC), were also working on the project as hardware engineers.

There was a large range radar at Truro on the end of Cape Cod and many gap filler radars scattered around New England. The system took the radar data which came in over phone lines, converted it from range, azimuth coordinates to X and Y coordinates and displayed the data on a large console on the face of a Cathode Ray Tube of about 20 inches in diameter.

Tracks were established by the computer of returns from aircraft. The data was correlated with known flight data. Those that correlated were termed “Friendly”. The others were “Unknown”. Isn’t it curious that on 9/11/01 the Friendly were the Enemy?

In a simulated military situation, jet fighters were scrambled from Otis Air Force base to intercept the Unknowns. The computer calculated and transmitted to the pilot heading instructions for either a head on interception or an interception from the tail.

The lessons learned from the Cape Cod System went into the design of the Semi Automated Ground Environment (SAGE) system—our nation’s air defense system. IBM was selected to be the equipment builder, they were taught how to build magnetic core memories, and the rest is history.

I left MIT on December 15, 1954 to start my own business while going to graduate school full time and I haven’t had a steady job since.

5.4 First Independent Contract

Even though I had a BS in Physics and a Masters degree in Mathematics, MIT was paying me less than \$5,000 per year. They gave me a raise and I was still making less than \$5,000 per year. Furthermore, I had a wife, child, and cat to feed and my tuition was costing me \$400 per semester for one course.

I figured that something had to change. Therefore, when I heard that Meteorology Professor Austin needed someone to program some meteorological equations for him I met with him, made a fixed price bid of \$4 per hour for 1000 hours, and he accepted it. I then left steady employment on December 15, 1954. I can remember programming in the MIT library since I couldn’t afford an office and it was nice and quiet there. I never looked back even though I grossly underestimated the length of time that it would take me to finish. However, I persevered and did finish the work. Thereafter I had completed my first complete project as an independent consultant and I had my first job reference.

However, before I started Professor Austin's job I was detoured into another effort. (Section 5.5) That first year, 1955, I consulted with Humble Oil in Houston (Section 5.6) and I also consulted with Arthur D. Little in Cambridge. My earnings totaled \$18K by the time the year was through. The following year I earned over \$25K since I became heavily involved in work at the Avco Everett Research Laboratory making \$12.50 per hour. (Section 5.7)

Note that in this work the term "K" will be used to connote "thousands" of the item being described—whether it is dollars or memory. This is a slight misnomer since K in computer terms is really referring to two raised to the 10th power or 1,024.

5.5 Nuclear Reactor Design

Charlie Adams and his group wrote a compiler called the Comprehensive System of Service Subroutines or CS. They then improved it, gave it the label CSII and made it generally available to programmers. My first experience with it was also my first job as an independent programmer in 1954. Professor Benedict, then head of the Nuclear Engineering Department with Professor Pigford, wanted some equations solved that were critical to the design of the type of nuclear reactor to be built at MIT.

Graduate student Marius Troost and I set about the task of solving these equations on WWI. We only had two weeks to do the work since the contract was to be let for building this reactor and these equations must be solved so that they could determine which type of reactor would be the safest for Cambridge. I was able to obtain top priority due to the importance of the work to MIT. That meant that I could get on and off the computer whenever I was ready, stepping in front of others in the queue.

We then began one of the most intensive two week periods of work that I ever experienced. There were several days in which I did not sleep at all—working 24 hours continuously. Without the benefit of CSII, we would not have been able to complete the work in that time period. We finished on time and the design process

went forward. I often think of that experience when I drive past the reactor on the campus just off Massachusetts Avenue. There have been no major problems to date.

Marius who was a student at the time with no programming experience learned a lot as well. In addition to working with me he performed hand calculations to check on what was coming from the computer. He went on to a noble career working with General Dynamics in San Diego. I went on to build a successful computer company.

5.6 Humble Oil

In the Spring of 1955 I was interviewed in a hotel room in New York by a Vice President of Humble Oil named William Rust. He was an MIT graduate and he was referred to me by Jay Forrester. He told me that he was interested in a study to address the application of these new digital computers to the field of oil exploration. I agreed to go to Houston that summer and work with Humble.

I had never been to Texas before and it was a very interesting business and cultural experience. So I packed up the family and we flew to Houston. My first impression of their scientific equipment was one of amazement. I had just come from what I thought was a progressive computer laboratory filled with the latest equipment. However the equipment at the Geophysics Laboratory at Humble was considerably more advanced.

For example, they had very sensitive seismic equipment whose readings were hung along a wall and one could "see" the structure of the earth below the surface. What one looked for were salt domes—rock impervious to the oil which gathered underneath the dome. These were clearly visible, when they occurred.

The professional journal for the industry was called Geophysics Research and I read all of the journals in a very short time. There were practically no articles on the use of computers. As a sign of the degree of modernism that those in the business were willing to

share with others, there were pictures of equipment but they were being transported in horse-drawn wagons.

With respect to their geophysical research, 90% of every research dollar was being spent on seismic exploration and 10% was spent on the detection of gravitational anomalies. In seismic, they would string a set of geophones and then detonate a stick of dynamite in the center. They recorded the resultant reflections on magnetic tape and on seismographs. For the gravity work they had a spring made of quartz crystal which was so sensitive that it could measure the difference in the gravitational constant from the top of a desk to the floor. At the end of the summer I submitted a report detailing suggested digital techniques and algorithms for processing the data from each procedure.

Culturally, Houston was an education and a half. I still remember my experience in the supermarket when I noticed two drinking fountains—one labeled “White” and the other labeled “Colored”. Out of curiosity I turned on the colored fountain in order to see what color the water was. The manager came over and brusquely told me to leave the area.

We visited the Houston Art Museum one Sunday afternoon which turned out to be in someone’s former residence. I recall there being one lone painting in the center of a whole wall. Air conditioning made the intense heat bearable. The outdoor phone booths were air conditioned. Even a dog house had an air conditioner on it. Then there was the drive that we took through the exclusive River Oaks section where we read the mailboxes of the two Hogg sisters—Ima and Ura.

But there was a tender trap side to the picture. I can remember the head of the department for which I worked telling me there was no way that he would move back to New Jersey. He was being paid \$75,000, a very large sum at the time, and could not afford to change his life style. The worst thing that can happen to an oil company is that they lose one of their top technical people to a competitor. Therefore, they pay them very high salaries to keep them in the fold.

5.7 Avco Everett Research Laboratory

After spending the summer of 1955 in Houston I returned to Boston and consulted with the Avco Everett Research Laboratory (AERL) on the heat shield design to solve the reentry problem. Dr. Arthur Kantrowitz, an Aeronautical Professor at Cornell, had convinced the Air Force that he could build a shock tube to duplicate the heat of reentry. When a body enters our atmosphere from outer space (a process termed reentry) the heat generated is so intense that the material physically dissociates molecule by molecule. We see evidence of this effect when we see what we call a falling star.

Dr. Kantrowitz obtained the Air Force funding under the umbrella of the Avco Corporation and established a laboratory in Everett, Mass. with some of his former students—Mac Adams, Fred Riddell, et al. The goal of the lab was to design a protective heat shield to absorb the heat of reentry and allow us to safely bring back a satellite and, eventually, a manned spacecraft.

The shock tube was a copper tube about 12 inches in diameter and about 100 feet long. At one end would be built up a great pressure of gas behind a metal membrane onto which was etched a large X mark. This ruptured after a designated build up of pressure and the shock wave would travel down the tube and hit a target model of the heat shield that was being designed. The time until the target dissolved was about 100 milliseconds. Thus the heat of reentry was duplicated experimentally. Various shapes and materials were used to determine how they would fare during these simulated reentry experiments.

The computer work was to refine the theoretical basis by solving a set of partial differential equations that had not been solved before. In so doing we were able to determine the heat transfer through the boundary layer. This was the very thin layer around the reentry vehicle wherein the normal laws of fluid motion break down [specifically, LaPlace's equations]. The mathematical work involved an incremental solution of the partial differential equations where the increments were very small. Then when the end points of the

range in question were reached, the initial conditions were changed in proportion to the results. This iterative procedure would take of the order of an hour to run until each set of initial conditions converged to a solution on the relatively slow IBM 650 drum computer.

We did not have a computer to work with but there was an IBM 650 at the John Hancock Life Insurance Company in Boston. I requested an appointment with Robert Slater, then President of the John Hancock, and asked his help. I told him what we were doing and how important the work was to the nation's space effort. He agreed to let me use their computer so long as it did not interfere with their use of it. This meant starting when their evening work was completed—about 10 PM—and working until they started in the morning—at 8 AM. I would bring in our own IBM punched cards on which were our programs and our data. It's amazing how much like a pillow a box of IBM cards feels when you are tired. I remember setting up a long run and then catching 40 winks on the top of a desk or cabinet with a box of cards as a pillow. Weekends were great. I could work all day Saturday and Sunday during the daytime instead of at night. This work went on for about eighteen months until completion. Since Slater would not accept any money, when it was all over I wrote him a letter of thanks telling him how important his contribution was to our country's space efforts. I also enclosed a framed signature by "John Hancock" which I got from a dealer in New York. Ken Olsen later told me that he had hung it prominently in his vestibule at his home in Weston.

While working at night, I eventually began to get hypnotized by the chunketa—chunketa—chunketa of the card reproducing punch. After a progressively shorter period of time, I felt myself going into a zone where there was only the computer and me—I was aware of nothing outside. When a guard would walk by, I would jump up about 2 feet from the startling intrusion into my entranced world. I also attribute my lack of hearing in my 60s and thereafter to the collective noise from all the computers I worked with through the years.

This work was so important that the Air Force wrote two contracts—one with AERL and one with Douglas Aircraft out on the West Coast. One of the reasons that we beat Douglas was because we had access to the computer and could correct errors as they occurred. Douglas had a much more expensive IBM 701 but their programmers would have to share the time with others and so did not have the luxury of getting on and off the computer at will.

The programming was in machine language and I can remember counting fractions of drum revolutions and placing the instructions around the drum so that they could be executed optimally in the time that it took for the drum to revolve a given distance.

I was usually working alone but occasionally some of the AERL folks would work with me to see how the results were coming out. The job and the hours were not without their humorous moments. I can remember the night that Dr. Fred Riddell called his wife Margaret at 4:20 in the morning to assure her that everything was all right and we would probably be at the computer all night. Dance music suddenly coming over the loudspeakers cast doubt on Fred's story about working all night. The John Hancock used to pipe in dance music at 4:20 PM since the staff was predominantly female and someone probably in what was then called the personnel department told them that the music was a good idea since it would make everyone happy when leaving work. However, the music also came out at 4:20 AM as Fred found out. Later, in the morning, MIT Professor Jay Fay who was working with us told Fred—"I'll write you a note telling Margaret where you were all night." Fred's reply—"You may have to."

At the lab, safety was an issue. With all of the high temperature gases and the high pressures built up to make the shock wave go down the shock tube there was plenty of cause and concern for safety. In fact, there was a safety engineer—a person whose total job was to look for things that can go wrong. However, the only accident in the two years while I was there was during a Christmas

party when one of the Northeastern students was sitting on the glass table used for drafting and the glass broke. The student was rushed to the hospital to remove glass splinters from his derriere.

After this work was completed and computers became easier to buy I advised AERL on their installation of their own IBM 650 which they used for administrative as well as scientific use. I was given a bright young mathematician to work with named Calvin Keeler who wanted to learn how to program. After a few preliminary discussions with him about what programming and the computer were all about he and I did the following.

I took a relatively simple program such as payroll and asked Calvin to literally look over my shoulder as I wrote the program. I explained to him why I was taking each step. I then gave Calvin an assignment and reversed positions with him. That is, I looked over his shoulder while he wrote the program and we talked about various steps in the procedure. That was all that was necessary. Calvin then began to write programs and would only occasionally bring a problem to me concerning which we would have a discussion and derive a solution. I felt really good about that and was amazed at how easy it was to train a bright and motivated student. There was no elaborate classroom or text exercises to wade through. We just sat down and did it. There is probably some fancy Greek scholar—Socrates or whomever—who has appended his name to the method we used but to us it was intuitive. The teacher does the job with the student observing. Then the student does the job with the teacher observing. Then the teaching is done. It was almost like basket weaving—but a lot more fun.

5.8 Derivation of Mouse Tracking Principles

When I first saw and took apart a hand held mouse as an input device to the PC it reminded me of an invention that I encountered in 1951. My first job out of college was with an Army Operations Research group at the Frankford Arsenal in Philadelphia (Section 5.1). My boss was Dr. John Tappert, a brilliant scientist and engineer. Our group was concerned with Fire Control Instruments—

those devices used to control the firepower of the military unit. The way that an anti-aircraft gun was positioned to fire was to have one person turn a set of cranks to move the gun in azimuth while the other person turned cranks to move the gun barrel in elevation. Occasionally you can see this operation in some old time war movies. In the movies the gunmen shoot down the attacking warplanes. In practice, this rarely happened. At best, the guns kept the planes far enough away so that their aim was poor. This fire control was cumbersome at best and resulted in relatively poor performance.

Dr. Tappert reasoned that the job would be better done if control were done by one person. He took a bowling ball the size of a grapefruit and attached two rollers to the bottom at right angles to each other. From these rollers he took the azimuth and elevation readings. Thus, the gunner was able to use his thumbs and move the ball in a slewing motion. The gun barrel would take these motions and slew across its range of motion.

The concept of taking motion in two directions off a rotating ball is used in the present day mouse. If one looks at the bottom of a mouse, one sees the ball that rotates to give motion to the arrow which can be taken across the screen in both horizontal and vertical directions at the same time. By unscrewing the base plate and dropping out the ball, the rollers at right angles to each other are visible. Although Doug Engelbart from Stanford got a patent on the mouse and is generally credited with being its inventor, in fact the tracking from a rotating ball principles were established in the 1950s by Dr. John Tappert from Philadelphia.

5.9 Pushbutton Dialing

One day while working at MIT in the 1952-1954 period I got tired of the long time it took me to dial a phone number so I took the phone apart to see how it worked. I noticed that it only counted pulses while on the back part of the dialing cycle. This made sense to me because each person dialing the phone rotates the dial at their own speed but the return motion is performed at

a constant speed in a regulated manner and thus one can form and send pulses uniformly.

However, I was frustrated with the length of time that the whole process took of cranking around the dial, then waiting for the dial to return to its normal position for each digit. I reasoned that there should be a better way to dial if one used pushbuttons instead of the dial that was then ubiquitous. We had a lot of experience with pushbuttons in putting information into the digital computer and I thought that pushbutton dialing made a lot of sense.

I took my idea to my supervisor and told him that since I had conceived of the idea while on the job, I would be pleased to assign patent rights to what I considered to be an invention to the Institute. He thought about it for a while and told me that in his opinion there was no basis for an original patent since the jukebox people would have that field covered in their selection of records by pushbutton. He told me to go back to work programming which I did. After all, who was I to question the wisdom of my supervisor? He was older and smarter than I was—he was the boss.

If I hadn't listened to him but proceeded anyway, both MIT and I would have been well off from the effort. A royalty for every phone that uses pushbutton dialing would so fatten the coffers of MIT that they could afford plenty of scholarships to educate their students. Inventors then and now participate to the amount of 10% of the royalties received by the Institute.

5.10 Light Dimmer for Wall Switch

I can remember having the idea of installing a rheostat in a wall switch to vary the brightness of incandescent lights. I recalled from my Physics laboratory experiments that one could control on a continuous basis the brightness of a light by the amount of resistance in the circuit. However, I never pursued that idea and it lay fallow for many years. Then when I saw it on the market I felt bad that I had not done anything with the idea. I thought of at least applying for the patent. However, the cost of the patent, around \$10,000 which would have been two years salary, made

such an application prohibitively expensive. Today, thanks to the efforts of a Boston patent attorney named Rines and others, an inventor may file a preliminary application for a patent by sending in his idea to the US Patent and Trademark Office (USPTO) plus an \$80 application fee. He then has one year to find funding for the idea and for filing a full blown patent application.

5.11 WWI Story—Apple Pie

The best time to work on the computer was when no one else wanted it—late at night. At this time, one could run one’s program up to a certain point, find an error and fix it, and then proceed. If one had to wait a long time between runs, as one did in the daytime, it would take a relatively long time to check out a program. Thus one could get a lot of work done by having the ability to get on and off the computer frequently. This could only be done in the off hours.

One night I was on a schedule, finishing off by midnight.

My wife had brought over an apple pie that she just baked in Boston. She said that the bus driver could smell the pie and wanted some. However, she brought it into the computer room intact. After thanking her, I asked her to sit in the only comfortable place—the ladies room, where there was a couch, until I finished working.

The technicians who were responsible for fixing the computer if it was down used to lounge in the ladies room while waiting for some problem to occur. Suddenly, one of the technicians burst into Test Control and shouted—“There’s a LADY in the LADIES room.”

To which I replied, “That’s no LADY, that’s my WIFE.”

True story.

5.12 Sheldon Best

One of the writers of CSII—Sheldon Best—left MIT to join the IBM effort in New York to write FORTRAN—certainly the most powerful and frequently used scientific compiler in its time.

Sheldon was from Illinois and he was a pure programmer. I can remember one lunch time we walked to the Harvard Trust bank to deposit our payroll checks. I waited so long for him outside the bank that I asked him what was the delay. He answered that he kept his checkbook in Octal and he was making the conversion from decimal to octal.

His filing system was great and involved only two drawers in his filing cabinet. Anything that he received in the mail or via interoffice memo went into the top drawer. At the beginning of each month he moved everything in the top drawer down to the second drawer, after throwing everything in the second drawer into the wastebasket. He figured that paper and its content only had a lifetime of two months.

Sheldon came to my home for dinner one night and proceeded to cut his spaghetti with a knife and fork—the only time in my life that I ever saw anyone do that. He also carried on a chess game with a friend from Illinois. They would send each move in turn on a single post card. I'm sure they are now using the Internet and the games are much faster.

5.13 Grace Hopper

It was 1955 when I first met Grace Hopper. I was consulting with Arthur D. Little in Cambridge and wrote a program for the UNIVAC computer. It was a relatively brief routine that I wrote for the purpose of comparison with another machine on which I had written the same routine. I wanted to check it out on a UNIVAC and there were very few of them around—none on which I could buy time. Someone recommended that I call and ask her help. I found her very easy to approach.

She invited me down to Philadelphia to try out my program. I can recall going to the second floor over the PEP Boys (Manny, Moe and Jack) warehouse where the UNIVACs were being assembled. Testing time was after hours and I recall meeting her and Mary Hawes. They were the principal COBOL developers

with Grace being the spokesperson for the language, as well as for programmers in general.

My program was written in machine language since COBOL was under development. The program did not work the first time, of course, but the experience was so exhilarating that when I left I took the Elevated the wrong way, going West instead of East—understandable behavior at 5 AM.

We had a second meeting when she was in Boston for a computer conference and I invited her to dinner at Locke Obers. I recall that she ordered duck under glass. I had the habit in those days of spooning vanilla ice cream into my coffee for dessert. She commented that her grandmother had that same custom. We had a truly memorable evening talking shop and sharing experiences. She showed genuine interest in what I was doing in building my company.

I remember her telling me the story of one of her critics complaining that her COBOL programming was so easy and effective that it would eliminate the requirements for programmers. Their argument was that once a payroll program was written there would be no reason to write another payroll program. As if on cue, the city of Philadelphia helped her cause by changing the rates and the formula for computing the city tax. In Philadelphia the city taxes payrolls if you work within the city limits.

A third meeting we had was near the end of a computer conference in some city and we both sat down for a drink and a rest. She asked what we were up to and I brought her up to date with some of the more interesting things in which our company was involved including our space work. It was at a time when our nation was having difficulty launching anything successfully. I told her about the Canadians who were able to achieve orbit when they launched a grapefruit sized meteorological satellite by shooting it into orbit through a smooth bore artillery piece. Her response was—"That's just what I feel like—a smooth bore artillery piece."

Another time she appeared on the David Letterman show carrying a few segments of copper wire, each about 10 inches long.

When he asked what that was she explained, “That is a nanosecond. That is how long electricity will travel in one nanosecond.” I don’t remember his response, nor do I remember why she was on the show, but I do remember my feeling that the show’s producer was casting pearls before swine.

The last time I called her I was told that she was retired and seriously ill and not taking any calls. I later read about her in the newspaper where her obituary mentioned her life’s work but missed the essence of one of the truly great people in the computer world.

5.14 Industrial Publications Corp.

An example of how quickly technology can change the work environment was our experience with our printing company. One of the things that bothered us after our first government contract was the length of time it took to have the final report published. It took weeks, including corrections. There had to be a better way.

We hired Al Nelson, the guy who did the printing for us and formed a new business—Industrial Publications Corp. The company performed about 50% of its work from outside customers such as Raytheon and 50% from Wolf R&D Corp. It solved our time delay problem and gave our programmers first priority on getting the job done expeditiously. This went on for a few years until the Xerox came along. The government accepted Xerography both in final reports and in proposals where the timing was critical. Since the turnaround time was immediate, our engineers and programmers didn’t need the publications company any longer.

So we closed down operations, paid all the bills, and terminated the company. Funny, I even remember what it cost us to close down—\$18,000.

5.15 Hooper Holmes

It was in the late 1950s when we were first visited at our offices in Boston by Theodore (Ted) King, President of Hooper Holmes, Inc. of Moorestown, New Jersey. His firm was engaged in various

activities of gathering investigative data on individuals for the insurance industry. Ted and his associates had concocted the idea of creating a computer-based file of dead beats directed toward aiding the direct mail industry.

Columbia Records, Grolier's, and other direct mail companies routinely place ads in the newspapers seeking people to join their book, record or other programs. To those who respond they mail a book or record of the month with the agreement that the customer will mail them a check to pay for the items. This was before the day of credit card payments, so customary today. Deadbeat customers would receive the merchandise and never pay. It is not worth the effort to pursue in court the return of an item that might cost of the order of \$20.

Ted envisioned a computer-based deadbeat file against which the results of an advertising campaign would be compared to identify those who had failed to pay in the past. This sounded like an intriguing computer application so we agreed to work with Hooper Holmes on establishing this "Credit Index". Someone thought that this would be a better name for it than what it was—a file of deadbeats.

The first thing to be established was which computer on which to program the application. From other experiences and general knowledge of the two, we preferred the Honeywell "H200" to the IBM "IBM 1401". It was much more powerful, less expensive, and at least as reliable. Ted's New Jersey IBM marketing men refuted our decision and leaned on Ted to maintain the continuity in what was an "IBM shop". That is, all of the other equipment at Hooper Holmes was IBM owned. At that time, it was popular throughout the business to take the safe route and select IBM, especially for new applications. The argument that one heard time and again was—"You can't go wrong if you pick IBM". A paraphrase of this feeling is—"If it can't be done on IBM, it can't be done." More hogwash. At one time I told people that I make my living refuting the lies told by IBM salesmen. This was fact, not prejudice. To his credit and very satisfying to us, Ted had the courage to support our decision.

We then set about our work of establishing the formats, writing the comparison programs, etc. Our project director, Richard Tear, surmised that the sort of person for whom we were designing the file would change their names, to escape detection, but would be less likely to change their addresses. Therefore, we keyed on the addresses for comparison purposes. This enabled us to pick up on fraternities, sororities, and other places of fun-loving no-payers.

The running of the program against real data also revealed one fellow who had a "tree" complex. That is, from his same address he would send in an entry with the names—Mr. Peachtree, Mr. Appletree, and Mr. Peartree, none of which worked. Another chap would mail an entry on different days of the week—one on Monday, one on Tuesday, one on Wednesday, etc. He got a letter from the customer's Vice President of Circulation stating—"You can try until doomsday, Sir, we have your number."

Hooper set the price at \$.05 per name and address checked. Therefore, if we found at least one deadbeat in 20 entries, there would be a savings of \$1.00 to justify the application. This was the correct price and the application worked like a charm, thanks to Ted and his sales force carrying the message to the industry.

One interesting feature was the importance of the Credit Index Master Data File (of deadbeats). As Ted's sales force approached each new prospective client one of their strong selling points was that if someone was a no-payer for someone else, his or her behavior would undoubtedly prevail for the prospective customer. This merging of deadbeats made the file become more valuable as time went on. To ensure that it would be preserved in its early stages, our programmer would bring a magnetic tape containing a copy of the file home with him to his house in Boston each weekend when he came home, taking the old file back for updating. It may sound crude in the age of computers but it worked and we never lost a copy.

In the 1980s Ken Rossano, Ted's brother-in-law and a former Senior Vice President of the First National Bank in Boston, called me and said that Hooper Holmes was setting a new direction for the firm and therefore wanted to sell the Credit Index application.

He knew that we had established the application and would be able to appreciate its value. I can remember feeling frustrated because it was a cash cow but I did not have the funds or backing to make an offer. It was eventually sold to a management team who are now operating it very successfully, I have been told.

5.16 IBM Tactics

Back in the 1950s when IBM owned 80% of the computer market, IBM salesmen were tenacious in their approach toward grabbing more sales.

When the Air Force Space Track programming and operations contract went out for competitive bid, our bid of \$64K per month was less than 8% lower than IBM's bid and about 15% lower than that of General Electric. We were ecstatic that we outbid the giants by such a close margin. We wanted the business so badly that we would have taken the job for much less but our Price Waterhouse auditing consultant advised us to bid the \$64K amount. This gave us financial latitude to make some mistakes in our staffing estimates and still come out ahead.

When IBM learned of the results of the open competition they decided to employ a typical IBM dirty trick. They passed the rumor to the Air Force procurement folks that I was having a nervous breakdown.

The next thing I knew I was called by Carmen Iadonisi (nicknamed "ID"), the head of the Air Force Hanscom procurement office who wanted to talk with me personally. I was tipped off by one of my computer operators as to the purpose of the meeting. The Air Force was required to check out the truth of the rumor. They could not award the contract to any company about whom there was a question of performance.

This was one of those experiences that confirmed that insider expression—"the operators always know." They know everything that is going on in a computer installation, perhaps because they are the human interface between the computer user and the machine. We stressed personal service and when the government

technical personnel were in a bind to get work out in a hurry, we tried our best to support them.

Returning to the IBM ploy, I dressed appropriately for my meeting with ID, the procurement director—neat, clean, but not too spiffy. I can still remember our conversation even though it was held in 1958. At the appointed time I showed up, shook hands and accompanied ID into his office—just the two of us.

He told me that he had heard that I was having a nervous breakdown and asked me if it was true. I replied—“No, but if I have to deal with you much longer, I will.” We both laughed and chatted about our new contract and how important it was to us and to the Air Force space effort. This was before the days of NASA and the Air Force had the prime responsibility for space activities. Project Space Track was set up to track all earth orbiting objects. ID was satisfied and I left.

When I returned to my office in Boston, I called the head of the Boston IBM office, Paul Knaplund, and asked him to come over. I also told him why I wanted to see him. He and one of his salesmen showed up the next day and I invited them into my office to meet with me and one of our Vice Presidents—Dick Jenney. I told them in detail what had happened and the legal steps I would take if IBM spread any more lies, rumors, or innuendos reflecting on me or my company. They apologized profusely and promised that it wouldn't happen again. I noted to myself that they didn't deny it.

So, what did IBM do with Phil Bradley, the manager of the Cambridge office who was behind it all? They gave him a promotion and transferred him to Washington, D.C.

5.17 Federal Reserve Work

We were invited to write some programs for the Federal Reserve Bank (Fed) in Boston. They constituted comparing individual bank statistics with others in the region as well as with national averages. I was impressed with the tightness of their security back in the 1950s but also with the modernity of their equipment.

On tour of the Federal Reserve Bank in New York I was told that the reason why our founding fathers decided on a national currency was because there was too much counterfeiting being done—especially in Massachusetts. I wondered what the crowd would be told on a tour of the Boston branch.

On my first sales call to the Fed in Boston I noted a quotation on the wall from the Act of Congress establishing the Fed. On the bottom right hand side were the words: Carter Glass. When I met with our client, whose first name was Ted, I asked him what kind of glass is the Carter glass that I noted in the lobby. He explained to me that Carter Glass was the name of the Senator who wrote the law establishing the Fed.

Then he covered my embarrassment by asking me what kind of animals live in the Jordan Marsh? Jordan Marsh was the name of a large department store in Boston, now owned by Macy's.

5.18 Flash Data Triangulation

Before our age of satellites, back in the 1950s, we had a contract to work with the Air Force Cambridge Research Laboratories (AFCRL) to attempt to determine the relative distance between the three continents—North America, South America, and Africa.

From a geodetic survey point of view, the continents were pretty well surveyed. What we didn't know with any reasonable precision was where the continents were with respect to each other.

The program we were working on had been struggling for years in trying to launch a rocket and trigger a set of flashes that would be visible from the 3 continents. The plan was to photograph these flashes against a star background. From these data, employing triangulation, we could measure the relative distance between three land stations—one positioned on each continent.

There was a very expensive camera at each site called a Baker-Nunn camera. This camera had a very large lens which enabled one to photograph the flashes since they were pointed at the spot in the sky where the flashes were to take place.

In the past, something always went wrong. If it wasn't bad weather, it was equipment failure such as the launch aborted, the flash didn't work, etc.

Finally, on the last attempt to conduct this experiment there was a successful launch of a rocket from the Wallops Island launch site. The rocket climbed to altitude high over the Atlantic on schedule. The weather was clear. The flashes went off as they were supposed to and to everyone's expectation, results were finally envisioned. And it was just in time because the program had run out of money. Furthermore, any future experiments were destined to be run using satellites containing the flash mechanisms.

Everyone anxiously awaited the pictures from the Baker-Nunn cameras. The ones from South America were perfect, as were the ones from North America.

However, the films from Africa were totally blank.

The problem?

An Airman had forgotten to remove the lens cap from the camera!

Now, annually, the AFCRL published a report on their research for the preceding year. I always admired what the Director of the Laboratories wrote in summing up the work done on the Flash Rocket Triangulation program. I can even remember his words—"Technical difficulties precluded the gathering of any meaningful data from this program."

5.19 Aqueduct

We negotiated a contract referred to us by Honeywell to operate the pari-mutuel betting computers at Aqueduct Race Track in New York. The programming was done by the customer and it was our job to operate the computers faultlessly. The software was programmed to operate on one computer. For the sake of backup an additional computer was installed. Then to be ultra safe a third computer was added. The customer was an Australian company which provided betting equipment and service to race tracks around the world.

Everything was going swimmingly until one fine day in August when a programmer from the Australian company came on the scene and asked if he could install new software. Our operator who was very experienced with computers said, simply “NO!” very firmly “not during track operation”.

The programmer then appealed to a higher authority who overruled our operator. You can’t imagine what happened. Not only did he knock out the third computer, he also affected the second, and, of course, the primary operating machine.

The track was shut down for over an hour and there were unhappy campers all over the place. It made the front page of the New York Times and from that date forward no changes were allowed during operations.

The important lesson learned from this story is not the malfeasance of the Australian programmer, although his was bad behavior that needed to be reckoned with. It is the realization that without computers there was no way that the track could operate. That is, their pari-mutuel computations and display of odds, etc. were so computer-dependent that they could not return to a manual system—either in an emergency or when planned.

5.20 Pat McGovern

One of the computer people that I have always had a lot of respect for is Patrick McGovern, an MIT graduate of the 1950s era. After graduation he worked for an accountant in Wellesley named Edmund Berkeley who was so taken with computers that he founded a monthly magazine—Computers & Automation. Pat left and formed his own company that he called International Data Corp. (IDC) based in Framingham, MA. His first publication was Computerworld a weekly newspaper that was the most knowledgeable computer publication in the early days. His reporting of events such as what was new at computer shows was accurate and incisive. Consequently, his publication was considered *the* authority and was often quoted by other media. Today IDC is

an international news conglomerate producing Computerworld, PC World, Macworld, Network World, etc. in 85 countries around the world.

He also had one of the earliest active and useful databases listing the computer installations by application and geography. This was very useful if one wanted to contact the decisions makers and operators of the country's mainframe computers.

One of the most remarkable things about his career path is that he never took the company public, preferring to keep it private and independent of any outside investment interests. Yet, the company grew. Recently, Forbes magazine claimed his net worth to be two billion dollars.

A few years ago, he and his wife committed \$350 million over twenty years to MIT to found the McGovern Institute for Brain Research. This was the largest gift in the history of the Institute.

Section 6.0

The 1960s

6.1 Whirlwind Move

There was a line by Steve McQueen in that powerful movie—“The Magnificent Seven”—when someone asked him why he and the other six gunfighters were there, guarding an obscure Mexican village from the bandidos. He answered—“There was a fellow who took off all his clothes and went running through the tumbleweeds. When someone asked him, Why?, he said—Seemed like a good idea at the time”.

The time was April 1, 1959 when we first approached the Office of Naval Research (ONR) with an unsolicited proposal to lease the Whirlwind I computer. MIT had told the Navy that they had no further use for it and wished to abandon it in place. The Navy was faced with the dilemma of what to do with it. I learned later that one fellow at ONR thought at first that our proposal was an April fool’s joke. Would that it were.

Our thought was that there were several unique features associated with the computer that were not generally available in the open market and that if we had this computer we could perform some research and development work that other companies could not. Most of these ideas centered around the fact that this computer had a large number of cathode ray tubes mounted in large consoles with which an individual could sit and interact directly with the computer. By sampling from one to another, the computer could be programmed to service the needs of a variety of users simultaneously. Another feature that it had was a unit in which a

cathode ray tube was mounted vertically with its face pointing up. Above this was mounted a photoelectric cell which could receive information displayed on the cathode ray tube. These features and others could allow us to perform some things with the computer that no one else was able to at that time. After a lengthy negotiation, the Navy agreed to lease it to us for a nominal rate after we had moved it from MIT and set it up elsewhere. This was said to be impossible to do by many of the experts at MIT.

In a remarkable and unusual offer of cooperation, MIT President James Killian offered us the opportunity to buy the building in which it was housed—the Barta Building on 277 Massachusetts Avenue in Cambridge. There was a stipulation that we sell it back to MIT when we no longer needed it for the computer. The price was established at \$250K and I searched unsuccessfully for the financing so that we could buy the building. After a reasonable period of time (about 6 months) the offer was withdrawn by the Institute. Thus, we set about moving the computer out. Over a period of about 6 months we disassembled the computer and prepared it for the move. The key was to move it in pieces that were as large as possible. This we did by separating it into three large units—two on the second floor and one on the first floor. We labeled and disconnected the wires from one unit to the other. We unscrewed the wireways from in between each of the racks and squoz it together like an accordion.

I can well remember the night when, after interviewing several movers, one of whom wanted to build a steel superstructure around the whole thing and move it that way, we interviewed John Price from the Litchfield Moving company. John is one of those imaginative yet practical people who was not afraid to take on an unusual job. Looking at it, he postulated that the structure of the rows of racks were so overdesigned in terms of strength that they should be able to stand the strain of moving. To prove his point he went out into his car and brought in a jack. We went up to the longest rack—about thirty feet long and lifted one end. Anything might have happened at that point. If the racks were not strong enough the circuit boards which made up the flip flops and other

logical functions could have snapped and popped—destroying those elements and making the whole move infeasible.

However, after several tense moments—the steel structure held, nothing was bent out of shape and we knew that we would be able to use the steel framework of the machine as a carrying structure. John Price was able to quote us an approximate figure for moving which we could afford and we went ahead with the project. My recollection tells me that the price was around \$25K.

We knocked out the brick walls and made a large opening in the side of the Barta Building, moved the three large units by a crane pulling them along the floor over round wooden logs and out of the building. As the crane operator picked them and put them on the truck he estimated that they weighed about 18 tons each. We leased some space from the Navy in the Terminal at South Boston and stored it there for about 2 years while we searched for a place to reinstall it. Finding nothing that worked in the way of an available building we finally decided to build our own building in Concord Mass.

I interviewed The Architects' Collaborative in Cambridge. Gropius was still alive at that time. At a site visit on Route 2 in Concord one of the architects observed that one of their partners—Louis McMillen—lived right across the highway. Therefore, they felt compelled to design something that would be pleasing to his eye when he woke up in the morning.

Bill Geddis and Alex Cjivanovic then designed a structure that was just right for our purposes. The walls were of cement block upon which they used a Swedish process called Bostic for coating and sealing. There were three hoses spraying simultaneously. One hose sprayed sand, the second sprayed a tan color, and the third was epoxy which bound the surface together. The result was a very attractive building. We built three walls, John Price rolled in the computer, and then we built the fourth wall. We then set about the task of connecting the computer back together.

Our Vice President Al Shortell, an EE from MIT, supervised the work and did an outstanding job. I can still remember the trauma engendered by Al's reporting to me one day that we are

experiencing a “silver migration problem.” That is the silver solder was migrating through the plastic board upon which it was mounted from one terminal to an adjacent one, causing an electrical short. This was so serious that it could sink the whole project. I can still feel my relief when one of his technicians came up with the solution which was to take a quarter inch drill and physically drill a hole through the board to interrupt the flow of silver. The board was substantial enough to hold together even though these holes were drilled through it at appropriate places. That is one example of the practical solutions we came up with to solve unanticipated problems—solutions that they didn’t teach at MIT.

I gained a great deal of respect for the Northeastern University students who we hired to work on this project. Both in disassembling it in Cambridge and then again in assembling it in Concord, on a unit of work per man hour basis they were unbeatable. The University had a cooperative program whereby the student went to school for a semester, then worked in industry for a semester, and so forth. Each semester we got a different set of students, some of whom had worked with us previously. I do recall having to make up some stories about the research and development that the students were engaged in because moving a computer did not fit into any of the professional work activities defined by the school.

Unfortunately, by the time we reassembled the computer our opportunities for R&D work had diminished somewhat with the intervening three or four years. We did do some work for the Air Force and some work for Buckminster Fuller on his World Game. In addition, we used the computer to program some of our administrative functions. The computer was also featured in the LIFE magazine article (See 6.15). After we sold Wolf R&D to EG&G the expense of the computer could not be justified. Therefore, I bought back the building and the computer in it. One number I do recall is that the power cost \$2500 per month from the Town of Concord who owned their own power plant.

Finally, when I needed to rent the space to get some income, I and a crew of dedicated men disassembled it and sent it to the Concord dump, preserving historically significant parts such as

the original magnetic core memories which are now in the Smithsonian Museum in Washington and the MIT museum in Cambridge.

What's the bottom line? Over a period of less than ten years we spent about \$250K on the move and our income from selling computer time was about \$100K. Not a profitable project, nor was the time we spent on it well invested since we could have been building our business in other directions. However, I never regretted the move since it proved, once again, that nothing is impossible if you have a good cadre of technically competent people and that most important element for success—persistence.

6.2 Ted Kennedy

In the 1960s Joe Freedman who had done some publicity work for Wolf R&D convinced me that I should apply for the honor designated "Ten Outstanding Young Men of Greater Boston". It seemed like a good idea so I did. The Boston Junior Chamber of Commerce bestowed that honor annually to young men under the age of 35 who had affected the community in a positive way. After an endorsement by James Killian, President of MIT, and some other endorsements, I was notified that I had been selected.

This was quite an honor and I relished it with pride. I found out that the number of awardees was to be eleven, not ten, and they were to include: Dr. John Knowles, General Director of the Massachusetts General Hospital; Boston Mayor Kevin White; and Ted Kennedy.

Since they placed us on the podium in alphabetical order I was the last and I made some joke about just making it. However, years later, one of my friends and I were talking about it and he asked, "Who do you think had enough political power to have the Chamber change the number from 10 to 11?" Not knowing, I asked him, "Who?" He said, "Ted Kennedy, of course. He wanted the award since his brothers had received it before him and he needed some credibility in his race against George Lodge for the Senate seat that Fall."

George Lodge was a featured speaker that evening, yet the best politician of them all [Kennedy, Lodge, and White] was John Knowles. He had the audience eating out of his hand. His humor and presentation were superb and far superior to the others.

6.3 Moving Madagascar

In the course of our work for the Goddard Space Flight Center we were reducing some radar data from the Moon 250,000 miles away. There were three radar sites on earth pointed toward the Moon to receive data. One was located in England, one in California and one on the island of Madagascar. Thus, as the earth rotated, we could be in constant contact with our astronauts as they traveled to and from the Moon.

However, our geodesists noticed that the Madagascar data were displaced from the data received by the other two sites. After pondering the source of these errors they came to the conclusion that the coordinates of the Madagascar radar site must be incorrect. By adjusting these parameters they were able to get consistent data.

Therefore, they concluded, and reported to NASA, that Madagascar was four hundred meters North of where all the maps said that it was. That's about 4 football fields—a significant measure in terms of the cartographers—those who make maps.

NASA crowed about that discovery for a year—in scientific publications, etc.

6.4 Boston Strangler

It is difficult to imagine the paranoia throughout Boston in the early 1960s when murder after gruesome murder by strangulation was committed, always of women, with no apparent clues as to who-dun-it. One could not buy a guard dog or any other kind for that matter. The TV and Press were having a field day fanning the flames of fear amongst females.

Attorney General Ed Brooke stepped in and assigned one of his most able lawyers, John Bottomley, to coordinate the effort to find and stop the Strangler. One of the members of his team was a representative of the District Attorney's office—Julian Soshnick, a current neighbor.

One of the most significant things Bottomley did was to pool the evidence. Since the stranglings occurred in different towns under different police jurisdictions there was no central depository of the evidence. He also got the Police Chiefs to meet and talk with one another about what was happening.

Another thing he did was to respond positively to my offer to volunteer our assistance to the Attorney General in any way we could. Thus, we sent in a small team of computer people headed by Sandy Isaacs who was one of our best consultants.

Sandy tells the story about one of the meetings of Police Chiefs, convened to meet Peter Hurkos, the mystic, who was also called in to help. One of the Police Chiefs was late and apologized, mumbling something about traffic. Hurkos looked at him and said that it wasn't the traffic that delayed him. He described the hotel room, what she was wearing, and who pulled down the shade. The Police Chief turned very red in the face and just sat there, confirming the Hurkos description. This story was confirmed by Julian who was also there. Hurkos was a very scary guy to be around. But, in the end, he couldn't do anything to help.

One of the things we insisted upon was anonymity. Tensions were very high and we did not want a kook coming to our building in Concord and throwing a rock through our window. However, we did allow a TV crew to take footage of some cards being sorted to represent a search for clues. This was shown on the evening news and newspaper stories were written describing an anonymous computer company that was using the computer to track the Strangler.

Then, an amazing thing happened—

The stranglings stopped!

In subsequent discussions about why they stopped—it was apparent from the evidence that not only was there a Boston Strangler but there were imitators. How could one tell? The knot was tied differently. And, as we found out later, Albert de Salvo, the confessed Strangler, was behind bars on other charges.

As it turned out, that was the end of the stranglings.

We surmised, I believe correctly, that the publicity about the computers stalking the strangler scared the imitators off the streets and de Salvo being incarcerated ended the whole episode. I never before realized the power of the computer in the minds of the public. We will never know, of course, but it was our opinion that the public's perception that the computer would find the Strangler, fueled by the news media, frightened the imitators and a nervous calm was gradually restored.

As it turned out, there was no way that we could do anything to solve the crimes. In the apartments of those strangled there were various phone numbers written on scraps of paper, etc. In one case, investigators found in the bathroom torn off pages from a directory which was reconstructed to be the West Suburban directory. We talked about putting all the telephone numbers in the computer and searching for matches. However, we never got that far.

We found out later that de Salvo would leave work on a construction site in Revere at the end of a working day, cross over the bridge into Boston, ring a doorbell at random posing as a handy man that the landlord had sent, and murder a woman in a most terrible way which I can not bring myself to repeat to the reader even though 40 years have passed. He would then go home and sit down to supper with his family in Woburn. Since his hits were random there was no correlation that we could possibly have made from the evidence in the apartments.

The Strangler was a real baddy. I couldn't sleep nights just thinking about the gruesome, perversely sexual things he had done to women he didn't know who were helpless victims of his sick mind.

What the whole experience taught me was the power of the computer (as amplified by the TV and the press) in the minds of the public—at least the segment of our society who were willing and able to imitate the stranglings for whatever joy this behavior held for them.

When it was all over, we were privately commended by Brooke's office and we had a very good feeling about our work and its effect. In his final report on the subject Brooke mentioned the possible future uses of the computer in the field of criminal detection and apprehension.

Today the FBI is able to file, find and transmit over phone lines the criminal's fingerprints with the aid of the computers. Technology is also available for the authorities to match face and voice images as further tools for detection and prevention.

6.5 Magnetic Core Dispute

Back in the early 1960s R.J. Horn called me one day to discuss a problem on which he was working. Over lunch he described a serious situation at MIT. It centered around the magnetic core memory that Jay Forrester had invented as a primary storage device for the Whirlwind Computer. Forrester had patented it and assigned the patent to MIT, as was and still is the custom. MIT was a member of a consortium of colleges and universities which relied upon a New York company called the Research Corporation to take its patents and write royalty agreements with commercial companies. Succinctly, the Research Corporation had just mucked up a negotiation with RCA over the core memory by asking too high a royalty—insisting on something like \$.10 per core when RCA was only willing to pay \$.05. RCA then took a serious look at their forecasted use of cores and withdrew from the negotiations altogether.

The leading manufacturer of computers with over 80% of the market was the International Business Machines Corp. (IBM). There was a dispute between MIT and IBM as to what royalties

IBM should pay MIT for a license to use the Forrester patent. This dispute was so serious that Thomas Watson, President of IBM, had resigned from MIT's board of trustees; and James Killian, President of MIT, had resigned from IBM's board of directors.

RJ had left his job on the Whirlwind computer project to become a patent attorney with Kenway Jenney—one of Boston's most prestigious patent law firms and MIT's patent counsel. He asked me if our company—Wolf R&D—would take a look at the present magnetic core population and forecast what the population might be in the future. I agreed to do so and estimated that it would cost \$25K and take about six months. This was at a time when our commercial rate was \$12.50 per hour. During the course of the next six months we studied the problem and wrote a final report.

The first thing we did was count the cores in existence at the time. We simply counted the computers. There was a government publication by Martin Weik in which he listed all the government computers and their technical characteristics. Thus we could add up the cores from each computer. That covered the government market. The commercial market was not difficult to determine since the types of computers having core memories was known and the numbers of these computer sold was fairly easy to estimate. An extrapolation was made based upon what we felt the likelihood of new sales of these computers would be.

The second thing we did was to talk with core manufacturers. They knew how many they were selling and how many their competitors were selling. Of particular help was my friend Jim Schallerer who at that time worked in marketing for Indiana General, the New Jersey firm which was the leading manufacturer of cores. I had known Jim from our Whirlwind days together at MIT's Digital Computer Lab. Jim's estimates for future production and sales provided a second curve of extrapolation.

Finally, we looked at IBM's sales figures. We defined a date at which the computer was introduced. Before that time the growth was fairly steady and linear. We presumed that this growth was

due to their ordinary non-computer line of office equipment—typewriters, etc. We projected that line forward for the number of years in question. We then observed the differences between that line and the actually reported numbers of IBM sales. This difference we attributed to the sale of computers. We then extrapolated the difference, i.e. what we presumed to be the computer component, forward a number of years. We reasoned that these increased computer sales would result in a particular number of computers being sold, thus cores. At the time there was an average number of cores sold per computer.

None of these three projections were the same. However, they bracketed what we thought would happen in the number of years of interest. The rationale that produced these numbers was so sound that the projections were used as the basis for settlement of the dispute between IBM and MIT over how much in royalties IBM should pay MIT. This resultant settlement, based upon our projections, resulted in the largest income to the Institute from any MIT patent to that date—of the order of \$20 million—of which Jay Forrester received 10%. In those days (the 60s) a million dollars was a million dollars. Inflation would peg those numbers at more than ten times that amount in today's dollars.

For our work we billed Kenway Jenney (thus, MIT) \$25K. The Research Corporation billed MIT \$250K for doing the wrong thing. That bill was also paid, I learned later. The disparity in payment did not detract from our pride in knowing that our work figured so prominently in settling the dispute between such giants of industry and academia (IBM and MIT).

Once the dispute was settled IBM donated a multi-million dollar computer center to the Institute and the Watson Computer Center was founded. Also, Watson and Killian rejoined each other's boards. About a year later, at an annual dinner at the President's house, President Stratton took me aside and personally thanked me for the work we did. Thirty years later, the remarkable Mrs. Stratton remembered our work and again thanked me at an MIT alumni dinner in the President's house.

6.6 Hal Seward

One of the most inventive engineers I have known is Harold (Hal) Seward. One of his inventions is the Optisyn. Before the Optisyn, to detect and measure shaft rotation, one used a Giannini analog to digital converter that had a series of metal fingers in contact with a circular surface which had a series of bar codes etched on its surface. Thus, as the shaft to which the circle was attached rotated or moved, a different set of bar codes would make contact with the fingers and a digital readout would be transmitted which a computer could read as an angular position. This device had a number of things wrong with it. The principal one was that the brushes which were in contact with the circular disk would wear out and the device had a useful lifetime of only about 200 hours. This was not an acceptable lifetime.

Hal invented the Optisyn which had no touching parts to wear out. It was predicated upon the shining of light through a circular disk which had a series of circular arcs or holes cut into the disk. Thus, as the disk rotated, the device delivered a series of electrical codes which were generated by the varying configurations of light passing (or not passing) through the designated holes or arcs cut into the disks. Since there were no parts in contact with one another, there was no wear and the products had a relatively unlimited lifetime.

Wolf R&D used some of Hal's Optisyns to follow the position of the cursor in a board which we designed for the Air Force to trace the contour of weather maps. We digitized these contours for computer input along an orderly grid which provided the data input to various weather forecasting programs.

Hal told me later that ours was the first order for his company. He was very successful through the years selling the Optisyn and his other inventions. I liked his company name—H.H. Controls Company. H.H. are his first initials and he always controlled the company—a private company as long as I have known him—for 50 years now.

6.7 Nasa Houston

One of the most important and exciting things about business is the opportunity to be open to change. Oprah Winfrey said it—“Luck is a matter of preparation meeting opportunity.”

Back in the early 1960s Harry Kahler told me about a friend of his named Bob Buckley who lived in Florida. Harry suggested we hire Bob to open a Cocoa Beach office to solicit work from the NASA launch facility at Cocoa Beach. I had breakfast with Bob one morning in Washington and immediately liked him. Bob’s principal qualification for selling was that he had sold cars at his father’s used car lot in Florida. I admired his aggressiveness and agreed to give him a try.

On a subsequent trip, Bob introduced me to Clayton Taylor who wanted to represent us at Huntsville, Alabama, where Von Braun had settled to help the Army, later NASA, get its space program off the ground. Clayton lived in Huntsville and wanted to represent five non-competing companies for a fee of \$5K per year each. This was the first time we tried that form of salesmanship but I felt that Clayton knew what he was talking about and would make a good representation of us to NASA. The first and only business Clayton won for us was a \$25K consulting contract from Brown Engineering at Huntsville. This job was handled by our Vice President, Dick Jenney.

Meanwhile, we bid on every NASA procurement that we felt was applicable. One day, we read in the Commerce Business Daily that NASA advertised a procurement for staffing the computers at the Manned Spacecraft Center(MSC) in Houston, Texas. The MSC was just getting established and a local contractor had an on-site contract for 27 computer people. We responded to the Request For Proposal (RFP) and eventually were asked to come down to Houston to make a presentation. This we did and learned that we were one of two competitors from whom NASA was prepared to make a selection. The other was Brown Engineering.

In the final stage of the procurement process, NASA asked us for a “best and final” offer. We had never had such a request before although it is routine today. We couldn’t understand their reasons until we surmised, correctly, that they had a tie bid financially and couldn’t decide between the two of us. The deciding criterion in a personnel services contract like this was the overhead rate.

We asked Dick Jenney to do some ferreting around. We knew that he was working for the manager who Brown Engineering had bid to go over to Houston to head up their proposed effort. Dick went to lunch with him and there was a lot of talk about how the guy was packing up his family and preparing himself for the move to Houston. During the course of the lunch Dick said—“Our overhead rate is 75%, what’s yours.” The manager answered “The same.”

Dick called that afternoon and opened the conversation with “75%”. That’s all we needed to know. It confirmed our guess. We then sent a telegram to Houston in which we modified our bid in the following way. For every \$1M worth of business that NASA gave us, we would lower our overhead rate 5%. That broke the tie and we were awarded the contract. They bought it on a fixed price per labor category basis. Since our company was so small the effect of getting \$1M worth of new business was that our overhead rate was actually reduced by 10%. Therefore, the extra 5% dropped down into profit.

That victory was especially sweet since one of the stockholders of Brown Engineering was Lady Bird Johnson. We feared that her political power would influence the bid in Brown’s direction. At that time, she had Austin, Texas, sewed up with her ownership of the only TV station in Austin.

The Houston effort required that we increase the staff from 27 to 350 people in 18 months. That was the kind of strain that we liked. In one year we increased our gross sales from \$2 Million to \$4 Million.

We observed an interesting phenomenon. We could not get New Englanders to move to Texas. But we could get people from the same latitude as Houston to move laterally. That is, from San

Diego to Florida we brought in people to help with the vision of putting a man on the moon. A good source was Slidell, Louisiana where Chrysler had a plant making rocket bodies. They were then shipped by barge around Florida to the launch site. For professional people from Slidell, Houston was a huge cultural draw.

We tried everything to hire people—ads in the New York Times, Wall Street Journal, local papers in Boston and Houston, as well as professional magazines. I can remember buying the back cover of the journal, "Communications", published by the Association of Computing Machinery—the professional society for programmers. In the middle of the blank page, I put the following message.

"What job can be more exciting than putting a man on the moon?
If you want to help, join the Wolf R&D Corp.
Call Bill Wolf at (617) 369-2843."

I figured that the people that we wanted would understand it.

For some odd set of circumstances I was in the Washington Airport when I learned that I had to get the copy to the West Coast immediately. I remember walking into an FAA office and sweet talking my way into the use of one of the young ladies' typewriters. She even supplied the blank page. I then typed my 3 sentences, thanked her and faxed it to the West Coast. This ad had two interesting reactions: One advertising designer from the West Coast thought it was the best ad he had ever seen. On the other hand, a board member of the ACM was so upset with it that he established a review committee to assure that only professional ads would be placed in the magazine.

Our best return on recruiting investment was the bounty program we instituted within the company. That is, for every recommendation by an employee that resulted in a hire, we offered to pay the employee a bounty of \$100. We made use of our name—Wolf—in spreading the word on our bounty. I can still remember our personnel director coming to me excitedly and asking me what to do. Norman Roy had recommended 5 employees and we were

obligated to pay him \$500! I told him to not only pay him but to take a picture of the check presentation and put it on the front page of our company newspaper.

Our Texas personnel people had some unorthodox experiences. Once a prospective hire showed up with an application that listed the fact that he had been married 7 times. Our personnel person asked him if that was right? He thought a moment and said—“No, that number should have been 8. I forgot one.”

Another time, a landlord called looking for one of our ex-employees. It seems that our ex-employee had left town with the landlord's wife, record collection, and guns. He only wanted his guns back.

A typical technical challenge occurred when one of our programmers determined that the equations he was asked to program were incorrect. That is, that the “Z” component in a three dimensional spatial array (X,Y,Z) had the wrong sign. It was in the closure equations for the Gemini program. Two space capsules were supposed to meet in space (hence the name of the program was Gemini, the twins). If we had programmed them the way they were presented to us by IBM the instructions to the space capsules would have driven them *apart* instead of together. It felt good to detect and correct such an important error, especially when made by IBM.

6.8 A-OK in Seattle

One of the things we invented at Wolf R&D was an Automatic Orbit Calculator or A-OK. This term, A-OK, was one that the astronauts and others used around NASA to indicate that not only were things “OK” they were “A-OK” as though that added “A” gave an extra superlative to things having to do with the space program.

Incidentally, the derivation of the term “OK” may be of interest. During World War I there was a beef inspector named O'Kelly from Somerville, Mass. who had the job, as did several other inspectors, of inspecting the beef sent to our soldiers overseas. It

was common practice during those days for the beef inspectors to be bought off by unscrupulous sellers who would sell the government spoiled meat. Everyone, that is except O'Kelly who would stamp the beef he inspected with his initials—"O.K." When the soldiers came back from overseas they coined the term OK as meaning that things were all right.

Our A-OK was constructed in the following manner. We had printed three successive mercator projections of the earth on a background in three colors—blue for the oceans, brown for the continents and black for the letters, latitudes, and others. We constructed two plastic slides with the equator sketched in the center of both of them. One slide had John Glenn's orbit printed on it. This orbit was a sinusoidal one of about 20 degrees inclination. The other slide was a blank one upon which the user could draw the orbits of subsequent spacecraft as these orbits were announced in the paper. We also provided a booklet of instructions with the various paths of the orbits drawn so that they could be copied unto the clear slide. The final part was a time scale so that when things were properly assembled, one could determine where the space capsule was over the earth at various times in its approximately 90 minute orbit of the earth. This device allowed the average person the opportunity to track the astronauts in their journey around the globe.

To sell the A-OK we bought a booth at the Seattle World's Fair right underneath the Space Needle and when I heard that the TODAY show was going to feature the Fair for a week, I called New York and sweet talked them into featuring our A-OK in one of their programs. I also promised that I would have the inventor there—an MIT engineer named John Pasioka. Now John was a very proud but stubborn man who could not stand it if anyone mispronounced his name. We all have our faults and that was one of John's.

The program was scheduled to air on a Tuesday morning. I was in Orlando trying to get some business from NASA at Cape Canaveral. So I turned on the TV. There was Frank Blair interviewing John. Except that Frank mispronounced John's name and called

him John Basioka, with an emphasis on the B. All the way across country I could see John getting his dander up. I can remember saying to myself—"Oh, No!" John clammed up and wouldn't tell Frank how the A-OK operated. He just stood there and fumed. So Frank put it down and closed the interview. Talk about opportunities lost.

Nevertheless we staffed the booth and began selling our A-OKs. I can remember the Saturday morning when I got the first phone call from Dick Gagan who was running the operation. By prior agreement he read me the number of A-OKs sold per hour. The first number he gave me was "one". I asked "One what?—One Hundred, One Thousand?" Dick replied—"No—ONE."

We tried everything we could think of to increase sales. We varied the price from \$1 to \$10 but the number was constant regardless of price. The average was one per hour. It turns out that the teen age kids would grasp what it was all about but the parents did not. After about six weeks we sold our space to Eva Gabor so that she could sell cosmetics and we shut down our booth and came home. It was not hard to come to the sobering realization that product sales of a commercial item to the public was not our business. The final tally was about \$45K lost.

Some time later, at a convention in Boston I presented an A-OK to Alan Shepard and his wife and I told her that she could track him and know where he was in space. Years later I gave the remaining boxes of A-OKs to the Science Museum for sale in their store.

6.9 Richard Buckminster Fuller

6.9.1 First Meeting

It was sometime in the late 1960s that I decided to attend back-to-back conventions of the Young Presidents' Organization (YPO)—first in Bermuda, then in Puerto Rico. I was asked to accompany R. Buckminster Fuller and his wife, Ann, since he would

be speaking at both meetings. Thus, I first met Bucky Fuller—attending his lectures and squiring him from one place to the other.

I called his lectures—truth upon truth. He spoke with clarity in a seemingly endless stream of his observations about the world and how one should behave and use the technologies available to us. Our friendship warmed when, in 1968, I attended a meeting in Hawaii at which he described to me in detail his plans for a World Game.

6.9.2 World Game

It was Bucky’s dream to have world leaders gather and, through the use of visuals and computers recognize that we are all living on one piece of real estate hurling through space. He coined the term Spaceship Earth. He pointed out that we have only finite resources available and we should all work cooperatively to better the standard of living of everyone while preserving what’s precious and available to mankind.

It was Bucky’s contention that if all the world leaders gathered in one place and played a computer-simulated “World Game” they would see that we are all interdependent and would understand the folly of wars, trade barriers, and other artificial walls preventing the good life from happening for everyone.

I was invited to join a group of his friends and working associates in the founding of the Design Science Institute. The purpose was to foster the continuation of his work. We applied for and obtained a grant of \$25K to work on his concept of the World Game. Under this grant and working with Bucky, we wrote a detailed proposal to implement the World Game. However, further funding was not obtained through the Institute so this effort did not continue.

6.9.3 United Nations University

One of the things I spent some time on was fund raising for an exciting new project—a United Nations University. In the course of this effort which I discussed with Bucky I arranged a meeting

between him and the President-designate—James Hester, then President of New York University. We met in Hester's office in New York and Bucky told Hester about the potentially wonderful things he could do for the World. Hester replied—"You mean I have an opportunity to do good in this job?" Bucky replied—"You not only have an opportunity—you have an obligation!" Unfortunately, Hester did not live up to that obligation and was fired to great embarrassment by the Japanese who had selected him over other more deserving candidates such as Harold Taylor who fostered the effort in this country. One of Hester's qualifications was that he had a Japanese wife. But that didn't help him when it came time to can him.

6.9.4 Typical Behavior

An interesting aside about Bucky. I was talking with Vernon Alden one day on another subject and I told him about the work I was doing with Bucky. He then told me that he and Bucky and others were asked by Nick Salgo to form an advisory committee for his conglomerate. To compensate the committee members he offered them their choice of \$25K worth of stock in his conglomerate or \$25K in cash. Each of the other members took the stock, wanting to show confidence in the growth aspects of Nick's conglomerate. Bucky was the only one who opted for the cash with some statement that he had a lot of private R&D projects that needed support. As time went on, Nick's stock tanked and Bucky's decision proved to be the shrewdest of the lot.

6.10 Concord Floor Covering

In the general realm of trying to make life interesting we had a second floor of the building in Concord to tile. This was an open area of about forty feet wide and at least 100 feet long. We decided to write a computer program to design the floor tile layout using a random number generator. We thought that the light tan tile should predominate and for every eight tan tiles there should be inserted

at random a dark brown tile. Then, for every eight dark brown tiles there should be a bright red one to spark up the pattern.

However, the computer programmer presented the random number selection sequence by printing the first tile in the upper left side of the printed page. He didn't think or he didn't know that the floor tile layer chalked off the room into four squares and started his laying of tiles from the center of the room. In an attempt to resolve the disorientation we suggested that if he would allow us to sequence his tiles, he could put them anywhere he wanted. But, he did not want us messing with his tiles.

Therefore, we had one of our programmers manually lay out on the floor a section of tiles according to the computer printout. The tile layer then said—“O.K., now I know what you want.” and proceeded to lay out and cement down the tiles.

Somewhere between the computer's random generation and the tile layer's random generation is what we ended up with. It was very pleasing and made the large area interesting to look at.

One clear lesson to be learned from this exercise is that the theoretical solution is not always the practical solution. Another lesson is that programming computer results are one thing—presenting them in a form that the user can use is another matter altogether. It's also a lesson in the difference between a programmer's perception of how the real world operates and how it actually does. They are not always the same.

6.11 Smart Buildings

I think the idea first came from Jackson Granholm, Vice President in charge of our Los Angeles office in the mid 1960s. The concept was to have a large time-shared computer installed in the office building and treat it like air conditioning, heat or any other utility. In fact, the charge for the computer would be included in the rent bill with separate accounts metered for each lessee just as one has a separate meter for electrical use. I talked with a number of real estate developers over the years and got interest but no commitment. It was too new for them.

Today, with the computer compressed to desktop size having enormous capacity compared to those days, the idea is no longer economically valid, except in special circumstances. I suppose that this is an example of an idea which is sound technically but is not bought by the customers. That is, will the dogs eat the dog food? (Section 11.4)

6.12 First Computer Graphics

The first computer graphics was done using the Whirlwind computer for some TV commercials. The great part about having a Los Angeles office is that that is where all the movies were made. TV, in its early years, was viewed as a movie replacement so the natural focus for TV production was Hollywood.

Jackson Granholm, Vice President in charge of our Los Angeles office, arranged for two projects which we programmed for the computer. One was a commercial for Mexican TV in which the traditional shape of a Coca-Cola bottle was displayed. This was then dissolved into the Spanish words for "Drink Coca-Cola".

The second commercial was for the Carol Burnett show. It had a number of sparkling stars or points of light selected at random. These dissolved into the words

"WHAT'S NEW IN THE STARS?"

Then the outline of a five-pointed star was displayed and the TV camera superimposed the face of a star on the show for that performance.

Both of these jobs took a minimal time to program and photograph. The work was done in one or two weekends. I recall that we never got paid for our effort.

6.13 Banking

"Anyone can start a bank. All one needs is a license. If you want to start a national bank you need a license from the US Comptroller of the Currency. If you want to start a state bank you

need a charter from the State Treasurer. It is not an easy thing to do since one must—establish the need, such as to offer services other banks are not offering; promise that you will serve specific segments of the public not currently being served; have enough money on deposit to be stable; etc.

Back in the 1960s, a friend recommended me to a young Harvard graduate named Harvey Wachtel who was organizing a new national bank as part of the New Boston. Over a sandwich at the Harvard Club he described his plans. There hadn't been a new national bank started in Boston in forty years. But the then Comptroller of the Currency—James Saxon—was encouraging the starting of new banks to foster competition. So we started one. Our first choice of name was “New Boston Bank” but the First National Bank objected since it was known as “The Boston Bank” so we changed our name to the Harbor National Bank. I was one of five who signed the incorporation papers and served as a Director for several years.

The common denominator in each of the 40 businessmen who organized to start this bank was that they had all been screwed in one way or another by the conservative Boston banking establishment and this was a way to get even. One of the first things we did was to offer “free checking”. It was so popular that our deposits increased over \$1.5M in the first month we offered it. Considering our total deposits were only \$10M this meant a lot to us. To put things in perspective for today's numbers, multiply those figures by 10.

This innovation forced the other banks to likewise offer free checking to remain competitive, much to their unhappiness. This practice has since been buried but it is an example of what competition can do. I could go on about other lessons learned there but that is not the point. I merely mention it to establish my perspective on the views to follow.

Replacing Small Business Accounting Departments

At its incorporation, a bank is established to serve the community in which it operates with services to help that

community. Usually, one thinks of the bank as a place to borrow money—a principal function. Today, however, the Feds have loosened up on the reins of what the banks are allowed to do. This is fortunate and makes the possibilities very large—especially in the age of the computer.

In the past, much of what bankers thought of when they expanded their services were directed toward the consumer—that is, individual people. They opened branches to reach more people and listed a whole bunch of services from multi-rate deposit plans to multi-faceted loans. I'm not going to spend any time talking about individual customers except to say that the banks have finally adopted and are trusting the computer enough to substitute branch banking with Automatic Teller Machines—ATMs.

There exists an opportunity that the banks have, to date, failed to recognize. That is, in the accounting servicing of the small businessman and/or woman. In terms of numbers—90% of the businesses are so-called small businesses. Usually they are run by a single entrepreneur—or perhaps two or more. They have a limited number of employees—less than two or three hundred. The successful ones concentrate on doing a relatively few things well—computer services, building widgets, etc. In today's world, where the legislators continue to pass new and ever-confusing laws, full of contradictions and obfuscations, it takes a CPA to understand and comply with all the payroll exemptions, monthly tax reports filed to the State and Feds, insurance and employee withholding tax submissions, etc. The small businessman keeps getting burdened with more and more paper work from which there does not seem to be any natural forces to let up on him. Meanwhile he could be doing much more business if he focused his attention on staying ahead of competitors and offering new services to his customers.

Enter the bank.

There is no reason why the bank could not install a terminal in the small businessman's office and replace his accounting department. Daily, or in real time, the small business man could enter significant transactions such as checks in, receivables

generated, employee work experience from which payroll may be computed, etc.—all those things that eventually sum to his balance sheet and financial statements as end results.

The bank could and, in my opinion, should be his accounting department.

For example—the bank could offer free checking accounts to the employees. Then the employer need only give the employee a slip (prepared by the bank's computers and printed on the terminal in the employer's office) on pay day telling the employee how much money was transferred from the company's payroll account to the individual employee's account. Deductions would be detailed on this slip. Under the employee's direction, transfers could also be made to his savings account, 401(k), pension, etc. all maintained by the bank (as, of course, potential new business for the bank).

Another example—presumably the business has loans from the bank covered by his accounts receivable, or other assets of the business. As his cash needs are experienced, for instance to meet payroll, the bank could increase his loan on an as-needed basis.

Speaking from experience—the biggest problem in dealing with a bank is that they don't know until the middle of next month (nor, usually, do you) how your business is doing in any given month. Therefore, the banker is afraid to loan money in questionable situations due to his worry about how the business is doing.

If the banker is doing the accounting, he knows on a daily basis how secure his loan is and whether or not he should continue with a company or move to collection. This will enable the banker to have fewer problem loans and allow the business man the freedom to get more money loaned to him enabling him to buy more, build the business faster, etc.

And, consider how much cheaper it would be for the businessman to not have a whole department headed by an accountant speaking a foreign language (credit's toward the window, debit's toward the door). He should love it, unless he is dishonest in which case the bank shouldn't have him as a customer.

The bank could charge a fraction of what it would cost the businessman for accounting services, yet a significantly large

amount of money compared to what the bank gets for other services. All of a sudden, instead of the computer being a cost of doing business for the banker, it is a significant money maker. This idea alone, if properly implemented should double or triple a bank's bottom line!

Of course, a natural outflow from this service is to have the bank pay the bills, at the businessman's direction, by merely transferring funds from the businessman's account to the account of the telephone co., the electric co., etc. Consider all the new business accounts the bank could get if they went about it properly—every entity with whom the businessman does business.

That big bastion of fiscal lethargy—the U.S. Government—is now doing electronic transfer of funds. They prefer to pay your bill to them no longer by check but by transferring funds to your checking account. The IRS is also encouraging payment of taxes by computer—a natural for the bank to do for the small businessman.

In one of Peter Drucker's books a few years ago he postulated that everything that could be wrung out of the manufacturing process was pretty much in place. The future growth in earnings for a company, he said, was to figure out how to do the distribution function more efficiently and, thus, more economically—generating more profits.

A similar analogy can be drawn with the banking industry. They have for years concentrated on doing what they could for the consumer, while treating the small business man as a necessary evil—worrisome because he may fail and the bank would lose large sums of money. Therefore, the bank ties up his assets so tightly that the businessman often can not maneuver sufficiently—forcing him into Chapter 11 or Chapter 7—complete insolvency.

Today, with the intelligent use of computers, the bank can gain a great deal more business and profits to an extent that staggers the imagination if they would only focus on this suggested change of attitude—to treat the small business man as a profit maker for his comprehensive computer services yet to be defined and implemented.

A Totally Different Idea

There is no reason, using the above model, why a medical professional can not rely on the bank to be its agent in getting his money from the insurance industry. The professional would love to be able, at the end of the day, to have some significant fraction of the money in his account for the work that he did that day. Then let the banking industry take on the insurance industry for payment—terms, rates, etc. I agree with your initial assessment that this may be a bucket of worms fraught with pitfalls but you get my drift.

In Conclusion

The bank should rethink its mission and look upon its computers—which it needs anyway to process all of its day-to-day business—as a profit center. Let it build a service company that can do outsourcing—taking over the whole computing function from some of its clients. This one should be especially ripe for plucking now—with the trauma from the Year 2000 problem and all of its life-threatening consequences for all kinds of businesses.”

Note

The preceding is from a letter I wrote to my son Will, a management consultant for McKinsey and Co. in February, 1998. It spells out many of the views I have had since the 1960s when we formed the Harbor National Bank. It contains, in fact, my reason for being involved with the bank. However, I never got a chance to try out my ideas. We had so many problems trying to be a successful bank that we never reached the critical mass required to be able to experiment with new ideas. Not until we hired Bob Fitzgerald, Ted Kennedy's cousin, to be our President did we attract enough deposits to earn a decent profit. When then State Treasurer Robert Crane called looking for campaign contributions in return for which

he promised deposits from the Commonwealth we told him to go take a hike.

The Harbor National Bank was eventually sold to the New England Merchants Bank which subsequently was acquired by the Fleet, making the combination the largest bank in New England. This year the Fleet was acquired by the Bank of America.

In summary, my experience from the seemingly endless meetings was that incorporating a bank and serving on its board was a very large time sink. However, in my opinion, the business opportunities described above remain there until someone implements them. They are all feasible with the fast and secure computer network technology available today.

6.14 Midwest Computer Service, Inc.

We were visited in Boston one day in the mid 1960s by the heads of two civil engineering firms from Decatur, Illinois. They asked us to join them in forming the Midwest Computer Service, Inc. (MCSI)—a cooperative effort of five civil engineering firms in Illinois. Their thesis was that if they banded together they could share the cost of a computer service bureau. This seemed like a good idea and we eventually joined with them and agreed to send one of our best programmers, Steve Jones, a Harvard graduate who hailed from Illinois, to manage the operation.

In addition to doing the work for the civil engineering firms, Steve was encouraged to look elsewhere for business. He made a proposal to the Decatur water billing department to do their accounting work—setting up a data base, sending out the bills and so forth. When the news was carried in the local paper that a computer was going to do the work of the water billing department at less cost, more efficiently, and so forth, the employees of the water billing department read it and they all quit to find other jobs.

This premature announcement by the Decatur water department came back to haunt us. Our computer was a Bendix G-15D that was essentially a drum computer with a punched

paper tape input and output. A serial printer, a converted typewriter, was another output device.

As Steve was soon to learn, paper tape does not have the versatility of punched cards. Every time he changed billing information, he had to duplicate a long input tape. Therefore, he was unable to produce the billing from the programs he had written for the Bendix. The situation reached a crisis state when the end of the year came, the bills did not go out and the city of Decatur told us that without the money from the water billing collections, the whole town would go broke. After a few trips out to Decatur to determine the best way out, it was apparent that Steve's computer solution was not going to make it in time, if ever. Therefore, we hired back enough ex-town employees from the water billing department to get out the bills by hand.

In my total computing experience, this was the only time that an application went from manual to computer and back to manual. By the next year we gave up the contract and the town either did it themselves or hired someone else. My interest was only academic at that point so I didn't pursue to find out what they did.

We learned one important lesson—don't get involved with the running of a company at long distance. Our meetings every quarter were not enough to sufficiently control the operation. And there wasn't enough money involved to afford more travel expense.

Steve married one of the local young women and I attended the wedding with Buck Chastain, one of the sponsor company owners. The whole congregation waited for the groom to arrive for over a half hour. I whispered to Buck that I bet Steve was back at the computer. He was.

A couple of side adventures that I remember—one was seeing Carl Sandburg at the Midway Airport. He was as tall and striking as his poetry is powerful. Another experience was being flown up to Midway from Decatur in one of the company's private planes. The private plane terminal was on the opposite side of the airport from the major airlines terminal. Therefore, we hitched a ride in a truck to get from one to the other. Just as we were riding along the perimeter fence I heard a plane landing overhead and felt a distinct

BUMP in the truck. When we arrived at the other terminal I went out and looked at the top of the truck. Sure enough—there was a double tire track mark from where the low flying plane struck our truck. That airport sure is small. They built O'Hare and I haven't been back to Midway since.

6.15 Life Magazine

Back in the summer of 1964, on a Wednesday morning, a LIFE Magazine reporter named Ronald Bailey called and asked if he could come out to our home office in Concord, Massachusetts, for a visit. He had gone to MIT looking for a company that could relate its growth to the space business for a special two-issue feature that the magazine was preparing devoted to SPACE. We were recommended as well as a few others along Route 128 and he was surveying the area.

After about a half-day interview and look around, Ron asked if he could come back on Thursday. I politely declined because I had to fly to Washington to sign a contract with NASA.

He then returned on Friday.

After a few weeks, Ron and Burk Uzzle, photographer, showed up and spent the next two weeks at my side. I toured them around government facilities where we had contracts. This included our home office in Concord; L.G. Hanscom Field in Bedford, Massachusetts, where we were tracking satellites for the Air Force; the Goddard Space Flight Center in Maryland, where we were programming and operating the National Space Flight Data Center; the Air Force satellite tracking facilities in Colorado Springs, where we were installing the programs we had written at Hanscom Field; and the Manned Space Flight Center in Houston, where we were staffing all the computers for NASA.

We had a great time and Burk shot pictures galore. I'll never forget his taking his cameras and associated equipment into the Pentagon. I thought that he would be stopped but Ron showed them their cards from LIFE magazine and the military men not only welcomed us, they helped Burk with his bags.

The resultant nine page spread put us on the map as far as a growth company is concerned. However, we never made any money out of it. In fact we lost a \$25,000 competitive contract that was up for consideration. The contracting officer was reputed to have said—“Those Wolf guys have enough publicity. They don’t need this contract.”

As Susan says, “Fame is transient—People remain”.

Letters

I got about 130 letters from all over the world since the article was carried in a Russian version of LIFE. One amusing sidelight was that Burk was on assignment in Vietnam and read the article in a barbershop. Burk came back with the horrific story about military men who were flown by helicopter to an aircraft carrier so that when they died they would not be included in the body count in Vietnam.

It was pointed out to me by one of my programmers that I was the subject of at least two sermons where I was uncharitably portrayed as an evil person since I thought more about computers than I did about people. I suppose the pastors had a message but I didn’t think that the portrayal indicated evil behavior. I still don’t. One can’t generalize about a thing like that, but I’m sure the reader will agree that there are a lot of computers that one would rather be around than certain people. They are less boring, for one thing. And I don’t mean that in an elitist way—it’s just a plain statement of fact.

Perhaps this is one of the differentiators between programmers and other people. A computer, regardless of its age, appearance, or power consumption is easily apt to be more interesting than someone who can’t add a million numbers a second. So interesting, in fact, that ordinary things like sleeping and eating and bathing (ugh) fall by the wayside and seem less important than the computer challenge of the moment.

One looks for things to do in parallel in order to save time for programming. I learned to go to the bathroom, brush my teeth, and comb my hair all at the same time. That is also part of the reason why I drive so fast. I can’t wait to get there, wherever there is.

I answered all of the letters personally—except for two. One was from a “political” prisoner incarcerated in a California prison. He had an elaborate tale of woe that he was being persecuted because of all of his inventions which “they” did not want to recognize since the implementation of his inventions would put “them” out of business. I confess that I feared the potential and unknown consequences of answering his letter.

The other was from some Middle European country. I remember paying \$85 to a translator from Harvard to find out what it said. It turned out to be an elaborate request for money—the goat died, the cold winter was harsh, etc. I probably should have been more charitable and sent him money but I didn’t. I related to that person’s misery. My folks came from such a humble background and no one ever helped them.

Visitors

Then there were the visitors—all of whom I agreed to meet and spend some time with if they would come to Concord.

YMCA

There was the YMCA campaign solicitor who drove all the way from Watertown, New York to ask for \$5,000 to help them build a new Y. When he told me that it was to be in the suburbs where only kids with cars could go, I sent him packing. The YMCA I knew and valued during my youth was downtown and accessible to all.

I realized those were different times but my family could never afford an automobile. I can remember walking 5 miles in below freezing temperatures to save the nickel bus fare. There were exceptions of course when the Fahrenheit temperature hit 40 degrees below.

FIRE CHIEF

Another visitor was a Fire Chief from some town in Connecticut who wanted me to endorse the book that he had written concerning his experiences with fires. He traveled out to Concord by train, not an easy trip. I of course endorsed his book and met with him for a couple of hours, learning a great deal about the physical dynamics of a fire from him.

QUEEN OF QUEENS

Another fellow that was attracted to us by the LIFE article was a guy who wanted to institute a new twist on the Miss America contest. He felt that the audience, not a panel of judges, should decide which of the contestants should be crowned. That is, he wanted to wire up an auditorium with "Yes/No" switches at each seat and have a vote on each contestant. This sounded like a good idea so we priced it out. As I recall, it would have cost about \$250K at the time which made the idea uneconomic. Therefore, nothing was ever done about it.

Today, the price of equipment has been so reduced that the implementation of the idea is practical. For example, the Massachusetts legislature is wired up so that the members' "Yes" or "No" votes may be recorded electronically. Another application is the TV show called "Who Wants to be a Millionaire?" If the contestant is stumped he or she has an option of calling for a vote from the audience for their answer to the question which has four possible answers. The contestant then sees a computer generated display showing the percentage of the audience votes for each of the multiple choices. Every time I see this process it reminds me of the promoter. He planned to call his contest and his winner "Queen of Queens".

REALLIES

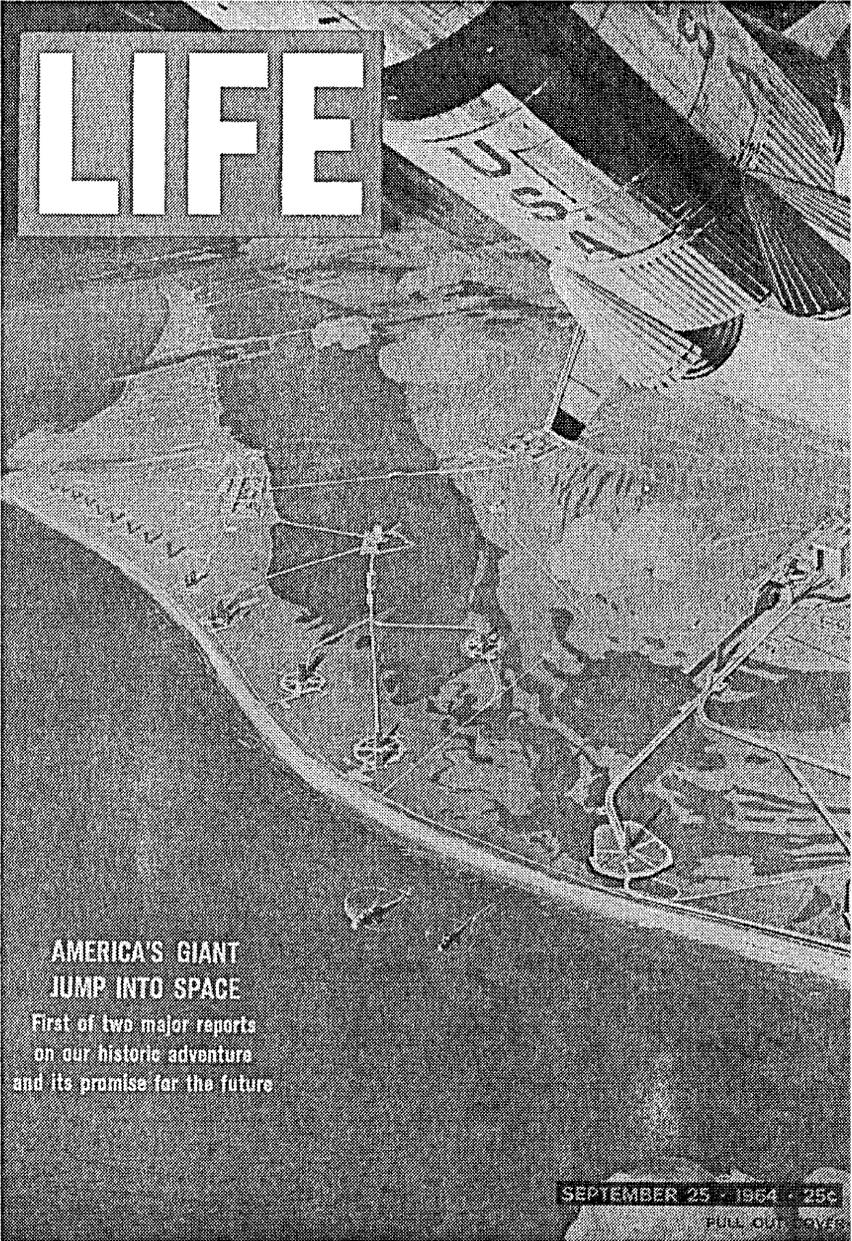
Another promoter came by one day and said that he had devised a new method for entertainment and wanted to talk with me about it. I invited Al Trakowski (Trak) into our meeting. Trak was a former Colonel in the Air Force who joined our staff to do long range planning for our company. The man described his proposed venture in circuitous terms. He said that it was a proprietary idea for urban entertainment for traveling salesmen and others. The term "reallies" was a follow on term from the "movies", following "talkies". He now had a three dimensional form of entertainment which he called "reallies". He said that he had Walt Disney under contract to provide the animation and three dimensional characters, he had financing from the Irving Trust Company in New York, and he wanted us to do the computer work. His headquarters was in his ski lodge in Aspen, Colorado.

Trak and I listened patiently for some time to his spiel and his guarded explanation of what it was all about. Just when he would get to the good parts he would interrupt himself and say things like—"Oh, I can't tell you about that, it's a secret." Finally, Trak, who is a very straightforward person said, "I know what you want to do. You want to build an automated house of ill repute." From the promoter's reaction, we knew that Trak had hit upon his secret. He suddenly excused himself, said he had another appointment to keep and left the building. About once or twice after that I would get a letter progress report on how he was doing with his plans. But then I stopped hearing from him.

Postscript

The magazine came out in September. In October I proposed to Ron a trip to Acapulco to go sail fishing, something that I had longed to do for some time. So off we went with our wives to Las Brisas and two days of sail fishing. Each of us caught a sail fish except my wife who came back with child. So our trophies were hanging on the wall while hers was crawling around the kitchen floor. Before going, Ron's wife was reluctant so I called her on the phone and started singing Mexican songs to her. That did it. My only son, Will, now has the sailfish hanging in his den. Will was living with me when the 1980 census forms came in the mail so we included "Manuel" the sailfish in the 1980 census. I was trying to teach him the appropriate disrespect for government statistics.

A copy of the LIFE magazine story is reproduced on the following pages.



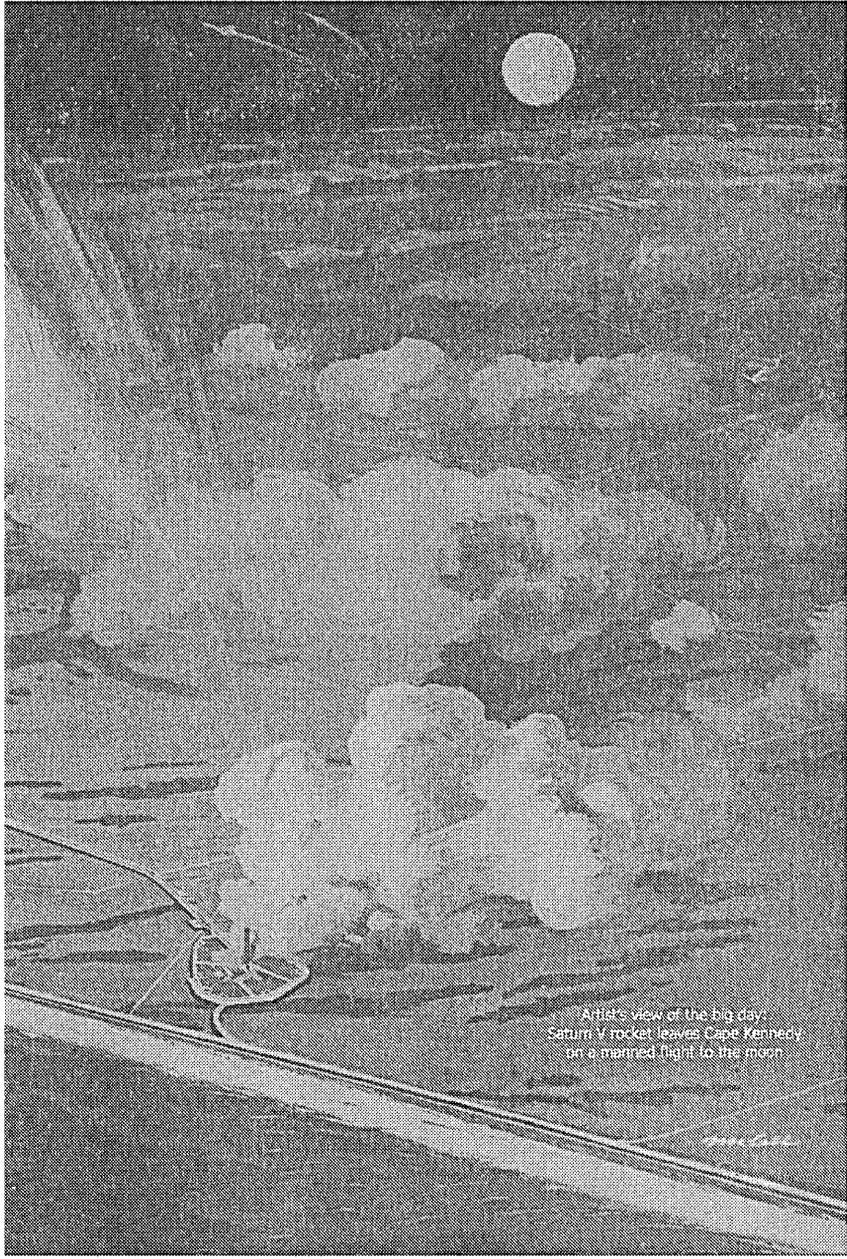
LIFE

AMERICA'S GIANT JUMP INTO SPACE

First of two major reports
on our historic adventure
and its promise for the future

SEPTEMBER 25 • 1964 • 25c

PHOTOGRAPH BY



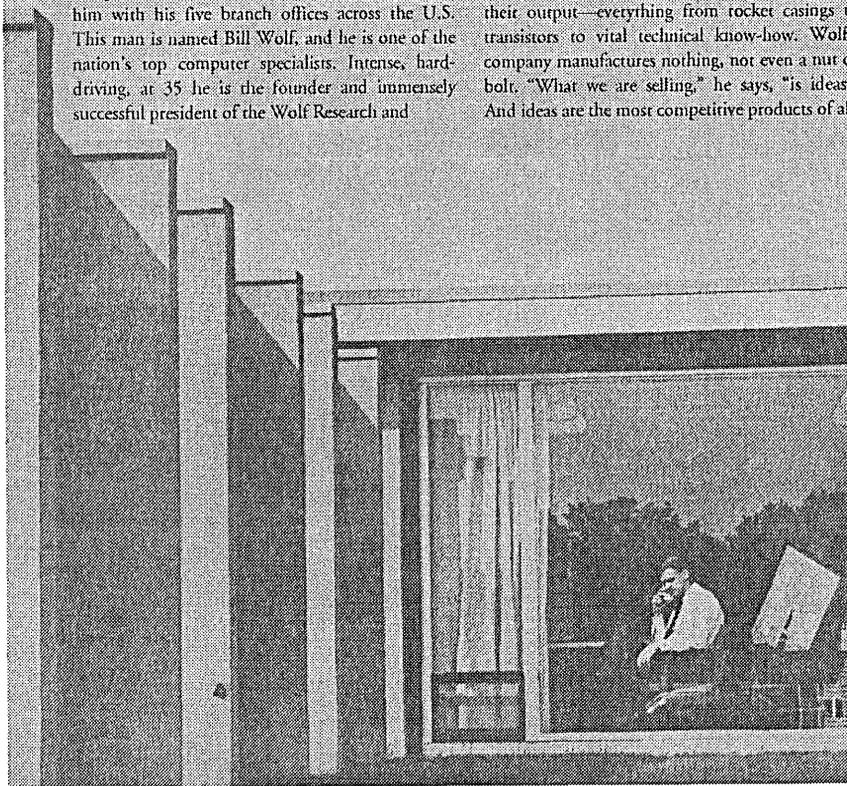
Artist's view of the big day:
Saturn V rocket leaves Cape Kennedy
on a manned flight to the moon.

Bill Wolf of the New Electronic Breed

YOUNG WIZARD OF COMPUTERS

He sits by a picture window in a low-slung modern plant near Boston. Tilted at his side is an electronic display scope that renders the calculations of a computer into visual images. His telephone links him with his five branch offices across the U.S. This man is named Bill Wolf, and he is one of the nation's top computer specialists. Intense, hard-driving, at 35 he is the founder and immensely successful president of the Wolf Research and

Development Corp. and one of a new breed of entrepreneurs, mostly scientists and engineers who have turned prospectors in a Space Age Klondike. The whole U.S. space effort is geared to their output—everything from rocket casings to transistors to vital technical know-how. Wolf's company manufactures nothing, not even a nut or bolt. "What we are selling," he says, "is ideas. And ideas are the most competitive products of all



HARD THOUGHT TEACHES MACHINES TO

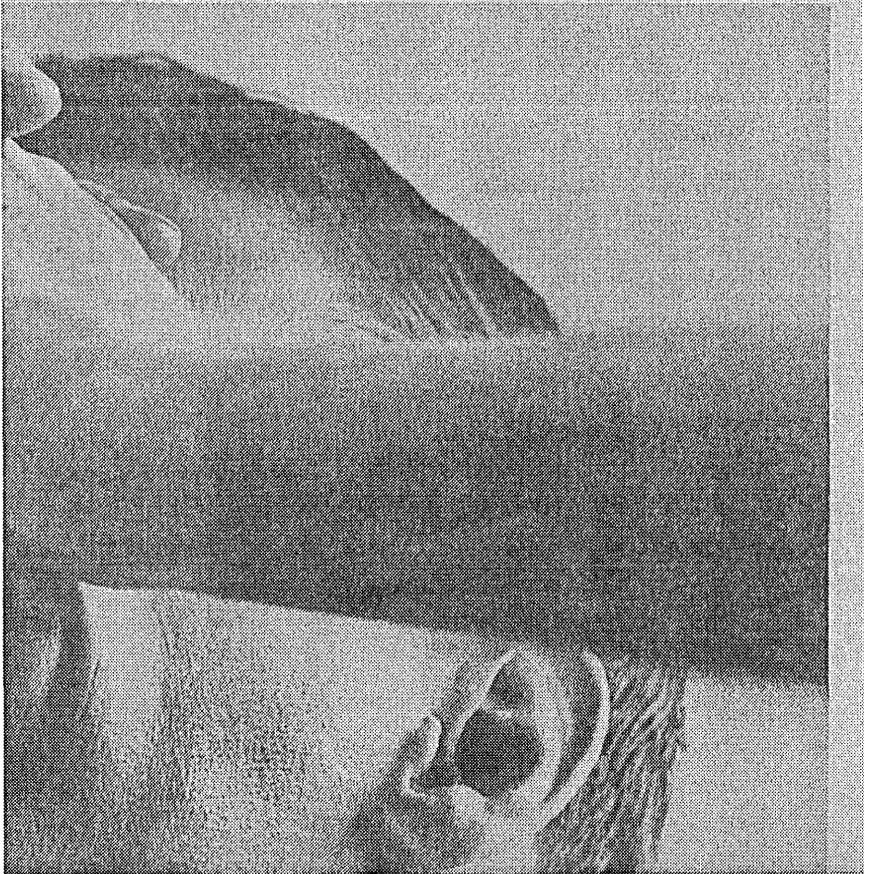
...e the impersonal computers that
spectally, Wolf arrives at his big and
isions by an agonizing process of
nd weighing alternatives. "My job,"
"is to know when, where and how
es or no. And, once I've made my
s, I've got to live with it."

Every day Bill Wolf faces the agony of creativity. He and his staff of 275 are in the business of "programming" computers for anyone who owns one and has problems to solve. This involves translating the problem and data bearing on it into the computer's electronic language. Then the computer must be adapted to work the problem through to a meaningful answer. It is an intensely intellectual process, and Wolf has built his mastery of it into a \$2 million enterprise—and has set up computers to solve an incalculable number of space-age problems.

Trained as a mathematician, he abandoned his studies for a Ph.D. at M.I.T. in 1954 and went into business. Initially he ran a one-man operation. As contracts came in, he began hiring M.I.T. engineers. When the Air Force set up satellite-tracking stations, Wolf—outbidding giants like IBM—won the computer contract. Last year he landed his biggest contract yet—from Houston's Manned Spacecraft Center. All the while he has served other clients, including Boston police for whom he is programming a computer to track the Boston strangler. As for finishing his doctorate, he says, "If I want a Ph.D., I can hire one."



THINK HARDER



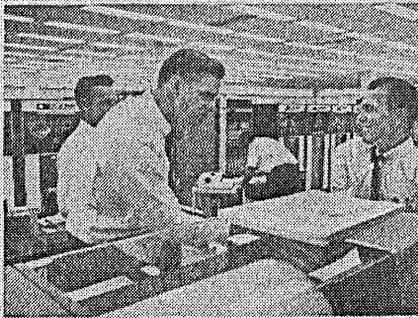
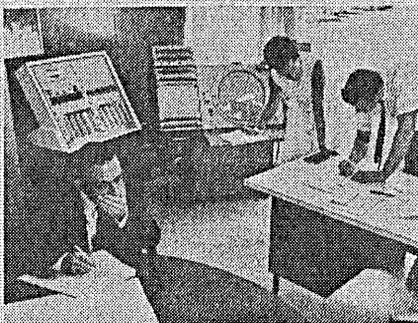


THE UNRELENTING PRESSURE THAT FILLS ALL HIS HOURS

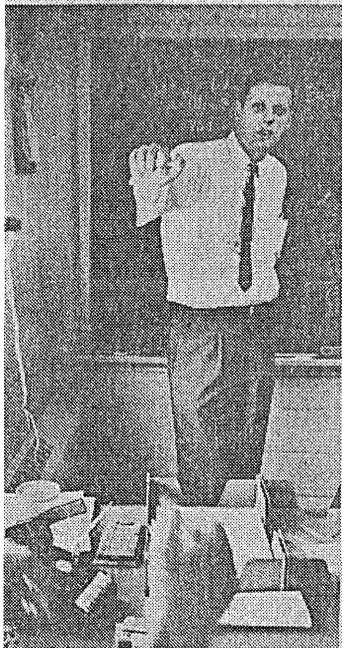
To most men an after-hour treat or a poolside party is the occasion for relaxation. Not Wolf: he never escapes the unrelenting pressure of his work. At top left, in a Colorado Springs tavern, the very air is electric as he talks computers with one of his vice presidents, Paul Staderman, who directs his operations at the Colorado headquarters of the Air Force's space tracking network. At a weekend swimming party (bottom left) at his 250-year old home near Boston, Wolf, helped by his wife Eileen (at right), entertains banker Pete Eierman, with a heartiness fully matching the intensity of his work—with computers. Eierman is the president of a new bank that Wolf is helping to organize—not only to expand his own sources of credit but also because he believes banking is a potential new market for his computer services. Wolf first met Eileen at an Army arsenal in Philadelphia where she was a secretary and he worked as a mathematician before going to M.I.T. "We don't have the fun we used to," Wolf admits. "Money builds fences."

In the antiseptic presence of computers (right) Wolf and the brilliant technicians who serve him nurture ideas the way a culture grows bacteria. At top, sitting in front of a computer console, Wolf has inspirations tuck and forth with Al Shorell, a vice president and his electronics expert, and George Kuell, his tough-minded treasurer at a regular Monday morning idea-swapping session they call "the happy hour." Time and again it produces solutions to technical problems on contracts already held as well as ways to win new clients.

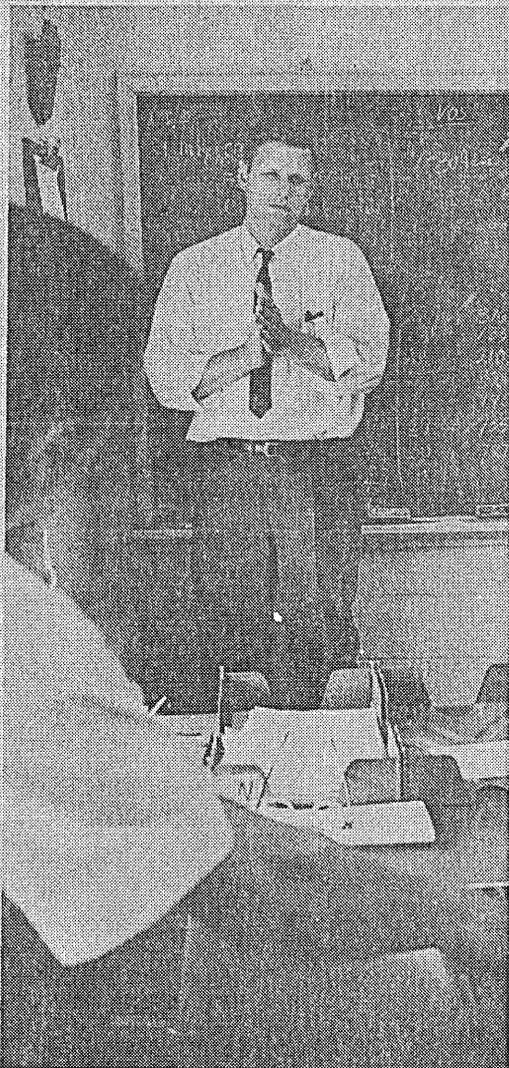
Kuell was Wolf's fraternity brother at St. Lawrence University in Canton, N.Y. and was one of his first business partners: they waded automobiles together. Kuell attends all skull sessions to cast a hard business eye on ideas. Wolf calls him his "no" man. At center, Wolf checks reservations for a flight to Houston with a secretary while Dick Jenney, another vice president and former M.I.T. colleague, studies a contract proposal. At bottom, having arrived in Houston to supervise computer work at Manned Spacecraft Center, Wolf hurriedly greets a computer operator newly hired by his rapidly growing company.

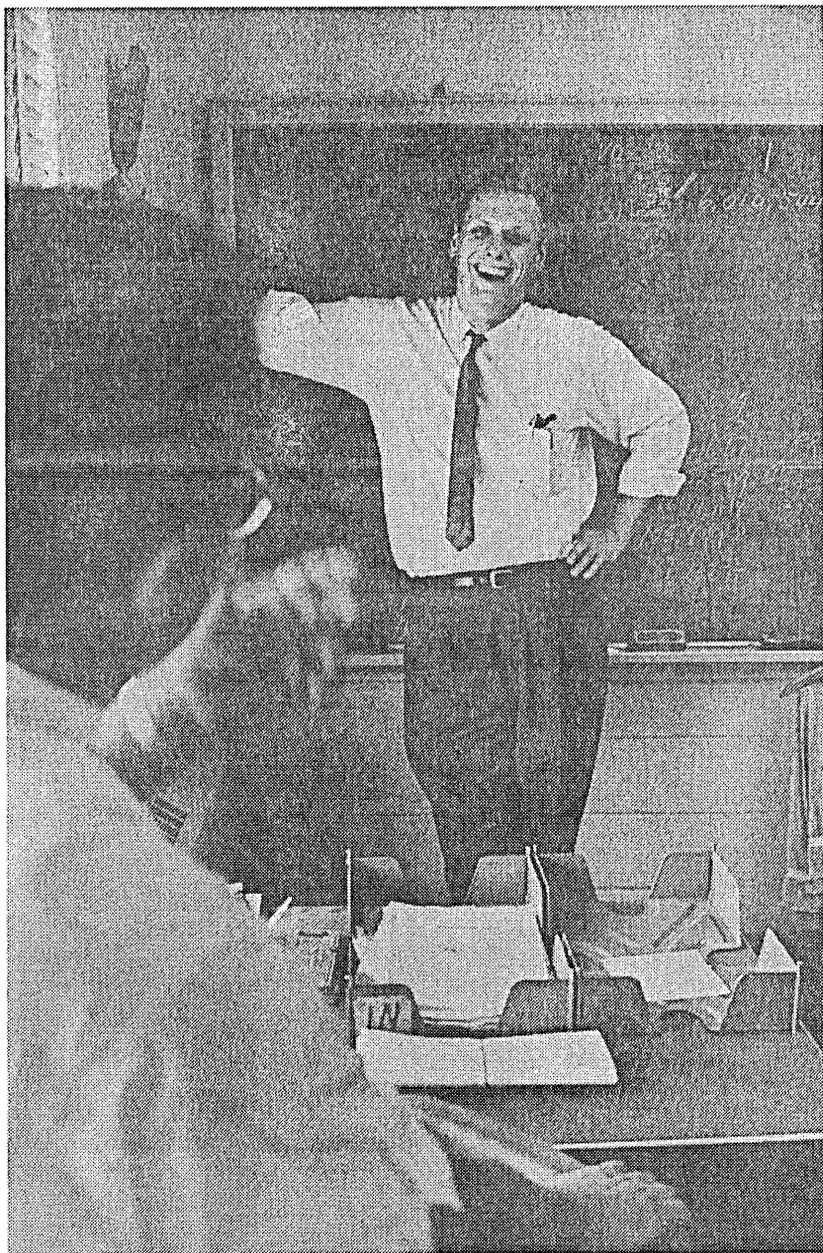


A HARD-SELL SPIEL OF FACTS FOR A CLIENT



...t having ideas is not enough," says Wolf. "You've got to sell them." In dealing with his biggest client, the U.S. government, he has developed a knack for slicing through red tape. Standing 6-foot 5-inches and towering over most of his peers, he all but overpowers them with his sheer physical presence and with the facts that he marshals with the tenaciousness of an earnest young professor. In this sequence, after he makes a pitch for a contract clause favorable to his company, he steps to the blackboard to answer a question put by an Air Force procurement officer (foreground). "What's up there, Bill?" Sleeves rolled up, and looking him squarely in the eye, Wolf shows him—a compelling spiel of facts and figures. Then as the officer is won over, Wolf roars with delight.





S LONG ROMANCE WITH AN ING CHUNK OF HARDWARE

his machinelike intensity, Bill Wolf is his argument against the computers taking

et his first big computer in 1952 while he J.T. Its name was Whirlwind I, and it was world's biggest and fastest, spewing out answers every second. To a mathematician id was marvelous to behold, sprawled over s at M.I.T.'s Digital Computer Laboratory. maze of wires and vacuum tubes linked by at never erred.

and day, whenever he could get away from ral studies, Wolf worked on the computer, to speak its machine language. "He spent time with Whirlwind that I used to call istress," recalls his wife Eileen. "She was a petitive lady."

s first job as an independent consultant—a prediction study for M.I.T.—Wolf used d. But because he had underestimated his ound up earning only 40¢ an hour. It was he never made again. Within three years ularly included words like "kilobucks" and k" which, in the space industry, stand for s and millions of dollars.

99 Wolf heard that Whirlwind, 15 years considered obsolete because it used vacuum ead of transistors, was about to be junked. l to Washington to try to persuade its owner, to save the computer from the scrap heap. e first of April," says Wolf, "and at first they was playing an April Fool's joke."

hrewdly saw new uses for Whirlwind in boom then just over the horizon. For one ike other computers, it had a set of display at not only presented information like images but also reacted when a beam of flashed at one of the screens. In effect, this the compute and its master to cate visually. Using a light gun, he could correct mistakes much more quickly than : even with the most modern computers. id was one of a kind," says Wolf. "It was

ston plant, Wolf stands in the enormous : maze of his aging computer Whirl-

The Navy agreed to lease the machine to Wolf for nothing, and he had it carted off to a warehouse to await the new plant that would house it. Meanwhile his business grew so rapidly that at times it almost got out of hand. Though he knew all about the complexities of computes, the personalities of people bedeviled him. When his personal secretary edited and revised an important letter he had dictated, Wolf, angered at her gall, simply abolished her job and set up a pool of six secretaries to make the boss-secretary relationship more impersonal. There were other personnel problems. One key employee cost him some business because he refused to travel by airplane. Another, who lived in a rooming house, ran off with his landlord's wife, guns and hi-fi set.

"People frustrate me," says Wolf. "I like a machine because I can push a button and it will run until I push another button to make it stop."

Whirlwind was finally installed in his new plant and immediately began costing him \$5,000 a month in maintenance, operators, programmers, electric bills and floor space. And it brought in no business. Then Wolf had the germ of an idea: Why not make Whirlwind earn its keep by running the company? The final management decisions, of course, would be Wolf's, but the machine could put at his fingertips the information he so sorely needed. He gave the idea a lot of thought.

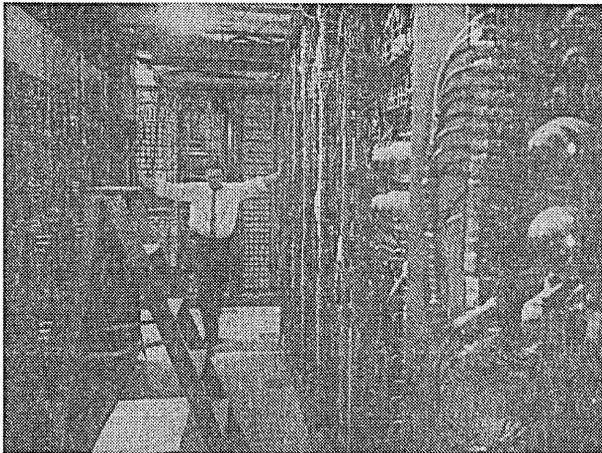
Two months ago, when the Whirlwind lease came up for renewal, Wolf called a staff meeting to

consider whether his plan was feasible. To his annoyance it was pointed out that the big computer was tainting his reputation for efficiency. Customers were calling it "the white elephant." His executives swore it was driving off business and even chipping away at office morale. And Treasurer Kuell, the "no" man, harped on the cost.

Sentiment aside —Wolf loves to tinker with Whirlwind, like a teenager with a hot rod—he was sure that with the computer's help he could increase the scope of his company fivefold, to a \$10 million operation. He was almost as sure he could not do this if Whirlwind were not around to monitor expansion. But he told the staff he would sleep on the decision.

That night Wolf did a rare thing. He put business aside and took his wife to a play. But after 15 minutes of listening to the actors talk about their troubles, he walked out, dragging Eileen with him. "I've got enough troubles of my own," he growled. Then, as they had so often done in the past, the Wolfs sat down at home and talked about the machine. "I'm his sounding board," says Eileen. "It's a part of my life." Finally, after a sleepless night he decided to keep Whirlwind. Perhaps significantly, he had never consulted the computer itself about what was best.

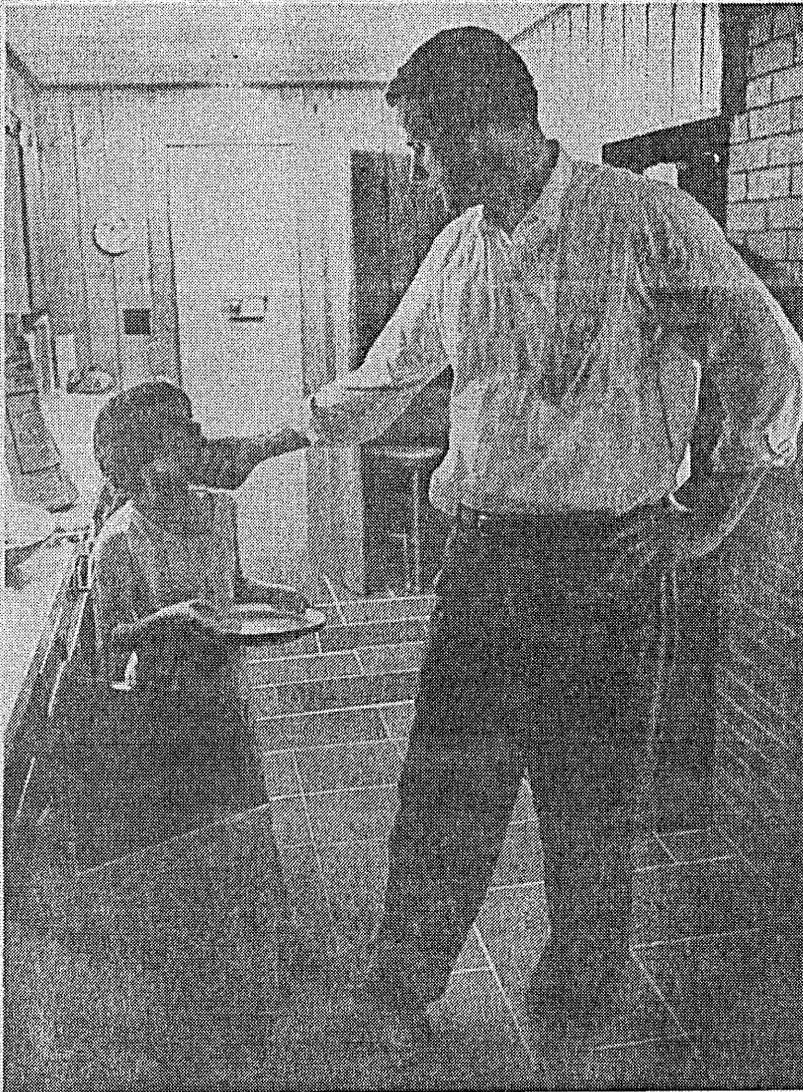
RONALD BAILEY



MUCH GAINED BUT SOMETHING LOST

At home Wolf reaches out to his younger daughter Sylvia. A deeply reflective man, he despairs of being all that he would like to be to his family. His own childhood was bleak: his father died when he was 12 and he had

to put himself through. Now that he has so much, he knows that along the way he's lost something. "I don't know where the hell I'm going," he says. "We've got a kite by the tree, we'll see where it takes us."



6.16 Sale to EG&G

It was the Fall of 1967 when I wrote Ken Germeshausen, Chairman of Edgerton, Germeshausen and Grier (EG&G) suggesting that EG&G acquire Wolf R&D Corp. He asked me to come over and talk with him and Bernard O'Keefe, President. I never did get his name straight. Some people called him Bernie and some called him Barney.

After a few negotiations they made an offer to acquire us for 100K shares of EG&G which were then selling at \$55. We accepted.

At the time I owned about 90% of our company. O'Keefe suggested that I consider a gift to the employees who were valuable to the company so that they would feel a sense of participation. I agreed and gave 20K shares to 15 of my employees. The gift had a market value of \$1.1 million. Two of them thanked me—my lady Vice President—Marion Callaghan; and Bill Creager. One person expressed the opinion that he should have gotten more.

The last time I looked, both Marion and Bill Creager were Presidents of their own companies in the Washington, D.C. area. Marion was consulting with small companies installing computer-based accounting systems for them. Bill had built a company doing over \$1M in sales. One of his products is a catalog of all the data bases that are commercially available.

I can remember my financial vice president asking me after the closing—"How does it feel to be a millionaire?" I told him—"No different today from how I felt yesterday."

O'Keefe was jealous of me because I ended up with more shares of EG&G stock than he had. How do I know? He told me so. He had other reasons to be jealous. I belonged to a more prestigious country club than he did (Brae Burn vs. Woodland). I bought and drove a Continental Mark III. He then traded in his Ford Thunderbird for a gold colored Cadillac Eldorado which looked and was gauche. And then there was the LIFE magazine article.

Furthermore, Wolf R&D Corp. was better organized than EG&G, with a clear organization chart and a set of written job descriptions for everyone in the company. Our accountants were

better (Price Waterhouse vs. Arthur Andersen). We didn't have a single law firm representing us so there was no comparison there. Our reporting system for what was going on in the company was superior. All in all we were a more organized company and we and he knew it.

In retrospect, there were several warning signs along the way that I should have heeded but didn't. After a while O'Keefe assigned the reporting of our activities to a Dr. Jacob J., a physicist from Harvard who thought he knew how to run a company but never had.

O'Keefe read in the newspaper that my wife and I were attending the Inaugural Ball in Washington after Nixon was elected the first time. He then called a meeting for the first thing in the morning on the day after the ball. That meant that I had to get up after only 3 hours of sleep to board the 6:30 flight to Boston. After the meeting was over around noon, I was asked by the Chairman if I had any suggestions about the meeting. My response was—"I think there should be a meeting called to see what can be done to eliminate the meetings." My reasoning was that during a meeting of several folks only one spoke at a time and the rest were wasting valuable time listening when they could be working.

Dr. Jacob J. would play such games as ordering one of my VPs to call me when he knew that I was in Hawaii and that it was 4 AM. Another trick was his subverting of my authority by going to Louisiana and taking one of my VPs with him to talk with a woman who owned a taxicab company about buying her service bureau. Having had a bad experience trying to manage a subsidiary by long distance (see 6.14) I was furious for two reasons—the idiocy of taking such a pointless trip, and the deception of not telling me about it until after the fact.

It was obvious that Dr. Jacob J. was trying to run my company so I confronted O'Keefe with the question—"Who is in charge?" He never satisfactorily answered me so I decided for him by leaving the company after two years—very disappointed. It didn't help that the stock tanked—falling from 65 to 7 $\frac{3}{4}$ during a period when I was restricted from selling by SEC regulation. Those

regulations have been changed but they were in effect during those years.

Another big disappointment was the fact that I turned down an offer from Henry Taub to sell to Automatic Data Processing (ADP) for \$1M worth of his stock. I showed Henry the EG&G offer of \$5.5M and told him that he should at least match that. When the \$1M worth of ADP stock surpassed \$25M I stopped tracking it.

A final irony occurred in the spring of 1968. Computer software firms and the potential profits that they could make were suddenly discovered by Wall Street. By comparison with what was happening to other companies, if we had waited we could have done an Initial Public Offering with a market cap that was 10 times the value for which we sold our company to EG&G.

6.17 Association of Independent Software Companies

I don't recall who phoned me in 1968 and invited me to a meeting in Washington, D.C. to be held simultaneously with an upcoming computer conference. I do remember that the leaders of the computer programming companies were invited. The attending companies were: Applied Data Research, Inc.; Aries Corp.; AUERBACH Corp.; Charles W. Adams Associates, Inc.; Computing and Software; Computer Applications, Inc.; Computer Sciences Corp.; Computer Usage Corp., Inc.; Comress, Inc.; Informatics, Inc.; Merle Thomas Corp.; Planning Research Corp.; and our Wolf Research & Development Corp.

After this informal meeting, I wrote a "white paper" setting forth the reasons why forming a national organization was a good idea. At our next meeting, the group was formalized into the Association of Independent Software Companies (AISC). Since I wrote the white paper, I was elected President.

There is nothing that unites people like a common enemy. In this case it was the System Development Corporation (SDC). SDC was a non-profit computer programming company set up by the

Air Force to program the SAGE system. They were spoon-fed very large contracts and were then grossing over \$50M per year. It was rumored and verified that the Air Force was planning to turn the company loose to enter our companies’ competitive arena, with continuing support from the Air Force. Since its inception, we profit-making firms were excluded from bidding on the work given to SDC even though our programmers were at least as smart if not smarter and our overheads were about half of those charged by SDC. Further, their salaries were higher so that the Air Force was paying about twice as much per man-year as it would if it had opened up the work to competition. Our fear was that SDC would enter our marketplace, still maintaining its Air Force business, and force some of our companies out of business.

At an MIT dedication of the new Watson Computer Center [see 6.5] I sat at the luncheon table next to John McLucas with whom I was acquainted through the Young Presidents’ Organization (YPO) and who was then Secretary of the Air Force. I described what was happening.

SDC management was proposing to buy the corporation from the Air Force for an amount in the high teens—around \$18M or so. They had a tier one underwriter selected who had agreed to loan the management the money to buy the company and achieve a windfall profit when the underwriter took them public. Companies were then selling for one times sales so their IPO would be based on a company having a market value of over \$50M. McLucas investigated and put a halt to that action. The windfall never happened. Instead, a charitable trust was established a few years later and the company was sold to that trust. Many years later it was sold to Burroughs and got absorbed into their corporate structure.

However, as often happens in life, solving the original problem that brought us together was not the most significant thing we did.

One of our members, Applied Data Research (ADR), located in Princeton, NJ, was a pioneer in selling a software package as a separate and distinct unit that would operate on any IBM computer

of the class for which it was written. It was a utility program called AUTOFLOW which they priced at \$4K. AUTOFLOW was designed to take a program that was already written and, by sensing and interpreting branch instructions, create and print out a flow diagram. So far as I can recall, this was one of the first attempts by any of us in the industry to package a program and sell it to more than one user.

Sales were just getting underway for ADR when IBM noticed it, wrote a competitive product, and gave theirs away to their users. This was a typical IBM strong-arm tactic. Dick Jones, President of ADR, hired a Philadelphia lawyer and sued IBM for violation of the Sherman anti-trust act, restraint of trade, monopolistic practice, and anything else he could think of.

AISC then considered whether or not to join ADR as an amicus curia (friend of court) in this suit. I can still remember the meeting discussion. Some members felt suing IBM was hopeless. Others wanted to leave things the way they were. They felt that if IBM separated prices and found out how profitable selling software was, they would focus on it and wipe us all out.

However, the majority felt that software should be sold separately from hardware and if we all united behind ADR we stood a chance of breaking new ground and opening up our business opportunities to the sale of software products instead of just software services. Because we wanted to send a strong message to IBM, we voted unanimously to support ADR.

IBM capitulated and unbundled—that is, they separated the pricing of software from hardware. Thus, the software industry as we know it today was created.

In the beginning the cost of software was far less than the cost of hardware. Today, a software library can easily cost several times the cost of the hardware to run it.

In those years IBM had 80% of the market with \$700M in annual sales. Today, IBM grossed \$86B in year 2001 sales with after tax profits of \$7.7B. Microsoft in 2001 grossed \$25 in sales with identical after tax profits of \$7.7B! Interestingly, the price to earnings ratio of IBM is 24 while that of Microsoft is 55.

Consequently, the market capitalization (number of shares X price per share) of IBM is only \$177B while that of Microsoft is \$326B! We had no idea that these impressive numbers would result, but they did and we feel good about our role in helping to create the foundation for allowing this to happen.

A press release announcing our formation is presented below. Some of the computer trade journals published this notification of our founding but no national media took note.

AISC PRESS RELEASE

19 February 1968

PRESS RELEASE WITH RESPECT TO THE ASSOCIATION OF INDEPENDENT SOFTWARE COMPANIES

The formation of the Association of Independent Software Companies was announced today in Washington. One of the principal objectives of this organization will be to foster, advance, and promote trade and commerce in the interests of those profit-seeking companies engaged in the business of supplying services for the analysis, design, coding, testing, documenting and installation of information handling systems for operation with electronic data processing equipment.

The fact that this association is formed at this time is a further sign of the continuing maturity of the computer software field. The total business of the originating members sums to about two hundred million dollars annually.

The founding member firms are:

- 1) Charles W. Adams Associates, Inc.
- 2) Applied Data Research, Inc.
- 3) Aries Corp.
- 4) Auerbach Corp.

- 5) Computing and Software
- 6) Computer Applications, Inc.
- 7) Computer Sciences Corp.
- 8) Computer Usage Corp., Inc.
- 9) Comress, Inc.
- 10) Informatics, Inc.
- 11) Merle Thomas Corp.
- 12) Planning Research Corp.
- 13) Wolf Research and Development Corp.

The principal activities of the Association in the coming months will revolve around the preparation of four position papers which will form the basis for determining what steps might be taken by the Association as a group with respect to each of these subjects.

The subjects to be covered are as follows:

- 1) Non-profits—non-profit organizations will be studied, with particular emphasis on the degree to which these organizations compete with the independent software companies.
- 2) Civil Service—an attempt will be made to clarify the misunderstanding that exists with respect to the roles of civil servants and private contractors in producing programs for computers.
- 3) Protection for Proprietary Programs—an overall look will be taken at the proprietary program question with specific respect to pending legislation before the Congress.
- 4) Separation of Pricing between Hardware and Software—consideration will be given to promoting separate procurement and pricing of hardware and software and to the benefits that might accrue therefrom to the software industry.

It is interesting to note the results of each of these concerns and our involvement in encouraging these changes.

Non-Profits—Air Force Secretary McLucas and I lunching @ MIT—thus scuttling the SDC sale to insiders.

Civil Service—We supported the opponent of the Representative who was stirring up all the fuss and thus helped to remove him from office.

Protection for Proprietary Programs—One can now patent software.

Separation of Pricing of Hardware and Software—The legal action that we took with Dick Jones and ADR (Applied Data Research) forced IBM to invoke the separation of hardware and software—thus creating the software business as we know it today.

Note: AISC was eventually acquired by ADAPSO (Automatic Data Processing Services Organizations) and was operated for years as a division of ADAPSO.

6.18 First Impressions

One of the incorporators of the Harbor National Bank (Section 6.13) was a Damon Runyonesque character named Charlie Rennie. According to hearsay he and his wife made their money by opening and operating a string of mom and pop do-it-yourself Laundromats.

Charlie lusted to buy a small railroad that ran from suburban Boston down to Cape Cod. I think he wanted to develop the valuable real estate that the railroad owned. It was a public company, the stock of which he began to accumulate. When he got to the point where he owned a significant share the railroad directors called him and asked for an appointment to learn of his intentions. Charlie scheduled a brunch for a hotel in New York City. He went down early and checked into a suite. He had arranged to hire a young professional lady of substantial dimensions and cooperative attitude.

When the railroad directors arrived he greeted them dressed in a kimono and asked them in for brunch which was served by the young lady wearing only a large rhinestone in her navel. Talk about creating a first impression.

It wasn't long before Charlie owned the railroad, on his terms. His partner in the deal was Bob Eder, another investor in our bank. They later split and I don't know what happened to the railroad. It was from Charlie that I learned the expression—"He is a little careless with the truth." Another person descriptor that might have been attributed to Charlie is—"He can't manage a pay toilet."

Section 7.0

The 1970s

7.1 Computer Facilities Management

After I left EG&G, I spent the second half of 1969 planning what to do next. I was impressed with what Ross Perot was doing with his Electronic Data Systems. Starting in the area of Blue Cross, Blue Shield in Texas, his approach was to take over the complete management of and responsibility for a company's computer installations, hiring all the employees and charging about 20% more than the previous cost of doing business. His sales were predicated upon the argument (but not necessarily the fact) that he had better, faster, smarter programmers and analysts. After winning Blue Cross Blue Shield in Texas he went on to take over similar operations in other states.

I looked back at Wolf Research and Development and reasoned that programming and operating computer installations was what we had done for the federal government since 1957 when we ran Project Space Track for the Air Force at L.G. Hanscom Field in Bedford, Mass. Therefore, we had built a reputation for doing this and doing it well. I reasoned that if we did that for business and industry at a reduced cost (20% less, rather than 20% more) I was bound to have a winner. I thus founded a new business, Computer Business Management (CBM), dedicated to computer facility management.

The first computer facility that we acquired was at the AVCO Everett Research Lab (AERL) in Everett, Mass. I had worked with AERL as a consultant during the 1950s and helped them establish

their computer facility. Therefore, we knew and trusted each other. We negotiated a contract under which we assumed financial responsibility for the two IBM 360 computers there as well as the operations staff. Their employees became our employees and we paid IBM its monthly rent.

One of their employees was an ex-WRDC operator so we had minimal personnel problems in the transition. We charged AERL about 20% less for the computers and the same amount for the employees plus personnel overhead. We had the two unused, extra shifts—5PM to 1AM and 1AM to 9AM to sell to other customers. As I recall, the total monthly contract price was in the neighborhood of \$20K.

Our marketing manager, Curt Emmons, drove across the Mystic River and sold the second shift to the First National Stores. They had an identical set of two IBM 360 computers so they could plug right into our hardware and run their programs. They were able to return one of their IBM 360 computers to IBM and thus save money. We were profitable from the outset.

As we attempted to duplicate that experience elsewhere we encountered management resistance from potential customers. I couldn't figure out why we weren't selling more installations. After about a year and at the suggestion of a friend I had lunch with the President of Aardvark, an advertising firm in New York City who listened to my story and gave me this advice. He said that we were proposing corporate emasculation. The Chief Executive Officers (CEOs) and Chief Financial Officers (CFOs) to whom we had been directing our "money saving—same performance" pitch were as proud of their computer installation as they were of their corporate jets. For us to come in and "take over" that essential part of their administration was not something that they could brag about to other CEOs at the country club. It took me a while to accept that basic flaw in our approach but the lack of results proved it.

I was reminded of the passage in Machiavelli's "The Prince" which, though written in the 1700s was still applicable. It will be quoted in full:

Advice on Change from "The Prince" by Niccolo Machiavelli

"It should be considered that nothing is more difficult to handle, more doubtful of success, nor more dangerous to manage, than to put oneself at the head of introducing new orders. For the introducer has all those who benefit from the old orders as enemies, and he has lukewarm defenders in all those who might benefit from the new orders. This lukewarmness arises partly from fear of adversaries who have the laws on their side and partly from the incredulity of men, who do not truly believe in new things unless they come to have a firm experience of them. Consequently, whenever those who are enemies have opportunity to attack, they do so with partisan zeal, and the others defend lukewarmly so that one is in peril along with them. It is however necessary, if one wants to discuss this aspect well, to examine whether these innovators stand by themselves or depend on others; that is, whether to carry out their deed they must pray or indeed can use force. In the first case they always come to ill and never accomplish anything; but when they depend on their own and are able to use force, then it is that they are rarely in peril. From this it arises that all the armed prophets conquered and the unarmed ones were ruined. For, besides the things that have been said, the nature of peoples is variable; and it is easy to persuade them of something, but difficult to keep them in that persuasion. And thus things must be ordered in such a mode that when they no longer believe, one can make them believe by force."

I found that there was a direct correlation between the above advice and selling a new idea in business today. One of our adversaries, of course was IBM. If our strategy were to be successful they would get a pile of computers returned to them. I recall one corporate executive saying to me—"I asked my IBM representative if what you are saying is credible and he said that it wouldn't work." And this man was being paid good money for such lack of leadership. Another corporate Treasurer took me on a tour of his "IBM room" in which was housed a Honeywell computer.

One other success we had was with a publishing company in Norwood called the Plimpton Press. The Treasurer was an old friend

from the days when he worked for Price Waterhouse and had my company, WRDC, as one of his accounts. Thus, as with AERL, we trusted each other. By sending his computer back to IBM and buying a block of time on our equipment he was able to save \$7K per month at a time when he needed the money. Plimpton Press company eventually went into Chapter 11 and I wondered—If I have to find a company on the verge of bankruptcy in order to find a company that would listen to and act on my sales pitch, how big is my market?

Today, of course, the computer facilities management concept has a new name. It is called “outsourcing” and it has a new cachet. Companies are transferring their computer departments to outsiders such as EDS and Computer Sciences in very large contracts—tens of millions of dollars per year. But in the early 1970s, as often happens to me in life, the concept was too new for ready acceptance and I lacked the ‘Machiavellian force’ to make it happen.

7.2 Teheran Trip

Back in the 70s I flew to Teheran, Iran. My anticipation was so great that I dreamt about the trip. In my nightmare I was burglarized on a beach and robbed of all my money. Before going I bought a Persian language book from Schoenhofs, a bookstore in Harvard Square. I practiced the Persian way of saying “Hello, How are You” all the way over on the plane. When I arrived, they didn’t know what I was saying—I had learned the wrong language. They all spoke Farsi and English.

My trip had a dual mission—

- 1) To establish an agreement with a trading partner for selling goods and services in the US and Iran. This was done and I came home with the agreement.
- 2) To introduce the concept and advantages of holography to the Shah.

Through an architectural friend I was hoping to be introduced to the Minister of Culture—the Shah’s brother in law. However,

that meeting was not confirmed. I flew over on a weekend for a week long visit. On Tuesday I got a phone call that the Minister would meet with me on Thursday at 2 PM. I explained that I had a conflict since I was scheduled to meet with the President of the Bank. The person on the phone politely but firmly said "Tell your hosts that the Minister of Culture will meet with you at 2 PM. They will understand. And, Mr. Wolf, don't be late." I used exactly those words and they said, "We understand." I was so excited that I was there an hour early—at 1 PM

I was escorted into the most sumptuous office I have ever seen. It had an immense picture of the ruins of Persopolis and a crystal chandelier that was as big as one in a hotel ballroom. The lemon served with the obligatory tea was wafer thin. I told the Minister that we wanted to make a hologram of the Shah and his family so that they could appear to their subjects in three dimensions in the 21st century. He listened with a great deal of interest and promised to get back to me.

In a few months he did send a delegation over to the US to learn more about the process and to actually see a hologram of a person. However, historical events, namely the student uprisings, intervened and the Shah was toppled from power.

I was impressed with Iranian culture in many ways—some good, some bad. For example, I saw no homeless persons or beggars in the streets. There were persons asking for money, but they offered something in return. One fellow had a scale and he would sell you your weight for whatever coins you would offer him.

Everywhere you looked there was the picture of the Shah. It was said that no matter where you walked, the Shah's face was following you. On the front page of every morning's newspaper there was a picture of the Shah and a story about him or some member of his family. I got the feeling that his omnipresence must have contributed to his downfall. People were tired of looking at him.

The people were very polite and gracious. While waiting for the Minister of Culture, I admired a poster on a wall advertising a cultural exhibition. The secretary stood on a chair, took it down, and gave it to me.

Traffic was very polluting and very intense. There was an eight-lane highway and in the morning there would be seven lanes going one way and only one going the other. There were probably some traffic regulations but they were not apparent. Every driver seemed to be at liberty to race with others in a frantic pace to get somewhere.

My hosts arranged a meeting with an Iranian Colonel with whom we discussed computer applications. I recall his asking me—“How do you feel about Command and Control?” I replied that he would not be able to set up an effective Command and Control system until he built reliable communications. My experience with the phone system was that it was as bad as that in Mexico. One could not hold a conversation for longer than 20 minutes without the call being disconnected. After a while I asked the Colonel what problems he had.

He replied, “Oh, I have no problems.” I talked with my host about his answer later. He explained to me that he had plenty of problems. However, his pride stood in the way of his admitting that he had any problems. I suggested that it would be very difficult to set up a dialogue with someone that close-minded.

I was very pleased with the results of my trip and looked forward to doing some international business with the Iranians. Alas, history intervened, as mentioned above and nothing ever came from my visit there except a broadening of my view of the world beyond Europe.

7.3 First Software Specification

Although the government had bought billions of computers under a rigid set of rules of performance, no one had ever written any rules for purchasing software. One of my ex-programmers—Mike Landes—was working at the Air Force Rome Air Development Center in Rome, New York. I visited him to see if there was any business up there. He challenged me with the task of writing the first software specification. And I accepted the challenge.

The work was done on a subcontract basis under SAIC—a prime contractor from California. I remember billing SAIC for a

month's work of work—about \$4,000 and not receiving payment in the usual time—about 10 days. When I called I was told that the invoice had been paid. After investigation, I learned that the company had paid another William Wolf, one of their consultants from some university in Arizona, and he had cashed the check! I told the SAIC folks that to even things they should send me a check for the next invoice that he sends them. They didn't think it was funny—nor did I until the payment finally came in about a month late.

After spending a good part of a year writing, Mike and I contacted industry and government installations to promote acceptance of the work. This was done using a set of questionnaires, personal visits, etc. One of the visits I recall was to the Boeing Corp. in Seattle, WA. It was a rare sunny day and I remember asking our hosts—“This seems like the best place in the country to live and work. Why isn't everyone here?” Their response was—“Sssh—don't tell anybody.” Another visit was to an AT&T Lab in No. Carolina where they had developed UNIX. As one might expect, everyone had their own idea as to what should be in a software specification—and no two ideas were the same. I haven't kept up to date as to whether or not this work endured.

7.4 Edulogical Systems

One of the companies we started was Edulogical Systems, Inc. to do classroom scheduling. It was very effective. One school in a midwestern town for whom we had done the scheduling of all its schools suffered a fire on a Monday which totally destroyed the school. They called us in a panic. We asked them which school it was and set about our work. By Wednesday night we had all the students rescheduled in the other schools which had a surplus of classrooms in them. We shipped them the results on Thursday and by the following Monday all the students were back in classes which had been scheduled by our computer. In fact, the whole process was so efficient that the town could not justify rebuilding the school which had burned down!

I recall that one of the Edulogical salesmen was a priest who called on all the parochial schools. However, he had taken a vow of poverty. Therefore, the staff did not pay him any salary, only expenses.

The company had an unscrupulous President named Dr. Richard Rovinelli. Later investigation pointed out that he was no "Dr." Nor was he honest. He and another employee stole our software and went to work for another company. We sued him and the other company for \$1M. It had taken us over \$250K to write the modifications to IBM's software and to make it perform properly. The case was assigned to a Master who heard the case on a Saturday and decided in our favor.

Then the Judge "lost" the case. In a typical example of Massachusetts judicial corruption he obviously was bribed by the other side. He said that we would have to try it again because he had physically "lost" the papers. At that point our attorney, Jerome Cohen, settled our \$1M suit for \$7K which he put in his pocket. Any wonder why some attorneys get and deserve their reputation as being the scum of the earth? I promised myself that the next time I saw Jerry I was going to give him a fistful of knuckles. However, I didn't. It was at a Museum of Science function and I restrained myself because I was an Overseer of the Museum at the time.

7.5 Unemployment

There were two experiences with Unemployment worthy of repetition.

In 1974, after selling our service bureau to Grumman Corp. I was asked to leave even though they had promised me a long term contract. Piqued, I decided to apply for unemployment compensation. The company tried to deny me those benefits but the unemployment person did not comply with their objection and awarded me the benefits of unemployment. This meant that I had to show up weekly in Watertown to receive my unemployment check—\$225 tax free. Also I had to be interviewed by a young

lady to see if she could help me locate a job. I recall her question: "What is your occupation?" To which I replied, "President". "Oh", she said, "I never had one of those before. What are you President of?" I replied, "Oh, I can be President of anything. I'm not fussy." We scanned the microfilm listings of jobs but couldn't find a President's job anywhere. Interestingly, the microfilm system used was one that one of my companies, COM Service Bureau, had set up for the Commonwealth a few years before that time.

In the early 1970s I had fallen behind in paying the Unemployment office the unemployment compensation to the Commonwealth for one of my companies. I got a letter asking me to come in to discuss the matter at 2 pm on a Wednesday. I called and accepted the appointment. However, I got stuck in traffic and showed up 10 minutes late, at 2:10. I was told that the man I had the appointment with had waited a few minutes but when I didn't show up on time he left to go home. When I tried to reschedule, I was told that he lives on Cape Cod and only comes in on Wednesday afternoon. I could not believe that this crone was getting a full salary for one afternoon's work per week. I paid the arrearage and never heard from him again.

7.6 Queen Elizabeth

One of the best examples of raw political power I ever saw was the day in 1975 when a fellow member of the Young Presidents' Organization (YPO) and I took Bill Eberle down to Washington to meet with John Warner. Eberle was also a member of YPO who had moved to Manchester, Mass. after serving in Nixon's Republican administration following a successful business career as head of American Standard Company. Warner was then head of the US Bi-Centennial Committee which was planning how the nation would celebrate in 1976 the 200th year of our founding—1776.

We four sat around a table in Warner's office.

We told him how great it would be to have the Queen visit Boston—the closest seaport to Europe. We reminded him of the important historical things that happened in Boston in 1776—shot heard ‘round the world, etc.

After listening to us, Warner turned to Eberle and said—

“You want the Queen in Boston?”

Eberle nodded.

“You’ve got her”, said Warner.

And that was that. The planning folks in New York were beside themselves when they found out about it. They were our only competition since Washington did not have a seaport.

I remember attending a meeting with the British Counsel in which he tactlessly remarked that we had to plan every step of the Queen’s visit here including when and where she went to the bathroom. So much for bawdy English humor. None of the Americans thought it was funny.

7.7 Concord Computing

It was back in 1970 that I sweet-talked Victor Tyler into leaving EG&G and forming a new company named Concord Computing, Inc. named after his hometown, Concord, MA. The fundamental field that the company addressed was on-line credit verification. The culprits we were looking for were customers cashing checks with insufficient funds to cover them—bad check passers.

To a computer person, a supermarket is not a food selling enterprise, it is a check-cashing machine. Statistics show that a supermarket cashes checks in an amount that can equal sales. In some neighborhoods the amount of check cashing can exceed the supermarkets sales by as much as 25%. For an enterprise that operates on a profit margin of 1 to 3% it doesn’t take many bounced

checks to wipe out profits. And yet check cashing has become a necessary function of the market.

Concord Computing's solution was to wire up the markets to a computer based database in which a negative file was stored. That is, if a person had ever bounced a check in any of the supermarket chain's stores, his or her key personal information was stored in this negative file. From the time of the first offense forward the person would be banned from any further check cashing in any of the stores.

Using a company-supplied computer terminal in the supermarket, the operator would stroke in the key information and, within a very few seconds the terminal would indicate whether or not the person's check would be approved for cashing. One of our first customers was the Kroger supermarket chain out of Chicago. The online computer we employed was a Honeywell computer located in Bedford, MA and we built and supplied the terminals. Communication was over normal phone lines, dedicated to this application. The results were exceedingly effective and we shut down the bad check passing at the Kroger stores in a matter of days.

I can still remember the time at one of our early meetings during startup when Vic asked—"What are we going to do about desks?" I said—"Come with me." We got into my station wagon and I drove to Grossman's discount lumberyard where we bought 4 doors and 4 sets of legs. We took them back to our office in Bedford, assembled the 4 legs on each door and I said—"There, that's a desk." Vic was used to calling a supply person at EG&G and shortly thereafter a desk and chair would appear. But he was a quick study. That 'doors into desks' attitude pervaded the company's early years. In later years, Harry Healer, the Venture Capitalist who provided our first round of startup funds told me one time—"You know, that was the most parsimonious company in which we ever invested."

Another early client was the Playboy Clubs. They had a number of customers who ran up big bills without paying and still kept

charging food and drinks. I can still remember the planning session of the MIT engineers sitting around the table designing a terminal that would be user-friendly to a Bunny. A very chauvinistic meeting to be sure. In the first week of operation we caught a guy in Miami who owed the club in New York over \$10K so the customer was very pleased.

I brought the investment opportunity to Charles River but they turned us down. The First National Bank Venture Capital group decided to fund us and was our first investor. When the Charles River group heard about the First National Bank's commitment, Jack Neises called me and asked to be part of the group. I checked with Harry and he said—"No, thank you." This was a first hand lesson in the exclusivity of the venture capital community.

Concord Computing was ranked the first in Massachusetts by the Boston Globe for return to investors. The next year the company moved to Tennessee and merged with EFS to form Concord-EFS. This is a money machine. Once the network is established and the break-even level is met, more workload can be piled on with relatively little increase in capital equipment and no appreciable increase in service personnel or other variable expense.

However, it was not easy getting to break-even because of the intense capital expenditures associated with buying all of the computer and communications equipment. In fact, Harry Healer tells the story of Bill Brown, the First National Bank's president storming out of his office one day saying, "This is the *worst* loan in the bank." Today, Concord-EFS is doing well while the bank is gone—taken over by the upstart and acquisitive Fleet bank from Providence.

In 2001 Concord-EFS [market symbol—CEFT] grossed over \$1.7B in sales with profits of \$213M. Fortune magazine ranked the company 781 within the Fortune 1000, up from 998 the preceding year. Better still, within its group in the ten year period from 1991 to 2001 the company ranked first in return to the investor at 40%. In the investment world it is called a cash cow. Its market cap is over \$15B in July of 2002—a down period for stocks.

7.8 Wilbur Mills and Fannie Fox

It was 1979 and I was headed to the White House to give a speech to President Ford about the effects of government on small businesses. I was President of the National Council of Professional Services Firms and we were invited there by the Administration during one of their "let's hear from the small businessman" campaigns.

I was writing what I was going to say to the President on a Friday with the White House meeting coming up the following Thursday in Washington. I didn't think it appropriate to tell any football stories since Ford at the time was stumbling on and off planes and the press was accusing him of having played too much football without his helmet.

I read the paper searching for ideas and came upon a story about Wilbur Mills. The Boston Globe reported that Fannie Fox, his love interest at the time, was appearing in one of the strip joints in Boston's Combat Zone. Thinking that I might pick up a joke or two, I decided to go downtown to see her. However, I didn't feel safe going alone, so I called up one of my drinking buddies—Dick Jenney. He had a date but when I told him what I had in mind he called off his date and told me to meet him in "Good Time Charlie's" at 8 o'clock. We'd have a drink and make the 9 o'clock show. This I felt was the true mark of a drinking buddy—one who had the nerve to call off a date and go out with you.

I continued working and about 7 I called "Good Time Charlie's" to find out where they were. I looked up their number in the phone book and called them. The bartender answered and I asked him where he was.

He wouldn't tell me.

So I dug out a street map and located them, in the heart of the Combat Zone.

I drove into town and parked on the street in an open spot. Since I had never been in the Combat Zone before, other than driving through to get to the other side, I was worried about what

might happen. So I changed my shoes and put on sneakers in case I had to run. Also, I took off my watch and put it into the glove compartment. I pulled up the collar of my raincoat and walked to our meeting place.

After a couple of drinks in one of the weirdest bars I had ever been in, Dick and I strolled over to the strip joint. I remember walking in with Dick and sitting down near the back of the dimly lit theater. Dick wears glasses and couldn't see too well so he suggested that we move down a ways. We ended up in about the sixth row near the middle of a runway that had been built out into the theater.

As the show was going on Dick whispered to me "Look who's sitting beside you". There, two seats over next to the stage was Wilbur Mills. Between us sat a burly looking guy who I surmised, correctly, was his chauffeur and bodyguard. This I had read in the Boston Globe. He was also Fannie Fox's husband.

The last act, the highlight of the show was, of course, Fannie Fox. As part of her routine she walked up the runway and handed out lollypops to all the boys. She knelt down and surreptitiously slipped one to Wilbur. As we got up to leave the theater, Wilbur headed back stage with a bottle of champagne under his arm. After we came out of the theater, I went to my where I had parked my car but found out, sadly, that it had been stolen.

After the car was recovered I filed an insurance report for the things in the car that were stolen including a Brooks Brothers shirt, my shoes and watch and a Salvador Dali print that the thieves had stepped on and tore. I reported the whole story to my insurance agent—about going to get material for my meeting with President Ford and what happened during the course of the evening. I concluded with the statement—If you don't believe me, ask Wilbur Mills—he was there. The insurance claims person told me that his boss said that that was the most absurd story he had ever heard—therefore it must be true. They paid me for the full amount of the missing things.

The following Wednesday I arrived in Washington with a speech all prepared for our dress rehearsal for the Thursday meeting. I

told the lawyers and other members of the Board what had happened but they advised me against using the material in the White House. Ford didn't show for our meeting. His excuse was that he was meeting with Henry Kissinger about some foreign crisis. The next year he lost his bid for reelection.

7.9 A Curious Example of Luck

In the mid-1970s I was consulting for a Hartford, Connecticut company which owned a group of companies—a mini-conglomerate. They had an IBM System 3 and their only programmer, Bill G., had just left to work for Travelers Insurance. Therefore I was documenting his work and making myself generally useful as an interim programmer. One day, I was told that the company had decided to sell off a plumbing supply business located in Norwood, Mass. to its general manager—Sam.

For obvious reasons the selling price was heavily dependent upon the inventory. I was asked to help determine this so I ran a program which produced a set of IBM cards—one for each item in the inventory. This summed to a full box of cards representing hundreds of items. I took these to Sam and sat down with him on a Thursday afternoon and told him: “This is what the computer says you have in inventory.” He went through the cards, one by one, tossing out about a third of them with remarks such as—“We don't have this anymore.” Obviously, since he was planning to buy the company that weekend it was to this advantage to lower the cost by discarding cards.

When I returned to Hartford on Friday I told the Treasurer what had happened and implored him to send an auditor in to do a spot check to eliminate the inaccuracy of the inventory. I was told that the company had to be sold that weekend and that there wasn't time to check. Therefore, on Saturday morning, I ran off an inventory count totaling what remained after Sam's editing. I used the program that Bill G. had written to do this. The total summed to about \$650K. [“K” is a computer programmer's notation for “1,000”. Actually it isn't “1,000”—it is “1,024” which is a power

of 2 (Section 2 on Programming). However, in the common vernacular it has come to mean “1,000” since it is close enough. This is really not meant to confuse you—that’s just the way it is.]

That Sunday the owners sold the company to Sam with the purchase price based upon the \$650K inventory.

On Tuesday of the following week I was asked by the Treasurer to run another copy of the inventory, which I did. However, this time the total was only around \$400K. I reran it and got the same answer. I couldn’t figure out the difference for some time.

Then it dawned on me.

When I ran the total on Saturday, about a third of the way through the run, the paper tore in the printer. When that happened, I fixed the paper and restarted the program.

Now, it is good programming practice to set all of the summing and totaling registers equal to zero at the start of the program. Since programs don’t usually work correctly the first time, this practice allows the programmer, when he is debugging it, to interrupt his program at the sign of any incorrect functioning, fix the program, and then restart at the beginning with the first step being to clear out all the registers to prepare for a rerun.

I deduced that the only way the computer could have summed to a different total was to have the first third of the inventory counted twice—once from the beginning until the time that the paper tore and once from the time that I restarted the program. I read the program, and sure enough, Bill G. had not set the totaling registers to zero. He left them the way they were. I was appalled. This was not the way I had been brought up at MIT and I had never before encountered such sloppy programming practice.

Obviously, when the paper separated and I restarted the program, the sum from the first third or so was added in twice. This created a total which was overstated by about a third. When I told the Treasurer what had happened he was dismayed but told me not to tell anyone and to forget about it.

On Thursday, Sam phoned me and said “Hey, Bill. How come that IBM computer was smart enough to put back all of the

inventory I threw out?” I replied, “Well, Sam, the computer is getting smarter every day.”

Moral: Sometimes fate (or luck) comes down on the side of the good guys. However, in this instance I’m not sure who the good guys were. The Connecticut company went into Chapter 11 and didn’t pay my invoices for the last two months I worked there. I passed the plumbing supply company the other day and business seemed to be booming—new and expanded building, many cars parked, etc. I couldn’t help but wonder what, if any, computer system Sam is using now.

Section 8.0

The 1980s

8.1 The Personal Computer

According to legend, Thomas Watson Jr., Chairman of IBM, was visiting his grandchildren in their school in Connecticut where he saw them all excited about their new computer—an Apple II. They used it for playing games and doing their mathematical exercises. He returned to Armonk, IBM's headquarters, and called a meeting wherein he told his executives what he had seen. There followed a crash program to develop the IBM Personal Computer (PC). It was decided to base this operation in the Boca Raton, Florida offices of IBM and it was headed by an MIT graduate named Don Estridge who was instructed to get out a product as fast as possible.

One of the most interesting things about this operation was the carte blanche given to Estridge to produce the product using non-IBM components and procedures. He was to design and build the computer with off-the-shelf equipment wherever possible. There was even a tape cassette reader and recorder as an option with the first IBM PC. The tape recorder was a hobbyist's way of recording digital information cheaply and no one at IBM knew whether or not it would sell so they produced it as part of their product line. It didn't sell so it was dropped after the first year.

Another decision made to hasten the introduction into the marketplace was to buy, not build an operating system. A team of IBM men went searching for a working operating system they

could install. They visited Gary Kildall in California, President of Digital Research, who had a rather tried and true operating system called CPM. Unfortunately, Gary did not take their visit seriously and went flying in his plane and asked his wife to meet with the IBM folks.

From California, the IBM team traveled up to Seattle to visit with Bill Gates and Paul Allen who had a company called Microsoft. Gates and Allen convinced IBM that they could deliver what IBM needed within a time and cost framework that made their offer attractive to IBM. Microsoft did not own the operating system but did have a licensing agreement with a Seattle firm, Seattle Computer Products, who did. The time was November 1980 and Microsoft signed an agreement with IBM to provide the operating system, simply termed DOS for Disc Operating System. Microsoft then paid Seattle Computer Products \$50,000 for the complete rights to the system which was an integral part of the IBM PC introduced in August 1981. Every time IBM sold a PC at \$5,000, a copy of Microsoft's DOS was sold at \$50. IBM's entry legitimized the personal computer and the world of computing was forever changed.

This has got to go down in the history of American business as one of the most colossal ironies. In IBM's haste to get to market with its version of the micro-computer it made a deal with a firm to buy a product it did not own. As we all now know, it enabled Microsoft to grow to double the market value of IBM while Gary Kildall, who had a superior product, drank himself into an early grave and died in a barroom in Monterrey.

IBM should not be faulted completely. Their mission, traditionally, has been "peddling iron" as we used to call the selling of hardware. They have never understood the value of software and the potential for making more money on software than on hardware. Their focus was to get out a product quickly to counter a threat that didn't exist. Apple Computer Corp. is still around but never was any serious competition to IBM—it caters to its own loyal group of experienced users who appreciate a superior product.

8.2 PC Effects

The advent of the personal computer had a significant effect on two groups of people—users and programmers.

8.2.1 Users

The computer user now had the ability to take the computer to where the problem was instead of vice versa. If the application were accounting, the computer could be placed on the accountant's desk where he/she could work more efficiently with the instrument of data retrieval and computation under their fingertips. Furthermore, the computer achieved the luxurious-in-time status of the typewriter. No one cared if it was idle overnight or during the day. Since it is not a multi-million dollar set of boxes requiring air conditioning and special power supplies the user could be wasteful of its utility. Networking the PCs added enormous power to the effectiveness of the working force.

8.2.2 Programmers

The programmer had a new found freedom that was enormously powerful. No longer did one have to wait on line for time on the centralized computer to test out one's programs. Mistakes were found and corrected much more quickly and easily. The old process of writing the program, transcribing it into punched cards or other computer input medium, and then submitting it for running and discovering one error at a time was quickly abandoned. Thus, the programmer was much more effective—and more portable. He could download a program onto a small diskette and travel to another computer and run it at another location where there would be a compatible computer.

8.2.3 Other Effects

There was another societal effect worth noting. The scientist or accountant or other user of computers did not necessarily have

to deal with the programmers any longer. They did not have to sit frustrated while the programmer told them the same story, week after week—that the program was 90% completed. The user could buy programs at the computer store which had been all checked out, debugged, and ready to perform the assigned task—from computing and printing payroll to computing, printing, and emailing taxes.

Not only was the user freed from the clutches of the programmer, he felt a new freedom in having the computing power directly under his control. He was able to predict with an increased degree of accuracy what his computing budget should be and what should be expected over a given period of time.

A casualty of these circumstances was the large-scale mainframe where the migration away by the user left it with a smaller base upon which to distribute its expenses. One government installation in Cambridge reacted unwisely to this loss of business by raising its rates—which hastened the departure of users.

8.3 Visicalc

One computer application earned the attribution of selling more PCs than any other program. That is a program that allowed the user to perform so-called spreadsheet analysis. It was named VisiCalc for Visible Calculation by its authors—Dan Bricklin and Robert Frankston. For example, it allowed accountants and business planners to produce a schedule of expenses over time with the expenses on the vertical axis and the time on the horizontal. Then one could vary the assumptions that went into this schedule and the computer would quickly determine the results—including the bottom line. This is an extremely powerful tool to provide to planners in that it opened up a utility to allow the testing of many assumptions and many alternatives before selecting those that suited the issue at hand.

It also provided a strong tool to overcome the users 'cyberphobia'—the fear of computers. This is a very strong emotion in many persons—they fear that the computer is going to make a fool of them by revealing their ignorance. This also is one of the

reasons that the young folks have taken up the computer with such abandon. They don't mind stumbling on their path to learning.

I learned an interesting lesson about pricing software from Dan Bricklin. He told me that when they first started selling VisiCalc they charged \$99 per copy and received a few orders. They decided to raise the price to \$275 and sales were fantastic. The software and the associated instructions were the same, the only thing changed was the price. There was a perceived value at \$275 that customers had that they didn't have at \$99. Note that the cost of material was a few bucks for the diskettes and instruction manual. It is easy to see how Microsoft maintained 25% compound annual growth for so many years.

8.4 PC Anywhere

An interesting utility program, called "PC Anywhere", made it possible to type something on one computer and have it appear on another. Both computers had to be linked by modem and phone lines, of course.

One day back in the early 1980s two of our programmers had the PC Anywhere link set up between a computer at our office in Cambridge and a computer at the Coast Guard headquarters in Washington. They were performing a demonstration of some of our software for a young officer in the Coast Guard. We used to call them "Coasties". Anyway, our man in Washington was typing in some text and his associate in Cambridge was simultaneously correcting his misspellings. The Coastie thought the computer was doing the real time correcting while the typing was taking place. He was mightily impressed, as well he should be. We can only imagine what happened when he told some of his compatriots what he saw. They were probably as gullible as he was and believed him.

8.5 Videodisc

When I first approached the National Security Agency (NSA) and told them about all the wonderful things one could do by

tying a videodisc to the computer they had never heard of it before. That was early in 1981. One of their problems that they admitted to me was that their security was so tight that they were usually a year or two behind times technologically since their people did not get out and go to conferences, etc. They depended upon outside contractors to bring them up to date.

My company at the time, Micro Computer Software, proposed an effort of about \$100K to take a look at what they were doing and to tell them how this technology could be applied. We never got too far in finding out what they were doing for security reasons. However, it became apparent that there was an application where the technology might be helpful. That was in training.

One of their instructors, Mark H., wanted to move up the ladder and was tired of training people in the operation of a DEC computer system that processed secure data from three governmental agencies. This involved all the operational aspects from the cycling up the system to shutting it down, backing up data, etc. It was a ripe application for an interactive training videodisc employing a Panasonic interactive videodisc player and a PC which we chose to be an IBM.

From the Panasonic folks I was introduced to Lou Lessard of Needham, Mass., who had been one of the producers of Sesame Street—the popular children's program. Lou was very helpful as a contractor in producing the disc. After spending a considerable amount of time working on and refining the script we went down on one weekend and shot all the footage we needed to make the training videodisc.

I was somewhat surprised at the ease with which we went through security with all of the camera equipment. NSA was so upright about security that the return address on the envelope when I received the contract through the mail was "Maryland Procurement Office." That's all. Another example of their caution occurred when we were having lunch. There was a stand-up cardboard advertising notice on all the tables recruiting folks to work in other NSA locations around the world. I gave it to my son saying something like—"Here, Will, you can join up and work

anywhere around the world.” Mark grabbed it out of his hand and said—“You can’t read that—it’s classified!” Will had a SECRET clearance at the time but Mark ignored that fact in his hypersensitivity.

A few years after we had completed this contract I checked back with the Agency folks and was told that our efforts had saved them hundreds of thousands of dollars in personnel time. Whenever a new employee came on board they let our combination of videodisc and IBM PC do the training for them. It was so good that even when seasoned veterans from the field came back for a refresher course they made use of the combination of disc and computer to brush up on things.

8.6 Tsongas Versus Harvard

One morning back in the 1980s I was flying down to Washington on an early flight, as usual, and I struck up a conversation with the man on my right. I always preferred sitting on the aisle. It seems less claustrophobic there. I also preferred the bulkhead because there was more leg room. My seatmate turned out to be the Treasurer of Harvard University. I asked him, “President Bok is not going to debate the Harvard investment policies with respect to South Africa with our junior senator is he?”

He replied—“No.”

That was a big issue at the time. Paul Tsongas, our junior senator from Massachusetts, challenged Harvard President Derek Bok to a debate about Harvard’s investments in South Africa.

On the way back that evening I was sitting on the aisle when who should come in and sit next to me but Senator Tsongas. I said “I’m so pleased to meet you again, Senator. I was just talking about you this morning.” He wanted to know with whom and about what, of course, so I told him.

He said “Do you know what they said to me?”

I said “No”.

Tsongas said, “President Bok’s office told me that they would be happy to debate the United States government’s investments in

South Africa, but not Harvard’s.” That story sums up the imperiousness of Harvard.

8.7 Colonel Comment

One day in the late 1980s I was visiting our people who were programming on a contract with the Department of Transportation (DOT) in the Volpe Center in Cambridge. One of the DOT Operations Research scientists, Donna, came running down the hall shrieking—“I don’t believe it!” When we settled her down we learned that she had just finished a phone conversation with a military Colonel from the Pentagon. In the course of their chat he gave her a reference whose last name was O’Neill. To be sure that she got it correctly he spelled it for her:

“O—comma up high—N-e-i-l-l”

Along the way to making Colonel, he never learned about apostrophes.

This was at a time when the first President Bush was calling up the National Guard to bolster our forces in preparation for the Gulf War. We couldn’t help but wonder how our forces would fare with such uneducated Colonels already on board.

8.8 Sources of Wonderment

8.8.1 Drugs and Thugs

Back in the 1980s during the elder Bush administration we had a contract with the Department of Transportation (DOT) under Federal Aviation Agency (FAA) sponsorship to set up a data base of the flight log cards. These were the information cards that a private pilot is required to fill out when logging a flight into the US crossing its border. The information includes: Pilot’s Name, Aircraft ID, Source, Destination, Date and Time, etc.

As the data was accumulated we then planned to look for patterns such as the number of times that a specific aircraft flew a

specific route into and out of US air space. We hoped to identify potential drug traffic aircraft for inspection and interdiction by US law enforcement agents.

We installed a time-shared DEC computer with four data input stations and our employees were busily transferring the data from the cards into the computer. It was clear to us that this work would be meaningful because suspicious patterns were showing up almost immediately.

One of the pilots identified as a potential trafficker was detained in the Los Angeles airport for about six hours for questioning before being released.

Suddenly, we were ordered to cease our work, the FAA sponsor was reassigned to another project, and the money for continuation was withdrawn. I didn't think much about it at the time. Government programs and funds are often shifted about due to budget cycles and approvals. But I later worried and wondered if the drug interests were so pervasive that they could persuade government officials to stop a program threatening to expose them. If so, that could be scary.

8.8 2 Pure Fantasy

As a continuation of the previous thinking, I concocted the following scenario as a potential movie plot except that I couldn't think of a happy ending.

Consider the Vincent Foster alleged suicide. What we don't know are the forces behind that incident. Imagine the following—

Shortly after the Clintons entered the White House, Hilary discharged the travel arrangements staff and transferred the function to a travel agency in Arkansas, allegedly run by some friends of the Clintons. Her motivation was political payoff and so-called improved efficiency although that argument is a stretch of the imagination.

What she didn't realize was that the White House travel agency had mob connections and was using diplomatic couriers and pouches to import drugs into the country. They were able to circumvent the customs inspectors at the border due to their

diplomatic immunity. By her actions, Hilary was unknowingly interrupting this avenue of drug traffic.

In retribution, the mob arranged for Foster's "suicide" to send a message to the President. Foster was selected because he was so close to the Clintons that they would feel the hurt personally and realize how deeply the mob had penetrated the workings of the government in general and the White House in particular.

As we now know, the Arkansas travel agency deal was canceled and things in the White House are back to normal, whatever that is.

Section 9.0

The 1990s

9.1 Wolsort

I wrote an accounting package for my dentist and wrote what seemed to me to be a straightforward sorting routine. I was impressed that it was extraordinarily slow so I started studying the routine to see what was going on. I learned that there was an enormous amount of interchanging of data that was taking hours instead of seconds, as I expected. I started thinking about sorting for the first time since I entered the computer field. I read everything I could get my hands on both at the MIT library and at the Boston Public Library. I could not convince myself that the rationale for any one method was a significant improvement over other methods.

After a few years of thinking about it I came up with a method which proved in my first tests to be 100 times faster than the one used by Microsoft in DOS. I later tested it against other packages and techniques and found that it was at least a factor of two faster. Thus, I applied for a patent in the Spring of 1990 and was awarded my first patent—#5,369,762. I called my method Wolsort since I figured that if Halley could name a comet that he discovered after himself, I could name a sort technique.

My attempts to market Wolsort were frustrating and, on the whole, unsuccessful. I remember the reaction of the fellow from Microsoft who was responsible for their sort utility. He told me two things that were significant:

- 1) No one has asked for a faster sort; and

- 2) If someone wanted one he could write a sort using someone else’s method and he would not have to pay me a royalty.

I also recall the reaction of the President of Stratus Computer. He told me that he asked his whole marketing staff—“How many computers would we sell if we had the fastest sort routine?” Their answer—“None.” I ran out of money in trying to sell my method and could not afford a full-blown generalized sort package in competition with others on the market.

In addition I had an unhappy experience with one of my investors. I was talking on the phone with and trying to sell Nathan Mhyrvold, Vice President of Microsoft responsible for new technology, when I mentioned that Gordon Bell was one of my investors. His reply was—“Oh, we are going to talk with Gordon on another matter and we will discuss it with him.” I then briefed Gordon on the importance of talking about Wolsort with them. After his meeting I asked him what happened. He said that they did not discuss it. I later read in the Boston Globe that Gordon had accepted a job to work for Microsoft. I relearned something I had learned long ago—Never expect someone else to carry your message for you.

Thus Wolsort is an idea whose development must await sufficient funding before being effectively implemented. Meanwhile, I got sidetracked by the Technology Capital Network experience (Section 9.2) and have not yet returned to Wolsort.

9.2 Technology Capital Network

I was minding my own business, testing my sort routine, when I got a phone call one day in the 1990s from Jack Carpenter. In 1955 Jack and I shared an office with John Kettle in the old Arthur D. Little Building on Memorial Drive. Jack had heard that the Board of Directors of the Technology Capital Network (TCN) was looking for a new Executive Director and he wanted to know if I was interested. My reply was—“Sure, it sounds like fun.”

After a few meetings with individual members of the Board, I was called and offered the job, which I accepted. I stipulated that

I was involved with Wolfsort and would want to continue to work on it since I had an obligation to my shareholders. This was acceptable to the Board.

TCN was a new name for the Venture Capital Network, started in 1984 by Professor William Wetzel of the University of New Hampshire. I had used it, unsuccessfully, to find money for Wolfsort and I knew how it was supposed to work. It is a computer-based system for introducing Investors and Entrepreneurs to each other. Each entrepreneur fills out an application which asks a number of questions such as:

What type of business do you have?

What phase of fund raising are you in—early, first round, etc.

How much are you looking for?

How much will you accept from each investor as a minimum, and so forth.

A similar application is completed by the investor who is asked:

What type of business are you interested in investing in?

What phase interests you—early, first round, etc.

How much are you looking to invest, etc.

The answers are then matched in the computer and the positive correlations are noted. The matches are then reported to the corresponding entrepreneurs and investors. Once they are introduced, the TCN computer matching service is complete and it is up to the entrepreneurs and investors to follow from the introduction to the investment stage.

Since new computer applications have always been of interest to me I felt that therein would be something that I could contribute. It was also interesting to again associate myself with MIT. One of my bylines was that I left MIT to start my own business in 1954 and I hadn't had a steady job since then. I then embarked on a new adventure and truly enjoyed my associations. MIT has a certain cachet to it which felt familiar and warm to me.

Another service sponsored by TCN was the periodic venture capital forums that we held at the MIT Faculty club. We would serve a minimal breakfast of juice, coffee and pastry followed by about ten sequential 15 minute presentations by entrepreneurs to an audience of potential investors—institutional as well as individual. Following the presentations we would serve lunch and allow time for the investors to visit tables at the perimeter of the conference room wherein they could meet the presenters, view their wares and swap cards, etc.

It didn't take long to observe that the face-to-face presentations in the venture capital forum were more successful than the computer matching. An entrepreneur could expect to find a match about 15% of the time while about 30% of the face-to-face presenters got some form of funding. Therefore, I increased the frequency and scope of the venture capital forums with a consequent increase in funding. We went from about \$1.8M total to over \$3M total in the first year.

One of the innovations I brought to the process was what might be referred to as a pooling meeting. That is, in addition to the entrepreneur addressing the group we invited an investor who had already invested in the company to tell the assembled group of investors why he had made his investment. This was done in a relaxed atmosphere after dinner and was constrained to two or three at most presenters. The very first night that I tried this we made a connection. One of the presenters had a device for dispensing soap without touching the dispenser. He had an infrared detector built into the dispenser just as we see in the water dispensers in public restrooms. In the audience was a doctor from one of the local hospitals who not only invested \$25K but also put the entrepreneur in touch with the proper person in the hospital where he worked. This kind of 'smart money' from an investor who could help the company is what one always seeks in a startup investment.

Another interesting experience I had was at an MIT Enterprise Forum at which I was asked to speak. I knew there were to be about 200 people in the audience and we had one entrepreneur from New Jersey in our network who was trying to raise startup

money for his product which was “the best candy bar in the world” which he called “Flyer”. It tasted somewhat like a Snickers bar but much more delicious. I called the entrepreneur, told him about the meeting to be held and who would be in the audience. I asked him to ship me 200 candy bars for distribution. It worked. There was a lawyer in the audience who took the bar home and that evening he learned that his wife who worked in a hotel chain had just been introduced to the “Flyer” that afternoon. She raved about it. The lawyer not only invested his year-end bonus of \$50K he also performed some free legal work for the company.

I observed an interesting cultural difference between US entrepreneurs and representative from Britain, Scotland, the Netherlands, Wales, and Japan—all of whom visited me at various times. They observed that what we are doing would have difficulty working over in their home countries. The reason was fairly simple. If a US business man fails and must put his company into Chapter 7 and loses his investors’ money, this is chalked off to experience and he goes right back to the well and gets funded again. Over there, failure is treated as a lifetime mark from which the entrepreneur is never allowed to recover. Thus, success over there is to find a lifetime job with Phillips, IBM, or Toyota rather than taking the chance of failure.

Another plan for expansion was to branch out into the neighboring states. Thus, I took the whole show to Vermont and to a joint New Hampshire/Maine meeting. I visited with the Connecticut folks and encouraged them to follow our lead but never actually conducted a venture capital forum with them. They started on their own and recently sent me literature in which they bragged about raising \$500M for presenting companies.

As part of the warm up procedures I would go to each presenter and talk with them, relaxing them and helping them with their pre-presentation jitters. One fellow in New Hampshire I remember was as calm as could be until he took the microphone for his presentation. He then started to yell his pitch. He yelled so loudly that he broke the PA system. And we had a specific length of time—around 15 minutes—which was sufficient for

the investors in the audience to judge whether or not they wanted further information. This guy went over the limit and I couldn't stop him. I finally had to step up to the platform and physically wrest the mike from him. Needless to say, he did not get any funding from our group.

The Vermont forums were more civilized and after my going up there for two successive years, they were able to go off and conduct the venture capital forum on their own which they are continuing on an annual basis.

After two years at this task it was time to move on and prepare for what was one of the most interesting and challenging exercises in the history of computing software—the Year 2000 problem. (Section 9.5)

9.3 Slovenia

When I was running the Technology Capital Network, Paul Johnson, then Director of MIT's Enterprise Forum, called me to his office one day and asked me if I would travel to Slovenia in his place since he had an unavoidable conflict. I readily agreed and flew to the northernmost country in what used to be Yugoslavia. Immediately after landing, I and three others from the US were driven to Tito's villa on Lake Bled where we met with local officials who briefed us on their plans for privatization of industries that were formerly government-owned.

Donna DiLuigi-Ostrec, a transplant from New Jersey, organized our visit there. In the small world department she worked in the US for Roy Boe, a fellow YPOer who I met in Florida. Roy owned the New York Nets (now the New Jersey Nets), a basketball team in the American Basketball Association (now part of the NBA). The team played and was then located on Long Island and had as a star player Julius Erving (aka Dr. J).

Donna also arranged a meeting modeled after an MIT Enterprise Forum meeting. In this meeting an entrepreneur describes his business plan and a panel of experts offers constructive criticism of his plan.

In the Q&A after the entrepreneur's presentation I was asked—"What does an investor expect in return for his money? -20% return? 30% return? I replied that an investor would like what Peter Lynch calls a ten bagger—an investor wants to invest \$100K and after 3 to 5 years receive \$1M in marketable securities. They replied—"Oh, we have a public market. It's open Tuesdays and Thursdays and it trades in the securities of 29 companies." It occurred to me that one of the areas of entrepreneurship in these developing companies would be to establish and run stock exchanges.

I had learned from Donna how to end my talk in their language. I thanked our hostess and wished them well in their new experience with capitalism. Their response was to give me a standing ovation.

The yearning for stock ownership is so great that one of the universities sold shares in the university—something I had never heard of before. I can't imagine any university making a profit or paying a return.

9.4 Tip O'Neill

In December of 1993 I read in the morning paper that Tip O'Neill would be autographing books in Lauriat's that day from 12:30 to 2:30. I arrived at 2:20 and asked the manager if Tip would still be signing books if I joined the line because it looked like an hour long wait. He said that I would be the last one, so I bought 4 books and, after an hour or so approached Tip with my books. He signed one for me with no significant inscription, other than "Best Wishes".

I asked him to sign one for my son-in-law, David, who had just written the best seller "Reinventing Government" with the inscription: "Reinvent Politics? Don't Try." For my son, Will, who was fund-raising in Washington for the new non profit convened to spread the word on reinventing government, I asked him to sign "Enjoy Washington. Beware Politicians."

Finally, for Susan, I asked him to sign "Politician Extraordinaire" He wrote Politician and then he studied the next word and said—

“What’s that spelling? That’s not right!” I explained that it was French. He said “Well tell her I’m spelling it the Irish way—Extraordinary”.

A month later, he entered the Brigham and Women’s hospital and was carried out a few days later to the local funeral parlor.

9.5 Year 2000 Problem

9.5.1 Problem Definition

The Year 2000 or Y2K problem had as its basis a programming convention. As you will recall, programming started seriously in the 1950s. During that time and since, it was customary to allow six decimal digits for the date—two for month(MM), two for day(DD), and two for year(Y Y)—often in the format—MM/DD/YY.

As we think about this representation, MM is sufficient to represent any of the months which run from 1 to 12, and DD is sufficient to represent any of the days which run from 1 to a maximum of 31. So long as the date remains within the 20th century YY is sufficient to represent the date which may run from 00 to 99. However, as one approached the century mark an interesting ambiguity arose. Does 00 mean 1900 or 2000?

When programmers from the 50s forward represented the date by two digits instead of four they were employing a popular form of shorthand. I can remember writing programs in 1950 in which I used only one digit to represent the year, since the program was not intended for use beyond 1959.

One can make arguments about the fact that programmers were trying to conserve storage which was limited in the early years. However, it is more realistic to observe that it was easier to use two rather than four digits. It also presented a certain symmetry to represent the date with two digits for each of the categories: month, day, and year.

As early as the 1980s and certainly in the 1990s those concerned with computing and programming became increasingly worried about what would happen to their programs when the year 2000

arrived and the two-digit date would be misinterpreted by the programs.

Let us consider an example. If a program depended upon calculating the number of years that a transaction was taking place from a previous date and one performed the calculation—

- 1) Take the current date
- 2) Subtract the previous date
- 3) Use the result as no. of years

One would find the following results—

- 1) 00
- 2) $00-96 = -96$
- 3) -96

Clearly the result which should have been = 4 is now = -96.

This wrong result can cause all sorts of problems subsequently depending upon how the result is used.

9.5.2 Solutions

There were many solutions proposed that were dependent upon programming tricks. One could, for example, inside the computer let the YY variable run to 9a, followed by 9b, then 9c, etc., where the a, b, and c are the binary values that are on beyond 9. That means a conversion before and after use in the arithmetic part of the program. However, some of the clever tricks in themselves contain such changes that errors can and will be made. That is, the cure can exceed the problem as far as errors are concerned.

The most straightforward method is to expand the YY to YYYY before any computation is processed. This will assure that the results of the computation will be as correct as before. However, one must be careful about consequent spacings, etc. on printouts, data storage, etc.

9.5.3 New York Experience

After spending an inordinate amount of time ‘inventing’ clever ways around the problem I finally decided to put into practice some of the ideas on practical problems. The programming conversion was such an immense problem that I felt that any and every person with programming knowledge should help out. Through the reference of an acquaintance I applied for and obtained a position as a programming consultant with a major accounting firm—PricewaterhouseCoopers. The work was in corporate offices in New York City.

Therefore, I joined the weekly pilgrimage on the early Monday shuttle from Boston to ‘The City’ as New Yorkers call it. The return was Friday afternoon. It was for me a very interesting experience. At no time during my initial interview was I asked my age which at that time, spring of 1999, was 70. I was assigned a number of COBOL programs that had to be converted to be ‘Y2K compliant’. In other words, they had to work correctly when the date went from 1999 to 2000. It was an ideal situation since I was the only person on the floor who knew COBOL and the previous programmer had died.

Rather than employing any tricks, I found it most convenient and most probable of success to expand the date fields from 2 to 4 digits. This meant finding the date fields which in COBOL was helped by the English language nature of the code. I then expanded them from 2 to 4 digits before any calculations took place, after which I compressed the date back from 4 digits to 2 so that subsequent printing and other programs would work properly. I forgot how many hundreds of instructions I wrote to fix the programs but I took the attitude that since they were already in use and checked out all I needed to do was to focus on the date changes.

It is worth noting my pay in order to observe the changes in the field over the years. Back in the 1960s I used to pay COBOL programmers \$8K per year or about \$4 per hour. I was now working for \$100 per hour and the firm was charging \$441 for each of my

hours. To make certain that they got their money's worth I would bill an eight hour day even though I would start each morning (except Monday) between 8 and 8:30 and work until 8 to 8:30 at night. Practically every day I ate at my desk since the firm had a fabulous cafeteria with all kinds of good food. I would then walk about 10 blocks to 44th Street where I was staying at the Princeton Club. I would get a good night's sleep and start over the next day. This went on for over five months.

One morning I recall walking down a street that I think is 52nd Street from Fifth Avenue to The Avenue of the Americas (the old Sixth Avenue). This was the diamond sellers' block—full of wholesale and retail diamond purveyors. I approached two Hassids who were engrossed in deep conversation. I figure that they were discussing some serious aspects of the Torah. As I came within earshot I realized that they were exchanging web site addresses. It's a small world when computers are involved everywhere.

This experience was proof of that old saw—Programming is like riding a horse or a bicycle—you may have not done it for a while, but once you learn you will never forget.

Section 10.0

The 2000s

10.1 1:11-1/1/01

I phoned my daughter, Rose, at precisely 1:11 EST on the first of January, 2001 to share a moment that any numerologist would love—the time of 1:11 on January 1st of the year 2001—hence 1:11-1/1/01. After joyously chatting a while about the New Year and the fact that she and her family traveled to Boston to visit the 25th anniversary of First Night on New Year’s Eve she asked that both Sue and I be on the same phone line so that she could talk with both of us.

She then told us that she was diagnosed with lung cancer on 12/21. She had a mass in her lung about 6.5 cm in diameter as revealed by an X-ray and the cancer had metastasized—spread to her brain and her adrenal gland. Sue and I were scheduled to go to two parties on New Year’s Day which we attended but I talked with no one in particular. After the second party, I headed the car toward Essex and rang my daughter’s doorbell. She and her family had just finished eating so we stayed and talked for a while. To drop in is not what we do—we always call first—both ways. However, when she opened the door I said—“I need a hug.” So did she.

Words can’t describe the strange feelings I had. They ran from incredulity to the gross unfairness of life. I couldn’t let the knowledge consume me so I kept it at bay by thinking about other things. However it always returned.

Here is a woman of 47 who worked all her life to get through Stanford, graduating Phi Beta Kappa; worked through med school

at Albert Einstein with the aid of her husband, David; did her internship at Yale; then left the Harvard HMO to start her own practice in Gloucester, a small Cape Ann fishing village where she grew up. She and her husband raised four children, one boy followed by three girls, and she worked brutally hard for many years to build an obstetrical practice all by herself, employing nurses and midwives to help out. However, she was on call all the time, delivering four babies over the Thanksgiving holiday, for example. Many women told me that Rose's early diagnosis of their health problems saved their lives. She treated hundreds of women and delivered thousands of babies over her working life. In recent years she had emphasized the treatment of menopausal women who have generally been neglected by the medical community.

If work wasn't enough, she ran and won election to the Essex School Board and led the way toward a merger with Hamilton to form a regional school district to make available to the Essex school children facilities and teachers that they had not had and Essex could not afford.

I searched the Internet and came up with a web site—lungcancer.org which revealed such startling statistics as the fact that women with lung cancer that had spread had about a 2.2% chance of surviving. I clung to that 2.2%. I could not reconcile myself to the unfairness of this tragedy.

Through her oncologist at the Mass. General she was allowed into a study of a new drug called Iressa. This drug was designed by an English firm to attack directly the lung cancer of non-smokers that had afflicted Rose. It worked for her—for a while. The 6.5 cm mass was reduced to 2 cm and the adrenal growth was stabilized. Technicians had zapped her brain tumor with radiation.

Instead of her predicted life span ending as of August 2001, she returned to practice three days per week and traveled to Barcelona where she accompanied David on a speaking engagement.

The irony in the help from Iressa is that when David was working with Vice President Gore on the Performance Review, they homed in on the Food and Drug Administration (FDA)—

the government agency that approves the use of new drugs. They convinced the FDA that their customers were neither the Press nor the Congress, they were the American people who would benefit from a more rapid approval process. They shortened it from years to months. This improved processing allowed Iressa to be tested and approved in time to help Rose. However, Iressa’s benefits only lasted nine months before those clever little cancer cells figured a way around it.

Rose had folks praying for her from San Jose to San Paulo. Her neighbors set up a web site and used the Internet to determine whose turn it was to cook dinner for the family of six. There were months when the neighbors showed up with supper every night.

Alas, there finally arrived July 12, 2003, when I eMailed this message to our family and friends:

“At 4:21 AM Dr. Rose Mary Wolf Osborne passed from my hands to God’s when she peacefully stopped breathing.”

There were over 500 people at her memorial service but only the family when we scattered her ashes and white and red roses from the breakwater into Gloucester harbor on a Sunday afternoon in August, in accordance with her wishes.

10.2 Letter to the Editor Re Chad

In the tumultuous times surrounding the year 2000 election I wrote the following letter to the editor regarding the election fiasco in Florida. I sent it to the usual suspects—the New York Times, the Boston Globe, the Washington Post and the Gloucester Times. No one published it.

THE CHAD AND THE VOTE

by William Wolf

If indeed “Past is Prologue”, consider the fact that the 1890 US census was never completed because there were too many

people's forms to be counted by hand. Herman Hollerith, a Census Bureau employee, inspired by a Jacquard loom he observed operating in France, invented the punched card and the equipment to process the card. In subsequent decades, from 1900 forward, all the people, represented by cards, were completely counted.

Moving ahead 50 years to the dawn of the electronic computer age in the 1950s, the Hollerith-encoded IBM punched card was adopted for computer input. IBM designed its punched card to be stiff and durable enough to be processed by electromechanical card readers, sorters, etc.; and yet be stored in file cabinets for a long time, and still be readable.

In the typical computer installation the card is perforated by an IBM keypunch machine. A keypunch operator strokes the keyboard and corresponding cuts are made in the card by a rectangular electromechanical cutting tool operating with a great degree of pressure. The rectangular cutout material we call "chad". Anyone who has heard the loud din in a keypunch room knows that the noise from this cutting is so loud that the keypunchers are usually isolated in a sound proofed room.

In a computer card reading cycle the card is automatically fed between a copper cylinder and eighty copper brushes—one for each column. The leading edge of the card interrupts the electrical current between the brushes and the cylinder and starts a counting cycle. As the card passes through, when the chad has been removed from the card in a particular location the resultant empty hole allows the brush to make both physical and electrical contact with the cylinder, thus generating a pulse whose timing tells the computer that a number from zero to nine was meant to be punched, indicating a numerical choice. [there happen to be two locations for an additional punch allowing 12 locations or choices but that is another story]. Thus the card was designed to take a lot of punishment by the card reader since the card acts as an electrical insulator before and after the hole is "read".

The card also gets processed by a card sorter where it endures even greater abuse as it travels down the length of the sorting machine.

In spite of its sturdy design, occasionally a card during sorting or reading will get tangled in the works of the card sorter or reader and be torn or chopped up. The device will stop and the pieces of the card must be picked out of the mechanism by fingers, tweezers, or pliers.

To reproduce the mangled card, the computer operator will then lay out the pieces and hand punch a replacement card with the duplicated information. The operator places a blank card in a small portable device, which has a perforated bottom and a plastic perforated top. The operator then puts a hand tool through the appropriate location matching the crumbled card and punches out a rectangle in the correct location. This punched out rectangle is also called chad. Philosophically, it is not unlike the hole in the donut.

The card stock is very substantial. In the usual computer installation, the used cards and chad are of such high quality that a scrap paper handler will pay the management for the privilege of picking up and carting away this high quality paper scrap, which he then sells at a profit.

The punched card was never designed to be hand-punched, except in unusual cases, described above. I heard the inventor of the Votomatic in a TV interview state that he employed the standard IBM manual punch mechanism. The ballot was adapted to be hand punched so that the chad could be punched out manually, indicating choice of candidates. However, this is not an easy job. And most folks (voters) who don't spend a lot of time around large IBM computer installations do not realize the force with which they must punch this hard card stock to make a clean hole. Thus we get the hanging chad, and the chad which does not budge at all because not enough force has been applied to push it through—only enough force to "dimple" the card. Of course a dimpled card does indicate choice and should be counted as a vote since the vote was made but the hole was not.

As stated previously, the manual punching is not what the card was designed for. Over time, with the wear in the plastic overlay and the manual cutting tools dulled by overuse, dropping

on the floor, etc., it is not surprising that thousands of cards do not get punched properly, cleanly, and with enough force to penetrate the card.

To create many punched cards manually and expect those cards to be processed by card handling equipment without problems is not a good practice and is discouraged in any large computer installation.

The principal problem is that the punched card has to be stiff and sturdy enough to survive subsequent processing by machine processors. Thus, it is not an appropriate medium to be hand punched. The process is bound to be flawed. It is surprising that only 60,000 out of 6 million votes were rejected by the computer equipment in Florida because the hole was not made properly.

Given all of the above, a hanging or dimpled or pregnant chad in no way diminishes the intent of the voter. These votes must be counted to make the outcome of the Florida and, therefore, the national election legitimate!

Procedurally, it is much safer to do as we do in Rockport—make an “X” in a box with a stubby pencil, although my daughter uses her pen since she doesn’t trust the voting folks and doesn’t want them erasing her vote and penciling in the Republican.

—30—

William Wolf
Rockport, Massachusetts

10.3 Letter to President Bush

Ten days after the disastrous events of 9/11 I eMailed the following letter to President Bush and got a standard computer generated reply thanking me. I also sent a copy to the Editors of the New York Times, Boston Globe, Washington Post, LA Times, and the Gloucester Daily Times. The only one who published it was the Gloucester Daily Times. Furthermore, September 21st was a Friday. On Monday, September 24th, the President announced

his plan to confiscate the terrorist’s assets. Either the timing of my letter was a coincidence or the President had a busy weekend.

PRESIDENT GEORGE BUSH
WHITE HOUSE
WASHINGTON, DC

September 21, 2001

Dear President Bush,

Obviously you are receiving much advice from many sources concerning how we should react to the events of September 11, 2001.

Here’s mine.

You are absolutely correct when you say that this is a new war. This war is not about armies confronting one another over land masses. The goal is not capturing territory as on Iwo Jima. The goal of our enemy is to see how many innocent people can be killed and businesses disrupted. One must admit that those you so aptly called “evil doers” were clever when they used our planes loaded with our jet fuel as their missiles. All it cost them was a few lives of maniacs anxious to reach Allah sooner plus the cost of a few first class plane tickets.

Since this is a new war, new tactics must be considered. My suggested tactic is quite simple—in addition to hunting down and destroying those responsible for September 11 we should also cut off their sources of funds.

Seize their bank accounts and other financial caches, wherever they lie, as *an act of the new war!*

bin Laden reputedly has \$300 million to bank roll his activities. This allows him to pay for his followers to attend

our flight training schools, rent rooms and condominiums in some of our best neighborhoods, and travel about the world in style. I started thinking about this when I asked myself—where did these men get the money to fly first class?? Our friend's daughter who perished on Flight 11 was back in the tourist section—saving her company money. Like most of us, her husband and two children haven't stopped crying.

Last week the Boston Herald ran a series of pictures of several \$600,000 condominiums owned by the bin Laden family in Cambridge and Charlestown. I'll bet that most of those flying in the tourist section of Flight 11 have never even been in the lobby of these elegant buildings.

It shouldn't be hard to mount a task force to appropriate the funds of the enemy. Our IRS agents are adept at tracking sources. Our bank and mutual fund computers can easily sort out the accounts of those our intelligence community identify as terrorists. Our allies will certainly cooperate as has been shown by the vast support pledged over the past 10 days.

*Seize their assets and those of their friends and families!
Watch what happens when their friends and families take care of them!*

It was reported that bin Laden controls the heroin production in Afghanistan and that that country supplies 80% of the world's heroin. Send over crop dusters to spray and eliminate the poppy fields. Perhaps Agent Orange will do the trick.

Any medical person knows that if we can cut off the nutrients to a cancerous tumor it will wither, shrink, and die. So be it with terrorists—the cancers of our society. A hungry terrorist will not do much plotting—except for food.

Put a price on the head of bin Laden of say \$10 million [yes, Dead or Alive] with a ransom of \$1 million for information as to his whereabouts. His followers should swamp us with data on this moveable target.

Think about it. Your speech to the Congress and the nation was right on target. You were correct in establishing our objectives. But let us also focus on cutting off their money supplies and we will net not only the bin Laden crowd but others who our intelligence community knows and suspects as plotting further destruction of our world as we know it.

I could never understand why for so many years we have been doling out money to less-privileged nations. There is an old saying—“No good deed goes long unpunished.” Common sense should tell us that these nations would resent us since they do not have the ability to repay us. We have not bought friends—we have funded enemies.

Finally, please reflect the will of our people and accept “God Bless America” as our national anthem. Also rename our Defense Department to the War Department to reflect our mood.

William Wolf
Cape Ann, Massachusetts

Section 11.0

Business Commentary

There are a few observations and experiences that transcend time and are worth repeating. I recall a fellow at AERL saying “A consultant should not be hired to tell you what to do. Rather a good consultant will tell you what not to do because he’s tried it and it didn’t work.” Be that as it may, the following may be of interest.

11.1 Organization

I attended a YPO week at the Harvard Business School twice. The first time I found the case study method very interesting but did not get anything out of the week that I could use in my business so I attended a second year. Surely the Harvard Business School would have something for me. However, it failed to impress me a second time so I left it alone after that.

One lecture I did remember was given by Professor Stephen Fuller—an inspiring speaker who told it like it was. I can remember him telling us that in designing our corporate structure we should study those organizations that have survived over the years.—and learn from them. In particular, he gave as examples the Catholic Church, the Military, IBM and the Communist Party. I often wonder what examples he would choose today since some of them haven’t done too well.

Nevertheless, when Wolf R&D grew to the point where we had to have a structured organization, I modeled ours after the military. That is, there were staff and line functions. The line was

our interface with the customer, which I decided to define geographically. The alternative method would have been technologically.

In charge of our four offices—Boston, Washington, Houston, and Los Angeles, I designated a Vice President. He was responsible for all the activities and business of that office. For support, we had the staff functions of personnel, financial reporting, and associated legal and accounting services. I made it crystal clear that although the staff was located at company headquarters in Concord, that staff was there to serve the branch offices.

When we got to the size that in our four offices we had 550 people to monitor, I instituted the following reporting mechanism.

Each Friday before leaving the office, the Vice President in charge dumped memory from his mind to a tape recorder. He FedExed or otherwise got the tape to me and I listened to them over the weekend so that by Monday morning I knew what was happening in each office across the country. There were no secretaries (now administrative assistants) typing anything so that the reports could be spontaneous, rapid, and informal. Starting Monday, we would work on the most critical problems in the most troublesome office. This, of course, varied from time to time.

Monthly, we invited each of the Vice Presidents to a meeting in our Concord office and we sat around a large round table and everyone listened while each person reported on how things were going at his location. Our financial person sat in on these meetings as well. Thus, everyone knew how we were doing and people could help each other out of difficulty. This often involved transferring technical people back and forth from one office to another. Occasionally we would meet in another office, but it was usually Concord.

This complete communication between offices allowed us to grow in a mutually supportive way and deal with the problems before they became major. When we sold the company to EG&G I observed that we were better organized than they were even though they were ten times our size.

11.2 Management Information Systems

The term corporation derives from the Latin “corpus” or body. Lawyers undoubtedly first derived the term corporation to characterize a separate body which can sue and be sued. However, if we characterize the corporation as a body we can consider it to have a pulse, what a mathematician might term a ‘characteristic time’, a time between significant events. If one is in the agriculture business this time can be a growing cycle. If one works in the stock market, it can be the pulse of the ticker tape.

To design a successful Management Information System (MIS) one needs to recognize (or define) the characteristic time of the business, get one’s managers to project in intervals of these characteristic times, and measure their projections vs. reality as these times occur. Computers may be used to record, compare and present results as soon as possible after the end of a characteristic time interval is reached. Thus, the management information can be presented to the decision makers for them to ask probing questions, weigh the answers, and take appropriate carrot or stick action.

If one employs this technique one is in control of the business, not controlled by it, as is often the case. Unfortunately, auditors and Wall Street think in terms of monthly and quarterly results. However, few businesses have a characteristic time that is monthly or quarterly.

Therefore, the results and projections must be transformed into periodic results for the sake of the accountants and investors since that is the way they were trained to look at a company’s results. However, that should be a mechanical offshoot from the system employed to control the enterprise.

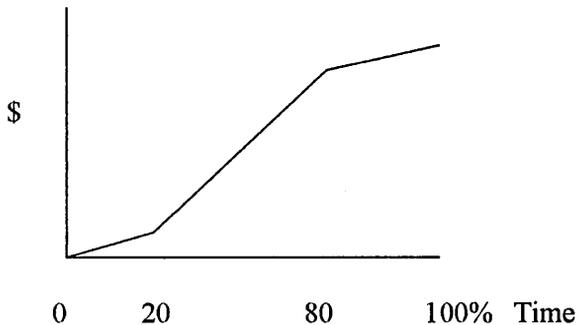
11.3 Contract Monitoring

Many of our contracts in Wolf R&D were cost plus fixed fee government contracts to conduct research in the computer field and/or programming. We found through bitter experience that

one could not wait until the contract was almost complete before monitoring its progress. We took our commitments seriously. Although there is a procedure in the cost plus fixed fee environment for "overrunning" a contract in time and money, if one did it too often one built a reputation for poor performance. Since we were a relatively young and small company, we tried very hard to build a reputation for getting things done within time and cost budgets.

Most contract reporting and monitoring in those years was done by tables of numbers including, as time went on, estimates of percentage of completion. These were weighed against the percentage of money spent in order to get a semblance of control on how the contractual effort was being done.

We devised a method for contract monitoring which was very helpful and, as far as we knew, unique. We asked the manager of the contract to plot his anticipated rate of expenditure over the time period of the contract. We then plotted this forecast against time on the "X" axis, normalizing the contract amount to 100% on the "Y" axis. Thus, we found that there was a typical curve generated, as may be seen in the following graph.



This curve represents the fact that the manager would be assembling his team and preparing to do the work in the first period of time, say up to 20% of the time period. He would then hit his 'characteristic slope' of expenditure as his team would be doing the work, say from the period 20% to 80% of the contract time period. Finally, the last portion of the curve would level off as

the final reports are being written and the team members are being assigned to other work.

We plotted these curves for each contract and measured the actual results against them. What we found was most interesting. We found that we could predict in the first third of the time scale of a contract whether or not that contract was going to be in trouble! This was revolutionary since the early prediction allowed us time to take corrective action and avoid contractual difficulty when the final report due date was upon us.

We programmed the Whirlwind computer to produce these curves for us and I made slides so that we could produce them in a management meeting. What was interesting was that as soon as a manager's slide was shown and significant deviations from the predictions were displayed, the excuses came forth. Everyone could see that the contract was headed for difficulty and the manager would talk about his problem(s) and we would take corrective action. This could mean assigning more or fewer people to the project, asking for an extension in time but not money, etc. I actually felt that we were in control of our work and thus our company.

11.4 Marketing

Beware of problem solutions that you have devised but no one wants!

At Wolf R&D we surveyed the results from our marketing efforts over a two-year period in terms of the number and kinds of contracts we were awarded in response to our proposals and obtained some interesting results. We found that we were 80% successful if we responded to what the customer said he wanted. On the other hand, we were only 20% successful if we proposed work by which we suggested to the customer our ideas as to what we thought would help him do his job. These percentages were in terms of dollar volume of all contracts, not numbers of contracts.

Consider the story entitled—"Will the dogs eat the dog food?"

This is a classic fictional marketing yarn. It seems as though there was this Major in the Army who was in charge of the Army disposing of its horses. The cavalry was long ago out of business and it was finally decided to dispense with the horses. The major

had the bright idea that this would be a natural source for dog food. He quit the Army and offered to take the horses off their hands at no charge to the government.

He then set up a company to can and distribute the dog food (made from slaughtered horses) to local supermarket stores. He put all his life savings plus all the money he could borrow from friends and family into this new venture.

Then reality set in.

Although the stores would take a trial order there were no repeat orders. It turns out that the dogs didn't like the horsemeat. Thus, came that famous line—“Will the dogs eat the dog food?”

11.5 Free Advice

Consider the source when hearing and acting on business advice.

For example—I once visited a small business adviser in New York city as part of a consulting assignment. He was a retired businessman working pro bono for the US Small Business Administration. We were talking about strategies in running a business. He advised me that if and when my business was ever experiencing a tight cash flow situation, I should pay the phone and electric bills by mixing checks—putting the electric company check in the phone bill envelope and sending the phone check to the electric company with the electric company bill. That way the utilities will know that you are trying and will chalk it off to clerical error. They will return them to you and you can buy another week of time.

Years later I had a computer service bureau with cash flow problems. I remembered this advice so I tried it. Both utilities deposited the checks in their own account even though they were made out to the other company. Their banks accepted them and presented them to my bank and they both bounced.

So much for free business advice from the government.

11.6 Business Ethics

This happened early on in my career. I had my first government contract with the Air Force. After a year, the contract was due for

extension—in both time and money. Over the phone, John S., the contracting officer, asked me for a bottle of scotch for their office Christmas party. He said that he would let the procurement office know where it was coming from. I told him that I didn't do business that way. Therefore, he delayed the extension.

In time, Frank Lee, my banker, wanted to know why the contract was not being renewed and I told him what had happened. He instructed me to report this to the head of the procurement office, which I did. The head of procurement asked me to come out the next day and asked me to repeat my story in front of him and his assistant, which I did. Fortunately, by a strange coincidence, Marjorie B., the secretary in the office I was sharing at the time knew John S. and knew that he had been fired from the Army in Maine for a similar incident. Thus, after I finished my story, I told them to check his previous record and look into why he was fired from Maine. They did and asked him to leave.

The lesson to be learned was that for a lousy bottle of Scotch, John lost his job. But I got a reputation—that of being no one from whom to ask any favors. This was a good reputation to have because I was never bothered after that time.

Where did John go? He got a better paying job in procurement at Raytheon.

With all of this moralizing, the world markets are handled differently and one needs to consider what is necessary to get things done if one is dealing in world commerce. I have had no experience in selling overseas so I don't know what international business ethics are. I only know what I have been told and that is that other countries look at our high moral business standards as being unrealistic. However, I feel more comfortable with them.

11.7 University of Maryland Lecture

Back in 1990 I was invited to speak to students and others at the "1990 ENTREPRENEURSHIP SYMPOSIUM—KEYS TO

SUCCESS". So on Saturday, February 10, 1990, I was one of the speakers at this forum. My lecture was in two parts from the notes below.

11.7.1 Business Advice

- 1) Be Innotative—Find a Need and Fill It.

Example of Harry Hoagland—Patent Attorney who built Unit Packet Corp.

Example of Federal Express—Key element of success—
Receives \$12/lb for packages versus airlines who receive \$400 for 200 lbs. = \$2/lb. for people who must be fed, housed, environmentally controlled, etc.

- 2) Specialize—Don't try to be all things to all people.

Build a reputation for doing one or a very few things very well. Word will spread, and when people want that thing, they will come to you.

- 3) Be Market Driven at all times.

Interview your customers, especially your former customers. They will be flattered that you asked their opinion and will tell you things your salesfolks will not.

- 4) Find or Develop a Sugar Daddy.

Locate someone who needs your product or services with whom you have rapport and who can buy what you are selling for long enough for you to establish other business. This should be done at an early stage and may be a key element in establishing your business.

5) Never commit to more than half of your time.

Use the other half for selling new clients.

This presumes your startup is a bootstrap one with no outside capital—a much preferred way to go if you can stand it.

6) Understand, talk, and price in the other person's language.

If you are selling computer software your customer will be frightened by talk of bits & bytes. Learn to talk in his language. When we established a service bureau for doing back office accounting for Boston brokers, IBM's Service Bureau Corp. was charging the brokers as they would any other service bureau customer—by the amount of memory used, by computer cycles, by lines printed, etc. We set up a pricing scheme that charged by the number of trades made. We won clients because they could understand our bills which were written in their language.

7) Learn Business Law and Accounting and Finance

This is very important and there are many ways to do this, from reading "Accounting for Non-Accountants" to interviewing lawyers and other professionals. Especially learn how to read balance sheets; profit and loss statements; and cash flows—the language of bank officers and financiers.

8) Get and use the best advice possible.

Large public accounting firms—Peat Marwick and Price Waterhouse—all have small and developing business departments. Don't skimp on advice. Much of it is free.

- 9) It is better to sell a high quality item at a high price than a low quality item at a low price.

When you sell on the basis of price only, the customers that you win will be very fickle and will jump to your competitor as they lower their prices.

- 10) Never take on a job unless you expect to make a profit.

Leave the loss leaders for others. You may lose some business, but you will be ready to take on the next job for a profit when the opportunity arrives.

- 11) If at first you don't succeed—Give Up and start something else.

This is more than jest. It ties in with the next item. At first they may seem to be contradictory, but they are not. What I am trying to say is that you should constantly question everything about what you are doing—your goals, your techniques, your results, etc.

- 12) Be Persistent and Maintain Persistence.

Persistence is the single most important attribute for the Successful Entrepreneur. To stick to the principles that you know in your heart are correct is the most important tenet for you to follow. If you learn nothing else today, learn that Persistence equals Success.

- 13) Don't blame others for your own errors. Learn from your mistakes.

This is pretty obvious but we are all guilty of it at one time or another. If you find yourself saying—‘he’, or worse, ‘they’

did this or that to me, this is a sign that you are blaming others. If, in fact, 'they' did it to you, learn not to trust 'them' again.

- 14) **Employ Leverage.** Determine in whose best interest it is for you to succeed.

Example of the Bendix Computer sale on time. [I was leasing a G-15D computer from Bendix and wanted to buy it. No one would loan me the money but my banker told me to go to Bendix—the firm for whom it was important that I succeed—and talk to them about a time payment plan. I had to threaten to remove the computer and bring in a competitor before they would change their policy and allow me to keep it but convert the lease payments to time payments. They later thanked me—they sold many computers under this plan. Meanwhile, I sold \$250K worth of computer time on this machine that cost me \$60K.]

Example of John Kasarda—\$10K problem and solution. [John was a student friend who asked me how much stock he should give up for the \$10K he needed to finance his new business. After learning more details I told him to go to the person for whom it was important that he succeed—his first new customer—and ask him for the \$10K up front so that he could finance his performance. The customer gave it to him and John built a very successful business—without giving up *any* stock.]

- 15) **Read the Wall Street Journal daily.**

You have two things to invest—your time and your money. Your time is more important than your money because the things in which you invest your time will dictate where your money will come from in the future. The WSJ is worth the time it takes to read on a daily basis. When I get too busy

to read it, I store copies and take them on my next plane trip. Then I read and discard them as I go.

- 16) Never lose your sense of humor. Have fun in what you do.

If you don't enjoy what you are doing, then you are “working” in the cruelest sense of the word. You might as well do it for someone else where there are company benefits such as cars, pensions, etc.

- 17) Conserve Cash, Cash is King.

Remember the Golden Rule—Them's with the Gold, Makes the Rules.

- 18) Always Walk Fast.

This creates an impression that what you are doing is important and you can't wait to get to it. It also discourages people from stopping you and wasting your time on trivia.

- 19) Observe Institutions and learn from them—the military.

Organizations that have stood the test of time deserve to be studied and the best ideas from them should be emulated in your work. Staff and line organization in the military, for example. Splitting your organization either technologically or geographically is another important factor.

- 20) Finally—be wary of advice and advice givers—consider the source.

We all have our different philosophies of life. To me, life is an exciting adventure. I can't wait until tomorrow to see what exciting new things it brings.

11.7.2 Business Opportunities For The 90S

Avoid Manufacturing—Beware of The Manufacturing Decision—“One must commit millions to build an assembly line for a product that the public will still want in the time it takes to build the capability.”

Thus, personal prejudice toward Services and Information Industries.

1) Personal Computer Software.

File Locators.

User-Friendly Interfaces—User-friendly computer is an oxymoron.

2) Personal Computer Installation and Training.

3) Personal Computer Maintenance.

Sell Insurance/maintenance policies.

4) Networking of Personal Computers.

5) Personal Use of the Personal Computer—No one has gotten this right yet.

Source, Prodigy (both IBM and GE failed), Compuserve, aol.

6) Add value to 1990 Census Bureau Data.

7) Credit Information in New Forms.

Hooper Holmes & Concord Computing examples.

8) Videodisc Applications.

Programmed Learning.

Storage & Retrieval of Pictures as well as Data—Real Estate Listings.

9) Backup Storing of Computer Tapes and other Data.

Archiving periodically (daily or weekly).

10) Manipulating Data & Presenting it Differently.

Computer Output to Microfilm and Microfiche.

Note that in Opportunity no. 5, above, aol finally developed this field by doing two innovative things—allowing unlimited usage [i.e., not charging by the minute for usage but charging about \$20/mo. for unlimited usage] *and* by offering a 'bounty' of \$25 to a user to introduce a friend. Aol enjoyed an over \$200B market cap before the recent downslide to \$60B.

Section 12.0

Personal Commentary

A number of things happen to a person in the course of some 70+ years from which some lessons may be learned. Here are some of my experiences and observations.

12.1 Boring Life

William F. Buckley spoke of his writing—“It is a terrible sin to bore people.”

Above all else—do not lead a boring life.

When you think about it we all have an awake and potentially working life of from age 20 to age 65 or 45 years. Then, there are

$$45 \text{ years} \times 365 \text{ days/year} \times 16 \text{ hours/day} = 260,800 \text{ hours}$$

at our disposal. If one spends these hours in a boring pursuit one is existing but not living.

I firmly believe that we were put on this earth to do something worthwhile and the only thing that we have complete control over is our own lives. Some people get bogged down by being slaves to another's domineering nature and they are to be pitied. Others spend an awful lot of time taking people on and challenging them—to no personal avail.

However, we are bound to be successful if we remember that we have two things to invest—time and money. Of the two, time is more important because how you invest your time will dictate where the money comes from down the line.

12.2 Internal Revenue Service

A few lessons I have learned over the years concerning the Internal Revenue Service (IRS) have led me to the following—which may not be current since they are an ever-changing body.

1) *Never fear an audit.*

A Price Waterhouse auditor once told me “If you never get audited we are not doing our job.” His premise was that reasonable limits should be pushed to the client’s advantage. When called by the IRS for a conference, also known as an audit, negotiations usually resolve differences.

2) *Forget about trying to invoke sympathy—the IRS has none.*

The first time I got audited back in the late 1950s I wore some old trousers which were beginning to wear through at the knee. During the taxi ride down to the examiner’s office I kind of wore through the bare spot with the leather patch on my jacket so that the skin would show through. However, it did me no good whatsoever. When my case was called and I went to shake hands upon meeting the examiner, I discovered that he had no right arm. Talk about gamesmanship.

On the subway ride back to the office (forget about taxi) I swore that the next time I would go to see him I would take a tax accountant. I did and I distinctly remember my tax accountant and the examiner discussing job opportunities with the IRS. I can remember thinking to myself—what am I paying this guy for? So that he can find another job? He wasn’t my tax accountant much longer after that.

3) *Always file in August and always print it by hand.*

I don’t remember when I started doing this but I haven’t had an audit since then. One must file a Request for Extension form

on or before April 15. A four months extension is automatically granted. Then when you file your return on or preferably earlier than August 15, the return must be entered into the IRS computers by hand and my guess is that it is not processed by the same filter programs to which other early, punctual returns are subjected. These filter programs look for discrepancies and subject the return data to a set of criteria that are unknown to the general public. For example, one check might be the percentage of gift giving reported as a percentage of income. If one's return shows a ratio that exceeds a limit placed by the IRS in its computer program, that return is set aside and subject to audit. My guess is based upon the way that big computer installations handle their workload. That is, they schedule large runs such as their filter programs when they have massive amounts of data to run them against. They would not bother with a few returns. It wouldn't be worth it to gin up the whole production mechanism.

- 4) *If ever called in for an audit, get there early and fall asleep in the chair.*

This is an empirical observation based upon personal experience. One time in the mid 60s, in the winter, I was called in by the Boston office of the IRS for a 1 PM appointment. I had worked all night the night before and I didn't have time for lunch. Therefore, when I showed up for my appointment at 12:45 and the auditor had not yet returned from lunch, I sat down and fell asleep. It was overly hot in the office to combat the cold outside and I was exhausted and hungry.

When the Examiner arrived he called out my name and, hearing no response, he came over to where I was sitting and shook me to wake me up. He was so impressed that I had fallen asleep that he breezed me through with no problem. He told me that I must have a clear conscience if I was so unconcerned that I had fallen asleep. The reason for the audit was that I had sold a house at a profit and deducted a number of improvements which I had made. However, I did not have all of the receipts for all of the supplies

and material that I claimed. The auditor questioned nothing. He said it all sounded reasonable to him and I passed the audit with no further questions asked.

12.3 Organized Religion

I was raised a Lutheran and went through the whole routine—Church every Sunday, Sunday School, etc. At my Confirmation (at about 13 years old) I memorized and recited in front of the whole congregation the names of the books of the bible—forward and backward—old and new testament. This feat had been done by my sisters before me so it was a family tradition.

The pastor was a large Humpty-Dumpty-shaped man named Reverend Vogt with a soft, happy, mellifluous voice. He used to take the month of August off and go to a farm in the country. I can remember asking my Mother—“What happens if someone is in trouble and needs the Minister?” Her reply was—“They will just have to wait until September.”

I was taught to say my prayers every night before going to bed starting with the Lord’s Prayer; followed by the Apostle’s Creed; then, the Ten Commandments; next, the 23rd Psalm; a few small ones that I can’t remember, some in Saxon that I couldn’t understand; and ending with “Now I lay me down to sleep. I pray the Lord my soul to keep. If I should die before I wake, I pray the Lord my soul to take.” A gruesome thought for a young mind to think about before sleeping.

I used to feel comfort in praying to God whenever a personal crisis occurred in my life. I can even remember praying that I would pass an exam at MIT. It didn’t work.

Religion was so entrenched in my family that one wouldn’t think of missing church on Sunday morning, even if one were sick. But such devotion had its dark side. For example, I can remember coming home from college and talking with my Uncle George on his porch. It seems his second oldest son—John—had committed one of the most unpardonable sins that one could conceive of—he married a Roman Catholic. My uncle was so upset that he refused

to talk with him. I argued with my uncle about his attitude. I can remember his telling me—"But, he is going to Hell!" It seems so childish and idiotic to be writing about this 50 years later. At the time, however, this was serious business.

I married in a Catholic church with the understanding that my wife, who was raised Catholic, would convert to my Lutheran religion after marriage. However, she was unable to keep that agreement. I won't bore you with the trauma that that evoked in me but I will say that I later converted to Catholicism even though I had a great deal of difficulty swallowing some of the dogma. My heart was never in it. My principal reason for doing so was that I did not want the children to grow up in a divided household. I had seen the searing personal divisions and trauma that was evoked in other families.

The closest I ever came to a "religious experience" was in 1958. My wife and I were among a group of New England business men, women, and spouses on an Associated Industries of Massachusetts trade tour of Europe. We started with the opening of the US exhibit at the World's Fair in Brussels and toured Paris, Frankfurt, Vienna, Innsbruck, Venice, Milan, Florence and Rome. In Rome we and hundreds of others attended a Sunday morning Mass in St. Peters. As part of the ceremony Pope Pius came down to meet us in the front row. As he passed I knelt and kissed his ring—a ritual restricted to Catholics. When I did, I felt his "charisma". A tingling glow encircled my body and I could physically feel his personal electricity. I have never felt such an all-encompassing electric experience before or since. This description is grossly inadequate to explain the physical emotions I felt.

After my 1974 divorce, with the children all raised and off at school, I returned to going to a variety of Protestant churches. I tried the Lutheran church in Boston but was put off by their clustering around me wanting to know all about me, etc. I ended up at Trinity in Copley Square because the liturgy was thought-provoking and non-threatening and the music surpassed any I had heard before. It brought emotional tears to my eyes listening to

and trying to sing "Amazing Grace", "Ein Feste Burg", and other favorites.

In summation, however, at this stage of my life I have to confess that my experience has been that religion is a time sink. I learned and rejected prejudice from the pulpit. Reverend Vogt railed against the Catholics. I can remember thinking "Who are you to say such things about anyone?"

I can remember talking with Bucky Fuller about organized religion. He told me that, in his opinion, if religion had not already been invented, it would have to be. His principal reason was that, in the early days, people led such miserable lives on earth that they had to believe that there was an after-life that was better than their earthly misery. Otherwise, they would despair.

I do believe in Extra Sensory Perception because I have experienced it. I believe that we have a means of communication that we know nothing about from a physical description. I have learned that if we work at it we can hone our skills at psychic response.

However, from the Reformation to the Crusades to the Holocaust, I see the Church doing more harm than good and I advise one and all to be wary of going overboard on organized religion. It can harm more than it is willing or able to help.

After touring the Holocaust Museum in Washington, DC, I came away with new insight in the active role that the Church played in the whole Holocaust experience. Perhaps in future years my anti-organized-religion prejudice will mellow but I don't think so.

12.4 Jury Duty

I've had two experiences with Jury Duty.

There was a period in which I was so busy that leaving what I was doing for 6 weeks or months would have been disastrous. Therefore, when the computer-generated notice came in the mail I ignored it. I continued to receive ever-increasingly threatening letters, all computer generated. I made up my mind that if I ever got a letter written by a human, not a computer, I would respond. However, this never

happened. I checked my strategy with a lawyer in my building one day while riding up in the elevator. I asked him if anything would happen to me. He said, "No, but don't quote me."

Another time I did respond when I was less busy and I went through the whole routine of appearing, being interviewed by lawyers from both sides, etc. Just as we were about to go to trial, the sides settled so I never got to serve. It was an interesting experience but a time sink.

Incidentally, the courts got my name from the voter registration list which was the only place that listed my address as 40 Staniford Street. To everyone else, including the Post Office, I lived at One Longfellow Place which, in the voter registration books only, was known as 40 Staniford Street. So I concluded that if I didn't vote, I wouldn't get called to jury duty. This posed an interesting conflict of loyalties.

These days one of the things that I luxuriate in is the fact that I, as a "Senior", don't have to participate. I guess they figure that those over 65 don't have time on their hands. In my case, that's correct.

12.5 Extra Mile

I think it was in Dale Carnegie's "How to Win Friends and Influence People"; or, it might have been in one of the sermons by Rev. Norman Vincent Peale which I used to read in my youth. Somewhere along the line I learned and followed the principle of going the extra mile. That is, to always deliver more than what your client asked for. This philosophy has proven to be a very important advantage over the years. Fundamental to this idea is to deliver what the contract calls for, then deliver more. Perhaps the principal benefit of this extra effort is that you end up standing apart from everyone else that works for the client and the client remembers it. Repeat business then flows and you have a good feeling about your work.

One must be careful when applying this philosophy on a personal basis. For example, I had a summer job while at college

washing windows in the New York Air Brake factory in Watertown, NY. The work was tough in that it involved scraping off the industrial soot with a wire brush before washing and drying these windows that were mounted at about a 15 degree angle from the vertical on the factory roof. In my enthusiasm to go that extra mile I would tend to wash more windows than the average during the course of the working day. After a few days of this I picked up my lunch pail and found that someone had scratched on the side the choice words: "PISS ON WOLF". I studied that for a while, then provided some extra scratches to read: "PASS A TON WOLF". I suspected that Shaughnessy was the culprit but I corrected my behavior and dropped down to the average output of my fellow workers. They were also college students—never to be heard from again.

12.6 Who's Who

I'm not sure when it started but one day I got an invitation to submit my resume to the Marquis Who's Who of New Providence, New Jersey. I looked for a catch and found that there was none. That is, to buy a copy of the directory was not a requirement. When I found this to be true, I was hooked. Thereafter, whenever an invitation came from them to be listed, I filled out the forms and sent them in. Along the way I did buy one year's edition at the biographee's discount so that I would have it on my bookshelf for reference.

That said, I have been listed at various times in the following editions of their directories:

Who's Who in the World
Who's Who in America
Who's Who in the East
Who's Who in Finance and Industry
Who's Who in Science and Engineering
Who's Who in the Media and Communication

I particularly enjoyed that last one.

But to those skeptics who believe that there is a tie-in between listing and buying, I can assure you that that has not been my experience. The one drawback is that I get a tremendous amount of junk mail and I suspect the addresses listed as one source for the mailers.

12.7 Humor

The most important personal characteristic for a successful career is persistence. The second most important characteristic is a good sense of humor. Humor can be used as an ice-breaker to relieve tension and apprehension in a sales or social situation. If you can get a person laughing they will generally be more receptive to whatever you may be promoting at the time.

As time has gone by, humor has changed. Ethnic humor is practically non-existent—no Pat and Mike jokes. Jewish humor may be allowable if it is funny, not discriminatory. It is usually safe to tell a joke on one's self or a member of one's family. True stories of happenstances that are funny usually qualify as well. It is most important, if one is listening to a joke, that one hears it through even if one has heard it before. It is rude to do otherwise.

Some examples of humor that come to mind follow. However, it is better if one makes up one's own jokes.

- 1) Two elderly gentlemen who hadn't seen each other for a long time meet on the street corner. One says "How good to see you again, Sam. Tell me, was it you or your brother who died?"
- 2) I once knew a fellow from Maine who said—"I was only wrong once. That's when I thought I was wrong, but I wasn't."
- 3) Two fellows meet on a street corner. Dave says, "Hey Frank, I just bought a new hearing aid. It cost me \$275 and it is the latest in hearing technology."

Frank replies, "Oh really, what kind is it?"

Dave says, "4:30"

- 4) Then there is that old standard from the days of burlesque—

"Who was that lady I saw you with last night?"

"That was no lady, that was my wife."

- 5) Don't forget the Henny Youngman-type one liners:

"Now, take my wife—please".

- 6) Doctor: "I'm sorry sir, but you only have six months to live."

Patient: "But, doctor, I can't afford to pay your bill."

Doctor: "In that case, I'll give you another six months."

- 7) Four grandmothers were having lunch when the waiter came over and asked:

"Is *anything* all right?"

- 8) Out-of-town visitor in New York asks a student carrying a violin—

"How do I get to Carnegie Hall?"

Student—

"Practice, Practice, Practice."

- 9) A car pulled over the other day on Tremont Street in Boston and the passenger rolled down the window and asked me—
"How do I get to City Hall?"

I replied—"First you go to law school, then you become a Democrat, and then you get elected. However, if you don't want to wait that long, it's the funny looking building over there behind the flagpole." The passenger did not laugh but the driver thought it was hilarious.

10) HARbalearing

Here's a joke that is bound to break the ice in a mixed crowd of 4 or more.

Start off with:

"Have you heard about the new study they are conducting over at Harvard (or whatever university is nearby)?"

Then quickly answer your rhetorical question with:

"They are trying to correlate SEXUAL PERVERSION (say it loud and with emphasis) with HARbalearing (say "HAR" loudly and let your voice trail off so that no one can hear the "ing")."

Invariably someone in the group will ask "with what?"

At this point, reply in a loud voice "HARD OF HEARING!"

If it fails to bring a laugh, go home because everyone is sleeping.

Section 13.0

Summary and Hope for the Future

13.1 Summary

So there it is—a chronicle of one programmer's life and experiences to date. I sincerely hope that you have enjoyed revisiting some of these tales of the past. In my personal view, Life is a glorious experience. One should live each day, every hour, to the fullest since these times, these places, these opportunities, will not recur.

Furthermore, I feel that we should learn from our experiences and pass that learning on to others. If we continue the process of living, learning, and passing along the results, there may come a day when we can all:

- * Focus on solving the problems worthy of our time and attention, using lessons learned from the past,
- * Live in harmony with one another, in societies capable of continuous self-renewal,
- * Employ computer and other technology, our skills and our energy to strive to leave the world a better place than that which we inherited.

If we do these things, and do them well, we can feel proud to be a member of the most distinguished product of evolution that nature has devised—the human race.

In the following sections are some thoughts about the future—what changes may transpire related to computers and the societal effects that those changes may have.

13.2 Hope for the Future

13.2.1 Birth to Death Registry

Our society has become so number-centric that it is not inconceivable that in the future each baby will be assigned a number at birth that will travel with the person through their lifetime plus a few years after to round up post mortem transactions. When one begins to work, one must apply for a Social Security Number that travels with that person throughout their lifetime. Why not extend it a few years backward until a person's birth? In the newspaper a few years ago a man in Minnesota wanted to change his name to a number but the judge wouldn't let him. The article did not publish the reasons for either argument.

13.2.2 Tracking and Location

With the advent of the Geophysical Positioning System (GPS) we can now walk out into the open and hold a computer in our hand which will shortly thereafter tell us our precise location on earth to an accuracy of about fifty feet. In order to do this we must be clear of any occlusions and in line of sight of at least three "birds" (as the GPS satellites are known).

The Federal Communications Commission (FCC) is demanding that the telecommunications companies install the ability to locate a caller transmitting a "911" emergency call to within about 300 feet even in occluded areas such as in garages and under trees where GPS can not function.

A natural extension is for our society to be able to track where everyone is at any time. Gone will be the excuses for the employees on baseball's opening day. Parents and spouses will have new weapons with which to track errant children and adults.

An obvious benefit to society will be the emergency situations where this technology can and will be life-saving. However, as an intrusion into our privacy it can be annoying if not harmful. The location of property is another matter. We will be able to eliminate

car, boat and computer theft completely and that will be a good thing,

13.2.3 Work at Home

The computer, coupled with communication now enables whole sections of our business to be able to be done from one's home office. This will alleviate one of the most insidious inventions of mankind—commutation. The extra two hours or more saved every day plus the relief from road rage and fender benders will greatly relieve our physical and emotional states and make us more productive and happy.

Or will it? It takes mental discipline to stay within your workspace and not roam. Then, there is that old spousal complaint—"I promised to live with you through sickness and through health but not through lunch."

Also there is that spontaneous, synergistic creativity that results from rubbing minds together at the water cooler. The environment for this is lacking when everyone works at home. As this migration continues its success will depend a great deal upon our ability to solve the resultant societal problems.

13.2.4 Medical Applications

I once went to the MIT library to do some research on the first sales of Computer Aided Tomography (CAT) scanners. I was looking for data on the market acceptability of a new computer-based medical technology. I was amazed. The entry curve was almost vertical. One year there were none. The next year it seemed that every hospital in the country had one. And at \$1 million per installation. This is obviously a testament to the importance of the doctor's ability to do non-invasive scanning of the inside of a patient's body so that he might "see" the tumor or other problem.

The medical applications iceberg is obviously much bigger. With new equipment we can provide the doctor with ever more powerful instruments of diagnosis and treatment. In addition, communications

and teleconferencing advances will permit doctors to consult and diagnose patients' problems with much greater accuracy.

One consequence of all this is an increase in longevity with our expectant lifetimes increasing greatly as we are able to replace limbs, vital organs, hearts, etc. Thus a new set of problems will arise in how to deal with and provide for all those old folks with young ideas, running around the tennis courts and golf clubs.

13.2.5 Space Travel

We all marveled at the American businessman who bought a Russian ride out into space for \$20M. That price will come down. Conceivably there will come a day when as a graduation present or honeymoon trip one might take a trip to outer space and view the world as it really is—a large, finite globe circling the Sun, with oceans, mountains, and clouds from a distance of about 200 miles. Since the Russians first launched successfully in 1957 and we started tracking all space satellites I have always lusted to ride in one—perhaps, some day.

13.2.6 e-Commerce

Peter Drucker once wrote that American companies have wrung as much as they can out of making the manufacturing more efficient and that the future lies in cutting back the expenses of distribution by using more efficient methods. Certainly the promise of e-Commerce has just begun to be realized. As more and more buyers and sellers communicate via computer and as the advantages move down the chain to the consumer there will be many changes in the way we do business. When a new, confirmed order comes in to a manufacturing organization all of the people effected by that order can and will be notified. This includes suppliers as well as those within the company. As the need for inventories diminishes through Just In Time and other computer-based methods, profitability will increase, to everyone's advantage.

Appendix

Companies Founded

Over the course of fifty years (1954-2004) I have been involved as founder or co-founder of at least 50 startups, including 5 not-for-profits. Of the list below 20 out of 45 were successful, were sold, are still in operation or did not generate a loss. Four out of the five not-for-profits are still in operation. Successes are underlined. KEY: F=FOUNDER; S=SHAREHOLDER; D=DIRECTOR; O=OFFICER; T=TRUSTEE; Z = OVERSEER

For-Profit Companies

American Technology Corp.—FSDO—This company was founded with Steve Spurlin and performs technical contracting work in Melbourne, Florida.

American Trade for Kuwait—FSDO—Founded with Alex Cjvanovic to work with some Kuwaitis that Alex knew who were working on rebuilding Kuwait after the Gulf War. The company failed when our partners turned out to be untrustworthy. When we researched a need and located the best US supplier, the Kuwaitis contacted the supplier directly in an end-around play so that they wouldn't have to pay us a fee.

BSW Corp.—FSDO—Founded with John Bardson and John Schwendiman to work with alternative energy sources for industrial plants.

Boston Service Corp.—FSDO—Established as a subsidiary of CBM to perform back-office accounting for member firms of the Boston Stock Exchange. Sold to the Exchange after 3 years of successful operation.

Centennial Farms—FS—a race track half way between Colorado Springs and Pueblo, CO. Founded with Colonel Miller after his retirement from the Air Force. Opened and closed after one season. Loss (\$50K) was equal to the cost of the dung removal. I explained to Col. Miller that if the track were in New England we would have bagged it and sold it for fertilizer.

CHASI—FSDO—Incorporated with a Middle Eastern architect named Chadiri who was introduced to me by Alex Cjvanovic. The goal was to automate the layout of architectural designs for buildings. The company was unable to obtain initial funding.

Computer Business Management Corp. (CBM)—FSDO—A Facilities Management company that I established in 1970. CBM was the parent of Boston Service Corp.; COM Service Bureau, Inc.; and Systematic Data Processing Services, Inc.

Computer Realty Trust—FSDO—A realty trust established to fund and manage the Wolf R&D Corp. home office building in Concord, MA.

COM Service Bureau, Inc.—FSD—A service bureau to take computer output from magnetic tape and portray the information on microfilm and microfiche. The company was capitalized at \$5K and sold three years later to the Fleet Bank for \$500K.

Concord Computing, Inc.—FSDO—Founded in the early 1970s with Victor Tyler from EG&G. Company is now a \$15B market cap public firm called Concord EFS. [Market symbol—CEFT] (Section 7.7)

Command Data Systems—FS—It was a Van Praag deal with a President named Will Little, an Annapolis graduate. The alleged reason for the core stringing facility in Hong Kong being unsuccessful was foreign competition who could string cores at lower prices.

Corp. in joint venture with Photon—FSDO—It was founded out of our LA office in the 1960s to do Computer Aided Design work but it was too early and \$250K was not sufficient funding.

Data Synteks, Inc.—FSD—Founded with Charlie Adams to do some computer input work whose uniqueness I don't recall.

Documentor—FS—Another VanPraag startup with a contract to install computers in MacDonald's restaurants. When I was told by a broker that I had lost my money I rationalized to him—"Oh well, at least I lost my money with Arnold Palmer." He said, "With whom?" I replied, "Arnold Palmer, the golfer—that's who someone told me was in on the original investment with me." "Oh no," said the broker "That was Arnold Palmer the dress maker from San Francisco." Imagine my deflation.

Edulogical Systems, Inc.—FSDO—A company to do classroom scheduling. (Section 7.4)

Eureka.Com—FSDO—A company started in 2000 to address a response to the FCC demand that telecom firms determine the location of the placer of a "911" emergency call. Absorbed into Focusystems, Inc. in 2001.

FocuSystems, Inc.—FSDO—A company founded in 2001 to continue the work of Eureka.com. The company's inventor, Vice President Len Thomas, contracted Lou Gehrig's disease and expired in 2002.

Furniture Company for Computers—FS—Founded in the 1980s with VanPraag and his carpenter associate who wanted to build

furniture especially designed for the personal computer. I don't remember what the name of the company was nor what happened to my investment.

Gorman Computer Inc.—FSDO—Founded with Pat Gorman, one of the writers of FORTRAN, to build and sell DICTRAN—a software package to interpret computer commands spoken into a dictating machine.

Harbor National Bank—FSD—Founded in 1960s—first new national bank in Boston in 40 years. (Section 6.13) Sold to New England Merchants bank.

Mass Medical Agency Inc—FSDO A corporation founded to provide Home Health Care assistance to persons with debilitating illnesses yet who prefer to remain within the comforts of their own home. The company's accounting procedures were programmed to serve as a model for my concept of the bank providing such services (see 6.13)

Industrial Publications Corp.—FSDO—A company started in the 1960s to produce reports for Wolf R&D as well as other technical companies in the Boston area. Superseded by the entry of the Xerox copier. (Section 5.12)

Midwest Computer Services, Inc.—FSD—A company founded with a group of five civil engineering firms in Decatur, Illinois. (Section 6.14)

Megapot—FSD—A company founded with Jim Laura to use computers in a new line of betting machines. Company was acquired, then unacquired.

Memistor Corp.—FSDO—Founded in 1960 with Stanford Professor Bernard Widrow to produce and sell his invention—the memistor—a resistor with a memory.

Micro Computer Software, Inc.—FSDO—A company I started in the early 1980s to write software for the PC. Worked for NSA on a videodisc computer learning application (Sec 8.4). Closed down in the late 1980s.

Planning International, Inc. (I)—FSDO—Founded this in early 1970s as a management consulting firm. Company subsided after about 3 years.

Planning International, Inc. (II)—FSDO—Founded this version of PI in the late 1970s as a management consulting firm. Sought business in Iran (Section 7.2).

Planning Systems International, Inc.—FDO—An "8(a) company" started in the late 1970s to help a disadvantaged person start a business. Achieved a level of \$1M in profitable sales in 3 years. Disbanded in 1982.

Problematics—FSD—a Van Praag company started in the Boston area with Joe Grandine to use computers for chemical analysis. The patents and the company were sold to Hewlett Packard.

Satellite Data—FS—Started with Victor Pomper as President. Sold my stock after 2 years at a profit of \$80K.

Standard Computer Corp.—FS—Founded in the 1960s with Lazlo Rocozi to build a computer that emulated the IBM 704 which was the standard main frame in those days.

Systematic Data Processing Services, Inc.—FSD—Bought this service bureau in the 1970s from DPF&G. After four difficult years Grumman bought the company and moved its service bureau business from Long Island to Waltham.

Technology Acquisition Corp.—FSD—A company formed to acquire the AVCO Everett Research Laboratory. Unsuccessful after

our inability to raise the \$20M required on terms that were favorable to us.

Umbrella Technologies, Inc.—FSDO—A “roll-up” which almost developed into an IPO but a New Jersey firm pulled out at the last minute.

Venture Research Corp.—FS—Norman Barnett and Chet Krentzman were the operating partners in the 1970s but they could not get along with each other so the company was disbanded after 2 years at a cost to me of \$25K.

Vertical Software—FSDO—Started with Walter Frank to develop computer applications to be applied to vertical markets. Ceased operations in the 1970s when promised funding failed to materialize.

William M. Wolf Company—FO—a company founded in 1950s to formalize the work being performed by my private consultancy. Evolved into the Wolf R&D Corp.

Wolf and McManus, Inc.—FSDO—Founded in the 1990s to assist start-up companies with obtaining funding from the VC and angel communities.

Wolf Computer Corp.—FSDO—Started in the 1970s to perform consulting and government contracts.

Wolfsort Corp.—FSDO—Formed in the 1980s to capitalize on my patented invention for a sorting method which can sort at least twice as fast as any other method.

Wolf Research and Development Corp.—FSDO—A computer consultancy founded in 1950s to take over work of William M. Wolf Company. Grew over 12 years to 550 professionals and \$5.5M

in profitable sales when we merged it into EG&G in 1967. Company is no longer in operation as a separate entity.

Wolf Realty Trust—FSDO—Founded in 1968 to reacquire the Wolf R&D headquarters property in Concord from EG&G.

Wright Brothers, Inc.—FSDO—Started in 1970s to work with Stanford University in marketing WYLBUR software developed at Stanford.

Y2K Software Corp. FSDO—Formed in 1997 to work on the “Y2K problem”. Performed consulting work in helping firms with their turn of the century software problems. (Section 9.5) Invented and obtained a patent for a “Y2K” method but did not employ it.

Not-For-Profit Organizations

Association of Independent Software Companies—FDO—Founded in 1968 and did some important work of significance to the industry (Section 6.7). Merged into ADAPSO in the 1970s.

Design Science Institute—FDO—Founded by friends and associates of R. Buckminster Fuller to carry on his work. The Institute subsided following Fuller’s death in the 1990s.

Ex-Ten Club—FDO—Founded with Al Corkin, Jack Drummey and others to bring together those recipients of “The Outstanding Young Man” award given annually to ten men in Boston.

Franklin Pierce College—F—Seed Capital put in with a few friends to support Frank diPietro in fulfilling his dream of founding a University. Franklin Pierce was the only US President to come from New Hampshire. Still in existence and thriving in New Hampshire, although Frank was deposed by an ungrateful faculty who conducted a mutiny.

National Council of Professional Services Firms—FDO—Founded with Bob Krueger to carry forward the work started by AISC over a much broader spectrum of companies. Grown to be a successful Washington-based lobby group for professional services firms.

Total $45 + 5 = 50$

Also

Addison Gilbert Hospital—T

Museum of Science—Z

Technology Capital Network at MIT—DO

Council for American Russian Cooperation—D

Young Presidents Organization—O

Data Distributors, Inc.—S

Scientific Measurements Systems, Inc.—S

Index

- Aardvark, 118
ADA, 30
Adams, Charlie, 42, 110, 113,
 195
ADAPSO, 115
AFCRL, 59
Allen, Paul, 9, 135
Alpha test, 26
American Technology Corp.,
 193
American Trade for Kuwait, 193
Anderson, Harlan, 40
A-OK, 78 thru 80
Applied Data Research (ADR),
 110 thru 115
Approximations, 28
Aqueduct, 60
Aries Corp., 110, 113
Arthur D. Little, 42
Association of Independent Software
 Companies (AISC), 11, 110-
 115, 199
AUERBACH Corp., 110, 113
Austin, Professor, 41
Avco Everett Research Laboratory
 (AERL), 42, 45 thru 48, 117
 thru 118
Babbage, Charles, 30
Bailey, Ron, 92
Banking, 84 thru 90
Barta Building, 64
Benedict, Professor, 42
Best, Sheldon, 51
Beta test, 26
Binary number system, 21 thru
 23
Boe, Roy, 149
Boston Service Corp., 194
Boston Strangler, 68 thru 71
Bothwell, Paul, 39
Bottomley, John, 69
Boy, 4, Swallows Pin, 32
Brady, Don, 39
Bricklin, Dan, 137
Brooke, Ed, 69, 71
Brown, Bill, 128
BSW Corp., 193
Buckley, William F., 178
Buffett, Warren, 9
Bug in Operation, 26
Bugs, 25
Bull, 30
Burnett, Carol, 84
Bush, President, 160

- Business Ethics, 169
 Buzzer, 33

 Callaghan, Marion, 108
 Cape Cod System, 10, 40
 Carpenter, Jack, 145
 Centennial Farms, 194
 Chad, 157
 CHASI, 194
 Cjvanovic, Alex, 193, 194
 COBOL, 52
 COM Service Bureau, Inc. 194
 Command Data Systems, 195
 Computer Aided Tomography (CAT), 191
 Computer Applications, Inc. 110, 114
 Computer Business Management, 117, 194
 Computer Graphics, 84
 Computer Instructions, 23
 Computer Realty Trust, 194
 Computer Sciences Corp., 110, 114
 Computer Usage Corp., 110, 114
 Computing & Software, 110, 114
 Comress, Inc., 110, 114
 Concord Computing, 126 thru 128, 194
 Conditional Transfer of Control, 25
 Contract Monitoring, 166
 Creager, Bill, 108
 Credit Index, 55

 Crossword Puzzles, 28
 CSII, 42

 Data Synteks, Inc., 195
 DEC, 40
 Design Science Institute, 199
 Digital Computer Laboratory, 40
 DiLuigi-Ostrec, Donna, 149, 150
 Documentor, 195
 DOS, 135

 Eberle, Bill, 125
 Eberly, Don, 36
 e-Commerce, 192
 Edgerton, Germeshausen, & Grier (EG&G), 10, 108
 Edulogical Systems, Inc., 123, 195
 Electronic Data Systems, 117
 Ellison, Larry, 9
 Englebart, Doug, 49
 ENIAC, 38
 Estridge, Don, 134
 Eureka.Com, 195
 Evans, Robley, 40
 Ex-Ten Club, 199
 Extra Mile, 184

 Fay, Jay, 47
 Federal Communications Commission (FCC), 190
 Federal Reserve Bank, 58
 First National Bank, 128
 FocuSystems, Inc., 195

- Food and Drug Administration (FDA), 156
 Ford, President, 129
 Forrester, Jay, 43, 71
 FORTRAN, 51
 Fox, Fannie, 129
 Frankford Arsenal, 38
 Franklin Pierce College, 199
 Frankston, Robert, 137
 Free Advice, 169
 Fuller, Professor Stephen, 164
 Fuller, R. Buckminster, 10, 66, 80 thru 82, 199

 Gates, Bill, 9, 135
 Gates Foundation, 9
 Gagan, Dick, 80
 Geophysical Positioning System (GPS), 190
 Glenn, John, 79
 Gore, Vice President, 156
 Gorman Computer Inc., 196
 Granholm, Jackson, 83, 84
 Groups of Tens, 33

 Harbor National Bank, 85, 89, 196
 Hardware vs. Software, 28
 Harvard Business School, 164
 Harvard Mark II, 25
 Hawes, Mary, 52
 Hi-Y Cup, 36
 Hooper Holmes, 54 thru 57
 Hopper, Grace, 25, 52 thru 54
 Horn, RJ, 71
 Houston, 43, 75

 Humble Oil, 43
 Hurkos, Peter, 69

 Iadonisi, Carmen, 57
 Industrial Publications Corp., 54, 196
 Informatics, Inc., 110, 114
 Intel, 19
 Internal Revenue Service (IRS), 19, 179, 180
 International Business Machines Corp.(IBM), 11, 55, 57, 58, 71 thru 73, 110 thru 115, 118, 119, 134, 135
 Iran, 120 thru 122
 Iressa, 156, 157

 Jenney, Dick, 75, 76, 129,130
 John Hancock Life Insurance Company, 46
 Jones, Dick, 112
 Jones, Steve, 90, 91
 Jury Duty, 183

 Kantrowitz, Arthur, 45
 Kennedy, Ted, 67
 Kenway Jenney, 72
 Kessel, Ben, 39
 Kildall, Gary, 135
 Killian, James, 64, 72, 73
 King, Ted, 54 thru 57
 Knowles, John, 67

 Leahy, Frank, 35
 Lessard, Lou, 139

- LIFE Magazine, 11, 92 thru 107
 Light Dimmer, 50
 Lincoln Laboratory, 40
 Lodge, George, 67
 Lotus, 11
 Lovelace, Lady Ada, 30
 Lynch, Peter, 150

 Machiavelli, Niccolo, "The Prince", 119
 Madagascar, 10, 68
 Magnetic Core Dispute, 71 thru 73
 Maleska, Eugene, 29
 Management Information Systems (MIS), 166
 Manned Spacecraft Center (MSC), 75
 Marketing, 168
 Massachusetts Institute of Technology (MIT), 40 thru 43, 49 thru 51, 71 thru 73, 146, 147
 Mass Medical Agency Inc, 196
 McGovern, Pat, 61, 62
 Megapot, 196
 Memistor, 196
 Merle Thomas Corp., 110, 114
 Mhyrvold, Nathan, 145
 Micro Computer Software, 139, 197
 Microsoft, 9, 11, 112, 113, 135, 144, 145
 Midwest Computer Service, Inc. (MCSI), 90 thru 92, 196

 Mills, Wilbur, 129, 130
 MIT Museum, 67
 Mouse, Derivation of Tracking Principles, 48, 49
 NASA, 75 thru 78
 National Council of Professional Services Firms, 200
 National Security Agency (NSA), 138 thru 140
 Nuclear Reactor Design, 42

 Octal number system, 21 thru 23
 Office of Naval Research (ONR), 63
 Olsen, Ken, 40, 46
 O'Neill, Tip, 150
 Optisyn, 74
 Oracle, 9, 11
 Organization, 164, 165
 Organized Religion, 181 thru 183
 Osborne, David, 156
 Osborne, Rose, 155 thru 157

 Palmer, Arnold, 195
 PC Anywhere, 138
 Performance Review, 156
 Personal Computer (PC), 134, 135
 Photon, 195
 Philadelphia, 38
 Planning International (I), 197
 Planning International (II), 197
 Planning Research Corp., 110, 114

- Planning Systems International, System Development Corp.
 Inc., 197 (SDC) 110, 111
 Playboy Clubs, 127
 Plimpton Press, 119, 120
 Price, John, 64
 PricewaterhouseCoopers, 153
 Problematics, 197
 Programming, Example, 24
 Project Space Track, 117
 Pushbutton Dialing, 49

 Queen Elizabeth, 125

 RCA, 71
 Riddell, Fred, 47
 Rossano, Ken, 56
 SAGE, 41
 Satellite Data, 197
 Schallerer, Jim, 72
 Seattle Computer Products, 135
 Seward, Hal, 74
 Shah of Iran, 120, 121
 Shepard, Alan, 80
 Shortell, Al, 65
 Slater, Robert, 46
 Slovenia, 149
 Smithsonian Museum, 67
 Software, 28
 Software Specification, 122
 Software Standards, 30
 Soshnick, Julian, 69
 Space Track, 57, 58
 Space Travel, 192
 Standard Computer Corp., 197
 Stern, Isaac, 29
 Stratton, President and Mrs., 73

 Tappert, Dr. John, 48, 49
 Technology Acquisition Corp.,
 197
 Technology Capital Network
 (TCN), 145 thru 148
 Teheran, Iran, 120, 121
 The Architects' Collaborative
 (TAC), 65
 Troost, Marius, 42
 TRW, 31
 Tsongas, Paul, 140
 Turkle, Sherry, 31
 Tyler, Vic, 126 thru 128

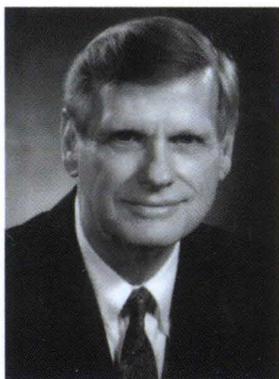
 Umbrella Technologies, Inc.,
 198
 Unemployment, 124
 United Nations University, 81,
 82
 UNIVAC, 52
 University of Maryland, 170
 thru 177
 Uzzle, Burk, 92

 Van Praag, Vincent, 195
 Venture Research Corp., 198
 Vertical Software, 198
 Videodisc, 138
 Visicalc, 137

 Warner, John, 125
 Watson, Thomas, Jr., 72, 73,
 134

Whirlwind, 38, 40, 63 thru 67,
71, 106, 168
White, Kevin, 67
Who's Who, 185
William M. Wolf Company,
198
Wolf and McManus, Inc., 198
Wolf Computer Corp., 198
Wolf Realty Trust, 199
Wolf Research & Development
Corp. (WRDC), 10, 110,
114, 164 thru 168, 198
Wolfson, Bill, 39
Wolfsort, 144, 145, 198
World Game, 81
Wright Brothers, Inc., 199

Young Presidents' Organization
(YPO), 80, 125
Y2K, 10, 151 thru 154
Y2K Software Corp., 199



COMMENTS

"If there is an easier way to do something, he will find it," bemused high school mathematics teacher, Mrs. Lines. I always wondered if she was politely calling me lazy.

"You can't judge a book by its cover," said my disgusted Philadelphia landlady when, in my enthusiasm and ignorance of plant tending, I over watered her plants, killing them.

"You tell an interesting story, but no publisher would be interested," advised my professional writer son-in-law.

"The juke box people have those patents all sewed up," responded my MIT boss when I brought him my idea of a push button digital pad to replace the dial phone then in use.

"I'm not going to include him in my entourage," warned Owen's obese operatic girl friend, Mary, after I joked about her trip to a fat farm which burned down during her stay.

"I found NO "e" fascinating reading. I loved your twenty key pieces of business advice. Based on my own experience, they are the most insightful and useful such list that I have ever seen!" wrote Patrick McGovern.

Xlibris

