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CHAPTER 14

Epilogue

*This **Epilogue** is a look toward the future. It explores the challenges facing the next generations of our family, as they continue to support and grow the American dream.*

"Life can only be understood backwards;

but it must be lived forwards."

Søren Kierkegaard[14-1]

We have looked back in time and explored the roots of our Falkenburg family. This chapter points to the future— a future you Ben, Jon and Joseph will help craft. What will that future look like? If the past is an indicator, then science will continue to accelerate our understanding, and engineering will create wondrous new technologies to change our lives. But science and technology are not the only factors which shape our future. The social structure of our communities, nation and the world will either support or inhibit progress.

In 1687, Sir Issac Newton wrote his famous *Philosophiæ Naturalis Principia Mathematica*.[14-2] This was written about the time that your 9th great-grandfather Henry Jacobs Falkinburg was negotiating treaties with the Lenape on behalf of William Penn's Quaker commissioners. Newton postulated a scientific basis for the laws of motion; the motion of the sun, moon, planets and stars could now be understood and mathematically predicted. Newton's three laws set the framework for defining mass, space, and time. The first of his famous three laws states:

> *"Every body preservers in its state of uniform motion in a straight line, unless it is compelled to change that state by forces impressed thereon."*

14-1 *"Søren Kierkegaard was a Danish philosopher, theologian, poet, social critic and religious author who is widely considered to be the first existentialist philosopher. He wrote critical texts on organized religion, Christendom, morality, ethics, psychology, and the philosophy of religion, displaying a fondness for metaphor, irony and parables. Much of his philosophical work deals with the issues of how one lives as a "single individual", giving priority to concrete human reality over abstract thinking and highlighting the importance of personal choice and commitment." wikipedia*

14-2 *http://www.archive.org/stream/newtonspmathema00newtrich#page/n77/mode/2up*

In 1905 (the fifth wedding anniversary of your 2nd great-grandparents Juliet and Samuel Falkenburg) Albert Einstein published *Zur Elektrodynamik bewegter Körper* (On the Electrodynamics of Moving Bodies) This introduced radical concepts and set the foundation for his Special Theory of Relativity. In Einstein's world, space and time were not independent entities, but were a fabric which he called space-time. Objects in motion near the speed of light changed their dimensions, and time could be dilated, depending on the frame of the observer. Key to Einstein's theory was the Principle of *Invariant Light Speed*— light has the same velocity in empty space, and is independent of the motion of an observer.

Motivated by a belief that Newton's gravitational attraction could be explained geometrically (rather than as a mysterious force acting at a distance) Einstein explained that massive bodies deformed the fabric of space-time causing those bodies to accelerate toward each other. This new insight was postulated as your great-grandfather Edgar Robbins Falkenburg celebrated his third birthday.

As Einstein was providing isight into the very large structures of the universe, Max Planck, Neils Bohr, and others were working at the other end of the spectrum. This led to the theory of Quantum Mechanics which is used to describe the strange behavior of the very small sub-atomic structure of the universe. In the last few years the *Large Hadron Collider* housed at CERN[14-3] and located astride the French-Swiss border near Geneva, has begun experiments intended to allow physicists to build better models of the subatomic structure of matter. It is hoped that these experiments will yield a better understanding of the structure of matter, and uncover secrets of in the *Big Bang*— the beginning of time, as we know it.

When you stand back and look at what has happened to human knowledge in the span of two generations it is utterly fantastic. Of course, our understanding of the foundations of physics has led to the technologies on which we rely today. As I pointed out in several chapters, my grandparents were born in an age where lighting was by gas illumination; Edison revolutionized their lifestyle when he invented the electric light bulb and built an infrastructure to distribute electricity to homes. My parents were born into an age before airplanes, and during my lifetime televi-

14-3 *Conseil Européen pour la Recherche Nucléaire, (European Council for Nuclear Research)*

IBM 1620

sion was invented, and the information age was born.

When I was a graduate student, studying for the Master of Science degree, my university got its first computer— an IBM 1620. We all thought that it was a marvel. In those days, we measured computer memory in Kbytes, and core memory cycles were 20 µsecs. The cost of the IBM 1620 was about $88,0000. That computer pictured at the left, paled in terms of the compute capability of today's hand held smart phones, yet in the day it opened new vistas in scientific and engineering computation.

What kind of progress can we expect in the future? Using current day technology, the next step in personal transportation utilizing self-driving autonomous vehicles will be realized over the next decade. The real problem is not technology, per se, but out ability to adapt infrastructure and human systems to accommodate robotic vehicles. It is likely that we will see the commercialization of space with the initiation of space tourism. It will not be inexpensive, but ordinary citizens will be able to travel to the edge of the space within the next decade. Medicine will benefit in numerous ways from computer technologies. Today, robot assisted surgery is a reality and used to provide precise control to enhance delicate surgical procedures. The near future will see the use of artificial intelligence to assist medical professionals in diagnosis and provide suggestions for effective treatment. Progress in understanding the human genome will enable doctors to prescribe personalized treatments for disease based on an individual's genetic makeup. We are on the verge of using our knowledge to develop gene therapy to fight diseases like cancer.

Everything I have described in the last paragraph will be achieved on the scale of a decade or two. I could write dozens (if not hundreds) of pages describing what is possible in both the near and distant future. However, that is not what I want to focus on in this chapter. Technology change cannot occur without concurrent change in culture. What are some of the cultural challenges we face, which must be addressed if humankind is to make progress.

Specialization The opening paragraphs of this section describe one example of the rapid growth of scientific knowledge. In order to be a successful scientist or engineer, it becomes necessary to delve deeply into an area of specialization. This is not only true in science and engineering, but medicine, the law, and most other professions. Who will be the systems thinkers of the future? It is one thing to be able to ply your skills in a very specialized environment, but who will create the bridges that link specialized knowledge into holistic understanding, fertilizing one field with and understanding of another?

Data and Information Today the internet archives all sorts of data. One can find hundreds of cute cat videos. There are innumerable blogs on which authors opine on any number of subjects. You can even find passionate discourses touting flat-earth theories and the hoax the government has played on us fabricating a mock moon landing . What is real, and what is not? What is truth, and what is not? The internet provides a marvelous trove of data, but extracting information from the internet requires a great deal of judgement. I am not suggesting that we need to censor the net, but we will need tools that can help to organize and digest the enormous data glut that is accumulating. We need to better educate individuals to ask critical questions and prepare to filter this kind of data.

Inconvenient Truths When Vice President Al Gore left office he dedicated himself to bringing awareness to the issue of global warming occurring through the action of our human species. As we burn carbon fuels, CO_2 efficiently sequestered in oil, gas and coal over millennia is being released into the atmosphere changing the thermodynamics of the planet. The result— increased earth temperature, species extinction, and rising sea levels. How inconvenient! *'My company makes substantial money selling fossil fuel automobiles'; 'I have built an economic powerhouse exploring for, and extracting oil resources from the earth'; 'I believe that God has put us on earth to master the natural world'; 'I don't believe that this is happening';. 'God will solve the problem if we get too far;… 'That is something that can wait'… 'I believe that the warming planet is a natural phenomenon, not a human caused intervention— there is nothing to be done'.* Pandering to financial contributors, our United States Congress seems incapable of making decisions to address this inconvenient truth. Truth be told, while global warming is one in-

convenient truth, there are others. We as a nation, are often powerless to make change because we don't want to face the real issues that underpin our problems.

Global order When I was a young boy, Adolph Hitler was ravaging Europe. As I entered school, Soviet Communism grew out of the chaos of the war in Europe and again threatened world peace. A new dimension was added— nuclear weapons. The world stood still as the United States and the Soviet Union had a clash of wills over the placement of nuclear weapons in Cuba. When the Soviet Union imploded during the Regan administration, it seemed as though we were on the verge of a new world order— one that would allow us to turn away from cold war strategies and confrontation. Today, global terror has replaced the threat posed by the Soviet Union. Strategic attacks in the United States, Europe and the Middle East, have been perpetrated by religious zealots who believe that it is their god-given mandate to attack those whose belief differ from their orthodox views. Fighters find glory and expect eternal reward if they sacrifice themselves to kill and maim their adversaries. Equally disturbing is the response of Christian fundamentalists who seem ready take on a Holy War, a rekindling of the Crusades. Will the world ever be at peace, or will we continue to waste precious resources engaged in endless battles? Again, I could write pages, but my point is not to list all of the problems we face.

Just as our ancestors engaged in the building a new order in forming these United States, so you Ben, Jon, and Joseph, will work in whatever way fits your skills and vision continue the task of perfecting the vision of our founding fathers. Remember, the Declaration of Independence stated *"In order to form a more perfect union…"* It did not say in order to form *the perfect* union. When our family worked to gain independence for this new nation, or labored to correct the injustices of slavery during the Civil War, or supported civil rights initiatives in the 1970s, they were *moving toward* (not achieving) that vision of perfection. So each of us in this family and each of us in this nation must continue the drive toward that perfect union. We may never get there, but we must work toward that goal. Restating the words of Kierkegaard which set the stage for this chapter: Learn from the past. Assimilate the lessons of history. Know who you are a member this family and the

larger community, but work toward the future. Don't get lost in the past, but keep a this vision of progress as you move toward your future.