RADIO MAGiC
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"In the Year 2012…"

Introduction

In November 2020, I received this email: *"Hi Robert; I have a few radio related text books which my father used in the 1920s and on. He had a deep interest in radio and as a youth/young man demonstrated radio in small communities around the town in which he lived in Saskatchewan. If you are interested I can email you the titles and if you then would like to have them I would be happy to send them to you.*
Ted Pettersen, VE3KOH"

I replied back and selected two books of special interest, which Ted sent me gratis. The one that resulted in this article weighs 2.7 kilos with 2200 pages (!) titled "Proceedings of the IRE, Fiftieth Anniversary Edition" (May 1962). Published by the Institute of Radio Engineers (IRE), it recaps the past 50 years of achievements and advances in various radio and electronic technologies up to 1962 along with predictions for the next 50 years to 2012 (the IRE's 100th anniversary). *Note: The IRE was a professional organization in existence from 1912 until 1963. It merged with the American Institute of Electrical Engineers (AIEE) to form today's Institute of Electrical and Electronics Engineers (IEEE).*

The Way it Was

By the early 1960's, a plethora of military surplus radio and electronic equipment had flooded the consumer market and was converted for Amateur Radio use. Frequencies were measured in cycles per second. Most equipment used vacuum tubes albeit transistorized gear was becoming more affordable, smaller and lighter and used much lower (and safer) operating voltages. High frequency (HF) radio activity was on the 160, 80, 40, 20, 15 and 10 metre (m) bands albeit long-range navigation (LORAN) transmitters on 160 m combined with restrictive Amateur Radio operating rules because of LORAN meant that "Top Band" use wasn't as popular as today now that LORAN is defunct. Available HF radio modes were Morse code, radio teletype (RTTY), amplitude "ancient" modulation (AM) and "Donald Duck" single-sideband (SSB). AM and SSB proponents regularly "battled" each other on-air for voice mode "supremacy".

Figure 1: A Professional Amateur

Electrical engineer Matt Mathews, K4KMF, at the typical-for-the-time radio shack appears in a Raytheon Company advertisement looking for eager young electrical engineers who usually happened to be Radio Amateurs. Credit: *"73"* magazine, June, 1962.

Many Amateurs were often degreed professionals in various technical fields so they naturally brought their work home and incorporated it into their hobby and perhaps vice versa (Figure 1, previous page). Experimentation on the very and ultra high frequency (VHF/UHF) bands using repurposed equipment lead to the creation of the first two-way, mobile radio repeater networks. Orbiting Satellite Carrying Amateur Radio (OSCAR) satellites were built by engineers/Amateurs working at a now defunct aerospace defense industry company (TRW Inc.), and the first was launched in December 1961 (OSCAR I). They blazed a trail across the heavens—literally—which lead to the formation the Radio Amateur Satellite Organization (AMSAT) in 1969 by engineers/Amateurs working at the Goddard Space Flight Center.

It was also a time of the politically hot "Cold War" between the U.S. and Soviet Union, with each nation having nuclear missile arsenals so large and powerful that this "mutually assured destruction" or "MAD" policy prevented their actual use in the long run, but not without mishaps and missteps along the way. It was also the dawn of the "Space Race", and winning this race, as compared to an unwinnable nuclear war, was given top priority by the young and dynamic President John F. Kennedy; to plant the U.S. flag on the Moon by the end of the decade before the Russians planted theirs—no matter what the cost (it would cost both sides, dearly). Followed by orbiting U.S. space stations and lunar bases from where manned Mars missions and beyond would be launched before the end of the 20th century. But I digress…

Some of the IRE engineer's predictions were worthy works of science fiction, written as if from the year 2012, looking back and recounting supposed technological events of the previous six decades. Some were definitely Orwellian in nature, forecasting a "Big Brother" dystopian world controlled by a very totalitarian technology right from birth. Some came true; notably the "interconnected timesharing online man-computer network communication system", quite a mouthful later shorted to just "internet". Some others didn't, such as the highly-hyped "Picturephone", which was an analog wide-band combination of live-action video and audio data streams (Figure 2, next page). It was supposed to be the "next best thing since sliced bread" with a projected million users by 1980. AT&T ("Ma Bell") invested $500 million ($3.3 billion today) before the plugged was pulled on the project in 1973 having less than 500 paid subscribers in total.

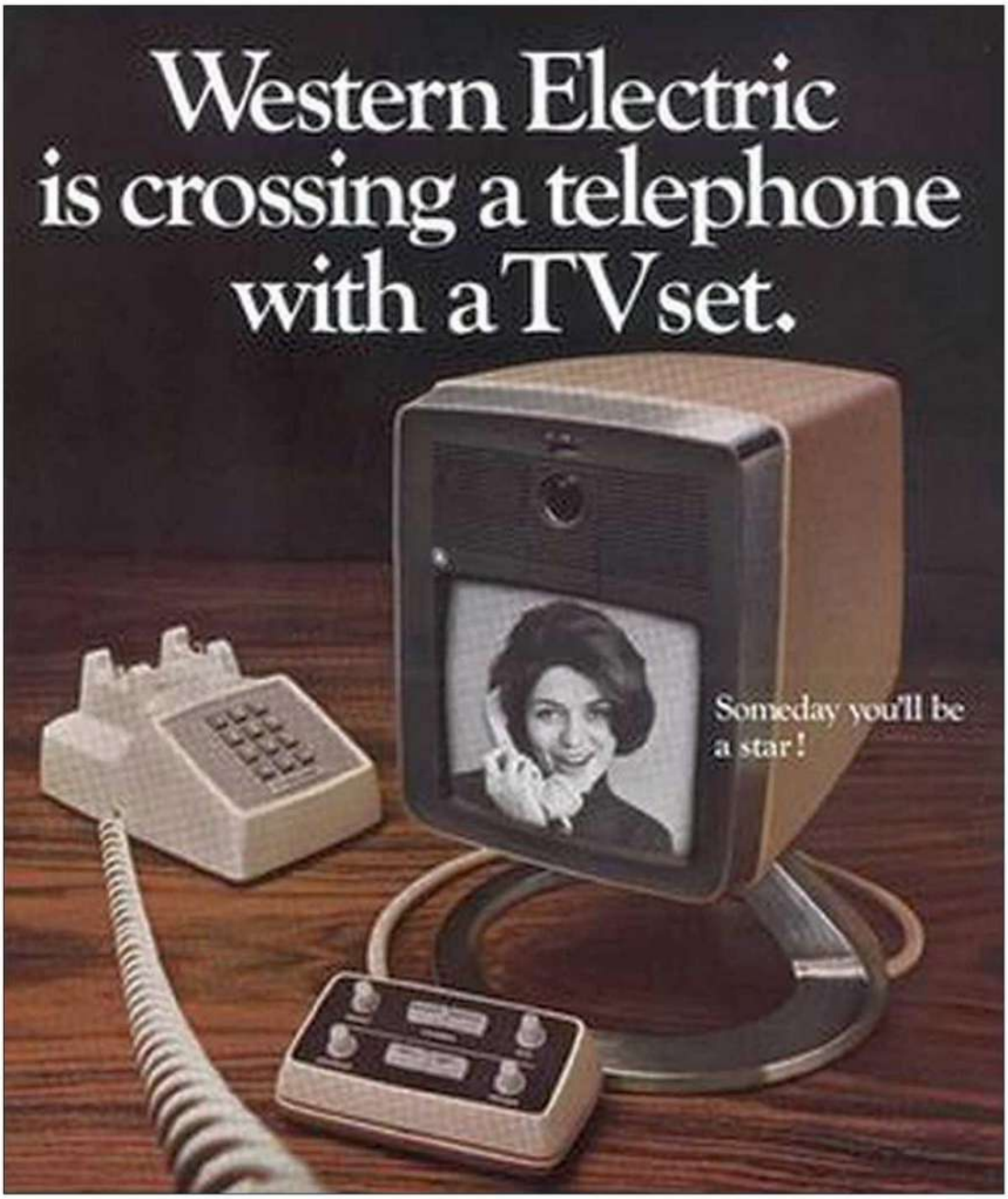

Figure 2: Picturephone Marketing
It was an expensive luxury few businesses could afford and fewer businesses used. People wanted to meet face-to-face and shake hands afterwards. Credit: Engineering and Technology History Wiki.

Thankfully, another prognostication was off the mark and we didn't become a mixture of flesh and machine with cybernetic body parts and mind-communication implants. Because of these implants, conventional radio wouldn't exist in the 21st century because you'd be able project your thoughts to anyone, anywhere on the planet and vice versa—so could Big Brother, too. "We are the Borg. Resistance is futile."

Back to the Future

Note: I selected a few predictions that came to fruition and some that didn't. They were chosen for their maximum impact that they have had or could have had on our world in the 21st century and not if the engineering had reached maximum miniaturization or optimization. A computerized talking toaster is still a toaster. In the long run, all predictions are made based on a "shotgun" approach, meaning if one makes enough logical guesses based on current trends then many future trends will logically occur. Toss enough darts at a dart board while wearing a blindfold and your hit to miss ratio will always convergence on Pi.

The following are excerpts from the "Proceedings of the IRE" (May 1962).

> **On Space Technology and Exploration**
>
> "On the occasion of this centenary of the founding of the IRE, the Editors of Proceedings thought it of interest to our membership to report the May 13, 2012, meeting from the Lunar Section of the Institute. The following summary lecture is delivered at our great international base near the North Pole of the Moon.
>
> Our 2-meter antenna with 100-watt peak focuses its entire energy on Mars or Venus with very little loss and permits simple high-speed data links with interplanetary travelers. Some of you will take part in construction of the new Jovian system designed to provide communication, navigation and control for the expedition to land on the minor satellite of Jupiter next year.
>
> I have just received a Laser report from the party that landed on Mars last month. The climate is a little cooler that Earth with a good, protective nitrogen atmosphere. They find surprisingly well-developed plant life in extraordinary forms. More interesting is their preliminary finding of some evidence of an ancient civilization perhaps a billion years ago when free water and oxygen were evidently available in considerable quantities on the planet.

For your entertainment, I have a history of the Institute for the first one hundred years since the founding of the IRE. You will be especially amused by the skepticism of our forbearers, a few of whom, by the way, are still living and were present at the IRE's 50th anniversary in 1962 when lunar operations on today's scale then appeared wholly fantastic.

In particular, we may expect that space technology will have a greater impact on communications than any other new developments in the field. International communications systems, depending upon equipment in space, will expand the flow of information for commercial as well as military purposes. Because space appears to be a government area against a private area, for all practical purposes, the present trend towards dependence of the electronics industry and the profession on government projects will probably increase rather than decrease." See Figure 3.

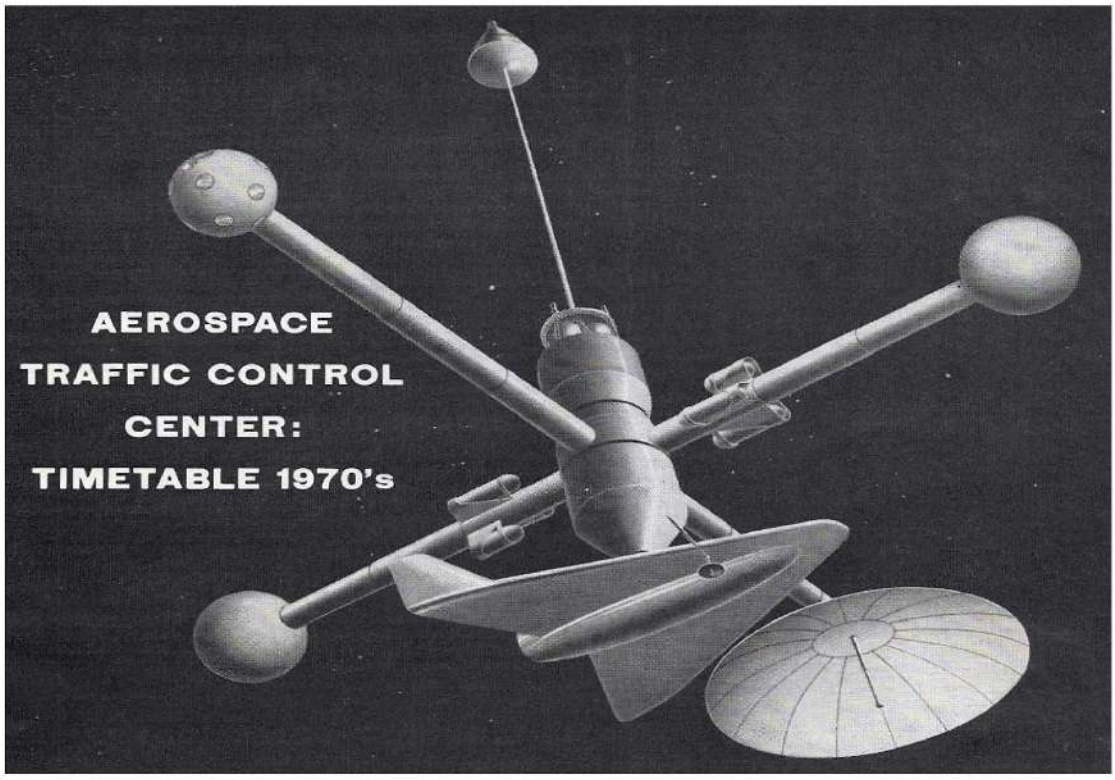

Figure 3: Command and Control Space Station
The planned orbiting traffic control space station(s) envisioned to handle "routine" two-way spaceship shuttle flights between Earth, lunar colonies and beyond. Credit: *Proceedings of the IRE (May 1962)*. *Note the uncanny similarity between 1962's envisioned space shuttle and the actual latter day version.*

On Global Communications and Computers

"In this 100th Anniversary issue of Proceedings of the IRE, May 2012, we feel privileged to discuss a very interesting article contained in the 50th anniversary edition dated May, 1962. It may interest some of our readers to go through a check list and see to what extent our 1962 colleagues were able to predict the state of the art today.

> "Practically all point-to-point long distance communication would be by microwaves in the millimeter region. This includes global television relay via satellite operations, as well as global telephone and facsimile service."
>
> "As to broadcasting, by 2012, the FCC would have approved the ultra-high frequencies for exclusive use by TV broadcasting. Our radio broadcasting would be entirely via FM, using the same portion of the spectrum of 1962."

They may be surprised to find that transatlantic telephone is still operating via coaxial cable and repeaters buried in the Atlantic. The satellite relay schemes forecast, as we all know, did not quite pan out, with so much of the nation's resources devoted to competing with the Russians in the race for reaching extraterrestrial bodies. Anyone in 1962, with some imagination, should have been able to predict our moon-to-earth citizen's radio service, operating so effectively in the millimeter band, but it would not have been easy to foresee our tremendously efficient high-power, solid-state wrist watch transceivers and plasma antennas.

When talking about computers, nothing radical was forecast beyond the fundamental principles on which computers were based. Now we can not only store and process complex information, but we can predetermine the optimum course of action to be taken based on the information furnished. National policies, business decisions, family issues are now settled on the basis of a computer's output, leaving little likelihood for chance and error entering into decisions. As a result of this technique, we now enjoy peaceful coexistence giving us a feeling of well being and security." See Figure 4, next page.

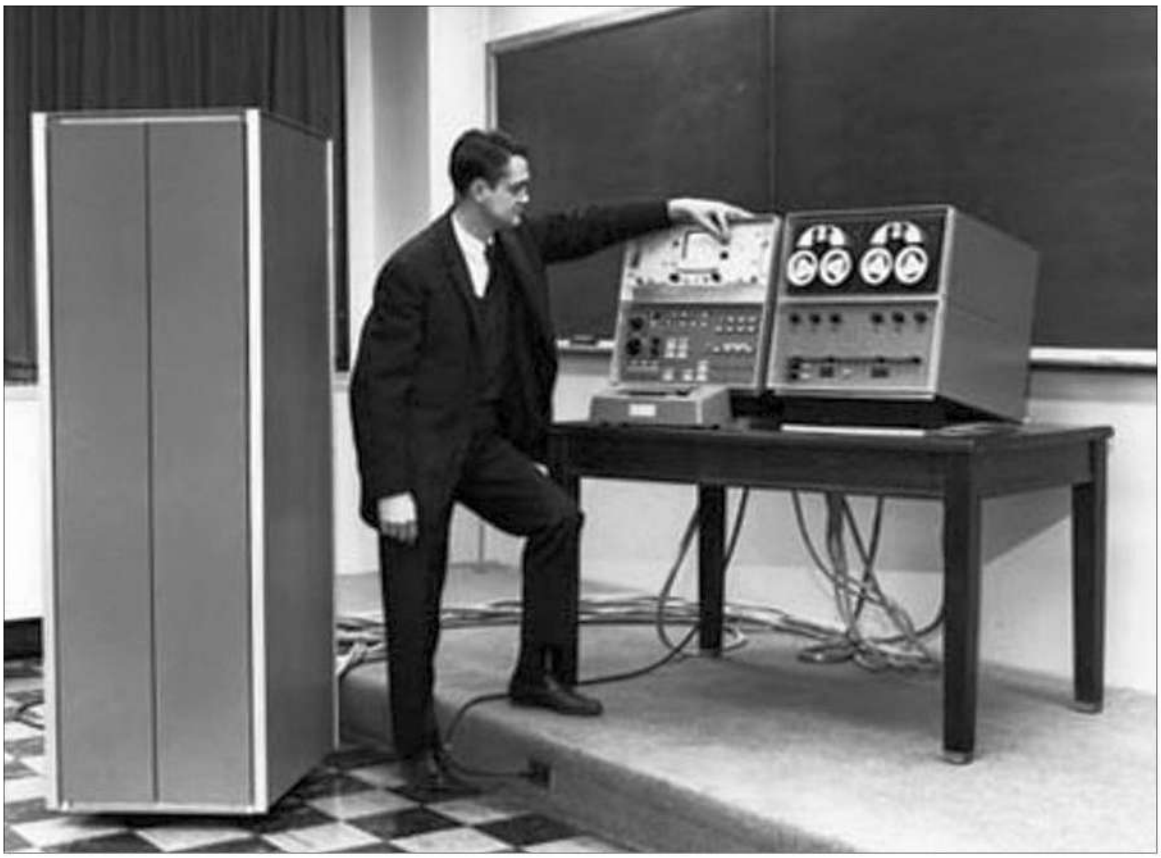

Figure 4: The "Personal" Computer
The first personal (designed for one person use at home) computer or "PC" was designed at the Massachusetts Institute of Technology (MIT) Lincoln Laboratory in 1962 by engineer Wesley Clark (pictured). Credit: Computer History Museum.

On In-Home Communications

"Device costs are rapidly being pushed down. This economic revolution will stimulate communications in several ways. A notable example is two-way television in every home—a technical possibility now but not an economic one. An abundant supply of cheap, high-frequency components and assembly techniques will make the "videophone" as commonplace in 2012 as the telephone is today. It seems likely that most communications will be transmitted electrically and not by transportation. The private citizen will have electrical access to machines of all kinds, for example, centralized data processing units for banking, reference libraries or entertainment.

Perhaps, most important, it is possible that a combination of visual recording, teaching machine techniques and human intervention where needed, will make available the best education in any subject, anywhere, any time, to anyone who wants it."

On Technology and Society

"Present-day electronics will become "classic" in 2012. Today's technological developments will have reached a certain settlement and to some extent they will have gained a "final form". But shall we be happier? The population of the Earth will have increased enormously by 2012. Men will live extremely close together. New social problems will thus exist. Raw materials, important for life, will be rare. A state of saturation or even exhaustion will occur. Any further development will then call for very large efforts. A higher technical dimension will bring to man neither more power nor more happiness. Certainly man will never be able to live without technology, but he will have to recognize that technology can never be the true purpose of life. "

On Social Media

"From the social point of view, the arrival of the telephone and radio had two major consequences. A telephone network requires some form of subscriber organization. Letters and telegrams are the affairs of individuals, but a telephone in your home requires a terminal connection, in your name, at the local exchange.

The advent of radio brought mass-communication. Radio and television sets are now owned by people of all classes and conditions. The voice and vision authority now appears in every home, to inflame or to hypnotize, to unify our language or to initiate clichés and slang, to model our heroes and set our norms. There is no doubt that radio and television will largely decide the road along which our society will pass into the future. They can be terrible weapons. We must watch ourselves."

That previous prophetic paragraph predates Canadian communication theorist Marshall McLuhan's "Understanding Media: The Extensions of Man" (1964) wherein the mass communication medium used—not the content—should be the main focus of study and concern. The medium *is* the message. Today, social media is mightier than the pen or sword—and far more deadly. We must watch ourselves, indeed!

Note: Serendipitously, I found a retrospective 2012 IEEE article posted online about the 1962 IRE predictions and contacted the 85-year young author Robert "Bob" Lucky (http://www.boblucky.com), who kindly gave permission to use a few paragraphs from it. As an aside, Bob mentioned that he gave a tour of Bell Labs to the renowned author, inventor and futurist Arthur C. Clarke, who was fascinated by a Picturephone sitting on Bob's desk, and AT&T provided several for use in Stanley Kubrick and Clarke's "2001: A Space Odyssey" (1968) motion picture. Great product placement and free publicity, to be watched by millions of movie goers worldwide—not—because the very sentient and very psychotic, malfunctioning killer-computer "Hal", who could see and hear ala a Picturephone (read lips, too) was a really bad "sales rep" for any advanced technology. The medium definitely delivered the wrong message for AT&T because no one wanted a "Hal in the house" after seeing thate movie!

Back to the Future—1962 Redux

"In 1962, shortly after I began work at Bell Labs, *Proceedings of the IRE* featured a series of future predictions authored by IRE Fellows. In my opinion the most serious failing was the collective failure to recognize and appreciate the revolution in electronics that would come about because of the integrated circuit. My favorite prediction, written as if an engineer in the year 2012 was looking back at the field in 1962, was as follows:

> "After a competitive race in the 1960s to produce the smallest units, reason had prevailed. While components were small by earlier standards, the ultimate sizes were such that costs were reasonable and servicing practicable. For example, whole receivers were the size of pound candy boxes rather than cigarette packs."

Jack Kilby had made his first integrated circuit in 1958, so it had existed when the predictions had been published in 1962, but it was not until 1965 that Gordon Moore had made his now famous prophecy about the exponential progress that would occur in the density of integrated circuitry. Moore's prediction was the one prediction that withstood the test of time, and the prediction that drove our profession into relentless acceleration. It was amazing to me that our most famous engineers in 1962 had had such an impoverished idea of future happenings. But in truth I would have done no better, and probably even worse. Of course, I was a callow, inexperienced engineer then, now I have no such excuse, and even so there is a high degree of probability that any predictions I would make now would be subject to equal derision by engineers in the future.

Following some variety of the second law of thermodynamics, the world gets continually more complicated as time passes. A young engineer starting his or her career today faces a world vastly more complex than I did in 1962. At first look that would seem to make great achievements much more difficult to attain, but perhaps overwhelming complexity also portends rich unrealized potential. In any event, I feel both sorry for and jealous of those young engineers. We took the low-hanging fruit. I have no idea what is growing farther up the tree."

My Final

Today we know that there's quantum mechanics bearing fruit growing farther up Bob's tree, and I boldly predict a "Star Trek"-like quantum-engineered world by 2072. But, as with all predictions, only time will tell. Or some far-in-the-future *TCA* reader can just quantum leap back and let me know. I'll leave the light on. And that's a wrap on this, my 50th *TCA* column article! To Ted and his dad, to Robert Lucky, to the IRE Fellows of 1962, and to all those who read (or will read) my column, a very heartfelt "Thank you!" for making it possible.—73