

# DR. SETI'S STARSHIP

## Searching For The Ultimate DX

### "This Lousy T-shirt"

**R**egular readers of this column have probably figured out, over the past decade, that some sort of ethereal connection exists between SETI science and satellite television technology. In this current installment we explore that connection in greater depth. It's a circuitous journey, so stay with me.

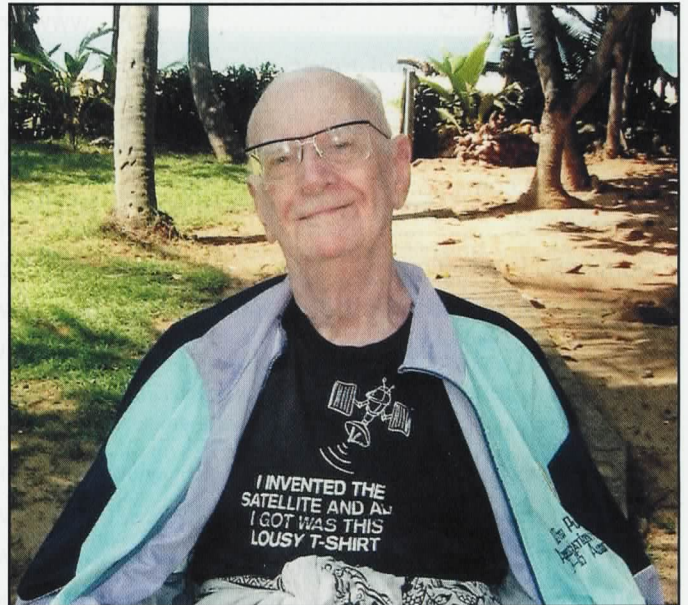
My personal involvement in this unlikely technological overlap began in April 1977 (roughly 35 years before this column is scheduled to see print). I was teaching microwave electronics at an obscure community college in the San Francisco Bay area. Microcomm, my modest Silicon Valley startup, had yet to catch fire. Down the road, another startup, co-founded by neighbor WA6BSV (better known as Steve Wozniak) was just about to. I was having fun designing low-noise receiving equipment for the 23-cm and 13-cm ham bands, but the market was somewhat limited. Adapting that technology, since 1976 I had enjoyed minor commercial success with a line of receivers for the 18-cm weather satellite band, but there again, I saw no mass market or economies of scale. Therefore, I was in search of a new challenge when Bob Cooper came to visit.

"Coop," K6EDX, was a pioneer in the cable TV industry, a well-known name in the ham radio literature, and editor of a mainstream trade journal. The television networks were just starting to make their programming available to affiliates and cable systems via satellite relay. Along with a few other hams, Bob was beginning to dabble with trying to intercept those satellite signals. At the time, commercial satellite Earth stations were marketed only to industrial customers, employed 60-foot dishes, and cost hundreds of thousands of dollars. Coop believed ham ingenuity could change all that. He thought that perhaps my circuit-design expertise could prove valuable.

My friend Tay Howard, W6HD, independently had come to the same conclusion. Tay was a research professor at Stanford University and living in the Sierra foothills. There, he was in the process of lashing a bunch of microwave receiving circuitry to a surplus 15-foot diameter parabolic dish stuck atop a positioner cobbled together from a Navy gun mount. Because we belonged to the same ham microwave club, we frequently swapped ideas and circuitry. By the time Coop came to visit, I had come up with an RF front end, and Tay a video demodulator and processor back end, for intercepting those exotic photons falling from the sky.

In truth, Coop, Tay, and I had very little interest in the program content locked loosely in those photons. We spent most of our time viewing waveforms on oscilloscopes and spectrum analyzers and occasionally deigned to connect our receivers to television monitors only to satisfy the curiosity of journalists and spouses.

Nevertheless, some journalists' curiosity was indeed piqued. *TV Guide* interviewed Coop, ran a piece about ham radio enthu-



*The shirt that started it all, worn by the man who started it all, the late Arthur C. Clarke.*

siasts poaching free cable TV programs emanating from space, and quite accidentally, the home satellite TV industry (then simply known as TVRO, for Satellite Television, Receive-Only) was born.

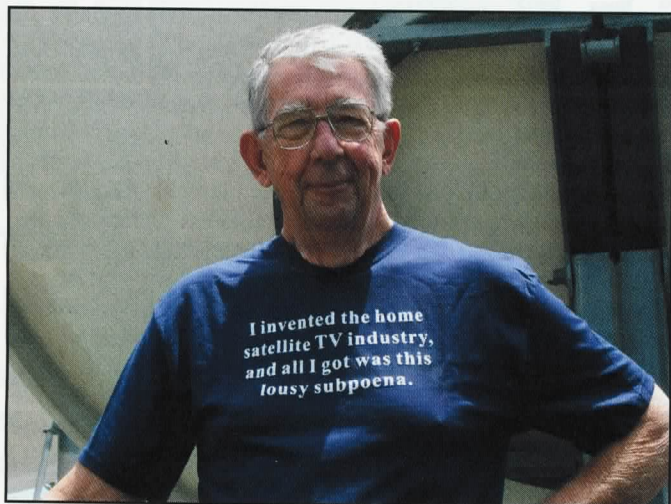
Tay Howard was elected first president of the Society of Private and Commercial Earthstations, a hastily formed TVRO trade association better known by its clever acronym, SPACE. He ultimately accepted Emeritus status from his university, to become a consultant very much in demand by the host of new companies springing up to compete in the emerging satellite TV marketplace. Tay served as a director for the market's leading firms, and by the time of his untimely death in November 2002 he had achieved elder-statesman status.

My own company had the distinction of bringing to market the first commercially successful TVRO receiver—my claim to fame and fortune. However, fame is fleeting, and the fortune is all spent. Although I enjoyed modest commercial success, I realized the competition was heating up and somehow couldn't see myself going head-to-head with the big boys. Thus, I bailed. By the middle of 1980 I had decided to remain in academia, sold my receiver design to an Oklahoma industrialist, and used the proceeds to purchase my first airplane. (That's the same airplane in which I was destined to commute for over a decade from my home in Pennsylvania to SETI League headquarters in New Jersey. We were very happy together for fully 30 years, but that's another story altogether.)

Bob Cooper, through his writing talents and organizational efforts, quite skillfully positioned himself as the impresario of

\*Executive Director Emeritus, The SETI League, Inc.,  
<[www.setileague.org](http://www.setileague.org)>  
e-mail: <[n6tx@setileague.org](mailto:n6tx@setileague.org)>





The shirt worn by Bob "Coop" Cooper, K6EDX/ZL4AAA, evokes the legal challenges faced by him and other early Satellite TV pioneers.

this new industry. He successfully navigated the legal labyrinth in securing the rights of individuals to intercept signals from space. He set up trade shows (at which Tay and I were keynote lecturers), launched the premiere trade journal *Coop's Satellite Digest*, and introduced his ham radio buddies to the true father of satellite communications.

Arthur Charles Clarke was perhaps better known as a science fiction author, but he was, in fact, a first-rate telecommunications engineer. Back in 1945 he penned a brief article for the British electronics journal *Wireless World*. "Extraterrestrial Relays" was a look into the future. It foresaw a communications revolution, a far-off time which would feature orbital space stations relaying television programming around the world. In this seminal work, Clarke popularized the geosynchronous orbit, first envisioned by Konstantin Tsiolkovskii (and now universally known as the Clarke Orbit). He specified the frequencies best suited to television distribution from that orbit, crunching numbers to derive coverage circles, orbital parking slots, frequencies and bandwidths, going so far as to evaluate path loss, power levels, and signal-to-noise margins. His back-of-the-envelope computations were all amazingly accurate—except for one.

This was 1945, after all. Television transmitters of the day were huge, bulky, massive affairs with heavy transformers, unreliable vacuum tubes, and dedicated cadres of maintenance technicians to keep the photons flowing. Television transmitters in space, Clarke reasoned, would have to await the development of manned orbital space stations. The heavy boosters that would be required to loft these behemoths were a good century into the future. Therefore, instead of patenting his greatest design, Clarke published it in the public domain.

How was Clarke to know that just two years later the invention of the transistor would be such a game-changer? Those who create the future are seldom able to predict it.

And here, at last, is where this story veers into SETI territory. By the time the modestly funded NASA SETI program was terminated by Congress in 1993, the C-band analog satellite TV technology I helped to pioneer in 1977 was completely obsolete, being rapidly replaced by a new generation of Ku-band digital Direct Broadcast TV satellites. Big Ugly Dishes (BUDs) littered the countryside, a solution in search of a problem.

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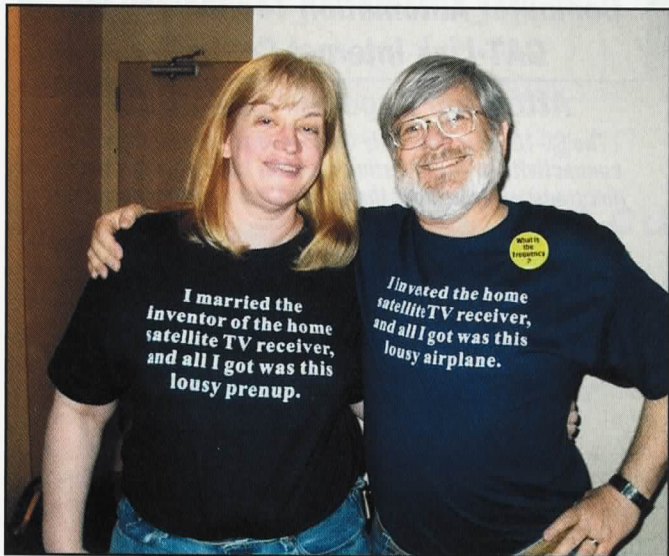
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The author's shirt refers to how he spent an unexpected financial windfall, following his development (and subsequent sale) of the first commercial home satellite TV receiver. His wife Muriel's shirt laments that his invention predates their acquaintance.

The problem, of course, was the privatization of SETI. When Richard Factor, WA2IKL, founded a new membership-supported, nonprofit science organization, he was well aware of my involvement in the formative years of the TVRO industry. He tapped me to run The SETI League, and to design its flagship effort. Project Argus emerged as an all-sky survey for signals from alien civilizations, employing a global network of small, amateur-built radio telescopes based on repurposed TVRO systems. For a while Project Argus boasted more operational radio telescopes than existed in the whole rest of the world combined.

Although never a licensed radio amateur himself, Arthur C. Clarke saw SETI as the ultimate DX. He continued as a strong SETI supporter, as chronicled in an earlier column (*CQ VHF* 11(1): 82-83, Spring 2008). Sir Arthur served on our scientific advisory board, contributing his considerable writing skills, insights, and significant personal encouragement. When he pointedly avoided offering The SETI League more direct support, I reassured him that his name on the masthead was worth far more than any possible financial contribution.

Which brings us to the T-shirts.

About a year before his death, Clarke posed for the first photo seen here in this column. The shirt he is wearing simply claims, "I invented the satellite, and all I got was this T-shirt."

I was to see that shirt a second time in April 2007. Bob Cooper had organized a Satellite Pioneer's 30th Anniversary dinner in Atlanta. My wife Muriel and I flew down to attend. Clarke was keynote speaker, but declining health precluded a personal appearance. Making appropriate use of the technology he pioneered, Sir Arthur appeared virtually, his speech, countenance, and T-shirt relayed via satellite from geostationary orbit.

Having been forewarned, I arrived in Atlanta armed with a few T-shirts of my own. In an act of shameless self-promotion, I had the backs of those shirts emblazoned with the logo of Microcomm, my one-time Silicon Valley startup. But it was the fronts of those shirts that are relevant here.

Now look at the rest of the accompanying photos. Alluding

to past legal challenges, the shirt I gave to Coop declares, "I invented the home satellite TV industry, and all I got was this lousy subpoena." My own shirt, in reference to my claim to fame and fortune (fleeting, and all spent, remember), simply reads "I invented the satellite TV receiver, and all I got was this lousy airplane."

Muriel and I met years after that fortune was spent. Thus, appropriately, her T-shirt's slogan declares, "I married the inventor of the home satellite TV receiver, and all I got was this lousy prenup."

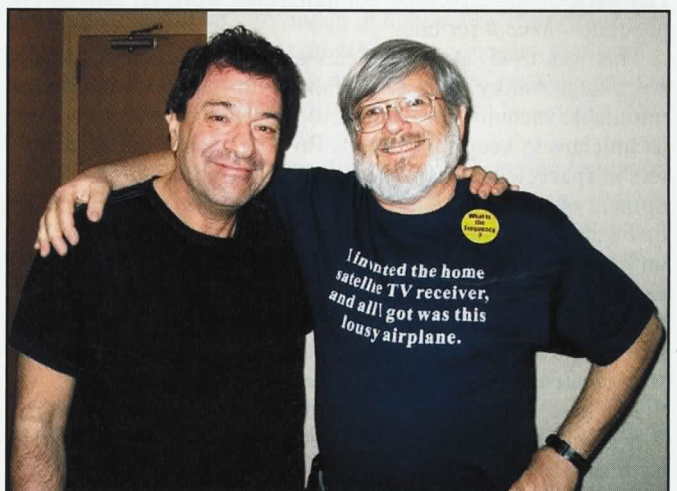
And finally, we introduce a new face into the list of dramatic personae. Kenneth Shaffer, N2KS, also came to Atlanta five years ago. Kenny had made his own, unusual contribution to satellite TV history, and indirectly it relates to both the Clarke Orbit and the SETI application. He was, as far as anyone can determine, the first Westerner to figure out how to use TVRO receivers to intercept Soviet TV.

One of the challenges was geographical. Because of the northerly population distribution of the former Soviet Union, that region's television appetite is not well served from Clarke (equatorial) Orbit, but rather from the Molniya highly elliptical polar orbit. However, TVRO antennas were mounted at fixed declination and variable hour angle, all aimed at the Clarke orbital belt, and thus not able to track Molniya birds. Kenny Shaffer figured out how to realign TVRO dishes, allowing him to watch Russian downlinks. Although I make no claim whatsoever that Kenny's accomplishments were responsible for the end of the Cold War, nevertheless, his T-shirt reads "I intercepted Russian TV, and all I got was the breakup of the CCCP."

Unlike TVRO reception, The SETI League's Project Argus all-sky survey required antennas that could track across the entire celestial sphere. After all, it's unlikely that the signals SETI seeks will be conveniently perched directly on the Clarke orbital belt. It became necessary to realign the typical TVRO antenna mount to track across the sky. Therefore, SETI science was well served by Shaffer's ingenuity.

None of which, I concede, has any bearing upon the prominent position Kenneth Shaffer's name has assumed in popular culture. But that, dear reader, is a subject for our next scheduled column. Stay tuned for a story stranger than Clarke's best science fiction.

73, Paul, N6TX



Kenny Schaffer, N2KS, declined to wear his T-shirt for this photo. Its inscription read: "I intercepted Russian TV, and all I got was the breakup of the CCCP."