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SIGNALS

Rockwell Collins

Monthly Newsletter of the

Amateur Radio Club

Volume 33 Issue 11 **Web Site** http://www.w5rok.us **August 2012**

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RCARC
Membership Meeting

Thursday, 23 August 2012
1700 Social 1730 Meeting
1800 Program

Methodist Richardson Medical Center
At Bush/Renner/Shiloh Intersection
Second Floor Conference Room 200

Subject:

Software Radio and its Future

By

Steve Hicks, N5AC

Local Club News

Meeting Notice Sounds like a great program at this month's meeting, so you are encouraged to attend. The program will be presented by Steve Hicks, N5AC, Vice President of Engineering at FlexRadio.

Steve Hicks joined FlexRadio Systems in 2008. As Vice President of Engineering, Steve is responsible for all aspects of the company's product development and product strategy. Steve brings over 22 years of technology experience having held posts at a number of companies including Rockwell/Collins, Digital Equipment Corporation, and Texas Instruments as well as his own software and consulting businesses.

Steve has been a licensed operator since 1977 and currently holds an Extra Class license. He is a life member of the ARRL, Central States Microwave Society and the Texas VHF-FM Society. He has also previously held the post of President of the North Texas Microwave Society. In addition, Steve was awarded the Mini Circuits Annual Award for Design Achievement in 2008. Steve received his BSEE from Texas A&M University and an Executive MBA from Southern Methodist University.

Newsletter Inputs Just a couple of notes about the RCARC newsletter, ***SIGNALS***, from the newsletter editor.

Articles, whether written by members or those received from other sources, are always welcomed. Every effort is always made to include them, even when they come in late in the newsletter preparation.

It has been the tradition of the club to publish the newsletter one week before the monthly membership meeting to ensure all members are aware of the meetings agenda and program, as well as to provide interesting items for potential discussion at the meeting. This is an encouragement to be timely with inputs so it will be possible to publish a week in advance of the meeting.

So, just an encouragement to all members to contribute articles that you think are informative and of interest to other members. And don't hesitate to submit information to the editor concerning upcoming events, such as fun, educational and/or service opportunities. Thank you! *(By Jim Skinner, WB0UNI)*

Officer Elections Soon. Our officers are asking all members to consider placing their names in nomination for the 2013 Officer Slate. The current officers would like to see more involvement of others in the leadership, and some can not serve another year. Current officers have taken on other duties in addition to their officer roles for the RCARC. So—here is your chance to make a difference: please volunteer to run for President, Vice President, Secretary, Activities Chair or Treasurer. You are guaranteed to get help from the past officers and other members active in the Club. The RCARC needs you. Can you help?

Make your interest known to the leadership now and help your club. There is plenty of lead time until the election this fall. When the nomination committee members call on you, respond—positively, please.

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VE SESSIONS

Dallas tests are held 4th Sat of each month at 10:00. 13350 Floyd Rd. (Old Credit Union) Contact Bob West, WA8YCD 972.917.6362

Irving tests are held 3rd Sat. of each month at 09:00. 5th and Main St. Contact Bill Revis, KF5BL 252-8015

McKinney VE test sessions are held at the Heard Museum the first Sunday of the month. The address is 1 Nature Place, McKinney TX. The time of the testing is 14:30, ending no later than 16:45. ***Note: no tests given on holiday weekends.***

Garland testing is held on the fourth Thursday of each month, excluding November, and begins at 1930 sharp. Location is Freeman Heights Baptist. Church, 1120 N Garland Ave, Garland (between W Walnut and Buckingham Rd). Enter via the north driveway. A HUGE parking lot is located behind the church. Both the parking lot and the Fellowship Hall are located on the east side of the church building, with big signs by the entrance door. Contact Janet Crenshaw, WB9ZPH, 972.302.9992.

Plano testing is on the third Saturday of each month, 1300 hrs at Williams High School, 1717 17th St. East Plano. Check Repeater 147.180+ for announcements.

Greenville testing is on the Saturday after 3rd Thursday, 1000 hrs at site TBA, contact N5KA, 903.364.5306. Sponsor is Sabine Valley ARA. Repeater 146.780(-) with 118.8 tone.

President's Message

Greetings to everyone. We're getting some good rain of late, and much needed too. I hope you have your go-kits charged and ready to go. I'm often reminded of Skywarn preparations when rain clouds form, but you never know when or where you might need a go-kit. Even if you travel by car, it is always nice to have your go-kit onboard.

There have been some recent club developments as well as upcoming activities in the near future for your consideration. First off, we received word that the Rockwell Collins Clubs and Leagues board will be meeting in September to distribute the funds requested by each club. Last year, the RCCLB got all of their requested funds, with a small exception of the RCARC in Richardson. But they made good by providing some monies this year. Thanks to our Treasurer, Andrew Robinson - K5VRA, we have put our request in for FY2013 on-time last March. So, we expect to see some good results next month. Also, we are going to be holding elections for new officers. As much as I would like to see things stay the same, I will welcome a change in position this October, when new officers take the helm of our club. Please be thinking of what you can do to help out our club this next year. I would like to see good participation from all of our membership in regards to officer elections and activities participation.

Paul Veenstra – KC0TEG, has done a splendid job of securing speakers for the next few club meetings. This month, we will be hearing from Steve Hicks – N5AC, the Vice-president of Flex Radio Systems in Austin, as he explores the topic of Software Defined Radio (SDR) and its future. This would be a great topic for engineers at Rockwell Collins that deal with radio SDR waveform products. Come out and get a look at what's new in SDR. I know Wayne Hughes – WA0TGH is planning to spread the word to folks in his area. Why don't you do the same and invite someone to the meeting?

I hope to see each of you at the next club meeting. In the mean time 73!

73,
Michael Ketchum
K5MDK
RCARC President

Secretary's Report

26 July 2012

The meeting was called to order by President Michael Ketchum K5MDK at 1735 with the Pledge of Allegiance.

The following attendees were present at the meeting:

Charlie Beis	K5UWD
Jim Brown	TBA
Larry Creech	KC5LOP
Michael Ketchum	K5MDK
John McFadden	K5TIP
Steve Phillips	K6JT
Andrew Robinson	K5VRA
Mike Schmit	WA9WCC
Jim Skinner	WB0UNI
Joe Wolf	N5UIC

Officers and Committee Reports:

President's Report: The President's report is in the newsletter. President Michael Ketchum K5MDK introduced new member Jim Brown to the membership.

Vice-President's Report: There was no Vice-President's report

Secretary's Report: The Secretary's Report is in the newsletter.

Treasurer's Report: There was no Treasurer's report.

Website Manager's Report: There was no Website Manager's report.

Station Trustee's Report: Steve Phillips K6JT reported that the repeater power project is still on hold pending battery purchase.

Database Manager's Report: There was no Database Manager's report.

CAF Restoration: The B29 activity schedule can be found on Collins Collectors Association web site. Bob Kirby, K3NT, and Loney Duncan, W0GZV are touring with the B29 to Cedar Rapids, and Oshkosh, Wisconsin.

Old Business:

Projects: The repeater power project is on hold pending battery purchase.

New Business:

Joe Wolf, K5UIC, reminded the club about membership renewal time.

Several expenses required club approval. These include expenditures for the recent B29 dedication ceremony, B29 microphone replacement, and QSL card stock for B29 special event cards. Steve moved to approve the expenditures, seconded by Jim. The measure passed unanimously.

Several upcoming activities were announced:

PARK high altitude balloon flight scheduled for July 28.
Hot Rocks Bike Race Saturday Aug. 8 in Rockwall TX.
RCARC Business meeting Thursday, Aug. 28.
JDRF Race for the Cure Saturday Sept. 29 at 7:00 at Plano Granite Park.

Program:

There was no program this month. The meeting was followed by a round table discussion about the club mission, club activities, and ways to increase interest in club activities.

Adjournment:

The meeting closed at 1839.

Something of Value: Echo and the Beginnings of Satellite Communications

by Donald C. Elder

[**33**] The world has changed in many ways since 1960, but few areas have undergone as radical a transformation as the field of telecommunications. From the virtually instantaneous transmission of television images to the relaying of telephone messages across vast distances, people have access to capabilities only dreamed of 35 years ago. If the world is indeed becoming a "global village," the revolution in the field of telecommunications is in large measure responsible for that development.

Although a number of technological innovations help explain this progress, the significant breakthrough involved the advent of communications satellites. They display a remarkable degree of technological sophistication today, yet it is instructive to note that they also have undergone a process of evolution. Indeed, the first such device seems almost simplistic in comparison to the communications satellites of today. That satellite, christened Echo, was in fact a mylar sphere coated with vaporized aluminum, and it could reflect only signals directed at it. Still, the story of Echo I does have great significance in the history of today's telecommunications revolution. It proved the viability of the concept of the communications satellite and allowed interested parties to conduct experiments that presaged the uses to which others would apply the ensuing generations of satellites.

The Theoretical Basis

The story of Echo actually begins during the days just after the end of the World War II. In October 1945, Arthur C. Clarke, already on his way to becoming one of the preeminent figures of science fiction, wrote an article suggesting that a device placed in orbit around the Earth could relay messages transmitted to it from one point on the planet to another.[1] His idea found resonance with others, who in various forms kept the concept of a communications satellite alive during the following few years. Indeed, individuals in a number of U.S. government agencies noted in reports the value of such a venture to both the public and private sectors of the country.[2] However, the postwar Truman administration never gave any official backing for the devel-

opment of communications satellites, thus keeping the concept in the theoretical realm.

This situation began to change in 1952. During that year, John Robinson Pierce, who was the director of research at the American Telephone and Telegraph (AT&T) Bell Telephone Laboratories, wrote a story for Astounding Science Fiction, in which he discussed the potential benefits of communications satellites.[3] In 1954, he further refined his thinking on the subject in a speech he delivered to the annual meeting of the Institute of Radio Engineers. In this address, Pierce examined possible communications satellite configurations and suggested that such a device could either actively repeat or passively reflect signals transmitted to it. An active repeater would require an internal power source to allow the retransmission of signals broadcast to it. While noting that this type of satellite had many advantages, Pierce concluded that it possessed one highly significant drawback: the limited lifetime of power sources available at the time would give such a device only a relatively brief period of usefulness. For that reason, active repeater satellites were impractical for private industry as an alternative to existing methods of long-distance communications relays.

[**34**]

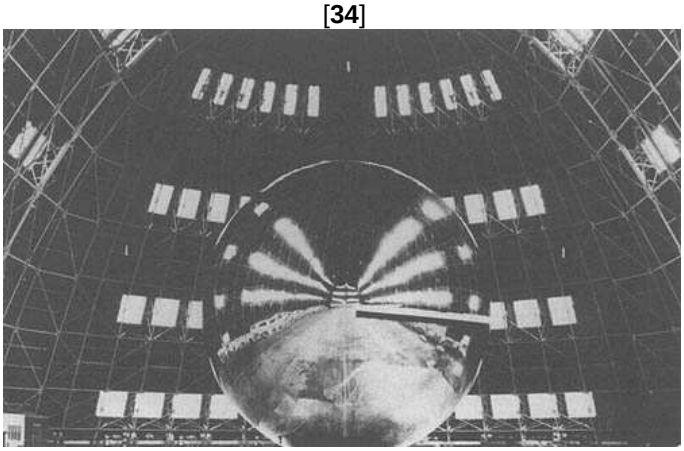

Figure 9. Echo balloon fully inflated for testing purposes. (Courtesy of NASA, photo no. 60-E-6)

Having rejected the viability of active repeater satellites because of technological limitations, Pierce turned to the concept of passive reflectors. Such a satellite would have no need for an internal power source, making it of more immediate utility than an active repeater. After establishing the superiority of the concept, Pierce then examined the potential configurations for a passive reflector. He rejected the practicality of both a plane mirror and a corner reflector for technical reasons. Instead, Pierce concentrated on the [**35**] concept of a uniformly reflective sphere. First, if such a satellite 100 feet (about thirty-one meters) in diameter were placed in an orbit 1,000 miles (1,600 kilometers) above the surface of the Earth, it would afford the best possibility for successfully relaying messages. A sphere of that size would not require a special alignment in orbit to reflect signals. Second, its characteristics would allow the satellite to relay the widest range of signal frequencies from one point on the Earth to another. Pierce concluded his speech by suggesting aluminum foil as a possible material for the construction of the satellite, as long as "one could inflate [the sphere] gently."

Pierce's speech received a favorable response. Encouraged by individuals in the audience to publish his presentation, he submitted a modified version to the journal Jet Propulsion, which published his paper in its issue of April 1955--an issue whose focus was on possible outer space ventures. In this article, Pierce correctly predicted all of the components that would make up the successful Project Echo venture five years later, but he also noted the one factor that prevented the immediate implementation of his proposal: such a venture would need information "from rocket men about constructing and placing satellites" in orbit.[4] Indeed, at the time, no government on the Earth had committed itself to launching such a craft. Until that situation changed, the prospects for communications satellites remained dim.

The Crucial Breakthrough

Nonetheless, in April 1955, official backing for a satellite was closer than Pierce could have imagined. For some time, President Dwight D. Eisenhower had known that the intelligence-gathering agencies of the United States would soon have the ability to photograph the Earth with remarkable resolution from high altitude; his advisors also informed him that a satellite had excellent potential as a platform for basing such an observation system. Eisenhower understood, however, that under existing practice, any nation could consider a satellite passing over its territory as an invasion of its airspace and therefore could legally shoot the surveillance satellite down--if it possessed that capability. Unless the United States could somehow convince the nations of the world to regard satellites as having a different legal status than airplanes, the value of surveillance satellites would be severely limited.

At this critical juncture, the world's scientific community had offered Eisenhower a possible way to establish the principle of legal satellite overflight. To enhance the gathering of useful data during the International Geophysical Year (IGY) 1957-58, these individuals in 1954 called on the governments of the world to launch satellites for conducting scientific experiments. American scientists did not hesitate to propose such a venture to the Eisenhower administration. Eager to provide a precedent for the overflight of other nations by surveillance satellites, Eisenhower approved the launching of an American scientific satellite in conjunction with the IGY. The official announcement came in July 1955.[5]

Soon after, the American coordinators of the IGY formed a committee to select experiments to include in the payload of a venture named Vanguard. One proposal presented to

this group came from William J. O'Sullivan, Jr., of the National Advisory Committee for Aeronautics (NACA). He envisioned ejecting a small balloon out of the final stage of a launch vehicle, inflating it, and then observing the effects of atmospheric drag on the [**36**] sphere. O'Sullivan suggested that this balloon could consist of either metallic foil or plastic with a metallic coating. The committee considered his proposal and shortly gave its approval.[6]

O'Sullivan and a small staff began work on the balloon project. While developing a prototype of the 30-inch (75-centimeter) sphere, O'Sullivan began to realize that larger balloons placed in orbit would offer greater opportunities for experimentation. He therefore began work on a balloon 100 feet (about 31 meters) in diameter, and in 1958 a picture of this larger sphere began to appear in journals and magazines. As fate would have it, John Pierce saw a copy of this picture and immediately realized that a sphere of that size met precisely the requirements of the passive reflector he had proposed back in 1954. After securing the backing of AT&T, he contacted Hugh Dryden, the director of NACA, and suggested the possibility of using the larger version of the balloon for a communications experiment. Dryden gave his enthusiastic approval; he then asked O'Sullivan for his opinion. After deliberating for two days, he, too, responded affirmatively. Thus, in April 1958, two separate and distinct ideas for utilizing a sphere placed into the Earth's orbit had become one.

The Technological Component

Certain developments soon aided the likelihood of a successful communications satellite venture. In July 1958, the director of the Jet Propulsion Laboratory (JPL), William H. Pickering, offered the services of his institution to Pierce for his venture. JPL already had begun work at the Goldstone Dry Lake in southern California on a parabolic antenna 85 feet (26 meters) in diameter to track and receive telemetry from the military's Pioneer probes. This so-called HA-DEC antenna, so named because its axes were arranged to measure angles in terms of local hour angle (HA) and declination (DEC), could receive messages using the proposed passive reflector sphere.[7] JPL soon constructed a second 85-foot (26-meter) antenna at the Goldstone location to broadcast signals as well.[8]

Meanwhile, Rudolph Kompfner, an associate of Pierce at AT&T who had aided him in developing the communications experiment proposal, found money in the budget of that corporation in late 1958 to build a large, steerable horn antenna at Holmdel, New Jersey, for receiving messages relayed from outer space.[9] AT&T later arranged for the construction of a transmitting antenna, giving the corporation the same two-way capability that JPL enjoyed. Finally, Pierce and Kompfner recognized that the perfection of the maser (an acronym for microwave amplification by stimulated emission of radiation) would reduce the power levels needed for the successful transmission of audible radio waves. The maser was a new type of solid-state microwave amplifying device vaunted by one author as "the greatest single technological step in radio physics for many years" and had become available outside the laboratory only earlier in 1958.[10] From a technical standpoint, then, as 1958 drew to a close, Pierce's balloon venture seemed very promising.[11]

[**37**]

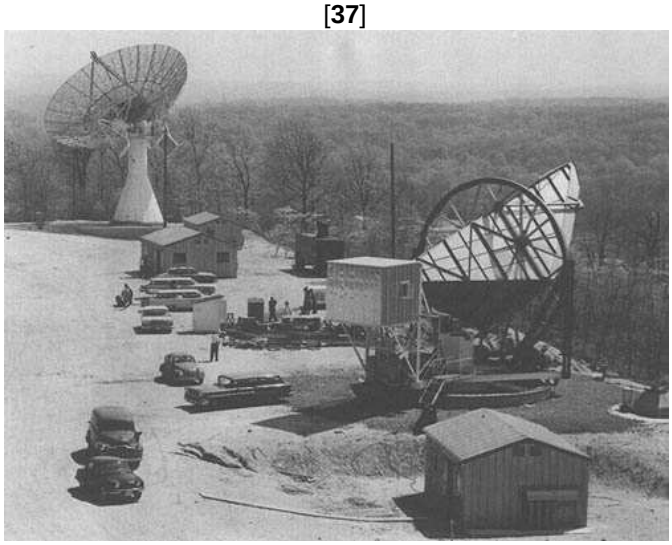

Figure 10. The Bell Telephone Laboratories satellite communications center at Crawford Hill in Holmdel, New Jersey, circa 1960. The steerable horn antenna used for receiving is to the right, while the sixty-foot (twenty-four) transmitting dish is in the upper left corner . (Courtesy of NASA, photo no. 227031)

Those associated with the communications satellite project soon found reason to rejoice in the political realm as well. NACA had approved the venture in April 1958, but that organization ceased to exist on 1 October 1958 because of a process of events set in motion months earlier. Spurred by the launch of Sputnik, the world's first satellite, by the Soviet Union in October 1957, President Eisenhower sought to demonstrate his administration's commitment to the development of a vibrant American space program. Accordingly, the president advocated the creation of a civilian space agency, the National Aeronautics and Space Administration (NASA). As part of the legislation authorizing NASA, Congress authorized the new agency to absorb NACA. The demise of the original governmental champion of the communications satellite project momentarily left the fate of the project in doubt. However, T. Keith Glennan, the first NASA administrator, saw merit in the concept and convinced the Eisenhower administration to give it official approval. Glennan made this news public on 19 February 1959.[12]

[**38**] Aware of the work under way on the signal transmitting and receiving equipment, and secure in the knowledge that the government stood solidly behind the project, the individuals interested in the communications satellite project turned their attention in 1959 to the progress being made

on the construction of the sphere. O'Sullivan had given the contract for the sphere to the General Mills Company. At the time, General Mills was a leader in the field of research balloon manufacturing, and that firm had built a prototype of the passive reflector sphere by the summer of 1959. General Mills, however, had never fabricated a balloon of that size before, and O'Sullivan had no facility large enough to observe the results of inflation procedures under the conditions that would exist at an altitude of 1,000 miles (1,600 kilometers). Until NASA could conduct suborbital tests with the General Mills balloon, he would not know whether the sphere could maintain its integrity in orbit.[13]

When NASA finally conducted the first test in October 1959, the results confirmed O'Sullivan's worst fears: the balloon disintegrated upon inflation, creating a dazzling spectacle of sparkling light in the sky over the eastern coast of the United States. General Mills in fact had warned O'Sullivan beforehand of a potential problem. The Minnesota company informed him that it did not believe the substance its technicians had used to bind the 82 separate panels of the balloon together would allow the sphere to withstand the tremendous pressure generated by rapid inflation in a near vacuum. The first test dramatically validated the concern of General Mills and put the future of the project in doubt.[14]

As it turned out, General Mills already had put into motion a plan to rectify the problem. Before the first suborbital test, the firm had asked a balloon-making rival, the G.T. Schjeldahl Company of Northfield, Minnesota, for help in creating an effective sealing procedure. After six weeks of intensive study, G.T. Schjeldahl himself, the company's founder, developed a satisfactory adhesive, and one of his employees devised a technique for applying it to the panels of the disassembled sphere.[15] After inconclusive results during two subsequent suborbital missions, a sphere built through the combined efforts of General Mills and the G.T. Schjeldahl Company performed flawlessly in a test flight on 1 April 1960. Now confident about the quality of the product, NASA officials began to plan for a full-scale mission.

The Dawning of a New Age

NASA scheduled the launch of the giant balloon for May 1960. The rocket left Cape Canaveral successfully, but control jets in the second stage did not function properly. NASA officials surmised that the Thor-Delta rocket had plunged into the Atlantic Ocean. Nonetheless, they did not let the failure prevent them from initiating plans to schedule another launch immediately.[16] After one additional successful suborbital launch, NASA selected August 1960 for the next attempt.

This mission, after a number of postponements, did succeed. The Thor-Delta performed flawlessly, lifting the payload on the morning of 12 August 1960 to the desired [**39**] altitude. The ejection mechanism in the final stage sent the tightly folded collapsed sphere into the near vacuum of the Earth's orbit; then a combination of chemicals inside the balloon underwent a process of sublimation and released gas that gently inflated the sphere. The satellite--at that point officially named Echo by NASA--had achieved orbit.[17]

The crews at Holmdel and Goldstone learned of the successful deployment of the sphere in orbit and immediately prepared for the first communications experiment. When both stations located the satellite in the sky, the JPL facility at Goldstone sent the first message. With remarkable clarity, Bell Telephone Laboratories personnel heard the voice of President Eisenhower, who previously had recorded a short speech for this occasion.[18] In this dramatic fashion, a new era in the history of communications began.

In the days following the launch, many different groups conducted experiments using Echo. JPL and Bell Telephone Laboratories successfully conducted the first two-way transmission using a satellite; after the California team again broadcast the message of President Eisenhower, the Holmdel personnel transmitted a recording supplied by Senate Majority Leader Lyndon B. Johnson. The Collins Radio Company completed a live, two-way radio conversation between its home location in Cedar Rapids, Iowa, and a subsidiary in Richardson, Texas. This firm also turned a teletype machine on by means of a signal bounced off the sphere. The Naval Research Laboratory joined with the original participants to "double bounce" a message from Maryland to New Jersey, then to California. Clearly, Echo had allowed interested parties to demonstrate the potential benefits of a communications satellite.[19]

While the results to that point would have been enough to satisfy all concerned with Project Echo, two later experiments gave them an even greater appreciation of what a communications satellite could offer in the future. First, on 15 August 1960, JPL and Bell Telephone Laboratories project managers used the satellite, and their transmitting and receiving equipment, in the words of a Bell publicity release, to engage in a "historic [telephone] conversation, exchanging pleasantries and carrying on small talk."[20] Second, in April 1962, the Massachusetts Institute of Technology and the U.S. Air Force joined in a successful effort to relay a live television transmission via Echo. With good reason, then, but perhaps with excessive modesty, too, Pierce later would refer to the satellite as "something of value."

Echo in Retrospect

Even at the time of the successful relaying of television signals, NASA officials realized that technological developments had made the passive repeater satellite obsolete. Indeed, in July 1962, NASA launched Telstar, an active repeater satellite. People soon remembered the original communications satellite more for its visibility to the naked eye at night than for the experiments individuals used it to conduct. The national news media noted the demise of Echo in May 1968, as it returned through the Earth's at-

mosphere, but recognized in their coverage that events had long since stripped it of its relevance.[21]

[**40**] Still, it is important to remember that a successful communications satellite effort, however simple in design and execution, was necessary for individuals to plan a more ambitious generation of devices. The telecommunications industry today may be "the world's largest economic sector," as the Los Angeles Times has proclaimed, but few companies would have allocated resources for a field that had yielded no apparent hope of success until August 1960.[22] Viewing the results yielded by Echo, individuals could envision more ambitious telecommunications projects for the future. Echo, then, represents the proverbial single step in a journey in which the world is still participating today.

END NOTES

1. Arthur C. Clarke, "Extra-Terrestrial Relays: Can Rocket Stations Give World-Wide Radio Coverage?," Wireless World 51 (October 1945): 305-08.
2. U.S. Senate, "Policy Planning for Space Communications," Staff Report Prepared for the Committee on Aeronautical and Space Sciences, 86th Cong., 2d sess. (Washington, DC: U.S. Government Printing Office, 1960), p. 3.
3. J.J. Coupling, "Don't Write: Telegraph," Astounding Science Fiction 49 (March 1952): 82-96. John Robinson Pierce often used the pseudonym "J.J. Coupling," an electrical engineering term, for his writings in the field of science fiction.
4. John Robinson Pierce, "Orbital Radio Relays," Jet Propulsion 25 (April 1955): 77-78, quotation from p. 78.
5. For a full examination of Eisenhower's decision to initiate an American satellite program, see R. Cargill Hall, "The Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," Colloquy 14 (December 1993): 5-6, 19-24.
6. Don Murray, "O'Sullivan's Wonderful Lead Balloon," Popular Science 178 (February 1961): 74-77.
7. Calvin Tomkins, "Woomera Has It!," New Yorker 39 (21 September 1963): 85; William R. Corliss, A History of the Deep Space Network, CR-151915 (Washington, DC: NASA, 1976), pp. 16-17, 20-25.
8. Corliss, Deep Space Network, pp. 25-27.
9. Tomkins, "Woomera Has It!," p. 87.
10. Quotation is from J.V. Jelley, "The Potentialities and Present Status of Masers and Parametric Amplifiers in Radio Astronomy," Proceedings of the IEEE 51 (1963): 31, 36, esp. 30. For the invention of the maser, see Paul Forman, "Inventing the Maser in Postwar America," Osiris ser. 2, vol. 7 (1992): 105-34.
11. Donald C. Elder, Out From Behind the Eight-Ball: A History of Project Echo, AAS History Series, vol. 16 (San Diego: American Astronautical Society, 1995), pp. 25-26.
12. "Highlights of the Inflatable Satellite Program," undated, Folder XII, Satellites, Echo--Project Echo, NASA History Office, Washington, DC.
13. DuPont Magazine 53 (May-June 1961): 14.
14. William J. O'Sullivan, Jr., interview with Edward Morse, 28 August 1964, "Historical Origins of Echo I," William J. O'Sullivan Jr., file, NASA History Office.
15. Sheldahl Company, The Fine Line, special ed., 1985, pp. 4-7, G. T. Schjeldahl Papers, Minnetonka, Minnesota. After G.T. Schjeldahl severed his ties with the G.T. Schjeldahl Company, its directors changed both the spelling and the name of the firm.
16. NASA Statement to the Press, 13 May 1960, Documentation Echo Folder, NASA History Office.
17. Elder, Out From Behind the Eight-Ball, pp. 99-110.
18. Washington Star, 14 August 1960, p. 9; New York Herald Tribune, 13 August 1960, p. 7.
19. Elder, pp. 113-116.
20. Bell News Release, 15 August 1960, Folder XXII, Satellites Echo I, NASA History Office.
21. NASA News Release, No. 75-217, 10 August 1975, Folder XXII, Satellites Echo I, NASA History Office.
22. Los Angeles Times, 26 July 1994, p. H-2.

Events and Public Service Ops

08-10 September 2012: ARRL September VHF QSO Party. The object of this event is To work as many amateur stations in as many different 2 degrees x 1 degree grid squares as possible using authorized frequencies above 50 MHz. Foreign stations work W/VE amateurs only. **Date and Contest Period:** The second full weekend of September. Begins 1800 UTC Saturday and ends 0300 UTC Monday (September 08 - 10, 2012)**.** More info at http://www.arrl.org/september-vhf.

15-16 September 2012: ARRL 10 GHz and Up Contest. North American amateurs work as many amateur stations in as many different locations as possible in North America on bands from 10-GHz through Light. **Date and Contest Period:** Third full weekend of September. The dates are September 15-16, 2012. Operations may take place for 24 hours total on the contest weekend beginning at 6:00 AM local Saturday though 12:00 midnight local Sunday. Listening times count as operating time. Times off must be clearly indicated in the log. More info at http://www.arrl.org/10-ghz-up.

Plano Balloon Festival: Friday, September 21 4:00pm ~ Sunday, September 23, 2012 9:00pm Oak Point Park in Plano and beyond. The balloons will be spectacular and we anticipate a wonderful weekend of flight and color. For more information, please visit the web link: http://www.w5adc.com/PBF/PBF.html. This link will provide links to training, signup web site, and other materials for operating and supporting PBF 2012. If you would like to simply watch, you can find out more information at http://www.planoballoonfest.org/.

Rockwell-Collins

Amateur Radio Club

Mail Station 461-290

P.O. Box 833807

Richardson, TX 75083-3807

TO:

CLUB STATIONS
(972) 705-1349

W5ROK REPEATER
441.875 MHz +5 MHz Input
131.8 Hz PL - RX and TX

W5ROK-1 PACKET BBS ROK Node
145.01 MHz

W5ROK-N1, W5ROK-N2 & W5ROK-N3 HSMM-MESHNET Nodes 2.4 GHz

Thursday, 23 August 2012

1700 Social 1730 Meeting

Methodist Richardson Medical Ctr
At Bush/Renner/Shiloh Intersection

Second Floor Conference Room 200

NEXT SIGNALS INPUTS DEADLINE:
➔➔➔ 16 September 2012 ➔➔➔