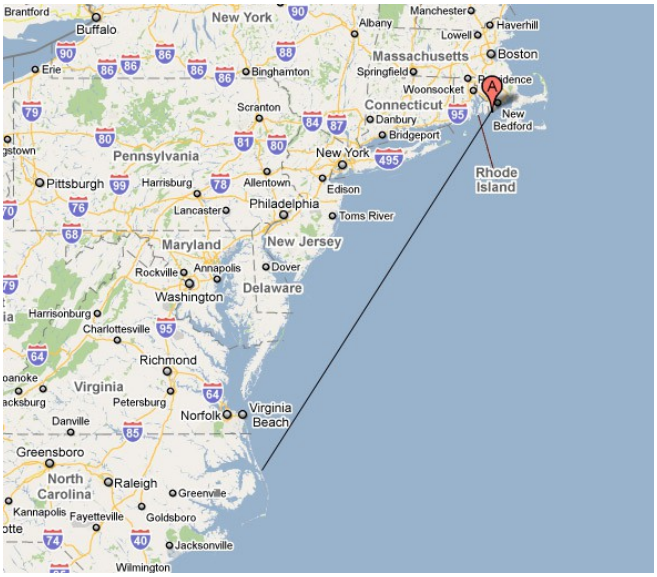
Nags Head, North Carolina
Pack Rat 1296 Mhz Expedition
W3CCX/4

September 19th and 20th, 1970
Bert Soltoff, K3IUV

On September 19th and 20th, 1970 the Mt. Airy VHF Radio Club Inc., known to all as the "PACK-RATS", sent an expedition to Rodanthe, N.C. on Cape Hatteras. The plan was to set up a 1296 Mhz station to communicate with East Coast VHF Club headed up by Allan Katz, K2UYH who had set up a station in Horse Neck State Park, Massachusetts. The hope was to set a new world record for amateur communications on 1296 Mhz.

The Pack-Rat force consisted of some 28 persons including the following members: K3BPP, K3DLS, W3FQD, K3IGX, K3IPM, K3IUV (Leader), WA2KOI, WA3LNH, WA3NFV, K3UJD, W3ZD, and K3ZSG. The remainder of the party was made up of XYLs and a number of harmonics.

This effort followed an earlier test between W2EIF working from his Summer Cottage in Avalon, N.J. and the East Coast group operating from Fire Island on the South shore of Long Island. The very strong signals experienced in this earlier test raised hopes that "Nags Head to Horse Neck" would be a picnic, and the majority of the time would be spent celebrating and enjoying the beach.. Such was not to be, for in spite of a forty-eight hour around the clock watch by the team members, communication was not established.



THE PROLOG

W3LHF (W3ZD), Dave lugs equipment from a Nags Head, NC motel to the operating site. WA2KOI, Lloyd and K3UJD, Mario trail behind.

In the mid-sixties, VHF/UHF activity continued to grow. Hams continued to press higher in frequency, and many of the Packrats were in the middle, if not on the forefront of this activity. Techniques and equipment did not have the sophistication of today's technology; however, that did not deter interest or experimentation. The bands of peak activity were of course 6 & 2 meters. 220 Mhz was in lesser use, although the Packrats helped to ensure it remained active by using it as our local "intercom" band.

The frequency of 221.4 Mhz was chosen as our net frequency. A variety of war surplus equipment was modified and placed on that frequency in AM mode. Most of the "rats" monitored the frequency whenever they were near the shack, and it was common to hear something like "Hi Ernie, are you listening?". A military surplus R48 receiver was easily modified to tune the frequency, and a surplus Radiosonde (used for buoy signals) transmitter could be easily retuned and crystalled to serve as the transmitter. Several runs were made to Canal Street (better known at that time as radio row) in NYC to pick up quantities of this gear for the Packrats use. The moniker "Barry Rig" came from the name of the store on Canal Street (Barry Electronics) where we found this item.

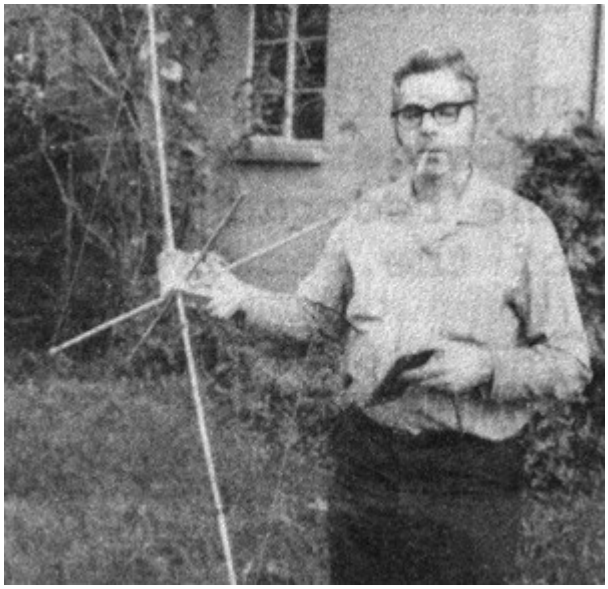
The 432 MHz band was similarly initially activated by modified surplus commercial equipment, supplemented by tech-savvy amateur construction. The initial transmitter of choice for many was a modified “taxicab rig”. These units were originally built for taxicab paging systems. Manufactured by Motorola, RCA, or the Link corporations, they would provide about 50W when retuned for the ham band. The Motorola unit used 2C39’s, while the Link and RCA rigs used the 5894 (a dual tetrode developed by Amperex) as a tripler and a final amp.

Activity on 1296 progressed at a slower rate due to the difficulty in developing reasonable power, and the greater uncertainties in proper techniques to use on the band. Some of the early experiments and contacts were made using a modified aircraft IFF (identification friend / foe) unit designated as the AN/APX-6. This unit used lighthouse tubes in the transmitter, and was modified for wideband FM use as a modulated oscillator by the ham community. The lack of frequency stability, and poor sensitivity were merely obstacles to be overcome, and did not prevent a number of hams in different parts of the country from using them to make contacts and learn more about the band characteristics. A picture (unidentified hams) showing use of the APX-6 unit, together with the war surplus BC-348 receiver in common use at the time, is shown below.

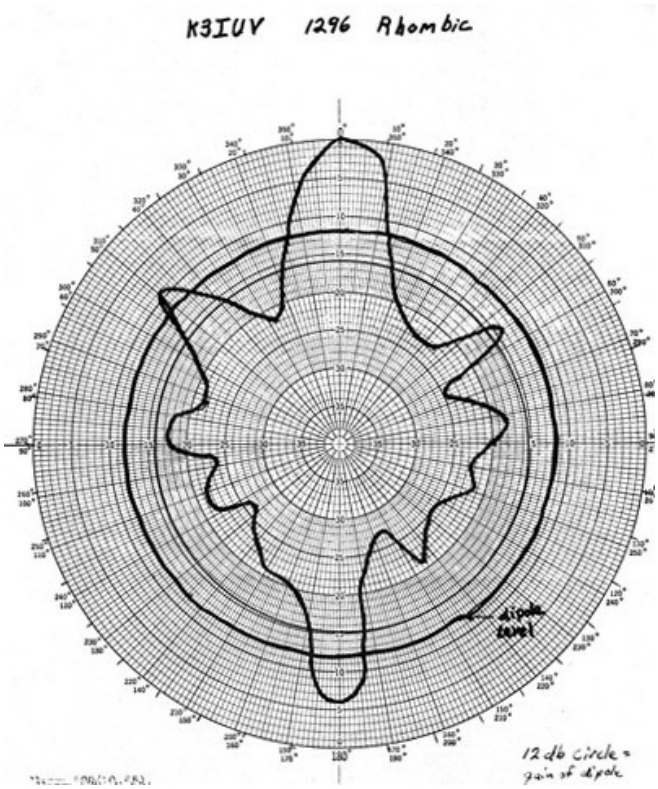
Left to right, Carl Croce, K3DLS; Bill Murphy, K3ZSG (rear view); Bert Soltoff, K3IUV; Chuck Benavides, WA3LNH; Dick Huntzinger, W3FQD (rear view).

A popular accessory for most hams in our area was a small dish sold by Fair Radio in Lima, Ohio (Still there). This dish was about 22” in diameter, and was usually fed with a homemade dipole and a splasher (reflector). Another antenna design that saw some use was a Rhombic design. Common on HF, a Rhombic could be constructed using wooden poles for support, and enameled copper wire for the antenna. It was lightweight, broadband, and provided good gain for 1296. The pictures show K3IUV holding his Rhombic antenna at a club gain measuring party (run by Walt, K3BPP, at the QTH of Mario, K3UJD), and the resultant gain pattern.

Walt Bohlman, K3BPP; Bill Murphy, K3ZSG; Bert Soltoff, K3IUV; Danny Mitten, WA3NFV; and Chuck Benavides, WA3LNH at the base of the tower, with some of the equipment



"K3IUV with his 60¢ rhombic, 12 dB gain - 5¢ a dB isn't bad Bert"



Picture and Gain Plot courtesy of Cheesebits, November 1969

As interest in the higher bands grew, improved equipment was developed. A Varactor multiplier design was developed to serve as a tripler from 432, permitting a crystal controlled transmit signal to be generated. A variety of designs evolved using the 2C39 (3CX100) triode as an amplifier. There were single, dual, and even a ring arrangement of 6 of these tubes in parallel that became popular. Some of the more adventurous hams developed water-cooled designs to keep the tubes cool while generating substantial power (up to about 500w).

Receiving gear was similarly slowly evolving. Designs in this period were always of separate receive and transmit chain systems. The concept of the modern transverter with a shared Local Oscillator hadn’t yet become commonplace. Many early contacts were made using a 1N21WE Radar diode as a mixer for the receiver front end. Noise figures were probably no better than 10db. Nevertheless, successful local contacts were being made (typically in the range of 20 miles), and enthusiasm developed to see what kind of longer distance paths could be bridged. Some of the Packrats decided to push for a series of experiments to see what could be accomplished.

THE FIRST EXPERIMENT

Bert, K3IUV, Walt, K3BPP and Mario Fontana, K3UJD. Bert at the receiving setup, Walt watching, and Mario with feed-line in hand. The Transmitter is sitting on the table next to the tower. Carl, K3DLS hidden behind tower.

Shortly after the June, 1970 VHF contest, Al Katz (K2UYH, member of the East Coast VHF society) discussed with Bert Soltoff (K3IUV, Packrat), the idea of trying some distance experiments with a 1296 expedition. Club members welcomed the idea, and a number of them attended a planning meeting, held at a diner in New Jersey, about halfway between the two groups. Discussions led to a plan to make an initial try for a contact over a path that consisted mostly of water. We reasoned that we might get some signal enhancement by reflections from the water surface, and would have minimal attenuation from obstacles in the path. We chose to make this initial try from South Jersey to Fire Island, New York Long Island. The South Jersey location we picked was at the summer cottage of a club member, Joe Kilgore, W2EIF (SK). The path was about 100 miles which was a significant distance in those days. Common knowlege of the day was that these were primarily "line of sight" frequencies.

[Author's note. Recollections of the equipment described here are uncertain, but believed to be correct]

For this first attempt, we used equipment provided by different club members. The transmitter, provided by Mario, K3UJD (SK), used a pair of 2C39's in a homebrew cavity of the design that had become common at that time. Power output was about 100-watts. The receiving equipment provided by Bert, K3IUV included a crystal controlled converter feeding a Collins 75A4 receiver. For an antenna, we used a 6' dish provided by Walt, K3BPP. The dish was mounted (if memory serves correctly) on a 20' tower section. WA3NFV, Danny Mitten, served as meter reader and tower climber. Don Hampton, W3CJU (SK), provided transportation and map reading.

W2EIF took off for Avalon at noon on Saturday, August 15, with the usual tools, aluminum ladder, clothes, sheets, beer, food, etc. He arrived at the cottage about 1:30pm, opened up the house, windows, turned on the water, and found the refrigerator not working! He called a serviceman – fixed two hours and fifty bucks later! Meanwhile, Mario arrived with his wife Flossie. She immediately took over and prepared a nice supper for the gang. Floss then spent time practicing her golf swing by cutting down weeds in the yard. About 9:30 p.m. (quite dark by then), W3CJU pulled up in his station wagon. K3BPP and WA3NFV were with him. On the wagon roof were two ten-foot lengths of tower, and Walt's six-foot aluminum dish. Nothing would do but to get everything up and ready immediately. (The mosquitoes had gone over to Wildwood where targets were more plentiful).

Walt, K3BPP with a coil of coax (probably RG17A), Lloyd , WA2KOI (K3ZPN), and Bert, K3IUV with a view of transmitter rack, W3LHF (W3ZD) behind transmitter.

The 6' dish mounted at top of tower, with Rotor. Memory suggests height of tower was about 20'.

Having completed the setup so quickly, everybody except W2EIF went over to Wildwood to “whoop it up”. The gang returned at 4:00 am, with Dan carrying the famous “red garter”. While he claimed he removed it himself, there are other opinions that he bought it! This earned him the nickname of “the red garter kid”.

At the other end of the path, Al Katz (K2UYH) and his group were using a 4-foot dish, mounted about 15 feet above the beach. They also had installed a 12’ diameter stressed dish of the design published in QST by Dick Knadle, K2RIW (developed for Dick’s experiments in receiving transmissions from the Apollo Spacecraft). They operated from Fire Island using the call WA2WEB/2, while the Rats used the club memorial call W3CCX/2.

Everybody got up at 8:00am on Sunday, August 16th, sleep or no sleep. There was breakfast for all, and then we got the 1296 gear ready to operate. Bert, K3IUV arrived at 9:30am with his wife and kids who hurried off to fish and swim. Jack, W2GQK, who lived about 75 yards away came over, and we went to his house to establish initial contact with the WA2WEB group using Jack’s 2-meter gear. Initial contact problems were overcome with help from W3ZD, Dave and K2EFB, Guy, from their home stations. At about 10:30 a solid link was established on two meters.

As the test began, we were unsure of what results we might get. To the pleasant surprise of all involved, we met with almost instant success. The signals received were “armchair copy”, and easily heard by the entire assembled group. The initial contact was on CW at 1296.1, later followed by a switch to NBFM with excellent results. (sidenote: while Bert was keying, the key came apart and the ball bearings in it rolled through the porch cracks into the sand. The neighbors watching were wondering what Dan and Floss were doing under the porch, pawing the sand. But they did recover the bearings!). Another interesting fact, was that we had some initial QRM from K2JNG, about 100 miles north on the Pallisades! We convinced ourselves that this result validated our idea of signal enhancement from the “over the water” path, and had high hopes that our subsequent test over a greater distance would be easily accomplished.The crew at the WA2WEB end of the link included K2LRE, K2JWE, WB2IRX, WA2ZZF, K2QVS, and K2RIW.

THE REAL TEST

Following the success of the initial test, plans began in earnest for the try at breaking the distance record (which was probably about 150 miles at the time). Site selection evolved with the Packrats choosing a site on the outer banks of North Carolina, just north of Rodanthe and south of Kitty Hawk. The town was called Nags Head, NC. We found a motel situated right on the beach (Hattaras Island Motel), a short distance from a fishing pier that extended about 100’ out into the ocean. This area was sparsely populated at the time, in stark contrast to the current highly developed vacation area that it has become.

Walt making adjustment to the feed-line dress. Notice the coffee can feed which was popular at the time.

The East Coast group selected a location in Horseneck Beach State Park (Massachusetts) for their station. We jokingly hoped that the synergy of the site names (Nags Head to Horseneck) would assist in ensuring our success for this real try. The path was just over 450 miles.

The test was planned for September 19th and 20th, 1970. The packrats sent an expedition consisting of some 28 persons (including Hams, XYL's, and harmonics) to the Nags Head motel site. The following members were part of the party:

K3BPP, Walt Bohlman
K3DLS (SK), Carl Croce
W3FQD, Dick Huntzinger and XYL
K3IGX (SK), Dick Boyle
K3IPM, Stan Smith, XYL Barbara, harmonic and baby sitter
K3IUV, Bert, XYL Harriet, & harmonics Rich, Michael & Bonnie
WA3LNH (SK), Chuck Benavides
K3ZSG, Bill Murphy (now W0RSJ)
WA3NFV, Danny Mitten
K3UJD (SK), Mario Fontana, & XYL Flossie
W3ZD (SK), Dave (ex W3LHF), XYL Jane, & harmonics

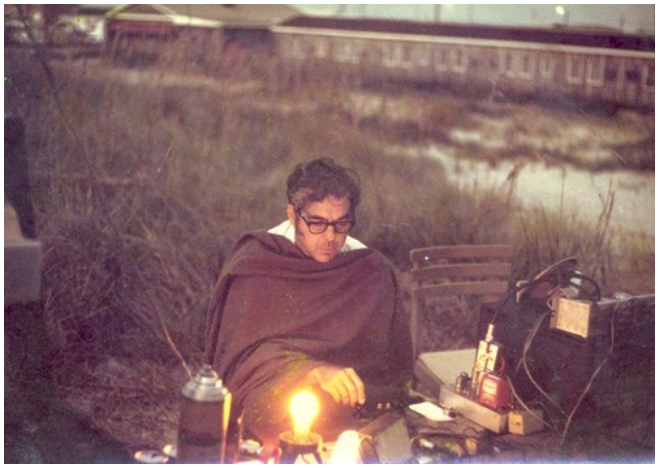
Nancy, Scott, Mark & Bill
WA2KOI (K3ZPN) Lloyd Schoenig

Dave Zimmerman, W3LHF (W3ZD), and Stan Smith, K3IPM on screened porch of Motel room, with 2-meter and HF liaison equipment.

Equipment was transported in/on the members cars (K3IUV's 69 Pontiac Station Wagon carried 3 harmonics, XYL, and the receiving equipment).

At the other end of the path in Horseneck, the East Coast group similarly assembled their station. Al Katz, K2UYH, wife was expecting the birth of a child at this time, so Al was unable to be present for the test. Memories of the calls of the other operators are dim, but may have included K2RXA, Mark, and Gene, K2KJI.

We set up our equipment right on the beach, outside of the motel rooms. W3ZD set up a HF (80 and 40 meters with dipoles on the beach,) and 2-meter station to be used for liaison operations. On two meters, we had no trouble working WA2WEB/1 (about a 475 mile path). We also worked Scranton, PA., Maryland, Virginia, North Carolina, and New Jersey. The only club member worked in NJ was Joe, W2EIF. "At home", W3CL, W3KKN, W3TNP, and K1SFF/3 supported our HF liaison. A 20' tower was erected to mount the 1296 antenna. We used K3BPP's 6' dish with a coffee can feed. Operation was on CW, run on a prearranged schedule (may have been 10 minutes send, 10 minutes receive). W3CCX/4 commenced operations with high hopes, based on the earlier test results from Avalon, NJ. Operators took turns listening, keying, and tuning for a signal from the Horse Neck group. Initially, we thought we detected very short bursts of signals from both W3VIR, and WA2WEB, but they were insufficient for a real contact. As time passed with no additional signals heard, our hopes began to fade but the group persevered. We ran tests around the clock, for close to 18 hours, but were unable to establish communication. In hindsight, the failure was probably attributable to several causes.



Bert keeping a vigil in the middle of the night, keying the CW signal. Motel rooms shown in the background.

1) Poor frequency calibration. Unlike our modern transverters which use a common LO we used separate receive and transmit crystal oscillators. And we did not have the benefit of the precise frequency standards that we have now come to take for granted.

2) Receiver sensitivity. The low-noise preamps that are common today had not yet been developed. Our converter front end probably had a noise figure of at least several db.

3) The vagaries of the communication path. Despite our expectation of success, had we been able to calculate the actual path loss we would probably have found that it exceeded our link margin.

Sunrise from the base of the tower, with the famous fishing pier in the background.

Bert, K3IUV, XYL Harriet, and the three harmonics Rich, Mike, and Bonnie.

Summary

Despite the failure to accomplish our intended goal, the trip was not a total failure. Those that made the trip had a chance to enjoy some relaxation at the beach area. The kids (and a few of the adults) took advantage of the motel's pool for some swimming. A bit of fishing and crabbing was done. In fact a few of the crabs that were caught were taken home to Phila (see anecdote about ice buckets later). Several of the group traveled a little further South on the Cape to visit the landmark Lighthouse on Cape Hatteras. Also visited was the Wright Museum at Kitty Hawk, NC where memorabilia of the first flight were exhibited.

Anecdotes resulted from different incidents during the endeavor, and were bandied about for some time. Those that come to mind include the following:

1. About 4:00am some fisherman went out on the aforementioned fishing pier, and began casting their lines in hope of catching early morning fish. K3IUV, huddled under a blanket, wearing earphones, and tuning the 75A4 back and forth around the expected frequency, was heard to say "look at those nutty people out fishing so early in the morning". One wonders what the fishermen thought as they looked in our direction to see a similar group of "nutty people" with radio equipment on the beach! Walt remembers that they actually stopped by to enquire if our equipment was being used to "track fish"!

2. At the end of the trip, recall mention of some local crabs that were caught. Well, the kids were excited about this and wanted to bring them home to cook for a meal. How to transport them? The motel rooms had low quality ice buckets made of molded plastic. Without much thought, several of the ice buckets were placed into service to transport the crabs (which did arrive home safely). Well, some time after we arrived home, a bill arrived for the ice buckets (for several times what they probably cost), and we got a good laugh about that!

3. Bill Murphy traveled down by taking a bus from Philadelphia to Norfolk, VA. In Norfolk, he arranged an interesting ride with a group of migrant farm workers, traveling in a converted school bus. This brought him to the area, but not to the motel. To get to the motel, he got a ride with the local postman, who commented that this was not an unusual way to travel. Contrast that with today's regulations! Arriving late afternoon, Bill was initially given a key to a room already occupied by a girl (who was traveling with a group of 3 others in another room). She graciously offered to move into the other room (to Bill's dismay?). Danny Mitten started his trip by driving his dad's car to Rio Grande, NJ, to Lloyd's mother's home. He rode from there with Lloyd, who was driving a pickup truck with the 6' dish and tower sections in the rear. They traveled via the Cape May – Lewis, Delaware ferry.

When they checked in at the motel at about 5:00 a.m., Danny was directed to a room already occupied by K3IUV and family. Danny's knocks on the door woke the family, and it took awhile for everyone to get settled in. This too became the subject of many later conversations. On the return trip, Bill Murphy decided to forego the interesting bus rides, and was dropped off by Lloyd in VA where he got on an airplane to go home.

4. Recall mention in item 3, of the girls staying at the motel (bet we know what you all thought, ed.). Turned out that they were somehow involved in the construction or maintenance of the property. We discovered this after an overload blew out some of the circuits in the cottage where the HF and 2-meter liaison were located. One of the girls stepped in and rewired the breaker panel, to restore operation!

5. We had a brief period of high hope, when we detected some weak cw which was read as a KL7 (Alaska) signal. Alas,

we quickly realized that it was nothing more than I.F leak-thru from the 10-meter IF band.

REFERENCES, and/or further reading:

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1. Details of the AN/APX-6
   http://www.tpub.com/content/radar/TM-11-487C-1/TM-11-487C-10917.htm

2. APX-6 modifications by WA6KBL, 1962
   http://www.pawlan.com/wa6kbl.html

3. K5PA shown with modified APX-6, 1966
   http://www.k5pa.com/Ham%20Radio/Stations.htm

4. W6OSA article in Ham Radio, page 32, April, 1965

5. Numerous references to starting on 1296 with an APX-6
   http://www.eham.net/survey/955