

## **Eaglehead History – (1975 – 1977)**

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**15 August 2020**

### **Background Leading to the Project**

I began working for Bob Leo, W7LR, at the Electronics Research Lab (ERL), Montana State University (MSU), Bozeman, Montana in the summer of 1967. I was between my sophomore and junior year in high school. Two others my age - Doug Ballard, WA7DCF, and Matt Montagne, WA7GHW – were employed with me. My ham call at the time was WA7HDD. We worked the summer putting a shelter on top of Bridger Ridge – having packed the prefabricated pieces of the shelter from the top of the chair lift to the top of the ridge by hand. Then we assembled the shelter and installed a weather station with a radio link back to the university. We also installed antennas near Bridger Bowl (for High Frequency – HF) which were used for some sort of propagation testing. Finally, we installed a large tower at the ERL Field Site, south of where today's football stadium is, with an HF Yagi antenna on top.

The next summer (1968), Doug had moved with his family to Billings and Matt had found other employment (I believe taking youth groups on saddle trips in the Tetons). Bob didn't have a slot at ERL that year for me – but I had taken computer programming in High School my junior year of high school and ended up working at the computer center at MSU as a summer Teaching Assistant (TA) for computer classes and then as a programmer converting Fortran II library routines for the old IBM-1620 to Fortran IV for the newly installed Sigma 7 computer for the campus.

The summer of 1969, I had graduated high school and went to work at ERL in the Fabrication department. There, under the capable tutoring of Chad Groth, I learned graphic layout design for front panel silk screening, the silk screening process itself, how to lay out circuit boards using slit tape, the process of coating and making photo circuit boards, fixing the etcher filled with Ferric Chloride and processes of aerodyting and anodizing aluminum for equipment housings.

After my first year of Electrical Engineering (EE) at MSU, I spent most of the summer of 1970 assisting with moving items from the old engineering building to the new Cobleigh Hall which had just been finished. Part of the job was to install a 100' tower on the top of Cobleigh Hall and put a large TH6-DXX antenna on top of it. The first contact on that antenna was on 20m SSB from W7YB to a station in Lebanon.

For the next two summers, I served a mission for the Church of Jesus Christ of Latter-Day Saints in Holland and Belgium. I returned home in September 1972.

I, once again, was hired about 6 months later by Bob but this time as a Research Assistant at ERL. By that time 2m repeaters and FM were beginning to be of general ham interest. The transistor was now commonly available leading to integrated circuits and small portable radios. Bob had established a repeater at Bridger Ridge – but there were no specific frequencies accepted and the pairing of receiver to transmitter was non-standard. Bob had me pick up work started by Doug Ballard (who had returned to MSU for his EE degrees in 1969) on modifying a transceiver, which was commercially procured, and split out the transmitter from the receiver. Anyone experienced with repeaters will know that the shielding and interconnection of the transmitter to receiver is critical to eliminate desensitization of the receiver due to broad band repeater noise. Lacking these skills at the time (repeaters being new), our optimum layout was realized by cutting an aluminum slab with the transmitter at one end and the receiver at the other – separated by about 2 feet. There was a problem with a transient in the audio that would over deviate the transmitter and cause the repeater to key over and over – that was fixed with replacing a bipolar audio buffer with an FET to eliminate a bias shift. Finally, the repeater on 146.28MHz receive and 146.88MHz transmit was put on Bridger Ridge. But that was not the end of it. There was a cable from the top of the ridge to a building at the bottom of the ski lift. Bob reasoned that if we could control the audio

levels from there and perhaps the squelch levels, one could go to that point and adjust the repeater in the winter without having to go to the top of the ridge. This setup was accomplished and worked fairly well. The only down side was that the audio sometimes had noise coupled from the chair lift motors in the background due to the long cable length down and back up the mountain. However, overall the repeater worked well.

### **The Eaglehead Repeater Project**

In 1973 Bob and I worked a project for Montana Power. We build interface panels to link radio repeaters into the Montana Power backbone microwave system across the state. Any truck could touchtone up a microwave link access in the state and then touchtone up an additional repeater link somewhere else in the state. The main dispatcher was directly tied to the microwave. This work ended around 1975 when Montana Power's communications division took the prototypes and began the project across the company.

By 1975, we began work at ERL with the Montana Board of Crime Control. This work involved going to different cities and mountain tops to assist Montana law enforcement in maintaining and expanding their radio coverage in the state.

My K7NM call happened that year – I had 20 years as a ham by then and the FCC offered 1X2 calls to those who qualified. As a CW operator, it was and is a great CW call!

About this time, Bob and I began to discuss the lack of 2m repeater coverage toward Yellowstone. He was aware of the Eaglehead Mountain site about 10 miles due north of West Yellowstone at 9976' MSL elevation and the presence of a solar powered Highway Patrol repeater there. There were a number of obstacles to overcome.

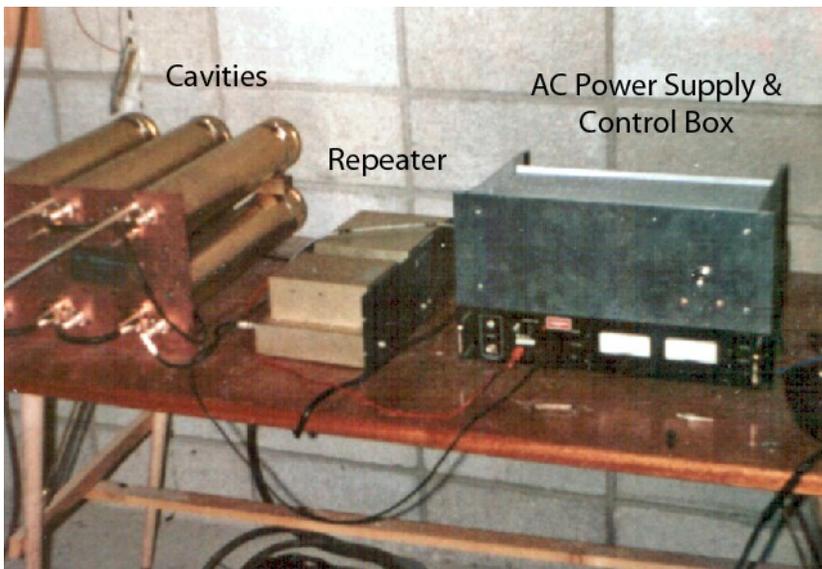
The first major obstacle was to obtain a Use Permit for Eaglehead from the Forest Service. I don't know how Bob sold it, but he managed to convince some rather negative Forest Service people that we should be allowed up there. The original use permit was for five years.

Bob and I decided to take a trip up to Eaglehead and do a survey of 2m coverage from the site. We started out one summer morning in 1975 from Porcupine Creek – arriving there at around 0700. The bridge had washed out a couple miles before the trail head started so we had an extra walk after leaving the car. We carried a 2m antenna and radio with use along with our lunches. It was quite the hike and climb. We arrived at the Highway Patrol shelter at about 1500. At that altitude, neither of us were very energetic. After eating lunch, we set up the radio and borrowed power from the Highway Patrol battery bank. The view from there was fantastic on a perfect day. We could see about 12 mountain ranges. The Crazy's on the north, the Tetons on the south, the Spanish Peaks to the West and the Bear Tooth on the East. Radio coverage was likewise impressive. We communicated with several hams with the southern most in Idaho Falls and then northern most in Helena. All-in-all, the site was fantastic! Our trip home was an adventure. Instead of taking the trail back the way we came, Bob had a Forest Service map showing a trail from the Upper Golden Trout Lake to the Lower Golden Trout Lake and then back to the trail head. We could see the Golden Trout Lakes from the summit of Eaglehead so we went cross country to the Upper Lake. After half an hour of searching, we realized there was no trail – only logging markers. A quick check of the map showed it was drawn in 1957 and we were now in 1975. It was getting dark so we began going cross country. We found the Lower Golden Trout Lake and, again, there was no trail. Soon Bob and I were going single file in the dark in very rough country toward the general direction of the car. A noise caused us to put the flashlight on an object near us only to reveal one of the largest porcupines I have ever seen – before or since! We encounter several of them and kept our distance. Finally, we decided that when we reached the next stream we would lie down for the night and continue in the morning. We came to what appeared to be a stream and began to take off the gear. We soon realized that the "stream" wasn't making any noise. It turned out to be the trail we had taken that morning up to

Eaglehead's summit. We packed back up and followed it down to the car – taking a number of stops to recoup – our strength being pretty sapped. We arrived home about 0400 the next morning. The things one does for ham radio!

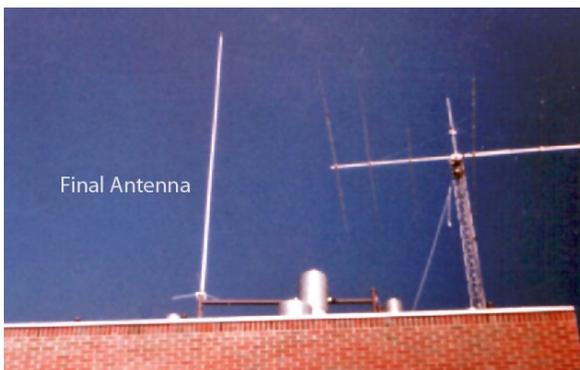
Now that we had the possibility of a home on Eaglehead and had data showing the coverage, the next effort was to find a way to fund the repeater project.

At this time, I was the president of the MSU Amateur Radio Club – W7YB. We learned of a program in Montana where the coal strip tax and coal sales tax were put into an "Alternate Energy Fund" (AEF). Any citizen or group in Montana could apply when they annually took applications proposals to develop alternate energy sources. Dennis Smith, WA7PMG; my wife, Judy Barrett, WB7BRN and I wrote a proposal to the state to fund the Eaglehead repeater. To keep it separate from the politics of MSU, we did it under a new entity called the Eaglehead Repeater Association. We were hoping for full funding of the repeater system – since many people had received funds to build homes with alternate energy sources. In the end, we received \$6200 to buy the solar panels, batteries and the charge control system. The repeater would have to come from other funding.



Judy and I approached Sully Sullivan, W7FC, and Peggy Sullivan, (Call?) – the owners of Crazy Ducks company - with the idea. Sully and Peggy were both supportive and privately paid approximately \$1000 for an off-the-shelf Standard Radio brand repeater and a six-cavity duplexer kit. A ham from Lincoln (John ?, call – sorry for bad memory) who worked for DeBolt came to MSU one Saturday and assisted me in putting the cavities and coaxial

jumpers together. Shortly after that, the repeater was put on the air in the southwest roof room of Cobleigh Hall's roof. A couple of 5/8 wave verticals with 4 radials each were used as transmit and receive antennas – separate – into the cavities to start with. Once the final antenna was procured, it was installed and the repeater ran duplex on it alone. The repeater operates on 146.22MHz and 146.82MHz.



Circa winter of 1975, with the help of Ian Elliot, W7JMX, and Dee ?, (Call – N7??? – bad memory again) from Big Timber (formerly Salt Lake), the first official Eaglehead Repeater Association meeting was held. I believe it was in Cobleigh Hall in a conference room on the 6<sup>th</sup> Floor in the northeast corner. A presentation was made about the repeater site and concept of how it would be put together. Approximately 30 hams showed up and many pledged money to support it. Within a month or so, we had another \$6000 over the amount from the state to finish the

repeater system and shelter.



A group of us hams with construction experience got together and built an 8' x 8' building out of standard wood construction materials. The roof trusses were re-enforced and large Eye Loops were put into the wall studs and header assembly so the building could be air lifted. The plywood on the outside would not be suitable because rodents eat the glue in the plywood. When finished, the building was transported to a custom car finishing company in Belgrade and the building was coated thoroughly with about a 3/16" thick coating of fiberglass – which the rodents will not eat. The building was then painted a Forest Service green color.

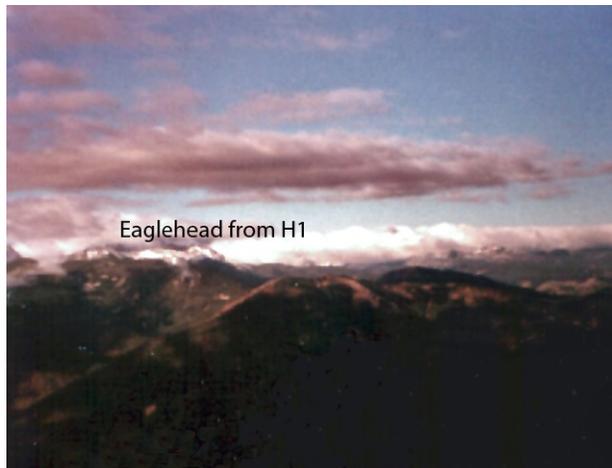
A ham in East Helena (Jim ?, Call?) who worked with the National Guard made a presentation to his commander(s) to support this effort due to its Civil Defense value. The squadron he worked for had H-1 "Huey" helicopters and their reserve crews had to fly so many hours each month to stay current in their ratings. Miraculously, the authorization was given to support the installation of the repeater at Eaglehead.

In the meantime, the repeater was made ready. It was mounted into a 4' tall 19" rack along with the control system consisting of a DTMF decoder and control boards. Each control board having 4 magnetic latching relays to keep power consumption at an absolute minimum. I borrowed a lot of the technology from the Montana Power project Bob and I had worked on at ERL. The control system operating current was around 16 milliamps in standby at 12VDC. That was low power for that day. The control system was tied to a 220MHz link transceiver. The 220MHz transceiver was also configured to be a link if one were ever established. The control station had a matching 220MHz transceiver (Clegg brand, I believe) with a DTMF pad to control the repeater. The 2m repeater squelch was able to be set at 3 or 4 settings in case temperature affected it in the unheated building.

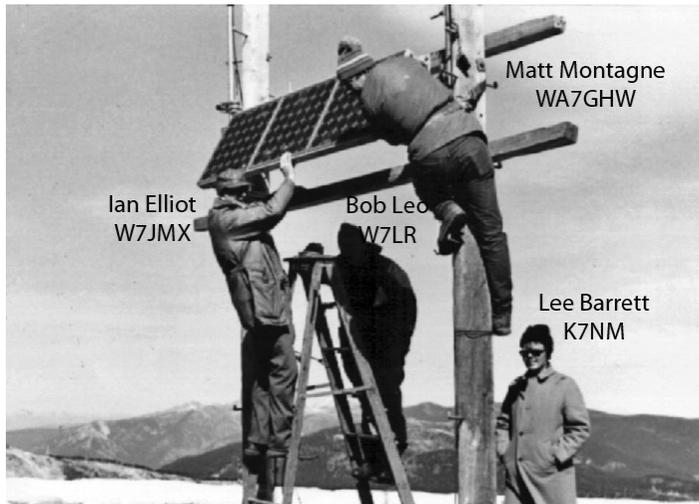
Part of the State of Montana grant for the solar system was a requirement to gather solar charging data and provide it to anyone who might request it. Also, the site needed to be open to visitors. That was no problem in that no one would want to make that trip – and if they did, they would be escorted. The CW ID for the repeater was set up and programmed to add a tail to the call sign every so many minutes that would give battery and charging status. In the end, the final report to the state showed that charge time in the summer was around 8 hours and useful charge time in the winter was around 5 hours. The panels were mounted pointing due South with an angle behind the panel to the horizontal of latitude (42 degrees) plus 10 degrees = 52 degrees.

The first day of support, the building was taken to a staging area near the base of Eaglehead (Porcupine Creek?) on a flat-bed truck. The H-1 met the crew at the Bozeman airport and the gear and crew were loaded into the helicopter. This was in the fall of 1976 – folks were wearing coats. The crew and gear were dropped on top of Eaglehead and the organization of items was completed much like kicking off a DXpedition.

The H-1 then went to the building staging area where a sling arrangement was connected to the pre-built Eye Hooks. The building was then lifted to the top of Eaglehead and lowered into place.



A pre-existing pole was used to mount the antennas and solar panels on. Matt Montagne, WA7GHW, did most of that work.



Due to the altitude, none of us were moving very fast. The H-1 crew left after setting the building in-place and returned around 1700 to pick us up. We were not done. The H-1 crew agreed to come again the next day and bring us back.



The next morning, we gathered at Gallatin Field and once again flew to Eaglehead. That day, the H-1 crew landed and shut the H-1 down. They took fishing poles out from behind their seats and hiked down to the Upper Golden Trout Lake and spent the day there. Around 1700, the repeater was up and running. After final checks, the crew buttoned up the building. The H-1 was fired up and the crew was ferried home. As I pulled up in front of my home on North Rouse, I was able to key up the repeater from my mobile. I worked a fellow briefly in Idaho Falls.

It was found that because of the distance south and the mountain terrain that accessing that repeater was spotty around Bozeman proper. The repeater only operated at 10W output as well. It covered the Gallatin and Yankee Jim canyons very well. The project was a success and now on the air. I moved to Havre in 1977 and was no longer involved with the system. When the use permit expired, it was not renewed for Eaglehead. Bob oversaw the move of the repeater to Mt. Washburn east of Eaglehead. It did not have good coverage from there and was rarely used. It was ultimately moved again to the Lone Mountain location where it is today.

The follow-on teams have done a great job improving and advancing the system. Congratulations!