Ross A. Hull - VHF Pioneer

by John Martin, VK3KWA

Ross A. Hull was born in Melbourne in 1902. He developed an early interest in radio and was licensed as OA3JU (later VK3JU). At the age of twenty, he was the first Australian to hear signals from American amateurs.

Ross visited the United States in 1926, in his capacity as secretary of the WIA. The ARRL was quick to recognise his talents, and appointed him to the position of assistant technical editor for QST.

Ross returned to Australia in 1929 to take up the position of technical editor for Wireless Weekly, which was edited by his brother, A. Galbraith Hull.

(Wireless Weekly was still with us for many decades, later known as Radio and Hobbies, then Radio, Television and Hobbies, and finally Electronics Australia.)

By 1931 Ross was back in the United States as Associate Editor of QST, a position which he held until his untimely death in 1938.

As associate editor, Ross spent much time in the ARRL laboratory, developing new equipment for use in W1AL, the ARRL's experimental station. His main interest was in the UHF spectrum, which in those days meant anything above 30 MHz.

All of his early work was on the 5 metre band (56 - 60 MHz). But in 1934, the FCC gave approval for amateur operation on any frequency above 110 MHz, and he began to experiment on two new bands: 112 MHz and 224 MHz. *(Reference 1.)*

Improved techniques

In the early 1930s, most amateur equipment was built in "breadboard" style: all of the components were mounted on a block of wood. Sometimes there was a front panel - also made of wood - but usually not.

This type of construction was quick and easy, but it left a great deal to be desired on bands like 5 metres. Component leads were too long, and the lack of any shielding caused instability and feedback problems.

Ross recognised the need for improved construction techniques. His projects were solidly constructed on metal chassis. Rather than mounting everything in a row, with long connecting leads, he often mounted valves sideways or upside down to make the lead lengths as short as possible. His projects were described in detail in QST and led to a significant improvement in the performance of homebrew equipment.

Ross A. Hull

Ross also led the way in the development of receiving techniques. He pioneered the use of bandspread tuning at a time when most receivers had very fast tuning rates and it was difficult to tune them accurately.

He also popularised the use of superhet receivers. But superhets were expensive, and Ross was aware of the need to get the best performance from the smallest possible number of parts.

Many of his projects used superregenerative detectors, which at the time were an excellent compromise between performance and cost. *(References 2, 3.)*

Cleaner transmitters

The typical 5 metre transmitter at the time was a modulated oscillator using a single valve. These transmitters were quite unstable and most stations produced as much FM as AM. By the mid 1930s there were serious QRM problems on 5 metres, as stations drifted, wobbled and splattered across the band.

Ross understood the need to improve frequency stability and reduce operating bandwidths. If transmitters could be made more stable, receiver bandwidths could be reduced. The benefits would be less interference and a much better chance of hearing more distant stations.

Ross described transmitters using separate oscillator and amplifier stages to reduce frequency pulling and FM, and designed receivers with improved selectivity. *(Reference 2.)*

Better antennas

In the early 1930s the average 5 metre station was capable of working about 15 miles. But in August 1934, Ross amazed his colleagues at QST by announcing that he had worked from Hartford to Boston. The distance was 100 miles - a very significant achievement.

His secret was the antenna. At the time everyone used vertical antennas, but Ross put up a beam. It was a simple antenna by today's standards - four quarter-wave radiators fed in phase with four reflectors - but it made a startling difference to station performance. *(Reference 4.)* The word spread and before long the distance records were tumbling.

This was a milestone: the beginning of the end for the "line of sight" theory of VHF propagation. We can still learn from it. Even today, more than sixty years later, a good many VHF operators would be amazed if they threw out their vertical antenna and put up a beam!

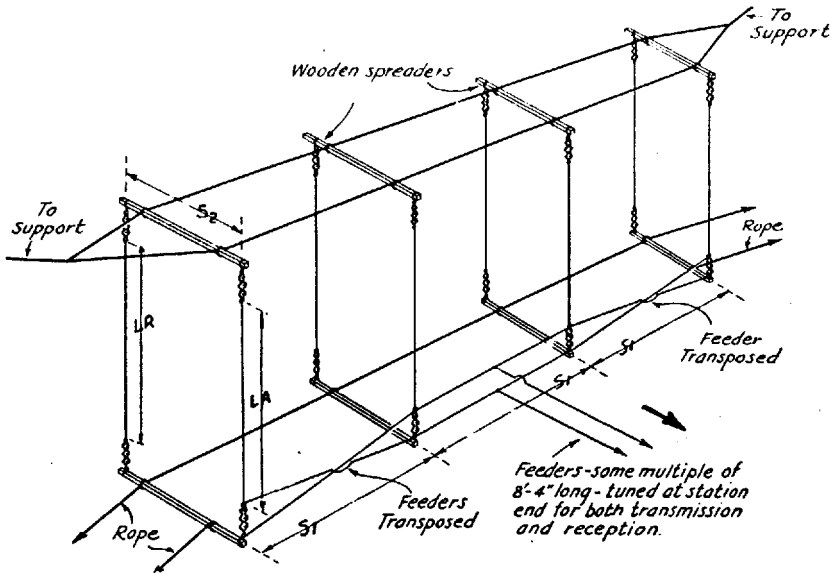
The big discovery

Ross had observed that signal strengths varied over time: a signal could be strong today and gone tomorrow - or it could be present in the morning but absent in the afternoon. To find the answer, he now turned his attention to a detailed study of VHF propagation.

In March 1935 he built the equivalent of a chart recorder. *(Reference 5.)* He fed the output of a receiver to a meter, and focused the image of the meter needle through a slit onto a strip of photographic film. The film was drawn slowly past the slit by a gramophone motor.

This enabled him to correlate signal strength with other data, and it became clear that signal variations were associated with changes in atmospheric pressure and moisture. This led to the discovery that VHF signals are refracted in the lower atmosphere, in much the same way as light rays.

Ross published his findings in QST *(References 6, 7),* and they led to a flurry of experimental



56 MHz beam antenna used by Ross Hull in 1934. *(Reference 4)*

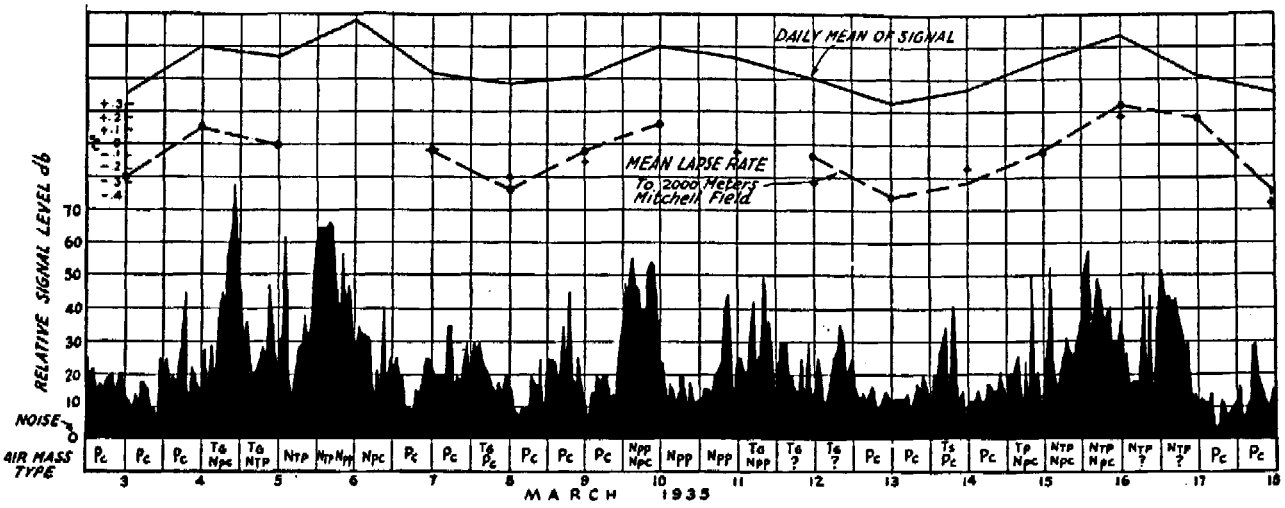


Chart by Ross Hull, showing a direct correlation between atmospheric lapse rate and the strength of received signals. *(Reference 6.)*

activity and another dramatic increase in VHF record distances. Within a short time, 5 metre contacts were being made half way across the country - a far cry from just a couple of years before, when even the most diehard experimenters thought that VHF would never be useful for anything other than chatting across town.

Higher Bands

Ross applied the same techniques - stable oscillators and beam antennas - to the 112 and 224 MHz bands. As early as 1934, he had succeeded in working over 75 miles on 224 MHz. *(Reference 8).* As more amateurs adopted his techniques, it was not long before the 112 and 224 MHz bands started to deliver the same kind of DX that had been achieved on 56 MHz.

Ross was a man of many talents. Apart from his amateur radio experiments, he was a talented pianist, artist and photographer. His interests also extended to astronomy - he built several reflecting telescopes - and to radio controlled model aircraft.

He was particularly interested in television, and caused quite a stir when he received good pictures from the experimental television station operated by NBC in New York, 100 miles away.

Untimely End

Sadly, it was his interest in television that was to bring a sudden end to his life on September 13, 1938.

He had built a television receiver which had its power supply in a separate cabinet underneath the table. He reached under the table to turn on the power switch, and was electrocuted by the 6000 volt CRT power supply. Attempts to revive him were unsuccessful. So ended the career of one of the most capable and intelligent experimenters in the history of amateur radio.

Nobody knows what Ross may have achieved if his life had not been cut short. If he were still alive today, no doubt he would still be trying to push the frontiers even further - better techniques, better antennas, higher frequencies, and - above all - greater distances.

References

(1) "Firing Up on the Newly Opened Ultra-High Frequencies", QST Sept 1934.
(2) "New Equipment for the 56 Mc Station", QST Aug 1934.
(3) "A New Receiving System for the Ultra-High Frequencies", QST Nov - Dec 1935.
(4) "Extending the Range of Ultra High Frequency Amateur Stations", QST Oct 1934.
(5) "A Simple Photographic Recorder for the Experimenter", QST Mar 1935.
(6) "Air-Mass Conditions and the Bending of Ultra High Frequency Waves", QST June 1935.
(7) "Air Wave Bending of Ultra High Frequency Waves", QST May 1937.
(8) "Progress on the Ultra High Frequencies", QST Jan 1935.