

The long history of “Windom” Antennas

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In the 1920's valve transmitters had replaced spark gaps, and the concept of transmitting continuous wave (CW) in narrow bandwidths was widely known. By 1924 the 80, 40, and 20m bands had been allocated for amateur use in the UK. These bands were internationally approved when the IARU (international amateur radio union) was formed in 1925. Two years later in 1927 the 10m band was adopted. You know the bands are related by being half wavelength, or double frequency. In technical language we say they're harmonically related.

It was “known” that to transmit a good signal, an antenna wire had to be a quarter wave long connected to one transmitter terminal, the other terminal connected to ground. Though dipoles were also known to transmit satisfactorily (the biconical dipole was patented in 1898) the Marconi idea of “ground” was prevalent. But the allocation of the HF bands brought the problem that simple wires and ground systems could generally not transmit on more than one band.

An early experimenter was Frank Conrad (W8XK) who came up with the idea of using a single wire as a “feed-line”. Later he invented the watt-hour meter for billing people! Then two brothers, V.D Landon, and E.B. Landon (W8VN) connected a single wire feed-line to a system consisting of an aerial and a counterpoise. As we know, that “windom” required a counterpoise (radials).

But the actual birth came when Howard M. Williams, W9BXQ, was first to feed a half wavelength horizontal wire off centre with a single feed-line. So Howard Williams was the original inventor of the Windom antenna - but he didn't get credit for it. Unfortunately there was no Internet in Ohio in the 1920's.

Before we continue, it's important to recognise that the following names were all hams at Ohio State University, collaborating with each other. The sequence of published documents is no reflection of who did what first. Though Byrne and Everitt were not officially part of the research, in their evenings and spare time they both assisted in the field.

In 1925 Loren Windom (W8GZ) was a law student at Ohio State University, and a well-known active ham. He had been studying the feedpoint position for feeding the single-wire-fed Hertz antenna and his results (later proved to be incorrect) were reported upon in the July 1926 issue of QST by Robert Kruse, the technical editor of QST.

Another student at Ohio State University was John Byrne, W8DKZ. Byrne was studying electronic engineering under the guidance of Everitt, head of the department of Electrical Engineering. Byrne was best friends with Windom and they jointly operated W8GZ, one of the most powerful ham radio stations at the time.

For his thesis paper, Byrne's [associate] professor, William Everitt (W8CRI) suggested that Byrne investigate the single-wire fed Hertz antenna, continuing the pioneer work that Loren Windom had begun.

Byrne found another person, E.F. Brooke, W8DEM, and together they wrote a paper over the single wire feed-line. This was 1925/26, but nothing came of it. The first paper was completed on time, but the work was not really finished. More work was needed. So in 1927/28 Byrne chose the same topic again for his graduate work thesis and was joined by A.B. Crawford (no call sign that I know of). Together the two men finished the work and wrote a comprehensive document that was so good, in October of 1929 it was published in

the magazine "Proceedings of the Institute of Radio Engineers" (PIRE). This was THE techie rag of the time. Three names appeared on the paper. In the meantime Everitt had become a full professor and as tradition had it then (as now with IEEE papers), the Professor's name was listed first, then the two students' names. As such, Everitt received the credit. His name is remembered, the other two forgotten.

Meanwhile, Windom liked the work so much he tried to persuade Byrne to publish it in QST magazine. Byrne declined because he was too busy re-writing his PIRE paper and suggested Windom write the article, which he did based on Byrne's (and Crawford's) paper. This was published in September issue of 1929 - one month before Byrne's original work was published in PIRE.

There was a delay of Byrne's own paper because the publishers at PIRE returned his hand-written document with some editorial changes and asked him to review and approve it. This took some time to do (no email back then). In the meantime, Windom's article was published in QST.

Windom was a Lawyer, Byrne an Engineer... Guess who eventually got the credit!

Although a key advance to feed the antenna off-centre makes it work with harmonically related bands, this was not a part of the original goal of the research. Indeed, the primary goal was to identify the point in which there were no standing waves on the single-wire feedline - regardless of the length of the feedline.

Upon conclusion, Windom jokingly said it isn't usual practice to put your antenna in the next state.

After finding this magical feed-point, it was discovered that there were also no standing waves on the feedline for the harmonic bands. So harmonic band operation was a pleasant discovery, not the design goal.

The true Windom design has a single wire feeder, later designs with different feed arrangement are strictly not Windoms, though the name has stuck and forms a kind of "brand" like G5RV.

In the 1930's and 1940's there were great advances in radio technology. It became clear that ground connection was not necessary for long distance communication. In 1950, a German amateur, DL1BU (Günter Schwarzbeck) published a design using ladder line rather than the single wire feeder. His design was more repeatable and reliable, by avoiding ground as part of the antenna. It was also found that a shorter 20m long version worked well on 40/20/10 metres. The 80m long version covers 80/20/15/10m.

On the other side of the Atlantic, a man named G.E. (Buck) Rogers, K4ABT became very interested in balun technology.

In 1958, Buck met another very famous man, Lew McCoy, W1ICP. Lew suggested ideas about the balun which Buck then tried. His initial antenna used an ugly balun consisting of 9 turns of RG-11, 8 inches in diameter. He wrote: "walla, almost like magic, Lew's current type BALUN design gave us the bandwidth that we needed to turn the WINDOM into an eight band plus HF antenna (even adding some VHF bands)."

Buck clearly states on his web site that he built his first coax-fed Windom in 1959, using the ugly balun described above. Buck Rogers wrote: "This is when I made the design changes to the original Windom". Buxcomm still sell antennas today.

(Note: in 1963, I personally met Lew McCoy. Lew still preferred the openwire-fed design to the coax-fed design. I don't recall if he gave me a reason or not, but today it is obvious: balun technology in 1963 was not what it is today. Our ferrite toroid and

now hybrid balun technology have advanced the usefulness of the OCFD to, IMO a more desirable antenna than the open-wire fed dipole (for matchbox reasons). Rick, DJ0IP.

In Europe, by 1970 Kurt Fritzel (DJ2XH) and Fritz Spillner (DJ2KY) replaced the ladder line with coax cable. They found having a transformer with 6:1 impedance ratio made the antenna match 50 ohm cable better. By 1970, DJ2XH was selling 40m long (FD4) and 20m long (FD3) versions.

In the 1980's the "Carolina Windom" was developed. This uses the coax as part of the antenna, with the balun some way down the coax. However this idea has fallen from favour with further technical developments in other areas, and the legalisation of the "WARC bands" at 30m and 17m.

It was found that connecting extra elements (stacking), also fed off-centre, can add extra bands. In particular this adds 30m and 15m, with the elements split at 33%.

By the end of the 20th century, the Windom design had been analysed by antenna simulation programs like NEC2 (Numerical Electro-magnetics Calculator). The results showed it was possible to feed the antenna at various "split points" to get different band coverage. In 1996 Bill Wright (G0FAH) and Richard Formato (K1POO) published a design split at 17.5% that adds 15m coverage to a 20m long "FD3" with no extra wires.

In 2009 Serge Stroobandt (ON4BAA) showed a 40m long design which adds the 30m band. In 2011 Russian amateur Evgeniy Slodkevich (UA3AHM) started selling the "City Windom" which feeds the antenna from the end, avoiding any coax hanging off along the wire.

The last few years have seen continuing research to improve the balun transformers, and bring out further variants like the COLA (Concentric Open Loop Antenna) which wraps the Windom design into a spiral, and adds more bands.

As you may expect after writing this article, I believe the Windom (or off-centre fed dipole) should usually be the HF wire antenna of choice, for these reasons:

1. People using antenna tuners with other designs (e.g. G5RV) have more loss in their tuners and cables than the transformers of a Windom antenna, which works with no tuner.
2. It's a well proven concept, yet takes advantage of 21st century technology, without any "magic" tweaks or contraptions.
3. The end fed versions are very practical when supported at one end by a building. They are also quick to setup for a portable station, using fibreglass poles.
4. For those with more space, there are 40m long options covering down to 80m. For instance the "807" design covering 7 bands from 80m upwards.

Off-centre feeding as a technique is not limited to ham antennas. It can be used on consumer devices (e.g. WiFi) when several bands have to be covered. So the Windom antenna is far from a dusty footnote, it has received a new lease of life as a multi-band antenna in all sorts of mobile devices.