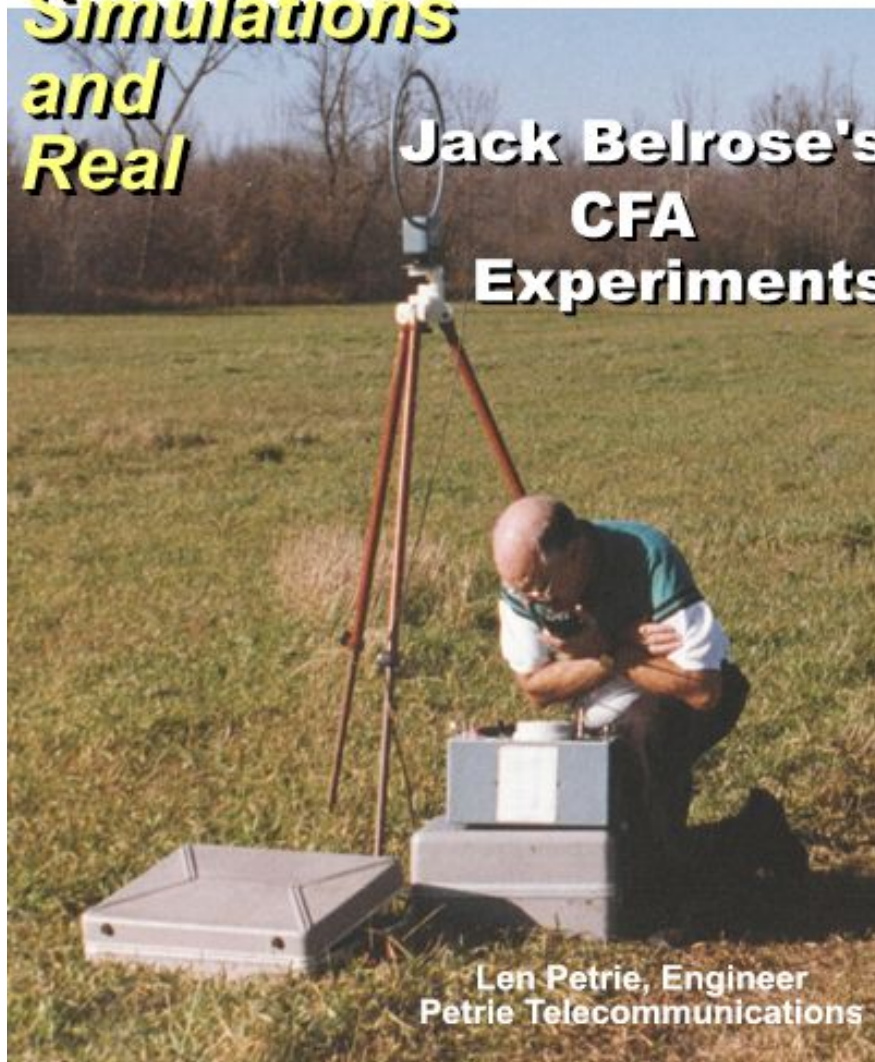


# Simulations and Real

## Jack Belrose's CFA Experiments



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### INTRODUCTION

**A**s far back as 1991, following an ICAP paper presented by the co-inventors of the CFA, John S. (Jack) Belrose, PhD Cantab, VE2CV, Senior Radioscientist, Radio Sciences Branch of the Communications Research Centre, located in Ottawa, Ontario, Canada, has been one of the leading skeptics of the CFA technology. In fact, Jack was in attendance at that very presentation and afterwards, took the co-inventors aside and told Dr. Kabbary and Mr. Hatley that they would probably realize more radiation from the grounding wires, or from the feeder coax if the antenna was fed without a balun, than from the CFA by itself.

Later, it was suggested that the real radiation came not from the CFA antenna device, but rather from the manner in which it is mounted atop buildings and its tendency to couple with other objects surrounding it. Within the past year, and especially in recent months, Jack has intensified

his study of the device utilizing NEC to simulate the performance of the device and to prove his theory about the antenna's actual poor performance. Of course there are those who will argue that NEC cannot simulate such a device accurately.

Jack's continuing simulation work is followed by actual experiments by constructing an 80-meter CFA, a scaled-down version of the barrel-shaped CFA originally used by Dr. Kabbary. By permission, I have included a reprint of his write-up about that experiment which may be read at this link:

[THE ENIGMA OF THE CFA – Pt. 2 : EXPERIMENTAL STUDY.](#)

As you will see from the above copy of his study, Jack concludes as follows:

**“...CONCLUDING REMARKS**

The inventors claim that their CFA, in spite of its small electrical size, is a broad band efficient radiator due to its ability to couple very effectively to the propagation medium and to minimize wasteful near field reactive power. Our study shows that the CFA is a very inefficient radiator. The near field is very strong. And, the very large reactive powers which circulate between the two feed points causes problems with the transmitter (an apparent mismatched load), with the matching and phasing networks, and results in power loss. There is (in the author's experience) an unbelievably wide divergence between the results of our study and the performance claimed for the MF broadcast CFA antenna systems in operational use in Egypt. Thus the excellent operational performance claimed by the inventors of the CFA is an enigma....”

Additionally, Jack has presented a formal scientific paper of his findings, which is available at this link (*Adobe Acrobat Reader 4.0+* is needed to view): [Davos AP 2000 Paper](#)



*John S. Belrose*

**EXCHANGING INFORMATION**

Jack and I have exchanged numerous e-mails about this controversial subject over the past year or so, and during the past month, Jack provided some of his latest thoughts concurrently with my own investigations of how the various CFA broadcast projects are progressing in various parts of the world.

***In one of those e-mail messages***, Jack had this to say:

**“The Sidney CFA is not performing like Kabbary says --- that is curious. According to what I've heard, its performance is so poor the owners are looking for a site to install a conventional antenna.**

**The following is abstracted from a recent note I have written regarding the present status of MF CFA antennas. Recall that the original CFA antenna was a dipole (no Ground Plane needed). Then the co-inventors had the idea to make a GP version. Since the antenna is so electrically small a relatively small GP is adequate. And so the GP version should work as well as the dipole version. No connection to ground is needed.**

**But, all MF CFA antennas are on the roof of buildings, excepting for the one at Barnis, Egypt. And, we note in articles/paper published, that the ground plane (GP) for the CFA is always said to be “well grounded. I told Kabbary and Hatley in 1991 (I was there for the presentation of their 1991 ICAP paper) that they would probably realize more radiation from the grounding wires, or from the feeder coax if the antenna was fed without a balun, than from the CFA by itself.**

**The Tanta antenna is on the roof of a building, which is certainly a part of the antenna system, since the building has copper strap grid all over the outside walls connecting to ground. The Nile Delta is an area of very high conductivity—probably something like 25 mS/m. I have numerically modeled this configuration. The building radiates better than the CFA by itself, and, the antenna radiates better if the two ports are fed in phase. But we are still dBs down on a quarter wave.**

**Feeding the two ports in phase eliminates the problem of reactive power surging out one port and surging back through the other port (a major problem for the transmitter engineer in my view).**

**Proven performance is still an open question. We have commented above on the Sidney CFA station. The MF CFAs in the Hamburg/Kiel area, and in San Remo are said to working well --- but to date no measured performance results have been reported.**

**I think we will have another go at making measurements with our experimental model --- for first results see my study report THE ENIGMA OF THE CFA – Pt. 2 : EXPERIMENTAL STUDY.**

**I will add conical sections, and install a remote FS monitor so we can try and tune for maximum FS. Tuning is a major problem, since when fed in quadrature we have all that power coming back.**

**A final comment: I wonder if anyone has fed their antenna in quadrature? We know we did because we had small feed through current transformers right at the antenna terminals, and we measured phase and amplitude with a laboratory vector voltmeter.... Jack Belrose”**

***Followed by this*** next message from Jack:

**“We have carried out many tests after the first results, and we did include an additional high power (high power not needed but high power means the inductor has a good Q-factor) pi-network between the antenna system and our transmitter. This made the transmitter happy—return power recycled—low SWR—but this REDUCED the measured FS.**

**Why? A property of the CFA is that a large reactive power surges out the port feeding the cylinder (high compared with the transmitter power), and a large reactive power surges back in the port feeding the disc. If we reflect that power back out, then the cycling continues—out and in I do not know how many times. This increases the losses in the pi-networks matching the port impedances. *The CFA (with quadrature feed) is an impossible antenna!***

**In my view most experimenters with the CFA feed the ports more or less in phase, since tuning for maximum radiated power results in conventional tuning—feeding the ports IN PHASE.... Jack Belrose”**

**And, next** came this message from Jack after I asked him about the dimensions used in his construction experiments. The three pictures shown here of his experimental 80-meter CFA also accompanied the message:

**“Dimensions are open cylinder 63.5 cm, length 79.4 cm, height above disc 19 cm; disc 127 cm diameter, hole in centre 6 cm, height above ground plane 19 cm; ground plane 3m x 3m, height above ground 2m. We used a scaling factor of 3.15 (the text in our note regarding the experiments which says 3.24 is wrong), and so 1161 kHz corresponds to 3667 kHz.**

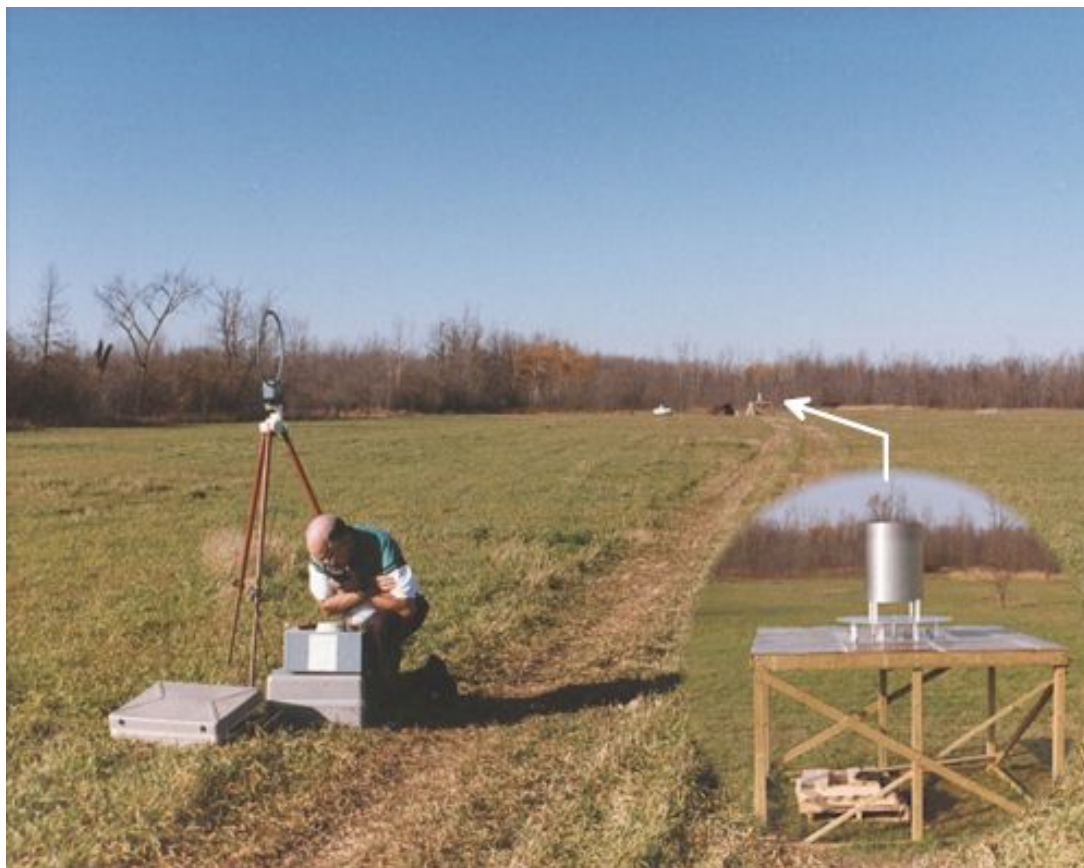


**The 10 m x 10 m wire grid GP was also scaled—but we used a copper sheet. The first photograph shows the antenna. The second photograph shows that the antenna was mounted 2 metres above the ground, so we could get underneath it with very, very short leads. The transmitter was not connected to ground, and 300 bead (ferrite beads over coax) choke baluns were used, so we were measuring the performance of the CFA BY ITSELF.**

The probes to our Vector Voltmeter (to measure currents in phase and amplitude) did not have beads, but these are very, very high impedance probes—little or no current could flow on these coaxes.

The third photograph shows that indeed FS measurements were made in a flat open field.

The antenna is an exact copy of the original Tanta antenna, given in the Hately et. al., 1991 paper --- an antenna which was said to provide performance equivalent to the previously used 75 m monopole."



*I then mentioned in a reply to Jack* that Dr. Kabbary had reported signals at the Sydney site that exceeded the “referenced antenna” by about 17%. My message also stated that San Remo CFA site Engineer **Dr. Fassio** had reported good results from his initial tests of that newly-constructed CFA. Jack responded:

“Concerning the high FSs reported by Kabbary for the Sidney Station, it should be noted that near field measurements in

an urban environment are very unreliable, particularly when the CFA is on the roof of a building, with a wire connecting to ground. In fact the building itself can be a part of the antenna system. For MF the building can be considered to a wire grid structure (the grounded ground wires of the AC mains). Currents induced in nearby conducting structures can strongly influence the apparent FS measured.

Steve Olney's measurements (which are consistent with a gain for this CFA - 8 dB wrt conventional monopoles) were far field, and absolute accuracy was not needed, since he referenced his FS to transmitters licensed to provide similar services, on about the same frequencies, similar distances (but distance correction was included), employing conventional antennas.

Concerning Alberto Fassio's e-mail, I too have a copy telling me the same thing, but measured FS data to substantiate this claim is not reported. ... Jack Belrose”

As is most obvious to even the casual observer, the CFA controversy still rages. I have said before, Jack Belrose is certainly well-qualified to study this baffling and mysterious technology and his observations are to be taken seriously. And, Jack is not alone in the scientific community in thinking that there is some sort of coupling at least subsidizing the radiation of the CFA. And, at the Egyptian sites, there is the added **Nile Delta** factor theory. However, in contrast, stations in other parts of the world not only continue to choose this technology, BUT, have decided to build more than one! True, we have not heard definitive reports from Kiel, Germany or San Remo, and there is bad news from Sydney, Australia (see my column this month, **Stone's Throw!**) but, there must be merits to the device or these stations would not be making such an expensive choice without considering all of the pros and cons after making their intuitive observations at the various operating sites. After all, these stations have well-qualified engineers helping to make these decisions.

**Thus, the jury is still out on the CFA** and the debates are likely to continue until ALL of the facts and evidence is heard. I sincerely hope Jack will continue his study of this technology and this magazine will certainly continue to report his findings as and when it is provided. My sincere thanks to Jack for this latest update from his efforts and we look forward to more reports.

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Last modified: July 04, 2004