and flat-plate lead-acid cells as used in car batteries: see **Table 1**.

Some of the points made are that an AA-size RAM cell made as a bobbin can now produce 2000mAh of energy, compared with 500-600mAh for industry-standard nicads, 800-1000mAh for high-performance nicads and 1100mAh for Ni-MH cells. RAM cells (**Fig 4**) cost little more than single-use alkaline-manganese cells to manufacture; it should therefore be possible to market them at about half the price of nicad cells, size for size. RAM cells are claimed to be ideal at 2-3 hour discharge rates (ie relatively high current loads) and are thus well suited for Walkman, portable computer and presumably hand-held transceivers. Using cells in series-parallel, or spiral-wound, the high-rate performance is good enough for power tools and electric vehicles.

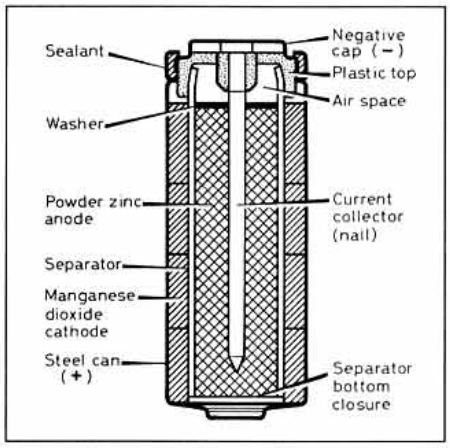

Fig 4: A bobbin form of reusable alkaline manganese (RAM) cell as proposed for AAA, AA, C and D sizes. It is uncertain when such cells will be marketed in the UK, but manufacturing licences have been issued.

G4IEY also draws attention to the Yuasa NP range of 'maintenance-free' sealed lead-acid batteries which are manufactured in Wales. This includes 4, 6 and 12V rechargeable batteries offering a choice of 25 models covering 0.8Ah to 65.0Ah.

BROADBAND RADIALS

THE AVAILABILITY OF FIVE amateur HF bands between 14.0 and 29.7MHz, including bands without any harmonic relationship, provides an incentive to develop broadband antennas capable of efficient operation over at least an octave of spectrum. A well established method of increasing the effective bandwidth of any antenna element is to increase the diameter/length ratio, as for example in the once popular caged dipole.

One practical form of broadband antenna exploiting this technique is the vertical biconical monopole, despite its rather complex structure. Way back in the *RSGB Bulletin* (now *Radio Communication*) of May 1966, pp305-306, an amateur example of a biconical antenna, originally described by W5WEU/4 in *CQ*, January 1966, was presented in *TT* together with details of a professional antenna of this type as used at a number of Royal Navy HF coast stations (described by H P Mason of the Admiralty Surface Weapon Establishment (now Admiralty Research Establishment) at a 1963 IEEE HF Convention) and implemented in three forms: for 2-5MHz, 4-11MHz and 10-26MHz. The W5WEU and ASWE designs are shown in the 7th editon of *Amateur Radio Techniques*, p277.

Property	Ni-Cd (spiral)	RAM (bobbin)	RAM (flat plate)	Lead-acid (flat plate)[a]
Energy density, Wh/kg	27	47	32-52[b]	35
Power density, W/kg	72	30	215-430[b]	150
Cycles, shallow	500	300	100	300-400
Cycles, deep	100-200	100	40	20
Relative cost	2.5	1	1	1.2
Relative weight	1	1	1	2.3
Operating voltage	1.2	1.2	1.2	2.0
Charge retention (20°C)	3-6months	2-3years	2-3years	3-6months
'Memory' effect	yes	no	no	no
Toxicity of components	toxic	non-toxic[c]	non-toxic[c]	toxic

[a] typical SLI vehicle battery
[b] lower figure has been achieved, upper figure appears readily achievable
[c] mercury-free version
(Condensed from *Batteries International*)

Table 1: Characteristics of rechargeable cells.

It was then emphasised that, as for any monopole antenna, it is necessary to use the best possible ground plane. For the ASWE designs, 36 buried radials about one quarter-wave long at the lowest frequency were used. Interestingly, I find that I then added the comment: "What I have never yet found is any detailed comparison between the effectiveness of a ground radial system and that of the three or four-wire up-in-the-air technique which we associate with 'ground-plane' antennas - and how much the ground conductivity below such sloping ground-plane systems affects low angle radiation". That was in 1966 and since then both these topics have been well aired (and answered) with some assurance!

It is now widely accepted (and in increasing evidence for amateur 1.8MHz practice) that a few elevated radials can be every bit as effective as a massive buried earth system (although the very low angle radiation will be much attenuated in either case in areas of poor ground conductivity extending out to some 50 wavelengths). But when used with a broadband radiating element it is clearly desirable that elevated radials should also be broadband in order to achieve equal efficiency and a similar radiation pattern over the full frequency range.

What appears to be an effective means of implementing such an approach appears in the Russian *Radio* No 12, 1991, page 19, in a short article by UT5YB in conjunction with a biconical monopole antenna originally described by UW4HW in *Radio* No 9, 1981: see **Fig 5**.

If my guesses at the Russian text are correct, then UT5YB claims that fed with 75Ω coax feeder, the antenna shows an SWR of only about 1.05 to 1.2 throughout the band 14 to 30MHz. Each of the radials is similar to the vertical element, 5.1m (5100mm) long.

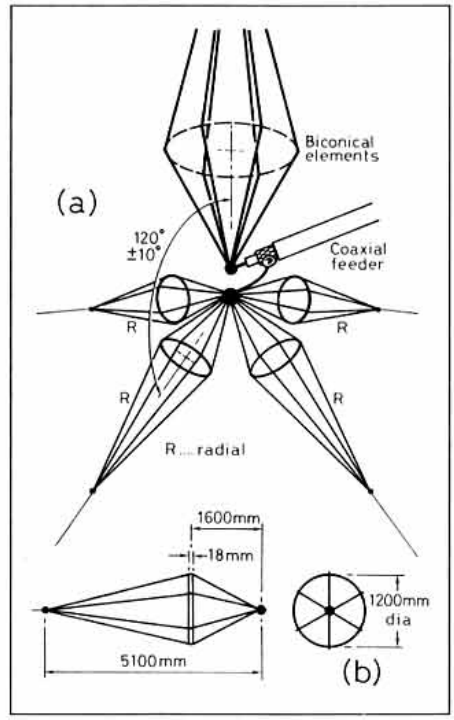

Fig 5: UT5YB's use of broadband radials in conjunction with a biconical vertical antenna covering 14-30MHz continuously with low SWR on the coax feedline.

MORE ON 1.8MHZ 'SWEET SPOT' PROPAGATION

IN *TT*, MARCH 1992, pp36-37, a letter from Roger Crofts, VK4YB, commented on the remarkably reliable 1.8MHz 'openings' between Australia and North America. These have been observed by the SEANCE net between May and August in recent years. One of the North American participants, Bob Eldridge, VE7BS of Pemberton, BC confirms the curious fact that horizontally-polarized antennas having relatively high-angle radiation usually considered almost as a sine qua non for 1.8/3.5MHz DX.

But first a correction. VE7BS points out that the two 'tropical bands' broadcast DX enthusiasts who have been unravelling this apparently chordal-hop form of 1.8MHz transequatorial propagation are not, as I wrongly assumed, Australians. John Bryant is in Oklahoma and is publisher of *Fine Tuning's Proceedings* and Davis Clark is in Ontario and writes for *DX Ontario*.

A personal observation: VK4YB suggested that the UK is too far north to experience a 'sweet-spot' of the tropical Spread-F enhancement that appears to form one of the two ionospheric tilts, and thus would be unlikely to benefit directly. But I note that Pemberton BC is around latitude 50° North, roughly the same latitude as say Plymouth or Torquay in south-