above roof-level is that it will be less affected by the many nearby conductive objects (resonant and non-resonant) that are present at the average site available to amateurs; these may absorb RF power, or re-radiate it, or a bit of each, distorting the radiation pattern and reducing the gain.

As pointed out by Les Mitchell, G3BHK, many years ago, the average house has electrical wiring passing up the walls and branching out at roughly 8 and 16ft levels. The water pipes extend upwards to around 20ft with extensions under the floor. TV and VHF broadcast antennas are often at the 32-33ft level. Water tanks, baths, hot-water cylinders etc may add to the clutter. Concrete buildings may absorb and reflect signals. Garden fences, trees etc may be quite close to a vertical monopole and will have a much greater effect on vertically- rather than horizontally-polarised signals. But do not imagine that an elevated ground-plane or a vertical dipole antenna that does not depend on a direct connection to earth is unaffected by the conductivity of the earth below.

Hardy Landskov, W7KAR (*QST,* November 1975, pp19-21, briefly reported in TT November 1976, pp831/2), concluded, in respect of horizontally-polarised antennas:

(1) Low heights should be avoided with all horizontal antennas, because their gains suffer badly at elevations under one wavelength above ground [in practice, this usually implies the higher the better].

(2) Antennas located one wavelength or more above ground have gains within a few tenths of a decibel of the perfect-earth case, *regardless of soil conditions.*

(3) High-angle radiation (above 45) suffers as much as 3dB for antennas over poor earth, regardless of antenna height. This is an important consideration on 3.5 and 1.8MHz, where few antennas exceed or even reach a quarter-wave above earth.

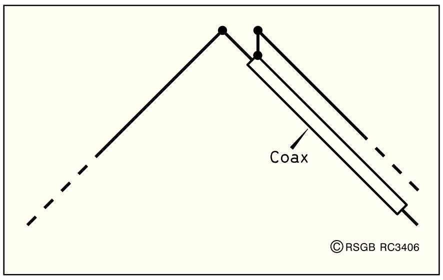

Fig 6: Sloping feedline to the Pyramid antenna. A balun could be used at the top of the pole if the coaxial cable is dropped vertically down the supporting pole.

G3ENI S 5.4MHz PYRAMID NVIS ANTENNA

THE PRIME PURPOSE of the experimental UK 5.4MHz spot-frequency allocations, as I understand it, is to check the extent to which these frequencies can be depended upon to support short-range (short or no-skip) emergency communications at times when the critical frequency is too low for good NVIS propagation at 7MHz and too high for fade-free 3.5MHz NVIS. It is not intended to provide another band for DX operation, although there is no doubt that 5MHz is suitable at times for DX, grey-line, etc. As noted in TT February 2002, Raynet has, for some time, sought to explore the use of HF for its UK operations.

John Pegler, G3ENI, has recently contributed to the Thames Valley ARTS a description of an omni-directional compact antenna designed specifically for NVIS purposes, radiating primarily in the vertical direction. He writes: This antenna is ideal for the small garden, can be assembled easily for portable use, has low visual impact and can be located clear of other antennas.

It consists of a half-wavelength of wire with the two arms bent in the form of triangles and assembled in the shape of a square-based pyramid as shown in **Fig 5(a)**, with **(b)** showing a plan view. When radiating, there is little reaction between the sloping wires that are at right angles, with orthogonal polarisation.

The apex is supported on a short insulated pole and the base points are secured to tent pegs or similar insulated ground anchors so that the horizontal sections are some 1 to 2ft above the ground. The feeder can either be led up and secured to the insulated pole or fed down one leg as shown in **Fig 6**, making sure that the coaxial cable outer is connected to the adjacent wire as shown.

For 5.4MHz, the total length of wire required is about 88ft (26.84m), the sloping wires 13ft (4m), and horizontal wires 18ft (5.5m), for a mast height of 11ft (3.35m) which includes the extra 2ft to keep the horizontal wires off the ground. Note that with QRO there will be quite high RF voltage on the horizontal wires at the low height of 2 to 3ft. For non-NVIS, there will be a loss of about 16dB compared to a half-wave dipole at 30ft

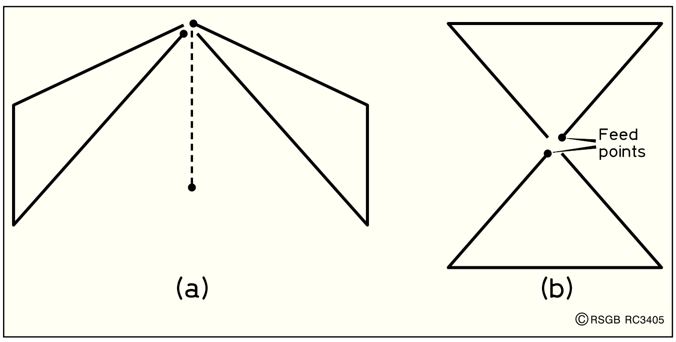

Fig 5: G3ENI's 'Pyramid' NVIS antenna for 5.4MHz. (a) General appearance. (b) Plan view. Dimensions for 5.4MHz in text.

ALTERNATIVE POWER SOURCES

THE DRIVE TO develop alternative sources of power based on renewable and / or pollution-free sources continues apace. A 1.4MW fuel cell, the largest to date, is being installed by Verizon at a call-centre in New York, based on seven natural-gas-powered cells backed up by four natural-gas generators to provide back-up and boost output to 4.4MW. Hydrogen (for fuel cells) could become a future major source of electric power.

Interest is being resurrected in thermo-photovoltaics (see *New Scientist*, 21 September 2002, p21), in which infra-red heat radiation is directed onto cooled solar cells. This technology was investigated some 30 years ago by the US military, but made little headway because of its low energy-conversion efficiency. The advantage would be that it could function at night as well as during daytime so that batteries could be dispensed with. Engineers at a Swedish solar energy research centre have now developed a method of making TPV more efficient by placing the whole TPV system inside an egg-shaped optical chamber with a highly reflective interior coating making it look like a FabergØjewelled egg. The three-dimensional, ellipsoidal shape ensures that most of the emitted radiation reflects off the inside of the egg and hits the infra-red filter almost head on. About 96% of the emitted infra-red rays reach the solar cell. The basic heat source could be hot flue gases, preheated air or warm household water etc, thus recycling waste industrial or domestic heat into electric power. Applications, it is suggested, could range from small domestic generators, producing heat and electricity, to megawatt power plants or back-up stations.

New Scientist also reports that Mike Rowe at Cardiff University has been working on ways to improve the efficiency of generators that use the thermoelectric effect. By linking a network of bismuth telluride / aluminium thermocouples, made resistant to high temperatures, they have generated about 100W when placed on a cooking stove. Prototypes can even use waste water from a hot bath to power a TV set for about an hour. ♦