Chelmsford Amateur Radio Society

Club Station Call Sign GØMWT

Issue Number 375 April 1997

THE APRIL MEETING

This month we welcome to the rostrum Andy Chapman G7TKK to present a talk entitled "Thermal Imaging" or how to receive signals at 37,500,000 Gigahertz.

Andy is an engineer at GEC-Marconi Sensors, Basildon, who over the years has worked on a wide range of Thermal Imaging Systems for land and air surveillance with applications mainly concerned with security, search and rescue. Some members may already be aware of the use of Thermal Imaging by the Police from video footage shown on national television, however, there are many other uses and Andy will explain some of the advantages and limitations of seeing objects in total darkness. The talk will be illustrated and some examples of equipment will be on display.

The meeting opens at 7.30pm in the Marconi College, Arbour Lane. Please note that the second annual Bumper Raffle Draw will be made during this meeting.

DATES FOR YOUR DIARY

1 April. CLUB MEETING - "Infra Red Imaging" by G7TKK.
19 April. INTERNATIONAL MARCONI DAY with GX0MWT.
20 April. CAMBRIDGE REPEATER GROUP RALLY.
6 May. CLUB MEETING - "Marconi Beam Stations" by G3RRN.
11 May. SOUTHEND & DRS RADIO & COMPUTER SALE.
18 May. DUNSTABLE DOWNS RC CAR BOOT SALE.
25 May. EAST SUFFOLK WIRELESS REVIVAL.
25 May. MAIDSTONE MOBILE RALLY.

DF NEWS

Two events are scheduled for April; on Sunday 13th an RSGB Qualifying event at Coventry; on Friday 18th a Chelmsford evening event at Tiptree Heath.

If you would like to volunteer to be an operator in a hidden station (great fun!) or require further information on any DF activities please contact Dick Brocks (01621)891868 or Philip Cunningham (01206)393737 during evenings.

MEMBERS NEWS

This month the Society is pleased to welcome two new members, C. Parker-Larkin, G8UVG, known to all as Squibs and Robert Tavener a S.W.L. We now have a Membership of 88.

COMMITTEE MEETING

The next Committee meeting will be held at 7.30pm on Wednesday 9th April, in Telford Lodge, you are welcome to join us.

REMINDERS

- Our Society's station at the Chelmsford Science & Industry Museum for IMD will be open for public viewing from 10am to 4pm this year; members, their families and friends will be welcome.
- The Society's Constructors Competition is now only 9 weeks away, how is your entry coming along? Remember there are lucrative cash prizes to be won, also the continuation of this event depends on the number of entries each year.

LAST MONTH'S MEETING

Report by Geoff, G3EDM on the Digimode lecture by Ken Godwin, G0PCA, BARTG's Rally Co-ordinator and Sales Expert.

Members little knew of what was in store for them as they sat down to listen to Ken's humorous presentation; he defined "expert" by breaking the word into two parts to get at its real meaning! That is to say, the first part "ex" means something old or ancient, the second part, pronounced "spurt", means a stream of water; in other words "an old drip under pressure." I'm sure he was not referring to himself.

The introduction was by way of first demonstrating the primitive communication of information, by use of Jungle Drums (pre 1837 at least). Ken described the early transmission of data from 1837 onwards commencing with the use of five clock faces each with pointers (attributed to Sir Charles Wheatstone and William Fothergill Cooke). Transmitted voltages set the pointers to positions on the clock faces to indicate letters of the alphabet; variations using two pointers on a clock face followed, producing a slow system for transmitting information in the years before Alexander Graham Bell invented the telephone and analogue voice communication. Morse came on the scene around 1844 but his system required skilled operators, but once trained they could get information across the continents very rapidly so long as the telegraph lines were not tampered with nor broken by freak weather conditions; even so, in those days transmission of telegraph signals took some 20 hours to reach the UK from Australia via the overland route. Emile Baudot, a Frenchman, was responsible for introducing the 5-unit code which takes his name. This was the basis of the code which needed a start and stop bit to use it with printing apparatus (the teleprinter). Prior to that Morse's first attempt was to use his code to operate a single needle system (in 1844) to improve on Wheatstone and Cooke's systems. Creed, who in 1902 was working for the South American Telegraph and Cable company in Peru, devised a system that would enable Morse Code signals to be punched on to tape by typewriter-style keys (a perforator). This subsequently avoided the need to have Morse reading skills; but, nonetheless, required typing skills. High-speed telegraphy had arrived!

Not until 1924, however, did the first teleprinter arrive in the UK from the USA although in the States it was known as a teletype machine. It utilised the five-unit start-stop code familiar to anyone who dealt with printers made by Creed. The "start" pulse of 20mS was needed with mechanical machines to enable the receiving teleprinter to synchronise with the sending machine. Both machines were kept adjusted to within 1% of nominal speed by a mechanical governor. Needless to say they required frequent maintenance. Some of us have known the Creed model 3, 7 & 444s. The mechanical weakness was not their only downfall because on the electrical side they had to operate from landline direct current pulses +80 or -80 volts representing space and mark. In digital parlance this means '0' for space and '1' for mark. On long distance landlines the signals were weakened by the resistance and leakage of the lines and because amplifiers would not pass the DC pulses, the space and mark were changed to audio frequency tones of 1275Hz and 1445Hz which could easily be boosted by amplifiers designed to pass speech frequencies. These tones are the standard ones generated in TU's (Tuning Units) which connect to computer serial ports. Ken demonstrated the tones, pointing out the audible frequency shift of 170Hz.

He explained the RYRY repetitive sequence as alternate 1s and 0's which were essential for synchronising and tuning when mechanical printers were being used.

Today's technology does not require a long sequence of RY's to synchronise; but nonetheless Ken admitted to using it prior to transmitting the BARTG news in RTTY simply to let listeners know he was about to send the news from GB2ATG (See below for the News Service Schedule). Ken then went on to mention the numerous TU types available for amateur use.

(continued on page 2)

LAST MONTHS MEETING - continued from page 1

These are:-

1. Straight Digital; the simplest being the JVFAX Hamcom unit, however, this lacks filtration.

2. TU + Filters and signal processor.

3. PLL TU with XR221 chip and good components and tolerances; this works well when static is present.

4. Modern commercial units such as the KAM or PK232. Ken said these were not designed for 170Hz shift and are not as good as the limiter/ discriminator TU designed specifically for the purpose. (Author's own experience with the KAM is that it can be programmed for whatever shift is required and whatever tones).

5. Limiter/discriminator type - FM detector - low pass switched capacitor filter - comparator/slicer - designed for 170Hz shift.

6. DSP unit completely driven by the computer.

7. A two-tone TU.

Ken's view was that nos. 5 & 6 compete well with anything available.

The BMK-Multy software was favoured by Ken as a good way to get started together with one of the better TU's.

Most RTTY transmissions will be at 45 baud but some will be at 50 and 57. Ken mentioned that RTTY is a good conversational mode insomuch as more than two stations can participate and nets having ten or more stations taking turns. This is not so for AMTOR and PACTOR which is strictly a one to one contact; for these two modes there are a number of mailboxes (BBS) around the world on 15m & 20m. Working long path to Australasia on AMTOR is difficult because of the frame (block) time of 450mS in which signals must be sent and their acknowledgement signal received back. AMTOR is sent in blocks of three characters taking 210mS so leaving only 240ms for propagation delay. Pactor is not so critical since the frame time is 1400mS when set to the DX parameter. The long path to Australasia is then quite straightforward so long as propagation is there. AMTOR can be used short path into Perth, Western Australia because propagation delay is not so long as on long path. AMTOR uses the ITA no.3 (International Telegraph Alphabet) and does not use all the 128 (=2E7) codes available from the use of a 7-digit code; it uses only those 7-digit combinations containing four '1' and three '0' (This is just 35 combinations). As in RTTY 5-bit codes one has to be allocated to letter/figure shift so leaving 62 for letters, figures and punctuation characters. BMK-Multy RTTY software automatically looks for, and adjusts to, the speed at which signals are being received; it also inverts the signals if necessary. Other software programmes are capable of responding and deciding automatically whether AMTOR, Pactor or G-Tor is being received. G-Tor was not specifically talked about by Ken nor did he make other than a passing mention of Clover both of which are proprietary systems marketed by Kantronics and Hal Communications in the USA. They cannot be got for free!! Pactor II marketed by SCS in Germany is also a system which must be purchased. Allegedly, it is much better than Pactor I which is freeware. Pactor II is compatible to version I.

AMTOR has three modes. The first is known as FEC (Forward Error Correction) and is used when calling CQ simply because there will be no acknowledgement of the blocks of characters as they are being sent. The second is the ARQ mode (Mode A) which is automatically locked into when your CQ is answered or when you answer another station who has just called (or which you have just seen finish a QSO). The third mode is the ARQ Listen mode (Mode L) whereby you can monitor another pair of stations already in QSO (but you cannot break-in!).

FEC is sent at same speed as RTTY but each block of three characters is sent twice (but with a number of other blocks in between). AMTOR ARQ is sent at 100 baud but because of the time in each block allowed for acknowledgement signals it comes down to an almost effective equal speed to RTTY but with the advantage of not so many errors because of its error detection facility provided by the four 1s and three 0s. However, unlike Pactor it cannot correct any errors found.... all it can do is to ask for the block to be sent again. And it will do just that for as many repetitions as it takes until it has a code which is valid.

It will occasionally get a 7-bit code where two corruptions have occurred, that is to say a 1 has been corrupted to a 0 and another 0 has been corrupted to a 1 thus satisfying the 4+3 criteria but yielding an incorrect character on the computer screen.

For AMTOR working one's own callsign is changed to a SELCAL which is recognised by the station you connect to. It comprises 4 letters made up from the first letter in your callsign and the last 3 letters (Mine is GEDM). If the call is,say 5N6GL then the SELCAL becomes NNGL.

Thus Selcals are not unique like callsigns but you are unlikely to find two stations on the same frequency with the same Selcals.

AMTOR and Pactor are synchronous systems and Ken suggested that timing needed to be within 50 ppm (parts per million). If you wish to get your timing spot-on then listen to the commercial shipping information station on 518 kHz and adjust your software. RTTY runs under Windows but DOS runs Pactor better. (Windows 95 will run Winlink which is the mailbox system devised by Victor Porr).

Ken said his system used tuning lights (Toni-Tuna type) plus a one inch oscilloscope, the latter being easier to tune. A switched capacitor filter (audio) made variable by use of two CB channel switches adapted for this purpose. He says the filter does not ring on CW.

A nice feature of the BMK-MULTY software is the ability to display a panoramic audio spectrum and it also has a built-in logging programme.

Finally, a demonstration of two stations communicating with each other was given (although the link was hard wired rather than tempting the vagaries of radio propagation).

Additionally, Ken demonstrated, on screen, the downloading of information received off-air from such a station as GB2ATG.

GB2ATG News Service Schedule

At 2000hrs local time on 3.584 MHz Mark (+/- QRM) RTTY on Monday-AFSK, Wednesday-AFSK and Friday-FSK. Pactor-FEC on Tuesday. AMTOR-FEC on Thursday and Saturday.

At 1000hrs local time on 3.595 MHz Mark (+/- QRM) RTTY on Sunday-FSK.

Thanks to Ken for such an interesting talk put across by an obvious enthusiast and not forgetting Chris, G0IPU and Roy, G3PMX, who helped to get the demonstrations working.

Editorial note:-

Due to space limitation in our NewsLetter, this report by Geoff on the very comprehensive lecture by Ken has had to be abbreviated in some paragraphs, however, any member requiring the full report only has to ask for a print.

HAIR DRYERS - Geoff, G7KLV

The first hair dryer I repaired was a very straight forward affair with a hot-cold switch. The circuit was just as one might have expected. A series field commutator type motor for the fan in parallel with a switched heating element with a safety cut-out to inhibit overheat. There was a mechanical interlock to ensure that the fan was on in the hot position. All quite simple and logical! It was some years later that another dryer came my way. You must know that familiar approach, "Dad do you think you could look at...?". I thought it would be similar to the first one but I hadn't taken into account the relentless advances in consumer technology, had I? It was featherweight compared with the first one. Opening them up is usually quite easy. Release one or two self tappers, perhaps concealed, and a little leverage in the right place and you are inside, hopefully, without any damage. However, designers are sometimes very clever at concealing the entry to modern consumer devices!

Modern hair dryers use permanent magnet DC motors to drive the fan. The circuit is simplicity itself. The heating element is in series with the AC terminals of a bridge rectifier. The element acts as a voltage dropper. The DC motor is connected to the DC terminals of the bridge together with a small capacitor, to reduce RF interference. Check that it blows, not suck!

A self reset safety cut out is wired in series with the heating elements. I have also seen one with the motor in series with the element and a single rectifier, there was also a rectifier, reverse connected, across the motor.

The DC motors are usually five pole types with excellent starting characteristics and start with about three volts applied and take approx: 100mA. Typical 'in circuit' measurements with an AVO on DC were 10 volts at 800mA. The resistance of the heating element in series with the motor circuit was 220 ohms. There was another element in parallel giving a total consumption of 400 watts.

With one machine I did a satisfactory repair using four 1N4007 rectifiers. Severed mains leads at the dryer end are not unknown. The DC motors are usually 'sealed' units and brush replacement is not possible. Good Luck!

73 from Roy & Ela Martyr,
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Deadline for the next NewsLetter is Saturday 26th April

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The introduction to the show was by way of first demonstrating the primitive and early communication of data, that is to say information, by use of Jungle Drums (pre 1837 at least). Ken described the early transmission of data from 1837 onwards commencing with the method of using five clock faces each with pointers (attributed to Sir Charles Wheatstone and William Fothergill Cooke). Transmitted voltages set the pointers to various positions on the clock faces to indicate letters of the alphabet; variations of the technology using two pointers on a clock face still, however, producing a slow system for transmitting information in the years before Alexander Graham Bell invented the telephone and analogue voice communication. Morse came on the scene around 1844 but his system required skilled operators, but once trained they could get information across the continents very rapidly so long as the telegraph lines were not tampered with nor broken by freak weather conditions; even so, in those days transmission of telegraph signals took some 20 hours to reach the UK from Australia via the overland route. Emile Baudot, a Frenchman, was responsible for introducing the 5-unit code which takes his name. This was the basis of the code which needed a start and stop bit to use it with printing apparatus (the teleprinter). Prior to that Morse's first attempt was to use his code to operate a single needle system (in 1844) to improve on Wheatstone and Cooke's systems. Creed, who in 1902 was working for the South American Telegraph and Cable company in Peru, devised a system that would enable Morse code signals to be punched directly on to tape by operating keys of a typewriter-style machine (a perforator). This subsequently avoided the need to have Morse reading skills; but, nonetheless, required typing skills. High-speed telegraphy had arrived!

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The mechanical weakness of the teleprinters was not their only downfall because on the electrical side they had to operate from direct current pulses which were applied to the landline with +80 or -80 volt pulses representing space and mark pulses.

In digital parlance this means '0' for space and '1' for mark.

On long distance landlines the signals were weakened by the resistance and leakage of the lines and cables, and because amplifiers would not pass the DC pulses, the space and mark were changed to audio frequency tones of 1275Hz and 1445Hz which could easily be amplified by the landline amplifiers designed to pass speech frequencies. These audio tones are the standard ones generated in the TU's (Tuning Units) which are driven by the DC signals coming out of the ports on your computers. Ken demonstrated the tones to the audience pointing out the audible frequency shift of 170Hz. He explained the RYRY repetitive sequence as alternate 1s and 0's which were essential for synchronising and tuning when mechanical printers were being used. Today's software and electronic hardware does not require such a signal in order to synchronise; but nonetheless Ken admitted to using a long sequence of RY's prior to transmitting the BARTG news in RTTY but simply to let other band users known that he was about to commence sending the news from GB2ATG (See below for the News Service Schedule). Ken then went on to mention the numerous TU types available for amateur use.

These are:-

1. Straight Digital; the simplest being the JVFAX Hamcom unit, this, however, lacks filtration.
2. TU + Filters and signal processor.
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The standard tones mentioned above are those recognised in the UK and elsewhere (Known as LOW tones); these are used with the USB mode for AFSK working. However, in the USA they use LSB and HIGH tones (a MARK of 2125Hz and a SPACE of 2295Hz). (Author: NOTE that this amounts to the same thing because the change of sideband is countered by the inverting of the tones. That is to say, in LO tones the SPACE is the lower audio frequency and in the HI tones the SPACE is the higher of the two audio frequencies).

Ken mentioned that, for example, when using the transceiver YAESU FT-ONE the FSK mode of working must always be used because this is the only mode in which the narrow filters can be used... usually 500Hz filters.

Most transceivers have an FSK input socket to which the MARK & SPACE DC potentials are applied and the transceiver converts these into the two respective RF signals by making the DC shift the RF oscillator frequency.

AFSK generates precisely the same two RF signals by the SSB process. Other transceivers have the optional narrow filters available in both USB and LSB modes, making the use of FSK unnecessary.

AFSK allows the two tones from the TU to be fed directly into the microphone input of the transceiver and additionally may obviate the need for a DC level changer due to incompatibilities between TU and FSK input. When specifying the operating frequencies of stations it is usual to give the radio frequency corresponding to the MARK frequency and this takes care of differences in the two RF's between using LO or HI tones, however, your transceiver frequency readout, which is the suppressed carrier frequency, will be different depending on whether HI or LO tones are being transmitted...for HI tones transmitted your readout will be approximately 2.1kHz above the published Mark frequency or 1.4kHz below respectively if your receiver is set to USB.

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