



# Digital visions

**Is digital television new? Maybe not, but Baird's television system was certainly a pig in a poke: wasn't it? Don McLean has some new evidence.**

**T**he much-hailed start of digital television may not be quite the giant leap you think. Digital television broadcasting – converting programme distribution to a fully digital environment – is just one small step in a steady 'technology refresh'.

This engineering process started over twenty years ago and will continue for many years yet. Fully digital television, and digital scanning standards, will emerge when the flat-screen tv replaces the cathode-ray tube in our television sets. Then, analogue tv and all its trappings, such as PAL (or NTSC) coding, sync pulses, colour bursts and interlace, will be history.

That digital future, with our current analogue tv obsolete, will give us a new view of television's engineering history. The early years of mechani-

cally-scanned television – viewed for decades with disdain – will then, I believe, sit alongside electronic analogue tv as an equally valid engineering solution to 'television'.

## Mechanically-scanned tv

Today though, most of us have accepted a view originating from the BBC back in the late thirties. We think of John Logie Baird's low-definition television system of the twenties and early thirties as somehow 'wrong', and of electronic television as being 'right'.

Part of this comes from 'technology arrogance'. In the sixties, the BBC<sup>1</sup> seriously questioned Baird's achievements because no part of his technology was in sixties' television systems. But, today, nothing directly of sixties' technology is in a nineties' consumer digital video camcorder – with its chip sensor, image stabilisation, digital auto-

focus, lcd, digital data recorder and computer interface.

We should neither revere nor ridicule historic technologies – they are merely the best solutions available at the time, Fig. 1.

## A new view on the past

To be objective about early television, what we need – and have not had up until now – is evidence. Without it, historians have had to rely on written or eyewitness accounts, some of them made decades after the event and most of them dismissive and derogatory.

In 1996<sup>2</sup> and early 1998, hard evidence turned up in the form of home video recordings made from BBC tv programme transmissions in the thirties. Until then, the entire mechanically-scanned era of television was thought to be devoid of any such recording. These digitally restored

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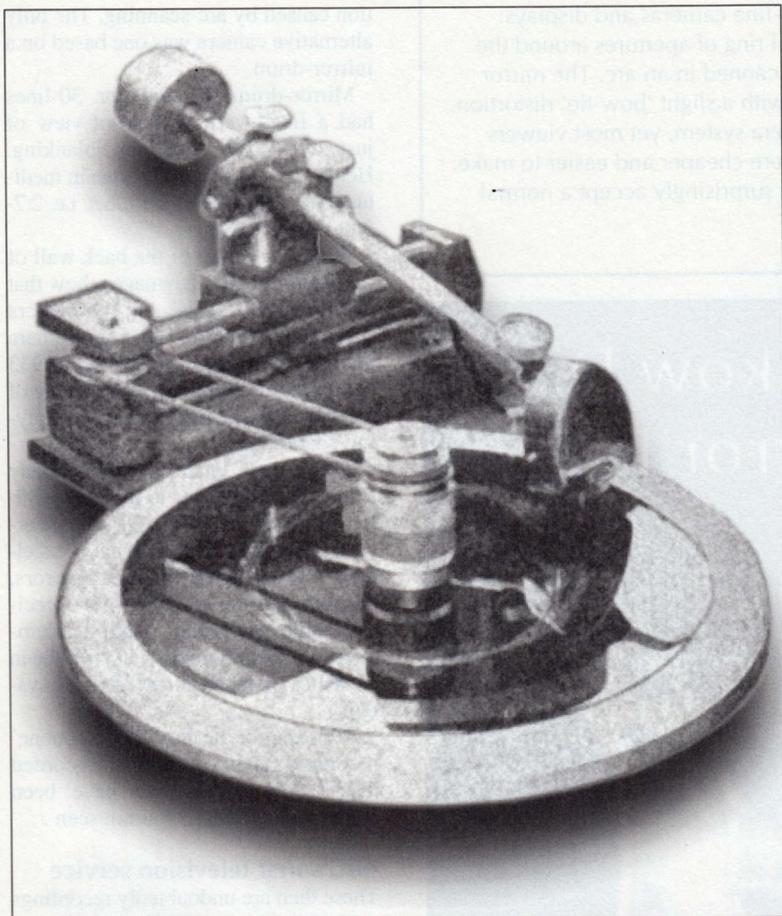


Fig. 2. One of the many consumer devices that recorded audio onto aluminium discs. On more than one occasion, machines such as this were used by viewers to record the video signal of the BBC's 30-line broadcasts.

recordings now challenge the long-established view.

To understand why this is so, let us fast rewind to just after Baird's experimental period of the years around 1930.

**BBC chooses Baird's 30-line system.**

In 1932 the BBC chose Baird's 30-line standard for its television service, despite higher definition being available. It was chiefly the lack of suitable wide-band transmitter hardware that forced the BBC into using an existing solution.

The 30-line video signal was low enough in bandwidth to be transmitted on an existing BBC medium wave frequency normally used for audio. The public simply used their existing radio for the audio channel and a second radio receiver for the video channel. Only the display had to be bought – or in some cases built.

Baird's mature 30-line system – developed in the late twenties – provided the BBC with an exceptionally low-cost engineering solution that

exploited their existing broadcast infrastructure to the full.

**No recordings?** If the BBC or the Baird Company ever attempted recording their programmes, there is today no record of it. Fortunately for us, a few enthusiastic viewers made crude video recordings on their domestic audio equipment, Fig. 2, from BBC broadcasts. They had been inspired by Baird's attempts to make a practical videodisc player in the late twenties<sup>3</sup> and were encouraged by articles describing how to do it.<sup>4</sup>

Recently, Jon Weller, a collector of old electronics equipment, retrieved a collection of direct-cut aluminium discs from a house clearance. The discs were previously owned and possibly recorded by Marcus Games, a keen amateur movie enthusiast. Jon later discovered that several discs in that collection had unusual material on them, Fig. 3.<sup>5</sup>

**What are the recordings of?** Although the discs were recorded at

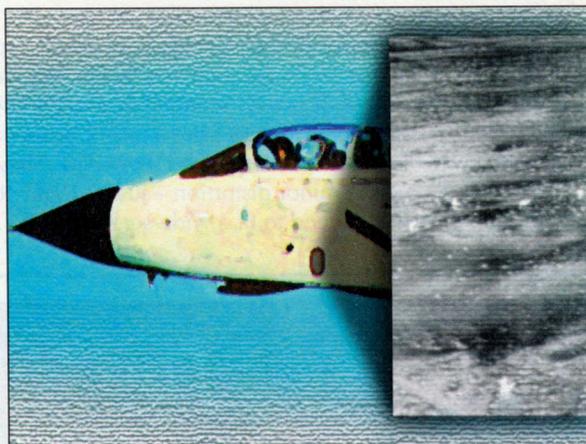
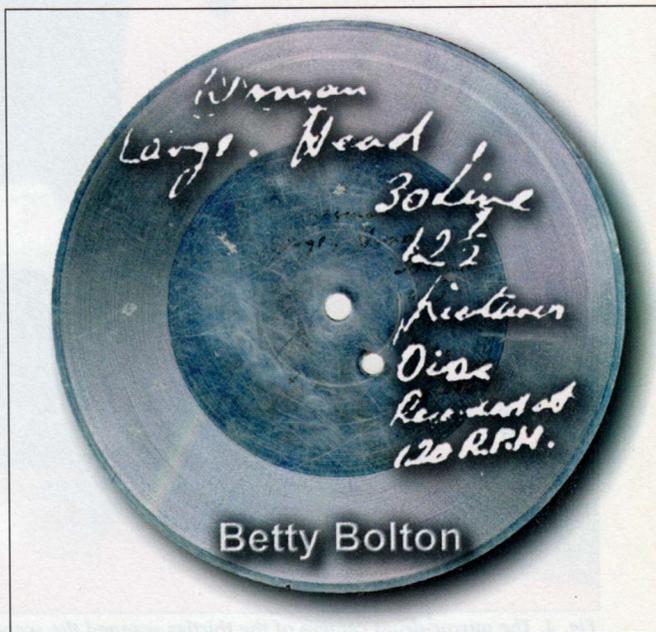


Fig. 1. Mechanically-scanned television is in use today by the military. In airborne reconnaissance, the high-resolution television cameras on RAF Tornado GR1A aircraft use mirror-drum scanning. Coincidentally the aspect ratio is similar to that of Baird's 30-line standard. (from Crown Copyright original)



different speeds, the starting point was that the signal matched Baird's 30-line video standard. Without a date to go by, I had to rely on comparing the video content with knowledge of the development of 30-line television in order to determine whether they were authentic or recent.

**The evidence**

Once restoration started, the clues began to appear. In the collection, there are eleven separate recordings of 30-line video. Each recording is a fragment from a programme and lasts no more than a minute. There were two types of programme – one type featuring four individual singers and the other containing what may be material from children's programmes.

Fig. 3. With no clue as to date or authenticity, one of the discs has a hand-written message "Woman Large Head". This unflattering message describes the main disc of Betty Bolton's BBC tv performance in the thirties.

## Scanning options

Two main types of mechanical scanning were used for 30-line cameras and displays: Nipkow disc and mirror-drum. The Nipkow disc – a spiral ring of apertures around the outer edge of the disc – created a curved image that was scanned in an arc. The mirror drum, shown in **Fig. 4**, however scanned in straight lines with a slight 'bow-tie' distortion.

The BBC transmitted its images from a mirror drum camera system, yet most viewers used receiver-displays based on the Nipkow-disc. They were cheaper and easier to make. Viewers accepted the minor distortion – just as today they surprisingly accept a normal television picture stretched to fit a wide-screen display.



**Fig. 4.** The mirror-drum camera of the thirties scanned the scene using a projected flying spot. The Nipkow camera disc of Baird's video recording experiments of the twenties used more traditional – but less efficient – lens-based imaging.

**Fig. 5.** Betty Bolton. The photo on the left and its simulated 30-line equivalent show Betty in 1929. The two pictures on the right have been restored off-disc. One shows the glint off Betty's hair and the other, her distinctive profile with kiss-curl and hair clasp.



The digitally restored images from the set of discs do not show the distortion caused by arc-scanning. The only alternative camera was one based on a mirror-drum.

Mirror-drum cameras for 30-lines had a fixed vertical field-of-view of just over 20°, excluding blanking. Hence the singers who we see in medium shot were around 9-10 feet, i.e. 2.7-3m, from the camera.

With the bottom of the back wall of the studio in shot, the images show that the studio was large and the camera system was sensitive. Showing camera features common with the 1933 'Looking In' recording, the quality of camera-work appears superior, implying a later date.

Relative to what amateurs today achieve<sup>6</sup> and relative to a genuine 30-line re-make of a 1930 play<sup>7</sup>, the inherent quality of the vision signal is excellent. With no detectable image errors, the mirror drum camera was a precision-built mechanism. Lighting, camera-work and production have all been perfectly matched to the 30-line system.

Allowing for the almost 'dictaphone' recording quality, the home-recorded discs show details that have been talked about before,<sup>8</sup> but not seen.

### BBC's first television service

These then are undoubtedly recordings made from the first BBC television service of 1932-35. The clues above suggest the transmissions came from the BBC tv studio at Portland Place between 1934 and '35.

With the 1933 programme, 'Looking In',<sup>9</sup> we now have the total complement of video recordings of broadcast television – at least in the UK – before the fifties. Since they were discovered and restored only in the last two years suggests that more material may yet appear.

**Singer without the song.** Only one of the singers is easily recognisable by her distinctive features and hair-style – Betty Bolton, **Fig. 5**. As an accomplished contralto, she recorded many dance-band songs in the late twenties and early thirties.

Between 1929 and 1935 she performed well over a dozen times on 30-line broadcasts including being the first performer on the opening night of the BBC Television Service in August 1932.

Betty's performance exudes professionalism. Here is a highly accomplished performer, perfectly natural in front of a television camera. When I showed the images to her, she immediately recognised herself from her appearance and actions.

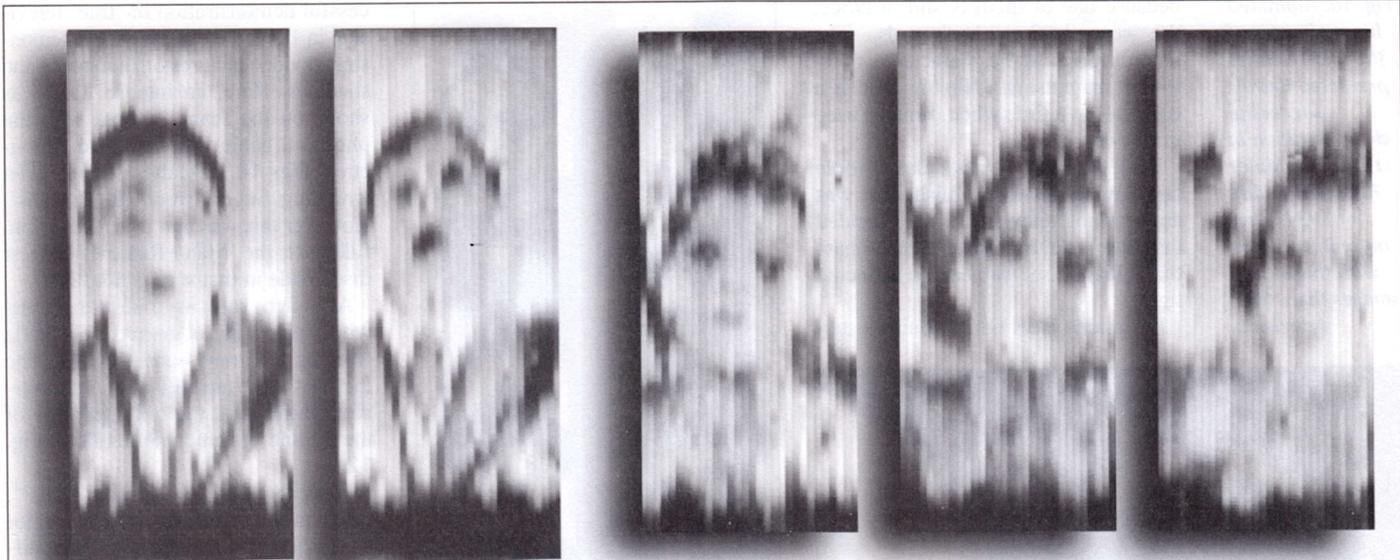


Fig. 6. An unknown male operatic singer. Details of his collar, tie and jacket show up well considering that the computer-restored sequence originated from a dictaphone quality audio recording.

Fig. 7. An unknown female singer performs in silence through a rain of high disc-surface noise. On the right she is caught part-way through blowing a kiss at us.



Fig. 8. Captured at 120rev/min, this female singer's performance is spread across three of the eleven separate recordings. They have been brought back together digitally as one long sequence.

The glossy shine of her hair, the glint of her tiny silver hair-clasps, her gem necklace and the pattern on her dress are all remarkably clear. A well-defined dark streak either side of her nose and dark eye shadow seemed to be the only make-up. Betty confirmed that only her eyebrows, nose and lips had been enhanced in dark-blue.

The other recordings of singers, Figs 6, 7, 8, are not distinctive enough to be identified. Hence it is difficult to establish when the recordings were made.

For the first time ever, we can truly appreciate something close to the original scene quality from a 30-line broadcast. The only surviving Baird

Company engineer described these digitally restored pictures as about as bad as they got.<sup>10</sup>

**The first commercial video disc...**

In mid-1935 – rather late in the day to be of much use – the first video disc was offered for sale. It was a double-sided 30-line vision-only test disc, bearing a 'Major Radiovision' label, Fig. 9. It comprised a series of twenty still cartoon images – ten per side of the disc.

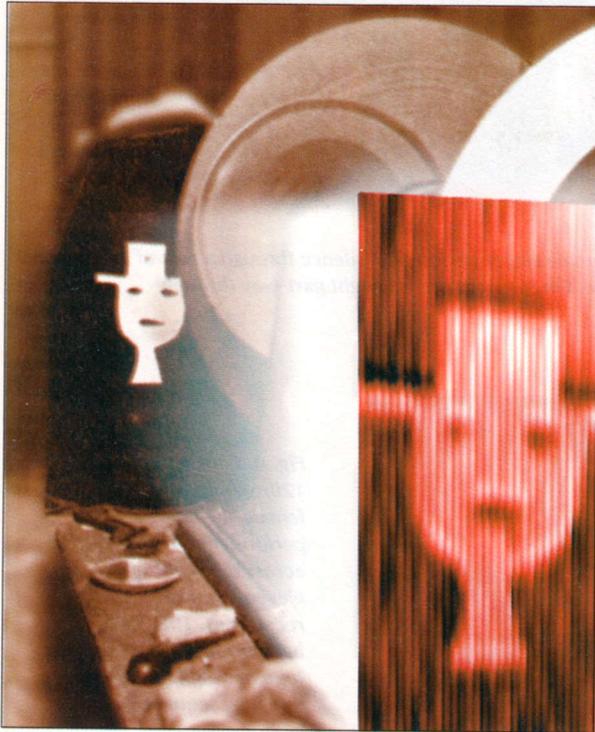
These stills are slid in, left for about twenty seconds, then pulled out. They are transparencies – lantern-slides –

**RECORDED TELEVISION**  
 PROVISIONAL PATENT 19161/34  
 A DOUBLE-SIDED record giving a variety of pictures running for 5 minutes on each side. Different modulation strengths are recorded on opposite sides to enable various types of pick-ups to be employed. Reverse pick-up leads to obtain a negative or a positive picture. Only one stage of amplification required. Recorded at the same speed and number of lines as the present B.B.C. transmissions (30 lines). A boon to the experimenter and demonstrator.  
**PRICE 7/-**  
**MAJOR RADIOVISION CO.**  
 RADIO & TELEVISION MANUFACTURERS  
 Major Radiovision Co. Ltd.

Fig. 9. The 30-line video test disc manufactured and sold for seven shillings by the 'Major Radiovision Company' under F. Plew. The only recording of 30-line Television in the BBC's archives is 12PH 69197.

Disappointingly, this turns out to be a poor copy of this 'Major Radiovision' disc.

**Fig. 10. Animated binary images of the mid-twenties pre-dated Baird's successful demonstration in 1926. The Major Radiovision disc of 1934-5 has more in common with those early images than 'true' television.**



because one of them is slid in twice, the second time backwards. The recording shows the characteristic distortion from using a Nipkow disc as a camera – at a time when cameras used mirror-drums.

Back in the early twenties, people laid down rules to establish what was and was not 'television'. They decided that 'true' television should encompass the ability to see subjects in reflected light.

For many years before Baird's suc-



**Fig. 11. The time-base corrected image directly off-disc shown on the left suffers from 'ringing' at around 5kHz. On the right, signal processing has greatly reduced the distortion and the proper arc-scan pattern has been restored.**

**Fig. 12. A composite of most of the pictures from the 'Major Radiovision' test disc. The strange pattern at bottom right is a high frequency test pattern.**



cessful demonstration of 'true' television in 1926, the early pioneers demonstrated video pictures of silhouettes and shadows. Here, an intense light was shone on the scanning area with the photocell behind it. Animated silhouettes, **Fig. 10**, a Maltese cross, even wagging fingers were all 'subjects'. However this was not 'true' television. Likewise, the 'Major Radiovision' test disc, made in that way is not 'true'.

Although sold as a test disc, the whole recording is marred by a 5kHz 'ringing' on transitions, **Fig. 11**. The fact that these are stills without movement means that the full capability of the 30-line system is not realised, **Fig. 12**.

There is a 'sister' disc of stills<sup>11</sup>, made in the same way as the 'Major Radiovision' disc but containing different subject matter. Strangely, whilst the recording is clear, none of the lantern-slides are even remotely recognisable, **Fig. 13**.

**The new television system**

Low definition TV had virtually national coverage with at least eight thousand viewing sets. After the last of 1,500 programmes was transmitted on 11 September 1935, these viewers found that their 30-line TV receivers had become obsolete. The new high definition service began a year later.

**True revolution.** Unlike digital television today, the transition from the 30-line service to the new high definition service was not an enhancement, it was a total revolution.

Thirty-line tv was designed to use existing radio channels intended for audio broadcasting. The BBC had used mature technology for its 30-line television studio. It had also used its existing audio distribution channels and radio frequencies for vision transmission, leaving the public to buy or even build their own receivers.

In sharp contrast, a totally new infrastructure supported the high definition system. Virtually everything had to be developed from scratch – cameras, cables, distribution amplifiers, routers, transmitters, receivers and displays.

The investment was enormous but the time was right and the public were crying out for a full television service. The potential returns for the right solution made the investment appear secure.

**Trial by television**

When test transmissions started in 1936 from RadioOlympia, the price of receivers, full of the latest technology, left the public far behind. Much like the start of BBC Choice in September

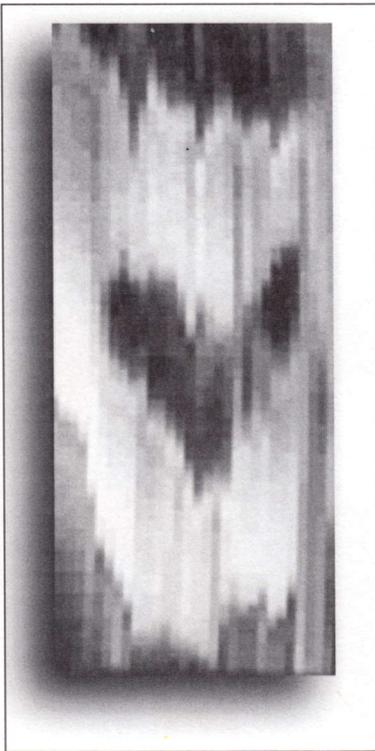


Fig. 13. Identical in every way but content to the 'Major Radiovision' 30-line test disc, a second disc contains test stills that are clear yet unrecognisable.



Fig. 14. John Logie Baird – Britain's foremost television pioneer, 1888-1946.

1998 on the digital service, hardly any of the public had the new receivers to watch it.

Television coverage shrank from most of Britain to London and the immediate vicinity. Initially, television sets had to be dual-standard: the choice between the Baird Company's totally new 240-line progressive scan system and rival Marconi-EMI's 405-line interlaced system was to be resolved on-air.

Dual standard reception made the first electronic televisions even more costly. By January 1937, the all-electronic 405-line system had been selected.

Viewers outside the London area, who switched off their 30-line receivers for the last time in 1935, had to wait more than fifteen years for television to return. It took until 1952<sup>12</sup> for coverage to reach Scotland and Wales and 1953-54 for prices of receivers to become affordable to the average working family.

#### But what of Baird?

John Logie Baird, Fig. 14, has easily earned the acclaim of Britain's foremost television pioneer. His list of achievements is legendary. He developed and demonstrated the world's first practical solution to television.

Uniquely amongst the tv pioneers,

Baird developed, demonstrated and patented almost every aspect of television including colour, infra-red, 3D, and video recording. He introduced and funded a broadcast television service. His 30-line system was adopted – and hence sanctioned – by the BBC for their first television service.

That he lost the prime competition for supplying the BBC's high definition service to Marconi-EMI in 1936 is unfortunate – the all-electronic system was simply better. This does not detract from his remarkable achievements and innovations throughout the dawn of television and, indeed, for the rest of his life.

Baird received only one honour – honorary Fellowship of the Royal Society of Edinburgh.<sup>13</sup> If we recognise comedians and retired politicians and their secretaries through our country's honour system, then the time is long overdue to bestow proper honours on John Logie Baird.

**Acknowledgments.** I would like to thank Jon Weller, the owner of aluminium discs described here and to Eliot Levin of Symposium Records, who freely gave up his time to transfer the discs expertly and professionally. Final thanks go to Betty Bolton, the earliest video star, who has charmed me both on disc and in person. ■

#### References

1. BBC, "The Discovery of Television", Documentary celebrating 25 years of Television, 1961
2. McLean, D F "First Frames", Electronics World, November 1998
3. McLean, D F "Restoring Baird's Image", Electronics World, October 1998
4. Practical Television, "Canned Television", Barton Chapple, November 1934
5. Weller, J. Private Communication, Jan-March 1998
6. NBTVA – Narrow Band Television Association – uses low definition TV as an alternative amateur radio mode
7. Remake of "The Man With The Flower In His Mouth", 1967, ILEA, produced by Lance Sieveking (the original 1930 producer) and filmed entirely in 30-lines by Bill Elliott.
8. Bridgewater, T H "Just a Few Lines", British Vintage Wireless Society, 1992
9. McLean, D F *ibid* Electronics World, November 1998
10. Herbert R M. Private Communication, June 1998
11. A tape copy of this disc was supplied by Doug Pitt, NBTVA, 1982. The source of this tape is unknown.
12. Briggs, A. "The BBC: The First Fifty Years". OUP 1985
13. Baird, Prof M H I, private communication, Sep 1998

Don will be describing his work in a lecture to be given at the IEE, Savoy Place, London on 11 May 1999 at 6pm. Admission is free and open to non-members. The multimedia presentation will rely heavily on the video restorations and will be entitled "Restoring Baird's Image: the restoration of the world's earliest-known television recordings."