# UNDULATOR DETECTION OF LORENZ CIPHER 5-HOLE TELEPRINTER CODES

Radio reception of broadcast Lorenz-cipher traffic (at the Knockholt "Y Station" in Kent) was beset with difficulties. Transmission of the signals was directional and was pointed away from the UK. Signals were often faint and distorted. It was soon found that the best way to record the signals was vias an ink trace on a sheet of paper, using technology similar to that employed for FAX.

Note that signals for one and zero were shown above and below an imaginary central line with '0' being signalled above the line and '1' below. Just as in ASCII serial line transmission, some 20 years later, the signal clock at the receiving end was turned on by a start bit immediately preceding the character and turned off by a stop bit at the end. In the case of 5-hole Lorenz traffic the start bit was a zero and the stop bit was a one. To ensure accurate detection the pulse length for the stop bit was lengthened very slightly, to be effectively "1.5 bits".

The diagram below shows a reconstructed undulator trace for the text message "COLOSSUS". In the boxes below the trace are shown the 5-bit code and the corresponding character

01110	00011	01001	00011	10100	10100	11100	10100
C	O	L	O	S	S	U	S
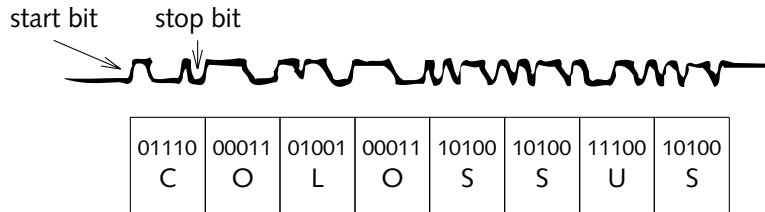
If reception conditions were good the above signal could be fed—directly and in parallel-with the undulator—to a teleprinter and to a tape punch. The punched output of the text 'COLOSSUS', rendered in 5-hole teleprinter code, is shown below.

COLOSSUS
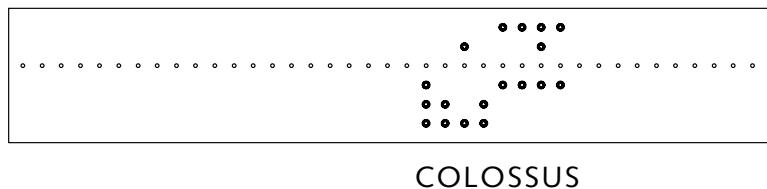
If reception conditions were bad then teleprinter and tape punch were turned off. The undulator trace was then painstakingly analysed and annotated before being keyed in, by hand, to produce a 5-hole tape and a printout. After further checking the tape was relayed twice, over secure land line, to Bletchley Park (BP). If both of these transmissions reulted in identical received messages at BP then the intercept was deemed "good" and passed on to the cryptanalysts. For secure storage and archival purposes, hard copies of all materials were sent by motorcycle courier from Knockholt to BP.

Acknowledgements

The above material has been adapted from the following reference:

1. B. Jack Copeland (and others), *Colossus* (chapters 3 and 7), Oxford University Press, 2006.