REPORT 1200*

THE EFFECT OF DELAY IN SOUND-PROGRAMME OPERATIONS

(Study Programme 51B/10)

(1990)

1. Introduction

With the increasing use of digital sound transmission equipment, delay effects are becoming significant on the circuits linking sound programme originating points and studio - centres as well as on circuits linking studio - centres and sound broadcast transmitters; the use of satellite links introduces even more serious problems. It is clear that the subject requires particular study and the following text presents a few examples of how delay effects can arise and the problems that ensue.

2. The problem of time differences between commentary and cue-programme signals in sound broadcasting.

Where a person presenting a sound broadcast programme has to receive cue programme via headphones, it is often unavoidable that the presenter's own speech signal is present in the cue-programme feed. Where the circuits carrying the broadcast and/or cue programme introduce significant delay, the resulting time-difference between the presenter's own speech and what is heard in the headphones can cause serious psychological effects. The following examples of the phenomenon are drawn from current operational practice:

* This Report should be brought to the attention of the CMTT.

a) Local Radio Operations

The presenter (who is often the only person running the radio station) listens to the programme output via an "off-air" receiver since he is responsible for checking that the signal is being radiated by the transmitter. This is shown in Fig 1. Problems can occur when the presenter is making an announcement whilst hearing his own voice via the transmitter, if more than a few milliseconds delay occurs between the studio output and the received signal fed to the headphones. In extreme cases, presenters have been so affected that they have disconnected the off-air cue-feed from the receiver, in consequence failing to detect shut-down of the transmitter

b) Outside-broadcast Operations

A contributor at an outside broadcast (OB) site will often be listening to the off-air signal, which is used as cue programme. An example of this is a commentator at a sports event. The off-air signal will be delayed by digital codecs in the distribution network, and there could also be significant delay in the feed from the commentator into the studio centre (for example, if there are digital codecs in the connections made via the telecommunication network). Figure 2 shows such a situation with a number of commentators at different events.

The commentator (who is alone at the event, without technical assistance) uses the cue signal to determine the starting point for his contribution (i.e. he is "cued" from the presenter in the studio) and he needs to listen to the cue signal whilst making his contribution. This is because he may be interrupted by questions from the presenter or by the need to terminate his contribution because of an event taking place elsewhere.

For some outside broadcasts, separate return feeds of cue programme can be provided. The return connection may be implemented with less delay than the off-air signal path, or (if the delay cannot be reduced to an acceptable level) it may carry a "mix minus" signal. In this case, the source receives back a mix of the full programme minus its own contribution. For sports events, however, it is often impractical (and invariably expensive) and off-air cueing tends to be used.

c) Laboratory tests

Preliminary tests have been conducted by the BBC in which both trained and untrained speakers have listened to their own speech, delayed, through headphones. These tests also included the effect of mixing some undelayed microphone output into the speaker's headphones. This technique has been found to produce a significant reduction in the disturbance caused by the delay.

Experienced broadcasters can normally cope with a delay of about 13 ms although it has been reported that some local-radio presenters find this unacceptable for continuous periods of duty. An inexperienced speaker, unaccustomed to hearing his own speech in headphones, may be affected by shorter values of delay, in the range 5 to 7 ms. This can cause problems, for example, when a member of the public is interviewed.

Initial results from the laboratory tests have, however, suggested that greater attention to accurate simulation of the operational conditions is necessary if anomalous results are to be avoided. Further work should therefore include study of the effect of a noisy environment, the loudness and frequency spectrum of the signal heard in the headphones and the degree of concentration required of the subject with regard to the subject matter of the test-speech material.

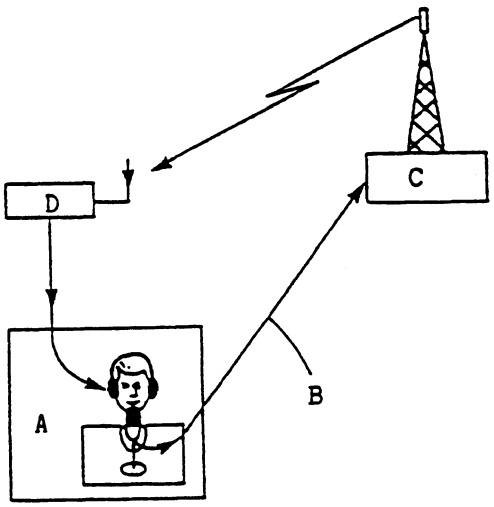

FIGURE 1 - Local radio situation

A: studio
B: distribution link
C: transmitter
D: receiver

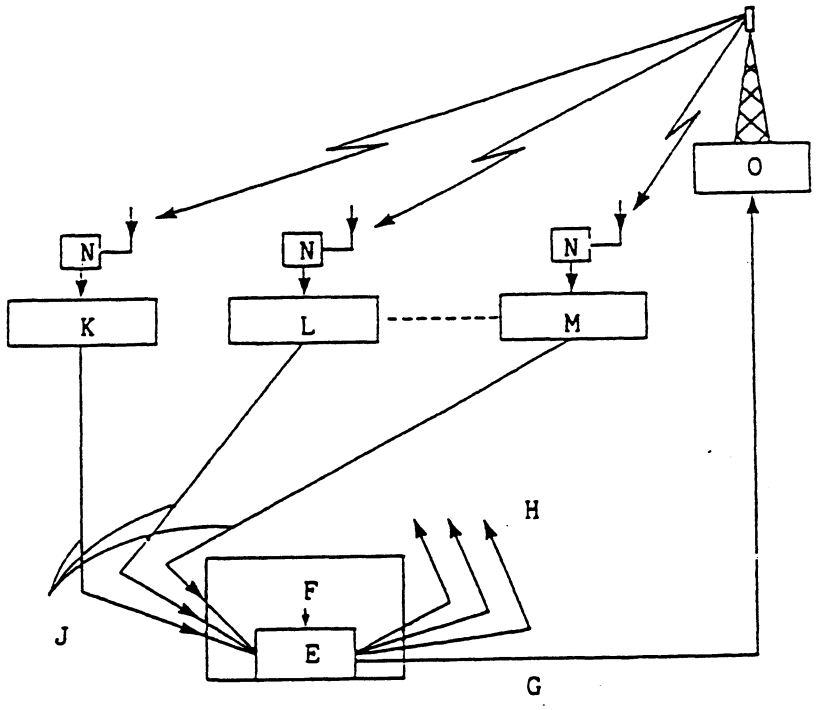

FIGURE 2 - Outside broadcast situation

E: desk
F: from presenter's microphone
G: distribution link
H: return feeds of cue programme, if available
J: contribution links
K: commentator at event 1
L: commentator at event 2
M: commentator at event n
N: receiver
O: transmitter

Note - Both contribution and distribution links may introduce delays.

REFERENCES

CCIR Documents

[1986-90]: a. 10/20 (United Kingdom).