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SIMULTANEOUS VIDEO AND DOSE RECORDING OF RADIATION WORK

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Introduction

The emphasis in current ICRP philosophy (and in anticipated UK Regulations) on the need to manage radiation doses and ensure that they are as low as is reasonably achievable (or optimised) has led to an increased interest in establishing how and why dose uptakes occur. For many operations the necessary information is already available to the health physicist and operational management and the appropriate steps to optimise doses can be identified. There are cases, however, where a much more detailed knowledge of dose uptake by individual workers would be valuable - special operations carried out on higher levels of dose rate are particular examples. To obtain this information by conventional means - a health physics monitor following the worker and recording the dose rate or other special procedures - is often expensive, time consuming and inconvenient. This paper describes a system under development in the UKAEA (SIMVIDOSE) which allows detailed dose information to be recorded in synchronism with and superimposed on a video recording of the operations concerned. The video recording with its superimposed dose record can be subsequently replayed and the dose information analysed by a microcomputer system

The SIMVIDOSE Equipment

The equipment is shown, in block diagram form, in Figure 1. The principle is that the worker wears a dosemeter which transmits its reading over a high frequency radio link. The signal is picked up by an aerial, processed and the dose information is superimposed on the video record of the operation made by the camera. This is the basic system, which has been subjected to active test. An additional recent feature is the transfer of dose information to a microcomputer for subsequent analysis and display.

The dosemeter/transmitter consists of an MX164 Geiger tube, a 168MHZ AM transmitter and an aerial and is powered by a standard 6V battery. The detector and electronics are contained in an 18 x 6 x 3cm metal case which is attached to the worker by means of a belt clip. The aerial is a single flexible wire about 20cm long.

The VHF receiver is contained, with a MOUSE microcomputer, video text mixer and an RS232 interface unit, in a Harwell 6000 series crat The receiver/transmitter combination has a range of about 25m overclear line-of-sight and the detector signal is processed by the microcomputer to convert counts in a predetermined time interval (1 to 16 seconds) into average dose rate.

The video camera records the operations being examined. The signal from it is fed into the video mixer unit where it has superimposed upon it (appearing on a single line at the bottom of the picture) the time and dose rate. This picture, which combines information about work activity and dose rate, can be watched during operations and recorded for later replay and examination.

A recent addition to the system is a portable,battery-powered EPSON HX-20 microcomputer which links into the signal processing system via the RS232 interface. This allows the collection and storage of time and dose information in a form which can be analysed by the computer and gives a capability to produce, for example, annotated graphs of the dose rate or detailed printouts of sequences of special interest.

Experience in Using SIMVIDOSE

A number of runs have been made using the equipment. After initial tests in mock-up non-active conditions it was used to observe and record a number of active operations including MSM extractions and filter changes. These tests showed that the equipment was performing satisfactorily: a sample graph of the time variation of the dose rate received by an individual during an MSM extraction is shown in Fig 2.

The practical difficulties in using the equipment were not as serious as anticipated. In the early stages of evaluation there was particular concern about the equipment becoming contaminated. This has not proved a severe problem to date because (a) the detector/transmitter is small enough to be worn under protective clothing, (b) it has been possible to observe through windows and (c) only the receiving aerial and video camera need to be close to the operations. The use of a relatively cheap black-and-white videocamera means that if it should become severely contaminated it could be regarded as expendable - although it is thought that adequate protection could be provided to it to prevent this happening.

One minor problem which emerged early in the evaluation was that when the transmitting aerial was bent sharply as a worker moved the signal was occasionally and temporarily lost. To allow for this a signal-loss detection system was incorporated into the processing electronics. This registers loss of signal in a counting period by displaying a question mark on the screen and transmitting a data-loss code to the logging EPSON microcomputer. This facility indicates that the data acquired in that period were unreliable. Thus, although the aerial bending problem has not been remedied it has been reduced to one of indicated data loss for occasional periods of a few seconds. This is no way impairs the usefulness of the system. The signal-loss detection system also registers when the worker wearing the dosemeter goes out of range or behind an obstacle.

Electrical interference has been encountered but, to date, it has been possible to eliminate it by relocation of the receiving aerial. The option exists to use an FM link rather than the present AM system (with significant reduction in sensitivity to interference) should this prove necessary.

Conclusions

The SIMVIDOSE system is likely to provide a useful addition to the facilities available to establish the sources of dose uptake by workers. It should prove valuable where special operations are concerned and whenever it is desired to have a detailed record of dose uptake which can be studied and analysed. It can then, not only act as an input to dose control and optimisation procedures but also be a facility which allows designers, trainees and others with different interests to see the relation between work activity and dose uptake in a variety of operations

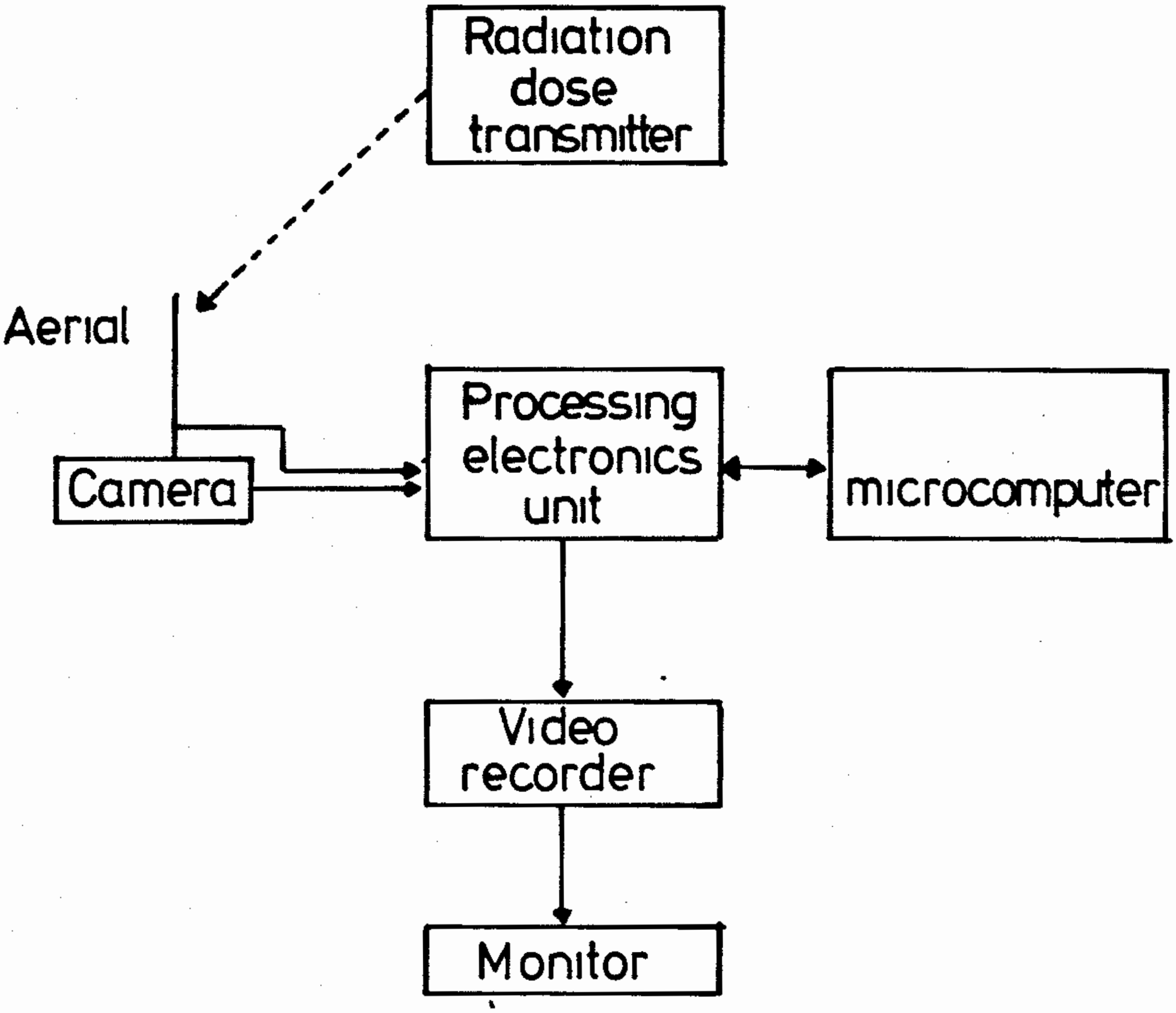

Figure 1. Lay out of the Simvidose equipment

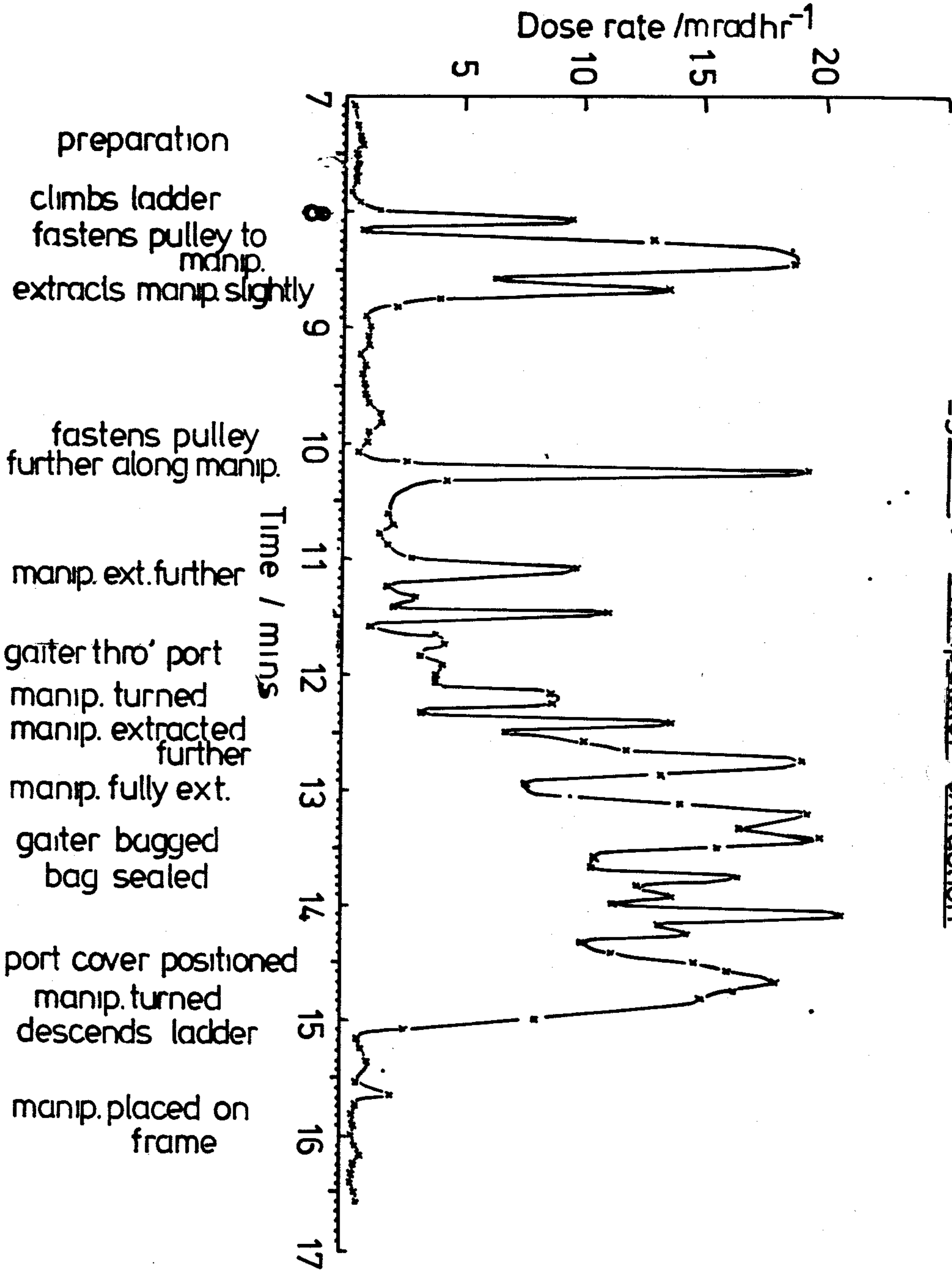

Figure 2. Manipulator extraction