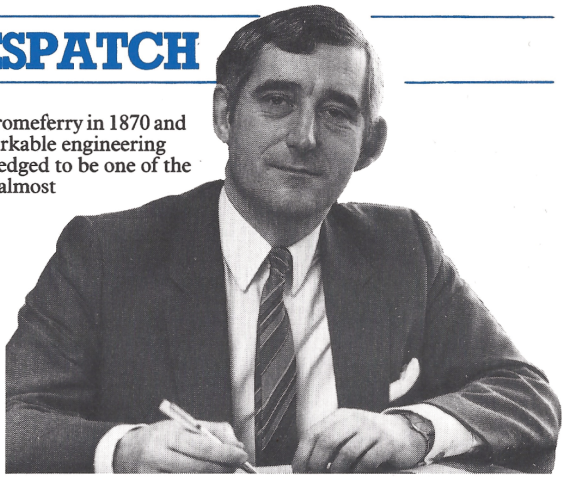
Scotrail
Radio Train Despatch

The End of an Era

Scotrail

RADIO TRAIN DESPATCH



The building of the railway from Inverness to Stromeferry in 1870 and its extension in 1896 to Kyle of Lochalsh was a remarkable engineering achievement. Today "The Line to Skye" is acknowledged to be one of the world's greatest railway routes — unrivalled for the almost magical enchantment of the ever changing vistas which it unfolds.

Alas, as we all know full well, that enchantment does not extend to the balance sheet. However aggressively it is promoted, the very remoteness of this line from population centres limits its capacity to generate sufficient year-round traffic to cover its costs. Scotland's beloved "Line to Skye" is, therefore, critically dependent upon external subsidy, however clearly that subsidy may be justified in terms of the social and economic importance of the line to the communities it serves and to the regional economy.

But the economic imperative, on which the future of the line must increasingly depend, is clear and unequivocal. Costs must be reduced!

That imperative is not unique to the "Line to Skye". It applies throughout British Rail and, particularly, to rural lines. What may prove to be a substantial part of the answer is, for the time being, unique to this line. And, like the creation of the railway itself, it represents a considerable engineering achievement.

Developed with financial support from the EEC by British Rail's Director of Signal & Telecommunications Engineering, backed by our Research and Development Department at Derby, it is a completely new system of signalling, called Radio Train Despatch, it is being introduced experimentally under operating conditions on the 63 miles of railway between Dingwall and Kyle of Lochalsh.

If it is successful this new system, which harnesses the very latest in microproccessor technology, offers the means of significantly reducing signalling costs on single track railway lines throughout the British Rail Network.

In view of the world interest focussed on this experiment, it is also, potentially, a source of considerable business for British Rail overseas.

Naturally, I am delighted that this particular route has been chosen for such a vital experiment which is consistent with the across-the-board range of improvements we are urgently seeking to introduce throughout the Scottish Region and British Rail as a whole.

It also reaffirms British Rail's commitment to do its utmost to safeguard the long term future of this line and of our passenger network in the Highlands.

I hope this pamphlet may help to explain how the new signalling system will operate.

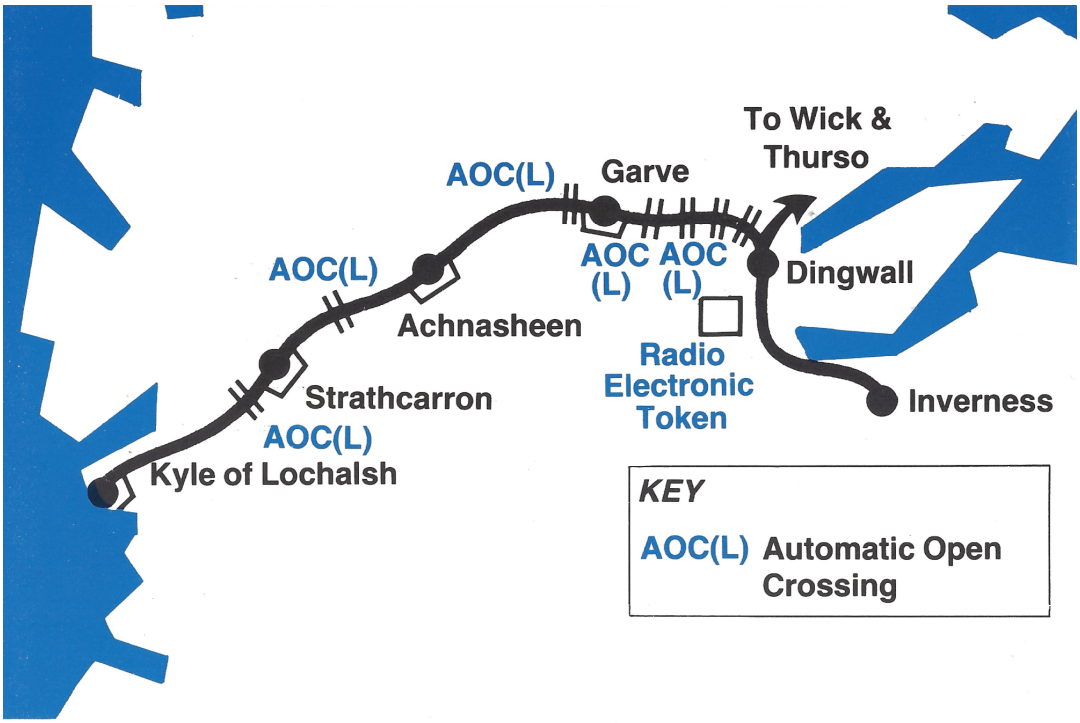
C. E. W. Green

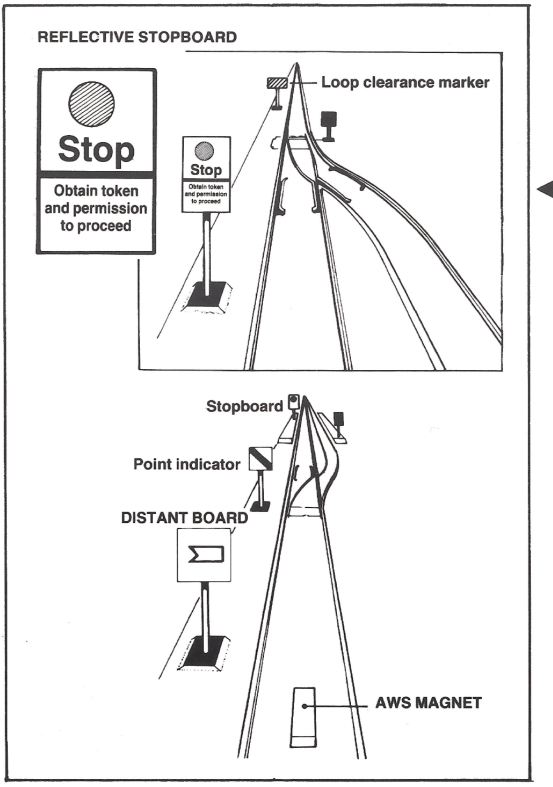
C. E. W. GREEN, *General Manager, Scotland.*

WHAT IS RADIO TRAIN DESPATCH?

Radio Train Despatch (technically, known as "Radio Electronic Token Block" within British Rail) is a microprocessor-controlled radio signalling system being developed by British Rail to supersede the traditional "single line key token" system used extensively within British Rail and worldwide.

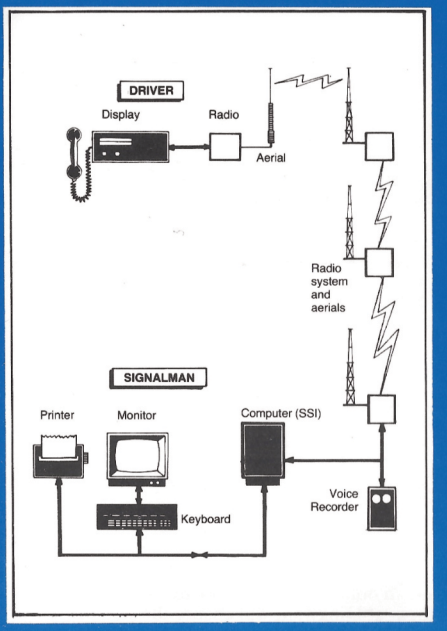
Basically the system comprises a microprocessor and radio equipped control centre covering a single line route (including the necessary loops or passing places on that route) and similar radio and microprocessor equipment installed in the cab of each locomotive using that route and unique to the particular locomotive. The radio equipment means that the driver can be in constant radio communication with control if necessary but the technological breakthrough is in the ingenious and completely tamper-proof microprocessor system which controls the access by individual trains, to successive stretches (or blocks) of single line track between any two passing places on the route. A specially coded signal must be received in the locomotive at the entry to the single line and at each passing loop thereafter before the train proceeds to the next "block" of single line track.





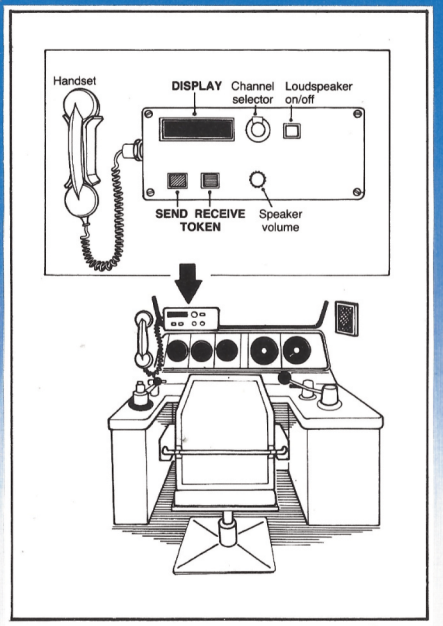
← *Stopping in the loop.*

View approaching the loop from the drivers cab.

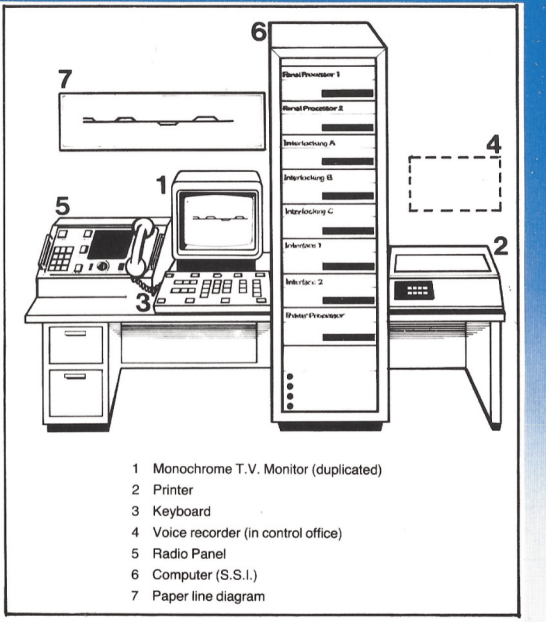


Electronic Token block network. There may be more than one lineside aerial, depending on the length of the route and the quality of radio reception.

The train cab control unit.



The signalman's control console.



1 Monochrome T.V. Monitor (duplicated)
2 Printer
3 Keyboard
4 Voice recorder (in control office)
5 Radio Panel
6 Computer (S.S.I.)
7 Paper line diagram

How it works

This is best understood by looking first at the system it is intended to supersede.

The Dingwall/Kyle of Lochalsh line is 63 miles long, and because the original builders realised that traffic levels would never be high, only a single line was provided. Nowadays three intermediate loops allow trains coming in opposite directions to pass each other. Safety of the trains was absolutely ensured by installing a signalling system known as the "single line key token system". This ensured that the driver of a train could not proceed on to the single line until the signalman had given him a large key made of brass (the "key token") which he would remove from the "key token instrument" in his signal box. These "key token instruments" were electrically interlocked in such a way that a second train could not obtain a key to proceed on a line already occupied by a train until the issued "key token" was replaced in the "key token instrument" in the signal box ahead.

How it will operate

Recent dramatic developments in microprocessor technology and mobile radio systems have allowed a completely new concept in signalling and communications to be developed. The microprocessor has reached the stage where not only can it be utilised as a signalling device, but also it can have inbuilt safety and security systems that ensure that the overall safety level is as high as with the key token system it replaces.

By combining microprocessor and mobile radio, there is no longer a need for lineside signalling equipment or for a signalman at each passing loop. One signalman at Dingwall can control the line to Kyle of Lochalsh whilst three passing loops at Garve, Achnasheen and Strathcarron suffice for traffic levels on the Kyle line. Other lines with a greater number of passing loops could still be controlled by one person.

The familiar lineside signalboxes with their multiplicity of levers for controlling the points and signals and the red painted key token instruments from which the signalman obtains the brass key to hand to the driver will vanish. A microprocessor in the one remaining signalbox, at Dingwall, will ensure the safety of the train. The driver of the train will know when it is safe to proceed onto a stretch of single line as, instead of being handed a brass key, a microprocessor in his cab will illuminate an indicator on the loco control panel giving details of the line over which he is permitted to pass.

Coding techniques

The signalbox microprocessor and the train borne microprocessor will be linked to each other by radio. The integrity of the message that passes by radio between Dingwall and the locomotive (as well as the assurance that the message goes only to the locomotive for which it is intended) is achieved by transmitting the locomotive address with associated information in the form of data telegram. Sophisticated coding techniques are applied to this telegram to ensure that any corruption of the original message causes the telegram to be rejected by the receiving microprocessor.

The signalman at Dingwall is provided with a microprocessor based interlocking and associated visual display monitor on which is given the current state of traffic on the line.

Dingwall, consequently, is the pioneer application of microprocessor based signalling on British Railways and a world pioneer of locomotive borne equipment for single line working.

The use of radio allows the elimination of the pole route that has carried communication between the Kyle line signalboxes for so many years. It also gives the locomotive driver speech communication with the signalman at any time in the course of his journey.

Do-it-yourself

Another piece of ingenuity was required by the railway engineers for the operation of points at passing loops. If the signalman no longer existed who would operate the points?

The answer was that the train itself should do this operation, by making the switch blades trailable, i.e. the train would push the blades over as it leaves the passing loop whilst a pre-pressurised hydraulic ram would restore the blades behind the departed train, thus leaving the blades in the correct position for the next train coming off the single line into the loop.

The system will soon be in operation. Trail runs have started and show that it is a success. However, safety is a very important factor and in a remote line reliability of operation is also very important. Extensive testing of the equipment is essential to ensure that these requirements for safety and reliability can be met. This testing has started with Engineers from British Railways Research and Development at Derby and Engineers from the Signal & Telecommunications Department.

By September, trains will be running to Kyle under RETB conditions. The familiar sight of the timber signalbox with a house nearby for the signalman, the mechanical signal arms, the multiplicity of timber telegraph poles and, above all the signalman himself exchanging both the brass key token and a few words with the locomotive driver will have vanished from the scene. The trains, however, will still be there.

LEVEL CROSSING

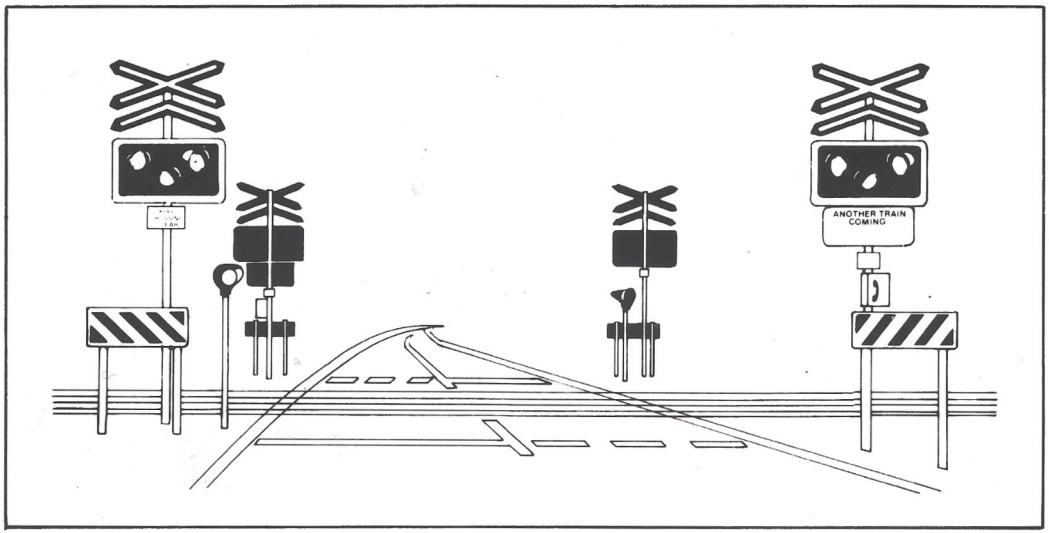
In addition to the visual changes on the lineside there will be changes significantly affecting road users.

The present system has seven manned level crossings where the railway line bisects the public roads. These will be replaced by automatic open crossings comprising the flashing lights in common use elsewhere in the BR network and on the continent. The first of these new crossings has been installed at Strathcarron and will be followed within a year by the remaining six.

The diagram shown below illustrates the new system.

All of these new systems — signalling and level crossings are the physical aspects of the new technology being harnassed to reduce the costs and improve the efficiency of this line.

With the assistance of the Highland Regional Council a programme of station improvements has been implemented.



Scotrail

RADIO ELECTRONIC TOKEN BLOCK