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Signed

Steven R. Cole
22nd September 2006



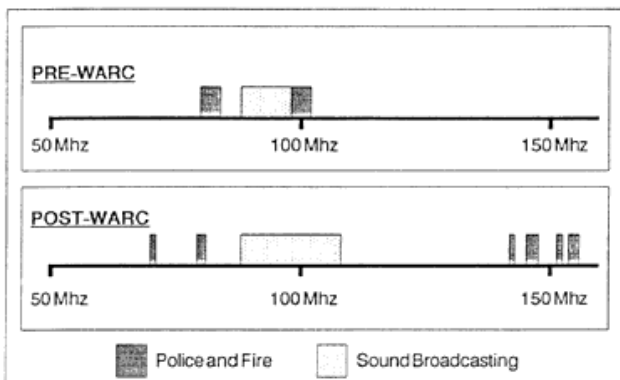
THE WARC PROJECT

The WARC radio conversion programme for Police and Fire services in England and Wales is the largest project ever carried out by the Directorate of Telecommunications.

Described by the Home Secretary as "the most complex engineering project ever undertaken by the Home Office", the ten-year project was highly successful, being completed five months ahead of the internationally agreed deadline.

WARC stands for World Administrative Radio Conference. At their meeting in 1979 this conference agreed that by 31 December 1989 the UK Police and Fire services should change to different radio frequency bands for their mobile radios. On that date their existing frequencies would be made available for sound broadcasting.

PHOTOGRAPH OF POLICE CAR AND OCCUPANTS



The old and new radio frequency bands

Changing radio frequencies involved the preparation of a new national frequency plan, together with the complete replacement of mobile radio equipment. The Home Office project consisted of preparing this frequency plan and designing, procuring and installing the radio equipment for 84 of the 97 Police Forces and Fire Brigades in England and Wales.

A radio replacement programme on this scale had never been carried out before. In capital terms alone, the project was to contain some 235 equipment contracts at a cost of £60 million, including the largest single mobile radio contract ever placed in Europe.

Planning the frequencies was a major exercise in itself. Each force and brigade had to be allocated specific frequencies within the new bands that would minimise the risk of interference with other radio users, as well as between themselves.

A dedicated computer application was used for this, taking account of all known radio users as well as topographical factors affecting radio transmissions.

Despite this careful planning, there was always the risk that interference might be found in practice when transmission started on each new frequency. Forces and brigades would go live at different times, and the risk would increase as the bands became more and more congested towards the end of the project.

However the computerised planning stood up well to the test. Some frequency changes had to be carried out during the course of the project but this proved to be far less than had been feared.

Whilst the frequency planning was taking place the radio equipment had to be obtained. At the outset, discussions had been held with the Police and Fire Services to identify their requirements, and this showed the need for new designs of radio.

Outline designs and performance specifications were prepared by the Directorate of Telecommunications so that contracts could be placed with industry.

Detailed discussions were held with each force and brigade to determine their requirements and allow their specific scheme to be designed. This covered equipment for base stations, hill-top relay sites and vehicles.

Once the manufacturer's design had been approved for each type of equipment, preliminary orders were placed on the basis of the likely quantities needed. Where necessary, further orders were then placed when the scheme designs for all forces and brigades were completed.

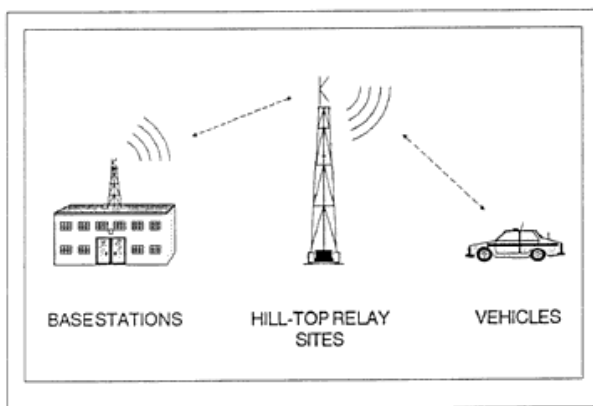
The installation work was carried out by the Directorate's team of engineers and technicians based at ten regional depots across the country. Normally used to the more routine nature of maintaining police and fire radios, the task now facing them was immense.

As each force and brigade could be converted to the new frequencies independently, the installation programmes were staggered to spread the workload. With each depot carrying out installations for between 7 and 10 forces and brigades in total, this kept the project within the scope of the staff resources available.

same time so as not to reduce the operational effectiveness of the force or brigade. When all vehicles had been completed, the old frequencies could be switched off.

By its very nature, hill-top site installation work could easily be affected by adverse weather conditions. Sites had been chosen because of their exposed location, and working several hundred feet up a mast in bad winter weather was simply not possible.

This presented a risk to the project, and contingency plans were laid to recover time lost if it occurred. In



Equipment had to be replaced at some 100 base stations, 350 hill-top relay sites and in around 20,000 vehicles

The overriding need was to ensure that radio coverage was maintained at all times. To do this, the new transmission equipment was installed at base stations and hilltop sites in parallel with the old. Broadcasting then took place simultaneously on both the old and new frequencies whilst the vehicle radios were exchanged. Typically, a vehicle would be out of service for half a day, but only a few could be done at the

event, the comparatively mild winters of 1987 and 1988 meant that these plans did not have to be fully implemented.

But maybe the one key point in the project was simply the number of people involved. Most of the Directorate's 1,000 staff were involved at various stages, working closely with all the forces and brigades in the project.

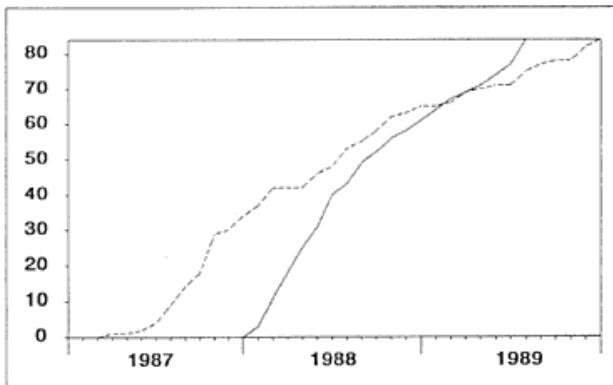
With a project of this size, not surprisingly there were several difficulties and problems that had to be overcome.

The initial process of agreeing the overall scheme with all affected parties and deciding the types of radio needed took two years. A further two years elapsed before the designs of the 80 new radios were sufficiently advanced to place contracts for their supply. Both of these times were longer than had been expected, so by the end of 1983 the project was about a year behind schedule.

During the next three years work continued on designing the individual schemes for each force and brigade. However by now the main emphasis had shifted to the contractors who were producing sample radios for approval. This approval process also took longer than had been expected and by the end of 1986 the project was two years behind schedule.

Even at this stage there were still several risks to be overcome. Some 20 - 30% of the hilltop sites were not owned by the police or fire authorities and needed the owner's

PHOTOGRAPH OF
HILL-TOP SITE



Work to complete the installations for the 84 forces and brigades started late, but then overtook earlier forecasts

approval. Also, many hill-top sites were shared with other radio users and care had to be taken not to interfere with their usage.

A further complexity at some hill-top sites was the need for microwave links. This occurred if the frequency band was too congested in that locality, and each solution had to be specially engineered.

By now there was a real danger that the project would not finish on time. Because the end date had been set through an international agreement it would be very difficult to re-negotiate.

The Home Office therefore decided to introduce a new management approach to the project - one that had been developed over the last 20 years and used successfully on other large projects, but not used before in the Home Office.

A dedicated project manager was appointed, with full responsibility for meeting the project objectives. The 20 or so plans covering different aspects of the work were integrated to form a single project plan consisting of around 17,500

activities. This plan would clearly show criticalities so that management could take action.

A project organisation was prepared, setting out the responsibilities of everyone involved and introducing co-ordinators to lead each of the main parts of the project - design, procurement and installation.

The project plan went live at the end of 1987. Throughout 1988 work was carried out absolutely to the plan. Staff knew what was needed of them and met the demands throughout.

Early in 1988 the final equipment requirements were agreed, bringing the end of the project in sight. By now, most problems were being overcome and the risks diminishing.

The project plan had been prepared leading to completion at the end of September 1989 to give three months contingency. However by the end of 1988 it was apparent that the project was going so well that it could be advanced further still.

On 31 July 1989, five months early, the final cutovers to the new frequencies took place, bringing the project to a successful conclusion.

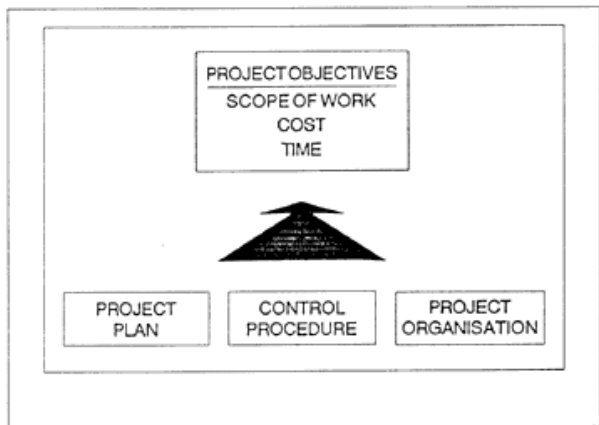
The management approach used in the latter stages of the project was simple in concept, but is known to be highly effective for all types of project if rigorously applied.

There were four fundamentals to this approach - objectives, planning, control and organisation.

Firstly, the objectives were clearly defined, reflecting the business need, otherwise there was no target to go for. This needed to be done in terms of the three main criteria - scope of work, cost and time - as they would pull against one another in the course of the project.

Once the objectives were properly defined the three main elements of project management could be brought into play - a project plan to meet the objectives, a control procedure to ensure that the plan was followed, and lastly a project organisation to execute the control procedure.

The project plan covered more than just the programme for the work. It also contained plans for achieving the other two objectives - the scope of work and the expenditure target. The plan was used not only to register progress, but also to look ahead to forestall problems before they could develop.



The management approach used on the WARC project

The control procedure was based on regular and frequent monitoring of progress against all aspects of the project plan, with agreement on recovery action as soon as any slippage occurred.

The project organisation was needed to co-ordinate all project effort, and was derived from project needs rather than from the line management

organisation. Single point responsibilities were agreed to ensure that all aspects of the project were covered.

When this form of project management was introduced on the WARC project, it involved many changes to previous practices. The Directorate adopted these new ways of working with little difficulty.

PHOTOGRAPH OF
POLICEMAN USING
RADIO BESIDE CAR

"This is a remarkable achievement and one in which all those in the Directorate who have been associated with WARC over the years - in headquarters, in the depots and elsewhere - can take justifiable pride."

Douglas Hurd
Home Secretary