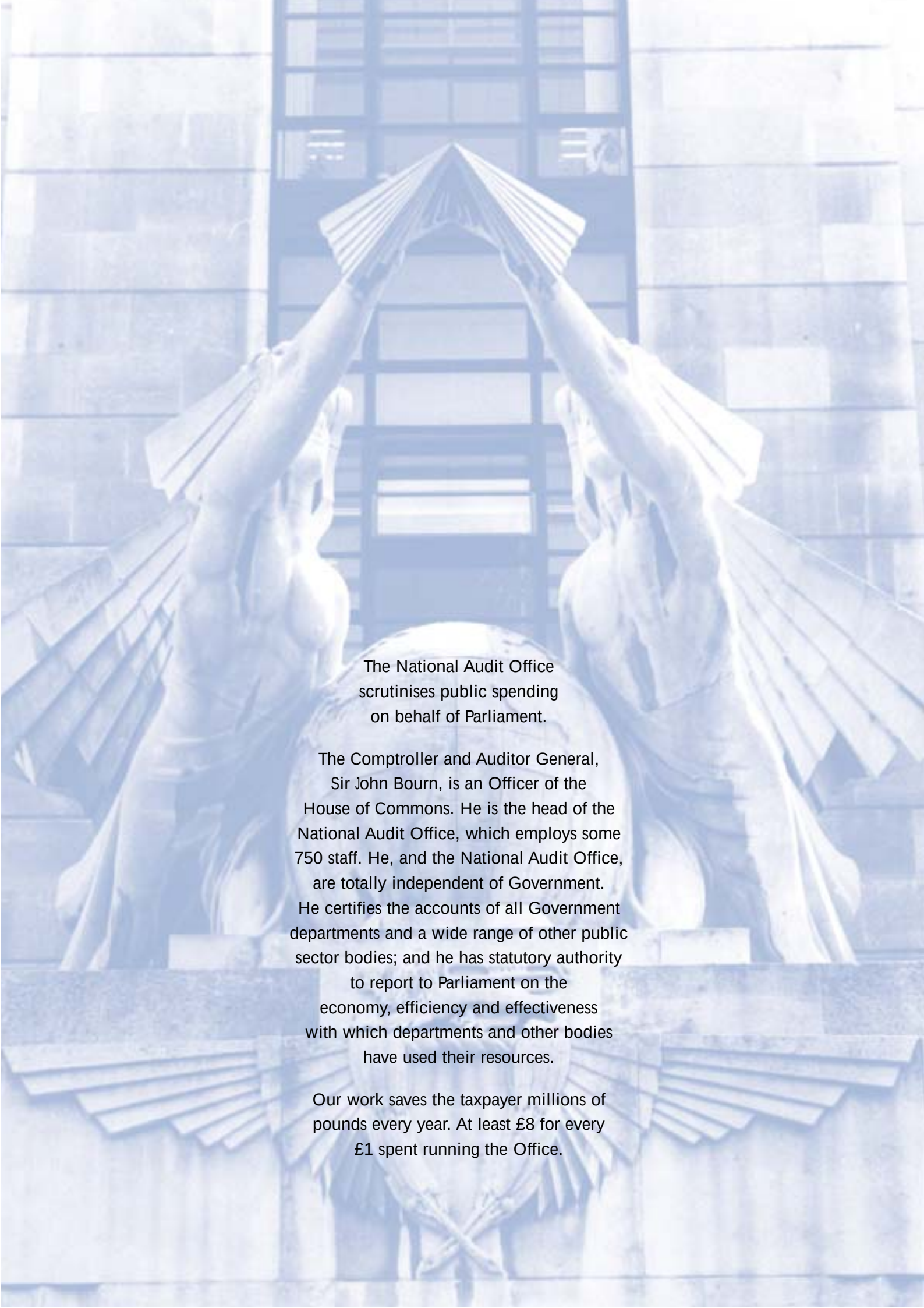
NATIONAL AUDIT OFFICE

Public Private Partnerships: Airwave

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 730 Session 2001-2002: 11 April 2002



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John Bourn
Comptroller and Auditor General

National Audit Office
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Contents

Executive summary 1

Part 1 9

The procurement strategy was well thought through but was not delivered in full 9

The project objectives were clear 9

PITO recognised this as an inherently risky project and took action to reduce the key risks 11

The relatively high costs of Airwave may be offset by wider benefits for the police 14

There is scope for other emergency services to join Airwave but they have yet to do so 15

Part 2

In difficult circumstances, the procurement was well managed by the project team 21

Conditions for a successful procurement were established 21

The interest of bidders was not maintained 24

Benchmarking of prices offered by O2 was moderately successful 24

Negotiations with O2 were problematic 28

The project was subject to external reviews 30

Part 3

A sound implementation plan is in place but risks remain 31

- Good practice for the implementation of IT projects is being followed 31
- The pilot was approved on a conditional basis 34
- Emerging risks continue to be identified and managed 35
- PITO and police forces are working together to realise the benefits expected from Airwave 36

Glossary 39

Appendices

1 Key events during the procurement of Airwave 41

2 Scope and methodology of the National Audit Office's examination 42

Figure 2 illustration by Mark Webb and Tom Owen

executive summary

1 Effective mobile communications are crucial to modern police work. For many years, each police force was responsible for the procurement and maintenance of its own radio communications systems. Many of the systems are based on what is now obsolete technology that does not meet current operational requirements and prevents each police force communicating easily with the other emergency services in its area or with its neighbours. In 1993, following a major review of radio communications in the Police and Fire Services, the Home Office concluded that a new system was required and that it should be procured on a national basis. Furthermore, the new system should be shared by the Police and Fire Services, along with other public safety organisations, if their requirements were met and it was cost effective to do so. An outline business case was produced and bids were sought from the private sector. Subsequently, the Fire Service had reservations about the project and opted in 1996 to be included only as a potential future sharer.

2 In 1998, the part of the Home Office responsible for the project was transferred to the Police Information Technology Organisation (PITO), a Non-Departmental Public Body established to provide a procurement, contract management and advisory service for communications and information technology used by police forces. One of PITO's key objectives in its early years was to take the project forward.

3 In February 2000, PITO signed a framework arrangement with British Telecommunications plc (referred to as O2 in this report[a]) for a new radio service (now called Airwave) across police forces in England, Wales and Scotland by 2004-5. PITO negotiated the contract under the PFI, whereby O2 will design, build, finance and operate the fixed assets used to transmit and receive voice and data signals. The total cost of Airwave during the 19 years in which the framework arrangement will be in place is expected to be some £1,470 million, made up of the first two of the three key services below:

a) **£1,180 million for the Core Service:** all police forces will receive, and PITO will pay for, a guaranteed level of radio coverage and other key services;

a *In November 2001 British Telecommunications plc demerged its mobile communications businesses, including the Airwave contract, into a separate company, O2 plc.*

b) **£290 million for "Menu Exclusive" Services:** police forces will need to purchase services over and above those provided under the Core Service to maintain or enhance their existing capabilities. As a number of these services, such as extra radio coverage and capacity, are integral to the network to be built under the Core Service, O2 will offer them to police forces at standard national prices negotiated with PITO; and

c) O2 and other potential suppliers will be invited to tender for the provision of **"Menu Competitive" Services,** including items such as handheld terminals and control room equipment. Each police force will determine the quantity of equipment and the prices paid will depend on the outcome of locally organised competitions. Estimated expenditure will be £280 million.

4 In this report we examine the prospects for achieving value for money from the negotiation and early implementation of the Core Service, including the pricing of Menu Exclusive Services. The report does not cover operational decisions by each police force on the use of Menu Exclusive Services or the arrangements to conduct local competitions for Menu Competitive items. These decisions will be taken by each police force in consultation with its police authority and are outside the remit of the National Audit Office.

Negotiating a deal was difficult

5 Some 70 companies expressed an initial interest in the project and a number of these joined together to create three potential bidding consortia. These consortia passed a pre-tender assessment, but two decided to merge to produce a stronger bid. Later on, this merged consortium dropped out, following the withdrawal of one of its key technical partners. This left the consortium led by O2 as the sole bidder. As existing radio systems were not meeting operational requirements, there was no do-nothing option and the preferred solution had to avoid delaying implementation of a new radio service. After wide consultation, PITO concluded that continuing with O2 as a single bidder offered the least risk of delay.

6 In the absence of competition and acting on a suggestion by O2, PITO sought to strengthen its negotiating position with the use of a should-cost model. Such a model was expected to provide an understanding of the costs of delivering the service and permit direct comparisons with, and challenges to, O2's estimated costs. To estimate O2's costs, specific information over the duration of the contract was required but difficulties were encountered. For instance, reliable cost information for equipment proved not to be readily available because the technology was new. Nevertheless, the should-cost model was used to challenge O2's costs and both PITO and O2 consider that prices were reduced as a result of these discussions.

7 The cost of Airwave was also compared to a public sector comparator. The comparator estimated the cost that would have been incurred if the public sector were to design, build, finance and operate a new police radio service to the same specification as Airwave. Our examination of the public sector comparator indicated that its value was limited by a number of factors. Concerns as to whether the public sector had the necessary skills and resources to successfully procure such a risky project meant that a public sector comparator was not prepared until 1999 when negotiations with O2 were at an advanced stage. PITO considers that the comparator helped with the assessment of value for money but added nothing to the decision on whether or not the PFI was the most appropriate procurement route. Although a sensitivity analysis was undertaken, the principal output from the comparator was a single number. PITO's financial adviser issued a positive verdict on value for money based on the comparator showing that Airwave, at £1,470, million was cheaper than the estimated £1,610 million cost of a conventional procurement.

Other emergency services have not as yet joined Airwave

8 Although the Home Office saw the Fire Service as part of the procurement from an early stage, the Fire Service itself considered that features of Airwave, such as encryption and roaming, were not needed to meet the operational requirements of fire brigades and were likely to add significantly to the cost. This was a key consideration in 1996, when a decision was taken in consultation with the Home Office, that the Fire Service should not be part of the initial procurement but should be included, with other emergency services, as a potential future sharer. In 2001, a review of Fire Service needs concluded that a regional rather than a national approach to procurement would be pursued. In conducting a series of regional procurements, it was also recognised that open competitions should be held to comply with procurement rules.

9 The review noted the need to specify a requirement for interoperability with other emergency services regardless of which radio systems are procured at a regional level. Individual fire services formed consortia, based on geographical proximity, to determine local radio communications needs and to procure suitable systems. In March 2001, a consortium comprising Devon, Cornwall, Avon, Dorset Gloucestershire Wiltshire and Somerset fire brigades requested tenders for the provision of wide area radio communications and mobile equipment. Although O2/Airwave was one of the bidders, the consortium has since entered preferred bidder negotiations with a supplier of an alternative technology. The decision of the Fire Service not to be part of the initial procurement of Airwave represents a lost opportunity for joined-up working by the emergency services and a loss of economies of scale. Quantification of the loss is problematic, although O2 has told us that it considers any figure would be substantial.

10 Current radio systems used by ambulance services are old and frequently of poor quality. As a result, the Department of Health is planning a national procurement for a new national radio network for ambulance services and other NHS radio users. Unlike the Fire Service, the Department of Health rejected a local or regional approach to procurement because it would not ensure a common standard of communications across all Ambulance Trusts and would necessitate up to 32 separate competitions. Interoperability with the local police forces and fire brigades will be a key requirement of the new ambulance radio system. The procurement will be an open competition and it is anticipated that Airwave will be one of the bidders.

11 The Fire and Ambulance Services are not, however, the only potential sharers of Airwave. The licence for Airwave allows others to join the service provided they are predominantly public safety organisations whose primary function is to respond to emergencies. In negotiating a deal, O2 assumed that sharers would join Airwave and estimated that additional revenues of between £1.8 million and £5.5 million a year might result. These estimates assumed between 3,500 and 12,500 extra radios on the system. As the number of potential users ranges up to 50,000, the additional revenues estimated by O2 appear low. PITO did not succeed in securing a provision for the police to share in the benefits from the take-up of Airwave by sharers. O2 considers that, as no sharers were delivered up-front, it is in effect taking all the risk on this aspect of the deal and should reap all the benefits, if it is successful.

A sound implementation plan is in place but the risks remain

12 A pilot stage was used to test Airwave over a six-month period in Lancashire and other police forces will join the new service through a phased roll-out with thorough testing and validation at each stage. Problems were encountered during the pilot in demonstrating that the required level of coverage had been achieved, particularly on major roads. PITO considered that the deficiencies were significant while O2 believed that there was a problem in measuring coverage and that, in operational terms, any deficiency would not be noticed. The problems led to an extension of the pilot period but were not fully resolved before Airwave was accepted, albeit on a conditional basis. This will allow a substantial portion of the income stream to begin flowing to O2, potentially reducing the incentive to take action to meet outstanding contractual conditions. Nevertheless, the service has been running successfully in Lancashire and PITO has been particularly careful to seek financial recompense for any failure to deliver, as well as retaining an option to step back to pilot status if key elements of the contractual requirements are not resolved within an agreed time frame.

PITO and police forces are working together to realise the benefits expected from Airwave

13 A review on behalf of the Association of Chief Police Officers concluded that, for the English and Welsh forces only, Airwave will involve additional expenditure of some £300 million over the contract period when compared against a series of less ambitious, locally procured systems. During the procurement, many police authorities considered that Airwave was prohibitively expensive, with some claiming they might need to reduce officer numbers in order to pay for the new service. The extra cost has been justified on the grounds that Airwave has the potential to enhance the efficiency and effectiveness of the police. Prior to the development of a full business case, police forces were asked to examine the potential impact of a new radio service on their efficiency. The results indicated that around 37 per cent of uniformed officers' time is spent in the police station. By reducing the need to return to the station for activities such as data checks and telephone calls, Airwave is expected to bring about at least a 10 per cent saving in time spent in the police station.

14 This early research might have been built on sooner. Although there was a clear intention to seek additional benefits, further work was not progressed until after contract signature as there were insufficient staff available to PITO at the time. In 2001, PITO established a Business Benefits Steering Group to develop a learning package that will allow police forces to implement Airwave in such a way that benefits will be achieved. But disentangling the effects on police performance due solely to Airwave will be difficult, as numerous other initiatives aimed at improving the efficiency and effectiveness of the police are also being implemented by PITO at the same time.

Lessons Learned

15 It is too early to reach a conclusion on whether Airwave will bring about all of the benefits envisaged. The three emergency services currently have radio systems which do not allow full interoperability between them. Following the implementation of Airwave, this will still be the case. Police forces will all be on the same national system; ambulance services will be on a national system, which may or may not be Airwave; and the fire brigades may be operating a number of local systems, some of which may be Airwave, some not. It is unfortunate that the potential economies of scale of a single procurement were not realised but, more importantly, the events in the United States on 11 September 2001 make it all the more important that all our emergency services have the best communications and information sharing capability.

16 Nevertheless, it is apparent from our examination that, in difficult circumstances, a range of complex issues had to be addressed and that PITO handled the negotiations with O2 on behalf of more than 50 police forces and their respective authorities in a competent manner. There are a number of important lessons to be borne in mind for future public-private partnerships.

1 Decisions on whether or not to go ahead with a single bidder must take full account of whether it will be possible to gain adequate assurance of good value

Full competitive tension in any procurement will usually ensure that the deal on offer is the best available in the market at the time. In the absence of competition, PITO put in place a should-cost model and started to prepare a fallback option to put pressure on O2 during negotiations. The use of a should-cost model was successful and should be followed by other departments when faced with a single bidder situation. For such a strategy to work effectively, it is essential to get the full co-operation of the bidder and to allocate adequate resources to analyse and interpret what will be complex calculations.

2 A public sector comparator can play a part in judging value, but a single-figure comparison with the price offered by a bidder cannot be relied upon

PITO used a public sector comparator as an element of a toolkit of methods to justify going ahead with Airwave on the basis that it would cost less than a publicly funded and managed procurement which delivered the same benefits. Because of the inherent uncertainty of forecasting 19 years into the future, it was very unlikely that a single figure output from the comparator would have been sufficiently robust to provide assurance on value for money.

3 To remove uncertainty in the pricing of a PFI deal, the number of sharers for a service should be settled as early as possible

The cost of building the fixed assets for Airwave will be borne by the police. If large numbers of additional emergency service and public safety sharers decide to join Airwave, O2 stands to make substantial gains but the police will get nothing in return. PITO attempted to negotiate a clawback of part of any additional income earned by O2 but were unsuccessful as no sharers for the service could be guaranteed. O2 argued that it had assumed Airwave would be used by customers other than the police and had priced this into the deal. As it was taking all the risk on this assumption, O2 refused to share any future income that would result from the use of the system by other customers. However, the number of additional customers for Airwave was, and remains, uncertain and there is little clear evidence of the effect, if any, on the pricing of the contract.

4 In most cases a pilot project should not be accepted if further work is needed to demonstrate that the service will be delivered in full compliance with the contract

If a pilot project is necessary to demonstrate that a PFI project will deliver, it is crucial that what is required can be measured accurately and, when measured, that delivery has been fully demonstrated before a green light is given to proceed. PITO faced difficult problems with Airwave in that it was based on new technology for which satisfactory measurements of coverage had not been fully developed before the pilot got underway. When O2 appeared to fail against one of the key measures, PITO could not be sure whether the results pointed to an acceptable or unacceptable level of service. Under time pressure, PITO gave an amber light to O2. In doing so, PITO saw the key issue as whether an improved service was being provided which could soon be brought to the contractual levels required. To encourage this to happen, PITO ensured that O2 would suffer financial penalties if certain conditions were not satisfied within an agreed timescale. In addition, other police forces are unlikely to take Airwave if it does not pass their acceptance testing and O2 would lose more of its revenue stream. Although PITO retains the right to terminate the contract, this seems unlikely as increasing numbers of forces take up the service.

5 The benefits expected from a PFI project go wider than cost savings in delivering a service and need to be understood fully

Value for money depends on more than just price. Business cases often make use of anticipated benefits to justify a deal, but more often than not, make little effort to quantify them as far as possible or set out a clear methodology to ensure they are achieved. When procuring a step change in technology, such as Airwave, it must make sense to develop mechanisms to ensure that the maximum possible benefits are obtained for what will be a considerable investment of public money. This requires the allocation of resources up front to analyse performance before the service is introduced. In this deal, such investment was not undertaken either early enough or in sufficient depth during the procurement. PITO chose instead to focus resources on ensuring that the new network would meet police requirements and on encouraging police forces to use Airwave as a platform for changes in working practices. In PITO's view, this should, along with other IT projects underway, maximise future operational benefits for the police. Since contract signature and following the establishment of the Business Benefits Steering Group, PITO is now taking this work forward.


Fishergate
FIRE EXIT

Part 1

The procurement strategy was well thought through but was not delivered in full

PITO and the Home Office set clear objectives for the procurement and remained aware of the risks involved in procuring such an advanced IT based radio communications system. But the original intention of procuring a system for the Police and Fire Services was not achieved. Although Airwave was designed to meet specific police needs, it is suitable for other emergency services if they decide to join. Airwave will cost more than previous radio systems but it is expected to provide additional benefits.

The project objectives were clear

1.1 The PFI can offer the prospect of better value for money than conventional procurement because it adds a wider range of private sector capabilities to those previously available to the public sector. For this to work, the private sector needs to be given the greatest possible scope to apply its skills. This means that, in specifying what they want from PFI deals, procuring departments need to avoid imposing unnecessary constraints on how the private sector carries out projects.

Existing radio systems suffered from severe operational limitations

1.2 During the 1980s, the Association of Chief Police Officers in England and Wales asked the Home Office to investigate and develop a strategy for the provision of modern radio systems for the police. This request was a key factor contributing to the initiation of the Major Review of Radio Communications in the Police and Fire Services of England and Wales. Its recommendations were endorsed by the then Home Secretary in April 1993. The police and fire services in Scotland carried out a similar review, which produced broadly similar results.

1.3 The reviews reported that existing police radio systems did not meet requirements. In England and Wales, the limitations were considerable. Radio systems were inflexible and suffered interference from continental radio transmissions, functionality was limited and the systems were unable to provide adequate capacity and coverage. **Figure 1** lists identified deficiencies.

1 Problems with existing police radios

Congestion	Existing radio channels are often very congested, with police officers unable to gain access when required. As a result there is a considerable level of suppressed demand because police officers do not communicate on routine matters. More importantly, police officers sometimes lose the ability to call for rapid response when required.
Flexibility	Allied to the problem of congestion, current radio systems are inflexible. Capacity cannot be re-assigned quickly to overcome congestion, or, when necessary, provide command and working-level channels.
Security	The majority of police radio systems are unencrypted and messages can be intercepted with simple scanning receivers available cheaply from high street stores. This can result in police operations being called-off, as suspects, monitoring police radio traffic, become aware of police surveillance.
Interference	Interference from commercial continental radio users causes severe problems to police radio systems in the south and east of England and some way inland (to the extent that the West Midlands Police Force told us that it too suffered from radio interference).
Operational	With vehicle-mounted radios operating on a different radio frequency to handheld radios, police officers in vehicles are frequently unable to communicate with police officers on foot, without the use of a second radio.
Roaming	Lack of support for regional and national roaming prevents police officers maintaining radio contact with their control rooms when outside their force areas. This is particularly relevant for organisations such as regional crime squads, which need to operate across force boundaries.
Management Information	Lack of information on the status and location of police officers can inhibit the ability of commanders to make operational decisions on, for example, deployment of police officers.

Source: Home Office

Planned changes to the radio spectrum and the age of existing radios meant that new systems would have to be procured

1.4 To tidy up the use of the radio spectrum and release a larger part of it to commercial organisations, the Government announced in the early 1990s that the emergency services intended to surrender access to their existing radio frequencies after 2004. With responsibility for the provision of radio communications resting locally in all services, each local body would have to replace its existing systems in the absence of any other solution. In any event, many police radio systems would have had to have been replaced before 2004 because they could not be expanded or upgraded. Spares were proving increasingly difficult to obtain and maintenance costs were rising. In the mid 1990s, some police forces were using systems that were already more than 15 years old, while only two forces had radio systems that were less than five years old.

A number of procurement issues were considered

1.5 The main recommendations of the reviews were that the Police and Fire Services required new systems and that the provision of these should be directed on a national basis. Furthermore, the new systems should be shared by the Police and Fire Services, along with other public safety users, if their requirements were met and it was cost effective to do so. To put these recommendations into effect, the Public Safety Radio Communications Project (Airwave) was initiated. A number of issues were considered.

1.6 **National vs. Regional:** The Home Office extensively researched, and consulted with the radio industry, on the options for procuring new systems on local, regional and national bases. Local procurements were discounted, since they were unlikely to achieve any economies of scale in the costs of procurement or in the prices to be paid for the new systems. There were significant obstacles to a series of regional procurements. The absence of a European standard for the interfaces between systems meant that it might not have been possible to link police forces together under a common system and maintain adequate levels of security through encryption across the UK. In addition, procurement and development costs would have been duplicated in comparison with a single national project. A national project was the preferred option but was not without difficulties. For example, the interests of over 100 stakeholders would have to be managed.

1.7 **Central procurement with peripheral equipment procured locally:** In order to implement a national strategy for renewing radio systems, the Home Office decided to run the procurement centrally. However, police forces would procure their own peripheral equipment such as handsets and control room equipment.

1.8 **TETRA was chosen as the best technology to deliver the project objectives:** Various technologies were considered for the new system. Research involved extensive market consultation and co-operation between PITO and manufacturers to ensure that the best available technology would be used. The GSM digital cellular standard (i.e. similar to mobile phones) was not considered to be suitable, since it would not have met several fundamental requirements. For instance, it would not allow rapid call set-up, so police officers would have to wait for a call to be processed rather than gaining immediate access to the system. It would also be difficult to reconfigure user talk groups while in the field and the efficiency of the use of the radio spectrum would be poor, compared to alternatives. Most of the other options assessed were proprietary and consequently would only offer one potential source of supply. Digital trunked products, conforming to the European TETRA (Terrestrial Trunked Radio) standard, designed specifically for public safety and professional users, emerged as the best option. TETRA products were expected to have the greatest spectral efficiency, and were expected to meet other needs, such as speed of call set up and the flexibility to set up and change the membership of talk groups. Although TETRA products are now available, in the mid 1990s, only pre-production forms of TETRA equipment existed.

1.9 **Use of the Private Finance Initiative:** The use of the PFI was seen as a way of engendering innovation by allowing the private sector to develop solutions for the new service. To support this, each short listed bidder would be contracted to produce a project definition study. The bidders would be provided with copies of the functional specification for the service and available service level requirements. Using this information, they were to research, plan and design their systems for delivering the required service. In effect, bidders would be granted an early opportunity to use innovation in the design, maintenance and operation of the network. A further reason for the project definition studies was that the Home Office wanted to evaluate technical proposals to assure itself that the design of the winning bidder's system was justified.

PITO recognised this as an inherently risky project and took action to reduce the key risks

1.10 The systems underpinning Airwave are IT dependent. Many IT projects in the public sector have encountered problems that resulted in failures to deliver in terms of cost, timeliness or quality of service. The risks are particularly high where the technology itself is new and estimates of the development time needed are very subjective. PITO understood from an early stage that the size of this deal, the number of stakeholders involved and the risks associated with implementing new technology would require careful management.

1.11 In the case of the Airwave project, the intention was always to upgrade to a superior but not fully tried and tested level of technology. There were also two deadlines putting additional pressure on PITO and the project. First, Greater Manchester Police needed the new radio communications service in time for the Commonwealth Games in July 2002. Second, police forces had accepted the need to vacate that part of the radio spectrum in which their systems operated. PITO identified risks inherent in the project as well as the risks of not meeting these deadlines at the start of the project and adopted a structured approach which included the use of a pilot (see section 3.1), a focus on meeting objectives and on ensuring that issues such as training had been properly planned.

Flexibility for local police forces was built into the structure of the deal

1.12 PITO divided Airwave into three parts:

- **The Core Service** - This service would be provided exclusively by the contractor with universal features across Great Britain set at a level just below that required to meet all operational requirements (see **Figure 2** overleaf). The contract for the Core Service would be between PITO and the contractor, with PITO paying the contractor directly for the service. The Core Service would provide:
  - interoperability between police forces;
  - economies of scale;
  - support for national police users such as the National Crime Squad and potential sharers; and
  - subject to availability and performance, an assured revenue stream for the contractor.
- **Menu Exclusive Services** - These services would be provided exclusively by the contractor from a call-off menu of additional services that augment the functionality of Airwave above the Core Service. Each police force would identify its local needs, for instance where it required enhanced coverage that allowed the use of handheld radios in an urban area or more capacity for simultaneous transmissions (see **Figure 2**). Each police force, through its police authority, would enter a tripartite agreement with PITO and the contractor for the provision of Menu Exclusive Services. Under these agreements, police forces would purchase their required additional services directly from the contractor. The price for each Menu Exclusive Service would be set nationally.
- **Menu Competitive Services** - These services would be for the supply and maintenance of terminals (vehicle-mounted radios, handheld radios and mobile data terminals) and control room equipment. Forces would conduct their own competitions for the supply of these services.

Splitting the service in this way was expected to reduce some risks associated with the project. Payment by each police force for its Menu Exclusive Services should bring local value for money disciplines to bear in determining local needs. The Menu Competitive Services would avoid locking police forces into a contract with a single supplier for equipment for which there would be an established market in which prices were likely to fall over the replacement cycle. However, this division also created risks that fault allocation and responsibility for rectification would be obscured by contractual interfaces. O2 has told us that this risk has materialised and has, so far, not been easily resolved.

Obsolescence was, and will remain, a constant concern

1.13 Radio communications is a fast-moving area in which current systems can quickly become obsolete. Careful thought must be given to whether the technology will still be usable by the end of the contract, whether it will be compatible with other relevant technology and whether there are provisions for upgrading the system should obsolescence become a problem.

1.14 In late 1998, the Home Office asked PITO to engage an independent expert in the radio communications field to review the project. An appropriately qualified academic was appointed to carry out a strategic validation review. This work involved assessing the police requirements and whether O2's proposed strategy for delivering the service was technically reasonable in the light of the then current and foreseen technological environment. The review concluded that the user requirements were reasonable and well enough scoped to permit the exploitation of future radio communication capabilities and opportunities. The review could identify no potentially relevant mobile-phone or dedicated mobile communications system, available at the time or in the near future, that could provide an operationally acceptable service as cost effective as Airwave.

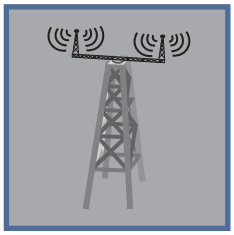
2 Radio coverage and capacity of the Core and Menu Exclusive Services

KEY

CAPACITY

A police force joining Airwave will receive a grade of service across its geographical area based on a greater than 87 per cent probability that an officer wanting access to Airwave would receive a channel without having to queue. This is linked to the capacity within the network. O2 will provide capacity at each base station to ensure that the grade of service is met when voice and data traffic levels sum up to:

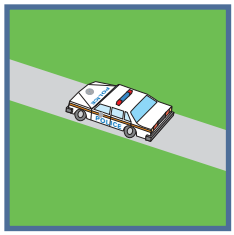
- The 95th percentile of the highest level of busy hour traffic (voice and data) measured at the base station over the previous 12 month interval;
- Extra capacity purchased by the force directly from O2 for high risk locations such as football stadia; and
- Additional capacity provided by O2 to cater for local traffic surges and to assure members of national roaming organisations, such as the National Crime Squad, that the network can support their needs.



The overall tariff for capacity will be related to the number of traffic units consumed. Included in the unitary charge for the **Core Service** is an allowance for a certain number of traffic units. If the force uses more units than covered by the allowance, it will pay for these as a **Menu Exclusive Service**.

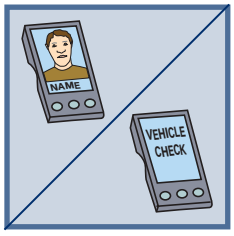
COVERAGE

Core Service



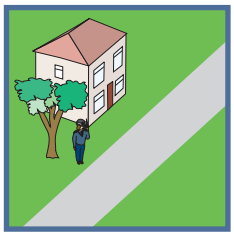
The police force will receive the Core Service across its geographical area. For the agreed unitary charge, O2 will guarantee the geographical coverage of the Core Service to service levels specified in the contract regardless of the number of base stations required to meet this obligation. The guaranteed coverage will provide police officers using vehicle-mounted radios with voice and data communications across the force's geographical area.

Some guaranteed coverage to handheld radios will be available. The force will have some say about the distribution of this guaranteed service over its geographical area.

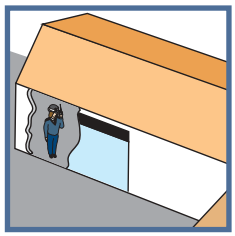


Police officers will be able to receive and transmit non-voice data. The speed of data transmission will limit this facility, in practice, to small sized parcels of data.

Menu Exclusive Services



The guaranteed handheld coverage provided under the Core Service will meet only some of the force's need for this service, which will be determined by the force's need to operate foot patrols. To meet its requirements for guaranteed handheld coverage, the force will purchase this additional coverage directly from O2.



Where the police force requires its officers to operate inside buildings on a regular basis e.g. shopping malls, the force can purchase guaranteed in-building penetration of Airwave from O2.


NAME
VEHICLE CHECK
MALL

1.15 PITO made efforts from the start to ensure that upgrading was enshrined in the contract. Because TETRA is an emerging technology, the need for upgrades, particularly at the beginning of the service, was readily apparent and was provided for in the contract. To derive most of the expected benefits, Airwave would also have to be compatible with changing police computer systems and databases.

Maintaining expertise will be important

1.16 Effective mobile communications are crucial to successful police work. Having outsourced its radio functions, the police risk losing their current skills and knowledge in this field. This puts a greater onus on PITO to provide technical assistance in future procurements. PITO is building up its own independent radio engineering section with this need in mind. While the police forces will remain experts in what they want from their communications systems, it is unlikely that most forces will, in future, have the technical capability to procure new systems individually.

The relatively high costs of Airwave may be offset by wider benefits for the police

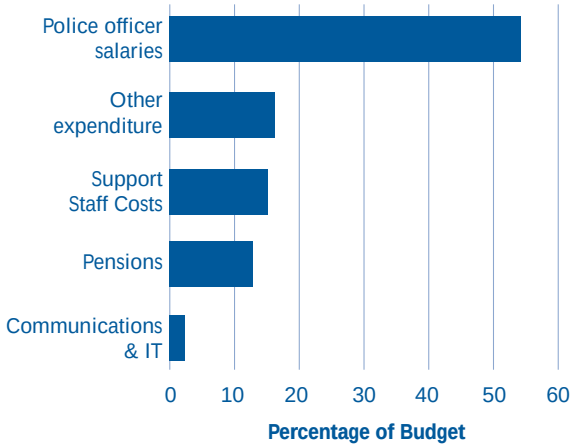
1.17 Airwave will solve the existing problems with radio communications, but will cost more than double the current spending on existing systems. Many forces have been under-providing for their communications systems for several years, partly in anticipation of Airwave, which may account in part for this disparity. Airwave will also cost significantly more than a series of separate replacement systems procured by individual forces, although some of the key functions offered by a national system would not be provided by local procurements. PITO considers that any modern radio system would be relatively costly, but that Airwave should deliver additional benefits that justify the additional costs.

Airwave should solve the problems with existing communications but will cost considerably more

1.18 Problems with existing communications systems should be solved by Airwave by the end of the roll-out period in 2004-5. Early indications are that the quality of voice transmissions is greatly enhanced in the new system. Short text messaging, talk groups, encryption and emergency buttons are already enabled and the contracted level of coverage will be guaranteed once agreement is reached on measuring it. Full national roaming is to be provided by 2004-5 when the entire infrastructure has been built.

1.19 Airwave will be considerably more expensive than operating either existing systems or new locally procured systems. Because many police forces do not disaggregate their spending on radio communications from other IT systems, it is difficult to determine accurately what forces currently spend on their existing systems (see **Figure 3**). As part of the Business Case for the project, PITO estimated that, on average, forces were spending 0.8 per cent of their annual budget. The Airwave service would cost approximately two per cent of the annual budget or £180 million a year.[1]

3 Breakdown of Police Spending



Source: CIPFA Police Statistics

1.20 The average figure for expenditure on radio systems hides wide variations between individual police forces. PITO considers that, in many cases, forces had under-provided in this area for a number of years because a national system was anticipated. However, some forces procured more sophisticated systems, for example, Metradio for the Metropolitan police and Starnet for Staffordshire police, even though plans existed for a national project. These forces successfully argued that their operational needs were so pressing that they could not afford to wait. The cost of these local systems is approximately one third of the Airwave system, however they still use analogue technology and do not provide the enhanced functionality of Airwave, such as encryption or data transfer. They also do not have the facility for national roaming and so would not meet all of the criteria laid out in the major review.

1.21 Although there was widespread support for the introduction of a new radio service, the cost of Airwave was thought by many police authorities to be prohibitive. There was a prolonged period of consultation and lobbying for additional funds, with some authorities claiming they might need to reduce officer numbers in order to pay for Airwave. Several authorities initially refused to sign their Airwave contracts, claiming they had an obligation to pursue

1 This figure is the total annual charge to the police and PITO for Core and Menu Services at the end of the rollout period expressed in 1999 prices. Airwave will cost a total of £1,470 million over the contract period, discounted at 6 per cent real to 1999.

local best value not national best value and that Airwave would involve, for English and Welsh forces only, additional expenditure of some £300 million, when compared against a series of less ambitious, locally procured solutions (see paragraph 2.40).

1.22 In July 2000, the Government announced the allocation of £500 million for Airwave over the first three years of the contract. This new money will pay for all Contracted Core Service costs and will make a significant contribution to capital and revenue expenditure as well as other costs associated with implementation, such as training. Following this allocation of funds, all the police forces of England and Wales signed up to the Airwave deal.

There may be additional and longer-term benefits which offset the additional cost

1.23 PITO considers that Airwave has the potential to provide technological solutions that enhance the efficiency and effectiveness of the police. Airwave is not just a high quality radio system but also a platform upon which other technologies can build. Police forces are focusing on the ability of police officers to access data systems, such as the police national computer, and possibly to file reports while on the beat. PITO regards the system as an enabler that can reduce the frequency with which police officers have to return to the station and the length of time they spend on tasks such as making telephone calls or receiving briefings, although initially not all forces were convinced that all the benefits envisaged would materialise.

1.24 Representatives of Thames Valley and other police forces which conducted initial benefits analyses for the project consider that the most important gains will arise from senior officers having an overview of officer deployment and being able to keep in touch while on the move. They also anticipate the development of new ways of working which allow for a much closer interaction with the community and higher police visibility. Mobile "Police Office Centres and Stations" are envisaged in which Airwave will be a key factor in enabling officers to spend less time in the station and more time on patrol.

1.25 Harmonisation of technology nationally will reduce the costs of changing force boundaries. Although boundary changes between forces are not common, they do occur. Because of the differences in current radio systems between neighbouring forces, enlarging radio provision can be problematic, involving as a minimum the procurement of additional radio terminals and frequently requiring additional base stations or other infrastructure. Clearly there is an associated cost in making these changes, but more importantly, some systems are obsolete and additional radios are simply not available.

1.26 Recent changes to the boundaries of the Metropolitan police force required changes to the radio systems of three neighbouring police forces at an estimated cost of around £1 million. Such boundary changes should be easier to implement under Airwave and should cost less. Talk groups would need to be reconfigured but the common infrastructure would already be in place. Additional radio terminals would be easily obtainable and officers, already familiar with the Airwave system, would need little or no training.

There is scope for other emergency services to join Airwave but they have yet to do so

1.27 One of the key recommendations of the Major Review was the procurement of a radio system which could be used by all the emergency services. Airwave was procured with this requirement in mind, although at the time the contract was awarded the police were the only customer. The scope remains for other emergency services to choose Airwave as their radio system following competitive tender. Airwave has now been selected as a replacement radio system for the Ministry of Defence Police and is one of the bidders in competitive procurements by a number of fire brigades at a local or regional level.

Despite an intention to include the Fire Service, the procurement was restricted to the police

1.28 Because police requirements for a radio system are demanding in terms of coverage, reliability and flexibility, providing for the needs of sharers should not be problematic. Nevertheless, the Fire Service considered that features of Airwave, such as encryption and roaming, were not needed to meet the operational requirements of fire brigades and were likely to add significantly to the cost. This was a key consideration when a decision was taken in 1996, in consultation with the Home Office, that the Fire Service should not be part of the initial procurement but should be included, with other services, as a potential future sharer. Therefore, the Fire Service remained a key player in a major sharers' forum. This body was set up by PITO to represent the interests of, and provide information to, organisations other than the police that might reasonably be expected to want to join Airwave.

1.29 In determining the provision of new radio communications, the Fire Service had to consider whether Airwave or alternative arrangements would provide best value and how differences in the legislative positions of the Fire and Police Services would affect the procurement. Fire authorities were in the same position as police authorities in seeing the cost of Airwave as

likely to be prohibitive and not providing value for money at a local level. Statutory responsibility for radio systems and for securing best value rests with local fire authorities which, unlike police authorities, do not receive a specific grant from central government. The powers and funding arrangements which the Home Office would be able to use to secure a national system for the police were not replicated in the legislation governing the Fire Service.

1.30 In 2001, the Fire Service published the results of a separate review of their own communications needs that concluded that a regional rather than a national approach to procurement would be preferable, particularly given the Fire Service's less demanding operational requirements. A single procurement on behalf of 50 fire brigades would be complex and difficult to organise. A local-level approach could help to maintain a competitive marketplace and value for money decisions would reflect local needs. After the publication of the Fire Service's independent review of its radio options, Home Office Ministers considered whether fire authorities might negotiate with O2 to take Airwave without further competition. However, advice was received from the Department of Trade and Industry and the Office of Government Commerce that not going out to competition would be a breach of procurement rules. As fire authorities could not be compelled to hold a national competitive procurement, Ministers decided to support the regional procurements that the Fire Service wanted with a recommendation for interoperability between neighbouring brigades and with other emergency services.

1.31 Failure to be part of the Airwave system from an early stage represents a lost opportunity for joined-up working by the emergency services and a potential loss of economies of scale during the procurement of Airwave. Quantification of the potential loss to the public purse because the Fire Service did not join up at the start is problematic, although O2 has told us that any figure would be substantial. On the other hand, waiting to determine the outcome of new technology implementations can be a prudent measure because it avoids the risk of all the emergency services being committed to what was an untried and untested system.

Other emergency services can become sharers of Airwave

1.32 Radio communications services in the UK require a Telecommunications Act licence from the Department of Trade and Industry (DTI). They also need a licence from the Radiocommunications Agency[2] specifying which part of the radio spectrum is covered and what use is to be made of it. The Telecommunications Act licence for Airwave was drawn up by the DTI in consultation with other official bodies such as the Office of Telecommunications (Oftel), as well as potential stakeholders and the communications market. The licence requires sharers to be predominantly public safety organisations, that is their primary function is to respond to emergencies. Organisations that meet this criterion are listed in **Figure 4**. Where only part of an organisation has a public safety/emergency response role, only that part of the organisation will be allowed to use Airwave.

1.33 The Telecommunications Act licence allows changes to be made to the list of sharers at the discretion of the Secretary of State for Trade and Industry and subject to a formal public consultation period of 28 days. Prospective sharers must show that they have a legitimate operational requirement to interact directly, instantly and frequently with the police and other emergency services.

1.34 O2 lobbied for a wider interpretation of public safety and a longer list of sharers to include some of the privatised utilities such as electricity, gas and water. DTI rejected this request on the grounds that the spectrum allocated to O2 for Airwave is designated for use by emergency services only. Allowing commercial users, with only a marginal public safety role, to use Airwave would alter the terms of the original competitive procurement for the provision of a public safety radio service. Furthermore, increasing the list of sharers would have been unfair to commercial TETRA service providers who had bid for their licences in open competition, and who had reasonable expectations that utilities and Local Authorities would form a substantial portion of their potential customer base.

Although sharers are expected, the police will not share in the benefits to O2

1.35 In offering a price to the police for Airwave, O2 assumed that sharers would join the service and modelled the probable income under both favourable and restricted licence conditions. The modelling for the restricted licence, which accords with the actual Airwave licence, indicated additional revenues of between an almost certain £1.8 million a year, with few sharers, and £5.5 million a year. Based on current pricing for radio access alone, this assumes between 3,500 and 12,500 extra radios on the system but this does not take into account any fixed charges, heavy user charges or optional services, such as data applications. Given that the number of potential users allowed under the licence can be up to 50,000, the income from sharers estimated by O2 appears to be quite low. However, the output from the model is unclear and is not a suitable basis on which to accurately estimate likely sharer revenues.

2 *An Executive Agency of the DTI*

4 The list of allowable sharers on Airwave

The Key Allowable Sharers on Airwave

Civilian Emergency Services	Ministry of Defence Organisations
British Transport Police	MOD Police
Ports Police	Navy Police
UK Atomic Energy Authority Constabulary	Royal Parks Constabulary
Borough Parks Police	RAF Police
Waterway, Tunnel and Airport police	Royal Marines Police
Fire Brigades	Royal Military Police
Airport Fire Brigade	Adjutant Generals' Corps - Provost Branch
Air Ambulance	Defence Fire Service
NHS Community Trust Staff	Army Fire
NHS Hospital Trust Staff	RAF Fire
Private Ambulance Services	Navy Fire
Donor organ and transplant team transport	RAF Ambulance
Patient Transport Services	Navy Ambulance
Coastguard Service	Army Ambulance
Air and Land Search and Rescue Services	Armed Forces' bomb disposal teams
	HQ London (Army Regional Brigade)
	Intelligence Corps
	RAF Nuclear Accident Response Organisation
	Security Services
	Special Forces
	Firing Range Security

Other public safety and emergency response services	
CCTV control rooms (under certain circumstances)	Traffic Wardens
Prison Service	Nuclear Accident Authority
Private Prisoner Transport	On-Site Fire Services (Magnox and BNFL sites)
Privatised Police Patrols (including stadia and complexes)	Volunteer First responders
Post Office Security and Investigation Service	Fraud Investigation Section of Department for Work and Pensions
Customs and Excise enforcement branch and National Investigation Service	Home Office Fire and Emergency Planning fire appliances and assigned personnel
EA Environmental Crime Unit	Immediate Care Schemes (eg. BASICS)
Environment Agency Enforcement Officers	Inland Revenue Special Compliance Office
UK Immigration Service - Ports and Enforcement Directorate	Local Authority Emergency Planning Departments
National Nuclear Accident Response Communications System replacement	

Source: Department of Trade and Industry

1.36 What is clear is that there is no provision in the contract for the police to share in the benefits from a higher than expected take-up of Airwave by sharers. O2 claims that, as no sharers were delivered up-front by PITO, O2 is in effect taking all the risk on this aspect of the deal and should reap all the benefits if it is successful. O2 is currently offering Airwave to sharers in the form of a voice service with guaranteed coverage. There is a basic annual charge plus an additional charge per radio connected to the service **(Figure 5)**. Where additional functionality or coverage is required, it is subject to additional charges. As the police are not charged on a per radio basis, a direct comparison between sharer and police expenditure on Airwave is not possible.

Other emergency services are reviewing their communications requirements

1.37 Although only the police signed up to Airwave from the beginning, the possibility remains that sharers could join the service in due course. All the emergency services are affected in some way by the need for radio spectrum efficiency and many are taking the opportunity to update their existing radio systems. Airwave is being actively considered as a radio system for the Ministry of Defence, fire services and ambulance services.

Ministry of Defence

1.38 The Ministry of Defence Police (MDP) has been part of the Major Sharers' Forum from its inception and is likely to become the first sharer on Airwave. It is a police force in its own right and interacts frequently and closely with other police forces across the country. However, the MDP is not the only part of the military with a primary public safety function or a legitimate need to act in consort with local police forces. Others such as the Navy's Fire and Police Services, the Provost Branch and the Armed Forces' bomb disposal teams are also included as allowable sharers in the Airwave licence.

1.39 As the Airwave project progressed, the Ministry of Defence (MOD) entered into negotiations with O2 about the terms of a framework agreement. This was finalised in July 2001 and allows MOD purchasers to select Airwave from a range of possible alternatives on offer through the Defence Communications Services Agency. Current MOD policy is that as existing radio systems for MOD emergency services are replaced, the new system should be Airwave. O2 considers that there are in the region of 17,000 potential MOD users. If they all take the service for 10 years this would cost the MOD more than £6 million a year. Only the MDP has a firm intention to join Airwave immediately. It has around 3,500 officers and expects to spend £1.5 million a year on Airwave.

Fire services

1.40 Local fire services are being encouraged to form consortia, based on geographical proximity, to determine local radio communications needs and to procure acceptable solutions. In this way the costs of procurement, while not as low as for a single national procurement, will be lower than for 50 separate procurements. There will also be a degree of interoperability between neighbouring brigades in a consortium, since they will have obtained the same technology. Local decision making means that local needs will be met but there will not be a common standard across the whole country. This reflects the fact that fire appliances generally do not need to communicate beyond their own local authority boundaries. But there is also the possibility that systems and standards will continue to diverge and technological refreshes will come at different times and with different priority levels. This is very like the current situation for the police and is one of the issues that the national procurement of Airwave was designed to avoid.

5 Sharers Tariffs

Length of Commitment	Annual Charges	
	Basic charge to organisation	Charge for each radio
3 Years	£5,169	£429
5 Years	£5,169	£398
7 Years	£5,169	£372
10 Years	£5,169	£357
15 Years	£5,169	£341

Source: O2

1.41 In March 2001, a consortium comprising Devon, Cornwall, Avon, Dorset Gloucestershire Wiltshire and Somerset fire brigades requested tenders for the provision of wide area radio communications and mobile equipment. The scope of the procurement did not specify any particular communications platform or standard, so GSM, TETRA or other mobile communications technologies were all possible contenders. Although Airwave was a potential solution, the consortium has since entered preferred bidder negotiations with a supplier of an alternative technology. Other fire brigades, including Lancashire, have already taken or are likely to take Airwave.

Ambulance services

1.42 As one of the three key emergency services, Ambulance Trusts need efficient and effective radio communications functions. Current radio systems are old and frequently of poor quality. As a result, the Department of Health is planning a procurement for a new national radio network. Ambulances will be the most significant group of users, numbering around 15,500 individual radios, and their needs are dominating the early specifications. However, the possibility exists that others within the NHS might want to use the same system and their needs will also be considered. The full project management support mechanism is in place and the procurement should be completed by September 2003.

1.43 Unlike the Fire Service, the Department of Health rejected a local or regional approach to radio communications procurement because it would not ensure a common standard of communications across all Ambulance Trusts and would necessitate up to 32 separate procurements. Although the Department of Health can require trusts to conform to a common standard system if it becomes necessary, initial responses from Ambulance Trusts have welcomed the idea of a common system. The Department of Health intends to learn from the experiences of the police and of PITO in the procurement of Airwave and will be talking to them and to other emergency services and public safety organisations.

1.44 Interoperability with local police forces and fire brigades will be a key requirement of the new ambulance radio system. While the procurement of a national radio system for the Ambulance Service will be an open competition it is anticipated that O2/Airwave will be one of the bidders.

Part 2

In difficult circumstances, the procurement was well managed by the project team

This part of the report examines how PITO managed the procurement. It shows that, despite efforts to establish a competition, PITO was left with a single bidder early in the process. Following a decision to go ahead on this basis, PITO successfully negotiated an acceptable deal on behalf of a large number of stakeholders, despite encountering difficulties.

Conditions for a successful procurement were established

2.1 For such a large and technically complex procurement to be a success, PITO needed to assemble a skilled team that understood the technical environment and how user requirements could be met. PITO also had to generate interest for the project among a number of potential bidders at a time when British Telecommunications plc was the principal player in many sectors of the telecommunications market.

The project suffered from limited public sector resources

2.2 From 1993, the Home Office supported the project by making available technical expertise from its Radio Frequency and Communications Planning Unit (see **Figure 6** overleaf). In addition, PITO employed radio communications experts seconded from police forces, who not only had experience of police radio systems, but also possessed knowledge of the costs of building and operating these systems. While the in-house members of the team were well qualified to support the project, there were insufficient resources to process administrative work properly during the procurement.

2.3 The project was managed using a methodology known as PRINCE (PRojects IN a Controlled Environment). This was used successfully in establishing user groups and other means to communicate widely with police forces and potential sharers. The procurement progressed through a series of phases, which were reviewed and cleared in accordance with PRINCE guidance.

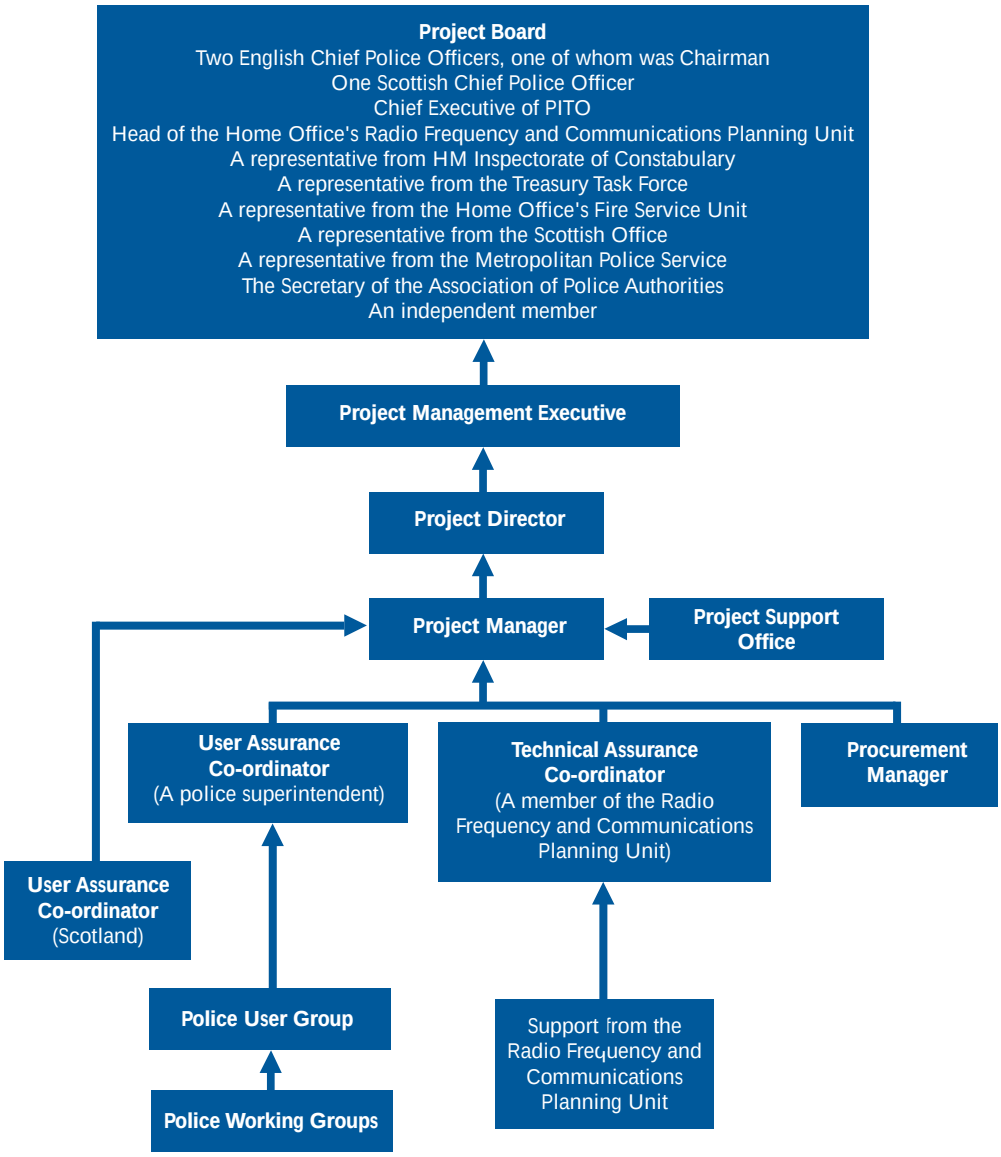
2.4 However, early documentation and record keeping was sparse. Progress reports were slow to cover all areas, while monitoring of procurement costs was incomplete. For instance, as late as July 1996, there was no mechanism in place to compare expenditure on advisers with forecasts. Without such mechanisms, PITO could not assess the performance of its advisers in terms of delivering procurement products within allocated budgets and so there was an increased risk that procurement costs could escalate unchecked. Despite our efforts to obtain early financial information, none was uncovered during the course of our work. As a result, we have not obtained comprehensive figures for the cost of procuring Airwave. **Figure 7** shows the advisers' costs we were able to obtain.

2.5 Later in the procurement, a lack of adequate resources also contributed to decisions not to take work forward that would have benefited the procurement process. For instance, although PITO prepared the ground for a robust fallback to Airwave, this work was not carried through. Also, PITO delayed quantification of future benefits until after contract signature.

Sufficient external expertise was procured

2.6 While PITO lacked sufficient internal resources during the procurement, it obtained external specialist advice in good time. In 1994, PITO employed a consultant to fill the post of project manager. The individual, who remained in post throughout the process, was an expert in project management and had proved himself through earlier contracts with the Home Office and in an earlier procurement of a major police radio system.

6 PITO's project organisation in 1999



Source: PITO

2.7 All key advisers (see **Figure 8**) were appointed following competitive procurements. The project team assessed the advisers' familiarity with radio communications technology, the emergency services environment and the then emerging use of the PFI, as well as their general expertise.

Initial approaches to the market were favourably received

2.8 During 1994 and 1995, the project team held a series of informal briefings with various radio communications companies. These companies researched the technical feasibility of various options for PITO. Radiant, a firm with telecommunications expertise, consulted with the telecommunications industry and concluded in its report that a national procurement was favoured. Indeed, O2 indicated that it would only participate on such a basis. In view of the complexity of the project, the industry also supported the need for bidders to prepare project definition studies in which they would produce detailed designs of their proposed networks.

2.9 PITO received 70 responses to a Prior Information Notice published in the Official Journal of the European Communities in July 1995. Three potential bidding consortia were formed (see **Figure 9**) after the publication of the project advertisement in January 1996. At this point, conditions were set for a fully competitive procurement.

7 Advisers' costs incurred from 1997

This figure shows that, from 1997, PITO spent £1.9 million on external advice.

	£000s
Project management	337
Procurement and technical	201
Technical (Mason Communications)	409
Legal (Dibb Lupton Broomhead/Shaw Pittman)	619
Financial (Charterhouse)	185
Others	160
Total	**1,911**

Source: PITO

8 Key Advisers

Type of Adviser	Name of Firm	Notes
Technical	Mason Communications	Appointed in 1995. Provided technical expertise to supplement that available from the Home Office's Radio Frequency and Communications Planning Unit. Provided information used in the financial models and constructed the public sector comparator.
Legal	Dibb Lupton Broomhead/ Shaw Pittman	DLB was appointed in 1996. However, when a key partner moved to Shaw Pittman PITO elected to retain his services. PITO not only eliminated a potential risk of delay by securing continuity of advice, but also negotiated a lower fee rate from Shaw Pittman. The division of work between the two law firms was distinct enough to avoid expensive duplication of effort.
Financial	Charterhouse	Appointed in 1995. Key tasks included checking financial models, assessing the reasonableness of O2's bid and ascertaining the overall value for money of the project.

Source: NAO

9 Consortia formed to bid for Airwave

Consortia	Lead company	Tetra equipment developer	Other primary members
Consortium 1	O2	Motorola Limited[1] Nokia Telecommunications Limited[1]	TRW Integrated Engineering Division
Consortium 2	Racal Network Services Limited	Ericsson Limited[2] Bosch Telecom[3]	Fluor Daniel Limited N M Rothschild Smith Consultancy
Consortium 3	NTL	Philips Communication Systems	ICL

NOTES

1. After being awarded the Airwave contract, O2 appointed Motorola Limited as the sole infrastructure provider.
2. Ericsson Limited withdrew from the TETRA market in 1996.
3. Bosch Telecom withdrew from the TETRA market in 1996.

Source: PITO/NAO

The interest of bidders was not maintained

2.10 Although PITO had established conditions for a successful competition, by April 1997 only a single bidder remained. After reviewing the reasons why the competition had collapsed and its options, PITO decided that the best course of action was to proceed with the project.

The market for such an ambitious procurement was small

2.11 The market for building and operating a national radio system across England, Wales and Scotland for public safety organisations was relatively small because only a few companies possessed the financial strength to take on such a large project. A further feature reducing the size of the market was the decision to adopt the TETRA standard, which required potential bidding consortia to include companies committed to the development of what was, at the time, an emerging technology. From this small market, the O2-led consortium included two of the key companies leading the development of TETRA technology (see **Figure 9**). Moreover, the market reduced during the course of the procurement when first Bosch Telecom, and then Ericsson Limited, pulled out.

Uncertainties about the project created bidder unease

2.12 When PITO started promoting the project, it could not confirm whether all of the emergency services would participate. Even when the scope of the procurement was reduced to the police, there were still many stakeholders whose agreement had to be obtained. This included 43 police forces in England and Wales, plus their authorities, as well as the eight Scottish forces.

2.13 Further uncertainty surrounded the project, definition study stage. In 1994, the cost to each bidder of undertaking a study was estimated at £500,000, but by 1996 quoted figures for this work ranged between £2.5 million to £10 million. Such an investment in the project was, for two consortia, too risky. PITO initiated discussions about the possibility of reimbursing some of the costs of carrying out the project definition studies but, without being able to establish how much funding would be made available to bidders, was unable to use this to maintain market interest in the project.

By April 1997, only one bidder remained

2.14 The three consortia all passed a pre-tender assessment, but NTL decided to join the consortium led by Racal Network Services Limited to produce a stronger bid. Following the withdrawal of Ericsson Limited from the TETRA market, Racal Network Services Limited dropped out citing uncertainties over police support for the project and doubts over the potential returns on the investment required.

2.15 PITO realised that, in the absence of competition, it would be difficult to demonstrate that any offer from the remaining bidder would represent value for money and so considered a range of options (see **Figure 10**). PITO not only consulted its three principal advisers, but also the Home Office Procurement Unit, the Treasury, the then PFI Panel and the Association of Chief Police Officers. As existing radio systems were not meeting operational requirements, PITO considered that there was no do-nothing option and that the selected option had to avoid delaying implementation of a new radio service. PITO concluded that the option that posed the least risk of delay was to continue with O2 as a single bidder. On the basis of these arguments, PITO obtained ministerial authority to proceed and awarded O2 a contract for a project definition study. In doing so, PITO was aware that proceeding with the procurement would be a risky endeavour. It intended to address these risks by developing a credible fallback solution and building a model to estimate what the project should cost.

Benchmarking of prices offered by O2 was moderately successful

2.16 PITO's strategy to assess the value for money of Airwave was based on calculating what the project should cost and using this information in negotiations with O2. Later in the procurement, PITO introduced a second strategy based on a direct comparison between O2's bid and the cost of a traditional procurement - a public sector comparator.

A should-cost model was used to simulate competition

2.17 O2 realised that PITO, in the absence of a competitive procurement, might struggle to demonstrate to the Home Office and police forces that the price of Airwave was the best available in the market. To counter the risk that PITO might cancel the project, O2 suggested that any assessment of value for money could be supplemented by the use of a should-cost model.

The approach adopted was sound

2.18 PITO saw benefits from using a should-cost model. It realised that compiling information about the costs of Airwave would permit direct comparisons with, and challenges to, O2's estimated costs. PITO consulted its advisers about using such a model as a pivotal element in its value for money assessment. The advisers

10 Options reviewed by PITO after competitive tension had been lost

Option	Reasons given by PITO to reject options
1 Continue with O2	■ None.
2 Re-run single procurement of a national system	■ There would be no new parties interested in bidding. ■ There would be a negative reaction from O2.
3 Implement fallback	■ User requirements would not be met. ■ There would be few opportunities for sharers to join thus losing the opportunity for the unit cost to the police being reduced. ■ Police forces would be burdened with the responsibility for replacing their radio systems. ■ Expected benefits from Airwave would be lost.
4 Do-nothing	■ Postponing the procurement for three or more years so allowing the TETRA supply market to mature would see consolidation of the market and there would be no new major players beyond those already in the competition. ■ Some police forces would obtain replacement systems in the interim and would resist, on value for money grounds, any move towards establishing, in the future, a national radio communications network.
5 Adapt procurement strategy to engender competition (e.g. a series of regional procurements)	■ There would be a need to restart the competition, which would delay the procurement of the service by at least two years. ■ Delaying the procurement would erode support from the police forces.

Source: PITO

supported the concept, but with the proviso that O2 should supply detailed information quantifying the assets and labour needed to deliver Airwave. PITO, with support from Home Office experts and Mason Communications, considered that it possessed the ability to analyse the reasonableness of quantity related information.

2.19 Mason Communications also informed PITO that there was sufficient cost information in the public domain to allow independent pricing of components. The project team considered that this cost information, together with information quantifying components and a construction programme, could be used to test the reasonableness of O2's bid. PITO also considered that the model would be an ideal tool to use in benchmarking exercises during the term of the contract.

But inputs to the model proved difficult to obtain

2.20 A reliable model could not be constructed without O2 providing detailed information about the quantities of components and labour, and the timing of when they would be required. In 1997, O2's obligation to provide component and labour quantities was formalised when PITO awarded O2 a contract to undertake a project definition study. The flow of quantity related information, which was dependent upon O2's progress in designing the network, was slower than PITO had anticipated. This led to concerns within PITO that a meaningful comparison with O2's costs might not be possible. Delays to the procurement, however, provided additional time to develop the model and to obtain more specific information about the quantities and costs of what would be required:

a) **Quantities of components and labour.** In compiling a should-cost model, PITO was concerned that O2 might overestimate the quantities required to deliver Airwave. The strategy to reduce this risk comprised two basic elements. The simpler of the two was a direct comparison with the quantities included in the public sector comparator. This approach was satisfactory for some capital assets such as base stations and switch centres. For instance, O2 calculated that the service required 3,012 base stations, whereas the number included in the public sector comparator was 3,415. The second approach involved using the combined expertise of PITO's in-house team, Home Office personnel and Mason Communications to challenge quantities of components and labour on a case by case basis at meetings with O2. Quantifying labour only activities that O2 intended to outsource proved difficult to resolve, as, for a long time, O2 did not have a clear understanding of what was required. For example, discussions about the amount of software development needed to integrate the various systems in Airwave were concluded in October 1999, two months after the production of the final version of the should-cost model.

b) **Costs of components and labour.** Some cost information was available from Mason Communications, the Home Office and police forces. Reliable cost information for TETRA equipment proved not to be readily available because the technology was so new. PITO estimated these costs using various sources, including suppliers' indicative costs, consultations with two European public bodies that had awarded contracts for the construction of TETRA networks, and comparisons of equipment costs designed for mobile telephone networks. However, because of different levels of functionality there were considerable discrepancies depending on the chosen supplier. For instance, the price of a switch varied from £300,000 to £1 million. Records of how PITO converted the raw cost information it had obtained into figures input into the model were not retained, so we have been unable to verify the reasonableness of the process. As a result, PITO has lost the opportunity to establish a robust database of costs for use in the future. Such a database, if it were to have been regularly updated, would have assisted in pricing future changes to the service and in future benchmarking exercises.

c) **Financing costs.** PITO envisaged using the cost information to model O2's cash flow and, by calculating the internal rate of return of the project, obtain assurance about the reasonableness of O2's bid. After O2 had refused to disclose how it intended to finance the project, Charterhouse advised PITO to design the model so that the output reflected pre-finance and pre-tax cash flows. Charterhouse also advised PITO to demand a breakdown of costs so that meaningful comparisons could be made. O2 refused to disclose costs on a component-by-component basis, but agreed to provide cost information for six capital and six operational cost lines.

Outputs from the model helped in negotiations with O2

2.21 PITO used the should-cost model to profile estimates of O2's six capital and operational cost lines. These were compared against cost information that O2 provided in a projected profit and loss account built up from these cost lines. PITO and Mason Communications used discrepancies to challenge O2's costs and both PITO and O2 told us that the estimated unit cost of base stations had been reduced as a result of these discussions.

2.22 Charterhouse told us that it was confident that the should-cost model provided a reasonable estimate of O2's internal rate of return on the project. It considered, on the basis of experience, that the rate of 17 per cent (pre finance and tax costs), calculated by the model, was reasonable for the nature of the project.

2.23 Until August 1999, PITO continued to refine inputs to the should-cost model as cost and quantity information was received from O2. With this exchange of information it was to be expected that the net present cost of £990 million for Airwave, as computed by the model, was close to the net present cost of £970 million calculated by O2 in its best and final offer.

The public sector comparator was not an ideal benchmark

2.24 As in most PFI deals, the cost of Airwave was compared to a public sector comparator. The comparator estimated the cost that would have been incurred if the public sector were to design, build, finance and operate a new police radio system to the same specification as Airwave.

2.25 Commissioned to prepare the comparator, Mason Communications designed it in consultation with PITO and the Home Office. To calculate the number of base stations, Mason Communications modelled the coverage requirements using industry standard techniques. Other parameters, including service level requirements, were obtained from information that police forces supplied to O2. Mason Communications priced the service using its own database of costs. The output was a cash flow analysis of capital and operational expenditure over the contract period, that when discounted gave a net present cost of £1,610 million for an Airwave equivalent system.

2.26 Our examination of the public sector comparator indicated that its value was limited by a number of factors.

The comparator was commissioned in the latter stages of the procurement

2.27 The 1996 Business Case for the project envisaged that the PFI would be the most appropriate method of procurement for Airwave, subject to tests of affordability and value for money once the procurement was underway. Also expressed was the view that the public sector would be highly unlikely to have the skills and resources needed for such a risky project, and so PITO took the decision not to prepare a public sector comparator. By February 1999, however, PITO considered that a comparator would supplement the should-cost model in the assessment of the value for money of O2's offer. The first version of the comparator was available in early April and a working version was completed in September 1999, when negotiations with O2 were at an advanced stage.

Considerable independent effort was needed to design the comparator

2.28 Using its expertise, Mason Communications independently designed a national network that would have delivered the same services as Airwave. Mason Communications used widely recognised modelling software to assess the number of radio sites needed for the comparator. Modelling radio coverage is a complex task where theoretical models have to be refined continually to take account of actual detailed terrain and other environments. Such modelling gives a reliable guide to the actual number of sites required, but the final number can only be determined after detailed on-site surveys of the sites, and hence the calculations in the comparator contained a margin for site errors. Mason Communications' approach resulted in an increased number of base stations in the comparator (3,415) over the number assumed in O2's design (3,012). Mason Communications considered that most of the difference was a consequence of the relatively short design timetable compared to that for O2, prohibiting the use of more sophisticated propagation modelling techniques that would have resulted in an optimum design. However, PITO considered that more refined modelling could just as easily have increased the number of sites, once factors such as detailed positioning and availability of sites were factored in.

Mason Communications exploited its market knowledge to estimate TETRA prices

2.29 The assumptions made about costs created a level of uncertainty in the public sector comparator. During the development of the comparator PITO was aware that O2 was engaged in price negotiations with Nokia and Motorola, two members of the O2-led consortium. Not wanting to undermine O2's bargaining position by giving any impression to these manufacturers that there was an alternative to Airwave, PITO instructed Mason Communications not to approach the market for cost information, but to use only its own cost information to price the comparator. Furthermore, to preserve the independence of the comparator, those employees of Mason Communications involved in analysing costs input into the should-cost model were not consulted. While Mason Communications had a wealth of cost information about radio communications, it possessed only publicly available costs of TETRA equipment.

Experts were used to estimate potential risks, but these are necessarily subjective

2.30 The comparator included provisions for risk. Risks to which the project was exposed were assessed in a workshop attended by representatives from the Home Office's Radio Frequency and Communications Planning Unit, the Metropolitan Police, Sussex Police, Hampshire Police and Mason Communications. Risks were identified and quantified in terms of likelihood and impact and were valued at £170 million. We reviewed this analysis. We found some arithmetic errors and no tapering of operational cost risk over the roll-out and roll-in of the service. We also found the inclusion of a number of relatively minor risks that may remain with PITO in the PFI deal, but which had not been included in the cost of the deal when comparing it against the comparator. Amending the analysis to account for these issues resulted in a reduction of the net present cost of risk to £150 million.

2.31 PITO was advised that, in major projects, the inclusion of separate estimates for contingency and risk is a regular practice. Therefore, Mason Communications included in the comparator a contingency allowing for unforeseen requirements equal to five per cent of all input costs (net present cost £70 million). There was, through the inclusion of this contingency, a possibility of double-counting some elements of risk, particularly in the light of specific risk allowances for underestimated capital and operational costs. However, any such assessment is necessarily subjective and PITO considers it could just as easily have under-estimated the eventual cost of risk.

The value for money analysis comparing the public sector comparator with O2's offer was simplistic, but was only one part of PITO's toolkit of measures

2.32 PITO's analysis of the value for money of O2's offer used the outputs from the should-cost model to test the reasonableness of O2's cost base and rate of return, as well as comparing O2's offer with the public sector comparator. Although the comparator was subject to a sensitivity analysis, for example by adjusting the number of base stations, the principal output from the comparator was a single number. In this part of the value for money analysis, the basis of Charterhouse's advice that the deal on offer was value for money was that the comparator, estimating the cost of a conventionally procured national network at £1,610 million, was more expensive than the Airwave deal at £1,470 million. Because of the inherent uncertainty of forecasting the future, in this case looking forward 19 years, the reliability of a single figure output from a computer is low, and so a favourable comparison between a PFI deal and such an output does not on its own prove value for money. This weakness was offset by PITO's development and use of the should-cost model to challenge O2's costs.

There was a limited comparison between the cost basis of the public sector comparator and that of the should-cost model

2.33 While PITO challenged Mason Communications about some of the quantities input into the comparator, PITO did not analyse in detail why the cost of a conventionally

procured national radio system was more expensive than the cost calculated in the should-cost model. Removing cost indexation, risk allowances and cost contingencies from the comparator reveals that the cost base of the comparator was £1,260 million (see **Figure 11**), £270 million more than the cost base of Airwave as calculated in the should-cost model. However, PITO had tasked Mason Communications to design a comparator to give an equivalent service to that of Airwave - not to replicate the system design. There were, therefore, inevitably many design differences. While this made any meaningful like-for-like comparison between the two systems impractical, a more detailed investigation of the cost difference might have provided greater confidence that the comparator was the most cost-effective traditionally procured system offering an Airwave equivalent service.

Negotiations with O2 were problematic

2.34 As it was the only bidder for Airwave, O2 was in a strong negotiating position. When commercial negotiations began in late 1998, PITO had to work hard to deliver a deal that it and other stakeholders in Airwave were prepared to accept.

The single bidder situation put PITO in a difficult negotiating position

2.35 PITO managed the negotiations through a number of working groups, allowing concurrent negotiations across a range of issues. During the negotiations, PITO was reluctant to concede to O2's proposed terms in five key areas: the limit of liability; the liability cap for the pilot; liquidated damages; service credits; and sharing the benefits should other emergency services join Airwave. Differences between PITO and O2 persisted for seven months and led to PITO postponing its request for O2's best and final offer. By September 1999, with a sufficient number of the differences resolved, PITO invited O2 to submit its best and final offer. In October 1999, negotiations recommenced and there was considerable effort by the two parties to conclude the deal by the end of December 1999. In the event, this proved optimistic and it was not until the end of February 2000 that the deal was signed. PITO acknowledged that the contractual remedies that it had secured were not ideal, but were still within the range of what it considered acceptable.

11 Comparison between the base cost of the public sector comparator and the cost of Airwave calculated by the should-cost model

This figure shows that there was £350 million of allowances in the public sector comparator. When these are deducted the base cost of the comparator is still £270 million more than PITO's estimate of what Airwave will cost O2.

	Net Present Cost (£ million)
Public sector comparator	**1,610**
Less:	
Indexation	110
Risk allowances	170
Cost contingencies	70
The base cost of the public sector comparator	**1,260**
Cost of Airwave calculated in the should-cost model	**990**

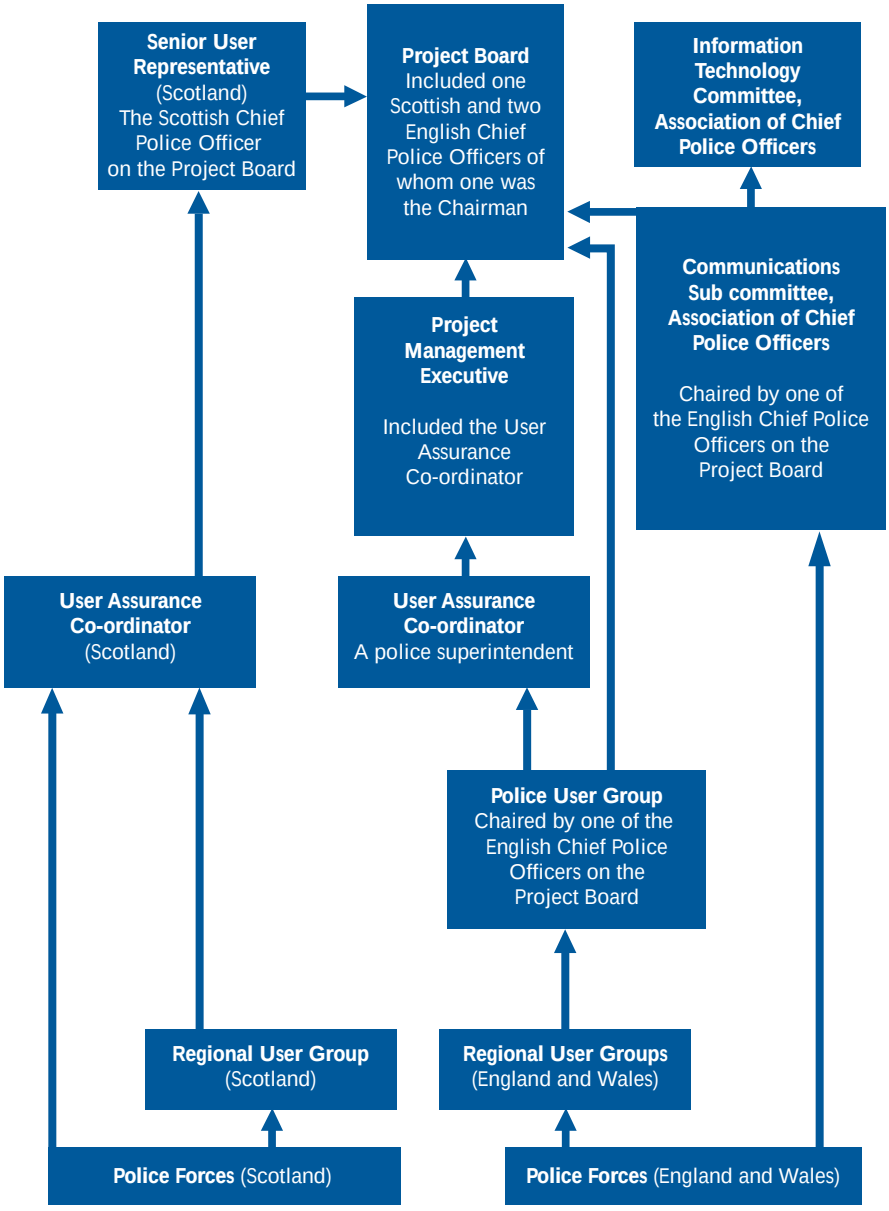
Source: NAO

The varying interests of police forces and authorities were difficult to manage

2.36 Throughout the procurement PITO kept chief police officers informed of progress. This was achieved through the inclusion of two chief police officers on the project board, one of whom was chairman, presentations to the Association of Chief Police Officers and regular written updates from the project director (**Figure 12** shows the organisation structure of the police involvement in the procurement). Although forces were generally supportive of the project, they did express concerns about the affordability of Airwave. During the negotiations, PITO attempted to use these concerns to gain more competitive pricing from O2. While all parties accepted that the proportion of the police budget required to pay for a modern digital radio service would be more than the then current allocation, it was assumed that O2 did not know what percentage would be acceptable. This strategy unravelled, when in June 1999, PITO considered that O2 had gauged this level to be two per cent of the police budget.

2.37 It was important that the police authorities were kept informed of progress because each police authority, rather than each police force, would sign the local service contract (**Figure 13** overleaf shows the position of police authorities in managing the budgets of police forces). PITO therefore invited authority representatives to top-level meetings and the Association of Police Authorities was given a permanent seat on the Project Board. Detailed discussions with authorities were delayed at their request until the costs of Airwave became clearer. As negotiations proceeded, several authorities refused to accept the Airwave service on local value for money grounds. O2 became aware of the problem, which created some uncertainty within the company about the take up of the service. This uncertainty eventually became a price affecting risk that PITO neutralised by agreeing to pay for the Core Service regardless of police take-up.

12 Involvement of police forces in the procurement



Source: PITO

The fallback was not complete at contract award

2.38 In deciding to continue with a single bidder, PITO planned to develop a credible fallback option. The view was that if O2 saw that a fallback was available to the forces, it would be less likely to exploit its single bidder position. The fallback that PITO envisaged was one in which the police forces, either individually or collectively, as small regional groups, procured their own digital radio systems. The overriding concern that PITO and the Home Office had about this option was that the police forces would procure systems that would not be compatible with radio systems operating in neighbouring forces. The goal of obtaining a national service would be lost. PITO, however, was convinced that O2 and its partners, having spent £20 million in bidding for the deal, also wanted to avoid losing the opportunity of building and operating a national network.

2.39 PITO started preparing a fallback in June 1997 but had to halt work in August because of a lack of resources. Work did not restart until late 1998, after the Association of Chief Police Officers expressed its concern to the Home Office about the lack of a fallback in the event that forces decided not to accept Airwave. As a result, the Home Office made extra resources available and, by the end of December 1998, a fallback strategy had been produced. The strategy set out the issues that would need to be considered if forces

13 Central funding of the police and powers of direction

Source: NAO

conducted their own procurements, and recommended that an implementation package should be developed by July 1999. However, this work was not taken further because resources were again not available. PITO told us that it would immediately have resurrected the fallback option if Airwave had failed, because it would have been the only realistic option for police forces.

The project was subject to external reviews

2.40 Because of concerns about affordability, the Association of Chief Police Officers established a group of seven forces to evaluate Airwave and to investigate the feasibility of locally procured alternatives. In June 1999 the group published its findings. Principal amongst these was the estimated £940 million net present cost for locally procured radio systems for English and Welsh forces, compared with the then estimated £1,220 million net present cost of Airwave (for English and Welsh forces only). In November 1999, PITO questioned the group's findings in the areas of service quality, service performance, risk transfer and pricing methodology. Despite the fact that the group's estimated cost was similar to that calculated in the should-cost model, PITO avoided using the findings productively for two reasons. Firstly, the timing of the publication of the group's findings was late in the procurement with the negotiations already well advanced and most pricing issues, through comparisons with the should-cost model and public sector comparator, explained. Re-examining issues in the light of the group's findings would have further delayed the award of the contract. Secondly, PITO was committed to the objective of procuring a national police radio system, something that was not assured if the group's alternative won support among stakeholders.

2.41 In January 2000, the Treasury asked PA Consulting to examine Airwave in the light of emerging recommendations from a Cabinet Office review of major Government IT projects[3]. PA Consulting focused on risk management, deliverability and issues regarding the contract and made recommendations for changes in these areas. PITO issued a detailed response, which indicated that it would implement some of these changes, including improving how it documented the management of identified risks.

3 *The review culminated in the publication in May 2000 of the report, "Review of Major Government IT Projects, Successful IT: Modernising Government in Action".*

Part 3

A sound implementation plan is in place but risks remain

This part of the report examines the way in which the risks inherent in implementing Airwave have been managed and how additional benefits are being sought by the end users. It shows that the plan for introducing the new service followed accepted good practice. It explores the reasons for PITO accepting the pilot conditionally and how difficulties arising within the project and the wider radio communications environment are being handled. All parties to the deal anticipate that there are significant benefits to be gained from the introduction of up-to-date systems for the police and work is underway to determine what these benefits might be and the most effective way of realising them.

Good practice for the implementation of IT projects is being followed

3.1 New IT systems should be implemented using a modular, incremental approach[4]. This should involve a pilot stage to monitor usage of the system over a limited period of time and a phased roll-out to enable the lessons learnt from early implementations to be incorporated into later ones. PITO specified just such an incremental approach at the outset for Airwave, following the project definition study phase. The Airwave project plan includes thorough testing and validation processes at each stage and requires a series of milestones to be accomplished, first in a pilot programme and then in a phased roll-out.

There is a rigorous testing regime

3.2 Individual components and the system as a whole are subject to a rigorous testing regime laid out in the contract. O2 is required to test components and sub-components at the factory and on site in four separate testing protocols and to provide certificates of compliance when they have been completed. Once installed, the system is again tested by O2 before being tested by forces in a series of simulated operational settings. PITO developed a number of scenarios for use in the pilot which simulated operational conditions and made use of all the available functions. This was augmented by the input from the Lancashire Police Force during the pilot period in light of their operational experience. The results will be made available to individual forces for their own force acceptance testing. As new functions are developed they will be subject to testing that is equally rigorous. The contract, therefore, contains a provision to ensure that all upgrades and new developments, whether hardware or software, are tested before being accepted and rolled out.

Roll-out of the system is dependent on a successful pilot project

3.3 Piloting a new IT system enables faults to be identified and remedied without exposing the whole of an organisation to the risk of service disruption and the possible resulting loss of public confidence. Although a pilot extends the time period before which the whole of an organisation can benefit from a new service, it also avoids the problems of a "big-bang" approach and so is a common feature of well thought out IT implementations. Lancashire was selected to be the pilot force because it had a number of operational and geographic features that enabled the system to be tested in a range of conditions. The Lancashire Police Force area is divided into six territorial divisions, each with devolved responsibility for policing and management. The technical infrastructure for Airwave was provided for the whole of the geographical area covered by the Lancashire force as shown in **Figure 14** and two of Lancashire's six divisions were selected to carry out extended operational testing for four months. In the event, such testing lasted six months.

4 *Review of Major Government IT Projects - Successful IT: Modernising Government in Action. Cabinet Office May 2000*

14 The Lancashire Police Force

Local Services
The force area is divided into six territorial divisions, each with devolved responsibility for policing and management. Northern, Southern, Western, Eastern, Central and Pennine

Source: Lancashire Police Force

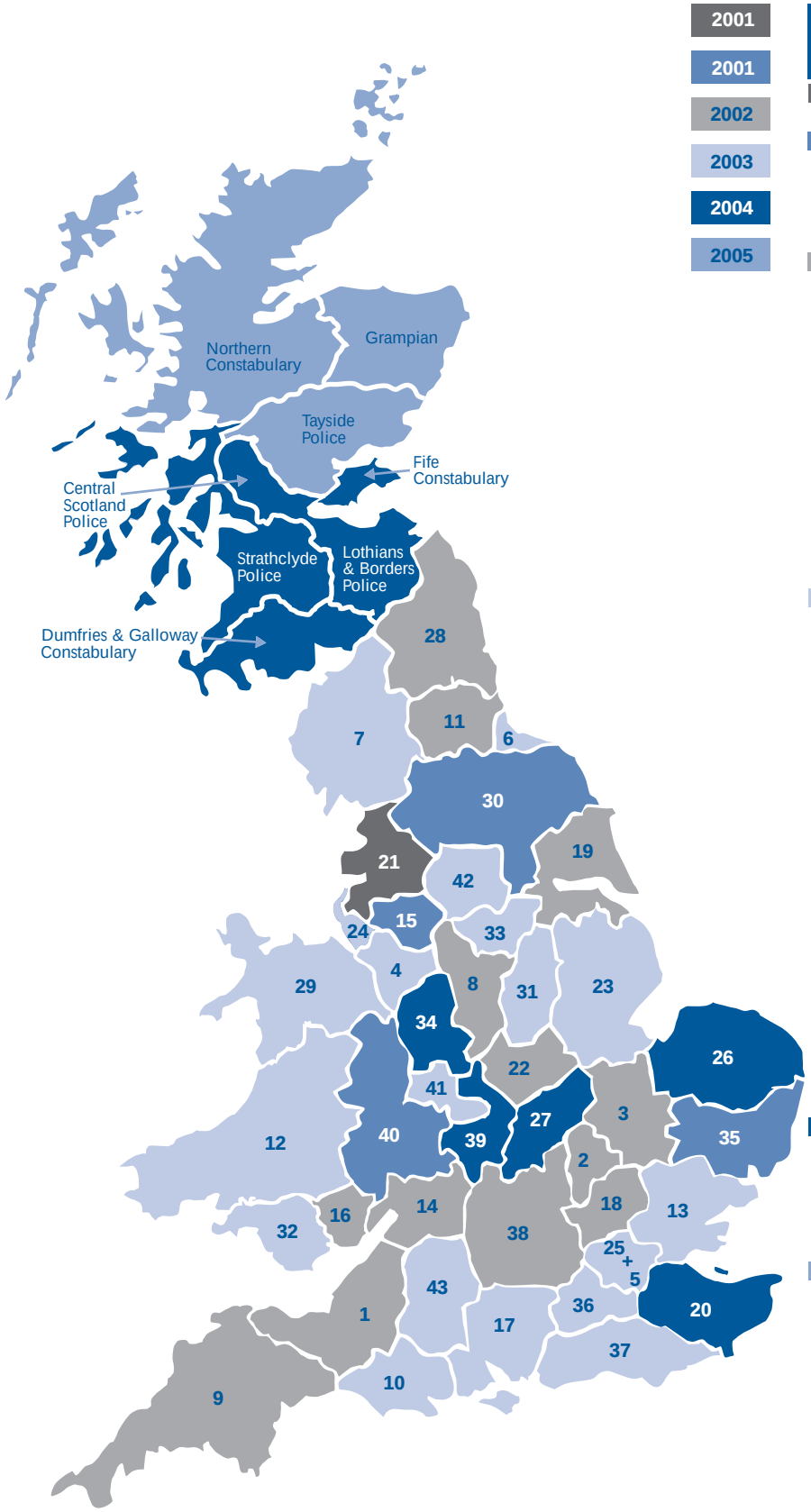
Implementation across all police forces will be phased

3.4 There are 52 police forces involved in Airwave (8 in Scotland, 43 in England and Wales plus the British Transport Police). The English and Welsh forces are split into four cohorts rolling out over a four-year period as shown in **Figure 15**. Scotland will join in 2005. Priority has been given to those forces which have the greatest need for Airwave, while forces that have purchased newer radio systems are in the later cohorts.

3.5 Within each police force there is a phased approach to migration to the new service, police divisions or areas will take up the service one at a time. This enables the force to conduct testing, complete training and identify deficiencies in service, coverage etc. Phased migration also avoids an all or nothing move and the risk of initial problems affecting the whole of the policing function in a force area.

3.6 Lessons learnt from the pilot and the earlier cohorts will be disseminated in order to make migration of later forces smoother. Scripts have been developed for the pilot, which test all of the functions and simulate heavy or complicated patterns of usage. These will be made available for forces to use as part of their own acceptance testing. Other technical solutions and fixes for any problems with interfaces between the infrastructure and the handsets or control room systems will also be shared, although some of these will only be useful if later forces are using handsets produced by the same manufacturer as those used in the pilot. PITO told us that gaining a greater understanding of how this type of technology affects user requirements has been important and will be particularly valuable learning points for forces later in the roll-out.

15 Order of roll-out of Airwave



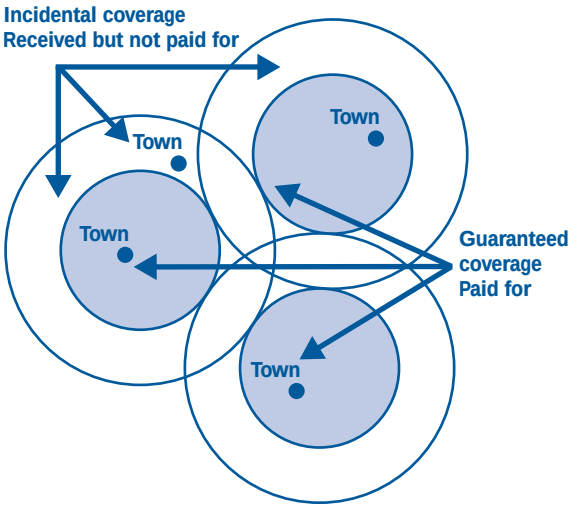
Force No.	Force (order in planned roll-out)	Year of planned availability of Airwave
	Year 2001	
21	Lancashire (Pilot)	2001
	Year 2001	
15	Greater Manchester	2001
40	West Mercia	2001
35	Suffolk	2001
30	North Yorkshire	2001
	Year 2002	
22	Leicestershire	2002
14	Gloucestershire	2002
9	Devon & Cornwall	2002
8	Derbyshire	2002
1	Avon & Somerset	2002
28	Northumbria	2002
11	Durham	2002
19	Humberside	2002
38	Thames Valley	2002
3	Cambridgeshire	2002
16	Gwent	2002
18	Hertfordshire	2002
2	Bedfordshire	2002
	Year 2003	
43	Wiltshire	2003
7	Cumbria	2003
32	South Wales	2003
12	Dyfed-Powys	2003
10	Dorset	2003
42	West Yorkshire	2003
29	North Wales	2003
37	Sussex	2003
13	Essex	2003
23	Lincolnshire	2003
31	Nottinghamshire	2003
6	Cleveland	2003
24	Merseyside	2003
33	South Yorkshire	2003
17	Hampshire	2003
36	Surrey	2003
4	Cheshire	2003
41	West Midlands	2003
5 & 25	Metropolitan Police Service and City of London	2003
	Year 2004	
27	Northamptonshire	2004
39	Warwickshire	2004
26	Norfolk	2004
34	Staffordshire	2004
20	Kent	2004
	Scotland	
	Dumfries and Galloway	2004
	Lothian and Border	2004
	Strathclyde	2004
	Central Scotland	2004
	Fife	2004
	Tayside	2005
	Grampian	2005
	Northern Contstabulary	2005

Source: O2

The pilot was approved on a conditional basis

3.7 Unlike any other radio system or mobile phone system, Airwave will provide contractually guaranteed access and coverage. **Figure 16** shows an example of areas where coverage is guaranteed as well as areas where coverage is obtained but not paid for and therefore not guaranteed. The coverage level is determined by the contract and is measured according to a complicated statistical model.

16 Guaranteed and Incidental coverage



Source: NAO

Problems were encountered during the pilot

3.8 Coverage was not adequately demonstrated in all the required areas, particularly on major roads. PITO considers that the deficiencies in required coverage (95.8 per cent as opposed to 96.0 per cent) are significant while O2 believes that the problem is the difficulty in measuring coverage and that, in operational terms, any deficiency would not be noticed.

3.9 Coverage had been a contentious issue throughout the procurement, with some police forces requiring 100 per cent guaranteed handheld coverage. Providing such coverage is the most expensive part of the system as higher levels of coverage often require more base stations and base stations can be costly. The effect of coverage on price was evident during contract negotiations and, as part of efforts to make the system more affordable, forces were offered lower prices for reductions in coverage requirements. Forces considered the trade-off being offered but were not prepared to lower their requirements.

3.10 Negotiations over acceptance criteria and measurement of coverage in particular were long and involved. Reasons given for this included:

- the relative newness of the technology;
- variability in actual radio reception when compared to theoretical norms; and
- the lack of previous precedent in guaranteeing coverage.

3.11 Although users expressed satisfaction with the clarity of voice transmissions, other aspects of the system created some disquiet. During the pilot, police officers were frequently dropped off the network without warning and had to re-boot their radios. This affected up to two per cent of calls and meant that every officer could expect this to happen at least once on every shift. This had important implications for safety as officers did not always know that they had been dropped off the network and were therefore out of touch with their control room.

3.12 These problems caused delays to the pilot. Attempts to resolve them led to the testing period being extended by 15 weeks.

Some but not all of the faults have been remedied during the extension

3.13 Many of the problems with call-dropping were solved following software upgrades although the exact cause of the problems was not identified. There was some debate over whether the problems lay in the infrastructure, the terminals or the way in which officers were using the equipment. Some of the problems were with the terminals and PITO took action to address these but such problems may have to be addressed again for any force which purchases its terminals from a different supplier than the one used in the pilot.

3.14 The need to provide adequate communications for the Greater Manchester Police Force in good time for the 2002 Commonwealth Games placed particular pressure on the timing of the project. This deadline placed PITO in a difficult position. It was caught between the need to meet a pressing and high profile operational requirement within one of its stakeholders while needing to ensure that it did not sign up to what might turn out to be a sub-standard service, which the police would be locked into for up to 19 years.

Accepting a pilot on a conditional basis is a high risk strategy

3.15 PITO saw the key issue as whether an improved service was being provided which could soon be brought to the contractual levels required. Following careful consideration, PITO accepted the pilot conditionally in September 2001. The conditions included:

- An option to return to pilot status if coverage on major roads is not resolved by February 2002 or to extend conditional acceptance;
- 10 per cent of the core service charge will be withheld until a resolution of coverage on major roads is reached. O2 will be repaid if it demonstrates that the coverage met contractual requirements all along; and
- An agreement that a permanent price reduction will be negotiated if coverage cannot be brought up to the contracted level, but reaches a level with which police forces are content.

3.16 Even though acceptance of the pilot triggers roll-out to all forces, O2 must pass the same comprehensive acceptance tests for each force, with each force having the option to refuse to accept the service until faults are rectified. It remains to be seen if any force exercises this option, but the potential delays to O2's revenue stream could incentivise O2 to resolve issues rapidly. It is doubtful whether any force could justify not taking Airwave providing it offers an adequate operational service. The only real alternative to any force would be to procure and pay for a separate radio system outside of the Airwave service.

3.17 As conditional acceptance of a pilot will allow a substantial portion of the income stream to begin flowing to O2, the incentives to take action to meet outstanding contractual conditions may be diminished. Previous public sector IT procurements have encountered problems when accepting a pilot service on a conditional basis and in our view it is not good practice.

3.18 In this case, however, the system is being used successfully by the Lancashire force. It was reluctant to have the service switched off while the remaining problems were resolved because it considered that Airwave was providing substantial operational benefits over the previous analogue system. Furthermore, PITO has been particularly careful to seek financial recompense for any failure to deliver, as well as providing for the opportunity to step back to pilot status if key elements of the contractual requirements are not resolved satisfactorily within an agreed time frame. These provisions appear robust and the ability to walk away remains, although the likelihood of this option being exercised once a number of forces have migrated to the service looks remote. As forces conduct their own testing prior to acceptance, they are likely to focus on areas where the pilot or previous forces have experienced difficulties. O2 continues to work on resolving the technical issues and is providing regular reports to the programme board.

Emerging risks continue to be identified and managed

3.19 Two important issues have arisen since the contract was signed which may have a potential impact on the success of the project and which require ongoing management by PITO and the Home Office.

Interference with other electronic equipment is being investigated

3.20 The operation of radio equipment in close proximity to other types of electronic device may result in interference and police radio systems are no exception. Guidelines have existed for many years about the use of radios where interference might be particularly problematic, for instance in hospitals or aircraft. Existing police radio terminals are also known to affect certain makes of traffic law enforcement devices (e.g. radar guns and digital breathalysers) and police guidelines exist which put restrictions on transmitting radio messages while using such equipment.

3.21 During the pilot phase, concerns were raised that Airwave terminals were affecting more equipment than the radios they were replacing. PITO and the Home Office therefore asked the Defence Evaluation Research Agency (DERA) to conduct tests on the electromagnetic compatibility of Airwave terminals with the various law enforcement devices in use in this country. The interim report from DERA identified additional makes of equipment, particularly older models, affected by TETRA radios and recommended that the existing police guidance be expanded accordingly. Manufacturers of these devices are being advised to increase the shielding on their equipment to protect them from the interference.

3.22 Technological fixes to TETRA terminals have also been proposed, such as an ability to inhibit the transmission function temporarily. The European Telecommunication Standards Institute[5] is expected to incorporate this as an additional requirement in the TETRA standard specification. Manufacturers consider this solution complex as it poses problems about how and when to resume transmissions, as well as needing to prove that transmissions have been inhibited at the correct time. However, the manufacturers have indicated to PITO that they expect to include such a facility in new terminals within a year.

5 *The European Telecommunications Standards Institute is a not for profit organisation representing stakeholders in the telecommunications market developing technical standards for use in Europe and elsewhere.*

The possible dangers to the health of people living near radio masts and to police officers are subject to further research

3.23 There has been widespread concern in the UK and internationally over recent years about whether mobile communications masts and handsets could be dangerous to people's health. Existing guidelines recommend limits to an individual's exposure to non-ionising radiation and feed into the police protocols on the use of their existing radios.

3.24 An Independent Expert Group on Mobile Phones, set up at the request of the Minister for Public Health, reviewed the available evidence and published a report[6] in May 2000 (commonly referred to as the Stewart report). The report made recommendations about the safeguards that should be employed in siting base stations and further research that should be carried out to ensure a fuller understanding of the effects of non-ionising radiation on humans. One recommendation of the report was that, as a precautionary measure, amplitude modulation around 16 Hz should be avoided, if possible, in signal coding. Because TETRA handsets use amplitude modulation at 17.6 Hz there was speculation that there might be an adverse health impact associated with the TETRA-based Airwave system. Following the recommendations of the Stewart report the Government announced, in conjunction with the mobile telecommunications industry, funding of approximately £7 million to carry out further, more extensive research into the impact of mobile communications systems on humans.

3.25 Because this research will take time, the Home Office in the interim, commissioned a review of the research relevant to TETRA. The National Radiological Protection Board (NRPB)[7] was asked to provide advice on any implications for the health of TETRA users. A report examining all the relevant research published to date was produced by the NRPB's advisory group on non-ionising radiation in July 2001. The review concluded that the current evidence suggests that it is unlikely that the special features of signals from TETRA mobile terminals and repeaters pose a hazard to health.

PITO and police forces are working together to realise the benefits expected from Airwave

3.26 Airwave offers the opportunity for police forces to achieve a number of other benefits over and above high quality voice transmissions with guaranteed coverage. PITO and police forces are, therefore, working to identify potential benefits and ways to realise and measure them.

Preliminary work to quantify business benefits was limited

3.27 Prior to the development of the full business case, police forces were asked to examine the potential impact of a new radio service on their efficiency. Because many forces were already conducting activity analysis showing how much time officers spent on particular tasks this was used as the basis of the impact assessment work. The activity analysis suggested that around 37 per cent of uniformed officers' time is spent in the police station. **Figure 17** shows how the time in the station is spent.

3.28 A later report in 2001, on the typical pattern of an officer's day, confirmed these findings[8]. If Airwave could help bring about a 10 per cent saving in the time spent by officers in the police station, this would be the national equivalent to deploying an extra 1200 officers on the streets, at an approximate cost of £37 million.[9] Thames Valley Police, who played a key part in this initial work, was confident that this level could be reached. Indeed it anticipated eventual efficiency gains of up to 30 per cent. The base-line work focused on uniformed police constables only; if uniformed supervisors and CID officers were to make the same efficiency gains, then the researchers concluded the savings could be doubled. These efficiency gains all depend on Airwave delivering all the necessary functionality and on police forces making the best use of the services available.

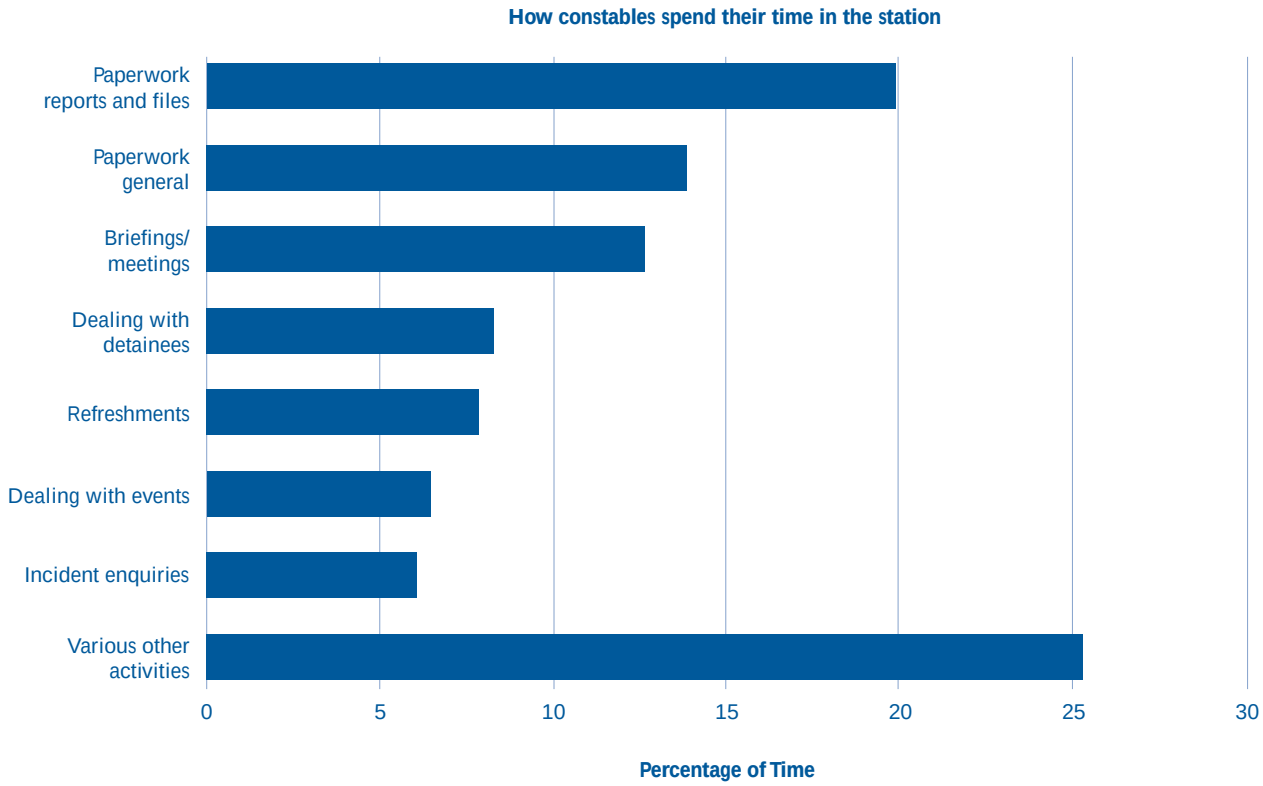
3.29 This early analysis might have been built on sooner. Although the 1998 work was acknowledged in the full business case for Airwave, and there was a clear intention to seek additional benefits, the work was not progressed until after contract signature. There were insufficient staff available to PITO at the time to take the benefits work forward. Other areas such as developing the technical specification and negotiating the contract had to take priority.

Work is now underway to determine what benefits can be realised and how

3.30 In 2001, PITO established a Business Benefits Steering Group, consisting of individuals from police forces, police authorities, the Home Office and unions. This group was tasked with directing the work of both a small, central team based within PITO, and of a working group consisting of representatives from 20 volunteer forces who were tasked with determining what functions of Airwave had the potential to deliver benefits and how to measure these benefits. **Figure 18** shows the composition of these groups.

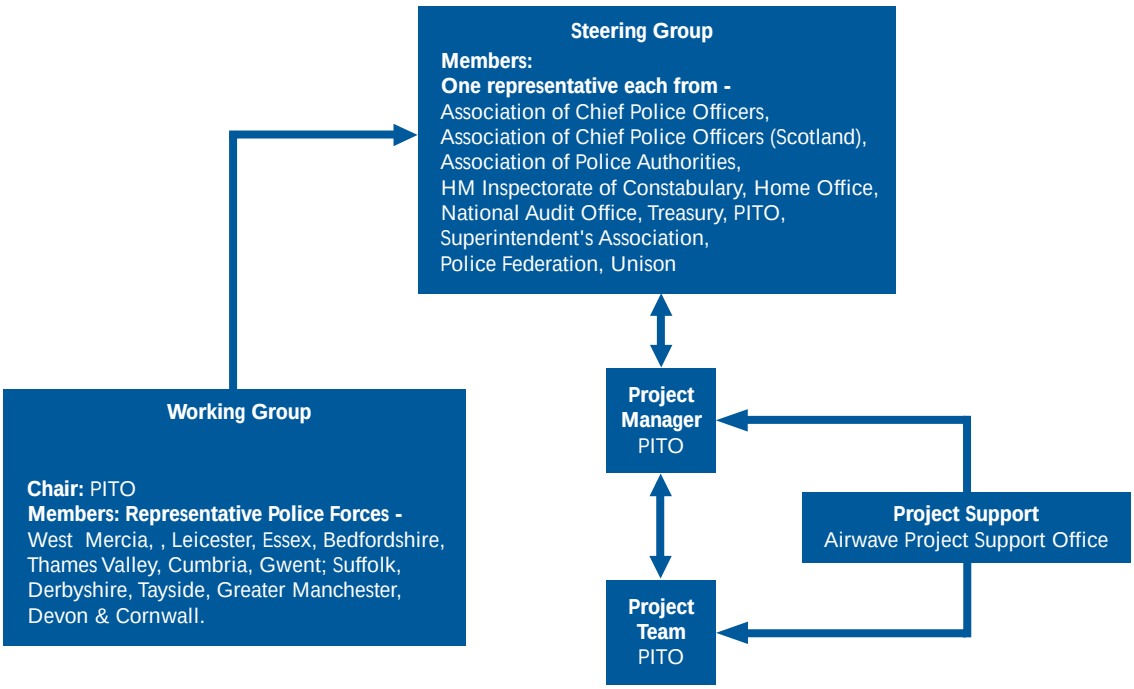
6 *Mobile Phones and Health. Report of the Independent Expert group on Mobile Phones.*
7 *A statutory body incorporated in 1970, responsible for directing research and providing information and advice on radiation and possible hazards.*
8 *Diary of a Police Officer PA Consulting November 2001.*
9 *1998 costs. Source Thames Valley Police Business Benefits Analysis.*

17 Analysis of time spent in the police station



Source: Thames Valley Police

18 Organisation of the business benefits groups.



Source: PITO

3.31 Rather than introduce additional measurements as a separate activity, performance, as already measured by national statistics such as Best Value and Key Performance Indicators, will be tracked over time. **Figure 19** identifies some areas where Airwave is expected to enable improvements in performance. This approach has the advantage of avoiding a significant additional data collection burden on forces. However, it does mean that additional expenditure cannot be matched with quantifiable benefits in monetary terms. The aim of the Steering Group is to develop a learning package that shows how the forces involved went about implementing Airwave in such a way as to enable benefits to be achieved. The package will also include methods that have been designed to measure changes in performance. Furthermore, PITO is willing to share lessons learnt with other Airwave sharers, such as the Fire and Ambulance Services, in the future.

There remain difficulties in separating the benefits of Airwave from other projects

3.32 Numerous other initiatives aimed at improving the efficiency and effectiveness of the police are also being implemented locally and by PITO at the same time as Airwave. There are local initiatives focusing on improving efficiency and delivering more effective policing. There are also projects implemented by PITO under the National Strategy for Police Information such as:

- HOLMES2 - an integrated suite of applications used for the investigation of major and serious crime;
- NAFIS - the National Automated Fingerprint Identification System; and
- The Police Portal - a new internet portal where the public can now report non-urgent, minor crime.

There are also other, more general, initiatives including increased use of CCTV and databases such as the national legal database. Disentangling the effects on police performance due solely to Airwave will therefore be difficult.

19 Examples of areas where Airwave is expected have a benefit

Feature	Benefit to the police
High Quality Transmission	Ease and speed of communication, reliable and understandable voice messages. Less need for messages to be repeated.
Encryption	Greater security of information, criminals unable to use scanners to intercept police communications and greater privacy for personal information transmitted over the radio.
Talk Groups	Enables everyone on a particular operation to hear radio messages intended purely for them and no-one else. Relevance of information received is therefore higher with less distracting background information.
Data Services	Access to Police National Computer and other data checking services while on the beat. Expected to lead to greater detection of crime as checks are made more rapidly and more frequently.
Management Information	Enables senior officers to have a greater understanding of the deployment of their officers and so improves command and control.
Emergency Button	Improved officer safety and improved officer morale.

Source: PITO

Glossary

Amplitude Modulation	A way of using variation in the amplitude (height) of a wave in order to carry meaningful information.
Analogue radio system	A radio system that transmits information using continuously variable signals. Analogue radio systems, because they are less efficient, are being phased out in favour of digital radio systems.
Base station	The mast and radio part of the network infrastructure. A single base station usually contains several radio transmitters, receivers, control sections and power supplies.
Conventional/traditional procurement	A procurement for a contract in which the public sector customer, using Government finance, pays the contractor as the works progress. Such projects are fully paid for on completion. Operation and maintenance of the resulting assets are dealt with in separate contracts.
Digital radio system	In relation to Airwave, a radio system that transmits information in time-wise discontinuous signals. These systems encode information into a binary "1" or "0" code and can transmit more information over a given radio frequency band width than analogue radio systems.
Encryption	Conversion of plain language into a coded signal. The greater the sophistication of the encryption, the greater the security so keeping communication private. Only other users or devices that have the key to the encryption can access the information.
Financial models	Spreadsheets designed to show the financial outcome of a particular set of estimated costs, revenues and fixed and capital charges for delivering a service over time.
Group calls and talkgroups	A group call is a call to a pre-set group of terminal users called a talkgroup (usually including a radio dispatcher) and works in a similar way to a traditional channel. When using a selected talkgroup everyone in that talkgroup receives the communication.
GSM	Global System for Mobile Communications -The digital cellular telephone system employed by most private mobile phones.
Non-ionising radiation	In general, light, microwaves and radio frequencies.
Output specification	In relation to Airwave, the specified aspect of PITO's service requirements and performance specification, for which PITO set minimum quality standards to be met by bids.
PITO	Police Information and Technology Organisation.
Police authority	A body that oversees target setting and budgets for its local police force and which monitors delivery of service and conducts reviews of Best Value. It is the means of achieving local accountability for its police force.
Police force	Headed by a Chief Police Officer, each police force is responsible for the maintenance of public peace and order, enforcement of laws, and prevention and detection of crime within the force's boundaries.
Private Finance Initiative (PFI)	A policy introduced by the Government in 1992 to harness private sector management and expertise in the delivery of public services.

Public sector comparator	An estimate of what the project would cost if traditional procurement methods were used. This is used to determine whether private finance offers better value for money than traditional procurement.
Repeater	On the Airwave service this is a device which receives the signal and retransmits it so it can be picked up by nearby units.
Roaming	Ability of police officers to move around the country and still be in radio contact with their control rooms and with other officers in their forces.
Should-cost model	In the case of the Airwave procurement, PITO's model that calculated the approximate cost to O2 of providing the assets and services needed to deliver Airwave. Input quantities of components and labour were provided by O2 from its design. Input costs were repeatedly renewed by PITO.
Terminals	A generic term for any device that can be used to access the Airwave service. These include handheld and vehicle-mounted radios as well as other devices such as Mobile Data Terminals.
TETRA	Terrestrial Trunked Radio - A European open standard for digital trunked radio systems, designed primarily for public safety organisations.

Appendix 1 Key events during the procurement of Airwave

	Year	Month
Publication of the final report of the Review of Radio Communications in the Police and Fire Services	1993	March
Publication of the Prior Information Notice	1995	July
Project Notice published in the Official Journal of the European Communities	1996	January
Fire Service withdrew	1996	January
Outline Business Case produced	1996	April
Invitation to tender for project definitions studies issued	1996	August
O2 left as the single bidder	1997	April
O2 awarded a contract for a project definition study	1997	October
O2 completed its project definition study	1998	September
Commercial negotiations with O2 started	1998	December
Publication of the Association of Chief Police Officers' review of Airwave	1999	June
O2 submitted its best and final offer	1999	October
PA Consulting's examination of the procurement	2000	January
Final Business Case produced	2000	January
O2 awarded the contract for Airwave	2000	February
Government announced £500 million available to fund the first three years of Airwave	2000	July
Pilot phase begun	2000	November
Pilot extended	2001	June
PITO conditionally accepted the pilot	2001	September
Roll-out commenced	2001	September

Appendix 2 Scope and methodology of the National Audit Office's examination

Scope of this study

1 We examined whether the Home Office and PITO achieved their objectives in procuring and implementing a national radio communications service for the Police and Fire Services.

Main aspects of the National Audit Office's methodology

2 Our examination covered:

- **The conduct of the procurement:** how the Home Office and PITO went about procuring Airwave.

  The purpose of this part of the examination was to assess whether the Home Office's and PITO's procurement strategies were well prepared and executed. We gave considerable attention to how PITO set about demonstrating value for money after the procurement lost competitive tension.

- **The conduct of the pilot:** how PITO managed its responsibilities during the pilot.

  This part of the examination focused on PITO's role in ensuring that the technological solution built by O2 met the requirements of the contract.

3 In undertaking this examination we followed the approach laid out in a published report[10] on our methodology for examining deals under the PFI. In particular, we:

- Designed the examination using experience acquired on our earlier studies of PFI deals;
- Undertook an issue analysis to scope our work through a pyramidal set of audit questions, with each level logically supported by a lower level of more specific questions until, at the bottom, we identified the evidence we had to collect;
- Collected information about the procurement and the pilot; and
- Evaluated the information and advice received.

Collection of information

4 We collected information from the following sources:

- A review of the Home Office's and PITO's papers recording the procurement and the legal agreements underpinning the deal;
- A review of PITO's papers documenting progress with the pilot and the key decisions taken;
- Interviews with the Home Office's and PITO's officials and advisers, on how they managed the procurement and the pilot;
- Interviews with O2 and Motorola Limited;
- Interviews with key stakeholders, including;
  - The Chief Constables of Northamptonshire and West Sussex, both of whom were members of the Project Board;
  - The Association of Police Authorities;
  - Thames Valley Police Force;
  - The police authorities for Avon and Somerset Police, West Yorkshire Police and Greater Manchester Police;
  - The IT Services Department for the West Midlands Police which led the group of police forces that reviewed Airwave on behalf of the Association of Chief Police Officers;
  - The Police Federation;
  - The Lancashire Police Force, in whose operational area the pilot was run;
  - The Telecommunications Branch of the Metropolitan Police Service;
  - British Transport Police; and
  - Oftel;
- Discussions with potential sharers, including:
  - The Fire Service;
  - The Ambulance Service; and
  - The Ministry of Defence.

10 *Examining the Value for Money of Deals under the Private Finance Initiative (HC739 Session 1998-99)*