

INDEPENDENT AUDIT OF SPECTRUM HOLDINGS

GOVERNMENT RESPONSE AND ACTION PLAN

March 2006

CONTENTS

1. EXECUTIVE SUMMARY
2. IMPLEMENTATION PLAN
3. INTRODUCTION
4. GOVERNMENT RESPONSE TO EACH RECOMMENDATION

**Published by the
Cabinet Official Committee on UK Spectrum Strategy
(UKSSC)**

**In consultation with the Office of Communications
(Ofcom)**

Government Response to the Independent Audit of Spectrum Holdings

Executive Summary

- 1 The Government welcomes Professor Martin Cave's report *The Independent Audit of Spectrum Holdings*, published in December 2005, which reviewed the management of radio spectrum in the public sector.¹ The Government agrees with the Audit that there is scope for more effective use of public sector spectrum through the introduction of spectrum trading and increased sharing with other users, and will work with Ofcom to enable this. The Government also supports greater consistency in the application of spectrum pricing across the public sector.
- 2 In implementing changes to public sector spectrum policy, the Government will ensure that sufficient spectrum remains available for national security, defence and essential public services. We will also seek to minimise harmful interference and ensure continued compliance with international obligations, including international spectrum management. This Government Response has been prepared in consultation with Ofcom.

Market Mechanisms

- 3 The Government supports the introduction of market mechanisms into spectrum management in the public sector. This will create new opportunities for public bodies to make more efficient use of their spectrum holdings, by enabling and encouraging trading and increased band sharing. In order to implement this new approach:
 - From March 2006, there will be a presumption that public bodies will acquire spectrum through the market, with administrative assignment by Ofcom only being made in exceptional cases.
 - Ofcom will take forward work on defining the spectrum rights of public bodies. Ofcom will aim by the end of 2006 to clarify how RSA can facilitate public sector trading.
 - Government departments will submit to HM Treasury, assessments of spectrum holdings and specific proposals for release by the end of 2006. This will inform discussions between departments and HM Treasury on targets and budgeting in the 2007 Comprehensive Spending Review (CSR), with the aim of providing effective and proper incentives.
 - The Government will publish a strategic Forward Look, assessing current spectrum use and forecasting future needs, in March 2007 and every two years thereafter. The effectiveness of market mechanisms in

¹ Available at www.spectrumaudit.org.uk

encouraging more efficient use of spectrum in the public sector will be reviewed in 2012.

Pricing

- 4 The Government agrees with the Audit that administered incentive pricing (AIP) remains an important tool for promoting efficient use, that it should be applied more consistently, and should more accurately reflect the market value of the spectrum.
 - The Government supports the principle that pricing for public sector spectrum should be set on a comparable basis to the private sector.
 - Ofcom has agreed to review the difference in pricing levels between spectrum classed as “fixed” and “mobile” by 2008. The extension of AIP to the 225-400 MHz band and to military radar, and rationalisation of MOD pricing below 3GHz, will be considered in the context of the CSR in 2007.
 - The Government is committed to paying AIP on its spectrum holdings, and supports Ofcom’s intention to progressively migrate to payment based on spectrum use defined by Recognised Spectrum Access (RSA). Better-defined Government use will improve opportunities for sharing with other users.

Band sharing

- 5 The Government notes the emergence of technologies intended to facilitate more automated sharing of spectrum between users, and supports the Audit’s recommendation that new regulatory and operational opportunities should be further investigated.
 - The Public Spectrum Safety Test Group (PSSTG) has already initiated the development of a clear and open safety certification regime for spectrum band sharing.
 - PSSTG is carrying out initial assessment work to consider potential opportunities for commercial applications to share spectrum currently used for radionavigation, radiolocation and military radars in the 2.7-3.4 GHz band, bearing in mind that in the civil maritime sector these also provide a safety of life function.

Ministry of Defence

- 6 The Ministry of Defence (MOD) is the single largest user of spectrum in the UK, using spectrum for communication, radar, sensing and control applications. The MOD already works closely with Ofcom in managing spectrum holdings and will engage fully in the implementation of the Audit’s recommendations.

- The MOD will contribute to the UKSSC Forward Look strategy in March 2007, and every two years thereafter. The MOD will report more detailed information on its usage and plans for key bands identified by the Audit.
- The MOD will identify key bands where action could be taken and outline specific proposals for these bands by the end of 2006. On the basis of these assessments and the Audit's band-by-band study, HM Treasury will discuss and set spectrum targets with the MOD during the CSR process in 2007.
- The MOD expects to establish its Spectrum Acquisition Authority (SAA) in April 2006 to improve internal co-ordination and management of spectrum requirements, and will report on progress in the UKSSC Forward Look in 2007.

Aeronautical

- 7 Economic incentives such as AIP could be effective in promoting greater efficiency in aeronautical spectrum where there is flexibility to influence choice of technology or service. In many cases, international agreements limit the scope to improve spectrum efficiency, and safety considerations will remain paramount.
- By the end of 2006, Ofcom will initiate a study to estimate the levels of aeronautical radar pricing. Subject to public consultation and impact assessment, Ofcom would expect to introduce incentive pricing from 2008.
 - The CAA will lead a review, with MOD and Ofcom, of navigation aids including radar and landing systems, to determine whether fewer systems could continue to satisfy the operational requirements. The study will take account of the outcome of WRC-07.
 - The CAA and MOD will work together more closely through two new sub-groups of the UK Spectrum Strategy Committee (UKSSC) to plan and manage the use of aeronautical spectrum. The CAA also plans to consider the introduction of band sharing in navigation bands, subject to the outcome of the band sharing safety certification process.

Maritime

- 8 The MCA and Ofcom will, where appropriate and there is scope for UK autonomy, extend AIP to cover navigation and communication systems from 2008 in radar bands, and more slowly for Differential Global Positioning System (DGPS) as new Global Navigation Satellite Systems (GNSS) deploy. Safety considerations, including MCA's capabilities as an emergency service, will remain paramount. The MCA will also consider increased sharing opportunities in the 3 and 9 GHz Safety of Life At Sea (SOLAS) radio navigation bands.

Emergency and Public Safety Services

- 9 Emergency and public safety services depend on spectrum for effective and efficient communications. The Government will not compromise their operational effectiveness. The Public Safety Spectrum Policy Group (PSSPG) will continue to coordinate policy for public safety and emergency spectrum use, and a new Terms of Reference to reflect the Audit's recommendations will be agreed in 2006.

Science Services

- 10 The Government agrees that principal users should be exposed to the cost of their spectrum use, but will remain aware of others who depend on measurements made in these bands. Ofcom consulted in 2005 on the introduction of RSA for radio astronomy spectrum and has announced its intention to proceed.

Fixed Links

- 11 The Government notes the Audit's conclusions that it is too early to tell whether a different spectrum management approach is appropriate for fixed links bands. Ofcom plans to work towards an auction for the 1790-1798 MHz band in 2007-08; award further spectrum at 32 GHz in 2006-07; and expects to have information available from the auction of 1452-1492 MHz within this timescale to inform plans for the future management of other spectrum around 1.4/1.5 GHz

Band Specific Audit

- 12 The Government, together with Ofcom, will use the Audit's band-by band study to prioritise action on pricing, sharing studies, definition of spectrum usage rights and consideration of a third party band manager. The Government, working with Ofcom, will also undertake the necessary preparatory work to enable decisions on specific spectrum bands to be taken, in response to the Audit's band-by-band recommendations. To deliver this:
 - Ofcom will clarify the mechanism for defining spectrum rights by the end of 2006, to enable trading or sharing by Crown bodies
 - Departments will identify key bands and outline specific proposals for action in these bands by the end of 2006. This will include an appraisal of any significant costs involved in implementation, for example, in re-certification, or procuring new equipment.
 - Departments will address the need for more detailed internal Audits to establish current spectrum use and include consideration to the accommodation of future needs

- Specific spectrum targets will be discussed and set by departments and HM Treasury in the context of CSR 2007, on the basis of these assessments.
- 13 Some of the frequency bands in the band-by-band analysis identified in green have already been opened up for commercial use. For example, the 900 MHz band, which was previously exclusively reserved for use by the MOD, is now almost entirely available and used for civil use. The main NATO band at 225-400 MHz has already been opened up to a limited but important extent for digital audio broadcasting (in the lower 5 MHz) and for emergency services mobile radio (2 x 5 MHz at the top).
 - 14 The bands identified as green or amber by the Audit, where there is scope for increased sharing or spectrum release, account for approximately 65% of public sector spectrum. This gives an indication as to the amount of public sector spectrum within which there is scope for action, suggesting that more efficient use can be made within the majority of public sector spectrum. Not all of the green or amber bands will be opened to commercial use: in some cases there will be increased opportunities for sharing with other users, or release of spectrum at the margins of bands. Further work is needed to assess in detail what action is appropriate, and how to take this forward effectively.
 - 15 It is difficult to quantify the total economic benefit of the changes under consideration since this will depend on future commercial decisions by network operators, equipment manufacturers and others, and on choices made by consumers about which products and services to buy. The Government's provisional estimate, based on expected AIP charges, is that it would realise efficiency savings of between £250m and £900m over the next 5 years although this does not take into account the costs incurred to generate these gains. However, the benefits to the wider UK economy can be expected to be considerably greater since there will be more opportunities for increased competition and innovation.

Programme of work

- 16 The Audit and this Government response map out a substantial programme of work. The Government, the CAA, MCA and Ofcom will pursue this purposefully and progressively. The Government will report progress every two years from March 2007 in the Forward Look that will be published by UKSSC. The UKSSC will oversee and monitor progress between publications against the implementation plan set out below.

IMPLEMENTATION PLAN

- 2006**
- **Ofcom** will aim to clarify how Recognised Spectrum Access (RSA) will operate for Crown bodies, to facilitate trading and sharing.
 - **MOD** will identify certain spectrum bands and outline specific proposals for release or sharing in these bands. Further band-by-band analysis will continue in subsequent years.
 - **MOD** will provide to HM Treasury an assessment of current and future spectrum requirements and specific proposals for release or sharing, including an appraisal of any significant costs involved in implementation.
 - **UKSSC** will adopt the presumption that public bodies will acquire spectrum through the market, subject to agreed criteria for exemptions.
 - **Ofcom** expects to publish regulations on the first public sector RSA for radio astronomy by September 2006.
 - **Ofcom** and **CAA** will seek to address issues in the 590-598 MHz band.
 - **Ofcom** will initiate a study into pricing levels for aeronautical radar spectrum in the first half of the year and expects to complete it by early 2007.
 - **CAA** will initiate a review, with **MOD** and **Ofcom**, of navigation aids, including radar and landing systems, by November 2006.
 - **Ofcom**, in conjunction with **CAA**, will review candidate aeronautical bands for the initial application of spectrum pricing.
 - **Ofcom**, in conjunction with **MCA**, will review candidate maritime bands for the initial application of spectrum pricing.
 - **UKSSC** will establish new radar and band sharing subgroups, to better co-ordinate spectrum management.
 - **UKSSC** will agree the criteria for safety authorisation of new band sharing techniques.
 - **UKSSC** will take responsibility for resolving disputes on public sector spectrum pricing levels
 - **MOD** will establish the Spectrum Acquisition Authority in April 2006 to improve internal co-ordination of MOD spectrum.
 - **Ofcom** will commission and publish a study examining the market demand for spectrum
- 2007**
- **HM Treasury** will discuss and set specific spectrum targets with relevant departments on the basis of the Audit's band-by-band study, and the assessments provided by departments in 2006.

- **HM Treasury** will agree with departments the framework for the treatment of gains from trading or leasing of public sector spectrum.
- **Ofcom** will work with the relevant Crown bodies to introduce RSA in key spectrum bands as required.
- **MOD** will deliver the first efficiency savings in bands where there are no significant obstacles to release or sharing.
- **UKSSC** expects to establish a third party band manager to promote commercial access to public sector spectrum holdings
- **Ofcom** expects to address issues relating to how payments for secondary use should be handled.
- **Ofcom**, in conjunction with **MCA**, will consult on the initial application of AIP to maritime bands.
- **Ofcom**, in conjunction with **CAA** and **DfT**, will consult on proposals for the application of pricing to aeronautical spectrum.
- **UKSSC** will publish the first Forward Look for public sector spectrum in March 2007. **DTI** will co-ordinate the production of the UKSSC Forward Look.
- **UKSSC** will review progress in implementing changes to public sector spectrum management, as outlined in this response, and report on progress in the Forward Look in March 2007.
- **Ofcom** will compile and maintain information about public sector spectrum use and tradability within the UK Frequency Authorisation Plan.

**From
2008**

- **Ofcom** and **CAA** expect that, subject to the outcome of consultations, spectrum pricing will be applied in selected aeronautical and maritime navigation bands
- **Ofcom** and **MCA** will, subject to the outcome of consultations, extend the application of spectrum pricing to selected navigation bands used in the maritime sector.
- **CAA** will formally report on the review of aeronautical navigation aids, and determine a UK position for international negotiations by June 2009.
- **Ofcom** expects to undertake a review of AIP levels. This will include the current differential between 'fixed' and 'mobile' prices.
- **Ofcom** expects to continue to progress its programme of spectrum awards and to review options for the 1.4 and 1.5 GHz bands.
- **UKSSC** will publish the second Forward Look for public sector spectrum in 2009. This will include a report on progress in implementing changes to public sector spectrum management.
- **Ofcom** will clear with UKSSC, the UK proposals for WRC10 and associated international forums, and set these in the context of

the efficiency savings recommended by the Audit.

- **HM Treasury** will commission a review of the impact of market mechanisms on public sector spectrum management to report in 2012.

Chapter 1 Introduction

- 1.1 The radio spectrum is a major resource for communications in the public and private sectors. Its effective management is essential if we are to make the UK the most dynamic and competitive communications market in the world while simultaneously ensuring spectrum is made available for national security, defence, essential public safety and transport services and scientific research applications.
- 1.2 The Independent Audit of Spectrum Holdings was commissioned by the Chancellor of the Exchequer in his Pre-Budget Report of 2004 to review major spectrum holdings with a view to releasing the maximum amount of spectrum to the market and increasing opportunities for the development of new services. Professor Martin Cave's report was published alongside the Chancellor's Pre-Budget Report on 5 December 2005².
- 1.3 The Audit consulted extensively, and worked closely with the relevant public sector spectrum managers, including the Ministry of Defence, Civil Aviation Authority and Maritime and Coastguard Agency. The Audit Report did not consider broadcasting bands, which were outside the scope of the study.
- 1.4 The Government would like to express its appreciation to Professor Cave and the Audit team for the comprehensive nature of its report, which makes a total of 55 recommendations, and for its cogent and wide-ranging analysis.
- 1.5 The Government agrees with the underlying analysis of the Audit that market-based spectrum management tools should play a strong role in making efficient use of a finite and valuable resource.
- 1.6 The Audit underscores the importance of effective spectrum management in the public sector.
 - The radio spectrum is a finite resource of considerable importance for national security, transport and public services, but also for the wider economy and future UK competitiveness. Effective management of this resource is crucial if we are to maximise the economic and social benefits of its use. Rapid and unpredictable change is both increasing the importance of spectrum and making its management more challenging.
 - The Government believes that centrally planned regulation alone cannot continue to meet this challenge. Market-based mechanisms, such as incentive pricing, auctions and trading, can deliver clear benefits by transferring spectrum to the user who values it most. In particular, they allow continuous dynamic adjustment as markets and technology change.
 - In the interests of maximising the economic and social value of the spectrum, the UK should seek the greatest flexibility in internationally

² Independent Audit of Spectrum Holdings, Professor Martin Cave, December 2005. Available at www.spectrumaudit.org.uk

agreed frequency allocations³ to enable commercial use within public spectrum holdings, subject to a minimum of restrictions on technology and services necessary to protect ongoing public sector use and international obligations. Emerging technology solutions might, with appropriate regulation, offer further avenues to more intensive spectrum use.

- 1.7 The Government agrees with this analysis, which underpins reforms in spectrum management policy over the last 5 years.
- Under the Communications Act 2003, Ofcom has continued to apply administered incentive pricing and intends to significantly increase the proportion of spectrum managed through the market under a liberalised trading regime as proposed in the Spectrum Framework Review (SFR⁴) and its Implementation Plan (SFR:IP⁵).
 - The Government and Ofcom are working to introduce greater flexibility and responsiveness in spectrum management. Following changes to EU and UK law, Ofcom is progressively extending spectrum trading, and its programme of liberalisation, to remove or reduce restrictions on spectrum use. Ofcom is also working in European and global spectrum bodies to make international spectrum policy more flexible.
- 1.8 The Government, with Ofcom, will continue to pursue opportunities to enhance flexibility in both spectrum allocation and assignment. This will involve removing any unnecessary restrictions on the services that may be offered or the technology that may be used.
- 1.9 The Government and Ofcom have already taken steps to implement a number of the Audit's recommendations. The Action Plan set out in this response and covering the next few years, details key milestones in further progressing the Audit's recommendations.
- 1.10 The Audit has proposed a more active role for public sector bodies in managing spectrum holdings, in terms of planning, monitoring and co-ordinating use of spectrum bands. Departments will need to consider both interim and longer-term resourcing of spectrum management activities to support the new approach.
- 1.11 Many of the Audit's recommendations will have significant implications for the procurement and operation of equipment by the Ministry of Defence and the policies and regulatory work of the Civil Aviation Authority. Furthermore, they will impact on their work with international organisations such as NATO and ICAO, visiting or collaborating forces, and international airlines. The Government intends that all departments and Agencies, with Ofcom, should take forward a unified approach to the Audit's recommendations in international forums. The Government hopes that the wider communications industry, including researchers, designers, standardisation bodies,

³ *Allocation* refers to the division of the spectrum into bands for particular services, such as fixed links, mobile communications and broadcasting. *Assignment* is the authorisation given to an individual users to use a specific frequency or frequencies under specified conditions.

⁴ <http://www.ofcom.org.uk/consult/condocs/sfr/>

⁵ <http://www.ofcom.org.uk/consult/condocs/sfrip/>

manufacturers and operators, will similarly engage fully in taking the Audit's recommendations forward.

Chapter 2 **Market Mechanisms**

Recommendation 2.1

The Audit recommends that there should be a presumption that new public sector spectrum needs should be met through the market in all but exceptional cases.

- 2.1 The Government supports the principle of meeting public sector demand for spectrum through the market, consistent with the approach taken by Ofcom in managing spectrum in the commercial sector. This is considered to be the most effective way of securing the optimal use of spectrum, a finite resource, and ensuring that spectrum is managed efficiently to support innovation and growth. There is a growing urgency for such an approach. Demand for spectrum is estimated to exceed supply in the medium term, driven by the evolution of new services and availability of new technology.
- 2.2 Ofcom estimates that, with the phased introduction of spectrum trading and liberalisation in the commercial sector, around 70% of this spectrum should be managed through the market by 2010.⁶ With the amount of underused spectrum decreasing, it is becoming increasingly impractical and inefficient to manage spectrum under a command and control approach. In light of this, it will be essential for public bodies to engage with the market to meet their future needs for spectrum.

Recommendation 2.2

The Audit recommends that, where there is an exceptional case where new spectrum needs cannot be met through the market, a process (set out in chapter 2) should be followed for assessing, through UKSSC, and against set criteria, the case for administrative assignment. Where this case is met Ofcom should be directed to make that spectrum available. Any costs involved should be met by the body or bodies responsible for generating the need.

- 2.3 Where public bodies have significant requirements for additional spectrum, there will be a presumption that these needs will be met through the market. There may be certain exceptional cases, as identified by the Audit, where it will be necessary for an administrative assignment to be made. The Government expects to minimise the need for such regulatory intervention through effective forward planning. Minor assignments, where there is no potential for distortion, will continue to be made on a first-come first-served basis, subject to agreement by the relevant sub-group of UKSSC.
- 2.4 If requirements cannot reasonably be satisfied through existing national allocations or through the market, and there is a demonstrated safety or security critical need, or mandatory international obligation, a non-market assignment will be considered through the UKSSC. If it is agreed by the UKSSC that an exception is justified, consideration will be given to formally directing Ofcom, under the appropriate provisions of the Communications Act 2003, to make the spectrum available through administrative assignment.

⁶ *Spectrum Framework Review*, Ofcom, November 2004 (sub 3GHz)

- 2.5 The public body or bodies responsible for generating the requirement will meet any costs incurred in making spectrum available through non-market assignment.
- 2.6 The criteria and process for administrative assignment recommended by the Audit has been agreed by the UKSSC. Decisions on non-market assignment will follow the process and be assessed according to the criteria, outlined by the Audit, from March 2006. The UKSSC will consider whether these criteria require further refinement⁷, and report any changes through the Forward Look

Recommendation 2.3

Public sector spectrum should be considered for its trading potential and in principle be made tradable on a comparable basis to commercially held spectrum. Decisions will need to be made on a case-by-case basis depending on the suitability for trading of each RSA agreed.

- 2.7 The Government supports spectrum trading by public bodies. Trading should facilitate competition and innovation in communications industries by allowing spectrum to be transferred to the highest value user. Both trading and sharing will allow access to the market for public sector bodies to realise gains that would otherwise not be achieved. Decisions over trading and sharing will be taken on a case-by-case basis by the departments and public bodies concerned.
- 2.8 There are both legal and practical issues that need to be considered before the implementation of trading by public bodies. For Crown bodies, RSA will be a critical enabler of trading, by clarifying and defining their legal rights. Ofcom will aim to clarify how RSA will operate for public sector spectrum holdings by the end of 2006, to inform the discussions on specific proposals for the sale or lease of spectrum in the Comprehensive Spending Review in 2007. Following this, Ofcom will work with the relevant Crown bodies to introduce RSA in key spectrum bands as required. There may be a role for a third party to act as an intermediary between public bodies and the market. This is discussed in more detail in response to recommendation 4.2.

Recommendation 2.4

Income generated from spectrum trading activities (including short term leasing and sharing arrangements) can be retained by departments, subject to capping arrangements. Departments should discuss this treatment with their Treasury spending team.

- 2.9 The Government agrees with the Audit that, in order for the incentives discussed in the report to have the desired effect on public sector spectrum efficiency, public sector bodies should be able to benefit financially from the sale or lease of spectrum. The treatment of income from such activities (and

⁷ The criteria and process for administrative assignment are set out in *Independent Audit of Spectrum Holdings*, December 2005, p.17

savings from reductions in AIP) will be discussed between departments and HM Treasury in the context of the 2007 Comprehensive Spending Review with the aim of providing effective and proper incentives. Interim budgeting arrangements for proceeds generated from trading and sharing activities before the CSR will be agreed between departments and HM Treasury.

Recommendation 2.5

Ofcom should work with key public sector spectrum users to introduce RSA, beginning with priority bands where there is most necessity for usage to be recognised. Charges should be attached, based on AIP. The presumption should be that RSA should be tradable and convertible unless there is a good case otherwise.

- 2.10 The Government and Ofcom agree with the Audit's recommendations on RSA.
- 2.11 Ofcom is already well advanced in preparations to introduce RSA for radio astronomy following public consultation in 2005 and expects to consult by September 2006 on the necessary Regulations. Ofcom will also discuss with the relevant departments and bodies at an early date the extension of RSA to other public sector frequency bands with a view to identifying priority bands. These will then be taken forward with the aim of clarifying and resolving legal and technical aspects as quickly as possible. The Government and Ofcom agree in principle with the Audit on the advantages of making RSA tradable and convertible (to a conventional Wireless Telegraphy Act licence) in order to promote sharing with commercial users. Decisions on implementation will be taken following discussions of specific proposals for trading and sharing during the Comprehensive Spending Review in 2007. Following this, Ofcom will work with the relevant Crown bodies to introduce RSA in key spectrum bands as required.
- 2.12 The Government will work closely in co-operation with Ofcom to introduce RSA for Crown bodies in line with the principle that public sector users should continue to pay for spectrum on a comparable basis to the private sector, whether through licences, whole-band AIP or RSA. Ofcom will set charges for RSA in consultation with relevant departments. Disputes will be resolved by the UKSSC in accordance with the principle of comparability with private sector fees.

Recommendation 2.6

UKSSC should produce a 'Forward Look' for public sector spectrum, every two years, including, for each of the public sector spectrum users who attend UKSSC: description of current spectrum use; changes to be made to allocations; changes to spectrum management; and quantitative predictions and justifications for future spectrum needs.

- 2.13 Forecasting future spectrum requirements will be essential as market mechanisms are introduced into public sector spectrum management. It will also be important for public bodies to comprehensively assess current use of spectrum holdings. The UKSSC will produce a Forward Look for public

sector spectrum every two years. Each of the public sector spectrum users represented at UKSSC will set out their spectrum strategy in the Forward Look. This will include description of current spectrum use, changes to allocations, changes to spectrum management and quantitative predictions and justifications for future spectrum needs.

- 2.14 By the end of 2006 departments will submit to HM Treasury, assessments of current spectrum use and forecasts for future requirements to inform the 2007 Comprehensive Spending Review. These will be built upon for the Forward Look. The first Forward Look will be produced by the UKSSC in March 2007. The Department for Trade and Industry (DTI) will be responsible for the co-ordination of the Forward Look document on behalf of UKSSC. Where there are commercial or security sensitivities, the UKSSC will retain discretion over which parts of the Forward Look to publish.
- 2.15 The Forward Look will additionally be used to report progress against the Audit recommendations and commitments made in this Government response.

Recommendation 2.7

Ofcom should build on the analysis done in the demand study commissioned by the Audit team, and take forward future work as appropriate to gather background information on likely future spectrum demand and market developments.

- 2.16 The Government agrees that the demand study is a valuable project that will help identify those areas where liberating spectrum is most valuable. In turn, this will maximise the ability of spectrum research to deliver benefits. Ofcom has agreed to undertake this work, has issued the invitation to tender and aims to start the project in April 2006 to report and publish by the end of 2006.

Recommendation 2.8

Ofcom should seek to incorporate information about public sector spectrum usage and tradability in its public registers/databases.

- 2.17 The Government and Ofcom accept this recommendation. It will be important to make public, information about opportunities to access public sector spectrum so that businesses are aware of, and can take full advantage of, available opportunities. This information will be published on Ofcom's spectrum licensing portal⁸.
- 2.18 By the end of 2007 Ofcom will compile, and thereafter maintain information about public sector spectrum use and tradability, publish it in the UK Frequency Authorisation Plan and, where relevant, the Wireless Telegraphy Register. The Government is committed to maximum openness in the context of transparency about public sector spectrum use and will cooperate fully with Ofcom in making the relevant information readily available. Ofcom

⁸ <http://www.ofcom.org.uk/radiocomms/isu/ukpfa/about>

will agree with Government departments what, if anything, needs to be withheld on grounds of security or commercial confidentiality.

Recommendation 2.9

There should be a review of the impact of the introduction of market mechanisms on public sector spectrum management in five years. Ideally, this should be independently led, but working with UKSSC. If the effect of the introduction of market mechanisms is not as envisaged by this Audit, the Government may wish to consider implementing a more interventionist approach, for example setting up an overarching spectrum management organisation for the public sector.

- 2.19 The introduction and strengthening of market mechanisms in public spectrum management, recommended by the Audit, is designed to provide effective incentives for public bodies to use spectrum holdings as efficiently as possible. This will be effective if the real opportunity cost of public bodies' spectrum allocations is reflected through appropriately set AIP and through awareness of the potential benefits realisable through trading and sharing.
- 2.20 The Government agrees that it will be important to examine the impact of the introduction of market mechanisms on public sector spectrum management, after allowing sufficient time for the Audit's recommendations to bed down. HM Treasury will commission an independent review to report in 2012. The review will assess the effectiveness of the market-based approach to public sector spectrum management in encouraging more efficient use of spectrum and, if necessary, whether alternative approaches should be considered. It is anticipated that the independent review will work closely with the UKSSC and Ofcom.

Chapter 3 Pricing

Recommendation 3.1

AIP (Administered Incentive Pricing) is, and is likely to remain, a fundamental element in recognising the value of public sector spectrum use and encouraging improved spectrum efficiency. AIP should be extended to a wider range of public sector spectrum bands and uses.

- 3.1 The Government and Ofcom agree with the Audit's conclusion about the importance of applying AIP to the public sector and will work to extend and apply it more consistently. They will work together to give effect to the detailed recommendations that follow.
- 3.2 AIP continues to be an important tool for promoting better use of the radio spectrum and the Government supports the principle that public sector users should pay for spectrum on a comparable basis to the private sector.

Recommendation 3.2

When Ofcom next reviews the level of AIP the sharp distinction between the pricing of both public sector and commercial fixed and mobile services should be addressed. In the longer term Ofcom should move to a service-neutral per-MHz pricing system which reflects the spectrum value curve, subject to any relevant restrictions on use.

- 3.3 The Government agrees that the difference in pricing between fixed and mobile bands needs to be reviewed and Ofcom has confirmed that it will address this issue in the next AIP review, which Ofcom currently plans to carry out by 2008. Ofcom is committed to a policy of liberalisation that involves removing restrictions on spectrum use that are no longer necessary or proportionate. Ofcom aims to move progressively to a position of greater service neutrality in its licensing in accordance with the implementation programme set out in its statement on liberalisation published on 26 January 2005. Changes to licences resulting from liberalisation will be reflected in the AIP fee structure in due course. In accordance with the principle of comparability between commercial and public sector users Ofcom will make changes to AIP fees in the public sector.

Recommendation 3.3

To formalise the application and enforcement of AIP fees for spectrum held by Crown bodies, pricing should be attached to public RSA on the same basis as AIP attaches to commercial WT licences. Until RSA are agreed, and in anticipation of the implementation of AIP changes recommended in this report, there should be a clear route for resolution of any disagreements over pricing levels (through the UKSSC structure). Government should also make a clear commitment to the principle of paying AIP charges on its spectrum holdings as requested by Ofcom, calculated on a comparable basis to commercial sector charges.

- 3.4 The Government is committed to the principle of comparability between public and private sectors' charges both for licences and for RSA.
- 3.5 There is no formal pricing procedure for Crown bodies. It has so far been possible for them to reach agreement with Ofcom (and its predecessor, the Radiocommunications Agency - RA) on the amounts to be paid in accordance with the principle of comparability with private sector charges. This will continue as the process for agreeing pricing levels. The UKSSC provides an appropriate forum to resolve any disputes that might arise between Ofcom and public bodies and will formally assume this responsibility from March 2006.

Recommendation 3.4

In future sharing or leasing arrangements should preferably be managed by the primary user (or a third party acting on its behalf), who would also receive payment direct from the secondary user. Where Ofcom manages the secondary use through granting licences or RSA, fees set in regulations should be linked directly to Ofcom receipts from the sharers, or to a sharing algorithm where that is not possible. The position on delegating charging functions should be clarified by Ofcom.

- 3.6 The Government and Ofcom agree with the principle that the financial benefit for public bodies from sharing should be aligned with the value of the sharing that has been enabled. The Audit outlined a number of options for achieving this. The precise arrangements whereby the secondary sharer pays for access to spectrum and the fee paid by the primary sharer is adjusted will need to be determined in the light of the terms of the sharing. For example, this will depend on whether the transfer is outright or concurrent, on the period of the transfer and any reversion or pre-emption rights.
- 3.7 Ofcom agrees with the Audit that there are advantages in direct payment and intends to move in this direction. However, as the Audit implies, this raises legal issues and is likely to require amendments to both trading and licence charges Regulations, and alternative arrangements may be more appropriate in some cases, e.g. for Short Range Devices (SRDs) and Amateur Service sharers. Ofcom expects to address these in the course of future reviews of those Regulations during 2006 or 2007.

Recommendation 3.5

Where the MoD has partial use in a band used extensively for commercial services, the MoD should negotiate with and pay charges to the primary user directly where possible. If this is not legally or practically feasible the MoD should pay for its use to the extent that it restricts the scope and value of commercial activity. The RSA should be classified if necessary, for use by Ofcom and MoD only.

- 3.8 The MOD and Ofcom agree in principle with the approach recommended by the Audit in bands where the MOD is not the major user.

- 3.9 Payments by the MOD as a secondary sharer to a primary sharer are a particular case of the application of recommendation 3.4 and similar considerations apply. The MOD and Ofcom agree that, where the above arrangement is not possible, the amount paid by the MOD should reflect the extent to which the current commercial use of the band is constrained and the value of the commercial activity that is foregone.
- 3.10 The Government is committed to maximum transparency and openness and will aim to publish as much information as possible. However details of RSA or licences held by MOD, or any other public sector user, will be classified where necessary.

Recommendation 3.6

AIP should be extended to the 225-400 MHz band at the standard 'mobile' rate with appropriate discounts for sharing included. This should be done at the next appropriate point in the budgeting cycle, probably the 2007 Comprehensive Spending Review.

- *AIP should be extended to the 3.1-3.4 GHz and 5.3-5.65 GHz military radar bands, charged on a national per-MHz basis. Pricing should be implemented on the same 2007-2009 timescale as for shared civil and military radar bands and on a comparable basis.*
 - *The treatment of MoD bands below 3 GHz currently classed as 'fixed' should be reviewed to assess the case for pricing these at the 'mobile' rate instead.*
- 3.11 The Government and Ofcom agree that AIP should be extended to the 225-400 MHz band for military users where there is scope for the UK to change future use; some non-military users in the band already pay AIP. HM Treasury and Ofcom, together with the MOD, will consider the extension of AIP for military use in this band, with appropriate discounts for sharing, in the Comprehensive Spending Review in 2007.
- 3.12 There is a strong case for extending AIP for radar for both military and civil use. This is in line with the approach proposed for civil radar in chapter 6 of the Audit, and the principle of comparability in spectrum charging between the public and commercial sectors. The Government therefore supports the extension of pricing to military radar in the 3.1-3.4 GHz and 5.3-5.65 GHz bands, to be introduced in the same timescales and on a comparable basis to civil aeronautical radar. During the CSR in 2007, HM Treasury and Ofcom, together with the MOD, will consider the application of pricing for military radar in this band and agree a timetable for its introduction.
- 3.13 The Government and Ofcom agree that pricing of MOD spectrum below 3 GHz is anomalous and should be revised as recommended. Ofcom will review the pricing of MOD bands currently classed as "fixed" and move towards pricing at a "mobile" rate. This revaluation will be discussed in the CSR 2007 and a timetable established for its introduction.

Recommendation 3.7

We endorse the principle of AIP. To ensure the effectiveness of AIP as a tool, the periodic reviews of AIP rates should be informed by (i) market value of the spectrum being taken into account in AIP application and level; and (ii) reviewing the impact of AIP.

- 3.14 Ofcom continues to regard AIP as an important spectrum management tool and has welcomed the Audit's endorsement of AIP.
- 3.15 Ofcom agrees with the Audit that it is appropriate for levels of AIP to be informed by information on actual market values of spectrum and will take emerging data into consideration in its periodic reviews while recognising that fee levels should be no higher than necessary for spectrum management purposes. This principle is enshrined in EU and UK law.
- 3.16 Ofcom also agrees that it will be necessary, in due course, to evaluate the impact of AIP to demonstrate its ongoing effectiveness. This is consistent with Ofcom's approach to evidence-based regulation. Ofcom will incorporate this evaluation in the review of AIP that Ofcom has committed to undertake by 2008 within 3 years of the changes introduced in 2005, following the last review by Indepen and Warwick Business School.

Chapter 4 **Band sharing**

Recommendation 4.1

In parallel to the work to establish RSA for Crown bodies, the NFPG should agree and codify existing sharing arrangements, beginning with the priority bands for RSA. These agreements could then be annexed to the relevant RSA.

4.1 The Government agrees with the need to formalise and codify existing sharing arrangements, given that many evolved over time and, although currently workable, may not be sustainable for the future spectrum management regime. The UKSSC National Frequency Planning Group (NFPG); radar; band sharing, and PSSPG sub-groups will be asked to undertake this work, starting immediately, with support from Departments, Agencies and Ofcom. Progress will be reported in the Forward Look documents.

4.2 The Government will work with Ofcom to establish RSA for Crown bodies in line with the response to Recommendation 2.5 on Crown body RSA.

Recommendation 4.2

A third party body should be set up to act as an intermediary between public bodies and commercial interests. This should be funded from the Spectrum Efficiency Scheme for a pilot period of 18 months to provide free facilitation of trading and sharing arrangements for public bodies (with an element of profit-sharing built in).

4.3 A third party acting as an intermediary between public bodies and commercial interests could play a valuable role in to facilitating sharing and trading. Before establishing a third party body, it will be necessary to address a number of legal and other issues related to spectrum rights and the transfer of those rights between parties. It may also be beneficial to focus on a limited number of priority frequency bands to start this process. The Government will work with Ofcom to resolve these issues on a timescale commensurate with that proposed in relation to recommendation 2.5 on development of Crown body RSA.

Recommendation 4.3

MoD, CAA, MCA and Ofcom should agree a specification for a test programme to be carried out on the use of band sharing technologies to allow sharing between radars and communications systems. Once PSSTG requirements have been agreed, and the testing programme is underway, there should be a presumption in favour of sharing being admitted with any technology meeting these criteria. Ofcom should facilitate the test programme, providing testing capabilities; the incumbents should provide reasonable help as necessary. If the testing programme reveals specific technology barriers to a promising technique being introduced, Ofcom should consider whether this merits further research funding from the Spectrum Efficiency Scheme to address these problems.

- 4.4 The Government will consider whether the PSSTG group should report to the new band sharing sub-group of UKSSC (see Rec. 4.5), which will formally adopt and maintain a database of protection criteria, assessment methodologies and approved system characteristics. The PSSTG in the meantime is developing a generic methodology for the development of protection criteria, and testing compliance with those criteria, with contributions from CAA, Ofcom, MOD, MCA, NATS and industry.
- 4.5 Work on developing specific band-by-band protection criteria has commenced starting with the 2.7-3.4 GHz band. This project has not yet been scoped but the timescale should be clear by the end of 2006. In all this work considerations of public safety will be paramount.

Recommendation 4.4

CAA and MoD should make spectrum available for sharing trials in the 2.7-3.4 GHz band on a spatial or time basis.

- 4.6 Work has begun on the identification of suitable spectrum for trials in the 2.7-3.4 GHz band. Further clarification of the suitable spectrum within this band is awaiting input from potential sharers as to the type of sharing they wish to trial and whether they are looking for temporal, frequency or spatial separation or a combination of these. Initial sharing trials will commence during 2006 subject to satisfactory completion of safety assessments and funding provision.

Recommendation 4.5

A band sharing group consisting of Ofcom, MoD, CAA and MCA should be established. Issues are suggested for early consideration by the group. The group should form a sub-group of the formal UKSSC structure.

- 4.7 The Government is committed to the establishment of a band-sharing group as a sub-group of the UKSSC by summer 2006. The DTI will chair the new band-sharing group. The first meeting of the group will be in 2006 in which the areas highlighted by the Audit will be considered.
- 4.8 The Government sees the PSSTG providing a considerable technical input to the business of the band-sharing group, and will therefore consider whether PSSTG should report to the band-sharing sub-group of UKSSC.
- 4.9 The band-sharing group will work closely with the PSSPG to ensure a coherent consideration of band sharing across all public services.

Chapter 5 Ministry of Defence

Recommendation 5.1

MoD should report, in the UKSSC Forward Look document, on its future plans for management of its spectrum holdings in the light of the Audit's band specific analysis and its own current benchmarking and future scenario planning work.

- 5.1 The MOD is committed to planning and managing its spectrum requirements effectively and efficiently. This forms one of the tenets of the developing MOD spectrum policy.
- 5.2 The MOD believes that the band-by-band Audit provides a useful top-level analysis and guide to where action may be appropriate in considering further sharing, opening new bands to be shared or the possible release of spectrum. The MOD's band specific analysis in the UKSSC Forward Look will build on the work carried out by the Audit in their band-by-band study. The MOD will identify key bands and will need to undertake detailed internal Audits to determine whether there is any scope for action. In assessing any scope for action the MOD will need to take account of future uses for a band recognising that these may not as yet have been identified and quantified.
- 5.3 The MOD agrees with the need for a UKSSC Public Sector Forward Look document and will fully engage in contributing to it in collaboration with other Government Departments. The MOD will report in the Forward Look on its spectrum strategy. This will include descriptions of current and future use in MOD managed bands and quantitative predictions and justifications of future spectrum requirements. This work will encompass detailed, and ongoing, spectrum usage Audits and scenario planning. The first Forward Look will be produced in March 2007 and the MOD's initial input will be built on in future iterations. In order to inform the 2007 Comprehensive Spending Review, the MOD will also provide an assessment of current and future spectrum requirements to HM Treasury by the end of 2006.

Recommendation 5.2

MoD should report to UKSSC on progress in implementing its spectrum policy in the first Public Spectrum Forward Look document. In particular, attention should be paid to the areas highlighted in this report.

- 5.4 The MOD is fully committed to contributing to the Forward Look. This will provide feedback on how the MOD spectrum policy is being implemented through its spectrum strategy, which will cover areas such as:
 - **Co-ordination** – providing coherence on spectrum issues;
 - **Detailed Spectrum Audits** – looking at current and future uses to determine frequency, geographical and temporal use in order to define spectrum rights;

- **Equipment Procurement** – ensuring spectrum requirements are identified and assessed throughout as well as factoring in the costs of spectrum use into equipment procurement decisions;
- **Dynamic Spectrum Management** – examining scope for frequency, geographical and temporal re-use to provide a more flexible approach given the appropriate management tools and suitably flexible equipment;
- **Resources** – matching the necessary increases in resources in order to fulfil a much more active role in managing spectrum.

5.5 The MOD will report progress against this strategy as part of the UKSSC Forward Look in March 2007.

Recommendation 5.3

Setting spectrum targets should be considered further in discussions between MoD and HM Treasury in the context of the 2007 Comprehensive Spending Review, when overall targets will be revised.

- 5.6 On the basis of the Audit's recommendations, the MOD expects to identify bands for further or new sharing and trading. The MOD will release or share certain bands, or spectrum at the margins of bands, where there are no significant obstacles to do so, with the first efficiency savings to be achieved by the end of 2007.
- 5.7 Further spectrum will be released or shared over the next 5 years where there is scope to do so. In bands where there are technical or other barriers to action, the Government and Ofcom will undertake further work to investigate how and when these barriers can be overcome. The Government will also engage with the private sector to identify the bands where there is commercial interest and will welcome commercial funding where appropriate to determine whether barriers can be overcome. As recognised by the Audit, it may not be possible to open all of the bands identified for sharing to commercial use
- 5.8 The band-by-band audit provides a useful guide to where action may be appropriate. Specific spectrum targets will be discussed and set as part of the 2007 Comprehensive Spending Review, on the basis of the Audit's band-by-band study and the assessment of MOD bands provided to HM Treasury by the end of 2006. In this assessment, the MOD will outline specific proposals for release or sharing of spectrum, based on the Audit's band-by-band study. The MOD will also include appraisal of any significant costs involved in implementation.

Recommendation 5.4

The MOD should produce an implementation plan for delivery of its spectrum policy with respect to spectrum in the UK, including timescales and responsibilities clearly identified and allocated.

- 5.9 MOD has produced an implementation plan as part of its spectrum policy. That plan includes timescales and assigns responsibilities. The policy considers both spectrum uses in the UK for contingency operations, equipment development and training and use outside the UK for UK led and coalition operations, and for overseas training. The MOD will establish the Spectrum Acquisition Authority (SAA) in 2006 in order to improve the internal co-ordination and management of its spectrum requirements. This will raise the profile and awareness within the MOD of spectrum as a valuable resource, and ensure that spectrum requirements and costs are taken in to account at an early stage in procurement programmes. The SAA will complement the Spectrum Joint User Working Group, which was established in early 2005 to coordinate spectrum usage and help identify and assess opportunities for band sharing.

Recommendation 5.5

The Audit recommends, with regards to the SAA: (i) that its Terms of Reference encompass the roles envisaged in Chapter 5; (ii) that the SAA consider amending acquisition requirements to include spectrum as an input for consideration; (iii) that the operation of the SAA is reviewed after one year and reported on in the Public Spectrum Forward Look document; and (iv) at this stage a decision should be made whether spectrum fees should be transferred to the SAA for management or disaggregated within the Department.

- 5.10 The SAA will ensure a coherent approach to spectrum is taken across equipment procurement programmes that are aligned, to the greatest extent, with MOD military partners. In order to do this the SAA will:
- Draft regulation and guidance for spectrum requirements;
 - Develop and maintain the MOD Spectrum Strategy for the Equipment Programme;
 - Screen equipment procurement projects through the scrutiny process to ensure that spectrum is included as an input for consideration and that projects meet spectrum access requirements;
 - Arbitrate on issues of potential conflict on spectrum access and adjudicate on issues of spectrum whole life costs;
 - Act as the core customer for a spectrum modelling capability that will provide a set of modelling tools to enable the MOD, coalition partners and defence industry to test the availability of spectrum for their purposes.
 - Initiate an education campaign to raise levels of awareness across the Department;
- 5.11 The MOD will provide feedback on the operation of the SAA as part of the MOD contribution to the UKSSC Forward Look. The MOD will review, as part of the first Forward Look, whether spectrum fees should be disaggregated or transferred to the SAA

Recommendation 5.6

Spectrum Efficiency Scheme funds should be made available to part fund, with the MoD, research into systems to enable MoD bands to be more dynamically managed and to increase sharing possibilities. Ofcom and the MoD should agree on a joint budget and specification for this work and manage the project together.

- 5.12 The MOD welcomes the proposal to collaborate on research into systems to enable bands to be more dynamically managed and to increase sharing possibilities. The MOD, HM Treasury and Ofcom will work together to identify and manage appropriate research areas.

Recommendation 5.7

The Audit recommends that MoD should review its resource allocation to spectrum management in the light of the more active spectrum management role recommended by this Audit and envisaged in the MoD's spectrum policy document.

- 5.13 The MOD has recently reviewed, and will continue to review, its internal management processes and required resources to endeavour to position the department to manage its spectrum allocation effectively and efficiently in the light of the developing spectrum management regime.

Chapter 6 **Aeronautical**

Recommendation 6.1

AIP should be extended to military and civil aeronautical uses of the spectrum where it has the potential to help increase efficiency of spectrum use now or in the medium to long term. Beneficial effects of pricing could include:

- *Maximising the benefits to aviation of its existing spectrum holdings*
- *Recognising and enabling other potential uses of the spectrum (where alternative use would be possible)*

- 6.1 The Government supports the principle of extending AIP to aeronautical spectrum and recognises the potential for increased efficiency as a result. Pricing can deliver benefits in the medium to long term through re-planning and procurement of more effective equipment. The Government, CAA and Ofcom agree that there is a strong case for introducing pricing for civil aeronautical spectrum where current use imposes an opportunity cost. This is consistent with the Government's support for the introduction of AIP pricing for military aeronautical spectrum. Ofcom will therefore work with the Government and the CAA with the aim of introducing incentive pricing in civil aeronautical spectrum from 2008 where appropriate.
- 6.2 It will be important to set AIP at a realistic level. Ofcom will work with the CAA to estimate the opportunity cost of civil aeronautical spectrum, in order to enable initial pricing levels to be set. Ofcom expects to initiate this study in the first half of 2006 and to complete it by early 2007.
- 6.3 Ofcom will consult by the end of 2007 on specific proposals to extend AIP pricing. Ofcom, advised by the CAA, will take account of the implications of AIP for airspace users, for safety and compliance with international obligations and for stakeholders in the wider economy who would benefit from the enhanced access to spectrum. The Government supports the implementation of AIP for radar, which is expected to commence during 2008.

Recommendation 6.2

CAA and MoD should report their future plans for management of aeronautical spectrum holdings in the UKSSC Forward Look document, including progress on the opportunities for spectrum release or additional sharing identified in the Audit's band specific analysis (see Annex B). Plans for shared civil/military bands should be coordinated through the new radar and aeronautical subgroup of UKSSC.

- 6.4 The MOD contribution to the Forward Look document has already been addressed in the response to Recommendation 5.1. Supported by DfT, the CAA fully supports the creation of the UKSSC Forward Look document and is committed to making a comprehensive contribution in collaboration with other Government Departments. This will also enable the spectrum management implications of global and regional programmes and policies,

particularly those that the UK is committed to support, for example Single European Skies, to be briefed.

- 6.5 The proposal for coordination of plans for shared civil/military bands through new UKSSC subgroups is fully supported and these will be created as reported elsewhere in this response.

Recommendation 6.3

Initial AIP charges should be set conservatively, in line with Ofcom policy for other AIP classes. As part of this process Ofcom will need to evaluate the opportunity cost of existing aeronautical spectrum use to an aviation user denied or granted spectrum use at the margins.

- 6.6 The Government and Ofcom agree, for the reasons given by the Audit, that AIP for appropriate aeronautical services should be set on similar principles to those adopted for other licence classes. The process will include an impact assessment and consultation on the pricing proposals in due course, which will take related safety issues into account.

Recommendation 6.4

As co-ordination between the regulator and individual users will generally be needed to enable redeployment of aeronautical spectrum, where possible pricing should be imposed as an overall per-MHz band price. It would then be the responsibility of a co-ordinating body to apportion the band price and work with users to enhance intensity of use or release spectrum. Algorithms which reflect impact on other spectrum users should be employed where this is not feasible (or desirable if it could create perverse incentives).

- 6.7 The Government accepts this recommendation, which will be actioned as part of the detailed work in implementing Recommendations 6.1 and 6.3, towards completion by financial year 2008/09.

Recommendation 6.5

For other airborne uses where the opportunity cost is effectively zero and there is no direct spectrum management pricing should remain at cost-recovery levels for the moment (Ofcom are considering options including a fee-free system for aircraft licensing). Currently cost-recovery licences do not always very accurately cover the true licensing costs, and where this is the case the pricing structure should be reviewed.

- 6.8 The Government and Ofcom agree that cost recovery licences need to be examined further, noting the requirement to retain a viable licensing process and the need to ensure the objective of spectrum efficiency, when considered in the wider context of overall spectrum efficiency in the aeronautical service, and the need to comply with international obligations. This will be examined further in conjunction with Recommendation 6.9 on adoption of spectrally efficient technology.

Recommendation 6.6

AIP should be introduced on the basis of both the value to aeronautical users and potential alternative users in all ground-based radar systems:

- *UHF Radar (subject to decisions on clearance)*
- *L-Band*
- *S-Band*
- *X-Band*
- *Ku-Band*

6.9 The Government accepts this recommendation as an initial step to the implementation of AIP as outlined in responses to recommendations 6.1 and 6.3 above. In view of the extensive interests in the different types of use of L band, progressing this aspect of the recommendation is likely to be slower.

Recommendation 6.7

There may be a case for pricing DME ground stations, since they are licensed with discrete and potentially scarce assignments. The case is not clear-cut but Ofcom should assess the case for pricing DME further as part of the exercise in determining the scope and level of aeronautical AIP to be implemented.

6.10 Although the principle of expanding the application of AIP is fully supported, it is recognised that there are both safety and institutional issues, including UK obligations in respect of international navigation strategies, which need to be considered in respect of Distance Measuring Equipment (DME). DME is fundamental to these international strategies, which aim to deliver a wide range of benefits including capacity; routing and environmental issues and AIP could have a potential impact on the ability to deliver the UK element. Furthermore, DME operates in an already heavily utilised band, which also supports some MOD applications and Global Navigation Satellite System - GNSS (GPS and Galileo). Therefore, Ofcom will need to work closely with CAA in assessing the implications of the introduction of AIP for DME. Ofcom and the CAA are aiming to have this assessment completed by December 2007.

Recommendation 6.8

The MLS allocation is currently underused and there may be a case for applying pricing to this spectrum on the same basis as ground-based radar sites. This is subject to a concern that disproportionate pricing on initial users should not discourage the adoption of an effective technology, and potential pricing of MLS should be linked to a review of navigation aids and landing systems as below.

6.11 The migration to Microwave Landing System (MLS) has undoubtedly been at a significantly slower pace than envisaged by the aviation community and the Government agrees that the application of AIP (for landing systems) merits further study in the light of the outcome of the wider review of

Communications, Navigation and Surveillance (CNS) systems mentioned in the response to recommendation 6.10.

Recommendation 6.9

There may be an economic case for differential pricing of ground-based and/or airborne VHF communications licences to accelerate adoption of more spectrally efficient equipment in congested spectrum. Ofcom should investigate the opportunities further, in conjunction with CAA.

6.12 The Government recognises the potential positive impact of AIP in providing the necessary impetus to speed migration towards new technologies and accepts that this may be a valuable addition to the regulatory framework in delivering efficient spectrum management. As the UK is currently participating in European programmes aimed at addressing the VHF congestion issues, this recommendation could be usefully progressed as a parallel activity with the aim of providing the findings of the investigation by Ofcom and CAA by December 2008. This would also take into account the outcomes of WRC 2007. This recommendation is linked to recommendation 6.5 and the Government recognises that CAA and Ofcom will need to ensure consistency in implementation in this area. The possibility of introducing AIP for certain categories of ground stations in this band will be kept under review in the light of progress in international discussions and entry into service of more spectrum-efficient equipment.

Recommendation 6.10

Ofcom, CAA and MoD should undertake a joint review of navigation aids and landing systems to consider whether any rationalisation of multiple allocations is feasible. The opportunities identified should be pursued through pressing for changes at a regional or global level, and through the use of market mechanisms where possible.

6.13 The provision of navigation aids and landing systems are determined in accordance with international requirements and the UK is required to fulfil its obligations in air navigation provision for international flight which have to be consistent with global and regional interoperability requirements. Furthermore, safety regulatory requirements demand redundancy in appropriate circumstances, which together with airspace needs, enable the safe and efficient movement of air traffic. Nevertheless, it is recognised that there may be scope to reduce duplication.

6.14 This issue cannot be addressed unilaterally by the UK as it has an international dimension. Therefore, the Government will task the CAA with conducting a review of the scope for rationalisation of these aids and systems in order to determine the UK position to be pursued in the appropriate regional and global fora. This will take into consideration the ICAO Global Strategy (and associated Standards and Recommended Practices), the ECAC Navigation Strategy and the outcome of WRC07, together with the European Commission mandates for Interoperability Implementing Rules in support of the Single European Sky project. In

addition, it will also be necessary to address national security issues as advised by the MOD.

Recommendation 6.11

Ofcom, with assistance from the CAA, should take forward discussions with the incumbents of the 590-598 MHz band with a view to vacating the band (including the option of a funded clearance project). These discussions should take place in the context of the wider debate on broadcasting spectrum in RRC06 in order to properly assess the costs and benefits of such action.

6.15 The Government agrees with this recommendation and Ofcom and the CAA intend to take forward formal discussions with the aim of identifying a feasible solution acceptable to all parties by autumn 2006.

Recommendation 6.12

Radar tends to produce significant levels of unwanted emissions which can adversely affect the intensity of use and hence value of other spectrum bands. The Audit considers that there is an economic case for taking account of these negative externalities through a system of penalties on radar users for the degradation they cause to spectrum use in other bands. Further research and proposals on this issue should be taken forward by Ofcom in parallel with the extension of AIP to radar.

6.16 The Government agrees with this recommendation and the necessary work will form part of the action plan in delivering the AIP process as set out in Recommendation 6.1. This work will also take into consideration, where available, output from the relevant ITU working groups that are considering elements of this issue from a global perspective.

Recommendation 6.13

As part of their response to this Audit, Government, Ofcom and the CAA should jointly adopt and publish a timetable for consulting on and implementing AIP for appropriate aeronautical spectrum classes. In the Audit's view implementation of AIP could realistically take place in line with Ofcom's plan to introduce trading in appropriate aeronautical licence classes between 2007 and 2009.

6.17 Linked to Recommendation 6.1, the Government agrees with this recommendation which supports its general commitment to ensure full consultation occurs in accordance with the "Better Regulation" principles. To this end, the CAA and Ofcom are aiming to publish the proposed timetable by the end of 2006.

Recommendation 6.14

The arrangements for joint CAA and MoD coordination of aeronautical bands should be formalised, perhaps including the use of a joint planning tool. A new radar and aeronautical subgroup of UKSSC should be constituted with a

membership of Ofcom, CAA, DfT and MCA. This group could be established in 2006, in advance of the introduction of AIP. Its eventual remit would be to:

- Apportion fees between individual users and collect them*
- Take decisions on competing demands for spectrum*
- Manage detailed compatibility and planning*
- Use a joint planning tool to enable more efficient and dynamic assignment*

6.18 Coordination of radar and aeronautical bands has been in place for some time. However, the Government agrees that there would be advantage in formalising current arrangements, particularly in respect of the jointly managed bands. The UKSSC has taken the necessary institutional steps to create the appropriate subgroups, and the first meeting under the formalised arrangements is scheduled for June 2006. MOD will be included within the recommended membership.

Chapter 7 Maritime

Recommendation 7.1

Ofcom, in conjunction with the MCA, should begin work to introduce Administered Incentive Pricing in the following licences classes: Navigational Aid (radar); Coastal Station (UK) radio; and Differential Global Positioning System (DGPS); including carrying out further work on future demand as indicated in this chapter. This should be carried out to the same timing as the development of aeronautical pricing where there are linkages.

- 7.1 Ofcom and the MCA intend to begin work as soon as possible on the extension, subject to consultation, of AIP to these licensing classes on a similar timescale as that proposed for introducing AIP for aeronautical services.

Recommendation 7.2

The MCA should examine in detail the possibility of increasing sharing in the 3 GHz and 9 GHz maritime radar bands, and should report on this issue to the Sharing Group for discussion with other users of these bands.

- 7.2 The Government agrees with the Audit that the possibility of enhancing sharing in these bands merits examination. The MCA will work with Ofcom and MOD on compatibility studies with a view to determining whether sharing with other services is feasible. It will be necessary to take account of other users of the band and any constraints imposed by international obligations.

Recommendation 7.3

Ofcom and the MCA should carry out a review of international applications in the bands 156.0 MHz to 158.5 MHz and 160.6 MHz to 163.1 MHz to ascertain the feasibility of promoting simplex use of the duplex channels and/or the conversion to 12.5 kHz bandwidths.

- 7.3 The Government and Ofcom agree that it would be desirable to examine simplex use or conversion to 12.5 kHz or narrower bandwidth as a way of enhancing spectrum efficiency in these bands. Ofcom and the MCA will take this forward in conjunction with Recommendation 7.1 on coastal stations but the timescale is likely to be considerably longer in those parts of the band that are subject to international obligations.

Chapter 8 **Emergency and Public Safety Services**

Recommendation 8.1

The role and composition of PSSPG should be reviewed:

- a) *The Audit recommends that PSSPG focus on policy rather than technical issues, and attendance at the group amended accordingly;*
- b) *PSSPG should consider whether it, or a contracted party, should act as a band manager for public sector spectrum. If the former, PSSPG will need more staff resource.*
- c) *Section 8.2 sets out some roles that PSSPG should fill*
- d) *PSSPG reporting lines should be changed so that PSSPG reports directly into UKSSC. Ministerial reporting should be examined.*
- e) *In addition, future needs of all the services need to be properly assessed, and coordinated through PSSPG. If PSSPG sponsor departments cannot do this they should fund contracted work.*

8.1 The Government fully endorses the recommendations of the report relating to future Emergency and Public Safety (E&PS) spectrum management.

- a) PSSPG will in future concentrate on strategic issues and policy decisions, and devolve technical matters to a dedicated Technical Subgroup. Revised terms of reference for PSSPG will be published by autumn 2006 and will take account of the Audit recommendations concerning membership.
- b) PSSPG will consider, with Ofcom support, the appointment of a third-party band manager. Until such time, the Technical Subgroup currently comprising OFCOM and Scottish Executive will undertake management of this spectrum. Resources will be kept under review by sponsoring departments.
- c) The revised PSSPG terms of reference to be published by autumn 2006 will take account of the recommendations in section 8.2 of the Audit report.
- d) PSSPG will report direct to UKSSC in accordance with the revised terms of reference to be published by autumn 2006.
- e) The PSSPG will contribute to the Forward Look recommended in Recommendation 2.6. This will be supported by independent assessments where required.

Chapter 9 Science Services

Recommendation 9.1

Subject to resolution of incentives issues as set out in Chapter 9, radioastronomy RSA should be made tradable.

- 9.1 The Government accepts the principle that RSA granted for radioastronomy or other passive scientific use should be made tradable, subject to holders being able to benefit from trading. This would encourage RSA holders to share spectrum with other users and facilitate leasing and temporal or geographic sharing where international obligations permit and to the extent that they judge is compatible with their scientific objectives.

Recommendation 9.2

PPARC should review the structure for devolving spectrum charges, and consider (in the light of discussions on income retention) either cascading charges to users or taking a more active role in spectrum management, to enable pricing to be applied at the level of those able to make decisions about the use of spectrum by these services.

- 9.2 PPARC has noted the findings of the Audit, which echo the current status of discussions between PPARC and Ofcom over the adoption of RSA and Spectrum Pricing.
- 9.3 PPARC is in discussion with the radioastronomy community with respect to the on-going requirements for spectrum protection in the UK and regularly consults with it on science priorities and amendments. In turn, the community and PPARC routinely consult with Ofcom with regard to the international radioprotection environment, since many of the primary frequencies for radioastronomy are protected under ITU regulations. Radioastronomy already shares many of these frequencies with other industry and government users. The community leaders are fully aware of the cost of spectrum protection and this is included as an opportunity cost within PPARC's assessment of the priority for radioastronomy projects. Given the current visibility of the cost to the community PPARC does not support the cascading of charges to users. The difficulty in re-establishing protection once commercial use has become established suggests that strategic decision-making should be preferred to local.
- 9.4 The Audit is correct in stating that there are no plans to move the current UK radioastronomy facilities, since this would not be commercially viable or practical. The principal UK radioastronomy project, MERLIN, controlled from Jodrell Bank near Manchester, is undergoing a major upgrade to operate via fibre optic cables and is expected to continue to deliver front rank science for the next few years. It is essential that the radio environment be maintained to enable the exploitation of the UK's investment in this leading research facility. The next generation of radioastronomy facilities are likely to be sited overseas, in radio-quiet areas, preferably protected by international regulation.

Recommendation 9.3

The budget for spectrum charges for the bands used by the Met Office should be transferred from the MoD to the Met Office to be managed there. MoD and the Met Office may wish to review the use of these bands before this transfer takes place.

- 9.5 The MOD and the Met Office will review how the budget for spectrum charges for the bands used by the Met Office should be treated and report back on the outcome in the Forward Look document in March 2007.

Chapter 10 Fixed Links

Recommendation 10.1

Ofcom should review the 1.4 GHz and 1.5 GHz bands in the light of the market value and environment revealed by the upcoming auction of adjacent L-Band spectrum. Ofcom should then give further consideration to the merits of a clearance project or overlay auction as appropriate.

10.1 Ofcom has accepted this recommendation and will review any disparity between AIP for mobile radio and fixed links in these bands as part of the implementation of the recommendations discussed in chapter 3. Ofcom will consider the options for this part of the spectrum in the light of the outcome of the award, planned for 2006-07, of L-Band spectrum (1452-1492 MHz).

Recommendation 10.2

With regard to 1790-1798 MHz:

- *Ofcom should pursue the resolution of the issues currently affecting the possibility of a successful auction, aiming for an award as they currently plan, in 2007/8;*
- *The MoD should pay Administered Incentive Pricing for this band;*
- *The option of migrating the MoD use out of this band into an internationally harmonised space operations band, probably over a longer timescale of 10-15 years, should be considered as an option for this band*

10.2 Ofcom continues to work towards auctioning this spectrum in 2007-08. As stated in paragraph 5.96 of Ofcom's Spectrum Framework Review: Implementation Plan⁹, there are complex issues that first need to be resolved in relation to use by the emergency services and professional radio microphones. Ofcom plans to consult during 2007-08 on the feasibility of an award although, because of the need to resolve the outstanding issues associated with clearing incumbent users from the band, it is currently considered unlikely that an award could take place before 2007-08. The Government will support Ofcom's plans to clear and auction the spectrum as soon as possible.

10.3 The Government and Ofcom agree that the MOD should pay AIP for its use of spectrum in this band. Ofcom will pursue this with MOD with a view to applying AIP following the 2007 CSR.

10.4 The Government and Ofcom agree that the suggested option of migrating MOD use out of this band into an internationally harmonised space operations band should be considered over the timescale indicated by the Audit.

⁹ <http://www.ofcom.org.uk/consult/condocs/sfrip/sfip/sfr-plan.pdf>

Recommendation 10.3

Ofcom should consider the use of RSA for receive-only satellite earth stations in the 3.6-4.2 GHz band, along other options for improving the management of this band.

- 10.5 Ofcom agrees that RSA could play a useful role in encouraging more efficient use of spectrum by recognising the position of incumbent receive-only earth stations and applying market mechanisms, and is currently considering the application of RSA in this band. Ofcom would undertake a full and detailed consultation with interested stakeholders before any decisions were taken. Ofcom is continuing exploratory work on the feasibility of licensing additional terrestrial services to share the band with satellite services.

Recommendation 10.4

The Audit recommends that Ofcom gives priority to gathering information to enable it to decide whether, when and on what terms the introduction of RSA in the 11 GHz band would be beneficial.

- 10.6 Ofcom notes the recommendation, which raises a number of complex issues with linkages to wider policy, as noted by the Audit. No conclusions have yet been reached on whether to introduce RSA in this band and no decisions will be taken without full and detailed consultation.

Recommendation 10.5

If the market study being carried out reveals significant demand, Ofcom should give the 32 GHz award a high priority in the interests of encouraging efficient spectrum management and obtaining information about the likely effect of the market in Fixed Links.

- 10.7 Ofcom agrees with the Audit's view of the potential benefits of auctioning spectrum in the band and is continuing to work towards an award in 2006-07 taking into account the possibility of interference to and from services and applications in the remainder of the 32 GHz band and adjacent bands.

Recommendation 10.6

Ofcom should run a one-off 'Spend on Technology to Save on Spectrum scheme' of around £500k. Criteria are suggested in Chapter 10.

- 10.8 Ofcom will consider any cases put forward for 'spend to save' projects on their merits. Under the SES, Ofcom can make grants with the consent of HM Treasury in order to promote the efficient management or use of spectrum. This is achieved through research into new technologies and, in certain circumstances, payments to spectrum users to clear spectrum.

Glossary

3G	Third Generation mobile system
Band sharing	In the context of this report, operating two or more radio services in a frequency band previously reserved exclusively for one service or major user. Band sharing may exploit adaptive techniques to manage the potential interference environment and will generally be based on technical trials to establish feasibility.
CAA	Civil Aviation Authority
CEPT	European Conference of Postal and Telecommunications Administrations
DME	Distance Measuring Equipment (aeronautical navigation aid)
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
Galileo	European satellite navigation system to complement GPS
GNSS	Global Navigation Satellite System – umbrella term for individual systems, e.g. GPS and Galileo
GPS	Global Positioning System – US satellite navigation system
GHz	Gigahertz – A frequency of one thousand million Hertz (cycles per second)
GSM	Global system for mobile communications
ITU	International Telecommunication Union
kHz	kilohertz – A frequency of one thousand Hertz (cycles per second)
MCA	Maritime and Coastguard Agency
MHz	Megahertz – A frequency of one million Hertz (cycles per second)
MLS	Microwave Landing System
MOD	Ministry of Defence
NATO	North Atlantic Treaty Organisation
NRA	National Regulatory Authority
Ofcom	Office of Communications
PMR	Private Mobile radio
PPARC	Particle Physics and Astronomy Research Council
PSSPG	Public Safety Spectrum Policy Group
PSSTG	Public Safety Spectrum Testing Group
RA	Radiocommunications Agency (predecessor to Ofcom)
RSA	Recognised Spectrum Access

SES	Spectrum Efficiency Scheme. A scheme funded by HM Treasury and managed by Ofcom to promote improvements to spectrum efficiency, normally through research, but also through clearance projects or compensating early retirement of equipment.
UKSSC	UK Spectrum Strategy Committee – Cabinet Office official committee responsible for cross-Government spectrum management, including determining which bands Ofcom manages for commercial use.
UMTS	Universal Mobile Telecommunications System - 3G mobile standard