

Ofcom Spectrum Advisory
Board
Annual Report 2006 - 2007

Publication date 3 May 2007

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Section 1

Message from David Currie

Management of the radio spectrum continues to be one of our key priorities within Ofcom. Indeed, this is reflected in our Annual Plan for 07/08 where one of our top five priorities is set out as “accelerating the development of a market-based approach to spectrum”. In order to deliver against our goals and to ensure that we meet our statutory objectives as effectively as possible, we have consistently acknowledged the importance of advice and consultation. Since the early days of Ofcom, OSAB has been one of the key sources of advice, both in terms of feedback on the policies we were pursuing, but often more importantly on what we were not doing, or were not doing well enough.

Engaging with OSAB continues to be a stimulating experience. Ofcom engages at a number of levels from those who attend the OSAB meetings and partake in dialogue between meetings, to the Ofcom Board who meet with OSAB around twice per year. The latter encounters lead to fascinating and often unpredictable discussion covering a wide range of areas and frequently resulting in many streams of new work emerging within Ofcom. For example, at the most recent encounter, OSAB challenged Ofcom to consider the wider aspects of its approach to technology neutrality and to look at the relationships between the drivers for deployment of fixed networks compared to those using spectrum, remembering that most wireless networks have a large fixed component.

When we initially established OSAB in May 2004 all members were appointed for a three year period. We have taken the opportunity of these appointments expiring to adjust the appointment cycles so that, ultimately, all appointment periods will be for three years but only about one third of the OSAB members will retire each year. As a result, retiring from OSAB this year are Professor Martin Cave, Stephen Low, Professor Mike Short and Gary Tonge. We warmly thank them for all their contributions, work and insight over the past three years and will announce their replacements in due course. I am delighted that Sir David Brown has accepted the invitation to continue chairing OSAB for another three years and look forward working closely with him and OSAB over the coming years.

It is always difficult to capture the work of a body like OSAB in an Annual Report. Most of the value that they provide is in the discussion and dialogue which so often changes the thinking of those within Ofcom, resulting in better policy making. Hence, while this Annual Report records the wide range of areas that OSAB has turned its attention to, it inevitably fails to do justice to the full extent and value of its advice. Nevertheless, it is still a fascinating document and worthy testimony to its efforts over the last year.

Lord David Currie

Chairman, Ofcom

Section 2

Foreword by Chairman

The Ofcom Spectrum Advisory Board (OSAB) is pleased to present its third annual report.

The report records the wide range of spectrum-related matters with which OSAB has engaged during the year and the principal outcomes from its discussions. I hope that it conveys, too, a strong sense of the richness of those discussions, both during OSAB meetings and between OSAB and Ofcom. OSAB's productivity, measured by the number and range of issues addressed and the quality of the advice offered, has continued to benefit from the diverse knowledge and the passion for their subject which its members bring to its meetings. I am grateful to all of them for having made the Chairman's job so easy.

I would like to take this opportunity to acknowledge my debt of gratitude to the four members of OSAB, Professor Martin Cave, Stephen Lowe, Professor Mike Short and Gary Tonge, who are retiring after completing their three years of distinguished service. We will miss their wisdom and energy.

Throughout the last year, OSAB's thoughts have turned often to the relationship between innovation and disruption in the technologies and business models which bear upon spectrum usage. We have dwelt on the ways in which disruptive technologies generate demand for spectrum, and how apparently non-disruptive technologies can combine to become disruptive. We have noted, although it hardly needs to be said, that the innovative pace is continuing to quicken. As OSAB begins its fourth year, these themes will continue to thread through its agenda, and its discussions are certain to be as lively and relevant as ever.

Sir David Brown

Chairman, Ofcom Spectrum Advisory Board

Section 3

Introduction

Background

- 3.1 The Ofcom Spectrum Advisory Board (OSAB) was established on 19 May 2004 to provide independent advice to Ofcom on strategic spectrum management issues. OSAB provides Ofcom with:
- A rapid way to test new ideas across a wide range of experts.
 - A means of identifying issues that are beyond Ofcom's regulatory "headlights".
 - A demonstration of Ofcom's commitment to consult industry in an open and collaborative manner.
 - A mechanism to help reach an agreed industry view of difficult and contentious issues through the hosting of open fora.
- 3.2 This document reports on its third year.

Membership

- 3.3 The membership of OSAB continued unchanged until the end of its third year under the chairmanship Sir David Brown (Chairman of Motorola Ltd). At the end of this year, in May 2007, the terms of reference of all members came to an end. Ofcom, in discussion with OSAB, took this opportunity to stagger appointments such that, as from May 2009, one third of OSAB will retire each year.
- 3.4 The members who stepped down at the end of 06-07 were Professor Martin Cave, Stephen Lowe, Professor Mike Short and Gary Tonge. OSAB and Ofcom recorded their thanks and gratitude to these members, who in some cases had advised Ofcom and its predecessor the Radiocommunications Agency for over eight years.
- 3.5 All other members were reappointed, including Sir David Brown who agreed to serve for another three years as the Chairman. At the time of writing, Ofcom was in the process of selecting new members to replace those retiring.
- 3.6 Details of OSAB membership including the length of tenure are at [Annex 2](#).

Work Programme

- 3.7 OSAB is responsible for agreeing its own work programme. During its third year, key topics for OSAB were:
- Devising a suitable set of metrics to track the success of new spectrum management concepts.
 - Providing input and guidance to the digital dividend review (DDR) programme.
 - Helping shape the Ofcom research and development agenda.

- Discussing a wide range of issues associated with the use of spectrum for satellite applications.
 - Looking at international issues including suggestions from the EC for a single European spectrum regulatory body.
 - Assisting Ofcom in its planning work associated with the 2012 Olympics.
 - Looking at whether a special case should be made for Mobile TV.
 - Considering how transport infrastructures might evolve and the role that wireless would play.
- 3.8 In addition, a theme underlying much of OSAB's discussion during the year was disruptive technologies. OSAB discussed a range of issues associated with these at its brainstorming event and made disruption the focus of two meetings it held with the Ofcom Board.
- 3.9 OSAB meets 5-6 times a year and holds an annual brainstorming where a whole day is devoted to a particular issue.

The Year Ahead

- 3.10 OSAB sets its agenda from meeting to meeting depending on progress made in particular areas, time available and topics arising. It deliberately does not plan a year ahead to allow for flexibility and responsiveness. Topics areas that are likely to be addressed in the coming year are:
- short range radio,
 - scenarios for delivering high data rate wireless services,
 - further examination of the role of market forces including spectrum auctions and the optimal extent of technology neutrality,
 - the World Radio Conference to be held in 2007 and the implications that might flow from this,
 - further work on the DDR including societal issues,
 - spectrum access security,
 - network architectures in both fixed and wireless networks and the manner in which incentives in architecture and those in spectrum interact appropriately,
 - international spectrum initiatives.

Further Information

- 3.11 For further information on the work of the Ofcom Spectrum Advisory Board, please contact the OSAB Secretary:

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2a Southwark Bridge Road
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Tel: 020 7783 4031

E-mail: paul.rogers@ofcom.org.uk

3.12 Or visit the OSAB website at www.osab.org.uk/ .

Section 4

Topics considered during the year

International issues

- 4.1 OSAB noted a number of international developments during the year. They received a presentation on the outcome of the Regional Radio Conference (RRC) held in 2006 and congratulated Ofcom on achieving all their main objectives at this event. They also considered briefly some of the key issues that might arise during the World Radio Conference (WRC) in 2007.
- 4.2 During the year, the EC made a suggestion that there might be a “European Spectrum Agency” (ESA), providing many of the functions currently performed by national regulatory bodies such as Ofcom, but at a pan-European level. The EC had suggested three options;
- Option 1: create a European Spectrum Agency with implementation and enforcement powers at national level.
 - Option 2: improve the regulatory framework while keeping existing institutional arrangements.
 - Option 3: no change to the regulatory framework.
- 4.3 OSAB noted that in Options 1 and 2 the principles of technology and service neutrality are assumed. In Option 3 these principles (particularly service neutrality) are less clear.
- 4.4 OSAB was of the view that Ofcom should be receptive to the idea of the right kind of ESA and engage with other regulators to test workability and implementation milestones with a view to producing a rigorous and robust international regulatory framework. OSAB also thought that Ofcom should examine the possibility of the UK going it alone and working alongside an ESA.
- 4.5 OSAB also commented frequently throughout the year that Ofcom should take note of developments in other countries, in particular those in the Far East, learn from those developments and shape their agenda accordingly.

The content and direction of Ofcom’s Research and Development work

- 4.6 Throughout its existence OSAB has retained a key interest in the R&D work sponsored by Ofcom. OSAB has provided a mix of high level advice and detailed steering on particular pieces of research.
- 4.7 OSAB also plays a major role in the events associated with Ofcom’s R&D programme. A number of OSAB members attended a “future technologies” day that Ofcom arranged to gain further insight as to how technologies might evolve and what the associated research implications might be. OSAB members also played a key role in Ofcom’s second annual R&D Symposium, providing some of the panel members, a substantial amount of comment and discussion from the floor and helping behind the scenes.

- 4.8 Early in the year OSAB Members received an update on the Ofcom technology trends workshop¹ and on the topics provisionally selected for the Ofcom R&D Report and Symposium. Members were informed that key threads for 2006/7 were turning previous research into practical tools, implementing the Cave Audit recommendations, a detailed look at licence exempt spectrum, and some leading edge research activities.
- 4.9 In particular, OSAB received a presentation from the consortium studying what OSAB had previously termed "IP-Radio", but which is now known as dynamic spectrum access. This was a concept devised during an OSAB discussion and one that OSAB had recommended Ofcom pursue. OSAB noted the outcome and the continued importance of the work. Further details on this project and Ofcom's R&D work during the period can be found in Ofcom's Annual Research Report.²
- 4.10 In considering the future of R&D at Ofcom, OSAB were of the view that:
- The R&D programme is imperative and relevant to Ofcom's purposes, has high value and is not duplicated elsewhere.
 - Planning should be on a multi annual basis of a minimum of 3 years.
 - OSAB felt that it would be impossible for Ofcom to achieve its spectrum management duties without its R&D programme.
 - Innovation and technology was moving at an increasing rate, the R&D programme was unique and an extremely small budget for what is ultimately delivered to the British economy.

Satellite applications

- 4.11 During the year it had become increasingly clear that allocation of spectrum to satellite applications did not always sit well within the market forces led approach to spectrum management that Ofcom was adopting. This issue in particular was highlighted by developments at 2GHz where a possible European satellite allocation might occur through a beauty contest. If this allocation was linked to the ability to deploy a "complementary ground component" (CGC), allowing terrestrial base stations to provide additional service, it could come into competition with terrestrial wireless networks that had gained their spectrum via auction, potentially creating an imbalance in the market.
- 4.12 OSAB started its deliberations by receiving a comprehensive presentation on spectrum management for satellite networks. OSAB noted some key trends including:
- Broadcast satellite services had the greatest growth of all satellite industry segments in 2005, with a 13% growth and an expectation that HDTV will continue to push market growth.

¹ Full details can be found at <http://www.ofcom.org.uk/research/technology/events/techtrends06/>
² <http://www.ofcom.org.uk/research/technology/overview/techrandd0506/>

- Large earth station services are becoming less dominant but are still important for truly global connectivity especially.
 - Bespoke broadband satellites are emerging in the US and Asia.
 - In respect of broadband on the move - passenger vehicles, aircraft, boats and trains - many R&D projects were looking at the use of satellites.
 - Eight million homes in the UK are served by satellite TV. Satellites are cheaper to roll out HDTV rather than through terrestrial television by a factor of 5 to 10. Satellites are also more environmentally friendly in terms of CO₂ release.
- 4.13 OSAB debated the issues associated with operating mobile satellite services and concluded that there may be a case for considering parts of the L-Band, S-Band and C-Band spectrum to be allocated on an exclusive basis to satellite services. OSAB also accepted that spectrum is vital to the satellite industry and that issues are inherently global, generally requiring global and not national regulation.
- 4.14 OSAB agreed that spectrum used for satellite might be of a very high market value but it was also noted that the satellite systems may have a high social value and may support EU infrastructure objectives and safety of life systems. This clearly led to tension in both promoting market forces while achieving socially desirable outcomes. OSAB were of the view that the area of spectrum provision for satellite services required a sustainable planning regime which balanced social value against innovative planning. OSAB pointed out that this was a crucially important subject and one that OSAB would likely revisit on many future occasions.

Metrics for measuring the impact of Ofcom's spectrum initiatives

- 4.15 Towards the end of the previous year, Ofcom had approached OSAB to explain that it was considering whether there might be a set of metrics that could be used to understand how successful its spectrum management policies have been. Such metrics might enable errors in spectrum management to be corrected, align all spectrum management policies to a common goal, provide additional information to stakeholders as to the intended outcome of actions, and assist in the setting of relevant budgets such as for research & development.
- 4.16 During this year, Ofcom had taken on board comments made by OSAB and returned to OSAB with clearer proposals for further discussion. In particular, on the advice of OSAB, Ofcom had aligned metrics around the licensing process. Ofcom had divided these metrics into "leading" metrics – those which gave indications of trends, and "following" metrics – those which captured actual data after the event.
- 4.17 Ofcom proposed that user satisfaction and classification of spectrum quality would be the leading metrics. Spectrum utilisation, innovation, value of services and impact on the economy would be the following metrics.
- 4.18 OSAB Members recommended that the implementation timetable should, if possible, relate to other milestones such as the next steps for spectrum trading, and the metrics should include such issues as interference. It was agreed that OSAB would revisit the metrics as they were captured.

2012 Olympics

- 4.19 With London having successfully won the bid to host the 2012 Olympics, it now fell to Ofcom to facilitate access to sufficient spectrum to enable the Games to operate. OSAB expressed considerable interest in many aspects of this, from the basics of spectrum provision to the ability to use the Games to foster innovation in wireless applications or act as a testbed for new policies related to the trade-offs between deploying fixed and wireless solutions.
- 4.20 OSAB initially received a presentation on spectrum for the London 2012 Olympic Games and Paralympic Games where it noted that Ofcom's role included:
- The organisation of a full frequency plan for the Games and arranging for all the spectrum licences in good time in support of the plan.
 - The delivery of Government guarantees on the allocation of necessary frequencies.
 - Working closely with relevant bodies such as the London Organising Committee for the Olympic Games (LOCOG).
- 4.21 OSAB was concerned about the lack of detailed contingency planning. It suggested that Ofcom needed to take into account the likely growth of outside broadcast needs and to ensure that support services (eg emergency services etc) were not affected. OSAB noted that Ofcom did not have central control but needed to be in a position to guide decision making. However, OSAB took comfort from the amount of rigorous work underway as there was an awareness that there was only a short period of time left (mid 2007) for effective decision making to take place.
- 4.22 OSAB also expressed concern that the spectrum was being provided free of charge and hence there was an incentive on the organisers of the Games to use less fixed infrastructure, for which they would have to pay, and more wireless solutions. This might result in an economically inefficient outcome where large bands of spectrum were used for low-value applications. OSAB explored some ground rules such as requiring video signals to always be fed to the nearest access point and some innovative ideas such as the use of a "token" payment system which would replicate the role of the market but with "pretend" money. OSAB also noted that the Olympics showed the link between wireline deployment and the need for spectrum that was reflected more broadly in national telecommunications networks.

Mobile TV

- 4.23 OSAB felt that as an important emerging new service, and also in connection with the digital dividend review, Mobile TV was worth careful attention.
- 4.24 When considering Mobile TV in general, OSAB concluded that it would offer a new balance of convenience and control with TV broadcasting, video-on-demand and non-real time viewing. There are a number of influences affecting the future direction of mobile TV – such as the size of the TV screen and the technology to be adopted eg:
- DMB Technology at VHF – which offered a low cost of national coverage but limited TV channel choice, only QCIF picture quality and the need for the headphone lead to act as an aerial.

- 3G at 2 GHz(HSDPA + MBMS) – which would give a rich multimedia mix, 60% coverage, content on demand and choice of handsets but with limited TV channel choice and only QCIF picture quality.
 - DVB-H at UHF or L-Band – this was the de facto EU standard with a reasonable channel choice and good picture quality on larger mobile phone screens but could not provide video on demand and was not the best technology available.
 - S-DMB with complementary ground component at 2GHz had the potential for the most comprehensive coverage and a reasonable channel choice and picture quality but was the most expensive of the infrastructure options and would take the longest to industrialise.
- 4.25 OSAB questioned whether Ofcom's 'technology neutrality' policy should mean indifference to common technical standards for broadcasting. Common technical standards for broadcasting were thought to be in the consumer's interest as they would maximise choice of TV channel, service provider and handset. OSAB suggested that, while Ofcom should not mandate a standard, it might indicate its preference as a way of guiding the market towards a common solution.
- 4.26 OSAB then focussed on the possibility of an early release of one of the channels to be liberated as part of the DDR – so-called "channel 36". OSAB noted that because of the current use of this channel it might be possible to make it available sooner than the rest of the digital dividend. They concluded that while there were good arguments both in favour of early release and against it, that in they were minded to recommend to Ofcom that it pursue an early release in order to stimulate development in the UK.

Wireless in transport

- 4.27 Over the year, OSAB has become increasingly convinced that there is merit in considering a few specific "sectors" which may become significant users of radio spectrum, but which may not react to market forces and may not be well represented within the wireless and regulatory community. In particular, OSAB identified transport and healthcare as potentially falling into this category.
- 4.28 Therefore, OSAB arranged for the Chief Scientific Advisor to the Department for Transport, Brian Collins, to attend an OSAB meeting and provide a briefing around developments in transport and the possible implications for technology. A fascinating discussion ensued, examining the issues with current transportation systems and how they might evolve over time. A key thread was that solutions needed to be integrated and their wider implications thought through. For example, if the majority of vehicles had traffic congestion avoidance systems operating autonomously, this might cause congestion to "spread out" around a particular area, potentially resulting in gridlock, and making the overall situation worse.
- 4.29 Overall, OSAB concluded that the need for spectrum for applications associated directly with transport, such as sensor networks and road tolling systems, was likely relatively small, or could be accommodated in the less-used higher frequency bands. There may be other applications that emerge or grow such as increased desire for entertainment within the car, but these would fall to the existing wireless networks and operators to provide and did not need to be considered separately. OSAB encouraged the transport community to identify their needs for future spectrum and determine whether this should best be licensed or for licence-exempt operation.

Digital dividend review

- 4.30 The release of spectrum resulting from switching over from analogue to digital TV broadcasting has been a major part of Ofcom's work on spectrum over the year. OSAB have engaged with this activity on a number of occasions, listening to presentations from Ofcom and then providing advice and guidance.
- 4.31 OSAB members broadly agreed with the proposed project outline and objectives but were concerned about certain issues, particularly related to Mobile TV (see earlier). OSAB argued that while in general they were in favour of the use of market mechanisms to manage radio spectrum, that in this case the regulator should use its influence to guide the market, particularly where harmonised international standards were appropriate, such as with Mobile TV. OSAB also expressed concern that DDR seemed to be driven from a spectrum management base with insufficient regard to UK competitiveness or GDP benefit and urged Ofcom to take a longer term view on the value of spectrum.
- 4.32 OSAB also made a formal response to the DDR consultation.

Section 5

Brainstorming

Theme and External Inputs

- 5.1 Each year OSAB sets aside a day for detailed consideration of a topic of its choosing. In 2006, OSAB considered issues surrounding disruptive technologies, looking at a range of trends and developments in related industries and examining possible applications that might emerge over time.
- 5.2 In order to stimulate discussion and understand whether there were lessons to be learnt from other industries OSAB first heard from Paul Bennun of Somethin' Else who talked about disruptive developments in the content industries and the effects that might have on communications.
- 5.3 OSAB structured its discussion around:
- The social and value perspectives of emerging disruptive uses of spectrum.
 - Technical pressures and limits.
 - The “long tail” theory and the disruptive effect that might have.
 - A look forward at predicting the most likely disruptive applications.
- 5.4 Each of these areas is discussed briefly below.

Social/Value Perspective

- 5.5 OSAB started with the thought that they might have a miniature wearable super-computer with a huge bandwidth wireless connection and considered how would they might use it to enhance their own quality of life and how groups like young people, older people and disadvantaged people might make use of such a device. They were then challenged as to how such development might help address some of the major societal problems of the 21st century.
- 5.6 OSAB noted that such a device could be used to monitor health; improve personal security; assist integration of family communication and as a money management device. It could replace the wallet and everything usually carried within it. It could hold all sorts of personal information; address books, driving licences, credit card numbers, it could even be directly used for payment.
- 5.7 It was particularly noted that any such device would necessarily be very personal to the individual, so protection of personal identity would be a prerequisite. An off-shoot of this would be enhancements to personal security. OSAB felt that identity and security concepts could be a key issue for such a device and in light of Government thinking on identity cards, a Government perspective would be very interesting to hear.
- 5.8 Given such a device would hold so much personal information, it would need to protect an individual's identity, but it would also need to engender trust to others who might be reliant on information that it would generate.

- 5.9 Among the actual uses explored was the idea of a personal lifestyle support device sufficiently intelligent to save time and reduce complexity. Interactivity with the device would need to be enhanced over today – it might be used via a keyboard or through some other functionality e.g. interactive glasses.
- 5.10 OSAB noted that in connection with unemployed citizens that there was an initiative in East London called “Slithers of Time” that used the mobile phone as a communication channel via text messages to notify people at very short notice about jobs. Many other threads were explored such as the possible benefit that could be derived from such a device for the homeless and disadvantaged in society noting that such a device could be geared towards social inclusion, engendering connectivity with society or promoting a sense of self worth.
- 5.11 A factor that generated discussion was the implications of such a device going wrong (which was characterised simply as the computer refusing all requests). Enabling such a device to operate and be effective would require massive back-office infrastructure. A knock on requirement would be that stringent data cleansing would be needed.

Technological Pressures and Limits

- 5.12 OSAB discussed the likely future evolution of technology based on a range of trends and limits such as Shannon’s Theory and Moore’s Law. Many developments were touched upon such as the implications of WiFi for the home environment with WiFi modules likely to soon become embedded in domestic devices such as fridges, the fact that more extensive and immersive video facilities are in the pipeline and a view that public demand will be untethered devices, steering away from products connected via wires.
- 5.13 OSAB concluded that there is sufficient spectrum to meet envisaged future wireless requirements although there are currently a few applications that, because they want specific pieces of spectrum, are unable to access the spectrum they require, eg Mobile TV. However, this assumption requires expected developments to occur, such as spectrum currently reserved for MOD use becoming available e.g. radar band-sharing in the 3GHz band. OSAB also predicted that the development of future technologies will have the likely impact of making spectrum cheaper.
- 5.14 A scenario OSAB explored in more detail was the idea of a fibre backhaul being made available to within 50 metres of most homes, with unrestricted transmission. This generated further discussion and it was noted that such a scenario could be the internet backbone of the future but that a number of key standards would need to be agreed and market alignment would be needed. Nevertheless, OSAB thought this was relatively likely to occur, mostly through economic pressure and pricing.

The Long Tail Theory

- 5.15 OSAB received a short presentation on the Long Tail Theory that was developed by Erik Brynjolfsson, Yu “Jeffrey” Hu and Michael D. Smith and applied to analyse Amazon’s success on the retail book market. The theory considers the economics of opening up the diversity of a market and looks at the gap between the mainstream markets against the specialist market sector. Essentially it notes that in markets such as books, while there are a few books selling in large volumes, there is an enormous number that could sell in small volumes if the search and distribution costs were low enough. Before Internet booksellers such as Amazon appeared these costs were generally too high, but with the changed business model pursued by Amazon a

whole new market had been opened up. The long tail model can also apply to many other markets.

- 5.16 OSAB derived some implications of the long tail theory. Firstly, it no longer matters if the device, service or application is used infrequently. Secondly it requires a platform with low incremental costs (perhaps favouring technologies like mesh), thirdly that social inclusion may be easier to achieve if there are long tail economics and finally that undifferentiated radio spectrum (such as traditional broadcasting) cannot be used to access the long tail, rather one-to-one connections are needed.
- 5.17 OSAB concluded that this approach had obviously worked for Amazon, and given the diversity of disruptive influences in the market it could well be applicable to spectrum related products or applications in the future.

Disruptive applications

- 5.18 OSAB started by considering what disruption was and concluded that it occurs when a new technology appears which is not necessarily better than the existing technology but allows something to be done differently and at lower cost. A particular marker that disruption is occurring is a change in the business players involved. OSAB felt that technology examples that could enable or trigger disruption included dynamic spectrum access (see earlier discussion on R&D), ultra-broadband to the user using fibre and wireless and the use of a mobile phone to provide applications associated with personal identification.
- 5.19 OSAB then brainstormed a number of possible applications that might emerge as listed below.
- 5.20 *Fashionable wireless wearable items.* These are enabled by new printing and weaving technologies and the ability of solar panels to be integrated into clothing. They would see new players emerging in the form of designers and fashion houses and result in applications based on technology embedded clothing such as proximity dating and information sharing.
- 5.21 *Personal security.* This would be enabled by increasing numbers of sensors and CCTV cameras. New players would include security companies, social services and insurers while new applications would revolve around a real time sense of being secure and safe. Media reaction and the sense of need created through media stories would be a major factor in the emergence of this area.
- 5.22 *One stop shop.* This application is essentially a form of convergence where all communications needs can be met from one provider. It would see new players in the form of Tesco and other large brands and new applications such as full IT support in the deployment and maintenance of home IT and telecoms networks.
- 5.23 *Mesh.* This is a set of applications based around the emergence of mesh wireless networks as a simple and low-cost means of providing connectivity, predominantly for sensors. New players might include local authorities and transport systems but there might be regulatory implications, for example around state aid or appropriateness of private sector involvement.

Notable points

- 5.24 Brainstorming sessions are intended more to raise thoughts and ideas that can be the subject for future discussion and analysis, rather than to reach clear conclusions that can be the basis for immediate action.
- 5.25 OSAB considered that some of the most notable points arising from the day's discussions were:
- The consideration that if managed appropriately, wireless technology could be used to draw people into society; as opposed to simply providing them with facilities which may have the unintended consequence of isolating them from society.
 - The likely growth of mesh deployments over time and the possible requirements for more licence-exempt spectrum to enable this.
 - Personal communications should really be personal – it should be tailored precisely to the needs of each individual.
 - There are many personal wireless services that could lead to disruption in the future. More thought should be given to the use of personal wireless applications and technologies, especially with regard to the human value that can be derived from them.

Annex 1

Ofcom Spectrum Advisory Board – Terms of Reference

1. The terms of reference for the Ofcom Spectrum Advisory Board are:

- a. The Ofcom Spectrum Advisory Board are to provide independent, strategic advice on spectrum policy issues to Ofcom.
- b. While the primary role of the Ofcom Spectrum Advisory Board is to look beyond Ofcom's normal planning period, there will also be a need to take a high level view of near-term issues. In particular, the Ofcom Spectrum Advisory Board are to advise on:
 - The UK Spectrum Strategy, major Ofcom allocation decisions, spectrum management, and the application of spectrum pricing/trading.
 - The spectrum policy objectives to be pursued in relevant international fora.
 - New technologies or means of managing the radio spectrum and their implications for Ofcom.
 - The high-level strategic direction for Ofcom's research programme, including key areas of market and technical research required for new spectrum allocation and analysis of gaps in industry/academia research programmes.
 - The extent to which spectrum policy objectives create a climate for innovation.
 - The need to safeguard the interests of citizen-consumers eg protection of vulnerable users, change management etc.
- c. The Ofcom Spectrum Advisory Board will be responsible for agreeing its own work-programme. Spectrum-related topics that might be considered include:
 - Broadband Fixed Wireless Access
 - Digital TV Switchover
 - Interference Management
 - Interoperability eg wireless and wireline
 - Broadband Public Safety
 - Defence use of Spectrum
 - Short-range Radio Technologies
 - Private Mobile Radio
 - Introduction of Spectrum Trading
 - The balance between licensed and licence-exempt spectrum
 - Development of new technologies eg UWB, SDR
 - Review of spectrum efficiency
 - Trends in international relations
- d. To avoid any conflict of interest, members of OSAB will not have access to confidential information pertaining to Ofcom decisions affecting specific

companies. This does not however preclude the discussion of potential Ofcom policies.

- e. With the support of Ofcom staff, reporting shall include an Annual Report, publication of key findings on the Ofcom website, and hosting occasional Open Fora.
 - f. Members of the Ofcom Spectrum Advisory Board should be drawn from a mix of commercial, academic and consulting backgrounds, in order to assess topics in a multidisciplinary manner, and to advise Ofcom on spectrum matters of strategic significance. Membership will include ex-officio representation by the Department of Trade and Industry who will participate fully in discussions but reserve the right to abstain from agreement on substantive matters. The Board should also consider how best to make use of global expertise, particularly from countries with innovative spectrum management policies eg through regular liaison, international representation etc. Members will not receive remuneration other than reimbursement of expenses.
2. An MoU has been established between Ofcom and the Ofcom Spectrum Advisory Board to establish their terms of reference and the basis of the Board's establishment.

Annex 2

Membership of OSAB³

Sir David Brown (Chairman) [May 2010]

Sir David Brown joined Motorola in 1991 and has been Chairman of Motorola Limited since 1997. He is a Fellow of the Royal Academy of Engineering, a Chartered Engineer and past President of the Institution of Electrical Engineers. He is a member of the President's Committee of the Confederation of British Industry and a Past-President of the Federation of the Electronics Industry. His interests include the promotion of links between engineering and education. He has twice been an Institution of Electrical Engineers Faraday Lecturer and is a Past-President of the Association for Science Education, the professional body for Britain's science teachers. Sir David was Chairman of the University for Industry Design and Implementation Advisory Group and a member of the University for Industry Board. He was also Vice Chairman of the Board of UK Trade and Investment and a member of the Industrial Development Advisory Board. He was knighted in January 2001 for services to British Industry.

Professor Martin Cave [May 2007]

Professor Martin Cave is Professor and Director of the Centre for Management under Regulation at Warwick Business School, University of Warwick. He is an academic economist who led the Independent Spectrum Management Review, commissioned by the Treasury and DTI, and the Independent Audit of Major Spectrum Holdings, for the Treasury. A former member of the Spectrum Management Advisory Group, Professor Cave specialises in regulatory economics and has advised a number of regulatory bodies in the UK and Europe. He was a member of the Competition Commission from 1996 to 2002.

Dr David Cleevly [May 2009]

Dr David Cleevly is a leading authority on telecoms policy and the digital economy, regularly commenting on industry trends and prospects at international conferences and in the media. Founder of Analysys and previous Chairman of Analysys Limited, David has worked with numerous governments at a national and supra-national level to create policy frameworks which encourage innovation and growth. He has made a major contribution to the UK Government's proposals for a unified regulatory body in the convergent world of telecoms, IT and broadcasting (Ofcom). He was also a member of the committee responsible for the Government report [e-commerce@its.best.uk](#) and chaired the launch of the report by Tony Blair. He continues to advise the Government on policy formation for communications and media, IT and broadcasting.

Professor Leela Damodaran [May 2009]

Leela Damodaran is Professor of Participative Design and Change Management in the Department of Information Science at Loughborough University. She leads the Information, Technology and Society Research group at the Research School of Informatics, conducting

³ After each member is given the date that their new appointments to OSAB expire.

research into the human and social aspects of informatics. Her expertise informs policy and the formulation of strategies to promote the adoption of digital technologies through participatory and inclusive design approaches in ICT development projects. Her influential report, "Analogue to Digital Switchover: Human Aspects of Adoption", proposing strategies for engaging citizens, promoting social inclusion and enhancing public access to information, has been published at www.digitaltelevision.gov.uk. Recent projects include research on the implementation of local eGovernment in the UK, evaluation of knowledge management in a petro-chemical company and on new ways of working in the construction sector. Professor Damodaran has been a member of the Strategic Advisory Team of the EPSRC on the Infrastructure and Environment Programme and of the Spectrum Management Advisory Group. She chairs the Digital Technologies and Social Inclusion Consortium in partnership with the University of Dundee and is also Vice Chair of the British Computer Society Sociotechnical Group.

Professor Barry Evans [May 2010]

Professor Barry Evans was appointed to the Alex Harley Reeves Chair of Information Systems Engineering at the University of Surrey in 1983, where he leads the largest UK and European academic research group in Mobile and Satellite Telecommunications. Founder Director of the Centre for Satellite Engineering Research, he became the Director of the Centre for Communication Systems Research (CCSR) in 1996 –a post he still holds. From 1999 to 2001 he was Dean of Engineering and from 2001 to date he holds the Pro-Vice Chancellor (Research & Enterprise) role at Surrey. He has been involved in the UK Foresight programmes in Communications and ITEC, EPSRC Strategic Advisory Committees, MoD-DSAC Committees, adviser to DG of OFTEL, board member of BNSC-TNAB as well as ITU, ETSI and EU Advisory Committees. He is editor of the International Journal of Satellite Communications and has an authorship of over 500 papers in the technical literature and three books. He was elected to a Fellowship of the Royal Academy of Engineering in 1991.

Debbie Gillatt [ex officio]

Debbie Gillatt is currently Director, Communications Networks at the Department of Trade and Industry. Her responsibilities include the regulatory framework for telecoms; the Government's relations with Ofcom and with BT and other major fixed and mobile network companies and equipment manufacturers; information security, Internet policy and relations with the ISP industry; spectrum policy; and communications technology.

Debbie has recently returned to DTI after several years in sector regulation. She has worked extensively with business on a sectoral and regional basis, focusing at different times on trade, investment and competitiveness. She has experience of both manufacturing and service sectors, and most recently has been responsible for establishing the framework for market opening in the postal sector. Other recent work has included reviewing Government support for service sector exports and outward investment, and the 2001 Government White Paper on competitiveness.

Stephen Lowe [May 2007]

Stephen Lowe is the Technical Environment Consultant in the Technical Strategy team for Virgin Media providing Television, Broadband and voice services for both fixed and mobile users. Prior to joining the communications industry he was Project Director for the television broadcast facility for Westcountry Television following twenty years with the BBC. He is Chairman of the Broadband Wireless Association and of the Broadband Communications Research Consortium and is a leading player in the development of broadband fixed wireless access in the UK, Russia and the Far East.

Phillipa Marks [May 2010]

Phillipa Marks is a Director of Indepen Consulting. She specialises in the analysis of economic, public policy and regulatory issues in the media and telecommunications industries. She is an expert in the application of market mechanisms to spectrum management. She was educated in New Zealand and at Oxford University. After a period as a research officer with the New Zealand Institute of Economic Research, she moved to the UK working for the Institute of Transport Studies. She then joined the National Economic Research Associates (NERA) where she became a director, leading assignments in media, telecommunications and utility sectors. In 2000, she was appointed by the Home Office as a member of the Gambling Review Body.

Professor Mike Short [May 2007]

Mike's career spans 29 years in Electronics and Telecommunications, with the last 17 years in Mobile communications. He was appointed Contracts Director of Cellnet in 1989 dealing with major infra-structure investments and UK interconnect agreements. In 1993 the focus moved to establishing Cellnet's GSM service. He was elected Chairman of the GSM Association for 1995/96 and served on their Executive Board for 3 years, was the 1st Chairman of GSM Europe in 1996 and the GSM Association Data Task Force 1999/2001. He was elected to the WAP Forum Board 2000/2 and was a founder Board Member of Open Mobile Alliance (OMA). He was also elected Chairman UK Mobile Data Association in 1998 (renewed for 2002/4). Mike has served as Vice President UK FEI 1998/2001, and led FEI (now Intellect) mobile / environmental committees. He has also been a member of Ministerial Advisory Groups on Spectrum (SMAG) and Security (Home Office TAB) since 1998, and was appointed a Visiting Professor at Surrey University in October 2003. Mike's focus today is on Third Generation cellular and steering O2's Group Research and Development in mobile.

Andrew Sleigh [May 2009]

Andrew Sleigh is Managing Director, Knowledge and Information Systems Division for QinetiQ. His career has included research in sensors and machine intelligence, operational analysis and strategic planning, and has undertaken a number of senior management positions. Previously, he was Managing Director, Defence Solutions for QinetiQ and prior to that he was responsible for the MoD's ICT strategy and programmes and was Co-Chair of the Cabinet Office Official Committee on Spectrum Strategy.

Professor Will Stewart [May 2010]

Previously the Chief Scientist at Marconi with wide interests in technologies from communications to biosensing, he was educated at Imperial College (Physics). His personal interests have been in optical fibre communications and optoelectronics. Recent interests include microstructured photonic materials (photonic crystals), optical slow-wave structures,

nanomechanical systems and the application of various optical, semiconductor and acoustic technologies to medicine, particle physics and industrial processes. He is a visiting Professor at UCL and at the ORC at Southampton. He is author on some 64 conference and journal papers, including many invited papers, and on 48 patents. He is a member of the editorial advisory board for the journal 'Science', chairman of Innos, resident expert on the Foresight' EEMS' project, on the advisory board of Antenova and many other committees.

Stephen Temple CBE [May 2009]

Stephen Temple spent 3 years in Vodafone's Corporate Strategy Group as Director of Strategic Projects that included innovation, battle for the home and mobile TV. He spent 7 years with the UK Cable TV Operator NTL, for the most part, leading their technology innovation programme and finished up as Managing Director of their Networks Division. Prior to that he was a senior official in the DTI representing the UK in a number of European telecommunications developments including the commercial strategy that launched GSM and establishing Europe's foundation for digital TV broadcasting. He was Chairman of the ETSI Technical Assembly for 4 years. In an earlier part of his Civil Service career he spent 7 years in frequency spectrum management. He was awarded the IEEE prize for International Communications in 1994, the GSMA Chairman's award in 1996 and the CBE for services to Trade and Industry in 1996. He is a Fellow of the Institution of Electrical Engineers.

Dr Gary Tonge [May 2007]

Dr Gary Tonge was until the end of 2003, the Director of Technology of the Independent Television Commission, a position he had held since the ITC's beginning in 1990. During his time at the ITC, he facilitated the development both of Channel 5 and of digital terrestrial television. He is currently doing some consultancy work in the field of electronic communications technology and policy. Gary is a Fellow of the Royal Academy of Engineering, the Royal Television Society and of the Institution of Electrical Engineers.

Dr Walter Tuttlebee [May 2009]

As Chief Executive of the Virtual Centre of Excellence in Mobile & Personal Communications - Mobile VCE - Walter Tuttlebee heads up a unique not-for-profit company established in 1996 by the telecoms industry, academia and UK government to undertake long-term, industry-steered, collaborative research. Mobile VCE today has 20 industrial members, operators and manufacturers, from Europe, Asia and America. Its research results 'seed & feed' its industrial members' internal R&D programmes as well as influencing international telecom organisations such as WWRF, SDR Forum, DVB and IETF. Its research addresses core technology evolution to support the growth of the communications industry. In the 1980s and '90s, Dr Tuttlebee led industry R&D teams in 2nd and 3rd generation mobile communications, conceiving and playing a key role in key European 3G research programmes, and contributing to ETSI standards. He is acknowledged as a pioneer of software radio in Europe and has operated in Business Development in personal communications, digital broadcasting and satcoms. He has edited several books, has published widely, has several patent filings and holds BSc, PhD and MBA Degrees.