ManSat thanks Ofcom for initiating the consultation on the strategic review of satellite and space science use of spectrum, and welcomes Ofcom's initiative to examine the forward looking implications of the long term use of spectrum in these fields.

ManSat makes this submission in its role as a provider of satellite regulatory and satellite spectrum services in connection with satellite filings to the satellite industry, acting under the terms of ManSat's agreement with the Isle of Man Communications Commission.

While for the most part ManSat works in partnership with leading companies in the commercial satellite sector, and, ManSat will seek address this sector, however it should please be noted that ManSat's expertise extends beyond the traditional satellite communications market and that the company also works closely with bodies such as the Society of Satellite Professionals International, the International Institute of Space Commerce, and the International Space University in examining both new potential uses and forward looking demands upon spectrum in different market sectors.

We note that the UK is home to many leading players players in the global satellite industry, and we recognise that this is in part due to the transparent and pragmatic application of the ITU Radio Regulations by Ofcom. While we understand that it is not Ofcom's role to be catalyst for inward investment for the UK or other jurisdictions, in reality we find that Ofcom position assists to this effect.

Our responses to the questions raised in the Consultation document (Consultation) are offered in the following.

Question 1: Do you have any comments on our approach to this review?

We note that this consultation addresses a comprehensive set of issues that would allow Ofcom to gain a good understanding on the developments and future trends in this sector. However, in your discussion in Section 2 "Our approach" we would like to see more emphasis placed on the international dimension of these services. In contrast to the terrestrial services there is no spectrum set aside for "UK operators"; access to spectrum is governed by the procedures set out in the Radio Regulations, and in most cases available on a first come first served basis and also subject to coordination. For these reasons, under "International connect" the role that Ofcom should play in assisting the UK operators to gain access to spectrum should be recognised and should become a part of Ofcom spectrum strategy for satellite services.

The industry has brought to Ofcom's attention on numerous occasions that satellite industry interests are set beyond the UK consumer and Citizen concerns. Although the UK (or other jurisdictions) may benefit economically from the enterprises of the satellite sector, there may not be a direct benefit to the UK consumer or citizen. Therefore the interests of the satellite sector should not be judged in connection with these duties placed on Ofcom.

Question 2: Do you have any comments on our broad overview of the satellite sector set out in this section? In particular, do you have comments on the completeness of the list of applications, their definitions and their use of the relevant ITU radiocommunications service(s)?

ManSat generally agrees with Ofcom's list of ITU designations, end-user applications etc. However, it should be noted that with the on-going convergence of services the end-user applications (and also other applications) could be delivered by satellites operating under many different ITU classifications. In many cases this means that "mobile" applications could also be served by satellite services that are expected to serve fixed installation (such as FSS).

Question 3: Do you have any comments on our broad overview of the space science sector? In particular, do you have comments on the completeness of the list of applications, their definitions and their use of the relevant radiocommunications service(s)?

ManSat generally agrees with Ofcom's list of ITU designations, end-user applications etc. In regards to the space science sector, we would recommend that Ofcom maintain its forward looking stance in relation to the potential growth of this sector, especially in regards to the growing use of private capital and private companies for the provision of public science as noted by the International Institute of Space Commerce in its recent paper on *Innovative Uses For Private Financing of Space Science Missions*[1].

With the involvement of the private sector there will be other uses of space science and space operations spectrum and these need to be considered in due course, Ofcom's forward looking stance in this regard is appreciated.

For example, the use of such spectrum to space based robotic servicing missions, including removal of space debris, satellite de-orbiting; a non traditional commercial use of space services that at present has no specific spectrum allocation has been made.

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[1] http://www.iisc.im/documents/INNOVATIVE%20financing.pdf

Question 4: Do you have any comments on our representation of the value chain for the satellite sector? How do you think industry revenues are broken down between players at different positions in the chain?

ManSat agrees in part with Ofcom's representation of the value chain as a general representation, but would suggest that Ofcom has inadvertently not represented part of this chain, which is paradoxically one of the UK's most notable strengths in the international satellite communications industry and is tied to the strong regulation provided by Ofcom. This is the provision of financial, banking, legal, regulatory and insurance services provided through, amongst other places, most prominently the City of London, and of course jurisdictions like the Isle of Man, to the satellite communications industry based in the UK and elsewhere in the world.

Question 5: What is the extent of your organisations' role(s) in the value chain?

Which satellite applications (as summarised in Table 1 in section 3) does your organisation:

- use;

- provide:

or - help to deliver?

Please list all applications that apply and your role in each in your response.

ManSat makes this submission in its role as a provider of satellite regulatory and satellite spectrum services in connection with satellite filings to the satellite industry, acting under the terms of ManSat's agreement with the Isle of Man Communications Commission.

Question 6: For each of the satellite applications you use, provide or help deliver (as identified in Question 5), and taking into account your role in the value chain, where applicable please provide:

- *the specific spectrum frequency ranges used for each application, distinguishing between the frequencies used for service provision, for the feeder / backhaul links and for TT&C ;*

- *the coverage area for services links; or, in the case of TT&C and feeder / backhaul links, the location of the gateway station(s);*

- *the estimated number of users (e.g. MSS terminals, DTH subscribers, FSS earth stations);*

- *an estimate of the average use by end user (for those applications for which the demand for spectrum is driven by end user traffic); and*

- *for applications for which the demand for spectrum is driven by other factors, please state what the factor is and the scale of the factor (e.g. for DTH TV the number of TV channels broadcast by format). Please provide your response with respect to the UK, the rest of Europe, and other parts of the world where this may be relevant to UK use.*

ManSat has no specific comments. However, parties who engage through the Isle of Man are satellite operators and these operators are likely to offer their comments separately to Ofcom.

Question 7: For each of the satellite applications you provide, please could you indicate how UK consumers and citizens benefit from their use? Where possible please also provide an indication of the scale of the benefits (either qualitatively or quantitatively).

Satellite filings are performed by Ofcom for the Isle of Man by agreement between the two governments. As an Isle of Man company working with the Isle of Man Communications Commission to support Isle of Man Satellite communications companies our focus is benefit to the Isle of Man, its economy, and its citizens. While the Isle of Man is neither politically nor legally nor constitutionally part of the United Kingdom it should however be noted that the Isle of Man as a Crown Dependency uniquely holds a Common Purse with the UK and that all satellite transactions and work via Isle of Man based satellite communications companies directly benefit both the UK Exchequer and the UK economy and thus UK citizens.

As it was mentioned above ManSat has not direct role as a service provider. Nonetheless, ManSat reiterates the point that UK consumers and citizens may not have a clear linkage with services provided by many satellite operators engaging in the UK (and also in other jurisdictions). UK consumers and citizens do benefit from many satellite services available in the UK and elsewhere, but the UK interests on satellite services should not simply be judged in the basis of their interests. When assessing the satellite industry interests in the UK, Ofcom should be empowered to take into account wider industrial and economic interests to the UK (also other jurisdictions).

Many of the UK satellite operators target mostly the overseas markets, which are markets elsewhere in Europe or in other regions of the world. Access to spectrum for such services will have to come from allocations made to all ITU Regions, namely Regions 1, 2 and 3. This places an obligation on Ofcom to manage the spectrum interests of such satellite operators irrespective of any linkage to UK consumers and citizens.

Question 8: From your perspective, what high level trends will affect the satellite sector in the coming years?

From our perspective the greatest high-level trends that will affect the satellite sector come from the ever increasing needs for the transport and transmission of digital data. This comes in many forms from new consumer demand to the Internet of Everything to Personal Data Clouds.

New technologies are being developed (8k televisions are already available) from tele-presence (virtual reality) to 'machine to machine' interfaces that are driving a veritable tsunami of new data needs, and this is from the worlds existing internet users.

We would expect the demand for satellite services increase with the opening of new markets in many parts of the world.

Question 9: For each of the satellite applications you use, provide or help deliver what do you see as the a) current demand trends; and b) underlying current and likely future drivers of demand for the satellite application(s) your organisation uses or provides?

ManSat has no specific comments on this.

Question 10: Taking into account the drivers you have identified in your response to Question 9 above, what (if any) challenges is your organisation concerned about in meeting potential future demand? Please provide the information by application and band, along with any supporting evidence, if available.

ManSat focuses on the efficient use of spectrum by Isle of Man Satellite companies. To this end it sees the difficulty in accessing the spectrum, especially from the Geostationary orbit, to serve many parts of the world. This limitation is mainly because of the scarcity of spectrum in the Ku and Ka bands available for FSS communications.

Question 11: Do you have any comments on the list of potential mitigations we have identified? What likely impact would each of the mitigations have on spectrum demand? E.g. what order of magnitude increase in frequency re-use might be achieved? To what extent do you believe that these mitigations apply only to certain applications?

The mitigations identified by Ofcom have already been implements by satellite systems. Satellite coordination is performed in such a way to place much greater burden on each party in order to maximise the access to available spectrum. However, there continues to be a problem with certain claims made for orbital positions by some administrations. Such problems will need to resolved through discussions at the ITU.

Question 12: What other mitigation opportunities do you foresee that we should consider? For what applications are these likely to be applicable and what scale of improvement are they likely to deliver?

ManSat has no specific comments on this.

Question 13: Beyond the activities already initiated and planned for the satellite sector (e.g. as part of WRC-15), do you think there is a need for additional regulatory action that may, for example, help your organisation to address the challenges it faces?

In your response, please indicate what type of action you consider may be needed and why, including any evidence to support your view.

One of the most important regulatory actions is the need to protect the existing allocations made for the satellite sector. Generally speaking the satellite industry make a sunk investment with each of the satellite project - running up to several hundreds of millions of Pounds. This investment is recovered over a long period of time. Securing the spectrum allocated to satellite services therefore becomes a matter of crucial interest to safeguard these existing and on going investments.

Many Isle of Man operators have an interest in Ka band having made significant investments in launching and operating Ka bands satellites. We wish to see Ofcom proactively safeguarding of this spectrum for satellite services.

Question 14: Do you have any comments on our representation of the value chain for the space science sector? How do you think industry revenues are broken down between players at different positions in the chain?

Similar to the response provided for Question 4, ManSat sees the need to recognise the providers of financial, banking, legal, regulatory and insurance in this value chain. The providers operate from the UK and other jurisdictions, notably through the City of London, and of course jurisdictions like the Isle of Man.

Question 15: What is the extent of your organisations' role(s) in the value chain? Which space science applications (as summarised in Table 2 in section 3) does your organisation: - use; - provide; or - help to deliver? Please list all applications that apply and your role in each in your response.

ManSat primarily manages satellite filings for the Isle of Man. In doing so ManSat undertakes certain tasks that are usually carried out by the regulatory authority and other tasks usually carried out by satellite operators.

Question 16: For each of the space science applications you use, provide or help deliver (as identified in Question 15), and taking into account your role in the value chain, where applicable please provide:

- *the specific spectrum frequencies used, distinguishing between the frequencies used for the science application, the frequencies use for downlinking data and, for TT&C;*

- *whether the application is limited to use of specific frequencies and why (e.g. due to fundamental characteristics of the phenomena being measured and/or availability of technology designed for that frequency);*

- *whether the applications use continuous or intermittent measurements;*

- *the typical resolution and associated measurement bandwidths, including an indication of any implication for spectrum requirements;*

- *the geography this use extends over (e.g. land or sea, and regional or global);*

- *the location of the gateway station(s) for TT&C and downlinking data;*

ManSat has no specific comments.

Question 17: For each of the space science applications you provide, please could you indicate how UK consumers and citizens benefit from their use? Where possible please also provide an indication of the scale of the benefits (either qualitatively or quantitatively).

As it was mentioned above ManSat has not direct role as a service provider. Nonetheless, ManSat reiterates the point that UK consumers and citizens may not have a clear linkage with services provided by many satellite operators engaging in the UK (and also in other jurisdictions). UK consumers and citizens do benefit from many satellite services available in the UK and elsewhere, but the UK interests on satellite services should not simply be judged in the basis of their interests. When assessing the satellite industry interests in the UK, Ofcom should be empowered to take into account wider industrial and economic interests to the UK (also other jurisdictions).

Question 18: From your perspective, what high level trends will affect the space science sector in the coming years?

We see two series of trends impacting this sector:

1. Declining Government budgets globally leading to the commercial provision of more space science data[2], a trend already noted and in action.
2. An increase in commercial exploration and use of space beyond Geostationary Orbit with a corresponding need for more spectrum to accommodate.

Question 19: For each of the space science application(s) your organisation uses or provides, what are the a) current trends; and b) likely future drivers of demand for spectrum?

Please include in your response:- the scale of the demand drivers;- the reason for additional demand (e.g. higher resolution radar data

rates/bandwidth required) and whether this increased demand is for data delivery

or for the taking of measurements;- whether increased demand can only be met at specific frequencies and why;- any variations in demand drivers by geography (i.e. regional or global), and why;

and

12 ITU footnote RR 5.340 lists all passive bands in which all emissions are prohibited

- whether future demand is expected to be temporary or intermittent, and the reasons for this.

In your response, please provide any evidence which supports your position on the drivers of demand (e.g. forecasts, studies and statistics).

.ManSat has no specific comment.

Question 20: Taking into account the drivers you have identified in your response to Question 19 above, what (if any) challenges is your organisation concerned about in meeting potential future demand? Please provide the information by application and band, along with any supporting evidence, if available.

[2] http://www.iisc.im/documents/INNOVATIVE%20financing.pdf

ManSat has no specific comment.

Question 21: Are there any future developments, such as the radio astronomy SKA, that could reduce the demand for space science spectrum in the UK?

ManSat has no specific comment.

Question 22: Do you have any comments on the list of potential mitigations we have identified? What likely impact would each of the mitigations have on spectrum demand? To what extent do you believe that these mitigations apply only to certain applications?

ManSat has no specific comment.
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Question 23: What other mitigation opportunities do you foresee that we should consider? For what applications are these likely to be applicable and what scale of improvement are they likely to deliver?

ManSat has no specific comment.
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Question 24: Beyond the activities already initiated and planned for the space science sector (e.g. as part of WRC-15), do you think there is a need for additional regulatory action that may, for example, help your organisation to address the challenges it faces?

In your response, please indicate what type of action you consider may be needed and why, including any evidence to support your view.

ManSat has no specific comment.