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What additional details do you want to keep confidential?:

No

If you want part of your response kept confidential, which parts?:

Ofcom may publish a response summary:

Yes

I confirm that I have read the declaration:

Yes

Additional comments:

NATS welcome the opportunity to respond to this consultation and is grateful to Ofcom for accepting our submission. We recognise that this a consultation about a more generic sharing framework but the majority of our views relate to issues that we foresee around the consideration of potential sharing in internationally harmonised bands that are used for aviation safety purposes, including those bands within which there may be similar systems in use by different sectors such as primary radar systems used for aviation, maritime or defence purposes. Unless otherwise qualified, references to "aviation use" or similar in this response should be understood as being in this safety application context.

NATS notes Ofcom's comments in section 2.18 of the consultation document: while we understand that there has been some involvement by CAA in the PMSE review work considering a band used by NATS around the country and by Air Navigation Service Providers at many airports, we would not consider that NATS being given by Ofcom in mid-September 2015 restricted use access to a completed study report represents "close cooperation with incumbent stakeholders" on work that we understand to have been under consideration by Ofcom for well in excess of a year.

Question 1: Do you have any comments on the barriers to increased sharing that we have identified above? Which are the most significant and why? Are there others we should take into account? :

The views taken by operators of incumbent systems as to what constitutes an unacceptable level of risk arising from potential sharing may well differ from that which Ofcom or a potential incoming user deems it to be. This is particularly the case where the incumbent use is supporting critical national infrastructure or a safety critical service, such as in harmonised bands allocated to services used for international civil aviation and where they are treated as being "public sector" bands. Moreover, these risks in the aviation case lie with Air Navigation Service Providers (ANSPs), airports and airlines thus having "government only" deliberations on public sector bands and presenting these outside the public sector at a point when it appears that policy decisions on sharing have been all but taken makes it more likely that conclusions may need to be be robustly questioned.

WT Act licence terms are only part of the controls placed upon access by aviation systems to bands allocated for aviation purposes and there are additional requirements placed on operators through civil aviation legislation. This, in part, creates as far as possible a known radio environment within which aviation safety systems may be (frequency) planned - often in co-ordination with other European states. The systems are then operated by organisations like NATS, that themselves must meet certain criteria for the integrity and continuity of the services that they provide; for example by demonstrating the abilities of the operators and maintainers and the adequacy of their processes. They are also required to present formal safety and security assurance, i.e. safety cases, for example considering issues such as equipment (hardware and software) availability, before they can gain approval from the Competent Authority (usually the CAA) to operate that equipment to provide the service. While this may represent a constraint on changes of use for aviation licensees, in NATS' opinion this is appropriate as having a known, stable environment is important for the assurance of our operations.

Question 2: Have you experienced or are you experiencing the effects of these barriers? If so, in what circumstances and with what impact?:

No, however the barriers identified do not, in general, affect access for aviation use to spectrum as this is managed through ITU World Radiocommunication Conferences (WRCs) due to the need for global harmonisation.

Question 3: Are the categories of information set out in paragraph 5.5 the right ones? Are there any areas here that you think we should prioritise? Are there other types of information that we should be improving? :

As a general observation, some bands may be used as receive only across the UK as a whole or received at specific locations that are not tied directly to associated WT Act licence (transmitter) information and mechanisms may need to be developed to identify these.

From the perspective of the operation of critical national infrastructure, the provision of detailed information on spectrum use may also be undesirable under certain circumstances from a security point of view as it may be exploited to damage or impede CNI.

Question 4: Do you think the information about spectrum characteristics described in paragraph 5.9 would be useful? What information would need to be included as a minimum to make it useful?:

NATS' view is that the usefulness of such "relatively simple information", in Ofcom's words, depends on the nature of the incumbent use and the constraints or flexibilities within which it operates. We think that the types of high level information described would be likely to rule out bands used by aviation and that more complex bands such as these should only ever be considered on a case by case basis involving all incumbent stakeholders from an early stage.

It is also our view that these are bands in which it may not be feasible for the UK to consider sharing on a unilateral basis due to the need to take into account aircraft at high altitude that may be flying over neighbouring administrations or using aviation systems licensed by those administrations.

Question 5: Have we identified the relevant market enablers, or are there others we should take into account? For each one, what is the potential for it to facilitate sharing and what are the downsides? Are there any that you think would be particularly effective or problematic? :

Leaving aside spectrum pricing/AIP, as it is understood this is already levied at Government level for aviation navigation and surveillance purposes, as well as having been implemented for end user licensees in the VHF communications band, the other market mechanisms appear to not be directly relevant at a licensee level to enable sharing within bands used for safety critical aviation services due to the constraints on aviation licensees' frequency usage in those bands (such as assignments in these bands in many cases being co-ordinated at European level due to the reuse distances involved, albeit then formally assigned nationally) and the wider regulated nature of the aviation sector.

Question 6: Have we identified the relevant technology enablers, or are there others we should take into account? For each one, what is the potential for it to facilitate sharing and what are the downsides? Are there any that you think would be particularly effective or problematic? What, if any, role should Ofcom play in helping to develop them? :

Safety critical users like aviation require of their own systems high integrity and reliability operations, certainty over performance and the radio environment as well as the ability of Regulators to take timely enforcement action should harmful interference be experienced. Where sharing is being considered within bands used for aviation, the performance, capabilities and failure modes of any potential sharer would then also need to be taken into

account. Issues such as the reliability of the proposed systems, appropriateness of the design, software assurance, construction, use and maintenance should be considered as precursors to decisions being taken on whether it is appropriate to pursue sharing.

Consideration would also need to be given to the integrity and reliability of any databases and mitigation techniques used for the management of the sharers to assess the risk of data errors leading to equipment being set up with the wrong frequencies or power levels either manually or automatically.

There would also need to be consideration of liability issues.

NATS sees difficulties with the various technologies and concepts identified in the document in the context of potential sharing in bands used for safety critical services like aviation and they stem in part from the basic point that there would be transmitters available that are inherently capable of transmitting in-band with aviation systems and the risks that this presents. It has been seen that spectrum sensing / detect and avoid systems still have performance issues, for example 5 GHz broadband systems impacting meteorological radar. In general, should interference be experienced then the "failure" that has led to this is not important as the effect to the incumbent is still that there is interference degrading its operation; whether this is due to the levels of maturity in the development of these mechanisms, these not being correctly implemented or end user equipment being capable of being modified by the user in order to bypass or change the performance of the sharing mechanism.

NATS is aware of a number of examples of harmful interference being caused to operational aviation systems in recent years by non-aviation equipment designed to operate in-band that required investigation by both NATS and Ofcom and enforcement action. While these were examples of illegal use, the availability of "legitimate" transmitters can only increase the risks of interference.

In the aviation context the abilities of spectrum sensing may also be limited where it is an aircraft use that is being listened for or being sought to be protected, due to issues such as the field of view from an aircraft or the "hidden transmitter" problem.
The potential for impact on the UK's ability to continue to meet, without restriction, its obligations under international agreements goes beyond the technical aspects of equipment and would need to consider the impact of, for example, seeking to restrict the operation of existing aircraft equipment in UK airspace in order to facilitate sharing with non-aviation systems that would otherwise interfere with or be affected by the incumbent aviation use. Even where sharing is deemed by Ofcom to be worth pursuing in the light of such potential impacts, were it to require technical changes to aircraft equipment then, recalling that this would affect any aircraft flying into UK airspace, not only UK flagged aircraft, the costs of this in terms of costs to airlines including aircraft downtime and the impacts on ANSPs should be considered seriously at a very early stage. The minimum notification period for changes to aircraft equipment would also be an issue. Any such consideration should be carried out in conjunction with aviation stakeholders including ANSPs and airlines, as well as the CAA, all of which are also governed by Single European Sky legislation, some of which directly impacts spectrum usage.

Question 7: Do you have any comments on the authorisation tools that we have identified above? Are there others we should take into account? For each

one, what is the potential for it to facilitate sharing and what are the downsides? Are there any that you think would be particularly effective or problematic?:

In general, spectrum access for aviation is achieved through global allocations in the Radio Regulations and due to the development cycles for aviation systems, these allocations may be agreed some years ahead of systems being implemented. Recent WRC processes have also effectively restricted aviation to seeking new terrestrial allocations in bands where there are existing aviation allocations.

It is NATS' view that national or (sub) regional spectrum sharing should not seek to circumvent decisions on spectrum use taken at WRCs. NATS notes that sharing is being actively considered by Ofcom in bands that have been allocated globally (with UK support) to facilitate developments in international aviation. These developments rely on international interoperability, such that a single aircraft is able to fly to or across any country in the world and operate safety and expeditiously without having to carry multiple radio systems to deal with local variations in radio spectrum use. If sharers were to be given or promised an elevated status over aviation systems developed to operate within the aviation allocations then this would be of significant concern to NATS. If access to these allocations for globally standardised aviation systems was to then be restricted or even denied then this could prevent the UK from meeting its international obligations, such as those under the Convention on International Civil Aviation (the Chicago Convention) or under Single European Skies legislation. This would also risk placing the UK at an economic disadvantage as airlines may choose to route flights away from the UK or reduce flights stopping in the UK, thus reducing choice for the travelling public and commerce.

As a general point that should not to be understood as NATS supporting spectrum sharing in any particular circumstance, if Ofcom was to pursue sharing in aviation safety bands then in NATS opinion it would be unacceptable for this to be authorised on any licence exempted basis.

Question 8: Are the characteristics of use we have identified sensible and sufficient to provide a high level indication of sharing potential? Are there other factors that we should expect to take into account? Are there any factors that you consider to be particularly significant? Are there any which we should attach less weight to?:

It is of concern in an aviation context if sharing potential whether at a high level or in detailed planning is assessed on the basis of operational (as against radio) system performance or using specific aviation frequency planning criteria or concepts. Minimum operational performance levels are often specified internationally for aviation systems and it is apparent that these are used inappropriately and incorrectly in sharing analyses as representing the levels at which the systems are (or "should" be) operating and that any performance beyond the minimum is considered as a margin that could be taken up by a sharer. It is the case, certainly for NATS, that ANSPs strive to operate systems at performance levels higher than the minima and it may also be the case that where a particular installation breaches these minimum levels it may have to be withdrawn from service.

Frequency planning criteria and concepts in aviation have been developed for a known (often

exclusively aviation) allocation environment and are used for aviation to aviation system (also "like to like system" in the case of primary radar) frequency planning. It is not appropriate to assume that aviation system planning criteria or concepts are valid outside their original context and "design envelope" for consideration in non-aviation sharing or with dissimilar signal formats.

"Planning in" sharing using these minimum levels or internal planning concepts has at least two potential implications in an aviation context that would mean that non-aviation sharing on this basis is not without impact to the incumbent systems, risking negative economic impacts to the UK and inconvenience to travellers:

1) aviation systems may have their operations restricted to those minimum levels as what is perceived to be the "system margin" has been taken up for the introduction of a sharer. This could for example mean that landing rates may have to be reduced at airports where the throughput has been improved over years through the optimisation of navigation and radar systems and operational procedures,

2) where specific installations may already be operating nearer to the performance minima, for example due to the radio environment in their particular location, the introduction of sharers then increases the risks of those systems having to be withdrawn from service.

While it may be undesirable from a radio regulatory perspective, it is the case that some aviation systems use older design concepts (albeit in modern implementations) that did not take into account the possibility of some future in-band sharer. This is not something that could necessarily be resolved unilaterally by the UK given the need for interoperability for many aviation systems and there could be significant costs for the aviation industry and lengthy timescales involved. In addition, standards for aviation systems have often been developed around operational performance measures and while radio characteristics may be specified at band edges for example, the "radio" performance within the bands may have been left to manufacturers' discretion.

With these in mind, relying on measured radio performance data from single instances of a small set of specific aviation equipment designs when assessing the possibilities of sharing in aviation bands means that inadvertent advantage may be being taken of characteristics of those manufacturers' implementations, leading to an optimistic view of the sharing potential. For the purposes of in-band compatibility/sharing studies then a wider envelope of parameters should be considered that should be linked to international standards where these are available and be relevant for all equipment meeting ICAO standards that may be used in UK airspace.