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| A close up of a sign  Description automatically generated | **World Radiocommunication Conference (WRC-23)Dubai, 20 November - 15 December 2023** |  |
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| PLENARY MEETING | **Addendum 6 toDocument 148-E** |
|  | **30 October 2023** |
|  | **Original: English** |
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| Iran (Islamic Republic of) |
| PROPOSALS FOR THE WORK OF THE CONFERENCE |
|  |
| Agenda item 1.6 |

1.6 to consider, in accordance with Resolution **772 (WRC‑19)**, regulatory provisions to facilitate radiocommunications for sub-orbital vehicles;

Introduction

Radio stations operating onboard sub-orbital vehicles are expected to operate in frequency bands currently allocated for certain terrestrial and space radiocommunications services, while not changing the interference environment with existing applications of the same service and on other radiocommunication services in-band and in adjacent frequency bands.

There is no intention to define a new category of station in the Radio Regulations (RR), and hence the station onboard a sub-orbital vehicle would have to conform to the definitions of “terrestrial stations”in RR No. **1.62**, “earth stations” in RR No. **1.63**, and “space stations” in RR No. **1.64**.

As the sub-orbital vehicle may be physically located within the major portion of Earth’s atmosphere and/or for a brief period of time in space, the definitions could lead to an inconsistency in the application of the regulations for the stations on the sub-orbital vehicle which intend to operate as terrestrial and/or earth stations, due to the brief period of time in space, since the terrestrial and earth stations would have to remain in the major part of the Earth’s atmosphere to comply with these definitions.

One view from the study is to consider that the RR No. **1.64** is the baseline for the classification of a station onboard sub-orbital vehicle. Sub-orbital vehicles are operated in space while not adversely affect the services sharing the band and in the adjacent band.

Another view is to consider that the sub-orbital vehicle terrestrial and earth stations retain the status of the terrestrial station or earth station during the whole flight. A *terrestrial station* is defined as “a station effecting *terrestrial radiocommunication*,” and *terrestrial radiocommunication* (RR No. **1.7**) is defined as “any radiocommunication other than *space radiocommunication* or *radio astronomy*”. As per RR No. **1.61**, each station shall be classified by the service in which it operates permanently or temporarily.

According to the description that currently exists for the sub-orbital vehicles, such vehicles are intended to have part of their flight in non-segregated airspace, therefore, the provisions of RR No. **4.10** may apply to certain aspects of sub-orbital vehicle operations.

Although three methods were proposed so far to satisfy this agenda item, Method B with its different approaches should not be considered at this stage unless all problems, difficulties, inconsistencies and ambiguities are properly addressed and fully responded.

Discussions

The terminology used for this agenda item “sub-orbital vehicle” is not clear nor defined anywhere. It is not clear at this stage whether this “sub-orbital” should be treated as a terrestrial or space service due to the fact that the regulatory procedure for each of these two are different in nature and in application. Moreover, if it is defined as “space service”, then it is also necessary to indicate the consequence of being referred to as “space-to-space” which may result in some confusion between inter-satellite. Serious concerns were expressed with respect to Method B and its associated approaches, in particular Approach A, and associated regulatory text in the Resolution which are ambiguous, un-implementable and vague, and require further clarification at a later stage.

Three methods are proposed to address this agenda item.

Proposals

This Administration supports Method A for the reasons in discussion parts, and due to the fact that Method B referred to four approaches which include serious ambiguities and inconsistencies:

1 Radio stations operating on board sub-orbital vehicles are expected to operate in frequency bands currently allocated for certain terrestrial and space radiocommunications services, and shall not change the interference environment with existing applications of the same service and other radiocommunication services in-band and in adjacent frequency bands. As the sub-orbital vehicle may be physically located within the major portion of the Earth’s atmosphere and for a brief period of time beyond a major portion of the Earth’s atmosphere, the definitions could lead to an inconsistency in the application of the regulations for the stations on the sub-orbital vehicle which intend to operate as terrestrial and/or earth stations, in case of a period of time in space, since the terrestrial and earth stations would have to remain in the major part of the Earth’s atmosphere to comply with these definitions. Consequently there should be no intention to define a new category of station in the RR, and hence the station on board a sub-orbital vehicle would have to conform to the definitions of “terrestrial stations” in RR No. **1.62**, “earth stations” in RR No. **1.63**, and “space stations” in RR No. **1.64**.

2 The alternative selected should clearly clarify whether to consider that RR No. **1.64** is the baseline for the classification of a station on board sub-orbital vehicle expecting to reach space due to the fact that in accordance with the definition of RR No. **1.64**, the classification of the stations on board a sub-orbital vehicle has to be “space stations” when the operation is intended to go beyond, or has been beyond, the major portion of the Earth’s atmosphere. These stations need to use the appropriate space service allocation. However, the relevant space service allocation or directions of the space services to be used for sub-orbital vehicles do not always exist in the current Table of Frequency Allocations. In this case, completing the Table of Frequency Allocations with relevant space services or with relevant direction of the appropriate space services would be a solution. However, *resolves* 2 of Resolution **772** **(WRC-19)** states “excluding any new allocations or changes to the existing allocations in Article 5”. Consequently, an earth station or a terrestrial station on board sub-orbital vehicle operating beyond the major portion of the atmosphere could then only be used under RR No. **4.4**. Recognizing that the application of RR No. **4.4** is not sufficient for earth stations or terrestrial stations intending to ensure safe operation when in space, the radiocommunications requiring to apply RR No. **4.10** for aeronautical application would then have to remain in the same service in which the terrestrial station or earth station are classified similarly as for conventional aircraft.

3 The alternative selected should clearly clarify whether or not to explicitly state that terrestrial stations and earth stations would operate in space or use the flexibility offered by the lack of clear delimitation between atmosphere and space. But this flexibility could only be considered for the terrestrial stations and/or earth stations required to safely accommodate or integrate a sub-orbital vehicle in airspace where air traffic services are provided, which has to be decided by the competent aviation authority of the Member State(s).

4 It also necessary to consider the classification of stations in the context of all RR Article **1** definitions in that the sub-orbital vehicle terrestrial and earth stations retain the status of terrestrial station or earth station during the whole flight when the purpose of the radiocommunications does not change. A terrestrial station is defined as “a station effecting terrestrial radiocommunication”, and terrestrial radiocommunication (RR No. **1.7**) is defined as “any radiocommunication other than space radiocommunication or radio astronomy”. As per RR No. **1.61**, each station shall be classified by the service in which it operates permanently or temporarily. While the sub-orbital vehicle is physically located beyond the Earth’s atmosphere for a brief period of time, the physical location of the sub-orbital vehicle on which the stations are located does not change the need for, or purpose of the use of, specific radiocommunication applications.

NOC IRN/148A6/1#1585

ARTICLES

NOC IRN/148A6/2#1586

APPENDICES

SUP IRN/148A6/3#1589

RESOLUTION 772 (WRC‑19)

Consideration of regulatory provisions to facilitate
the introduction of sub-orbital vehicles

Alternative Proposal

This Administration may consider any of the alternatives mentioned in Method B on which consensus is reached provided that the ambiguous and unclear points are fully addressed and included in the associated WRC‑23 Resolution accordingly.

Moreover, in order to properly and duly protect the incumbent services and their future developments the following *resolves* are to be added to the corresponding Resolution for agenda item 1.6.

ADD IRN/148A6/4#1588

DRAFT NEW RESOLUTION [A16] (WRC‑23)

Regulatory provisions for the operation of radiocommunications
on sub-orbital vehicles

The World Radiocommunication Conference (Dubai, 2023),

considering

*a)* that sub-orbital vehicles operate at higher altitudes than conventional aircraft;

*b)* that sub-orbital vehicles operate through the lower levels of the atmosphere, where some may operate in the same airspace as conventional aircraft;

*c)* that sub-orbital vehicles may perform various missions such as conducting scientific research or providing transportation;

*d)* that stations on board sub-orbital vehicles are expected to provide all or some of the following applications; voice/data communications, navigation, surveillance, and telemetry, tracking and command (TT&C);

*e)* that sub-orbital vehicles must be safely integrated into airspace used by conventional aircraft;

*f)* that some stations on board sub-orbital vehicles may need to communicate with air traffic management systems and relevant ground control facilities;

Approach A supports the *considering* below:

*g)* that some orbital satellite launch rocket systems or components may be considered as sub-orbital vehicles;

*h)* that the stations on board orbital satellite launch rocket or deep space launch rocket systems may be operated under the space operation service without having to apply the provisions contained in the present Resolution;

*i)* that sub-orbital vehicles moving at very high velocity might generate a plasma sheath that may envelop all or most of the vehicle, which could impact communications,

Approach C supports the following *considering*:

*g)* that some satellite launch rocket systems or components may be considered as sub-orbital vehicles, operating at times above the atmosphere,

**Approach D supports the following *considering*:**

*g)* that sub-orbital vehicles moving at very high velocity might generate a plasma sheath that may envelop all or most of the vehicle, which could impact communications,

noting

*a)* that Report ITU‑R M.2477 provides information on radiocommunications for sub-orbital vehicles, including a description of the flight trajectory, categories of sub-orbital vehicles, technical studies related to possible avionics systems used by sub-orbital vehicles, and service allocations of those systems;

*b)* that the provisions of No. **4.10** may apply to certain operations of sub-orbital vehicles;

*c)* that the development of conditions of coexistence between International Civil Aviation Organization (ICAO) standardized aeronautical systems is the responsibility of ICAO;

*d)* that ICAO develops, in some cases, Standards and Recommended Practices (SARPs) to address the coexistence between ICAO aeronautical applications,

Approach B and Approach C and Approach D support the inclusion of the following *noting*:

*e)* that Report ITU‑R M.2477 describes sub-orbital flight as an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur in space without completing a full orbit around the Earth before returning back to the surface of the Earth;

*f)* that Report ITU‑R M.2477 describes a sub-orbital vehicle as a vehicle executing sub‑orbital flight,

recognizing

*a)* that there is no internationally agreed legal demarcation between the Earth’s atmosphere and the space domain, nor between the sovereign airspace and outer space;

*b)* that Annex 10 to the Convention on International Civil Aviation contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation;

*c)* that, due to the increase of Doppler shift, emissions from stations on board sub-orbital vehicles may impact services operating in the same and adjacent or nearby frequency bands;

*d)* that, due to the higher altitude of sub-orbital vehicles compared to conventional aircraft, emissions from stations on board sub-orbital vehicles may have a radiocommunication impact on larger areas involving additional territories and/or on space stations,

Approach B, Approach C and Approach D support the following *recognizing:*

*e)* that some space launch systems may have space stations that already operate as part of existing space operation service allocations;

*f)* that stations on board sub-orbital vehicles may use systems operating under space or terrestrial radiocommunication services;

*g)* that some sub-orbital vehicles could reach altitudes for a brief period of time in space without sufficient energy to sustain its orbit,

resolves

Note – added *resolves* 1 to 5

1 that assignments pertaining to sub-orbital vehicles shall not cause unacceptable interference to nor claim protection from the assignments relating to incumbent services and their future developments;

2 that for the implementation of the above *resolves*, the notifying administration of sub‑orbital vehicles, when submitting Appendix **4** information/data elements shall also send a firm actionable evident, objective, measurable and enforceable commitment that in case of reported unacceptable interference immediately cease the interference or reduce it to an acceptable level; such commitment shall be objective, measurable and enforceable;

3 that, in case of no action taken in application of *resolves*2 above, the Bureau shall send a reminder and request that administration to comply with the requirements referred to in *resolves*2 above;

4 that, should the interference persist, 30 days after the dispatch date of the above-mentioned reminder, the Bureau shall submit the case to the subsequent meeting of the RRB for review and eventual suppression from the database of the Bureau and inform the notifying administration accordingly;

5 that the compliance to this Resolution does in no way, whatsoever, release the notifying administration(s) from its obligation to not causing unacceptable interference nor claiming protection from the incumbent services as indicated in the Resolution,

Approach A:

1 that stations fitted on board a sub-orbital vehicle shall be restricted to operate around the Earth without having the ability or intention to become a station on board a satellite (see No. **1.179**);

2 that terrestrial stations and earth stations required on board a sub-orbital vehicle to safely accommodate or integrate it into airspace where air traffic services are provided, as decided by the competent aviation authority of the Member State(s)[[1]](#footnote-1)1:

2.1 are allowed to operate in the same service under which these stations are classified when they are used on conventional aircraft;

2.2 shall, for the frequency bands identified in the Convention on International Civil Aviation and its annexes that includes SARPs, be operated in accordance with the relevant recognized international aeronautical standards;

2.3 shall not affect the existing and future applications of the same service and/or other radiocommunication services in the same and adjacent frequency bands any more than they would if the same stations were fitted on board a conventional aircraft;

3 that administrations allowing the operation of each station on board sub-orbital vehicles identified in *resolves*2 shall consider coexistence between these terrestrial stations and/or earth stations, and other applications, taking into account *considering c)* and *d)*;

4 that terrestrial and earth stations on board a sub-orbital vehicle other that those identified in *resolves* 2 shall not claim protection from nor create harmful interference to any station operated in the same and adjacent frequency bands unless there is an agreement between the administrations concerned, taking into account *considering* *c)* and *d)*,

Approach B:

1 that sub-orbital vehicles may use terrestrial stations (No. **1.62**) and earth stations (No. **1.63**) during all phases of flight;

2 that terrestrial stations and earth stations on board sub-orbital vehicles referred to in *resolves*1 shall maintain their station class unchanged;

3 that the stations on board sub-orbital vehicles referred to in *resolves* 1 shall not cause additional interference to nor claim additional protection from the existing applications of the same service and on other radiocommunication services in the same and adjacent frequency bands,

**Reasons:** This action will clarify that stations on board sub-orbital vehicles may be terrestrial stations (RR No. **1.62**) and earth stations (RR No. **1.63**) and can be used in all phases of flight, within their respective service allocations. The stations shall not impose any new constraints on applications of the same service and other radiocommunication services that are allocated on a primary basis.

Approach C:

1 that, for the purpose of this Resolution, a sub-orbital vehicle is a vehicle expected to reach the upper atmosphere and may reach space in portions of its flight, without completing a full orbit around the Earth;

*The view was raised that the texts used in the following* resolves *are not compatible with the intention of mandatory actions / operation which are covered in any operative / depository part of any resolution, and consequently, the language used therein needs to be revisited and aligned with the intention / and objectives.*

2 that stations on sub-orbital vehicles may operate in all stages of flight in the aeronautical mobile service (including the aeronautical mobile (R) service), the mobile-satellite service (including the aeronautical mobile-satellite (R) service), or in the radionavigation-satellite service;

3 that, when operating in the aeronautical mobile service (including the aeronautical mobile (R) service), stations on sub-orbital vehicles are subject to the same technical and regulatory conditions as aircraft stations operating in the applicable frequency bands and shall cause no more interference than conventional aircraft stations;

4 that, when operating in the mobile-satellite service (including the aeronautical mobile satellite (R) service) or in the radionavigation-satellite service, stations on board sub-orbital vehicles are subject to the same technical and regulatory conditions as earth stations operating in the applicable frequency bands and shall cause no more interference than conventional earth stations,

**Reasons:** This action clarifies that stations on board sub-orbital vehicles may be terrestrial stations (RR No. **1.62**) and earth stations (RR No. **1.63**) and can be used in all phases of flight, within certain services specified in the Resolution. The stations shall not impose any new constraints on applications of the same service and other radiocommunication services.

Approach D:

1 that, for the purpose of radiocommunications, a sub-orbital flight is described as an intentional flight of a vehicle expected to reach the upper atmosphere with a portion of its flight path that may occur beyond the major portion of the Earth’s atmosphere without completing a full orbit (see No. **1.184**) around the Earth, before returning back to the surface of the Earth, and a sub-orbital vehicle is a vehicle executing a sub-orbital flight;

2 that stations on board sub-orbital vehicles should be considered as earth stations or aircraft stations and may operate in the AM(R)S, MSS, RNSS and other potential services, and No. **4.4** shall be applied when stations on board sub-orbital vehicles in some above services operate beyond the major portion of the atmosphere;

3 that, when operating in the aeronautical mobile (R) service, stations on sub-orbital vehicles are subject to the same technical and regulatory conditions as aircraft stations operating in the applicable frequency bands and shall cause no more interference than conventional aircraft stations;

4 that, when operating in the mobile-satellite service or radionavigation-satellite service, stations on board sub-orbital vehicles are subject to the same technical and regulatory conditions as earth stations operating in the applicable frequency bands and shall cause no more interference than conventional earth stations,

**Reasons:** This action clarifies that stations on board sub-orbital vehicles may be terrestrial stations (RR No. **1.62**) and earth stations (RR No. **1.63**) and the aeronautical mobile (R) service, mobile-satellite service, radionavigation-satellite service can be used. According to existing Radio Regulations, the stations on board sub-orbital vehicles may have to operate under RR No.**4.4** when in space and relevant sharing and compatibility studies when operation in space have not been carried out at this stage. Moreover, the stations shall not impose any new constraints on applications of the same service and other radiocommunication services.

Note – The remaining elements are common to all approaches:

instructs the Secretary-General

to bring this Resolution to the attention of ICAO,

*The view was raised that after and if all problems, difficulties and inconsistencies mentioned above are fully resolved*,

invites the International Civil Aviation Organization

to take into account this Resolution in the course of developing SARPs for ICAO systems that may be used by sub-orbital vehicles,

instructs the Director of the Radiocommunication Bureau

to report to future world radiocommunication conferences on any difficulties or inconsistencies encountered in the implementation of this Resolution.

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1. 1 Defined accordingly with the Convention on International Civil Aviation and its annexes. [↑](#footnote-ref-1)