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Abstract

This report documents the standardisation and dissemination activities performed by the ORPHEUS project consortium from December 2015 to February 2017.

[End of abstract]

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Executive Summary

This report documents the standardisation and dissemination activities performed by the ORPHEUS project consortium from December 2015 to February 2017. These activities aimed at achieving the following standardisation and dissemination goals:

- Influence standardisation in the area of audio technologies.
- Create and raise awareness for the ORPHEUS project activities and results among target audiences.
- Encourage interest and involvement for ORPHEUS project activities among target audiences.

Standardisation Activities

The standardisation activities in the reporting period focused mainly on four organisations, including three standardisation bodies – ITU-R, ISO/IEC MPEG, and ETSI-DVB – and the EBU as a standards-related organisation. Standardisation contributions aiming to progress object-based audio technologies included:

ITU-R

- Work on updates on ADM Metadata
- Contributions on an ADM version for streaming
- Contributions on a standardised baseline renderer for object-based audio (RG33)
- Work for standardisation of object-based loudness calculation

ISO/IEC MPEG

- MPEG-H 3D Audio (audio codec)
- MPEG-H, DASH (transport container)

Contribution to MPEG-I discussions on immersive media formats

EBU

Contributions to SP-FAR (Future Audio formats & Renderer) group meetings, planning of “Object Based Audio” workshop

ETSI-DVB

Work on document ETSI 101154 to get a next generation audio part

Dissemination Activities

ORPHEUS performed a plethora of online and offline dissemination activities, based on the project’s dissemination plan (deliverable D6.1, March 2016). These dissemination activities included, among others, the set-up and continuous update of the project website, the creation of a newsletter, flyers and a poster, the publication of printed and online news, and other information material like videos.

A few selected highlights of these dissemination activities include:

- Launch and continuous updating of the **project website**, which attracted over 1,600 visitors.
- Impactful social media activities via **Twitter**: the project’s Twitter account @ORPHEUS_AUDIO has 201 followers and 137 tweets, which are frequently ‘retweeted’.
- Publication of two issues of the **project newsletter** ORPHEUS Audio News, a **project flyer**, and a **project poster** were published, among other dissemination material.
- ORPHEUS generated **12 papers and presentations**. The presentations at prestigious events like IBC and Tonmeistertagung directly **reached 1,274 people** from the project’s target audiences.

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Abbreviations

ADM	Audio Definition Model
DVB	Digital Video Broadcast
EBU	European Broadcasting Union
EC	European Commission
ETSI	European Telecommunications Standards Institute
HOA	Higher Order Ambisonics
ITU-R	International Telecommunication Union, sector radio communication
ISO	International Organisation for Standardisation
IEC	International Electrotechnical Commission
ISO/IEC	Joint Technical Committees of ISO and IEC
MPEG	Moving Picture Experts Group
W3C	World Wide Web Consortium

1 Introduction

This report documents the standardisation and dissemination activities performed by the ORPHEUS project consortium from December 2015 to February 2017. These activities aimed at achieving the following standardisation and dissemination goals:

- Influence standardisation in the area of audio technologies.
- Create and raise awareness for the ORPHEUS project activities and results among target audiences.
- Encourage interest and involvement for ORPHEUS project activities among target audiences.

In Deliverable D6.1 – Dissemination plan and innovation roadmap – the ORPHEUS consortium has outlined its approaches and envisaged activities for generating innovation and disseminating project results. In this report, D6.2, we are summarising a major part of these activities in the period from the start of the project in December 2015 to the mid-term after 15 of the 30 project months in February 2017.

In regard to innovation-generating activities, this report is focused on the standardisation activities of ORPHEUS, which are described in section 2. After presenting the rationale for standardisation activities by ORPHEUS and an outline of the targeted standardisation bodies, we describe the performed standardisation activities and outcomes.

The dissemination activities performed from December 2015 to February 2017 are described in section 3. This section is structured according to the main areas of dissemination covered by ORPHEUS: visual identity and logo, website and social media, publications, and events. The section includes an outlook on two major upcoming dissemination activities that have been already under planning in the reporting period, and which will be implemented in the second half of the project.

The continuation of the project's standardisation activities and the upcoming dissemination activities of ORPHEUS will be described in D6.3 – Final Standardisation and Dissemination Activity Report – that is due at the end of the project in May 2018.

2 Standardisation

2.1 Rationale for Standardisation Activities of ORPHEUS

ORPHEUS had decided from the start that contributions to standardisation would be one of the key paths for generating innovative impact. In a new area like object-based broadcasting, it is necessary to set new standards, fill the missing gaps and define the standards in a way fitting the object-based audio concept and architecture envisioned by ORPHEUS.

Such standards will enable the project to achieve broader recognition of its results by a wide industry community. They also stimulate higher levels of interoperability and thus contribute to establish economies of scale for ORPHEUS devices and applications. Moreover, close coordination between our research project and standardisation organisations is an important mechanism to exploit results and to stimulate innovation. Standardisation of selected ORPHEUS results can help to maximise compatibility, interoperability, and quality of novel object-based audio solutions.

There are quite a number of good reasons for our decision to use open international standards. They relate to knowledge diffusion, market development and interoperability.

In regard to knowledge diffusion, the following reasons are pertinent:

- The know-how of experts from all over the world is combined to develop the potentially best possible system.
- Systems get tested, documented and made available for everyone, including every manufacturer.

In regard to market development, the following arguments are relevant:

- Standards enable economies of scale, i.e. broadly accepted standards allow for cost-efficient production by a large number of vendors for a large market.
- Standards are essential for the broadcasting sector. They ensure that the user, i.e. the broadcaster, is not bound to one manufacturer.

The main argument related to interoperability is that compatibility between different systems and manufacturers, e.g. units, plugs, or software interfaces, is a pre-condition for effective production systems.

2.2 Challenges

While there are overwhelming reasons for ORPHEUS to use standardisation for spreading its results effectively, there are also a number of challenges to tackle in order to reap the benefits of standards. They include:

- Most of the standardisation organisations take decisions unanimously. This gives everyone the certainty that his opinion cannot be overruled. On the other hand, in cases when industry interests are blocking each other, only the lowest common denominator can be achieved.
- Several standardisation bodies or industry interest groups can standardise different solutions in parallel for the same object.
- Technology users generally prefer royalty-free standards, because they would benefit from such standards without any impact on the cost of their products. However, a number of organisations performing research and development, including some ORPHEUS consortium partners, have a business model which involves licensing of intellectual property. While ORPHEUS as an EU-funded project is fully committed to open standards, these business models and licensing interests of organisations involved in the standardisation process need to be taken into account.

2.3 Relevant Standardisation Bodies and Main Contribution Areas

The ORPHEUS consortium has identified a number of standardisation bodies and contribution areas which are highly relevant for ORPHEUS. The targeted standardisation bodies have in common that they develop standards related to object-based audio. Thus, ORPHEUS is focusing its standards-related efforts to the selected bodies, in order to achieve maximum impact.

Table 1 summarises the identified standardisation bodies, their degree of relevance, the ORPHEUS partners involved, and some of the envisioned contributions by these ORPHEUS partners.

Standardisation body	Relevance	Involved partners	Contributions
ITU-R	High	FHG, BBC, IRT, b<>com	Proposal of a report on object-based broadcasting Contributions on the streaming of ADM Contributions for the baseline renderer Contributions on loudness measurement and loudness handling
MPEG	Medium	FHG, IRT, b<>com	Streaming of object-based content, transport, IP delivery
EBU	High	BBC, IRT, BR, MAGIX, b<>com	Proposal of a report on object-based broadcasting, contributions on loudness measurement and loudness handling
ETSI-DVB	Medium	IRT, FHG, BBC, b<>com	Contributions for the next DVB specification that will be capable of object-based audio delivery
SMPTE	Medium	FHG, BBC	Participation in definition of requirements for audio metadata in an interchange format.
IEC	Medium	FHG	To be decided yet
W3C	Medium	BBC, IRCAM	Contributions on IP-based delivery of object-based content

Table 1: Targeted standardisation bodies

In the following sub-sections, we explain in more detail, why and how the selected standardisation bodies are relevant to ORPHEUS.

2.3.1 International Telecommunication Union – ITU-R

The **International Telecommunication Union (ITU)** is the main standardisation body in terms of visibility, and specifically to lead to the adoption of open ideas. The **ITU Radiocommunication Sector (ITU-R)** is in general responsible for radio communication. Especially the Study Group 6 (SG6) is relevant for ORPHEUS, which deals with radio communication broadcasting, including vision, sound, multimedia and data services, principally intended for delivery to the general public. BBC, IRT, and FHG are active members in many study groups and especially follow works related to broadcasting, spatial audio and audio evaluation. These project partners are therefore able to bring ORPHEUS findings to the sub-working groups on audio-related topics in the Working Parties 6B and 6C of SG6, as well as to multiple rapporteur groups. Joint, coordinated contributions of the relevant ORPHEUS partners will maximise the input.

2.3.2 Moving Picture Experts Group (MPEG)

The **Moving Picture Experts Group (MPEG)** deals among others with standardisation of video and audio compression, as well as container formats and transmission. MPEG is a working group that was formed by ISO and IEC (ISO/IEC JTC1/SC29/WG11). MPEG also works on the topic of object-based audio, especially in the context of MPEG-H. MPEG-H 3D Audio, specified as ISO/IEC 23008-3 (MPEG-H Part 3), is an audio coding standard supporting coding of audio as audio channels, audio objects, or higher order ambisonics (HOA). MPEG-H enables means for interaction, as well as adaptation to the listener environment. FHG technology has been selected as Reference Model technology for major parts of MPEG-H.

2.3.3 European Broadcasting Union (EBU)

Another relevant body is the **EBU**, the **European Broadcasting Union**, which is an alliance of public service media entities. Even though the European Broadcasting Union is not a standardisation body, it offers to the public broadcasters and associated members a vital assistance to disseminate information to associates. The EBU technical department (EBU Tech) considers any advanced work on audio, video and data to be discussed and potentially published as a recommendation or report, covering topics from HDTV to digital radio. BBC, IRT, BR, MAGIX and bcom are part of EBU Tech groups, such as the IA (Immersive Audio), BWF (Broadcast Wave File), PLOUD (Loudness Measurement) or FAR (Future Audio Formats and Renderers). These project partners actively contribute to the efforts of the aforementioned Tech groups and are, thus, bringing ORPHEUS findings to the EBU.

2.3.4 European Telecommunications Standards Institute – ETSI-DVB

The **ETSI-DVB** (Digital Video Broadcasting) is a family of standardised technologies designed to facilitate broadcasting of images, sound and multimedia by the European Telecommunications Standard Institute (ETSI). The standards provide formats for delivery of programme content via terrestrial, cable, satellite and mobile communication systems. In DVB, work is currently performed on formats for object-based audio delivery together with several vendors for their next generation systems. IRT, FHG and BBC are involved in DVB's Next Generation Audio sub-group of the Commercial Module (CM-AVC-NGA). The group is tasked with developing commercial requirements for audio and video encoding formats for Contribution and Distribution applications within broadcast and broadband environments. Furthermore, the technical decisions and solutions are discussed in the Technical Module (TM-AVC-NGA), where BBC, FHG and IRT are active contributors as well.

2.3.5 Society of Motion Picture and Television Engineers (SMPTE)

The **Society of Motion Picture and Television Engineers (SMPTE)** is an internationally recognised standardisation organisation working, among others, on standards for audio recording, information technology, and television transmission formats and physical interfaces. FHG and BBC are active in SMPTE standardisation. For example, the SMPTE technology committee TC-25CSS, dedicated to cinema sound, works on standards for digital sound delivery, new sound measurement techniques and sound reproduction. This includes work on object-based audio (metadata, transport and rendering) in the context of digital cinema sound. Besides, SMPTE Working Group 35PM50 works on an interchangeable master file format (IMF) as a distribution and interchange format. Both topics are related to the work in ORPHEUS, and it is therefore considered to bring ORPHEUS finding to the SMPTE, where relevant. One possible contribution, envisaged by ORPHEUS, would be the participation in the definition of requirements for audio metadata in an interchange format.

2.3.6 International Electrotechnical Commission (IEC)

The **International Electrotechnical Commission (IEC)** is the international standards and conformity assessment body for all fields of electro-technology. FHG is active in IEC standardisation, e.g. in the work of IEC TC100/TA4 on digital system interfaces and protocols. As digital audio and multimedia interfaces are relevant during the implementation of the object-based audio chain in ORPHEUS, it is considered relevant for ORPHEUS to bring findings to the IEC.

2.3.7 World Wide Web Consortium (W3C)

The **World Wide Web Consortium (W3C)** is the main international standards organisation for the World Wide Web. The W3C Audio Working Group is developing specifications for advanced audio capabilities with a new WebAudio API. The API will support the features required by advanced interactive applications including the ability to process and synthesise audio streams directly in web applications. The relevant W3C consortium is co-chaired by the BBC. The developed platform will play a key role in implementing object-based broadcasting based on IP delivery. As the topic of IP-based delivery of object-based content is also part of the work in ORPHEUS, results from the ORPHEUS project will be brought to the attention of W3C. IRCAM is also an active member of this group and will support BBC in submitting ORPHEUS results.

2.4 Standardisation Activities

The standardisation activities in the reporting period focused mainly on four organisations, including three standardisation bodies – ITU-R, ISO/IEC MPEG, and ETSI-DVB – and the EBU as a standards-related organisation. In respect to these standardisation bodies, ORPHEUS partners performed the standardisation activities summarised in Table 2.

Standardisation body	Contributions	Involved partners	Standard impacted by ORPHEUS
ITU-R 6B	Work on updates on ADM Metadata	FHG, BBC, IRT	ITU-R BS.2076, ITU-R BS.2094
ITU-R 6B	Contributions on a streamable version of the ADM	FHG, BBC, IRT	Not yet defined, under development
ITU-R 6C	Work on the topic of a standardised baseline renderer for object-based audio (RG33)	FHG, BBC, IRT	Not defined
ITU-R 6C	Work for standardisation of object-based loudness calculation	FHG, BBC, IRT	ITU-R BS.1770
ISO/IEC MPEG	MPEG-H 3D Audio (audio codec)	FHG	ISO/IEC 23008-3
ISO/IEC MPEG	MPEG-H, DASH (transport container)	FHG	ISO/IEC 23009-1
ISO/IEC MPEG	Contribution to MPEG-I discussions on immersive media formats	b<>com	MPEG-I
EBU	Contributions to SP-FAR (Future Audio formats & Renderer) group meetings, planning of “Object Based Audio” workshop	BBC, IRT, FHG, b<>com	Does not apply, as EBU does not define formal standards

ETSI-DVB	Work on document ETSI 101154 to get a next generation audio part	FHG, BBC, IRT, b<>com	MPEG-H & AC-4
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Table 2: ORPHEUS standardisation activities

The following sections provide a more detailed account of the standardisation activities in which the ORPHEUS partners FHG, BBC, IRT, and b<>com have been involved.

2.4.1 Standardisation Activities Towards ITU-R

The major ORPHEUS-related work within ITU-R occurred for the standardisation of a so-called **baseline renderer for Next Generation Audio (NGA) technologies**, including object-based audio. The baseline renderer is a crucial part in the production chain to ensure a predictable quality and reliable result of NGA audio content. The standardisation is currently done in a Rapporteur Group of WP6C (RG33). Multiple ORPHEUS partners are very active in this process and even co-chair this Rapporteur Group (BBC & IRT). Moreover, FHG and BBC contributed proposal candidates for the renderer in December 2015. Multiple proposals were submitted, and the views and goals of the participating members differ a lot. Thus, the standardisation process is still ongoing.

At the ITU meetings in January/February 2016 and October 2016, a draft for a future revision of **Recommendation ITU-R BS.2076** was created, including additional explanatory texts as well as technical fixes and additional XML attributes to ensure operability of the model for both spherical and Cartesian coordinates. There are also additions with respect to Higher Order Ambisonics (HOA). This preliminary draft revision is envisioned to be approved in March 2017. The preliminary draft revision was created based on input from – among others – the BBC and FHG. The input was mainly sent to the ITU rapporteur group via email and reflected in the rapporteur group report.

In addition to the preliminary draft revision of the ADM specification, a new Recommendation of **“Common Definitions for the Audio Definition Model”** was finished in January 2016 and published in April 2016 as ITU-R BS.2094. This Recommendation describes a set of common definitions for audio channels and configurations using the Audio Definition Model (Rec. ITU-R BS.2076).

The work on this new Recommendation was also highly promoted by the BBC and FHG as ORPHEUS consortium members. Input contributions to the relevant ITU groups (via email, via official ITU input document and/or in discussions at the ITU meeting) were provided by BBC and FHG. The new Recommendation ensures that channel configurations within ADM can be used in a defined and consistent way among broadcasters or companies. This is relevant for the ORPHEUS project, as the project includes the exchange of content in specific formats that need to be defined in an unambiguous way.

In addition, two editorial revisions were created in October 2016: one fixed errors within the ADM specification, and the other one fixed errors in Report ITU-R BS.2388 **“Usage guidelines for the audio definition model and multichannel audio files”**.

A majority of the fixes were proposed to the ITU by ORPHEUS project partners BBC and FHG, based on findings of erroneous or underspecified parts of the ADM during the deployment of the ADM in the ORPHEUS project, i.e. during investigation and implementation of metadata authoring and metadata translations.

During the definition of the needed architecture within ORPHEUS, streaming has been considered to be a very relevant use case; hence, a serialised ADM representation for streaming purposes would be very helpful for the project work.

Thus, the BBC promoted the work on a serialised version of the ADM within the ITU. The technical work in ITU-R WP 6B on this topic was mainly based on contributions by the BBC, with support by FHG at the ITU meetings. First, a working document towards a recommendation or report was created in January 2016 and after some refinement, a preliminary draft new Recommendation was

created in October 2016.

The following relevant input contributions were provided to the ITU by the BBC:

- Document 6B/5: “A proposed approach for a streaming format for the Audio Definition Model - A streaming format for the Audio Definition Model”
- Document 6B/74: “Preliminary draft new Recommendation ITU-R BS.[ADM-STREAM] - A serialised format for the Audio Definition Model”

There are no official input contributions by FHG, as the Fraunhofer Gesellschaft is no sector member of the ITU-R, but FHG employees act as part of the German delegation, representing the German National Body at the ITU. FHG however provides input to the ITU directly in technical discussions at the meeting or in-between meetings via email reflectors.

Therefore, additional provided input by the mentioned partners is collected in the following documents, which summarize the work in the inter-meeting period:

- Document 6B/24: “Progress Report on audio related metadata and file formats”
- Document 6B/95: “Progress Report on Audio Related Metadata and File Formats”

The corresponding rapporteur group (RG33) on the topic of “Audio related metadata and file formats” is currently co-chaired by a representative of Dolby Laboratories and a representative of the BBC.

The sub-working group for “Audio-related subjects” is currently chaired by Ms. Simone Füg (FHG), who is a vice-chair of ITU-R WP 6B.

These roles in chairmanships enable the ORPHEUS partners to ensure that ORPHEUS findings are appropriately discussed and considered.

Lead roles of ORPHEUS partners in ITU-R

ITU-R WP 6C:

Chair: Andy Quested (BBC)

Rapporteur Group (RG27) on Terminology relating to audio and video quality

Co-Chairmen: A. Mason (BBC) & A. Quested (BBC)

Rapporteur Group (RG32) on Loudness measurement algorithm for the advanced sound system

Co-Chairmen: A. Silzle (FhG) [*& S. Norcross (Dolby)*]

Rapporteur Group (RG33) on Baseline renderer for use in programme production and quality evaluation of advanced sound systems

Co-Chairmen: F. Melchior (BBC), M. Weitnauer (IRT) [*& S. Oode (NHK Japan Broadcasting Corp.)*]

Rapporteur Group (RG-BS.1116) on Operational room response

Co-Chairmen: A. Silzle (FhG) [*& I. Dash (Australian Broadcasting Corporation)*]

ITU-R WP 6B:

Vice-Chair: Simone Füg (FhG) – chairmanship of the subworking group of audio-related subjects

Rapporteur Group (RG13) on Audio related metadata and file formats

Co-Chairmen: D. Marston (BBC) [*& S. Norcross (Dolby)*]

Future Activities

All of the above ORPHEUS activities in ITU-R will be continued. In addition, b<>com is planning to contribute to the ITU-R with a method for **measuring the loudness of Higher-Order Ambisonics (HOA) signals**. Loudness measurement algorithms are typically designed for channel-based formats,

which means that contents using object or scene-based representations must be converted to loudspeaker signals before loudness can be measured. As there is currently no standard for playing back HOA signals over loudspeakers or headphones, the challenge is to design a HOA loudness algorithm that does not rely on a particular decoding scheme. b<>com has started designing such an algorithm and is currently running tests using signals obtained from FhG. The method will be finalised within the first half of 2017 and will be submitted to the ITU-R 6C group with the help of researchers from FhG and BBC, who are already involved in the standardisation of loudness measurement.

2.4.2 Standardisation Activities Towards ISO/IEC MPEG

Fraunhofer IIS is a main contributor to the standardisation of the MPEG-H 3D Audio codec standard and has therefore made a significant number of contributions to MPEG in the reporting period. However, as the development and standardisation of the MPEG-H audio codec itself is not in the scope of the ORPHEUS project, those codec-related contributions are not covered here. In the following we focus on **system-related aspects of object-based audio** that are driven by ORPHEUS because of the need for a complete transmission chain. Of particular interest is the distribution over the Internet using DASH, for which important contributions have been made.

In October 2015 the discussion about **signalling object-based audio in DASH** was started with an input document by Fraunhofer at the 113th MPEG meeting in Geneva.² This document addressed the problem of signalling different elements in an object-based audio presentation in a way that they can be accessed more flexibly and streamed only when needed. For example, instead of simulcasting three languages in a single overall stream, only the required language is selected and combined with the main stream in a multi-stream approach. However, this use case requires that the audio elements are accessible on the DASH-level within the MPD and their relationship can be expressed.

It was decided that the proposed extension, like Bundles and Partial Adaptation Sets should be included into Amendment 4 (AMD4) of the DASH specification. The proposal was further discussed within MPEG, revised, and the specification text was submitted by Fraunhofer to the 115th MPEG meeting in May 2016.³ The current status of this standardisation effort is documented in an MPEG Output Document from the 116th MPEG meeting⁴, which includes the agreed specification text that will become part of the DASH specification.

b<>com is also member of MPEG and has been participating to the MPEG-I meetings, in which audio and video formats are to be defined for next-generation, immersive and free-viewpoint media.

2.4.3 Standardisation Activities Towards EBU

The European Broadcasting Union is not a formal SDO (standards development organisation), but it produces recommendations of working practices and technical documents that are widely used by broadcasters. It also organises workshops and seminars to disseminate knowledge about recent and future technical developments. This encourages the sharing of best practices, leading to standardised ways of working.

b<>com took part in the SP-FAR (Future Audio formats and Renderer) group meetings, in which object-oriented audio formats were discussed. Furthermore, IRCAM and b<>com are planning to

² MPEG Input Contribution m37191, "Proposal for MPD signaling for Multi-Stream Audio", 113th MPEG meeting, Geneva, Oct. 19-23, 2015.

³ MPEG Input Contribution m38626, "Proposed audio updates to ISO/IEC 23009-1:2014 DAM4", 115th MPEG meeting, Geneva, May 30 – June 3, 2016.

⁴ MPEG Output Document w16461, "Text of ISO/IEC 23009-1:2014 FDAM 4 Segment Independent SAP Signalling (SISSI), MPD chaining, MPD reset and other extensions", 116th MPEG meeting, Chengdu, Oct. 17-21, 2016.

propose amendments to the ADM format specifications in regard to Higher Order Ambisonic objects.

IRT, BBC R&D, and BR are actively involved in the planning of an **EBU workshop on “Object Based Audio”**, which will be held in Geneva on 17-18 May 2017, and where also b<>com and IRCAM will participate.⁵ The goal of this workshop is to inform the broadcaster-related community about the latest activities in the area of object-based audio and to convince editorial staff and decision makers of the benefits of the technology. ORPHEUS will be very visible there with a specific session and additional presentations and demonstrations.

2.4.4 Standardisation Activities Towards ETSI-DVB

Whilst the technology of choice for delivery of immersive audio to the listener in ORPHEUS is either MPEG-H or AAC, other technologies have been, or are in the course of being, standardised in ETSI.

BBC R&D is an active participant in the **ETSI JTC (joint technical committee) “Broadcast”**, which is responsible for the standards used in DVB. In the reporting period, three activities of this committee were of relevance to the ORPHEUS project.

BBC R&D strongly influenced the process of standardisation in 2015 of Dolby AC-4 (ETSI TS 103 190). Continued encouragement of the system proponent resulted in the publication in 2016 of a subsequent standard, for a renderer for AC-4, ETSI TS 103 448.

BBC R&D has also been actively engaged in the on-going process of standardisation of another competing technology, ETSI TS 103 491 – the work item title is **“DTS-UHD Audio Format - Delivery of Channels, Objects and Ambisonic Sound Fields”**. BBC R&D has reviewed drafts and provided extensive feedback to the proponent.

In both these cases, the intent is to ensure that, as far as possible, the technologies that are standardised will be suitable for use by the BBC. Typical problems that have been overcome are the inadequate definition of some components of the systems, which would lead to differences between the behaviour of implementations by different manufacturers.

Following the proposal by FhG, MPEG-H is now to be included as a technology for use in broadcasting in the latest revision of ETSI TS 101 154 (along with Dolby AC-4). FhG, BBC R&D, and IRT have all been active participants in the process, to ensure that an acceptable compromise can be reached on the inclusion of these technologies for “next-generation audio”.

Fraunhofer IIS has contributed to two DVB working groups in order to assure that object-based audio can be transmitted in DVB broadcasting systems. Although these contributions are primarily related to DVB, they are also relevant for the ORPHEUS broadcast chain, as the underlying problems are of a generic nature and the proposed solutions can be used as a template for other broadcasting systems. As for MPEG (see sub-section 2.3.2) we do not include contributions that address the introduction of MPEG-H 3D Audio as a codec itself, but focus on system-related contributions also relevant for ORPHEUS.

The first DVB working group is the **Technical Module for Audio and Video Coding (TM-AVC)**, which has a dedicated sub-group working on Next Generation Audio (NGA), i.e. codecs with a similar scope as MPEG-H 3D Audio. In April 2016, Fraunhofer and Dolby started the system-related work in a joint contribution describing the use cases and terminology for NGA.⁶ In this document, the need for Multi-Stream Delivery and Hybrid Delivery is explained, and concepts such as Preselections are defined. A first proposal for including MPEG-H in DVB was made in DVB Input Document TM-

⁵ Further information about the workshop on the EBU website is available at <https://tech.ebu.ch/events/2016/object-based-audio>

⁶ DVB Input Document TM-AVC0883, “Examples of NGA Use Cases”, April 27, 2016.

AVC0966⁷, which is a draft specification text for ETSI TS 101 154, “Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG 2 Transport Stream”. This input was revised five times and finalised in October 2016.

The second DVB working group is the **Technical Module for Metadata and Generic Data Broadcast (TM-GBS)**, which is contributing to the DVB specification ETSI EN 300 468, „Specification for Service Information (SI) in DVB systems”. A first proposal (with 5 later revisions) for signalling NGA and MPEG-H in particular was presented in DVB Input Document TM-GBS0829⁸, which proposes the audio_preselection_descriptor(), the audio_multi_stream_info_descriptor(), and the codec-specific MPEG-H3dAudio_descriptor(). The draft specification text for ETSI EN 300 468 was submitted in DVB Input Document TM-GBS0849⁹ (with 4 further revisions) and is now in the DVB approval process.

b<>com participated as a DVB member in calls and meetings organized by DVB’s Next Generation Audio (NGA) group. During these meetings, b<>com has supported the audio formats, use cases and principles defined by the ORPHEUS consortium.

⁷ DVB Input Document TM-AVC0966, “Draft of TS 101 154 v2.3.1”, September 8, 2016.

⁸ DVB Input Document TM-GBS0829, “Proposal for NGA Audio Signaling in SI”, May 9, 2016.

⁹ DVB Input Document TM-GBS0849, “NGA Audio Signalling in EN300468”, July 15, 2016.

3 Dissemination

Based on the dissemination plan, which was outlined in March 2016 in deliverable D6.1, ORPHEUS performed a variety of online and offline dissemination activities in the reporting period.

The dissemination activities between the start of the project in December 2015 and February 2017 included, among others, the set-up and continuous update of the project website, the creation of a newsletter, flyers and a poster, the publication of printed and on-line news, and other information material like videos.

It is worth mentioning that most of the dissemination contributions coming from the project saw several partners collaborating together for the respective dissemination activities, whether it was a paper, a conference booth, or another important public event. This demonstrates the high-level of collaboration among all project partners for reaching the dissemination and impact objectives of ORPHEUS.

Among these activities, the highlights described below are particularly noteworthy.

3.1 Visual Identity and Project Logo

A vital part of ORPHEUS's successful dissemination and communication strategy is its unique visual identity. Thus, the ORPHEUS consortium partners agreed at the start of the project on a corporate logo and design elements for publications and presentations, in order to become easily recognisable for target audiences in the glut of daily information.



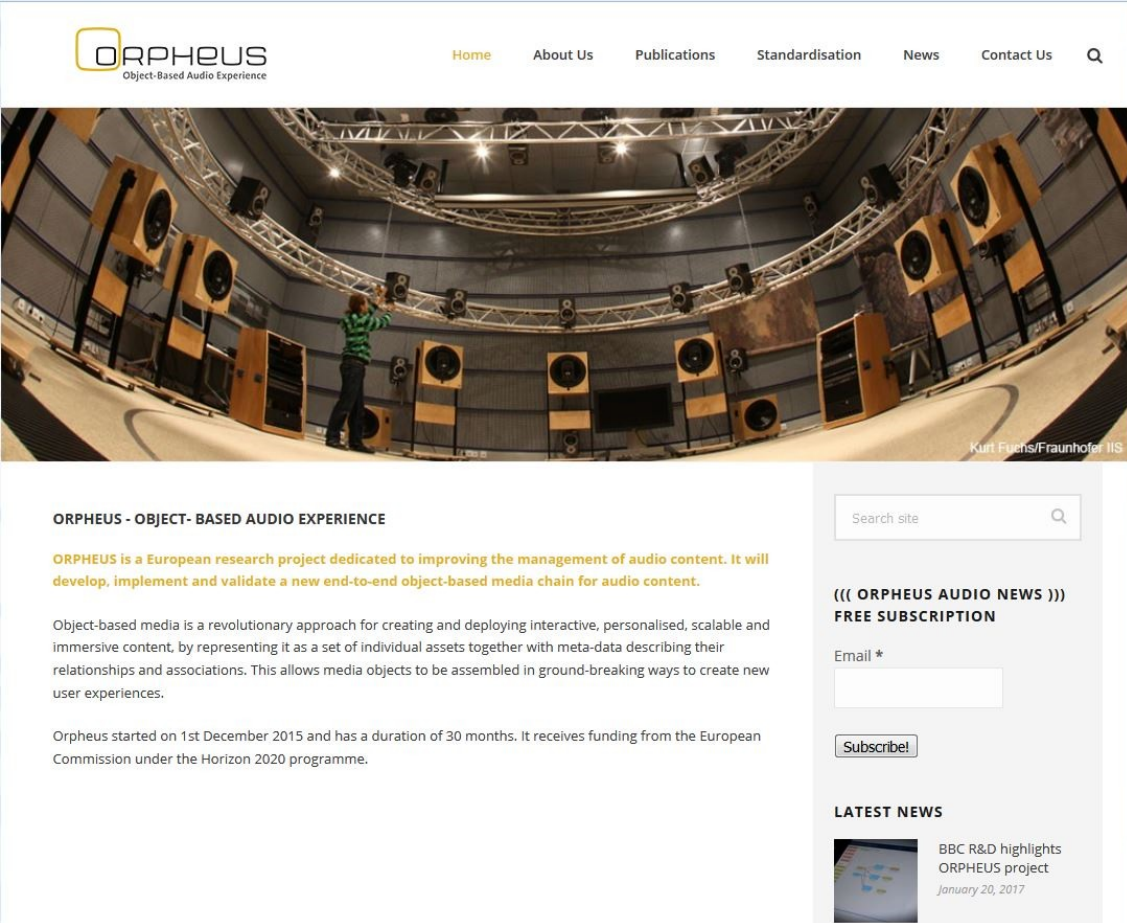
Figure 1: ORPHEUS logo and design elements

The main task was to create a recognisable symbol, the stylised 'O', which is also usable as a stand-alone element without the full project name. In addition, and to stress the project's unique selling proposition and objectives, the most important keywords of the project's full title are used as a claim in the subtitle. The logo design, which was created by consortium partner BR's graphic design department, symbolises the topical scope and goals of ORPHEUS in a visually appealing manner. Through consistent use throughout all online and offline publications, ORPHEUS maintains its strong visual identity and recognisability.

3.2 Project Website

The ORPHEUS website at <https://orpheus-audio.eu/> was launched in February 2016, thus achieving project milestone MS17. It serves as the central reference point for all of the project's communication and dissemination activities. Beyond the home page level, it is structured into five sections (see also Figure 2: ORPHEUS Website):

1. About us
2. Publications
3. Standardisation
4. News
5. Contact Us



ORPHEUS - OBJECT-BASED AUDIO EXPERIENCE

ORPHEUS is a European research project dedicated to improving the management of audio content. It will develop, implement and validate a new end-to-end object-based media chain for audio content.

Object-based media is a revolutionary approach for creating and deploying interactive, personalised, scalable and immersive content, by representing it as a set of individual assets together with meta-data describing their relationships and associations. This allows media objects to be assembled in ground-breaking ways to create new user experiences.

Orpheus started on 1st December 2015 and has a duration of 30 months. It receives funding from the European Commission under the Horizon 2020 programme.

Search site

**(((ORPHEUS AUDIO NEWS)))
FREE SUBSCRIPTION**

Email *

LATEST NEWS


 BBC R&D highlights
ORPHEUS project
January 20, 2017

Figure 2: ORPHEUS Website

The website is regularly updated. Particularly in the 'Latest News' section, website visitors will frequently find new items. The latest news items are also directly visible and accessible via the news column, which also contains syndicated news feeds from the ORPHEUS Twitter account.

The website, which is based on a WordPress implementation, is hosted and managed by Eurescom. Via the content management system, different partners have editing access, thus helping to accelerate the publishing process.

In order to measure the website's effectiveness, the project has closely monitored the number of visitors. The charts below provide an overview of the number of visitors (Figure 3) and page views (Table 3).

Audience Overview

Feb 25, 2016 - Feb 13, 2017

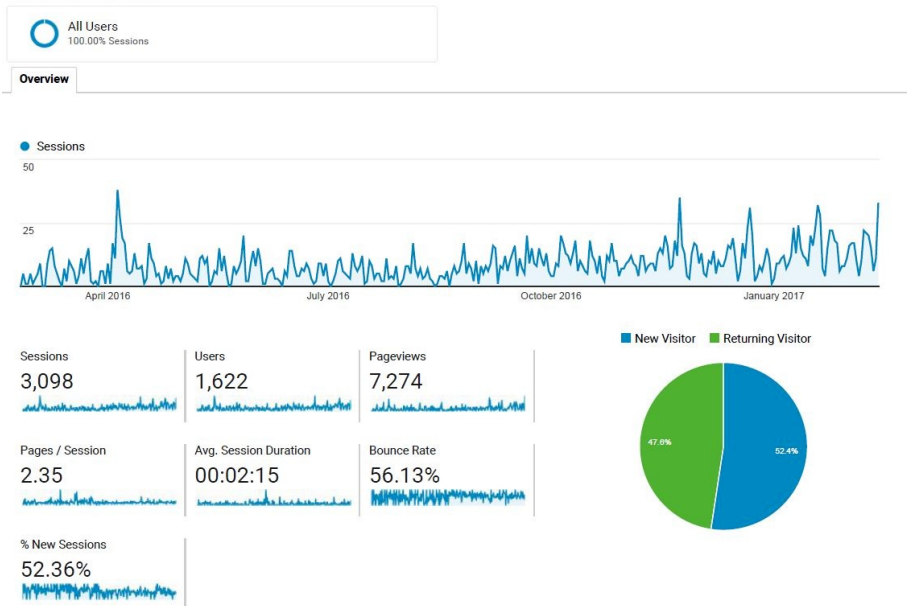
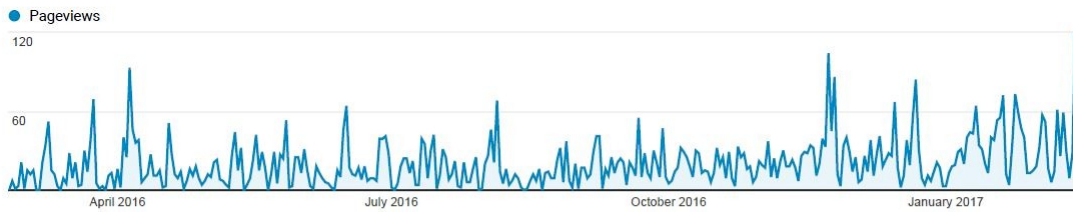


Figure 3: ORPHEUS web visitors overview



Page	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances	Bounce Rate	% Exit	Page Value
	7,274 % of Total: 100.00% (7,274)	5,954 % of Total: 100.00% (5,954)	00:01:40 Avg for View: 00:01:40 (0.00%)	3,098 % of Total: 100.00% (3,098)	56.13% Avg for View: 56.13% (0.00%)	42.59% Avg for View: 42.59% (0.00%)	\$0.00 % of Total: 0.00% (\$0.00)
1. /	2,799 (38.48%)	2,158 (36.24%)	00:01:45	1,996 (64.43%)	48.70%	46.59%	\$0.00 (0.00%)
2. /public-deliverables/	571 (7.85%)	421 (7.07%)	00:02:22	93 (3.00%)	62.37%	44.66%	\$0.00 (0.00%)
3. /project-summary/	538 (7.40%)	470 (7.89%)	00:01:20	148 (4.78%)	70.95%	38.29%	\$0.00 (0.00%)
4. /partners/	486 (6.68%)	421 (7.07%)	00:01:45	79 (2.55%)	75.95%	44.03%	\$0.00 (0.00%)
5. /conference-papers-and-presentations/	303 (4.17%)	233 (3.91%)	00:01:44	36 (1.16%)	63.89%	32.34%	\$0.00 (0.00%)
6. /latest-news/	235 (3.23%)	200 (3.36%)	00:01:24	77 (2.49%)	74.03%	39.57%	\$0.00 (0.00%)
7. /standardisation/	230 (3.16%)	214 (3.59%)	00:00:41	23 (0.74%)	86.96%	32.61%	\$0.00 (0.00%)
8. /orpheus-at-webaudioconference-2016/	226 (3.11%)	203 (3.41%)	00:03:45	132 (4.26%)	87.12%	70.80%	\$0.00 (0.00%)
9. /project-flyer/	159 (2.19%)	149 (2.50%)	00:02:15	35 (1.13%)	80.00%	45.28%	\$0.00 (0.00%)
10. /scientific-articles/	153 (2.10%)	143 (2.40%)	00:00:22	18 (0.58%)	55.56%	15.03%	\$0.00 (0.00%)

Table 3: Page views of top pages

Deliverable and Flyer Page Views and Downloads

The Public Deliverables page¹⁰ attracted 571 page views between April 2016 and February 2017. The download numbers for individual deliverables in this period have not been captured due to WordPress-related technical challenges. The deliverable downloads will be captured from mid-February 2017 on.

The page of the Project Flyer¹¹, which was published in mid-September 2016, attracted 159 page views by February 2017. Like for the public deliverables, the download numbers for the flyer have not been measured either; they will be captured from mid-February 2017 on.

Referencing of ORPHEUS website on partner websites

All project partners are referencing the ORPHEUS website on their respective organisation's website. BBC R&D is, for example, featuring ORPHEUS prominently on its website, as Figure 4 shows.¹²

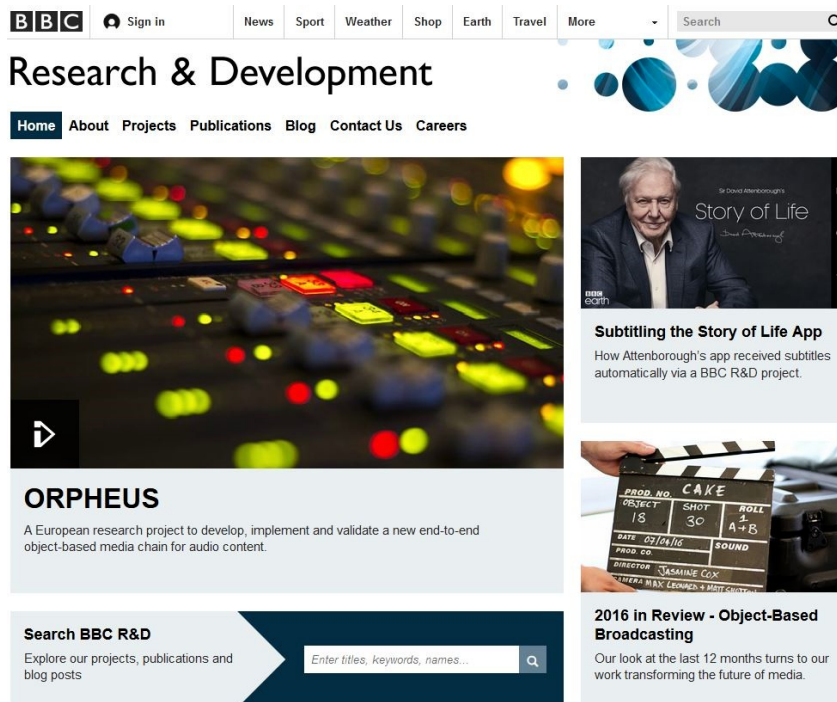


Figure 4: ORPHEUS reference on the BBC R&D website

Other partners either have a dedicated page for ORPHEUS, like for example Eurescom¹³, IRCAM¹⁴ and Elephantcandy¹⁵, or at least a link to the ORPHEUS website.

¹⁰ URL: <https://orpheus-audio.eu/public-deliverables/>

¹¹ <https://orpheus-audio.eu/project-flyer/>

¹² URL of ORPHEUS page on BBC R&D website: <http://www.bbc.co.uk/rd/projects/orpheus>

¹³ URL: <https://www.eurescom.eu/services/management-of-european-rd-projects/ongoing-projects/orpheus.html>

¹⁴ URL: <https://www.ircam.fr/project/detail/orpheus-1/>

¹⁵ URL: <http://www.elephantcandy.com/elephantcandy-part-of-international-consortium-researching-object-based-audio/>

3.3 Social Media

Social Media provide an important channel for communicating with the target audiences of ORPHEUS. The primary Social Media channel used by the project is Twitter.

3.3.1 Twitter

From the various social media options available, the ORPHEUS partners have decided to focus their on the channel most relevant within the audio and broadcast community: Twitter. All company partners in the ORPHEUS project run at least one Twitter account, posting regularly news, promoting activities and events and communicating with their 'followers'.

The consortium's own Twitter account – @ORPHEUS_AUDIO – was set up in January 2016. *Twitter Analytics* is used to get in-depth information on effectiveness and to plan further improvements.

As of 15 February 2017, @ORPHEUS_AUDIO had **201 followers**, and had posted **137 tweets**.

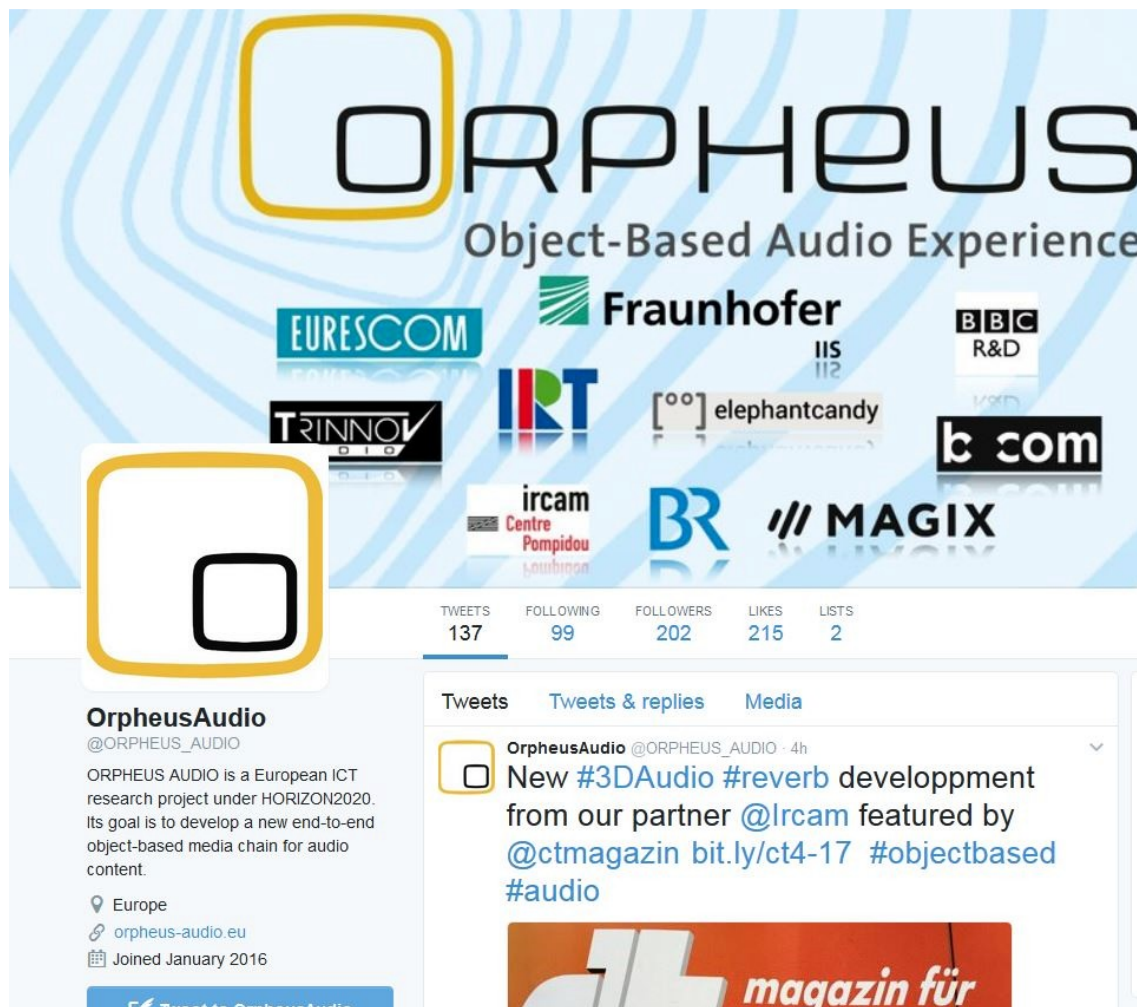


Figure 5: ORPHEUS Twitter page

Most of the official Twitter accounts from consortium partners support @ORPHEUS_AUDIO by regular 'retweeting'.

Besides actively tweeting, the project also carefully monitors the effectiveness of its Twitter activities, e.g. how many followers have joined and what the most popular tweets have been in terms of views, 'likes', and 'retweets'. Below screenshots, as an example, gives an overview of the ORPHEUS Twitter statistics as of February 2017.

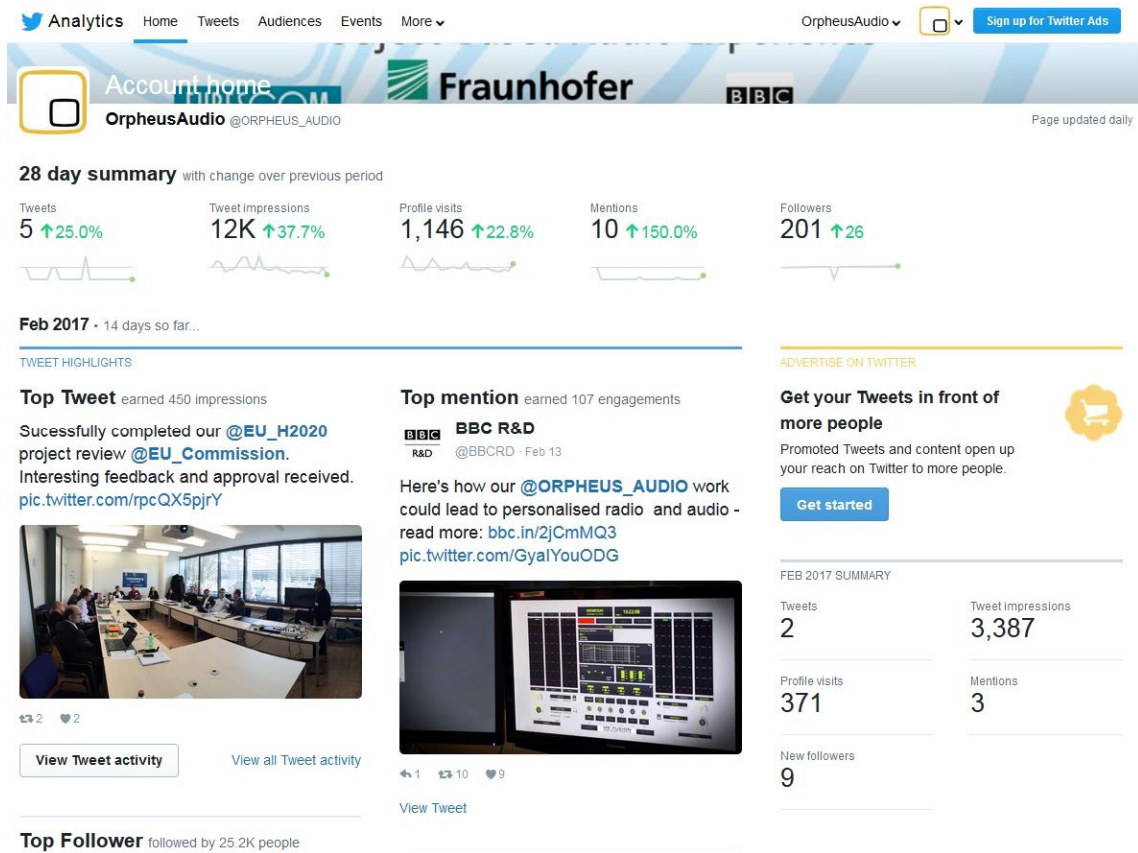


Figure 6: Statistics of @ORPHEUS_AUDIO Twitter account

3.3.2 LinkedIn

A number of ORPHEUS participants are also members of the global, business-oriented social network LinkedIn. On this network, informal exchange and discussions as well as sharing of professional news take place. One of our team posted a short article on the launch and goals of ORPHEUS in March 2016 and received fairly good responses within a short time:

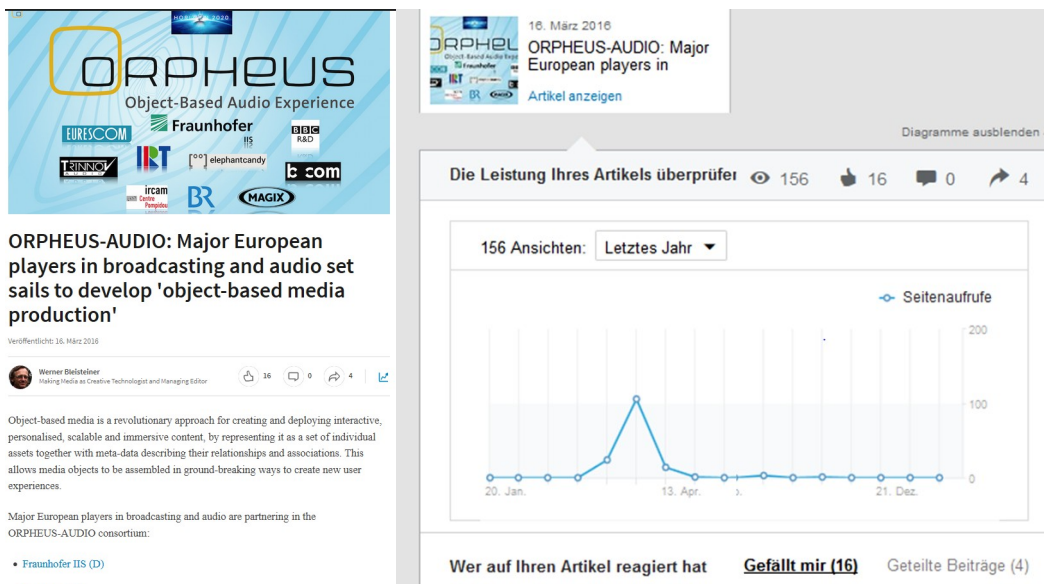


Figure 21: ORPHEUS article and statistics on LinkedIn

The ORPHEUS news item received 156 views, 16 “likes”, and was forwarded 4 times by others within the personal network of the member. At suitable occasions, ORPHEUS will make use of LinkedIn again, when relevant news for such a broad and diverse community are available.

3.4 Publications

3.4.1 Papers and Presentations

A total of 12 papers and presentations have been made by ORPHEUS in the reporting period. Table 4 provides an overview:

No.	Type	Title	Authors	Title of the Journal/Proc./Book
1	Publicat	The EU Project ORPHEUS: Object-based	Andreas Silzle, Robert S	29th Tonmeistertagung - VDT Internationi
2	Publicat	The EU Project Orpheus: Object-based I	Andreas Silzle (Fhg IIS)	Digital Broadcasting Workshop 2016
3	Publicat	bogJS - A JavaScript framework for obje	Michael Weitnauer, Micl	2nd Web Audio Conference (WAC)
4	Publicat	Creating new audio experiences with ot	Chris Baume (BBC)	Radio-Innovations: On the way to Interactl
5	Publicat	Zukunftsmusik: Perspektiven der objekt	Werner Bleisteiner (Bayr	Schoeps MikroForum
6	Publicat	Next Generation Audio	Frank Melchior (BBC), M	NEXT_AUDIO
7	Publicat	Das EU Projekt Orpheus: objektorientier	Andreas Silzle (Fhg IIS)	EMI-Forum: Trends und Hintergründe zur
8	Publicat	Object-based audio production	Chris Baume (BBC)	EBU Production Technology Seminar 2016
9	Publicat	Brave New World - Experiences in Next	Frank Melchior (BBC)	2nd Web Audio Conference (WAC)
10	Publicat	T27 - Parametric Spatial Audio Processin	Emmanuel Habets (Fhg)	140th International AES Convention
11	Publicat	Next Generation Audio	Michael Weitnauer (IRT)	IRT Open Lab Day
12	Publicat	To Immersive Audio and Beyond: New E	Chris Baume (BBC)	International Moving Image Society (IMIS)

Table 4: Publications and presentations

3.4.2 ORPHEUS Newsletter

ORPHEUS is publishing a bi-annual newsletter, called ‘ORPHEUS Audio News’. The purpose is to inform target audiences about activities and results of the project. Two issues have been published so far:



ORPHEUS AUDIO NEWS August 2016

- ORPHEUS Audio News 1 (August 2016): In the first issue Werner Bleisteiner from Bavarian public broadcaster BR explains the work of ORPHEUS on the foundations of an object-based production system for live radio. This issue has been mailed to 53 subscribers.
- ORPHEUS Audio News 2 (December 2016): In the second issue, Chris Baume from BBC R&D explains the ORPHEUS prototype studio at the BBC in London. Moreover, Marius Vopel from MAGIX provides information on Sequoia, one of the main tools used by the project. This issue has been mailed to 77 subscribers.

Each newsletter is complemented by additional information, e.g. on events. All articles published in the newsletter are also available in the News section of the ORPHEUS website. Anyone interested can subscribe to the Newsletter via a subscription form on the website.

3.4.3 ORPHEUS Flyer and Poster

In September 2016, ORPHEUS produced a 4-page project flyer (Figure 7, left) which can be used to inform target audiences about the purpose and activities of the project. 2,000 copies have been printed and are used by project partners for distribution at events and other occasions. A PDF version

is available on the website under “Publications”.

Moreover, a project poster (Figure 7 ,right) has been designed and a number of copies have been printed for use at various occasions.



Figure 7: ORPHEUS flyer (left) and poster

3.5 Events

3.5.1 Conferences and Exhibitions

Exhibition booths of ORPHEUS’ partner organisation have been used at important events for disseminating and creating awareness of ORPHEUS activities. At *Tonmeistertagung* in Cologne, Germany, ORPHEUS organised a panel session which was well attended and elicited positive audience responses. The presentations stimulated a lively and technology-orientated discussion with the audience afterwards. A detailed report is available on the ORPHEUS website¹⁶.

Date	Place	Event	Type	Partners involved	Type of involvement
8-13/09/16	Amsterdam	IBC	Broadcast event	FhG, BCOM	Exhibition booth
29/09-02/10/16	Los Angeles	AES 141 st Convention	Conference and fair	FhG	Exhibition booth
17-20/11/16	Cologne	Tonmeister-tagung	Conference and fair	IRT, FhG, Magix, Trinnov, BBC	Exhibition booths, Presentation, Panel session organised by ORPHEUS, see detailed report on ORPHEUS website ¹⁶

¹⁶ <https://orpheus-audio.eu/tmt16/>

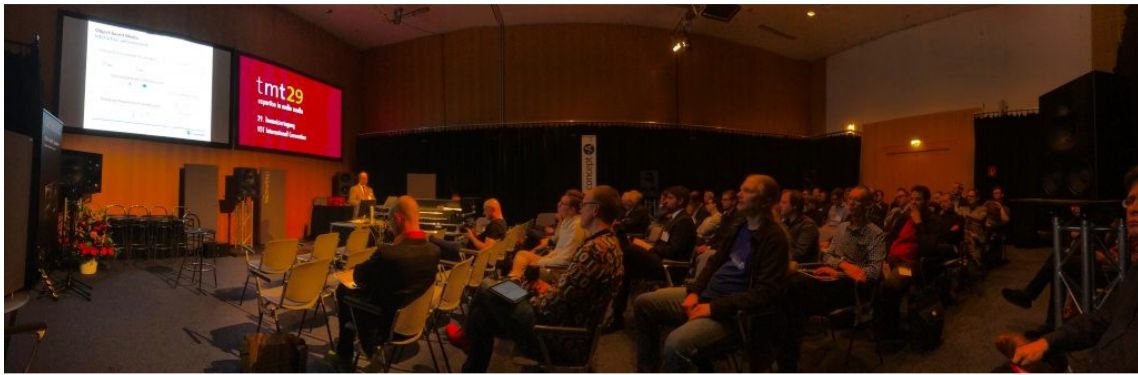


Figure22: Andreas Silzle speaks at Tonmeistertagung in Cologne

3.5.2 Lectures



Chris Baume (BBC) presented ORPHEUS at the International Moving Image Society (IMIS) Annual Bernard Happé Lecture in London on 22 November 2016. The title of his lecture was “To Immersive Audio and Beyond: New Experiences in Broadcasting”. The lecture has been live broadcasted and is available on YouTube¹⁷.

3.5.3 Audiences Reached Through Presentations at Events

From December 2015 to February 2017, ORPHEUS had reached 1,274 people from its target audiences directly and personally via presentations at 12 events. As Table 5 shows, industry representatives were by far the largest target audience reached – 637 people, which is 50% of all audiences reached. The next-largest target audiences are the scientific community (295 people, 23%) and the media (252 people, 20%). This main target audience profile is fully in line with the target audience priorities defined in the dissemination plan (D6.1).

#	Dissemination activity	(Start) Date	Scientific Community	Industry	Civil Society	General Public	Policy Makers	Media	Investors	Customers	Other	Total
1	EBU Production Technology Seminar 2016, Geneva	26/01/16		130								130
2	Schoeps MikroForum, Karlsruhe	01/04/16		90			10					100
3	2nd Web Audio Conference (WAC), Atlanta	04/04/16	150	5								155
4	NEXT_AUDIO, BR internal workshop	01/06/16		85			50					135
5	140th International AES Convention, Paris	04/06/16	75	75								150
6	IRT Open Lab Day, Munich	14/07/16		30			80			5		115
7	Digital Broadcasting Workshop 2016, Erfurt	28/09/16	30	30			30					90
8	Radioinnovation Day, MIZ Potsdam	29/09/16		30								30
9	Radio-Innovations - University of Cologne	06/10/16		62								62
10	EMI-Forum, OTH Amberg	10/11/16	10		70		2					82
11	Tonmeistertagung 2016, Cologne	17/11/16	30	50			80					160
12	International Moving Image Society (IMIS)	22/11/16		50	15							65
	Sum		295	637	85	0	0	252	0	0	5	1,274

Table 5: Target audiences reached via event presentations (Dec 2015 – Feb 2017)

¹⁷ URL: <https://www.youtube.com/watch?v=gP6Se11y9Q>

3.6 Interviews and Media Coverage

3.6.1 Interviews



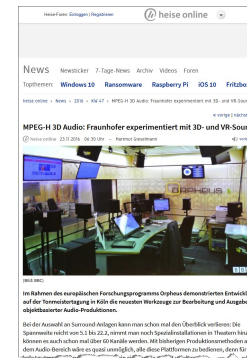
Three interviews have been given by ORPHEUS participants. At Tonmeistertagung Cologne, 17-20 November 2016, Andreas Silzle (FhG) and Michael Weitnauer (IRT) were interviewed on the status of the ORPHEUS project and workflows for next generation audio, respectively. Videos of the interviews are available on the TMT web¹⁸.

Chris Baume (BBC) was interviewed on 30 September 2016 for a radio programme of BBC World Service. Unfortunately the part referring to ORPHEUS had not been included in the final version of the edited interview that was broadcasted.

3.6.2 Media Coverage

The ORPHEUS approach presented at TMT was covered in a detailed article on 23 November 2016 in Germany's most reputable technical news and information portal, **Heise Online**¹⁹.

The article describes the project and its object-based approach, pilot 1, audio tools, and the potential impact on commercial users.



3.7 Planning of Upcoming Dissemination Activities

All regular dissemination activities mentioned above will be continued. Two future activities should be specifically mentioned:

First, the preparations for the **first ORPHEUS workshop** have started. It will be hosted by the BBC on 14 June 2017 (tentative date). The target audience will be broadcasters and manufacturers of broadcasting equipment. The programme will be interactive consisting of a tour at 3-4 stations and demo in a plenary room.

In addition, ORPHEUS is planning for a strong presence at **IBC in Amsterdam** in September 2017. This is the world's biggest broadcasting convention with 55,000 participants.

[end of document]

¹⁸

http://www.tonmeister.de/index.php?tref=eNortjl2t1lqsC3Jz8tNzSwuSS0qSUwvzUvXNzIwNNMvy8IPVysryS_ITLY1UbiGXDBI7A9Z

¹⁹ MPEG-H 3D Audio: Fraunhofer experimentiert mit 3D- und VR-Sound, Hartmut Gieselmann, Heise online, 23 November 2016, URL (retrieved on 2 February 2017): <https://www.heise.de/newsticker/meldung/MPEG-H-3D-Audio-Fraunhofer-experimentiert-mit-3D-und-VR-Sound-3496079.html>