“A Productive, Affordable and Reliable solution for large scale manufacturing of metallic components by combining laser-based ADDltive and Subtractive processes with high Efficiency”

Contract No: 723440


D6.3 Report on the business plan of ISO TC 261 as well as on standard of other ISO and CEN TCs that are relevant for AM technology

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<table>
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<th>Date</th>
<th>Responsible</th>
<th>Organization</th>
<th>Description</th>
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<td>0.1</td>
<td>06/03/2017</td>
<td>Renato OTTONE</td>
<td>GAN</td>
<td>Table of Content with identification of needed contribution</td>
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<td>15/03/2017</td>
<td>Renato OTTONE</td>
<td>GAN</td>
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<td>1.1</td>
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<td>Renato OTTONE</td>
<td>GAN</td>
<td>Inclusion of Annexes 1 and 2</td>
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<td>2.0</td>
<td>24/03/2017</td>
<td>Renato OTTONE</td>
<td>GAN</td>
<td>Final draft. Inclusion of contributions from all partners</td>
</tr>
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# TABLE OF CONTENTS

1. Introduction 5  
1.1. Background 5  
1.2. Scope of the document 5  

2. Overview of current standardization activities related to AM 7  
2.1. Structure of the AM standards development 7  
2.2. ISO/TC 261 structure and facts 9  
2.2.1. Structure 9  
2.2.2. Published standards 10  
2.2.3. On-going Work Items 10  
2.2.4. Joint working groups with ASTM F42 11  
2.3. ASTM International committees on AM 12  
2.4. CEN/TC 438 activities on AM 13  
2.5. VDI activities on AM 14  
2.6. Additive Manufacturing for aerospace applications 15  

3. Effective participation to standardization work 17  
3.1. Work at ISO 17  
3.1.1. Working Groups (WGs) 17  
3.1.2. Meetings 17  
3.1.3. International Standards and other ISO deliverables 17  
3.2. Systematic review of ISO deliverables 18  
3.3. Processes for the generation of new standards 19  
3.3.1. Approval of a New Work Item Proposal 19  
3.3.2. Initial work within the WG 19  
3.3.3. Electronic balloting within ISO member bodies (MB) and commenting 20  
3.3.4. Collation of comments by the PL and initial resolution of conflicts 20  
3.3.5. Detailed discussion of individual clauses content at meetings 20  

4. Commitments from the Grant Agreement and from the DoA 21  
4.1. Provisions of the Grant Agreement related to standardization 21  
4.2. Commitments from the DoA and corresponding actions 21
5. Responsibilities and opportunities  
5.1. The need to stay updated on safety standards  
5.2. Standards as a tool to maximize exploitation of project results  
5.3. PARADDISE project partners’ involvement in standardization works  
6. Conclusions  
Annex 1 – Report on the participation to the 9th ISO/TC 261 meeting  
Annex 2 – Report on the participation to the 2nd meeting of ISO/TC 44/SC 14/WG1
1. INTRODUCTION

1.1. Background

Standardization issues are duly addressed in the AM Strategic Research Agenda\(^1\) as indispensable to support industrial implementation of AM and are well defined in the AM SASAM Standardization Roadmap\(^2\) that foresee a structural approach for AM standards to include; (i) General, top level standards; (ii) Category standards, that are material or process specific and (iii) Specialized standards that are material, process and application specific. (See also section 2.1.1)

Standardization needs to be addressed at international level and the joint effort of ASTM F42 committee and ISO/TC 261 (together with CEN/TC 438) is already producing valuable results.

PARADDISE will help improving the quality of AM International Standards related to Methods, Processes and Materials as well as Test methods and Specifications for AM file format.

1.2. Scope of the document

This document has the following objectives:

1. To report on the updated business plan of ISO/TC 261 – Additive Manufacturing as well as on the current status of standards from other TCs that are relevant for AM technology as presented in Chapter 2.

2. To provide basic information related to the effective participation to standardization works as outlined in Chapter 3. (Those used to work within ISO may skip this chapter)

3. To recall on commitments deriving from the Grant Agreement and from the DoA and on corresponding actions, as addressed in Chapter 4.

4. To recall on legal responsibility related to safety issues as well as on how standardization activities can support the effective exploitation of PARADDISE project results. These topics are addressed in Chapter 5 that includes current and sought involvement / interest of project partners in standardization activities.

Annex 1 of this document reports on the participation to the joint 9\(^{th}\) ISO/TC 261 and ASTM F42 meeting that was held in Tuscaloosa, AL, USA between the 30\(^{th}\) of January and the 2nd of February 2017.

Annex 2 reports on the participation by teleconference to the 2\(^{nd}\) meeting of ISO/TC 44/SC

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\(^1\) http://www.rm-platform.com/linkdoc/AM%20SRA%20-%20February%202014.pdf

14/WG1 held Cambridge, UK on the 7th of March 2017.
2. OVERVIEW OF CURRENT STANDARDIZATION ACTIVITIES RELATED TO AM

Standards have been identified as the most important and urgent topic to enable commercialization and to further push the AM technologies.

Various industries ask for it as a prerequisite to industrialize AM applications.

European Commission (EC) and other funding bodies consider it as a must in every project proposal.

Standard Development Organizations (SDO) identified the needs through various enquiries.

The following items highlight how the topic is currently being addressed in general:

- Nearly every international and national SDO has started standardization activities.
- Even within the same SDO, several committees develop AM standards without coordination.
- Content of such developments is mainly focused on very individual needs and aiming for fast publishing; which, in many cases, is only possible by consensus among small groups of stakeholders, so not all interested stakeholders are involved.
- Additionally, national associations also start developing standards/guides.

There is a general consensus amongst ISO/TC 261 and ASTM F42 that the following items shall be considered for an ordered approach to the topic.

- Common approach within all world-wide standardization bodies – In a global economy there is no obvious reason on why standards/guides should define the same context differently in Europe, Asia and the United States.
- Development of new AM standards should be complemented by the adaptation of conventional standards (if partly applicable); in order to: (i) not ending up re-inventing the wheel, (ii) involve the right people, (iii) not lay out too wide or too academic and (iv) avoid parallel activities.
- The goal is: one world–one standard roadmap where all organizations stick to and where experts can be ensured that their input given once somewhere is used in the overall structure.

2.1.1. Structure of the AM standards development

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3 Most of the content of this chapter has been extracted from document ISO-TC261-N0231 that can be made available to PARADDISE project partners and to EC services by requesting it from Renato OTTONE.
Thanks to an excellent work led by the National Institute of Standards and Technology (NIST), Gaithersburg, MD, USA, an overall structure of the AM standards development has been prepared\(^4\) (see Figure 1).

\[\text{Figure 1. Additive Manufacturing Standards Structure}\]

It shall be noted that NIST has also provided significant technical input to the content of the America Makes & ANSI AMSC Standardization Roadmap for Additive Manufacturing\(^5\) that has been made available on late February 2017.

\(^4\) The document can be downloaded at: https://www.astm.org/COMMIT/F42_ISOASTM_AdditiveManuStandardsStructure.pdf

\(^5\) https://share.ansi.org/Shared%20Documents/Standards%20Activities/AMSC/AMSC_Roadmap_February_2017.pdf
2.2. ISO/TC 261 structure and facts

Some of the detailed information relevant to ISO/TC 261—Additive Manufacturing is available at: https://www.iso.org/committee/629086.html, is reported here for the convenience of the reader.

The Committee Chairperson is Mr. Jörg Lenz\(^6\) (until end 2019)
The Committee Secretary is Mr. Lutz Wrede\(^7\) from DIN.

ISO/TC 261 shares liaisons with the Committees listed in Table 1.

**Table 1. Summary of ISO/TC 261 liaisons**

<table>
<thead>
<tr>
<th>Committees That can access ISO/TC 261 documents</th>
<th>ISO/TC 261 can access the documents of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC/TC 76</td>
<td>Optical radiation safety and laser equipment</td>
</tr>
<tr>
<td>ISO/IEC JTC 1</td>
<td>Information technology</td>
</tr>
<tr>
<td>ISO/TC 39</td>
<td>Machine tools</td>
</tr>
<tr>
<td>ISO/TC 44</td>
<td>Welding and allied processes</td>
</tr>
<tr>
<td>ISO/TC 44/SC 15</td>
<td>Welding and brazing in aerospace</td>
</tr>
<tr>
<td>ISO/TC 119</td>
<td>Powder metallurgy</td>
</tr>
<tr>
<td>ISO/TC 150</td>
<td>Implants for surgery</td>
</tr>
<tr>
<td>ISO/TC 184/SC 1</td>
<td>Physical device control</td>
</tr>
<tr>
<td>ISO/TC 184/SC 4</td>
<td>Industrial data</td>
</tr>
<tr>
<td>ISO/TC 292</td>
<td>Security and resilience</td>
</tr>
<tr>
<td>IEC/TC 76</td>
<td>Optical radiation safety and laser equipment</td>
</tr>
<tr>
<td>ISO/IEC JTC 1</td>
<td>Information technology</td>
</tr>
<tr>
<td>ISO/TC 44</td>
<td>Welding and allied processes</td>
</tr>
<tr>
<td>ISO/TC 44/SC 5</td>
<td>Testing and inspection of welds</td>
</tr>
<tr>
<td>ISO/TC 44/SC 15</td>
<td>Welding and brazing in aerospace</td>
</tr>
<tr>
<td>ISO/TC 61</td>
<td>Plastics</td>
</tr>
<tr>
<td>ISO/TC 61/SC 9</td>
<td>Thermoplastic materials</td>
</tr>
<tr>
<td>ISO/TC 119</td>
<td>Powder metallurgy</td>
</tr>
<tr>
<td>ISO/TC 135</td>
<td>Non-destructive testing</td>
</tr>
<tr>
<td>ISO/TC 184</td>
<td>Automation systems and integration</td>
</tr>
<tr>
<td>ISO/TC 213</td>
<td>GPS</td>
</tr>
<tr>
<td>ISO/TC 292</td>
<td>Security and resilience</td>
</tr>
</tbody>
</table>

2.2.1. Structure

Working Groups that directly compose ISO/TC 261 are listed in Table 2 whereas Joint groups with ASTM F42 are listed in Table 5 in section 2.2.4.

**Table 2. List of ISO/TC 261 working groups**

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\(^6\) Senior Technology Partner Manager, EOS GmbH, Germany

\(^7\) Mr. Wrede has announced in Tuscaloosa that he will terminate his activities. The new secretary will be nominated by DIN.
2.2.2. Published standards

Table 3 provides the list of documents published by ISO/TC261. By entering: [https://www.iso.org/home.html](https://www.iso.org/home.html) and searching by Document Number, it is possible to:

- Preview the Foreword, Introduction and Scope of the selected document.
- Buy and download a copy of the document.

<table>
<thead>
<tr>
<th>Document N. and Date</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 17296-3:2014</td>
<td>Additive manufacturing -- General principles -- Part 3: Main characteristics and corresponding test methods</td>
</tr>
<tr>
<td>ISO 17296-4:2014</td>
<td>Additive manufacturing -- General principles -- Part 4: Overview of data processing</td>
</tr>
<tr>
<td>ISO/ASTM 52900:2015</td>
<td>Additive manufacturing -- General principles -- Terminology</td>
</tr>
<tr>
<td>ISO/ASTM 52915:2016</td>
<td>Specification for additive manufacturing file format (AMF) Version 1.2 (that replaces the originally envisaged ISO 17296-1)</td>
</tr>
<tr>
<td>ISO/ASTM 52921:2013</td>
<td>Standard terminology for additive manufacturing -- Coordinate systems and test methodologies</td>
</tr>
</tbody>
</table>

2.2.3. On-going Work Items

Table 4. provides the list of documents currently under development within ISO/TC 261. The meaning of different document identification acronyms is explained in section 3.3

<table>
<thead>
<tr>
<th>Document N. and Date</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 17296-3:2014</td>
<td>Additive manufacturing -- General principles -- Part 3: Main characteristics and corresponding test methods</td>
</tr>
<tr>
<td>ISO 17296-4:2014</td>
<td>Additive manufacturing -- General principles -- Part 4: Overview of data processing</td>
</tr>
<tr>
<td>ISO/ASTM 52900:2015</td>
<td>Additive manufacturing -- General principles -- Terminology</td>
</tr>
<tr>
<td>ISO/ASTM 52915:2016</td>
<td>Specification for additive manufacturing file format (AMF) Version 1.2 (that replaces the originally envisaged ISO 17296-1)</td>
</tr>
<tr>
<td>ISO/ASTM 52921:2013</td>
<td>Standard terminology for additive manufacturing -- Coordinate systems and test methodologies</td>
</tr>
</tbody>
</table>

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8 At the date of drafting of this document, this Ad Hoc Group has no active work item assigned to it yet.
D6.3
Report on the business plan of ISO/TC 261 as well as on standards of other ISO and CEN TCs that are relevant for AM technology

Doc Ref: PARADDISE-GAN-D6.3-24032017-v2.0

<table>
<thead>
<tr>
<th>Document identification</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO/ASTM DIS 52903-1</td>
<td>Additive manufacturing -- Standard specification for material extrusion based additive manufacturing of plastic materials -- Part 1: Feedstock materials</td>
</tr>
<tr>
<td>ISO/ASTM DIS 52901.2</td>
<td>Additive manufacturing -- General principles -- Requirements for purchased AM parts</td>
</tr>
<tr>
<td>ISO/ASTM DIS 52910.2</td>
<td>Guidelines for additive manufacturing design</td>
</tr>
<tr>
<td>ISO/ASTM NP 52902</td>
<td>Additive manufacturing -- General principles -- Standard test artifacts</td>
</tr>
<tr>
<td>ISO/ASTM NP 52905</td>
<td>Additive manufacturing -- General principles -- Non-destructive testing of additive manufactured products</td>
</tr>
<tr>
<td>ISO/NP TR 52912</td>
<td>Design of functionally graded additive manufactured parts</td>
</tr>
</tbody>
</table>

2.2.4. Joint working groups with ASTM F42

The list of ISO/TC 261 – ASTM F42 joint working groups (JG) is provided in Table 5, including cross-link with main ISO/TC 261 Working Groups.

<table>
<thead>
<tr>
<th>JG id</th>
<th>ISO lead</th>
<th>ASTM lead</th>
<th>Name</th>
<th>Relevant ISO/TC 261 WG</th>
</tr>
</thead>
<tbody>
<tr>
<td>JG 51</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Terminology</td>
<td>WG1</td>
</tr>
<tr>
<td>JG 52</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Standard test artifacts</td>
<td>WG3</td>
</tr>
<tr>
<td>JG 53</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Requirements for purchased AM parts (Set dormant)</td>
<td>WG3</td>
</tr>
<tr>
<td>JG 54</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Design guidelines (Set dormant)</td>
<td>WG4</td>
</tr>
<tr>
<td>JG 57</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Specific design guidelines on powder bed fusion</td>
<td>WG4</td>
</tr>
<tr>
<td>JG 58</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Qualification, quality assurance and post processing of powder bed fusion metallic parts</td>
<td>WG2</td>
</tr>
<tr>
<td>JG 59</td>
<td>□</td>
<td>□</td>
<td>Joint ISO/TC 261-ASTM F 42 Group: NDT for AM parts</td>
<td>WG3</td>
</tr>
</tbody>
</table>
D6.3
Report on the business plan of ISO/TC 261 as well as on standards of other ISO and CEN TCs that are relevant for AM technology

<table>
<thead>
<tr>
<th>JG id</th>
<th>ISO lead</th>
<th>ASTM lead</th>
<th>Name</th>
<th>Relevant ISO/TC 261 WG</th>
</tr>
</thead>
<tbody>
<tr>
<td>JG 60</td>
<td>□</td>
<td></td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Guide for intentionally seeding flaws in additively manufactured (AM) parts</td>
<td>WG2</td>
</tr>
<tr>
<td>JG 63</td>
<td>□</td>
<td></td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Test methods for characterization of powder flow properties for AM applications</td>
<td>WG3</td>
</tr>
<tr>
<td>JG 64</td>
<td>□</td>
<td></td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Specification for AMF support for solid modeling: voxel information, constructive solid geometry representations and solid texturing</td>
<td>WG4</td>
</tr>
<tr>
<td>JG 66</td>
<td>□</td>
<td></td>
<td>Joint ISO/TC 261-ASTM F 42 Group: Technical specification on metal powders</td>
<td>WG2</td>
</tr>
<tr>
<td>JG 67</td>
<td>□</td>
<td></td>
<td>Technical report for the design of functionally graded additive manufactured parts</td>
<td>WG4</td>
</tr>
</tbody>
</table>

Availability of information generated by Joint Groups needs to be improved. The problem is more significant for JGs with ASTM lead.

In practical terms, documents that are discussed within Joint Groups with ASTM lead are only made available to experts of relevant ISO/TC 261 WGs when they reach the Committee Draft (CD) level (i.e.: when they are distributed for ballot amongst national member bodies).

2.3. ASTM International committees on AM

Standardization activities on Additive Manufacturing within the American Society for Testing Materials (ASTM) are carried out by its F42 Committee – Additive Manufacturing Technologies that is mainly composed of the following subcommittees:

- F42.01 Test Methods
- F42.04 Design
- F42.05 Materials and Processes
- F42.06 Environment, Health, and Safety
- F42.91 Terminology
ASTM International has published a significant number of standards related to Additive Manufacturing. Such standards are published within the ASTM Volume 10.04 Electronics; Declarable Substances in Materials; 3D Imaging Systems; Additive Manufacturing Technologies that is accessible at: https://www.astm.org/BOOKSTORE/BOS/1004.htm

Table 6 provides the list of ASTM F42 published standards.

<table>
<thead>
<tr>
<th>Standard id</th>
<th>Status</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F3001-14</td>
<td>active</td>
<td>Standard Specification for Additive Manufacturing Titanium-6 Aluminum-4 Vanadium ELI (Extra Low Interstitial) with Powder Bed Fusion</td>
</tr>
<tr>
<td>ASTM F3049-14</td>
<td>active</td>
<td>Standard Guide for Characterizing Properties of Metal Powders Used for Additive Manufacturing Processes</td>
</tr>
<tr>
<td>ASTM F3055-14a</td>
<td>active</td>
<td>Standard Specification for Additive Manufacturing Nickel Alloy (UNS N07718) with Powder Bed Fusion</td>
</tr>
<tr>
<td>ASTM F3056-14e1</td>
<td>active</td>
<td>Standard Specification for Additive Manufacturing Nickel Alloy (UNS N06625) with Powder Bed Fusion</td>
</tr>
<tr>
<td>ASTM F2971-2013</td>
<td>active</td>
<td>Standard Practice for Reporting Data for Test Specimens Prepared by Additive Manufacturing</td>
</tr>
<tr>
<td>ASTM F3187 - 16</td>
<td>active</td>
<td>Standard Guide for Directed Energy Deposition of Metals</td>
</tr>
<tr>
<td>ASTM F3184 - 16(9)</td>
<td>active</td>
<td>Standard Specification for Additive Manufacturing Stainless Steel Alloy (UNS S31603) with Powder Bed Fusion</td>
</tr>
</tbody>
</table>

2.4. CEN/TC 438 activities on AM

CEN/TC 438 was founded in 2015.

The main objectives of CEN/TC 438 are:

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\(9\) This document was originally intended to be developed by ISO/ASTM JG 65 (dissolved in 2017)
D6.3
Report on the business plan of ISO/TC 261 as well as on standards of other ISO and CEN TCs that are relevant for AM technology

Doc Ref: PARADDISE-GAN-D6.3-24032017-v2.0

- To provide a complete set of European standards on processes, test procedures, quality parameters, supply agreements, fundamentals and vocabulary based, as far as possible, on international standardization work.

  The aim is to apply the Vienna Agreement\textsuperscript{10} with ISO/TC 261 “Additive Manufacturing” to ensure consistency and harmonization.

- To strengthen the link between European Research programs and standardization in additive manufacturing.

- To ensure visibility to the European standardization in additive manufacturing by centralizing standardization initiatives in Europe on additive manufacturing.


2.5. VDI activities on AM

Standardization activities on Additive Manufacturing are carried on in Germany by VDI Fachausschuss GPL FB1_FA105.

The FA 105 Additive Manufacturing Main Committee was founded in 2003, it is chaired by Prof Gerd WITT of the University of Duisburg-Essen and is composed of the following subcommittees:

- FA 105.1 Additive Manufacturing – Kunststoffe (plastics)
- FA 105.2 Additive Manufacturing – Metalle (metal)
- FA 105.3 Additive Manufacturing – Konstruktionsempfehlungen (design)
- FA 105.4 Additive Manufacturing – Public Relations
- FA 105.5 Additive Manufacturing – Legal Aspects
- FA 105.6 Additive Manufacturing – Operational Safety

Table 7 provides a list of VDI FA 105 published standards and Table 8 provides a list of on-going standardization works.

\textit{Table 7. List of VDI FA105 published standards}

<table>
<thead>
<tr>
<th>Document id</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDI 3405 (12/2014)</td>
<td>AM Processes - Fundamentals, Terms, Process descriptions</td>
</tr>
<tr>
<td>VDI 3405-1 (10/2013)</td>
<td>AM Processes - Laser sintering of polymer parts, Quality control</td>
</tr>
<tr>
<td>VD VDI 3405-2 (08/2013))</td>
<td>AM Processes - Beam melting of metallic parts - Qualification, QA and post processing</td>
</tr>
</tbody>
</table>

\textsuperscript{10} https://share.ansi.org/shared%20documents/Standards%20Activities/Background%20Papers/Supporting%20Documents/ISOCE%20VA.pdf
2.6. Additive Manufacturing for aerospace applications

The development of standards for Additive Manufacturing for aerospace application was initially attributed to WG1 – *Additive Manufacturing in aerospace* of ISO/TC 44/SC 14 – *Welding and brazing in aerospace*.

This was creating conflict with ISO/TC 261 – *Additive Manufacturing*.

The problem has been solved by suggesting to create a Joint Group under the “umbrella” of the ISO/TC 261 – ASTM F42 framework with the participation of experts from ISO/TC 44/SC 14/WG1 (that will be assigned the convenorship of the new Joint Group).

ISO/TC 261 approved the relevant decision (See Resolution 28 in Annex 1) that was...
accepted by ISO/TC 44/SC 14/WG1 (See Recommendation 1/2017 in Annex 2) and formally approved on 08/03/2017 by ISO/TC 44/SC 14 plenary meeting.
3. EFFECTIVE PARTICIPATION TO STANDARDIZATION WORK

3.1. Work at ISO

Valuable information is available in the “My ISO job” document\(^\text{11}\). For the convenience of the reader, we report here some extract from its content but we strongly recommend to read the referred document.

3.1.1. Working Groups (WGs)

Membership to working groups is limited to the experts that are nominated by the (ISO national) members that have agreed to actively participate in the project concerned. Whereas P-members of technical committees, subcommittees or project committees are required to represent their national positions, working group experts do not formally represent the members who nominate them. They are selected based on their individual know-how and experience in a given subject and therefore act in a personal capacity. However, they should understand the positions of the member that appointed them and keep them informed of progress in the technical work.

3.1.2. Meetings

Committees use electronic means – e.g. e-mail or Web conferencing – to carry out their work whenever possible.

Meetings are convened only when necessary to discuss matters of substance which cannot be settled by other means. The official languages of ISO being English, French and Russian, the work of a committee by correspondence and in meetings could be in any of these languages. However, English tends to be the most commonly used working language. Delegates and experts without solid English skills will find it challenging to effectively participate in committee work.

3.1.3. International Standards and other ISO deliverables

While ISO is best known for its International Standards, it has other deliverables. Below are the five types of deliverables developed by ISO committees. More information about these deliverables is available at \(\text{www.iso.org}\) or in the ISO/IEC Directives, Part 1\(^\text{12}\).

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**International Standards (IS)**

An International Standard provides rules, guidelines or characteristics for activities or for their results, aimed at achieving the optimum degree of order in a given context. It can take many forms. Apart from product standards, other examples include: test methods, codes of practice, guideline standards and management systems standards.

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\(^\text{12}\) \url{http://www.iec.ch/members_experts/refdocs/iec/isoiecdir-1%7Bed12.0%7Den.pdf}
D6.3  
Report on the business plan of ISO/TC 261 as well as on standards of other ISO and CEN TCs that are relevant for AM technology

Doc Ref: PARADDISE-GAN-D6.3-24032017-v2.0

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- **Technical Specifications (TS)**
  A Technical Specification addresses work still under technical development, or where it is believed that there will be a future, but not immediate, possibility of agreement on an International Standard. A Technical Specification is published for immediate use, but it also provides a means to obtain feedback. The aim is that it will eventually be transformed and republished as an International Standard.

- **Technical Reports (TR)**
  A Technical Report contains information of a different kind from that of the previous two publications. It may include data obtained from a survey, for example, or from an informative report, or information on the perceived “state of the art”.

- **Publicly Available Specifications (PAS)**
  A Publicly Available Specification is published to respond to an urgent market need, representing either the consensus of the experts within a working group, or a consensus in an organization external to ISO. As with Technical Specifications, Publicly Available Specifications are published for immediate use and also serve as a means to obtain feedback for an eventual transformation into an International Standard. Publicly Available Specifications have a maximum life of six years, after which they can be transformed into an International Standard or withdrawn.

- **International Workshop Agreements (IWA)**
  An International Workshop Agreement is a document developed outside the normal ISO committee system to enable market players to negotiate in an “open workshop” environment. International Workshop Agreements are typically administratively supported by an ISO member body. The published agreement includes an indication of the participating organizations involved in its development. An International Workshop Agreement has a maximum lifespan of six years, after which it can be either transformed into another ISO deliverable or is automatically withdrawn.

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3.2. Systematic review of ISO deliverables

Every International Standard and other deliverable published by ISO or jointly with IEC shall be subject to systematic review in order to determine whether it should be confirmed, revised/amended, converted to another form of deliverable, or withdrawn, as per Table 9.

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Max. elapsed time before systematic review</th>
<th>Max. number of times deliverable may be confirmed</th>
<th>Max. life</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Standard</td>
<td>5 years</td>
<td>Not limited</td>
<td>Not limited</td>
</tr>
<tr>
<td>Technical Specification</td>
<td>3 years</td>
<td>Once recommended</td>
<td>6 years recommended</td>
</tr>
<tr>
<td>Publicly available specification</td>
<td>3 years</td>
<td>Once</td>
<td>6 years (if not converted: withdrawn)</td>
</tr>
<tr>
<td>Technical Report</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not limited</td>
</tr>
</tbody>
</table>
The timing of a systematic review is normally based either on the year of publication or, where a document has already been confirmed, on the year in which it was last confirmed. However, it is not necessary to wait for the maximum period to elapse before a document is reviewed.

A committee may at any time between systematic reviews pass a resolution initiating a revision or amendment of a standard.

3.3. Processes for the generation of new standards

3.3.1. Approval of a New Work Item Proposal

Because of the large financial resources and manpower involved and the necessity to allocate these according to the needs, it is important that any standardization activity begins by identifying the needs, determining the aims of the standard(s) to be prepared and the interests that may be affected. This will, moreover, help to ensure that the standards produced will cover appropriately the aspects required and be market relevant for the affected sectors. Any new activity shall therefore be reasonably justified before it is begun.

In case the PARADDISE project would intend to generate a new ISO deliverable, this would be the most critical stage because the approval of a NWIP will need to be supported by at least five ISO (national) member bodies. It is therefore strategically important to establish good connection within such national member bodies in order to ensure their positive vote and their availability to nominate an expert to support the drafting of the (proposed) new document. In most cases, it is very important to convince experts to “sell” the idea within their national committees. This activity is typically informally performed during meetings, prior to the official ISO electronic balloting begins.

The following topics needs to be considered when planning to submit a New Work Item Proposal:

- Any proposal for new work shall lie within the scope of the organization to which it is submitted.
- The documentation justifying new work shall make a substantial case for the market relevance of the proposal.
- The documentation justifying new work shall provide solid information as a foundation for informed ISO or IEC national body voting.
- The proposed scope shall give a clear indication of the coverage of the proposed new work item and, if necessary for clarity, exclusions shall be stated.
- It is strongly recommended to submit a preliminary draft of the proposed deliverable.
- Typically, the proposer should be ready to become the Project Leader for the development of the proposed deliverable.

3.3.2. Initial work within the WG
Once a NWIP has been accepted, the Project Leader (PL), in cooperation with the experts that would have been nominated by the national ISO members when approving the proposed work, prepares a Working Draft (WD) for the deliverable.

When the WD reaches an adequate quality level, a recommendation is made by the WG to the Technical Committee (TC) to submit the document as a Committee Draft (CD) for balloting amongst national ISO member bodies.

3.3.3. Electronic balloting within ISO member bodies (MB) and commenting
It is typically expected that member bodies provide specific technical comments to complement the manifestation of their vote. This is compulsory in case of negative vote.

3.3.4. Collation of comments by the PL and initial resolution of conflicts
The standard ISO commenting template is a very effective tool that contains, for every relevant topic, the following information:

- Identification of the MB proposing the comment;
- Exact location of the topic within the document (e.g.: section, clause, sub-clause, paragraph and line number);
- Nature of the comment (e.g. general, technical or editorial);
- The comment itself (with the identification of the problem to be solved);
- The proposed change (that typically consists of the proposed text deemed to be apt to solve the problem).

The Project Leader collates all comments and, for each one of them, proposes a solution deemed apt to resolve the problem as well as resolving possible identified conflicts.

3.3.5. Detailed discussion of individual clauses content at meetings
The collated comments are individually discussed at virtual or physical meetings and for each one of them a consensus solution is identified and documented.

The project leader shall then incorporate the resulting decisions into the new version of the document to be submitted to balloting as a Draft International Standard (DIS).

The procedure is repeated collating received comments related to the DIS. If technical comments need to be resolved, the Project Leader applies relevant solution and the document is once more submitted for balloting as a Final Draft International Standard (FDIS). If only editorial comments are submitted with the votes form MBs, the document may proceed to publication stage, otherwise it returns to DIS stage.
4. Commissions from the Grant Agreement and from the DoA

4.1. Provisions of the Grant Agreement related to standardization

We recall that Article 28.1 of the GA — *Obligation to exploit the results*, clarifies (in item d)) that one form of exploitation of project results is using such results in standardization activities.

We also textually report, for the convenience of the reader, the content of Article 28.2 — *Results that could contribute to European or international standards — Information on EU funding*

If results are incorporated in a standard, the beneficiary concerned must — unless the Commission requests or agrees otherwise or unless it is impossible — ask the standardization body to include the following statement in (information related to) the standard:

“Results incorporated in this standard received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 723440”.

4.2. Commitments from the DoA and corresponding actions

Table 10 provides the textual listing of commitments contained in the DoA and the relevant planned or applied actions.

Table 10. Commitments related to standardization and relevant actions

<table>
<thead>
<tr>
<th>Item</th>
<th>Commitment from the DoA</th>
<th>Relevant action(s)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>At project kick-off, GAN will update PARADDISE stakeholders with current development regarding the standards that will have occurred between proposal submission and the KoM.</td>
<td>The list of ISO/TC 261 published standard was made available as part of KoM T6.4 presentation</td>
<td>Done</td>
</tr>
<tr>
<td>2</td>
<td>PARADDISE project will seek liaison with CEN TC438, Additive Manufacturing, in order to support the work of that Technical Committee (TC) and also in order to take advantage of the preliminary results of the on-going standardization activities that include (through ISO TC261) strong connection with the American Society for Testing Materials (ASTM) F42</td>
<td>The request for liaison was submitted to electronic ballot by CEN/TC 438 and was approved by unanimity.</td>
<td>Done</td>
</tr>
<tr>
<td>3</td>
<td>Specific participation to other TCs that address standardisation on topics that are relevant for PARADDISE expected exploitable results will be ensured through the activities of experts of</td>
<td>See section 5.3</td>
<td>On-going</td>
</tr>
</tbody>
</table>

Confidential. Contents restricted to participants as identified on title page
Page 21 of 43
# D6.3

Report on the business plan of ISO/TC 261 as well as on standards of other ISO and CEN TCs that are relevant for AM technology

<table>
<thead>
<tr>
<th>Item</th>
<th>Commitment from the DoA</th>
<th>Relevant action(s)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>PARADDISE partners.</td>
<td>Completion of this Deliverable</td>
<td>Done</td>
</tr>
<tr>
<td>5</td>
<td>A specific comprehensive report (D6.3) will be published on M6 to update on the achievements and on the business plan of ISO TC261 as well as on the evolution of standardisation activities of other TCs that address topics that are relevant to AM technology.</td>
<td>It is expected that we will not pursue the publication of IWA(s) or CWA(s) due to probable strong opposition from ISO/TC 261 stakeholders. This derives from specific past experience gained within ISO/TC 39 – Machine tools activities. A similar case was addressed and the TC requested specific action from the ISO Central Secretariat. This subject matter will be addressed at M6 project meeting.</td>
<td>Pending decision</td>
</tr>
<tr>
<td>6</td>
<td>PARADDISE project will seek cooperation with the consortium that will be granted the research activities that are defined in the FoF-05-2016 call: Support for the further development of Additive Manufacturing technologies in Europe, with specific attention to standardization issues that are considered in that call.</td>
<td>The relevant research activities were awarded to the AM-motion project. <a href="http://www.am-motion.eu/">http://www.am-motion.eu/</a>. Cooperation has already been established and the PARADDISE project is now listed in the AM PLATFORM database that is available at: <a href="http://www.rm-platform.com/index.php/am-database">http://www.rm-platform.com/index.php/am-database</a></td>
<td>Done</td>
</tr>
</tbody>
</table>
5. RESPONSIBILITIES AND OPPORTUNITIES

5.1. The need to stay updated on safety standards

Knowledge and application of safety standards are ethic and legal responsibilities.

Directive 2006/42/EC known as the Machinery Directive¹³, has the dual aim of harmonising the health and safety requirements applicable to machinery on the basis of a high level of protection of health and safety, while ensuring the free circulation of machinery on the EU market.

The PARADDISE machine, and most of its subsystems, are falling within the definition of "machinery" reported in Article 2 of the Directive itself that (primarily) means:

“an assembly, fitted with or intended to be fitted with a drive system other than directly applied human or animal effort, consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application.”

The technical backbone of the Machinery Directives is the list of Harmonized Standards¹⁴ that is regularly updated.

Harmonized standards are grouped into the following categories:

- **A-type standards**
  A-type standards specify basic concepts, terminology and design principles applicable to all categories of machinery. Application of such standards alone, although providing an essential framework for the correct application of the Machinery Directive, is not sufficient to ensure conformity with the relevant essential health and safety requirements of the Directive and therefore does not give a full presumption of conformity.

  **EN ISO 12100:2010** — Safety of machinery - General principles for design - Risk assessment and risk reduction is an A-type standard.

- **B-type standards**
  B-type standards deal with specific aspects of machinery safety or specific types of safeguard that can be used across a wide range of categories of machinery. Application of the specifications of B-type standards confers a presumption of conformity with the essential health and safety requirements of the Machinery Directive that they cover when a C-type standard or the manufacturer's risk assessment shows that a technical solution specified by the B-type standard is adequate for the particular category or model of machinery concerned. Application of B-type standards that give specifications for safety components that are independently placed on the market confers a presumption of conformity for the

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safety components concerned and for the essential health and safety requirements covered by the standards.

**EN 12198-1:2000+A1:2008** — Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 1: General principles is an example of a B-type standard.

- **C-type standards**

C-type standards provide specifications for a given category of machinery. The different types of machinery belonging to the category covered by a C-type standard have a similar intended use and present similar hazards. C-type standards may refer to A- or B-type standards, indicating which of the specifications of the A- or B-type standard are applicable to the category of machinery concerned. When, for a given aspect of machinery safety, a C-type standard deviates from the specifications of an A- or B-type standard, the specifications of the C-type standard take precedence over the specifications of the A- or B-type standard. **Application of the specifications of a C-type standard on the basis of the manufacturer’s risk assessment confers a presumption of conformity with the essential health and safety requirements of the Machinery Directive covered by the standard.** Certain C-type standards are organised as a series of several parts, Part 1 of the standard giving general specifications applicable to a family of machinery and other parts of the standard giving specifications for specific categories of machinery belonging to the family, supplementing or modifying the general specifications of Part 1. For C-type standards organised in this way, the presumption of conformity with the essential health and safety requirements of the Machinery Directive is conferred by application of the general Part 1 of the standard together with the relevant specific part of the standard.

**EN 12417:2001+A2:2009** — Machine tools — Safety — Machining centres, is an example of C-type standards\(^{15}\).

For each standard category, the List of Harmonized Standard identifies:
- Reference and title of the standard;
- First publication date;
- Reference of superseded standard;
- Date of cessation of presumption of conformity of superseded standard.

### 5.2. Standards as a tool to maximize exploitation of project results

Project partners that are involved with the exploitation of PARADDISE project results that are listed in Table 11, are expected to consider to apply the sequence of activities outlined in Figure 2 (extracted from Figure 3.4 of PARADDISE project proposal) to their own

\(^{15}\) It shall be noted that this standard is relevant to the IBARMIA machine tool and it is undergoing revision. The new document is named ISO(DIS) 16090-1 Machine tools safety -- Machining centres, Milling machines, Transfer machines -- Part 1: Safety requirements, and it is being developed by ISO/TC 39/SC10/WG4
expected results and to reflect their intentions in Table 12 of section 5.3 of this document.

Table 11. List of PARADDISE exploitable results

<table>
<thead>
<tr>
<th>ID</th>
<th>PARADDISE Exploitable Result (ER)</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>ER1</td>
<td>Hybrid Solution for efficient and affordable production of large scale metallic parts</td>
<td>TO5</td>
</tr>
<tr>
<td>ER2</td>
<td>Closed-loop control system for hybrid AM&amp;SM manufacturing</td>
<td>TO3</td>
</tr>
<tr>
<td>ER3</td>
<td>Smart LMD Head</td>
<td>TO4</td>
</tr>
<tr>
<td>ER4</td>
<td>Smart Powder feeder</td>
<td>TO4</td>
</tr>
<tr>
<td>ER5</td>
<td>Monitoring system for metal LMD process</td>
<td>TO3</td>
</tr>
<tr>
<td>ER6</td>
<td>Knowledge-Based Expert Database for metal LMD and machining processes</td>
<td>TO1</td>
</tr>
<tr>
<td>ER7</td>
<td>CAx Technologies for hybrid manufacturing</td>
<td>TO2</td>
</tr>
<tr>
<td>ER8</td>
<td>Metal powder recycling system</td>
<td>EO2</td>
</tr>
<tr>
<td>ER9</td>
<td>International Standards on test methods and procedures for the characterization of Aerospace</td>
<td>SO3</td>
</tr>
</tbody>
</table>

parts produced by AM technologies

Figure 2. Outline of standardization activities within the PARADDISE project
5.3. PARADDISE project partners’ involvement in standardization works

Table 12. Current and sought involvement in standardization work

<table>
<thead>
<tr>
<th>Partner</th>
<th>Current involvement</th>
<th>Sought involvement / interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECNALIA</td>
<td>Dr. Amaia Alberdi is the coordinator of PARADDISE project, which intends to support the work of the CEN/TC 438 Technical Committee.</td>
<td>Dr. Amaia Alberdi is the nominated PARADDISE representative within CEN/TC 438. The main function will be to receive updates on the Committee documents and to participate to meetings.</td>
</tr>
<tr>
<td>IBARMIA</td>
<td>Not involved in standardization activities</td>
<td>IBARMIA will collaborate to standardization activities related to AM safety issues in working group ISO/TC 261/AHG 2</td>
</tr>
<tr>
<td>SIEMENS</td>
<td>SIEMENS will be the responsible of standardization activities related to AM data management. Mr. Daniel Regulin will be in charge of this topic. He will be supported by Mr. Martin SHÄFER, who is the coordinator of DIN NA 145-04-01AA that is the German mirror committee to ISO/TC 261.</td>
<td>Mr. Martin SHÄFER is the nominated liaison expert from ISO/TC 261 to ISO/TC 184 and he is following up on the activities of WG7 of TC184 SC1 that is working on the standard: „Feature-based data formats for AM machines“ (STEP-NC: ISO14649 part 17)</td>
</tr>
<tr>
<td>PRECITEC</td>
<td></td>
<td>Follow-up on standards related to (i) safety issues for Directed Energy Deposition of Metals and (ii) process control/validation for AM in aerospace</td>
</tr>
</tbody>
</table>
### Partner | Current involvement | Sought involvement / interest
---|---|---
GAN | Mr. Renato OTTONE is: 1. Nominated liaison officer of ISO/TC39 – Machine tools to ISO/TC 261 – Additive Manufacturing (AM) and Italian nominated expert within its four existing WGs (including AHG2 on AM safety issues). 2. Member of the Italian mirror committee to ISO/TC 39/SC 2 – Test conditions for machine tools and of the Italian mirror committee to ISO/TC 39/SC 10 – Machine tool Safety as well as member of the Italian mirror committee to ISO/TC 213 – Geometrical Product Specifications (GPS) 3. Nominated Italian expert within ISO/TC 44/SC14/WG1 – AM for aerospace applications. 4. Active member of ASTM International F42 committee (including all relevant subcommittees) | Mr. Renato OTTONE will shortly become an Italian nominated expert to the Joint Group that is going to be established between ISO/TC 261 and ISO/TC 44/SC 14/WG1 – Additive manufacturing in aerospace. Virtual and/or physical presence to future ISO/TC 261 and relevant WGs meetings shall be considered. Physical meetings are typically held twice a year, they last 4-5 days (including individual WGs meetings) and they are held, in turn, in Europe, USA and Asia. |
MICHELIN | Follow-up on standards related to the safe application of Additive Manufacturing processes. | |
UPV/EHU | UPV/EHU will collaborate to standardization activities on AM and combined AM and conventional (i.e.: subtractive) machining activities by transferring technical feedback of PARADDISE project to ADDIMAT (Spanish association for Additive Manufacturing) which is involved in Spanish and European standardization committees | |
RWTH AACHEN | Follow-up on standards related to process control for Directed Energy Deposition of Metals, including process validation information. | |
6. CONCLUSIONS

Chapter 2 of this document thoroughly attains the original objective of Deliverable D6.3 as it reports on the updated business plan of ISO/TC 261 and also provides a comprehensive overview of the activities of the following Technical Committees:

- CEN/TC 438
- ASTM F42
- VDI FA 105
- ISO/TC 44/SC 14

Including the relevant list of published standards as well as the list of on-going development work within such committees.

Reference is also provided to the very recently published America Makes & ANSI AMSC Standardization Roadmap for Additive Manufacturing.

Additionally, this Deliverable provides information for the planning and the implementation of standardization activities within the PARADDISE project execution by:

1. Informing and providing references that are deemed apt to help project partners to better understand the rules and conventions that lead standardization processes.
2. Recalling on commitments deriving from the Grant Agreement and from the DoA as well as reporting on past and planned corresponding actions.
3. Addressing: (i) legal responsibility related to safety issues and (ii) standardization activities as a tool to improve the exploitability of PARADDISE project results
4. Outlining current and sought involvement / interest of project partners in standardization activities.

This Deliverable also provides, in Annex 1, the report on the participation to the joint 9th ISO/TC 261 and ASTM F42 meeting including:

- General considerations on the event that included the plenary meetings of the two organizations as well as individual working groups meetings;
- Minutes of ISO/TC 261 plenary meeting;
- Resolutions taken by ISO/TC 261 (that include valuable information on the progress of on-going standardization works).

Annex 2 extracts the content of the minutes of the 2nd meeting of ISO/TC 44/SC 14/WG1 meeting as prepared by the WG secretary.

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ANNEX 1 – REPORT ON THE PARTICIPATION TO THE 9TH ISO/TC 261 MEETING

The meeting was organized by ASTM F42 Committee and was hosted in Tuscaloosa, at the University of Alabama between the 30th of January and the 2nd of February 2017.

The event was attended by some 150 participants and included meeting of (i) ISO working groups, (ii) ASTM working groups, (iii) joint ASTM-ISO groups as well as the ASTM F42 and ISO/TC 261 plenary meetings.

Figure 3. shows an overview of the meeting schedule. It is meant to provide an idea of the event. Detailed information can be requested from Renato OTTONE.

The minutes of the ISO/TC 261 plenary meeting are reported in document ISO-TC-261_N0324 and the relevant resolutions are reported in document ISO-TC-261_N0313 that are reproduced here for the convenience of the reader.

The original documents may be requested from Renato OTTONE.
Draft minutes of the 9th plenary meeting of ISO/TC 261

on 2017-02-02 in Tuscaloosa

Chairman: Mr. Lenz, Germany
Secretary: Mr. Wrede, DIN
Participants: See the attendance list, doc. no. 319

TOP

1 Opening of the meeting
Mr. Lenz opened the plenary meeting of ISO/TC 261, thanked the hosts and welcomed the participants.

2 Roll call of delegates
A roll call was performed. The attendance list is given with doc. no. 319.

3 Adoption of the agenda
The agenda (doc. no. 308) was adopted unanimously.

4 Adoption of the minutes of the last meeting
The minutes of the last meeting (doc. no. 278) were adopted without changes.

5 Appointment of the drafting committee
Mr. Jurrens, Mr. Coissac and Mr. Wrede were appointed for the drafting committee (see also resolution 01).

6 Report of the TC Secretariat
Mr. Wrede presented the Report of the Secretariat (doc. no. 306). The report was approved (see also resolution 02).

Following the request of ISO/IEC JTC 1 “Information technology” for participation in its Study Group (SG) on 3D printing (see doc. no. 298), Mr. Lenz, Mr. Boivie and Mr. Pei were nominated to this SG as ISO/TC 261 representatives (see also resolution 03); Mr. Pei as liaison officer of ISO/TC 261 to ISO/IEC JTC-1 is already involved in its activities (see doc. no. 304 and 305).

Mr. Lenz reported briefly about the activities of the ISO Coordination Committee on “Smart Manufacturing” (see doc. no. 282), where he participates in his position as chairman of ISO/TC/261.

Mr. Wrede informed about the fact that ISO/IEC JTC 1/SC 29/WG 11 Coding of audio, picture, multimedia and hypermedia information is asking ISO/TC 261 with doc. no. 299 and 300 for cooperation and for comments on ISO/IEC 14496-16 Information technology — Coding of audio-visual objects — Part 16: Animation Framework eXtension (AFX), DAM 3: Printing material and 3D graphics coding for browsers. It was agreed that feedback from ISO/TC 261 members is to be sent to its secretariat until February 28th.
7 Report of Ad-hoc groups

7.1 Report of ad-hoc group on naming of standards
The ad-hoc group convenor, Mr. Jurrens, informed on the current status of discussions in the Ad-hoc group. His overview is given with doc. no. 315.

7.2 Report of ad-hoc group on safety issues on AM
On basis of doc. no. 316 the ad-hoc group convenor, Mr. Richard, reported about its work. He informed that a standard for measuring and controlling emissions of FDM Domestic printers is missing and that a proposal for such a standard will be prepared.

7.3 Report of ad-hoc group on Monitoring of data representation standards
No report of this ad-hoc group was given.

7.4 Report of ad-hoc group on Content for ISO/TC 261 homepage
Mr. Langlais volunteered as candidate for the position as convenor of the adhoc group “Content for ISO/TC 261 homepage”, which became vacant due to a change of job of Mr. Pfefferkorn. He was nominated with resolution 04, which also confirmed the remaining members.

8 Cooperation between ISO/TC 261 and ASTM F 42

8.1 Report of Joint Group 51 Terminology
The convenor of JG 51, Mr. Boivie, reported about its progress in the preparation of the revision of ISO/ASTM 52900.
With resolution 05 the ISO expert nominations to Joint Group 51 (including current changes) were confirmed.

8.2 Report of Joint Group 52 Standard test artifacts
The convenor of JG 52, Mr. Moylan, informed that it intends to finalize the draft for DIS ballot until the next plenary meeting.
With resolution 06 the ISO expert nominations to Joint Group 52 (including current changes) were confirmed.

8.3 Report of Joint Group 53 Requirements for purchased AM parts
The convenor of JG 53, Mr. Bertrand, informed about the successful ballots of the draft at ISO and ASTM and proposed to skip the FDIS ballot on this document. ISO/TC 261 agreed to this with resolution 07. It also decided to set JG 53 dormant now that its work is complete (see resolution 08).

8.4 Report of Joint Group 54 Design guidelines
The convenor of JG 54, Mr. Rosen, and Mr. Wrede informed about the successful ballots of the draft at ISO and ASTM and, following the example at the previous agenda item for ISO/ASTM 52901, proposed to skip the FDIS ballot on ISO/ASTM 52910 as well. ISO/TC 261 agreed to this with resolution 09. It also decided to set JG 53 dormant now that its work is complete (see resolution 10).

Using doc. no. 317, the convenor of JG 55, Mr. Buoniconti, reported about the progress of the Joint Group and the status of its three projects:

After the successful DIS ballot on ISO/ASTM 52903-1 the comments received during the ASTM ballot need to be addressed before sending the draft for FDIS ballot. The draft for DIS ballot for ISO/ASTM 52903-2 is currently being prepared, while the NWIP ballot for ISO/ASTM 52903-3 will end in March 2017.

With resolution 11 the ISO expert nominations to Joint Group 52 (including current changes) were confirmed.

8.6 Report of Joint Group 56 Standard Practice for Metal Powder Bed Fusion to Meet Rigid Quality Requirements for critical applications

Mr. Collins informed that the convenorship of JG 56 has been transferred from him to Mr. Farzadfar, so that he can concentrate on his ASTM F42 functions. In his stead he reported about the status of activities in JG 56 and in the cooperation with JG 58. He also asked the name of the Joint Group to be changed to “Standard Practice for Metal Powder Bed Fusion to Meet Rigid Quality Requirements for critical applications”, which was accepted unanimously.

Mr. Wrede informed that the preliminary Workitem ISO/ASTM PWI 52904 Additive manufacturing -- General principles -- Standard Practice for Metal Powder Bed Fusion to Meet Rigid Quality Requirements is close to automatic cancellation due to reaching its time limit. It was agreed that in this likely case a new work item will just be balloted as soon as JG 56 has provided a sufficient draft proposal.

With resolution 12 the ISO expert nominations to Joint Group 56 (including current changes) were confirmed.

8.7 Report of Joint Group 57 Specific design guidelines on powder bed fusion


With resolution 13 the ISO expert nominations to Joint Group 57 (including current changes) were confirmed.

8.8 Report of Joint Group 58 Quality assurance and post processing of powder bed fusion metallic parts

The convenor of JG 58, Mr. Lakomiec, reported about its progress in the preparation of the draft for NWIP ballot.

With resolution 14 the ISO expert nominations to Joint Group 58 (including current changes) were confirmed.

8.9 Report of Joint Group 59 NDT for AM parts

In the absence of the convenor of JG 59, Mr. Dutton, a short status report on the preparation of a draft of ISO/ASTM 52905 Additive manufacturing -- General principles -- Non-destructive testing of additive manufactured products was given by Mr. Farret.
With resolution 15 the ISO expert nominations to Joint Group 59 (including current changes) were confirmed.

8.10 Report of Joint Groups 60 Guide For Intentionally Seeding Flaws in Additively Manufactured (AM) Parts
In the absence of the convenor of JG 60, Mr. James, a short status report on its activities, which had only started the days before, was given.
With resolution 16 the ISO expert nominations to Joint Group 60 (including current changes) were confirmed.

Only a short status report was given on the activities of JG 61, which had only started its work the days before.
With resolution 17 the ISO expert nominations to Joint Group 61 (including current changes) were confirmed.

The convenor of JG 62, Mr. Moylan, informed about the status of JG 62, which has only recently started its activities.
With resolution 18 the ISO expert nominations to Joint Group 62 (including current changes) were confirmed.

Mr. Boyer as chair of the ASTM subcommittee on testing reported that the current direction of this project is currently being evaluated, with the options that it could be transferred to another ASTM committee outside AM (since it is despite its title not AM specific) or else to be revised thoroughly – in its current form it is not ballotable for both ISO and ASTM due to IPR concerns. Mr. Francqui gave detailed examples to these concerns.
With resolution 19 the ISO expert nominations to Joint Group 63 (including current changes) were confirmed.

On basis of doc. no. 320 the convenor of JG 64, Mr. Farret, reported on the current activities of Joint Group 64. He highlighted the need to separate ASTM WK48549 in two ASTM/ISO documents to review within JG 64, and he estimated this review to result in a ballot by mid 2017.
With resolution 20 the ISO expert nominations to Joint Group 64 were confirmed.

Mr. Wrede informed that due to an internal communications problem ASTM F42 had progressed with its work item without involving the ISO experts nominated for the Joint Group 65 at all, resulting in the publication of ASTM F3184 Standard Specification for Additive Manufacturing Stainless Steel Alloy (UNS S31603) with
Mr. Picariello informed that this document can be circulated in ISO/TC 261 for decision whether to adopt this as an ISO/ASTM document, to start its own project or to leave the current situation as it is (it is circulated as doc. no. 325).

With resolution 21 it was decided to disband Joint Group 65.


The convenor of JG 66, Mr. Giraud, reported on the status of the development of ISO/ASTM 52907 Additive manufacturing — Technical specifications on metal powders. He informed that a draft for NWIP ballot is ready, which will therefore be circulated soon.

With resolution 22 the ISO expert nominations to Joint Group 66 (including current changes) were confirmed.


Mrs. Loh (filling in for the convenor of JG 67, Mr. Pei) reported about the result of the meeting of JG 67 two days earlier. It was agreed that the document, when ready, will be published as a Technical Report (ISO/TR 52912 Design of functionally graded additive manufactured parts) on ISO side, while ASTM will decide if and in which form it will publish the document.

With resolution 23 the ISO expert nominations to Joint Group 67 (including current changes) were confirmed.

8.18 Report on the progress of ASTM task group on Design Rules for AM

Mr. Witherall informed about the status of the ASTM F42 project on Design Rules for AM, which ISO/TC 261 had decided to monitor.

8.19 Future Joint Groups

The finalized proposal for the New Work Item Proposal on Data Generation of Additive Manufactured Parts for Medical Applications has not yet been provided by the proposing experts. It was reported that according to the WG 4 suggestions the scope will be tightened and the content of the study will be build up. KATS will collaborate with ISO/TC 150 on Implants for Surgery, and finally more collaboration is suggested with relevant medical side.

Since unfortunately the US visa for the delegation from China did not arrive in time, Mr. Haibin was unable to present an update to their New Work Item Proposal on Additive Manufacturing Cloud Platform and Service Specification (see doc nos. 326 and 327). This was done by Mrs. Loh, who also reported that at the WG 4 meeting questions were raised regarding authorized regional shop, printing procedures, and the methods how the same outcomes will be provided with different printers. It was recommended that SAC gets in touch with ISO/ JTC1/ TC38 for cloud computing committee. A final presentation is suggested for the next plenary meeting in Stockholm; ISO/TC 261 hoped that no visa problems will prohibit the presence of the Chinese delegation there, and acknowledged the difficulties put on this initiative by such visa problems.

9 Status of the TC Working Groups

Mr. Boivie had nothing to add for WG 1.

Mr. Wrede informed that the position as convenor of WG 2 is vacant since Mr. Pfefferkorn has changed jobs – he made clear that some candidates do exist at DIN.
level, and that the decision which one to nominate to ISO/TC 261 for acceptance will be taken at the next national mirror committee meeting.

Mr. Bertrand reported about the work of WG 3, using doc. no. 318.

Mrs. Loh filled in for the convenor of WG 4, Mr. Pei, who had to leave the meetings early, and informed about the activities and decisions of WG 4.

10 Liaisons / Coordination of AM activities on ISO level

Liaison reports on the activities of ISO/TC 213 *Dimensional and geometrical product specifications and verification*, ISO/TC 184 *Automation systems and integration* and ISO/TC 292 *Security and resilience* are circulated with doc. nos. 303, 311 and 322. They were presented by Mr. Coissac, Mr. Schäfer and Mr. Farret respectively.

Since no candidates as liaison officer for the liaisons with ISO/TC 106 *Dentistry* and ISO/TC 106/WG 9 Dental CAD/CAM systems could be found despite a separate call for such nominations (doc. no. 292), it was decided to terminate the liaisons with both committees (see resolution 24).

New liaisons were established with ISO/TC 44/SC 5 “Testing and inspection of welds”, IEC/TC 76 “Optical radiation safety and laser equipment” and ISO/TC 135 “Non-destructive testing”, an liaison officers were nominated as given in resolutions 25, 26 and 27.

ISO/TC 261 welcomed the chairman of ISO/TC 44/SC 14 “Welding and brazing in aerospace”, Mr. Krüger, and appreciated his presence and interest in the activities of ISO/TC 261. Remembering the heated and intensive discussions at the last plenary meeting about the question how and where to cooperate with ISO/TC 44/SC 14, the delegates were glad to now have the chance to discuss this situation with Mr. Krüger and to find common ground. Mr. Wrede then presented a proposal for a possible method of cooperation between ISO/TC 44/SC 14 and ISO/TC 261 which had been drafted by Mr. Krüger, Mr. Lenz, Mr. Dekker, Mr. Boivie, Mr. Coissac, Mr. Baustert and Mr. Ottone. This proposal agreed on the establishment of a Joint Working Group and included, among other relevant points, that:

- this JWG will formally be organized under the “umbrella” of TC261/ASTM F42 network,
- decisions about convener and secretary of this JWG will be decided in agreement between TC44/SC14 and TC261/ASTM F42,
- draft standards will be balloted within all organizations that have participated in the development of that draft standard.

With some clarifying additions this proposal (doc. no. 312) was accepted by the delegates and ISO/TC 44/SC 14 was asked to agree to it as well (see resolution 28). Mr. Krüger expressed his satisfaction with the proposal and its acceptance by ISO/TC 261 as well; he informed that he will lobby for its acceptance by ISO/TC 44/SC 14. The question of which ISO/TC 261 expert would be prepared to attend the oncoming plenary meeting of ISO/TC 44/SC 14 on March 8th/9th in the UK as ISO/TC 261 representatives, Mr. Baustert, Mr. Boivie, Mr. Lenz, Mr. Lakomiec and Mr. Ottone expressed their interest but made clear that they need to check with their organizations first.

Finally Mr. Lenz gave a presentation on other worldwide AM standardization initiatives (see doc. no. 321).

11 Any other business

With resolution 29 the Engineering Department of the University of Alabama and all sponsoring companies were thanked for organising and hosting the meeting.

With resolution 30 the work of the outgoing secretary, Mr. Wrede, was recognized.

12 Approval of resolutions
The resolutions (doc. no. 313) were approved unanimously (see also resolution 31).

13 Requirements concerning a subsequent meeting

The next plenary meeting will be held in conjunction with ASTM F42 on September 21st, 2017 in Stockholm, as last meeting of a week of meetings together with ASTM F42 from September 18th to 21st, 2017. With doc. no. 323 information from the host (SIS) on accommodation, venue etc. is already available.

14 Closure of the meeting

Mr. Lenz closed the meeting, expressed his sincere thanks to the hosts and sponsors for all arrangement and wished the delegates a good journey home.

Written by Mr. Wrede, 2017-03-01
Approved by Mr. Lenz, 2017-03-16
Adopted Resolutions
taken at the 9th meeting of ISO/TC 261 "Additive manufacturing"
held in Tuscaloosa, USA on 2017-02-02

Resolution 01: Appointment of the drafting committee

The drafting committee is composed as follows:

— for the English language: Mr. Kevin JURRENS
— for the French language: Mr. Olivier COISSAC
— for the secretariat: Mr. Lutz WREDE

Resolution 02: Approval of Report of the Secretariat, document N 306


Resolution 03: Representative of ISO/TC 261 in ISO/IEC JTC 1 Study Group

ISO/TC 261 decided to nominate Mr. Joerg LENZ, Mr. Klas BOIVIE and Mr. Eujin PEI as its representative in the Study Group of ISO/IEC JTC 1 on 3D printing and scanning.

Resolution 04: New convenor of the ad-hoc group on Content for ISO/TC 261 homepage

ISO/TC 261 decided to nominate Mr. Daniel LANGLAIS as convenor of the ad-hoc group "Content for the homepage of ISO/TC 261" as successor of Mr. Florian PFESSERKORN, and to confirm Mr. Klas BOIVIE, Mr. Philippe BERTRAND, Mr. Eujin PEI and Mr. Carl DEKKER as its other members.

Resolution 05: Nomination of ISO experts to JG 51

ISO/TC 261 decided to confirm Mr. Klas BOIVIE as convenor and Mr. Jan SEHRT, Mr. Daniel LANGLAIS, Mr. Leonhard KLEIN, Mr. Bertrand BUSSON and Mrs. Maria AVERYANOVA as ISO experts in Joint Group 51.

Resolution 06: Nomination of ISO experts to JG 52

ISO/TC 261 decided to confirm Mr. Eric BAUSTERT, Mr. David WIMPENNY, Mr. Håkan BRODIN, Mrs. Gözde TUCU and Mr. Frank PFISTER as ISO experts in Joint Group 52 and to acknowledge that the respective national mirror committees have informed about the withdrawal of Mr. Frits FEENSTRA, Mrs. Agnes KLOKE and Mr. Alexandre SCHNEIDER.
Resolution 07: Publication of ISO/ASTM 52901

ISO/TC 261 decided to submit ISO/ASTM 52901 for publication following the resolution of comments received during the 2nd DIS ballot and the latest ASTM F42 ballot, thereby omitting FDIS ballot.

Resolution 08: JG 53 to be set dormant

ISO/TC 261 decided to set Joint Group 53 dormant and to thank its members for their work.

Resolution 09: Publication of ISO/ASTM 52910

ISO/TC 261 decided to submit ISO/ASTM 52910 for publication following the resolution of comments received during the 2nd DIS ballot and the latest ASTM F42 ballot, thereby omitting FDIS ballot.

Resolution 10: JG 54 to be set dormant

ISO/TC 261 decided to set Joint Group 54 dormant and to thank its members for their work.

Resolution 11: Nomination of ISO experts to JG 55

ISO/TC 261 decided to confirm Mr. Mario MONZÓN, Mr. Marco CAVALARO, Mr. Xiaoyong TIAN, Mrs. Annette BAUMANN and Mr. Miguel FERNANDEZ-VICENTE as ISO experts in Joint Group 55, to substitute Mr. Philippe RIVIERE with Mr. Jean-Francois CHRETIEN and to acknowledge the withdrawal of Mrs. Agnes KLOKE by DIN.

Resolution 12: Nomination of ISO experts to JG 56

ISO/TC 261 decided to confirm Mr. Jan SEHRT, Mr. Fouzi BAHBOU, Mr. Ravi ASWATHANARAYANASWAMY, Mr. Francois RICHARD and Mr. Eric BAUSTERT, Mr. Marius LAKOMIEC, Mr. Akihiro SATO, Mr. David HARDACRE, Mr. Håkan BRODIN and Mrs. Lisa PASTUSCHKA as ISO experts in Joint Group 56.

Resolution 13: Nomination of ISO experts to JG 57

ISO/TC 261 decided to confirm Mr. Christian SEIDEL as convenor and Mr. Benoit VERQUIN, Mrs. Suny MARTINEZ, Mr. Eujin PEI, Mr. Fouzi BAHBOU, Mr. Robin WESTON and Mr. Frank PFISTER as ISO experts in Joint Group 57 and to acknowledge the withdrawal of Mr. Frits FEENSTRA by NEN.

Resolution 14: Nomination of ISO experts to JG 58

ISO/TC 261 decided to confirm Mr. Marius LAKOMIEC as convenor and Mr. Fouzi BAHBOU, Mr. Jan SEHRT, Mrs. Laura PICKARD, Mr. David HARDACRE, Mr. Vladimir BRAIOLOVSKI, Mr. Lionel RIDOSZ, Mr. Akihiro SATO and Mrs. Linda ZOUAD as ISO experts in Joint Group 58.
Resolution 15: Nomination of ISO experts to JG 59

ISO/TC 261 decided to confirm Mr. Ben DUTTON as convenor and Mrs. Marie-Christin EBERT, Mrs. Anne-Françoise OBATON, Mr. Petros STAVROULAKIS, Mr. Jérémie FARRET and Mrs. Francine BOVARD as ISO experts in JG 59.

Resolution 16: Nomination of ISO experts to JG 60

ISO/TC 261 decided to confirm Mr. Ben DUTTON and Mr. Christophe GROSJEAN as ISO experts to JG 60 and to acknowledge the withdrawal of Mr. Florian PFEFFERKORN by DIN.

Resolution 17: Nomination of ISO experts to JG 61

ISO/TC 261 decided to confirm Mr. Håkan BRODIN as ISO expert to JG 61 and to acknowledge the withdrawal of Mr. Florian PFEFFERKORN by DIN.

Resolution 18: Nomination of ISO experts to JG 62

ISO/TC 261 decided to confirm Peter WOOLIAMS, Mr. Jan SEHRT and Mr. Philippe BERTRAND as ISO experts to JG 62.

Resolution 19: Nomination of ISO experts to JG 63

ISO/TC 261 decided to confirm Mr. Rainer MEISEL, Mr. Remi GIRAUD, Mr. Nobuhiro AYA, Mr. Henrik BLOM, Mr. Maik GREBE and Mr. Filip FRANCOUI as ISO experts to JG 63 and to acknowledge the withdrawal of Mr. Fouzi BAHBOU.

Resolution 20: Nomination of ISO experts to JG 64

ISO/TC 261 decided to confirm Mr. Jérémie FARRET, Mr. Martin SCHÄFER, Mr. Eujin PEI and Mr. Alain BERNARD as ISO experts to JG 64.

Resolution 21: Disbanding of JG 65

ISO/TC 261 decided to disband JG 65.

Resolution 22: Nomination of ISO experts to JG 66

ISO/TC 261 decided to confirm Mr. Remi GIRAUD as convenor and Mr. Rainer MEISEL, Mr. Adin STERN, Mr. Håkan BRODIN, Mr. Nobuhiro AYA, Mr. Ravi ASWATHANARAYANASWAMY, Mr. Fouzi BAHBOU and Mr. David HARDACRE as ISO experts to JG 66.

Resolution 23: Nomination of ISO experts to JG 67

ISO/TC 261 decided to confirm Mr. Eujin PEI as convenor and Mr. Christian SEIDEL, Mr. Alexandre SCHNEIDER and Mr. Mario MONZON as ISO experts to JG 67.
Resolution 24: Termination of the liaison with ISO/TC 106 and its SC 9
ISO/TC 261 decided to terminate the existing liaisons with both ISO/TC 106 “Dentistry” and its SC 9 “Dental CAD/CAM systems”.

Resolution 25: Establishment of a liaison with ISO/TC 44/SC 5
ISO/TC 261 decided to establish a liaison with ISO/TC 44/SC 5 “Testing and inspection of welds” and to nominate Mr. Robbie ADAMS as liaison officer.

Resolution 26: Establishment of a liaison with IEC/TC 76
ISO/TC 261 decided to establish a liaison with IEC/TC 76 “Optical radiation safety and laser equipment” and to nominate Mr. Francois RICHARD as liaison officer.

Resolution 27: Establishment of a liaison with ISO/TC 35
ISO/TC 261 decided to establish a liaison with ISO/TC 35 “Non-destructive testing” and to nominate Mr. Ben DUTTON as liaison officer pending his approval.

Resolution 28: Cooperation with ISO/TC 44/SC 14 on standardization of metals based AM
ISO/TC 261 decided to cooperate with ISO/TC 44/SC 14 on the development of standards based on the description given in doc. no. 312 and to ask ISO/TC 44/SC 14 for their agreement.

Resolution 29: Appreciations
ISO/TC 261 expresses sincere thanks to the Engineering Department of the University of Alabama and all sponsoring companies for organizing and hosting the meeting.

Resolution 30: Recognition of Mr. Lutz Wrede
ISO/TC 261 decided to express sincere thanks and congratulations to its Secretary, Mr. Lutz Wrede, for his excellent service and contributions to Additive Manufacturing standards and the collaboration with ASTM F42.

Resolution 31: Approval of resolutions
The resolutions are approved unanimously by the 9 P-members present (AFNOR, ANSI, BSI, DIN, JISC, KATS, SCC, SIS and UNI).
ANNEX 2 – REPORT ON THE PARTICIPATION TO THE 2ND MEETING OF ISO/TC 44/SC 14/WG1

This document textually reports on the content of document: ISO-TC-44-SC14-WG1_N0014

Draft agenda
for the 2nd meeting of ISO/TC 44/SC 14/WG 1 “Additive manufacturing in aerospace” in Cambridge, UK in 2017-03-07

Opening time 9:15 a.m.
Closing time 5:30 pm

Venue TWI

<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Institute</th>
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<tbody>
<tr>
<td>Kropp, Ralph</td>
<td>Convenor</td>
</tr>
<tr>
<td>Beck, Ruediger</td>
<td>Secretary (DIN)</td>
</tr>
<tr>
<td>Krueger, Holger</td>
<td>Germany</td>
</tr>
<tr>
<td>Ikeshoji, Toshi-Taka</td>
<td>Japan</td>
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<tr>
<td>Allison, Amanda</td>
<td>UK</td>
</tr>
<tr>
<td>Freeman, Richard</td>
<td>UK</td>
</tr>
<tr>
<td>Clide Grafton-Reed</td>
<td>UK</td>
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<tr>
<td>Stapleton, David</td>
<td>UK</td>
</tr>
<tr>
<td>Tooley, Steve</td>
<td>UK</td>
</tr>
<tr>
<td>Degenhart, Susan</td>
<td>US</td>
</tr>
<tr>
<td>Saharan, Ankit</td>
<td>USA – via WebEx</td>
</tr>
<tr>
<td>Eric Baustert</td>
<td>ISO/TC 261 delegate – France</td>
</tr>
<tr>
<td>Carl Dekker</td>
<td>ISO/TC 261 delegate – US – via WebEx</td>
</tr>
<tr>
<td>Renato Ottone</td>
<td>ISO/TC 261 delegate – Italy – via WebEx</td>
</tr>
<tr>
<td>Klas Boivie</td>
<td>ISO/TC 261 delegate – Norway</td>
</tr>
<tr>
<td>Agenda Item</td>
<td>Document Number</td>
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<td>-------------</td>
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<tr>
<td>1 Opening of the meeting</td>
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<tr>
<td>The host Dr Richard Freeman welcomed all delegates at TWI and the convenor Mr Kropp opened the meeting.</td>
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<tr>
<td>2 Roll call of experts</td>
<td>DIN-Livelink</td>
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<tr>
<td>A short roll call was taken.</td>
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<tr>
<td>3 Adoption of the draft agenda</td>
<td>N11</td>
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<tr>
<td>The agenda was adopted with the following modification:</td>
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<tr>
<td>• N 13 was added under point 4.2.</td>
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<tr>
<td>4 Report of the convenor, the secretary and follow-up of actions</td>
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<tr>
<td>4.1 Access to Livelink</td>
<td>DIN-Livelink</td>
</tr>
<tr>
<td>The secretary showed the N-documents list in DIN-Livelink, where all relevant documents for the committee can be found. All members will be informed via notification e-mails that new documents, including invitations and agendas, have been uploaded to DIN-Livelink. To get access to the Livelink committee please contact your national standardization body.</td>
<td></td>
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<tr>
<td>4.2 Cooperation with ISO/TC 261 &quot;Additive Manufacturing&quot;</td>
<td>N 12, N13</td>
</tr>
<tr>
<td>The chairman of ISO/TC 261 and the convenor of this working group discussed a potential collaboration of ISO/TC 261/ASTM F 42 and this working group.</td>
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<tr>
<td>The chairman of ISO/TC 44/SC 14, Holger Krueger, reported about his participation in the last ISO/TC 261/ASTM F42 &quot;Additive Manufacturing&quot; plenary meeting on 2017-02-02. As a result ISO/TC 261 took a resolution to create a joint working group for the standardization of additive manufacturing in aerospace applications under the umbrella of ISO/TC 261 (see N 13).</td>
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<tr>
<td>Recommendation 1/2017 was taken (see point 7).</td>
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<tr>
<td>If the new Joint Working Group is established, the experts are asked to get appointed to that group by their National standardization bodies.</td>
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<tr>
<td>5 Potential new standardization projects</td>
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<tr>
<td>5.1 Machine acceptance standard for powder bed based laser beam machines for additive manufacturing (English translation of DIN 35224)</td>
<td>N 9</td>
</tr>
<tr>
<td>The discussion of the German translation of DIN 35224 was continued and changes were implemented directly into the draft. The updated draft was circulated after the meeting as a marked up version with N 15.</td>
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<tr>
<td>5.2 Further topics</td>
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<tr>
<td>The following list includes potential standardization projects for the Joint Working Group of ISO/TC 261 and ISO/TC 44/SC 14:</td>
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<tr>
<td>• operator qualification for metal powder bed laser beam additive manufacturing (soon to be published DIN 35225 shall be used as the basis) – was circulated after the meeting with N 16 for information;</td>
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<tr>
<td>• procedure specification for metal powder bed laser beam additive manufacturing (soon to be published AWS D.20 shall be used as a basis);</td>
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<tr>
<td>• directed energy deposition (build up welding)</td>
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<tr>
<td>• machine qualification for metal powder bed electron beam additive manufacturing.</td>
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<tr>
<td>Recommendation 2/2017 was taken (see point 7).</td>
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<tr>
<td>6 Any other business</td>
<td></td>
</tr>
<tr>
<td>No discussion.</td>
<td></td>
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</tbody>
</table>
7 Approval of recommendations to ISO/TC 44/SC 14

Recommendation 1/2017
ISO/TC 44/SC 14/WG 1 recommends to ISO/TC 44/SC 14 to agree to Resolution 28 of ISO/TC 261 taken at the 9th meeting of ISO/TC 261 "Additive manufacturing" held in Tuscaloosa, USA on 2017-02-02 to create a joint working group for the standardization of additive manufacturing in aerospace applications under the umbrella of ISO/TC 261/ASTM F42.

– Ralph Kropp is proposed as the convenor of the joint working group.

Recommendation 2/2017
ISO/TC 44/SC 14/WG 1 recommends to ISO/TC 44/SC 14 to propose the following standardization project as a New Work Item Proposal for the to be established joint working group with ISO/TC 261/ASTM F42:

– **Aerospace applications — Qualification of laser beam machines for metal powder bed additive manufacturing** (the document in N 15, which is based on DIN 35224, shall be used as a basis).

Further topics for further standardization projects for aerospace application:

– operator qualification for metal powder bed laser beam additive manufacturing (soon to be published DIN 35225 shall be used as the basis);
– procedure specification for metal powder bed laser beam additive manufacturing (soon to be published AWS D.20 shall be used as a basis);
– directed energy deposition (build upwelding)
– machine qualification for metal powder bed electron beam additive manufacturing.

8 Date and venue of the next meeting
The proposal for the first meeting of the joint working group with ISO/TC 261/ASTM F42 is

**17th October 2017**

at **AWS in Miami (US)**.

The meeting of ISO/TC 44/SC 14 will take place at the same venue on 18th and 19th October 2017.

9 Closure of the meeting
Mr Kropp thanked TWI for hosting the meeting, thanked the participants for their active contributions and closed the meeting.

Approved: Ralph Kropp
Written: Rüdiger Beck
2017-03-07 2017-03-07