areola

XR Evaluation Matrix

The approach to research in this field is driven by a scientific mindset, with a focus on understanding the underlying principles and technologies that make XR possible. In the following, we will be sharing information about the so called "XR Evaluation Matrix" that we have developed to help detect and classify potential use cases for XR. This matrix is an essential tool for our team as we continue to explore the capabilities and limitations of this exciting technology in the following project phases.

The matrix includes various criteria that have been grouped together to effectively evaluate each potential use case that we identified within the curriculum of the EWF guideline for "International Metal AM Operators: Powder Bed Fusion – Laser Beam".

The following explanations provide a comprehensive overview of the matrix's overall structure and the individual criteria within the matrix.

The sections are composed as follows:

Matrix Section - Knock-Out Criteria:

This section summarizes criteria that necessarily must be met to successfully transform analog content into XR. This provides an initial filtering of the possible use cases. Some of the most important criteria in this section are the availability and accessibility of proper 3D/CAD data. If suitable 3D data material cannot be accessed, or if IP rights deny access, this makes the development of XR content much more difficult and expensive.

Matrix Section - Use Case Classification:

This section refers to the characteristics of the respective use case. Due to the ability of XR to use 3D animations, practical content of an application or training (e.g., manual steps) is often much better suited for the implementation as XR content than theoretical content (e.g., software training). The number of steps and the additional tools or equipment required also play a role.

Matrix Section - Business Case:

The "business case" cluster goes one step further and no longer just evaluates whether use cases are generally technically possible but includes business aspects and impacts. These relate both to the hardware for which the content is tailored as well as factors such as time savings or how frequently tasks are executed.

Matrix Section - Risk Assessment:

XR training content offers the possibility of safely depicting potentially dangerous content. This applies both to the people to be trained and to the hardware used. This section is trying to pin down and evaluate these risks.

Matrix Section - XR Related:

This last section of the evaluation includes criteria related to XR development. These are based less on hard facts, such as in the "Business Case" section, and more on experience.

Selection of PBF-LB Machine

In order to create the greatest benefit for the target group of aerospace PBF-LB machine operators within the AREOLA project, it was analyzed which machine of the project partner is currently most relevant. It turned out that this is the EOS M 400-4

This machine is widely used in the aerospace industry due to the choice of materials, such as Ti64, AlSi10Mg or IN718, and the suitable dimensions of 400 x 400 x 400 mm, combined with a choice of one 1000 W or four 400 W lasers.

>> AREOLA Project   >> Implementation

Selection of Use Cases

Once the appropriate tool (XR Evaluation Matrix) for evaluating and assessing potential use cases as well as the appropriate machine (EOS M 400-4) platform have been selected, the next project phases will focus on the final selection of use cases that will be mapped using XR technologies and integrated into the resulting training program for aerospace PBF–LB machine operators.

In addition to a sufficient evaluation of the EOS M 400-4 use cases within the XR Evaluation Matrix, the use cases must also result from the existing curriculum of the EWF guideline. Only in this way will they form, together with the theoretical content that will also be developed in the further course of the project, a comprehensive training program that meets the requirements of the project.

Although it has already been mentioned that future work packages of the project will deal specifically with possible use cases, here is a brief look at some use cases that at first glance might be well suited for the implementation with XR technologies.

AREOLA Use Case - Health & Safety Walkaround:

The handling of PBF-LB systems requires the observance of certain health & safety measures, such as the wearing of personal protective equipment, but also the knowledge of the machine-specific safety mechanisms as well as the safety-critical areas of the machine.

The safe operation of the machine can be ensured by an appropriate safety briefing. Currently, such briefings are often presented with the help of purely theoretical methods. This often does not do sufficient justice to the real practical situation that the machine operators face. XR technologies could be capable of preparing this theoretical content realistically and thus making it more memorable.
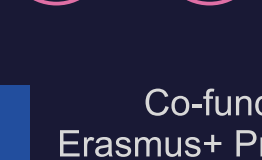
AREOLA Use Case - Laser Check:

The use of PBF-LB systems in the aerospace sector places special demands on the setup process of the machines. These specifications require, for example, a check of the laser power and the laser focus before each individual build job.

This can be supported with dedicated hardware and software tools. The explanation and use of these tools could be ideally suited for the use of XR technologies.