D6.7 Training Scenario and Evaluation Plan for Aeronautics

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Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Contributor(s)</th>
<th>Modification</th>
</tr>
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<tbody>
<tr>
<td>0.1</td>
<td>12.02.2018</td>
<td>Carlo Vizzi (AL)</td>
<td>TOC</td>
</tr>
<tr>
<td>0.2</td>
<td>24.02.2018</td>
<td>Chris Brox (LT), Aleksander Simonsen (LT)</td>
<td>Added all content for the new use case</td>
</tr>
<tr>
<td>0.3</td>
<td>26.02.2018</td>
<td>Chris Brox (LT), Aleksander Simonsen (LT)</td>
<td>Improvements based on the first peer-review</td>
</tr>
<tr>
<td>0.4</td>
<td>28.02.2018</td>
<td>Chris Brox (LT)</td>
<td>Improvements based on the second peer-review</td>
</tr>
<tr>
<td>1.0</td>
<td>28.02.2018</td>
<td></td>
<td>Quality review and final corrections</td>
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D6.7 Training Scenario and Evaluation Plan for Aeronautics

WP 6 | D6.7

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Deliverable number: D6.7
Dissemination level: Public
Version: 1.0
Status: Final
Date: 28.02.2018
Due date: M27
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Executive summary

This document describes the training scenario and evaluation plan for the aeronautical use case scenario.

As D6.1 described three separate tasks with different levels of complexity that were considered for testing in Iteration 1, this deliverable describes the maintenance task that will be tested in Iteration 2. In D6.1 we added three separate tasks we found fitting for the Iteration 1 trial. These tasks were then categorised into three different complexity levels which was non complex, medium complex and complex tasks. In the actual trial we then decided to go for the task of medium complexity as it was found most fitting to be performed at this time of the project, but also most fitting for the trial candidates.

The task that was used in the trials was of medium complexity, but mostly required the participant to visually inspect the relevant areas and equipment.

In this training scenario, we will also be using a task of medium complexity. However, this time we have chosen a more mechanically challenging task which requires the participant to be more hands on.

This document is composed of three chapters. Chapter 1 describes the scenario and the context of the maintenance activities that will be taken into account. Chapter 2 describes the use case in more details with a particular focus on the procedures. Chapter 3 describes how the scenario will be analysed.

The technical details of how the scenario will be tested using the WEKIT prototype and the description of the trial and evaluation phase will be reported in D6.10 – Implementation of evaluation trials in aeronautical.

This deliverable is very important for the organization, execution and evaluation of the trials that will be carried out in the following months with the supervision of WP6, but it is also important for the development of the WEKIT prototype, since it will provide input to the technical WPs (WP2, WP3 and WP4).
1. Use case introduction

In Aircraft maintenance we define the different kinds of scenarios that lead to a component replacement. One of these scenarios are referred to as "On condition", which basically means that said component does not follow specific intervals of replacement, but is instead closely monitored and eventually replaced due to its condition.

The task we have decided to use in Iteration 2 falls within this category as it is trigged by the "pre flight inspection", and also we remove the nose landing gear every 200 hours for base maintenance inspections.

The task that we have chosen and that will be described in the following chapter can be considered extremely relevant to our job due to the fact that the nose landing wheel has to be removed and installed every 200 hours due to the mentioned inspections, and also due to the on condition inspections which is done on the operative airplanes.

We believe that the WEKIT solution will eventually lead to more efficient learning, reduced use of resources, a standardized way of performing the task, and a more general understanding of how the task should be accomplished.

The official procedure for the nose landing gear wheel (Fig. 1) replacement is a bit lacking in its description of the job, so we believe that with the help of WEKIT we can make the job easier to understand and accomplish compared to just having regular tools. In addition to this, we can guide the candidate with the help of WEKIT in a way that will make him/her master the job by supplying our expert advice in addition to the procedure.

Figure 1. Beechcraft B200 Nose landing gear wheel.
2. Use case description

The use case which has been selected for the maintenance task training will simulate a situation where an apprentice or technician has to perform a nose landing gear wheel replacement. During the case the candidate will have to follow the attached procedure with multiple challenging steps along the way. The steps of this activity are described in an official procedure created by the manufacturer of the aircraft.

2.1. Maintenance procedure

The objective of this maintenance task is to remove and install the nose gear wheel in a safe and correct manner (Fig. 2).

Figure 2. Illustration of all the parts included in the nose wheel assembly
2.1.1. Removal

1. Remove the axle nut and spacer (Fig. 3).

*Caution: Use care when removing all internal and external nose wheel components to avoid damaging the axle surface and/or nicking the axle threads.*

Figure 3.

2. Remove the outer grease seal and the bearing cone, and remove the wheel and tire from the axle (Fig. 4).

Figure 4.
3. Remove the inner bearing cone and the grease seal (Fig. 5).

2.1.2. Installation

1. Pack grease (03-007, Table 401), into bearing cones and smear grease on ends of rollers. Spread an adequate coat of grease on the surface of the bearing cups (Fig. 6).

Caution: If grease is changed, make sure that all affected components are thoroughly cleaned before lubrication.
2. Check the axle and nut for burrs or rough threads (Fig. 7).

![Figure 7.](image)

3. Carefully place a seal on the axle against the inboard spacer with the legend "This side toward bearing" facing the proper direction. Place the inboard bearing cone on the axle and seat the bearing cone in the cup. Install the outboard bearing cone on the axle and seat the cone in the outboard bearing cup (Fig. 8).

![Figure 8.](image)
4. Install a seal on the axle with the legend "This side toward bearing" against the bearing cone. Install the outboard spacer (Fig. 9, 10 and 11).

**Figure 9.**

**Figure 10.**
Figure 11.

5. Apply a light coat of grease ([03-007, Table 401](#)), to the threads of the axle and the nut and install the nut on the axle (Fig 12).

Figure 12.

6. Tighten the axle nut to 150 to 200 inch-pounds of torque while rotating the wheel to make sure of the proper seating of the bearings (Fig. 13).
7. Back off the axle nut to zero torque, then torque the nut to 30 inch-pounds while rotating the wheel. Check to see that there is no side motion of the wheel (Fig. 14).

Figure 13.

Figure 14.

WEKIT project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 687669. [http://wekit.eu/](http://wekit.eu/)
8. Install the cotter pin. If the holes do not align, tighten the nut to the next available keying position (Fig. 15).

Figure 15.
Consumable materials to be used in the scenario, taken from the aircraft maintenance manual (Fig. 16)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MATERIALS</th>
<th>SPECIFICATION</th>
<th>PRODUCT</th>
<th>SUPPLIER/CAGE/WEBSITE</th>
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<tr>
<td>03-007</td>
<td>Grease (Airplane Wheel Bearing)</td>
<td>ML-PRF-23027</td>
<td>Mobil Aviation Grease SHC 100</td>
<td>Exxon Mobil Corporation, 3225 Gallowes Road, Fairfax, VA 22037, <a href="http://www.exxonmobil.com">www.exxonmobil.com</a></td>
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Figure 16. Consumable materials table from the aircraft maintenance manual (Beechcraft B200)
3. Analysis of the experience

The prototype developed within Iteration 1 allowed to achieve good results and to collect a lot of positive and constructive feedback from the users. This feedback was used as input for the development in Iteration 2. Nevertheless, in trial 1, the prototype was still in its early stage so it did not allow to carry out a comprehensive analysis of the experience and of the performance of the WEKIT methodology versus the standard approach used for training in the aeronautical field.

The prototype that will be developed in Iteration 2 will be more mature and will have a higher technology readiness level, which will allow to compare the results of the WEKIT methodology versus the non-WEKIT methodology. It will also allow to show to the users and the stakeholders the real potential of such a new training approach. The main key performance indicators (KPIs) that will be taken into account are:

- Execution time (Total duration of the procedure, duration of each step, etc.)
- Number of mistakes (Total number of mistakes, number of mistakes in each step, etc.)
- Confidence that he/she accomplished the task in the correct manner.

In addition, the satisfaction of the user will be evaluated through questionnaires and interviews will take into account specific aspects such as:

- Wearability and comfort
- User interaction
- Usability
- Technology acceptance

We believe that during this trial we will see the beneficial factors of the WEKIT training solution versus the non-WEKIT training approach. As mentioned above we have chosen a task that is somewhat demanding for the candidates, which makes it the perfect task for this trial as it gives us the opportunity to analyse the key differences between the WEKIT learning methodology and the non-WEKIT methodology. We believe that the implemented experience inputs we intend to give will provide the trial candidates with an advantage compared to doing it with only the procedure to rely on.

WEKIT will provide us with several benefits within the training sector of our profession, such as more standardized learning, less time consuming training (repeatable instructions), the possibility of remote training, easier presentation of the task and increased motivation of training.
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