A4BLUE PROJECT- Adaptive Automation in Assembly
For BLUE collar workers satisfaction in Evolvable context

Enjoy reading the A4BLUE newsletter!

## A4BLUE - Adaptive Automation in Assembly for BLUE collar workers satisfaction in Evolvable context

A4BLUE, funded in the framework of the Horizon 2020 TOPIC FOF-04-2016, developed and evaluated a new generation of sustainable and adaptive workplaces that can deal with evolving requirements of manufacturing processes and human variability. For this purpose, A4BLUE is working to introduce adaptive automation mechanisms to help workers execute their tasks in a more efficient and secure way, as well as to provide them with personalized worker assistance systems - including Virtual and Augmented Reality and knowledge management systems - to help them in assembly and training related activities. Furthermore, A4BLUE provides methods and tools to determine the optimal balance between automation and workers presence in new assembly processes with the main scope of maximizing the long-term workers satisfaction, as well as the overall process performance.

The three-year project is being carried out by a first-class international consortium led by IK4-TEKNIKER (Spain) and involving prestigious universities such as RWTH Aachen University (Germany) and Cranfield University (UK) and companies such as Airbus Operation SAS (France), Compañía Española de Sistemas Arenonauticos – CESA, a division of Heroux-Devtek Inc. (Spain), Engineering-Ingegneria Informatica SPA (Italy), Illogic Società a Responsabilità Limitata (Italy), Ingeniería de Automatización y Robótica KOMAT SL (Spain) and CiaoTech srl (Italy).

The A4BLUE solutions were tested and validated in four use case scenarios. They consist of two real industrial scenarios: at Airbus in France and CESA in Spain, and two laboratory-based scenarios, at IK4-TEKNIKER in Spain and RWTH Aachen University in Germany.

## A4BLUE technologies and automation: the operators express their thoughts!

Welcome to the latest newsletter of the A4BLUE project! Our project is going to end in a few weeks, and we are very satisfied with our work to shape the workplaces of the future!
We developed solutions aimed to make blue collar workers' lives easier and enhance their work satisfaction via new adaptive workplaces that change and respond to their individual profiles and to the evolving manufacturing environments.
For us, human workers remain at the center of the factories of the futures and automation and robots are conceived as an opportunity for increasing their wellness, satisfaction and professional growth, as well as productivity. By introducing new automation mechanisms, A4BLUE focuses on gaining trust and usability in the cooperation with automation. For these reasons, in this newsletter we asked to the operators involved in the implementation of our 4 demonstrators to express their thoughts and feelings on the co-existence with automation and its benefits on their work life. Enjoy reading!

# INDUSTRIAL USE CASES

**AIRBUS** | TOULOUSE, FRANCE

**SCENARIO** Complex, manual hydraulic system assembly.

**WHAT** To optimise hydraulic system assembly through the usage of smart tools and Virtual/Augmented Reality.

**WHY** To evaluate the impact of an adapted AR HMI in terms of performance and error rate for different skilled groups of people and to enable full quality assurance approach and operators performance thanks to traceability.

**CESA** | MADRID, SPAIN

**SCENARIO** Landing gear retraction actuator assembly: Manual deburring operation | Assembly process.

**WHAT** To incorporate a robot to assist the worker in the deburring operation | To incorporate AR based guidance based on operator's profile as well supporting knowledge sharing.

**WHY** To increase the quality, efficiency and ergonomics of the deburring process | To reduce operators training time through AR; to reduce time for reviewing documentation; to increase confidence, participation, and internal communication among the personnel.

## Q1: What did you think about the introduction of automated systems and smart devices before your involvement in the A4BLUE project?

### AIRBUS

**Lucas Dubois,**
Assembly operator

I was a little bit hesitant about their application in my daily work and worried to not be able to deal with all these technological devices, but then I was very surprised on how was easy and cool when the torque wrench was automatically set to the release point!

### CESA

**Javier Ruiz,**
Assembly operator
in Augmented Reality use case

Before being involved in A4BLUE tests, I have only heard about augmented and virtual reality in other applications, like videogames etc. I had never thought that these tools could be applied to help me and workers like me during the assembly tasks. Furthermore, I was not aware that the technology was so mature to start testing in a real assembly environment. It was a surprise for me.

### CESA

**Pedro Garcia,**
Deburring operator

Automated systems and smart devices are rising in our life day by day around, therefore these tools and devices are becoming necessary and we should improve our acceptance and co-existence with these new tools.

## Q2: What do your colleagues think about the introduction of automated systems and smart devices?

### AIRBUS

**Lucas Dubois,**
Assembly operator

I think that also my colleagues were initially a little worried of the introduction of these systems. But now that these devices are becoming more and more common, we are all curios of using these technologies that will change our lifes.

### CESA

**Javier Ruiz,**
Assembly operator
in Augmented Reality use case

Most of the operators are very young here in CESA: we are all very excited about testing new things and technologies, especially the Augmented Reality device.
After testing the Augmented Reality glasses during the assembly, we had different opinions and feelings; some of us felt dizzy while using these glasses, but others like them very much.

### CESA

**Pedro Garcia,**
Deburring operator

My colleagues belong to aerospace industry, so they are all in favour of introducing new technologies that would improve our benefits and quality.

## Q3: How do you feel about the A4BLUE work system now that you have used it?

### AIRBUS

**Lucas Dubois,**
Assembly operator

It was great to participate to these trials. It changed from our daily life and it will come to us in a future! Even if it is still in a research stage, it's very good that it comes here!

### CESA

**Javier Ruiz,**
Assembly operator
in Augmented Reality use case

I believe it is a very good idea, although there are some aspects that need to be improved. For example, the Augmented Reality glasses are quite heavy and can darken the vision of the worker. But once these aspects are improved, I believe that they have a very promising future.

### CESA

**Pedro Garcia,**
Deburring operator

My feelings about A4BLUE system are quite good. The collaborative procedure between the robot and the operator was perfectly introduced in the cell and it is going to make easier the whole process, with also better performances.
Furthermore, this work system will be implemented in new areas of our factories in a short time allowing more and more advantages.

## Q4: What do you think will be the benefits of introducing the A4BLUE work system?

### AIRBUS

**Lucas Dubois,**
Assembly operator

It's really interesting that these new technologies will be part of my work environment. They will improve a lot of things! And it is also fun & cool!

### CESA

**Javier Ruiz,**
Assembly operator
in Augmented Reality use case

Now we need to retrieve all the information needed – for example specifications, drawings etc. - through different software and applications. Thus, the main benefits will be the reduction of information fragmentation: we will be able to access information and signng the operation in only one place. This will reduce the chance of forgetting something during the assembly process. Furthermore, glasses could be used as well as a protective device. In the end, operators must use safety glasses, so these glasses could be equipped with Augmented Reality as well.

### CESA

**Pedro Garcia,**
Deburring operator

A4BLUE is an intuitive, simple and agile system. It allows operators spending their time only on high value-added tasks while A4BLUE is performing the deburring task which is also a very hard work to perform. Thus, A4BLUE minimizes process time and by giving at the same time a very good finishing to the parts.

## Q5: In what way do you think your working life will change/is changing with the introduction of the A4BLUE work system?

### AIRBUS

**Lucas Dubois,**
Assembly operator

I will add this mitigation from the operator that this is still a PoC and that this is more oriented for the training of novice people. than for the production by expert.
Even if in some cases, it guarantees the accuracy of the data if changes appear.

## CESA

**Javier Ruiz,**
Assembly operator
in Augmented Reality use case

Augmented Reality will not bring an extreme change to my assembly work. However, the smart glasses will help with some crucial aspects, like the training of operators. The training process is facilitated by having the information of the technical instruction documents shown through the smart glasses. Now, I would not use them in my everyday job because they are very heavy. However, if this aspect is improved in the future, I would definitely use them.

## CESA

**Pedro Garcia,**
Deburring operator

A4BLUE work system will definitely improve our process, allowing us to be more efficient and our working life will be better in every sense of the word.

# LAB USE CASES

IK4 TEKNIKER Research Alliance | EIBAR, SPAIN

**SCENARIO** Collaborative assembly in a fenceless environment.

**WHAT** To introduce active safety measures supporting Human-Robot collaboration; to support personalized ergonomic adaptation; to provide natural Human-Automation multi-channel interaction; to provide decision support dashboards for quality and maintenance.

**WHY** To evaluate trust, usability and worker satisfaction (in terms of safety, interaction, ergonomics, assistance).

RWTH AACHEN UNIVERSITY | AACHEN, GERMANY

**SCENARIO** Final assembly of electric vehicles.

**WHAT** To incorporate AR based guidance based on operator's profile and to provide the tools required for the assembly by means of an automated tool trolley.

**WHY** To improve worker satisfaction, to reduce training time, to improve process efficiency; to improve ergonomics; to validate a tool to determine the optimal degree of automation.

## Q1: What do you think about the introduction of automated systems and smart devices before your involvement in the A4BLUE project?

### IK4-TEKNIKER

**Goretti Alberdi**
Researcher of manufacturing
processes in the workshop

Automated systems are necessary for the users at the shop floor since they help in performing hard tasks and also to increase efficiency in production. These systems will end up being introduced in the productive environments and I believe that they will be important to facilitate the work to the workers by reducing for example exhausting productive tasks.

### RWTH-AACHEN UNIVERSITY

**Marc Locke,**
Research Associate
PEM of RWTH Aachen University

I think although it probably takes much effort to successfully implement smart devices in a way that you can benefit from them, they can have high potential. Before testing the devices, I was curious how mature the devices and the research are.

## Q2: What do your colleagues think about the introduction of automated systems and smart devices?

### IK4-TEKNIKER

**Goretti Alberdi,**
Researcher of manufacturing processes in the workshop

The perception of my colleagues is pretty much the same as mine. According to them, these systems are very interesting for the work environment and they are fine to work with them.

### RWTH-AACHEN UNIVERSITY

**Marc Locke,**
Research Associate
PEM of RWTH Aachen University

My colleagues thought there will be an advantage in Smart Devices especially in the area of training - in a running production these devices are seen negative due to handling.

## Q3: How do you feel about the A4BLUE work system now that you have used it?

### IK4-TEKNIKER

**Goretti Alberdi,**
Researcher of manufacturing processes in the workshop

At first, it was strange to me because I am used to starting the machine and having it run the process. So, working with a robot to assemble a part was unusual for me, but I got used to it quite quickly.
The system is straightforward and didactic, and I managed easily to work with it.

### RWTH-AACHEN UNIVERSITY

**Marc Locke,**
Research Associate
PEM of RWTH Aachen University

The application was really easy to understand and intuitive to use. Only the virtual overlay of the glasses was too small in my opinion

## Q4: What do you think the benefits are to introducing the A4BLUE technologies into a work environment?

### IK4-TEKNIKER

**Goretti Alberdi,**
Researcher of manufacturing processes in the workshop

These kinds of systems bring an improvement in the quality of work due to the adaptation to the user, especially ergonomically speaking. Besides, these systems will make it possible to eliminate demanding physical work as well as risks in the working environment so I think they are important and will be introduced little by little. Productivity will also be increased with such systems, but they need to be more robust.

### RWTH-AACHEN UNIVERSITY

**Marc Locke,**
Research Associate
PEM of RWTH Aachen University

I think one of the biggest benefits is that also un-experienced workers are able to understand new tasks quicker than without A4BLUE assistance

## A4BLUE use case dedicated videos and final general video

During the project lifetime we produced several videos to share and show the progresses and the remarkable results we were achieving in the different stages of our work. See with your own eyes our technologies by clicking on the following link: https://vimeo.com/a4blue. Here you can find videos dedicated to each use case implemented in alpha (initial) and beta (advanced) phase.

Moreover, a new video is now available illustrating an overview of the project and the major benefits that A4BLUE solutions will bring to the workers and production of the factories of the future. Our final video is available here: https://vimeo.com/a4blue.

Enjoy them!

## A4BLUE Consortium

IK4-TEKNIKER (Coordinator)
www.tekniker.es

RWTH Aachen Universtity (RWTH)
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Cranfield University (CRAN)
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AIRBUS Operations SAS (AIRBUS)
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ENGINEERING – INGEGNERIA INFORMATICA SPA (ENG)
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Illogic (ILL)
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CiaoTech S.r.l. (100% PNO Innovation B.V.) (CTECH)
www.ciaotech.com

Compañía Española de Sistemas Aeronáuticos (CESA)
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INGENIERÍA Y SERVICIOS DE AUTOMATIZACIÓN Y ROBÓTICA KOMAT, S.L. (KOM)
www.komat.es

For more info about the project visit the A4BLUE website at: www.a4blue.eu

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