

Advanced Industry 4.0

Assessment 1 – Report

MSc Industry 4.0 Advanced Manufacturing

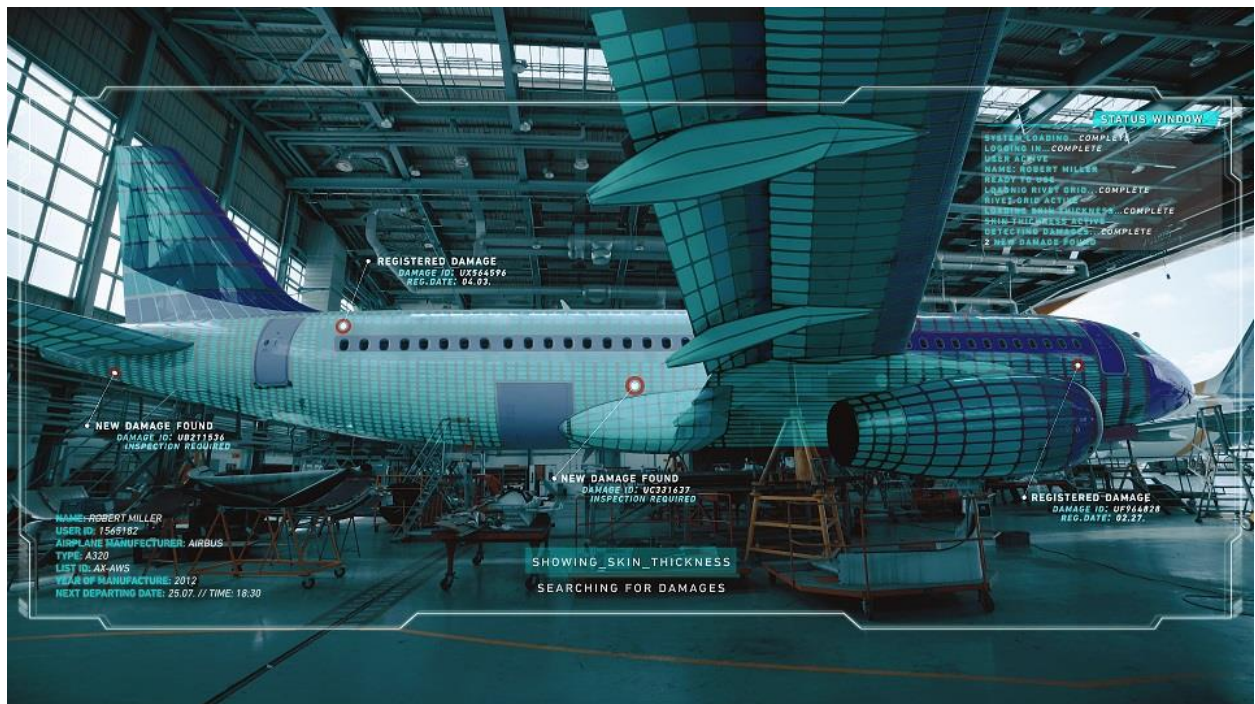
Module Code: ACPA7000

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25th December 2022

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Abstract

Most areas of business today are still in an analogue state, requiring manual intervention to complete operations and tasks. The main reason for this is that this state worked in the past and there were no reasons to change because efficiency was not seen as important due to a thriving workload. Because of the impact of Covid-19, we have been forced to manage our efficiency in such a way that the company will become a world leader. This is not to encourage people to work harder, but rather to work smarter, working smarter will reduce non-value-added waste in the business. The overall goal is to transition into a digital era, many systems and processes are used in other similar factories, and we must adapt these to fit our environment. The integration of VR, AR, and mixed reality into the aircraft installation area was observed in this report, and improvements were made that allow NVA time to be converted to VA time elsewhere. The most significant achievement here is that we have become proactive rather than reactive. In the analogue era, we were always looking back at what had happened the day before / week before to try and react so that problems did not reoccur, whereas now we are more proactive because instant data is available for the entire team to be active. Overall, the increase in efficiency rather than an increase in head count means that we have a method of attracting future work that we are confident in our ability to deliver.

Introduction

SSGB has a limited focus on VR, AR, and mixed reality, which limits many opportunities, the infancy of this technology frequently allows for the use of alternative analogue methods. The majority of operating procedures or manuals are written on paper and then converted into excel / word etc. Manual intervention is required for key aspects of the business such as build instructions, deliveries, and data analysis. As a result, common repetitive mistakes, a lack of communication between teams,

and decisions made without considering the implications for efficiency, profit, costs, and customer satisfaction become possible.

The image displays four documents related to Safran's production process:

- Technical Drawing:** A detailed drawing of a screw head with dimensions and a 3D model of the part.
- Production Build Traveller:** A document for the Centre Shroud (F29J50 series) showing project details, unit part, and a table of specific requirements with completion dates.
- Product Inspection Report:** A report for the F29J50 series, detailing inspection results and a list of items to be inspected.
- BOM Kit List:** A detailed list of parts and materials required for the production, including part numbers, quantities, and completion dates.

Because our current system continues to rely heavily on paper, we find that there is an increased risk of poor build quality, misunderstanding, and a lack of skills in operators. This can lead to a slightly less than relaxing work environment, pushing the culture in a negative direction.

By incorporating elements of Industry 4.0 into the business, new opportunities for driving improvements in all areas will be created. Working without paper is one of the highlights, with all installation guides available in a reality system, all important data is in one place. This would eliminate the need for repeated errors, lost or misinterpreted data, and misinterpretation of data collected from notepads, white boards, and various files.

To ensure seamless communication for building, installation, and ongoing maintenance, data must be delivered in a standard format throughout the process. A single format in a single location also means you only need to go to one location to manage all your production issues.

With the enhancements in place, the installation will flow to assist in the timely and efficient delivery of orders. This increases customer satisfaction and ensures that orders are delivered at the quality level specified in the initial customer requirements. Quality can be checked electronically on-site or remotely, and customer complaints and suggestions can be addressed and improved. With this in mind, there will be fewer warranty claims, free-of-charge orders, and an overall business rating within the industry contract value.

We can reduce the NVA elements of the business by incorporating VR, AR, and mixed reality systems into the installation phase. The goal would be to use these systems to boost our current efficiency of 55% (which is considered poor in the business world carrying nva) to 80%.

The main body topic will look at the below,

- Aircraft Installation – At SSGB, we build products that cannot be directly installed in aircraft; the delivered aircraft suites must be disassembled. In order to be more efficient and meet customer needs, we would like to supply the suite in modular format by demonstrating conformity using other methods, ensuring that there are no issues when the suites are built on the aircraft. This is accomplished by using the support of mixed reality and additive manufacturing.

Main Content

We strive to provide the customer with a simple and efficient method of receiving our products throughout the installation process. We previously provided our aircraft suites fully assembled however, in order to reduce installation time and potential damage, we intend to provide these in a modular format. This raises the question of how we can control key characteristics where key joining points intersect. Implementing industry 4.0 methods can lead to significant advancement in this area any advancement, even if it does not fit at first, will open the door to other avenues and thinking. There are several ways to accomplish this 3D printers are inexpensive, and software can generate kydex (plastic) parts that can replicate mating surfaces. (H.Amelia, 2021) describes how parts can be manufactured at a low cost and without the need for additional moulds using an additive manufacturing method. Tools and fixtures are also eliminated, and the speed of these parts can be far faster than orders sent to an outside supplier to be expedited. Instead of 3D printed parts a VR or AR process could be used for verification. (TWI, 2022) explains the key differences and what each method can accomplish.

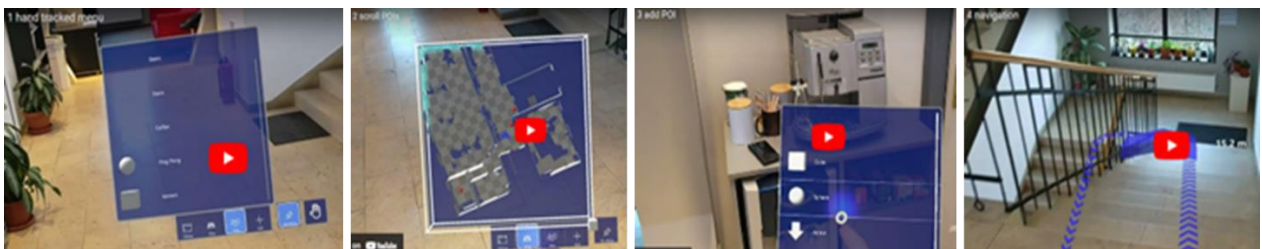
A VR method can help with our current issue, but it is dependent on both components in a CAD version being measured in a model fashion rather than physically, which can introduce significant risk into the analysis of the mating parts stack up. Customer satisfaction may suffer if the parts do not align during installation.

AR integration during the installation phase would provide an overlap of how the modular suites would integrate against key characteristics. (MANTEC, 2019) investigates the distinct definition, in order to support our customers' needs in terms of building correctly the first time, giving them confidence, and supporting cabin installations,

- AR (augmented reality) is a method in which a real-world background is overlaid with virtual components. This would be useful when providing a conformity package of how two parts are aligned in the installation area to avoid clashes or miss alignments. This is typically used in conjunction with headsets that can provide visual images and build documentation. During cabin installation this would provide the operator with the knowledge that would be available on the assembly line.



(ALL, 2022) provides a brief overview of how the software can be easily developed using the HoloLens 2. POI's or key characteristics against a catia model can provide alignment analysis which can be used to develop hand tracked menus by installation pieces. This Bluetooth-enabled technology has an integrated IoT system that allows reports to be auto-populated and saved for evidence when mating parts are correctly connected. This would improve the current operation's efficiency, allowing other issues to be reviewed, overall with the available tooling, this approach would be the more adaptable and accepted option for future cost-effective linking to an overall MES system.



Implementation Methodology

(Article, 2022) emphasises that integrating the HoloLens 2 is relatively simple because it was developed by Microsoft and runs in tandem with Windows 10. The connection is made via wifi, which will load the software package that includes iris setup for individual users onto the HoloLens 2. The air tap gesture is a part of the software that allows the operator to hold, release, and resize objects. This part of the software package also includes a training package. In SSGB we used model data from Catia V5 that would support the aircraft installation via paper documents, with the HoloLens 2 the files can

be exported into either an fbx or obj format this then can be uploaded into a Unity app and opened on the HoloLens 2.

Background Research

The above-mentioned reality system has the potential to have a significant impact on the future of our industry, despite the fact that it would require a significant investment that would be repaid several times over with the benefits listed above. According to (MANTEC, 2019) the market value of the VR and AR industries increased significantly in 2018. In 2018, the markets for VR and AR were \$7.9 billion and \$11.14 billion, respectively. This is expected to rise to \$34.08 billion and \$60.55 billion by 2023, indicating that the technology is widely regarded as a critical moving point for improvements within the industry.

(Hoey, 2018) also emphasises the use of Internet of Things (IoT) devices which can connect to the internet and instantly transfer data. An operation would begin by scanning a barcode or RFID tag on the work pack, as a result we would have a better understanding of our efficiency. Algorithms within the software would provide guidance on headcount requirements to complete the operational build in time to meet customer demands.

Conclusion

According to a survey (Uzialko, 2022) due to the integration of digital technologies, 94% of more than 400 companies were able to withstand pandemic effects. Covid-19 has brought about several changes that have pushed for new ways of working, our company must embrace new technologies for aircraft product installation using AR technology.

Industry 4.0 as previously stated, is not cheap and requires investment to begin or, more often than not, adapt to. Increased competitiveness, increased productivity, optimised manufacturing processes, increased revenue, and profitability are all possible. The government (GOV.UK, 2020) states that companies integrating AR, AI, and other industry 4.0 processes will be able to apply for funding of up to £300 million to help offset some of the costs.

The government assistance comes in the form of a grant that can be used to purchase hardware and software packages to support Industry 4.0 technology, but it comes with strings attached. The grant requires that local recruitment be used to supplement current headcount however, it can also be used to raise current salary bands within the business in order to retain employees. Many employees will need to understand what industry 4.0 is and why it is being implemented in the business, so training should be considered.

We must also keep in mind that Industry 4.0 is not the end of the road, (Kunovskiy, 2021) demonstrates that there is already a clear path to Industry 5.0 and how this will fit as another revolution. We would like to see machines in Industry 5.0 that can perform multiple, complex tasks without the need for human intervention thus integrating with AR to install product on aircraft.

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