TRIGO
Global Quality Solutions

BLENDING QUALITY & PRODUCTION IN AEROSPACE ASSEMBLY LINES:

How to optimize time & cash flow with smooth manufacturing and quality process execution

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AGENDA

- The Aerospace industry has become more and more specialized
- This specialization trend shows its limits
- A new organization is possible to improve efficiency of the sector

85% of declared in-flight incidents are not related to platform or system issues, but rather the result of pilot or other human errors.

Quality has proven its usefulness: avoiding incidents due to technical defects in materials.

PART 1: VERTICALIZATION & SILOS – THE AEROSPACE INDUSTRY IS SHOWING A SPECIALIZATION TREND.

For decades now, organization of Aerospace production lines has been showing a verticalization and specialization trend. This trend has surprisingly emerged, whereas all the other flow principles remain the same.

For example, aircraft assembly line specialized workers still intervene in their various field of capabilities and expertise whether they are Hydraulic Installers, Electrical Technicians, Composite Materials Workers, Cabin Inspectors, Painters, and so on... Sometimes, several levels of specialization for one job are in place.

Several reasons call for this specialization trend: first, no need to say that a high level of knowledge and experience is required for handling production tasks on an airplane. Second, specialization appears to ease the management of skills. And last but not least, qualifications and regulations impose their own criteria. In other words, an Electrical Technician certified on a specific ATA chapter will only work on this type of equipment and would be prevented to work on another kind of system. Therefore, he will be allowed to work on the electric power supply of a hydraulic actuator, but cannot intervene on the hydraulic system.

This ultimate “slicing” of work to be performed in the aircraft assembly is a direct consequence of the foundational rationale of aerospace manufacturing, which lies in this motto: “Do not touch anything you are not qualified to!” It is also the underlying principle that has been guiding the progress of build quality and airworthiness in the last 50 years. This approach has been quite successful, along with an increased maturity of the design, and it is today often attributed as the reason for the high reliability of aircrafts.

If this approach has set up the rules of reliability in the Aerospace manufacturing, it has also a few **drawbacks** that needs to be addressed.

Final Assembly Line in the 40s and Final Assembly Line now, showing a similarly staged industrial process. These two pictures are not showing what is beneath the surface: the complexity of the product and the verticalization of activities, and also a much more complex supply chain with a wide geographic span.

PART 2: THE SPECIALIZATION TREND SHOWS ITS LIMITS.

With workers laser-focused on only their piece, manufacturing and quality issues may not be properly solved. A culture of quality is created when workers are able to broaden their perspective and bypass the boundaries of their traditional responsibilities.

A classic example is the damage often done to insulation blankets, the soft sheets of material that lay on the fuselage sides for thermal insulation of the passenger cabin. Such damage is often created during cabin installation by coworking conditions, usually people having to work on equipment located below the blankets and not being concerned about the blankets themselves. Another root cause lies in the multiple assembly/disassembly of the blankets due to fuselage work that leads to damage.

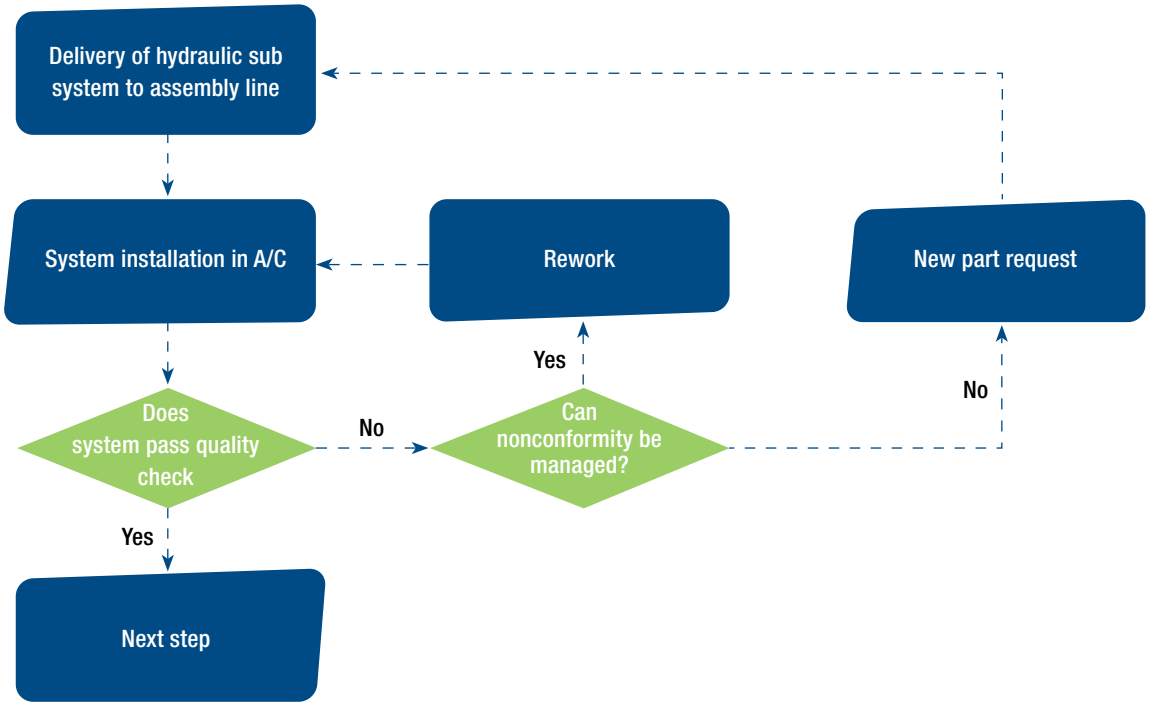
Another consequence of this extreme specialization is an overall loss of efficiency in the production process, created by task fragmentation and “super slicing”. This generates an additional burden for planning engineers in designing the assembly process in a way that accounts for coworking constraints.

QUALITY STOP AND GO

In such an environment, the mission of line quality control is often perceived as a perturbative action, as it is creates “gates” or stop points in the flow.

Let us have a look at a simple inspection process chart to see how actions/teams are arranged:

Quality inspection process in aerospace industry



Although easily and visually recognizable, this dedicated process loop unfortunately appears to be a time loss machine: the organisation itself leads to a lack of coordination, waiting time, stop & go, and team handovers at the boundary of shifts, etc...

Overall, while proving effective in terms of technical management & airworthiness liability, the verticalization combined with the time constrains generates a series of inefficiencies that could be tackled with a new methodology.

So let us flip the coin to ensure smooth manufacturing & quality process execution in a time constrained environment, while optimizing time & cash flow.

PART 3: A NEW ORGANIZATION IS POSSIBLE TO IMPROVE EFFICIENCY OF THE SECTOR

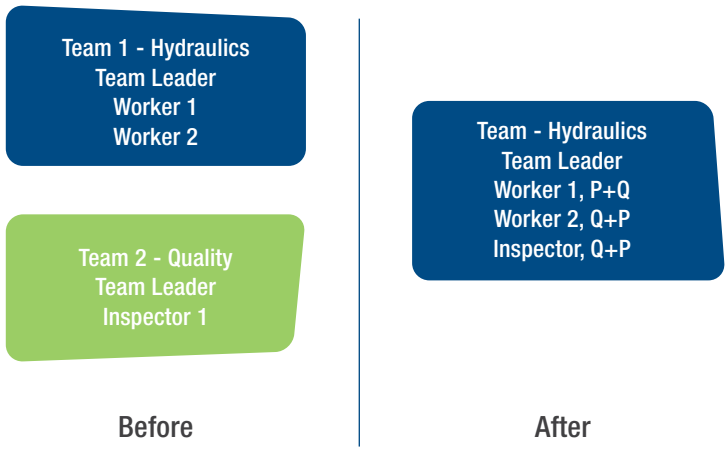
Let us imagine a new way of organizing quality controls and more generally of managing quality with two major goals in mind: break the silos and avoid the main time killer: process interruptions.

To do so would require the application of a principle: quality teams are also in charge of the delivery of the product, and not only of its quality controls.

At the same time, **let's strive for two goals instead of one: to achieve both On Time Delivery (OTD) & On Quality Delivery (OQD) under one single responsibility**. By experience, we know that quality workers will always push for OQD, while production teams will focus on OTD, with none of these goals eventually achieved. So let us flip the coin to ensure smooth manufacturing & quality process execution in a time constrained environment, while optimizing time & cash flow.

As a first consequence, Quality and Production teams need to be merged. Training of production people on quality as well as quality people on production is to be considered in parallel. And finally, this single team will be conferred both responsibility, along with empowerment, in order to perform.

New Quality Management organization in Aerospace



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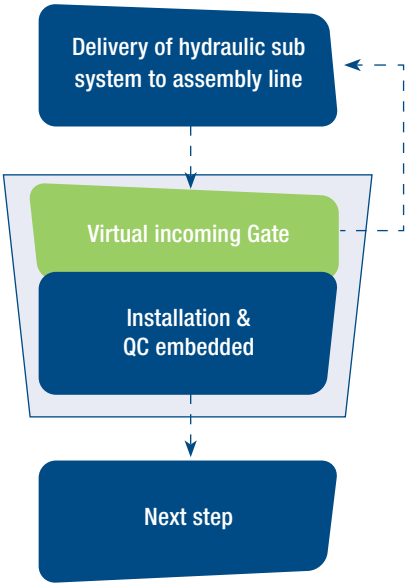
The new process, interruption free, has become the following one:

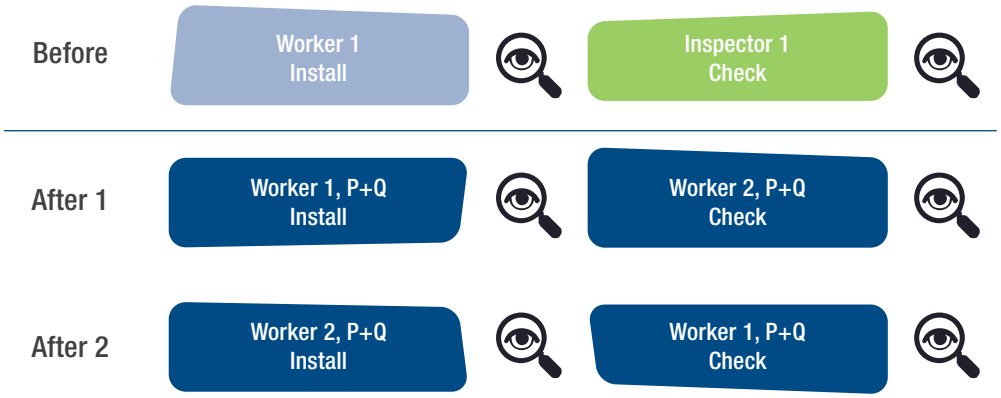


There is now only **one cause of interruption** in the production process: when the team detects that the product or system is showing a quality escape not coming from installation but from defective incoming quality.

With this process, **an incoming inspection filter is naturally created** by the installation team, embedding a free quality gate. Such an approach has been experienced by our teams at TRIGO for several years now, with the evidence of savings and efficiency regularly demonstrated in doing so.

It is also worth mentioning that we maintain the “double eye” principle, a key parameter in safety.

COCKPIT WINDOWS INSTALLATION



The classical installation process for windows displays includes 3 different teams and 3 interruption events:

- Team 1 – Installation on A/C
- Team 2 – QC
- Team 3 – Rework / repolishing / damage Repair
- Team 2 – QC – 2

We transform this traditional process into a 2-team scenario:

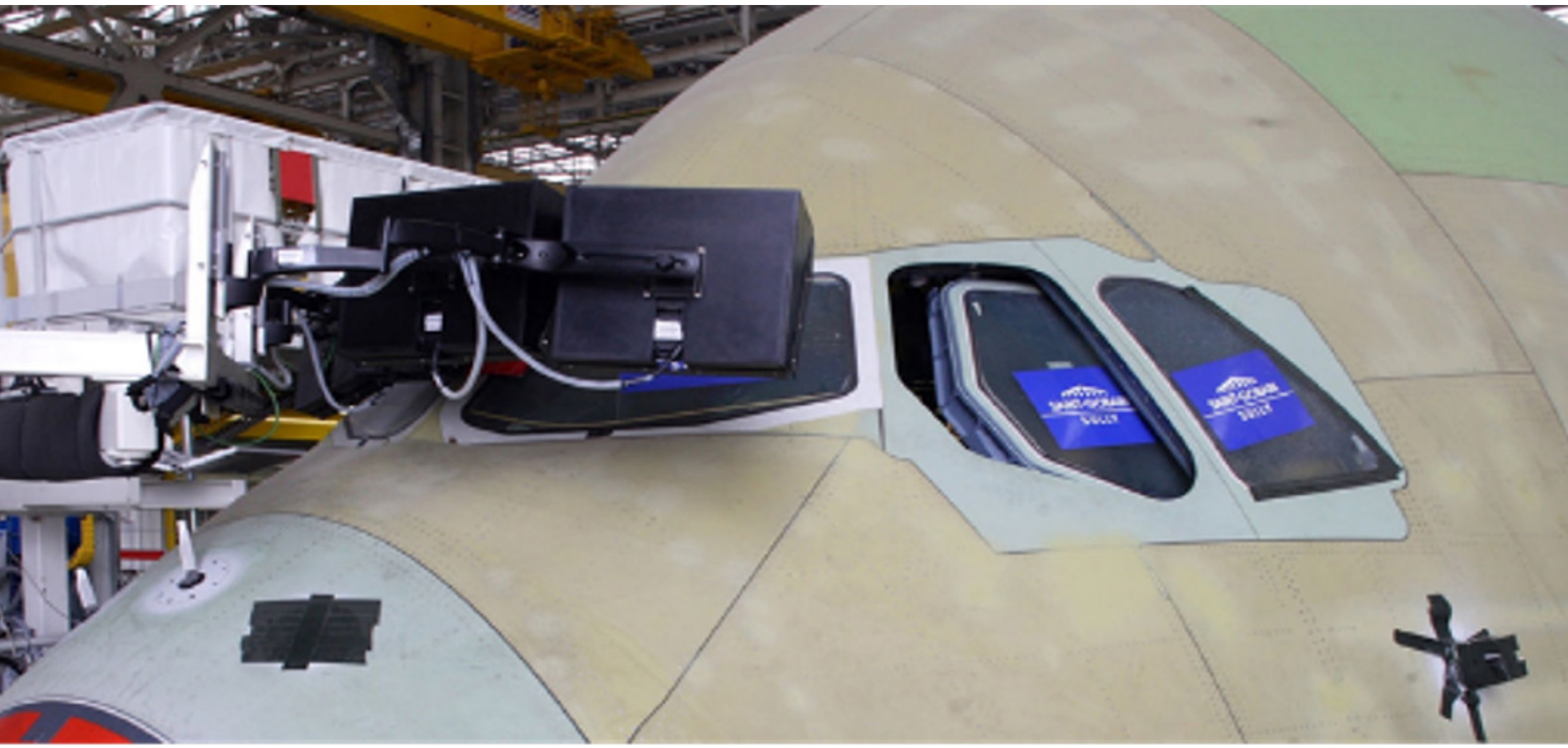
- Team 1 – Installation on A/C
- Team 2 – QC / Rework / QC

The benefits of this new organization are many. So let's have a look at some use cases from the TRIGO Aerospace Defence and Rail division.

USE CASE 1: REWORK ON COCKPIT WINDOWS

An Airbus partner developing cockpits, cabin and door windows enlisted TRIGO to rework cosmetic defects or slight damages on aircraft windshields mounted on production lines. The principle of an integrated team was applied.

Three trained inspectors / reworkers with a strong quality mindset were deployed to three Airbus sites (Toulouse, Saint Nazaire and Hamburg) and achieved a 35% reduction **in returns of windows to the supplier** with a full OTD/OQD method.



USE CASE 2: BRACKET INSTALLATION

A global commercial aircraft OEM requested TRIGO do a complete service of bracket installation in the fuselage section, covering the quality check of bracket positioning with:

- 3D Laser measurements of cabin brackets,
- support to rig the cabin brackets,
- record of the position of cabin brackets after rigging.

With the same philosophy, we empowered the team to do the full cycle of installation /QC /rework – or measurement / installation on a single process phase.

100% of the cabin interfaces were measured (+3,000) by 3D inspectors in 2 shifts, with a high flexibility and responsiveness, following top aircraft planning and intervention windows.

The result achieved is a **30% overall cycle time gain on such operations**.

USE CASE 3: FULL-SCALE EXAMPLE ON MILITARY AIRCRAFTS

An European Aircraft defence OEM commissioned TRIGO teams to ensure that installation had been performed according to the requirements. They also had to measure and calibrate balds, replace and install in case of vibration, check that the tasks had been performed well, confirm that there was no risk of FOD, and assemble the panels. The several tasks were achieved consecutively, including disassembling of panels already installed, conductivity measurement and calibration, replacement and area inspection.

Again, with the same philosophy, we empowered a team of 18 Aeronautical Maintenance Technicians with double profile to do the full cycle of installation / Quality Check / rework on a single process phase. Here, with more than 300 panels disassembled and assembled, 130+ balds checked, 150 ground tests performed, 10 replacements due to wrong installations, **we achieved a 30% overall cycle time gain on such operations for the complete package.**

In other words, creating an integrated team blending quality and production capabilities and fostering a mixed culture enabled us to complete the mission with 18 Technicians, when it was previously achieved with 25 workers.

HOW TO BLEND QUALITY & PRODUCTION

Conscious that mixing Quality and Production, OQD and OTD, is vital to improve efficiency in Aerospace manufacturing, it is all the more fundamental to identify how to blend quality culture for Technicians.

The following chart shows the training process to blend and leverage quality culture for Technicians profiles. This is precisely what has been applied at TRIGO, combining periods of quality trainings with production processes ones. As already exposed, this method has revealed several benefits, such as a better adaptability and flexibility of Technicians, fewer non conformities, less time and minor costs.

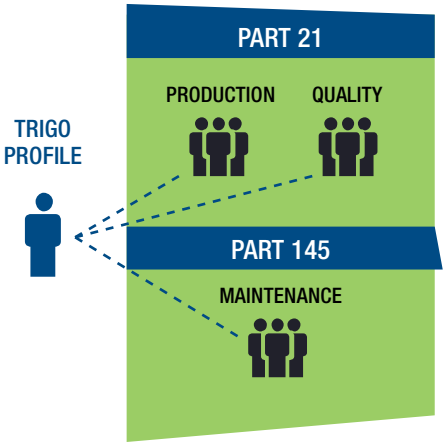
PROFILE

Aircraft Technician
+
TRIGO Quality Training
+
Special Processes Certifications & Qualifications

- Drilling and Riveting
- Hydraulic Installations
- Oxygen Installations
- Torquing
- Etc, ...

ADVANTAGES

- High versatility
- High adaptability
- High flexibility
- Reduction of Non Conformities
- Reduction of time
- Reduction of Non Quality Costs



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CONCLUSION

Flipping the coin and flattening the border between quality and production shows a good lever to further increase efficiency in the aircraft building process.

Once again, removing silos and boosting cross fertilization by creating mixed teams with blended cultures are the key success factors. Beyond automatization, the human element is essential to consider in continuous improvement. Consistent with TRIGO's vision of Quality achieved with relevant people, processes and technologies, we strive for developing such training approaches with our collaborators, in order to implement continuous improvements.

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