UC
THALES
ALENIA SPACE

Thales Alenia Space project in Belgium: SPC on hybrid production line

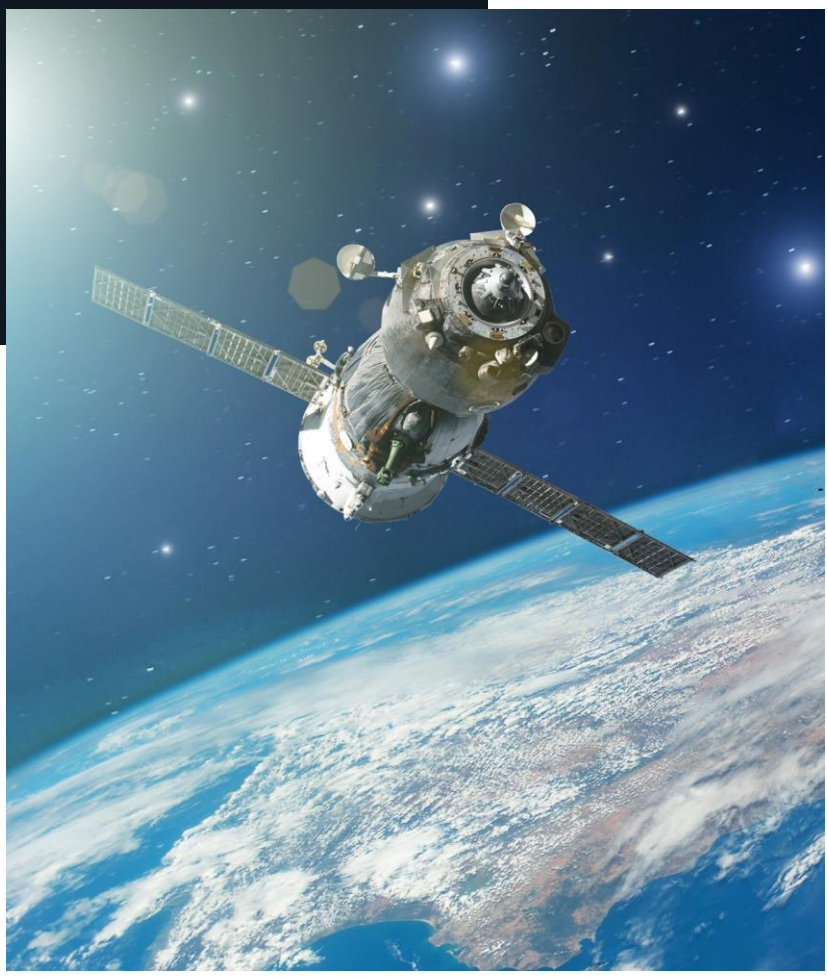
Results

Increased staff awareness of changes involved in a digital transition

Improved quality control

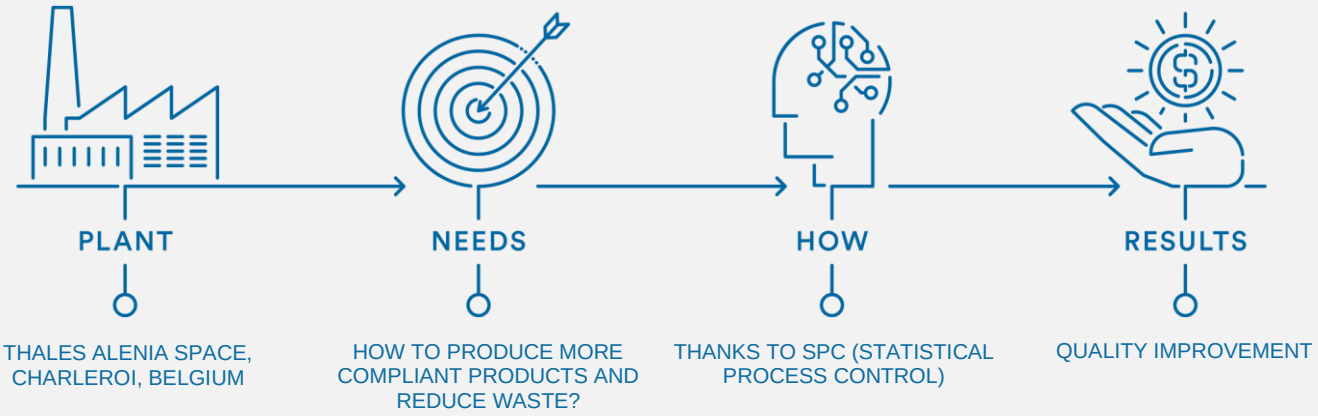
Improved traceability

Time saving



OPTI maestro

DATA maestro



Situation

Thales Alenia Space, the joint venture of Thales and Leonardo, is a **world leader in satellite systems and orbital infrastructure**. The company has 17 industrial sites including 3 sites in Belgium which represent 375,400 m² of installations. It was at the Charleroi site that Pepite was invited to collaborate with Thales.

The purpose of Pepite's mission at Thales Alenia Space was to **monitor, analyze and control data and production parameters** on different types of operations intended for the manufacture of hybrids. Hybrids are electrical components that enable the transfer of information within the orbital infrastructures of satellite systems.

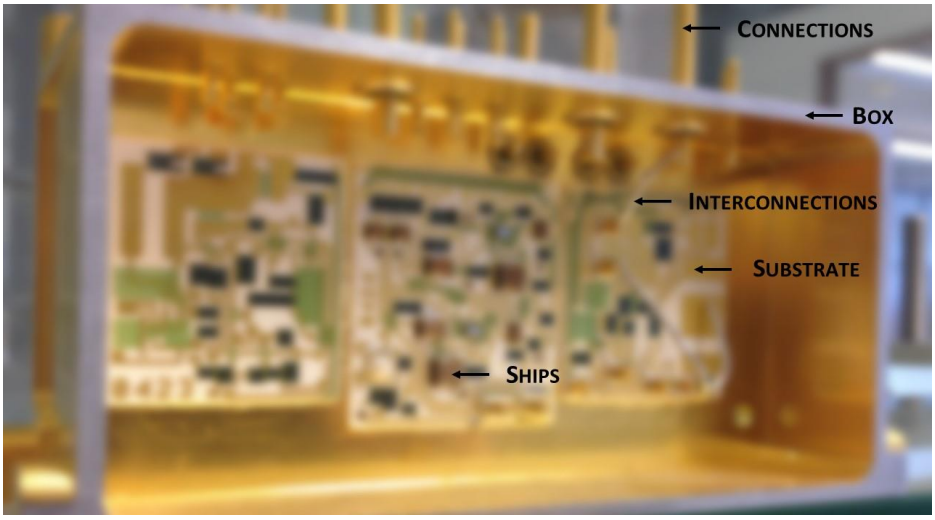
→ How to produce more products that meet quality specifications with less waste?

Thanks to Pepite's intervention, the Belgian teams of Thales Alenia Space are now able to monitor their production parameters in real time and **to perform a SPC (Statistical Process Control)** monitoring of production parameters **in order to validate the manufacturing process**. Thales Alenia Space Belgium can also, when a problem arises, **understand its root causes** thanks to the advanced data analysis software, DATAmaestro.

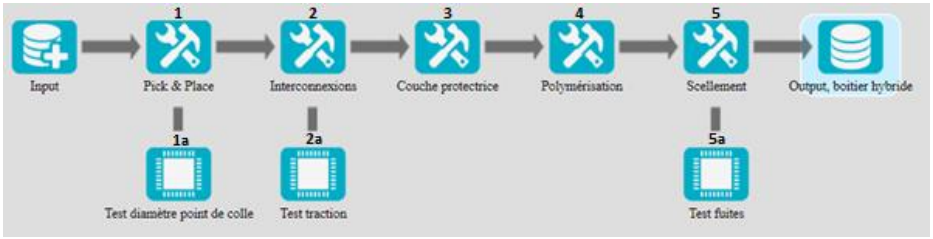
Process Explanation

Manufacture of **hybrids**, electrical enclosures consisting of a substrate, chips, interconnections and connections.

A hybrid is made as follows:



The assembly process takes place in 5 phases:



1. In order to produce this hybrid part, a Pick and Place machine deposits glue dots on the substrate to stick the chips.

1a. Every day, before production starts, tests are carried out on a sample and the diameter of the adhesive points deposited is measured.

2. The interconnection machine makes it possible to make connections by ultrasonic soldering of a wire (Gold or Aluminum) between 2 components of the hybrid.

2a. Tensile tests on interconnection wires as well as shear tests on bonded components are also performed daily before production.

3. Another machine then deposits a protective layer on the substrates.

4. The hybrid packages pass through ovens allowing polymerization after bonding (bonding of chip on substrate).

5. A machine then seals the box.

5a. Tests are carried out every 2 months on a sample of enclosures to ensure that there are no leaks.

CHALLENGES

- **Structure the production process data** coming from different sources, with different formats.
- Build **SPC models (Statistical Process Control)** to enable enhanced quality control.
- Create **Dashboards** and a **reporting system**.
- **Continuous Improvement Loop**: Introduction of advanced data analysis and machine learning algorithms for problem solving and process optimization.

Challenge 1

Structure the data

The data from this manufacturing process was stored in different tools: databases, CSV files, Excel, text files, ERP, etc. The first thing to do was therefore to **extract this data** from the different sources and **store** it in a **centralized database**. Significant work has been done to transform data for it to be directly used for advanced analysis. In addition, this allowed their automatic loading into DATAmaestro in order to feed the Dashboards in **real time**.

Challenge 2

Build SPC models

In order to allow statistical control of the process, it was first necessary to **understand the process**, the **specifications** that make the product compliant, **implement the limits** of these specifications and make this information visible to the **personnel**.

The SPC made it possible, via samples, to measure the various parameters in order to calculate the control limits **for each piece of equipment**. Every morning, measurements are recorded on each device and compared with the defined limits.

Beyond these limits, the measurement is declared non-compliant and an **alert system** is put in place to **warn the operator of any deviation**.
A monitoring screen presenting a Dashboard is present in the production chamber and **allows real-time monitoring of the status for each machine**. There is then a recalibration / maintenance before the start of daily production if necessary.

- **Example of the «Glue application» machine:**

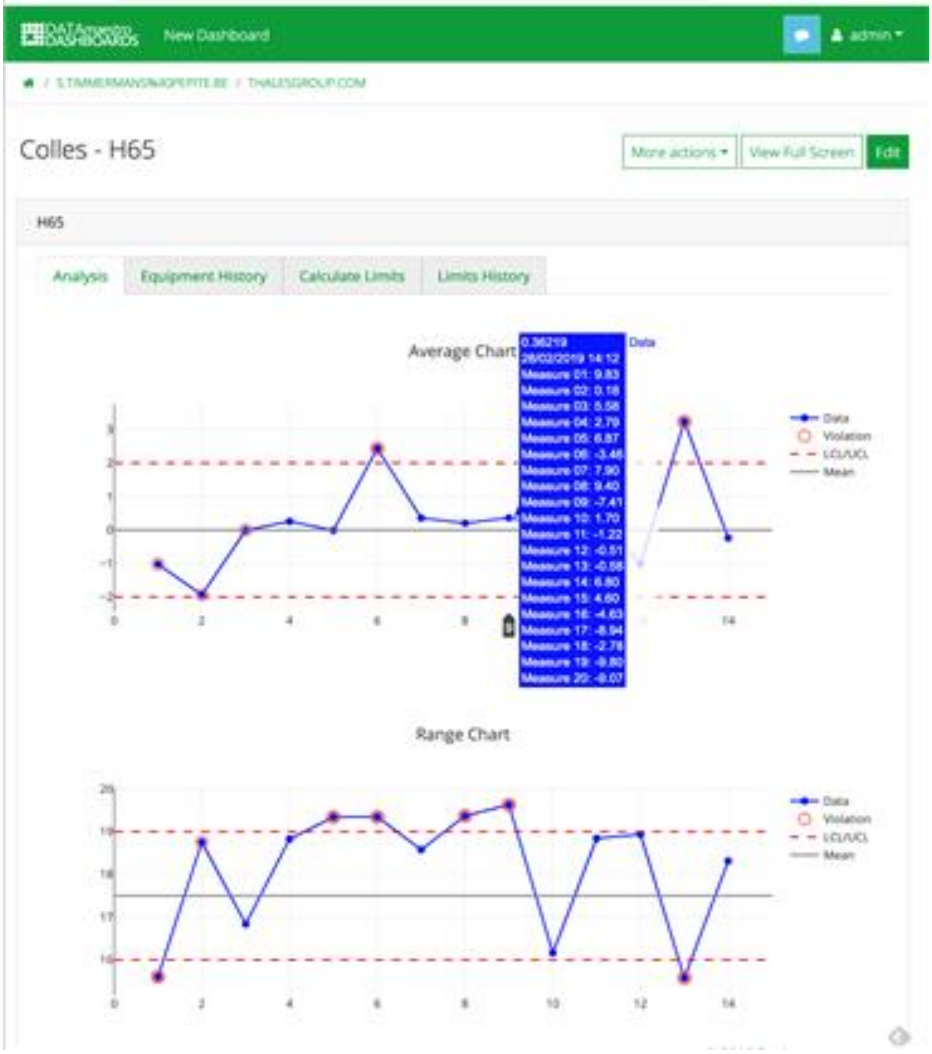
Before each daily use, the glue application machine must be checked. A test is carried out on a sample where there are 20 glue points. The measurement information is automatically extracted using a CSV file mentioning in particular the type of glue (use of different glues) and the diameter of the glue dots (these are diameters less than 0.5 mm). Thanks to the SPC, it is possible to analyze the measurements, by type of glue and the variations in the diameters of these points.

Two types of graphs were created for statistical analysis for this glue application issue:

Thales Alenia Space wanted to obtain a Dashboard to visualize a **graph of the averages and the deviations of the diameter of the glue points**. On these graphs, 3 horizontal lines correspond to the upper, central and lower limit (the 3 limits are calculated on the basis of a sample considered "compliant". The limits can be recalculated if necessary). Beyond these lines, the glue points are considered "non-compliant". In this case, an **alert** is sent to the control room. The quality controller can then validate or not the non-compliant status and **encode** the reason for non-compliance. In this case, a **recalibration of the parameters** or **maintenance** should be considered on the equipment.

The same process is operated for the other equipment. A series of tests are carried out on samples, the control limits are calculated and the Dashboards showing the mean values and the deviations (or standard deviations) are visible in the **control room**. In the event of a drift, the operator is notified and can **adjust production**.

A more in-depth analysis of the root causes of the non-compliance can be done with DATAmaestro Analytics.



Challenge 3

Create Dashboards

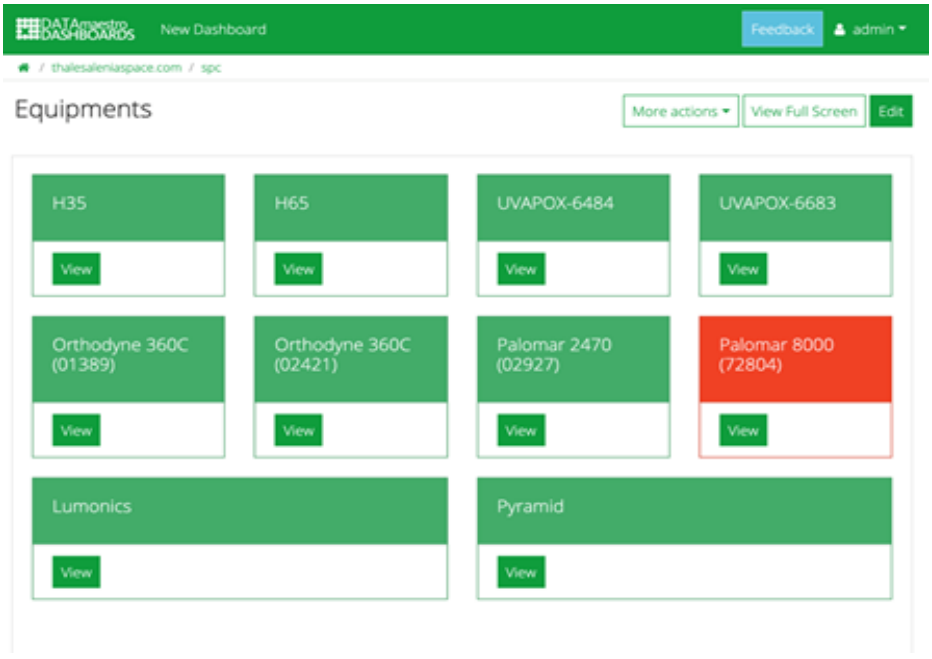
Once the statistical process controls were defined, PEPITe worked on the **design of Dashboards**. Each graph by equipment must be visible and meet the visual / practical criteria of Thales Alenia Space Belgium.

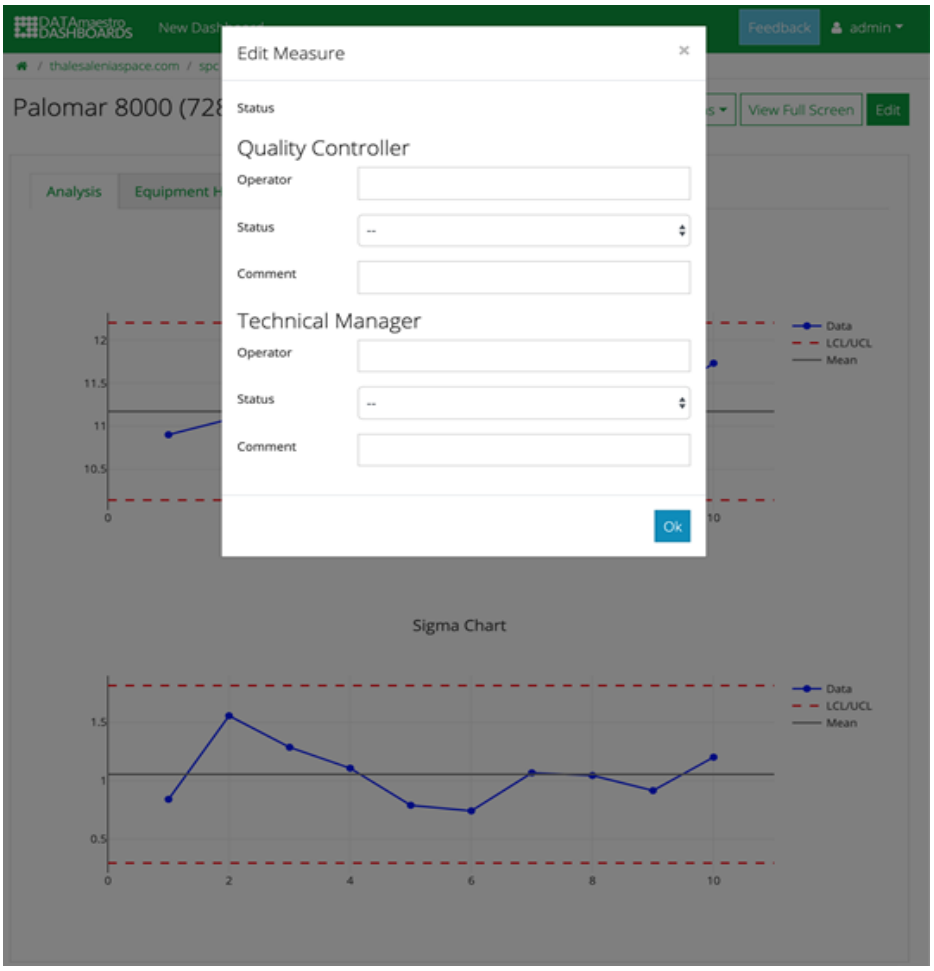
Dashboards must be accessible via a web interface. This makes it easier to switch between the different parts of the process to monitor the production in progress and to detect variations.

A summary Dashboard, listing all equipment, allows a quick overview of any process that are drifting. Colors (green and red) are used to represent the C / NC (conformity / non-conformity) results of the last checkpoint.
Dashboards must allow **encoding flexibility** for the operator. Analysis of the results and Dashboards updates must be done as quickly as possible (max 30 sec).

A "**traceability**" report showing the past limit calculations can be downloaded for later certification. The maintenance history actions per machine can also be downloaded as an Excel report.

The simple user interface makes it very easy for our partner **to add a new machine** themselves to the equipment list monitored by the system.





Challenge 4

Continuous Improvement

This first project enabled Thales Alenia Space Belgium **to raise awareness among factory employees about the changes involved in digital transition**. The factory now has **better quality control** of its products as well as **better traceability**. The hybrid process is more stable and **employees have more time to find the root causes of issues** when they arise, especially thanks to **DATAmaestro**, Pepite's advanced data analysis tools.