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How to transform a factory using Theory of Constraints

Ludovic Hagneré, Production Manager

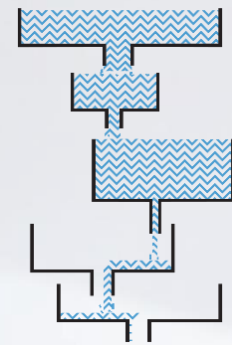
Guillaume Brethenoux, Maintenance Manager

Safran Electronics & Defense, France



SAFRAN

Marris
Consulting



Brief bio

- Quality Assurance Manager at Thirouard Promill (3 years)
- Quality Machining Manager at Goodrich (7 years)
- Quality Control Manager at Mecachrome (2 years)
- **Since 2007, Production Manager, Safran Electronics & Defense (ex-Sagem), Mantes-la-Ville (near Paris)**

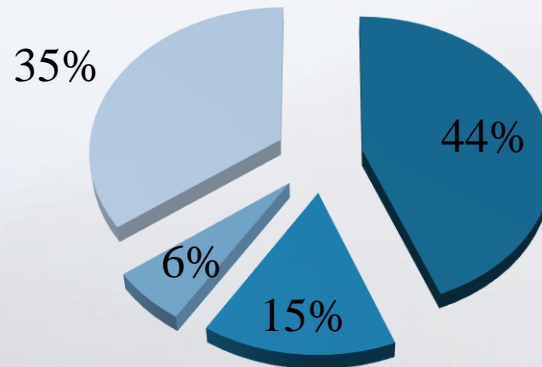


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Mantes-la-Ville factory produces mostly Flight Control Systems (FCS)

- FCS Helicopters
- Equipment
- Cockpit Controls
- FCS Aircrafts

14,000 units per year



Throttle control



Linear Actuator



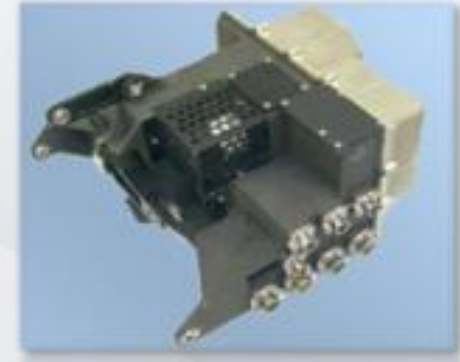
Servo Drive



SMART Actuator



Trim Actuator



Pedal Feel and Trim Unit



Backup Power Supply

We do the machining of the most complex mechanical components

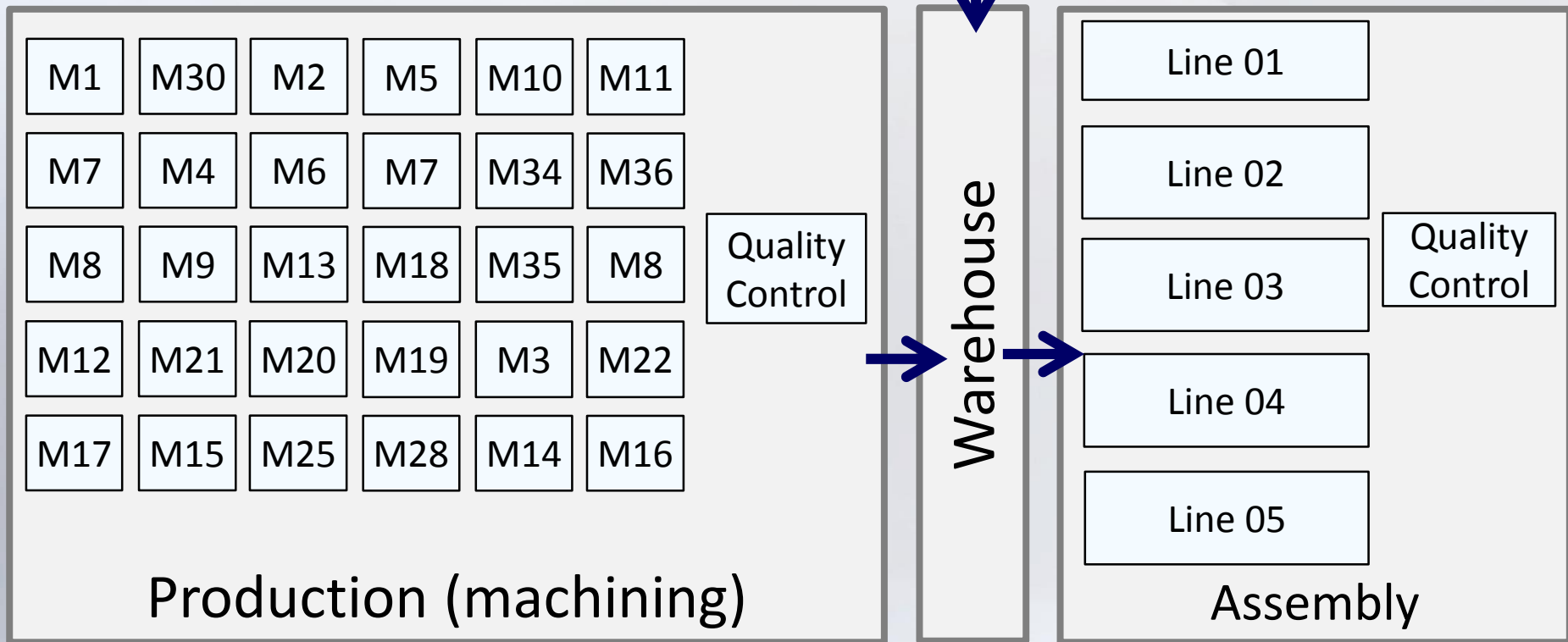
- Many different production processes: turning and turning centres (5 axis), milling (3, 4 & 5 axis), electro erosion, hobbing, grinding (internal & external), ...



A factory of 300 people, 2 units: Production and Assembly



Components
Supply
(>60% of parts)



The initial diagnosis: chaos

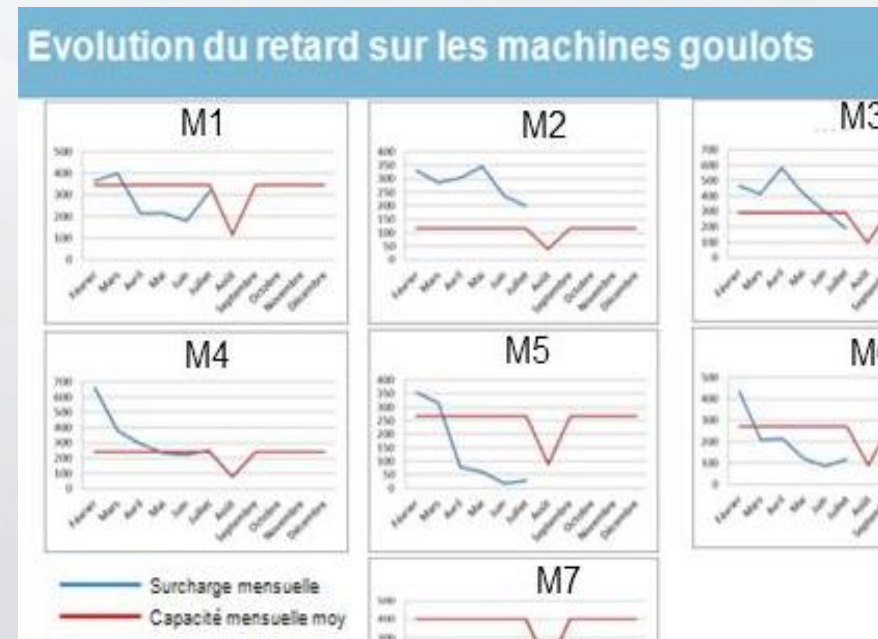
- Incapable of giving Program Managers and clients a reliable delivery date.
- Blind faith in the ERP.
- High scrap rates.
- Huge increase in Inventory and Work-in-Process.
- Management continuously firefighting.



Purchased parts
reception area

Management had identified 7 bottlenecks

- On these "bottlenecks", there was therefore:
 - Unlimited overtime
 - Over 40 temporary workers
 - Important use of subcontracting
- These machines closely monitored: OEE, reports, etc.

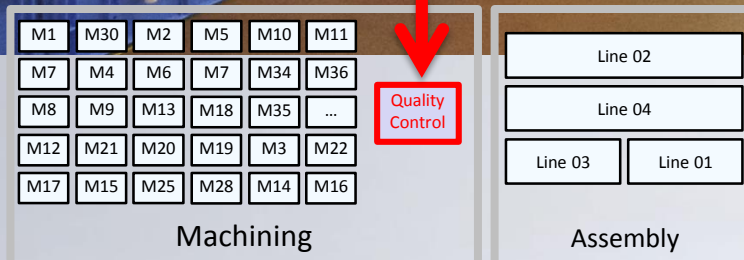


But the **real** bottleneck was... Inspection and Quality Control



Products waiting
before Quality Control:

- 370 Work Orders (35%)
- 8 out of 10 "Urgent orders"
- 20 days of work



When presented to management the diagnosis provoked some reactions

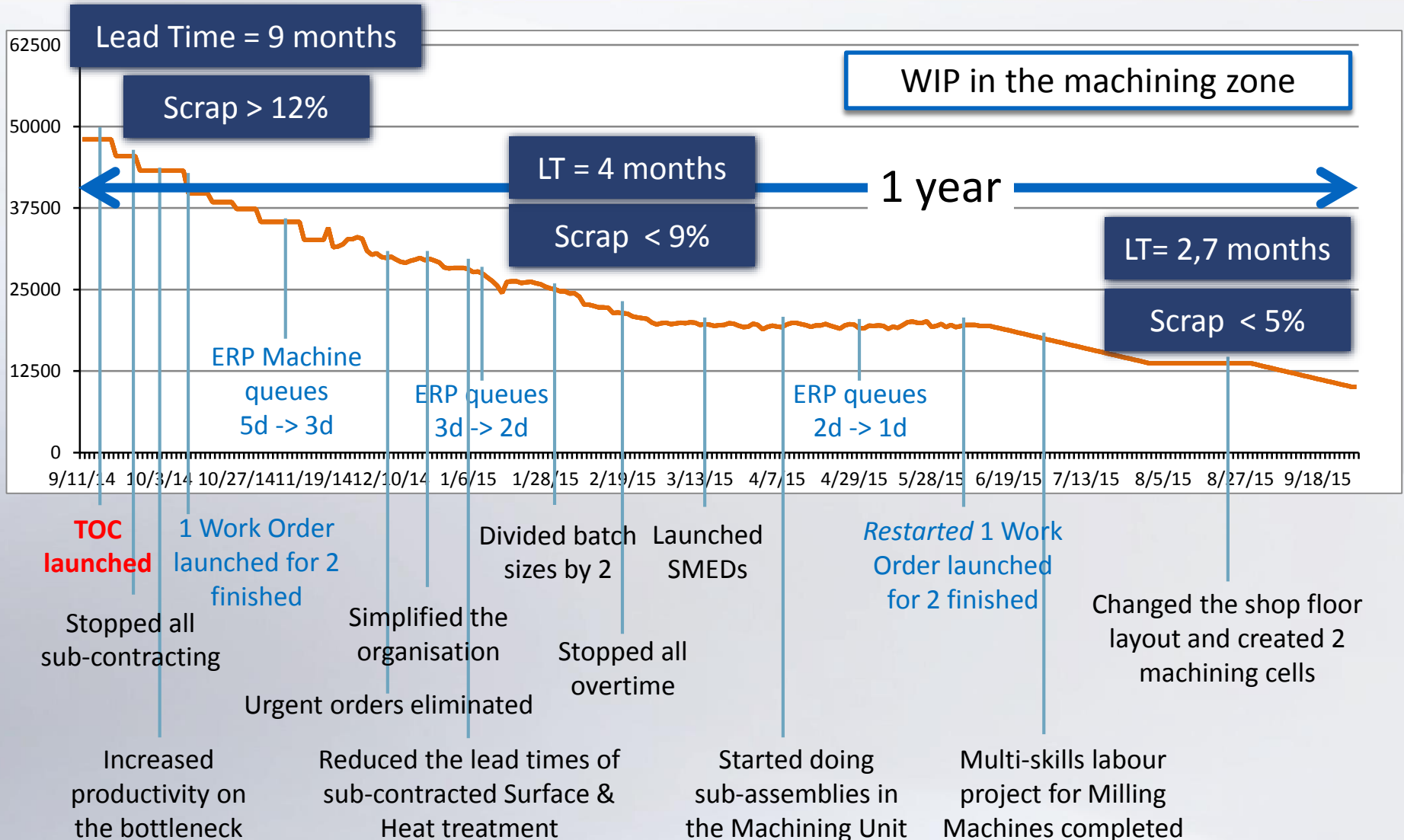
BENEFITS

- We had found the real bottleneck of the plant.
- The diagnosis revealed how many Emergency Systems there are (6!).
- It has provoked self-criticism of our current practices.
- We should stop trying to keep all the non-bottlenecks fully loaded.
- We have questioned (challenged) our way of doing things.

CONCERNS

- How to implement this TOC method?
- We already tried similar approaches [consultants], and it failed.
- Worry & questions about the implementation of the methodology.

Le slide that says it all



All actions were focused on the constraint

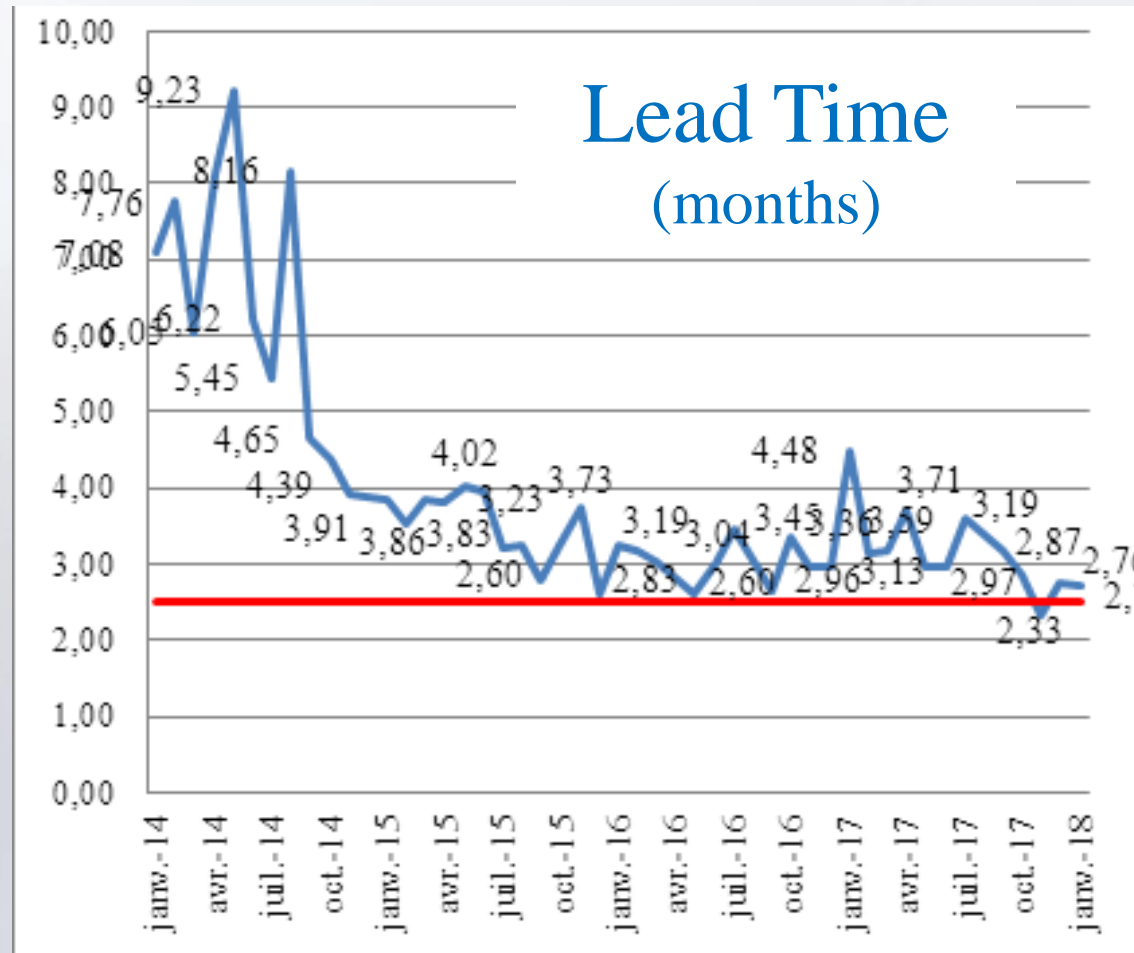
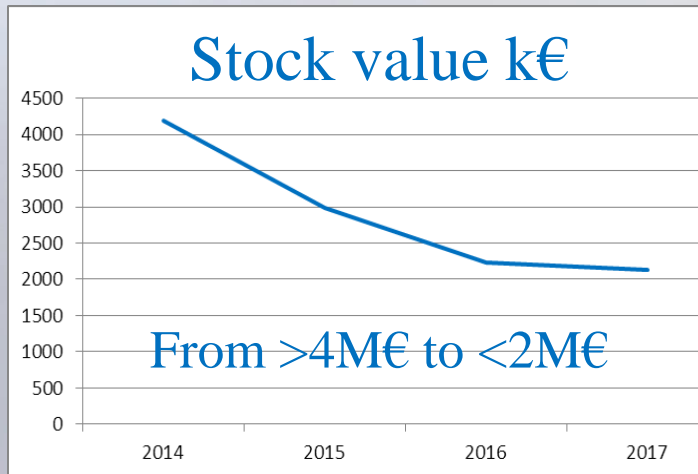
- Stopped subcontracting some operations.
- 2 workers from Machining were transferred to Quality Control.
- Inspections done directly on machines.
- Became the management's priority.
- Differentiation between technical and documentary checks.
- Implemented Statistical Process Control



**30% increase of throughput and productivity
within 2 weeks!**

The production times shrank from 9 months to 2,7 months

- To reduce Lead Times further we will have to reduce external sub-contracting (heat treatment, surface treatment, ...)



Brief bio

- Gear box design pilot at PSA Peugeot Citroën (3 years)
- Maintenance Manager at Renault (10 years)
- **Since 2014, Maintenance Manager, Safran Electronics & Defense (ex-Sagem), Mantes-la-Ville (near Paris)**



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Context:

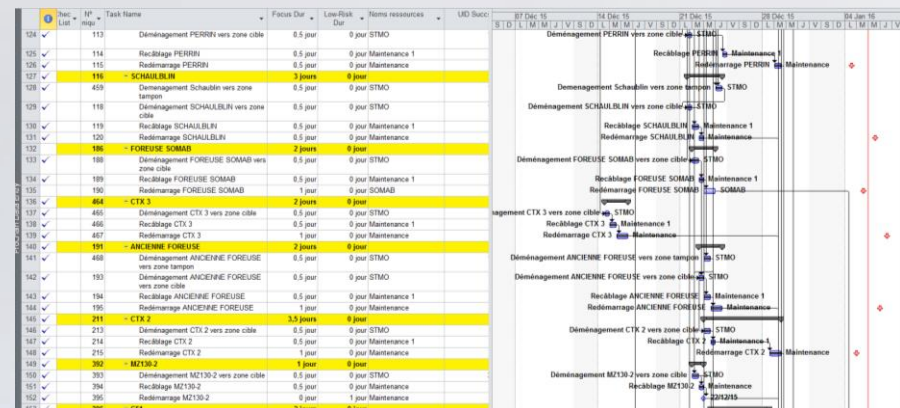
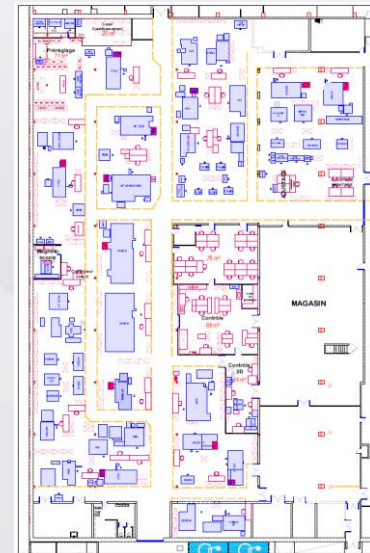
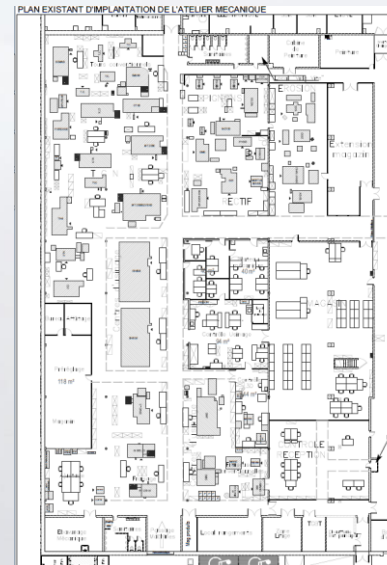
Critical Chain to change the plant layout

- A project of simplification of the production flow and organization of lines function of product types led to a new layout.
- The target of the new layout was to help:
 - Reduce lead times,
 - Simplify the flow of parts,
 - Increase throughput,
 - Improve productivity,
 - Reduce variation,
 - Improve work environment,
 - Enable the installation of new equipment.
- Around 70% of the machines were moved (48 machines from 300kg to 10 tons) after some civil works were carried out.



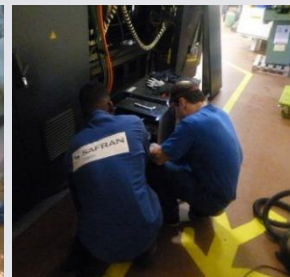
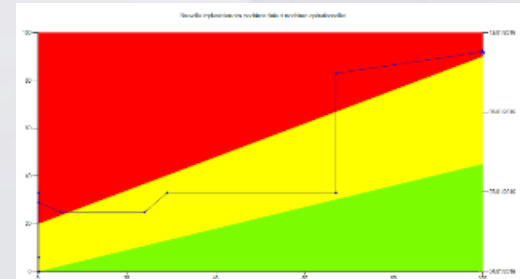
Critical Chain to change the plant layout

- **First estimate: 8 weeks of work.**
- But in order not to disturb production, a slot of only 2 weeks was accepted during the Christmas holidays to perform the works.
- Critical Chain enabled us to define the necessary conditions to meet the target (extra Cherry picker, etc.).
- All these elements were modelled in the schedule. It allowed us to organize the tasks, set in parallel as much as possible and prioritize the critical ones taking into account the resources.



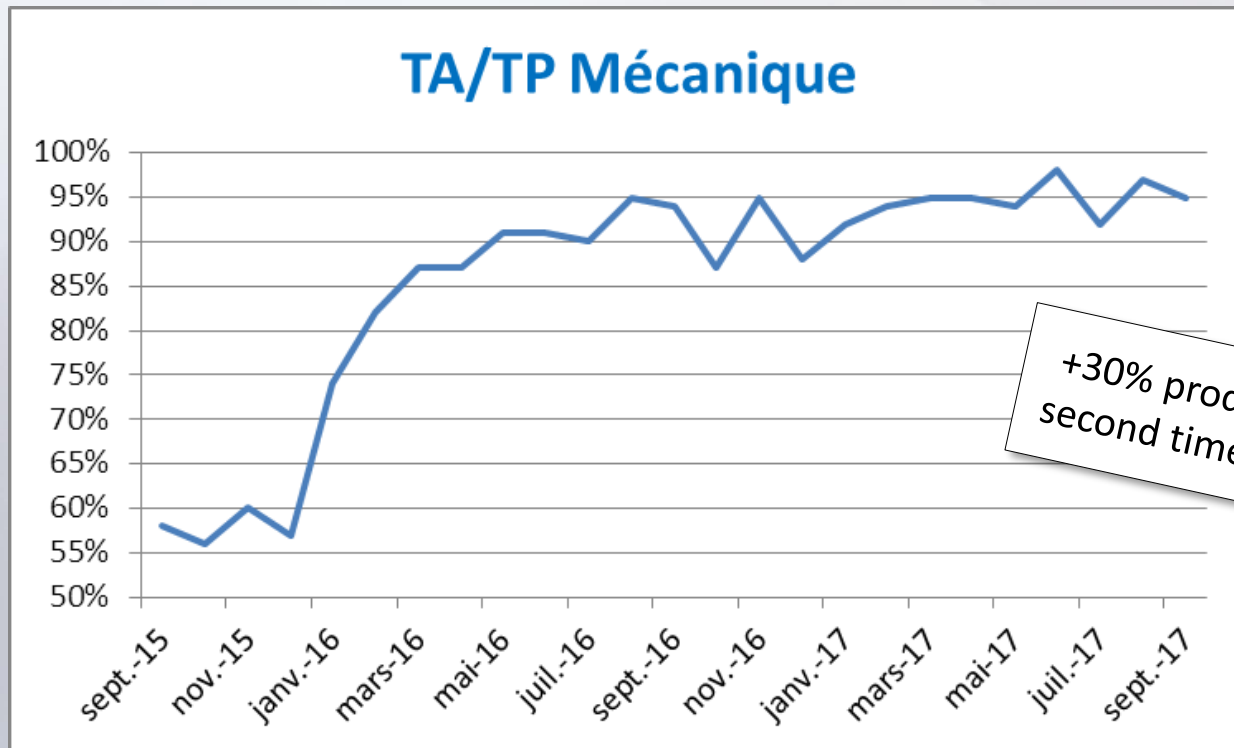
Critical Chain to change the plant layout

- Duration of the project: 6 days to move the machines.
- Involvement of the team, from preparation to restarting.
- Daily monitoring of the progress and of the buffer consumption.
- Distribution of the resources amongst the groups in order to respect the due date.
- Production started up without any problems (!) on the 4th of January 2016, the due date was respected.
- We have become much more agile. Since then new modifications were made throughout 2016 and 2017.



The overall productivity surged

- Productivity of the Machining Unit increased from 55% à plus de 95% (production time vs. Presence time).



- BEST PRACTICES DAY SAFRAN
- Presentation to Airbus.
- Several plants benchmarked the site:



- Safran Helicopter Engines,
- Safran Aircraft Engines:
 - Villaroche,
 - Vernon,
 - Gennevilliers,
 - Corbeil.
- Safran Nacelles,
- Safran Landing systems,
- Other Safran E&D units,
- ...

COMMUNIQUE INTERNE

01/03/2016

Sagem – Mantes-la-Ville

Remise des prix SAGEM AWARD

« Une dynamique de changement positive, des chantiers d'amélioration pertinents », les encouragements de Martin SION confirment l'évolution constructive des unités opérationnelles de Mantes - CEI Equipements Avioniques et MRO. Des résultats significatifs qui sont le fruit des efforts collectifs menés depuis plusieurs mois par les différentes équipes projets SAFRAN+. La TOC ou « Théorie des contraintes », déployée sur le CEI en 2015 en est un exemple.

Retour sur cette innovation, récompensée par Martin SION et Etienne GALAN, pour sa performance et compétitivité.



Quelques chiffres :

- Un cycle de production divisé par 3 en passant de 8 à 2,6 mois
- Diminution de l'encours de pièces qui passe de 53000 à 11799 à l'usinage
- Baisse significative des retards de l'atelier mécanique impactant nos clients de 500 à moins de 50
- Une réduction drastique de nos retards clients de 1300 à 121 équipements

De gauche à droite sur la photo :
Stéphane VITRAC, Christine PUECH – directeur amélioration continue Sagem, Martin SION – président directeur général Sagem, Joannis EPARVIER, Tony CAILLEAUX, Malane VANNESSCHE, Corinne RIVOLET, Gérard ROYANT, Ludovic HASNERE, Etienne GALAN – directeur qualité amélioration continue Safran, Jean-Paul TRABIS – directeur industriel Sagem

Une véritable conduite du changement a été menée, à commencer par la remise en question de nos process et organisation.

Le diagnostic réalisé a permis de détecter le goulot au sein de l'unité de production, occasionné notamment par la multitude des systèmes de priorités, les lancements excessifs d'OF qui engorgeaient les machines et augmentaient l'encours atelier, la sous-traitance de phase qui chargeait les équipes d'inspection.

Et la mise en action dans tout ça ?

Pour commencer, elle passe par la formation et l'accompagnement à la méthode des principaux acteurs de la chaîne. Il faut donc raisonner différemment en s'appuyant notamment sur la polyvalence et la poly-compétence de chaque contributeur.

Identifier des goulots, désengorger le contrôle final par des renforts de l'atelier. Modéliser différemment le lancement des OF (1 lancé pour 2 livrés) et réduire les délais interopérations.

Des solutions concrètes, durables et adaptées au terrain !

COMMUNICATION INTERNE

 SAFRAN
Sagem

Conclusion

- You can quickly improve the performance of a factory...
- ...if you concentrate on the bottleneck
- Critical Chain
can help you greatly speed up your projects
- The Theory Of Constraints and the Critical Chain
changed my way of looking at things even in my personal
life.
- Thank you.

QUESTIONS ?