TOC to boost aeronautical manufacturing performance

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Cape Town, South Africa

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Abstract

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2015 TOCICO International Conference – Cape Town, South Africa

Several recent cases of implementations of the Theory Of constraints in the aeronautical industry will be presented.

In all cases the performance of the plants were very rapidly and significantly improved: increase of 30% in Throughput and productivity in one month, reductions of >60% in WIP and significant increases in delivery due date performances.

To easily reduce Work In Progress the “2 for 1” rule was developed: a new work order could only be launched once 2 work orders have been completed. This facilitated the transition to a Drum-Buffer-Rope flow control mechanism.

SAP was often being used and hence had to be integrated into the solution.

In some cases the extraordinary speed and amplitude of the results were due to an error in the identification of the constraint of the factory.

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- Case B: Large Aeronautical Ball Bearings
- Case C: Small Aeronautical Ball Bearings
- Conclusion

- Annexes

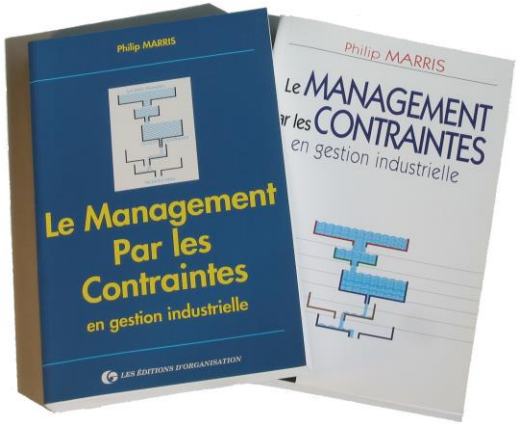
Introduction

Philip Marris

CEO – Marris Consulting, Paris, France

2015 TOCICO International Conference – Cape Town, South Africa

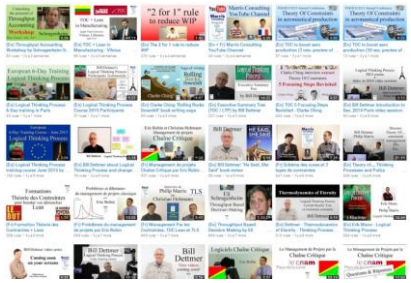
- Theory Of Constraints specialist. 29 years of TOC experience. Started working with the founder Eliyahu Goldratt in 1986.
- Consultant (warning!)
- >25 years of experience helping over 150 companies in all industrial sectors.
- Founder and CEO of Marris Consulting based in Paris, France. Founded in 2004. Motto: Factories, People & Results.
- Author of numerous articles on TOC.
- Gives over 10 TOC conferences a year worldwide.
- Author of a very boring French textbook about TOC in manufacturing *Le Management Par les Contraintes.*
- >15 years of experience in major consulting firms.

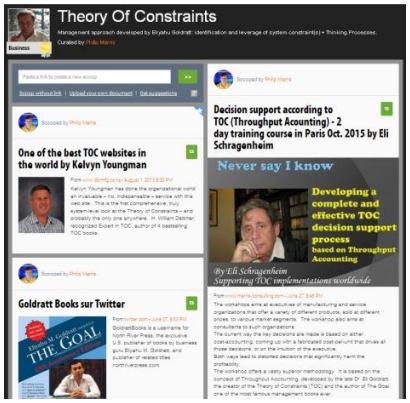


LinkedIn twitter

Theory Of Constraints marketing & awareness activities

- 5 Permanent news websites (www.Scoopit.com)
  - Theory Of Constraints (English & French)
  - Critical Chain in (English & French)
  - TLS: TOC + Lean + Six Sigma
- >80 Free Videos (YouTube Channel)
- Discussion Groups (LinkedIn)
  - Critical Chain
  - TLS: TOC, Lean and Six Sigma
- 2 dedicated websites in French
  - TOC in Production
  - TOC in Projects
- Others:
  - Twitter, Facebook, Viadeo, Etc.

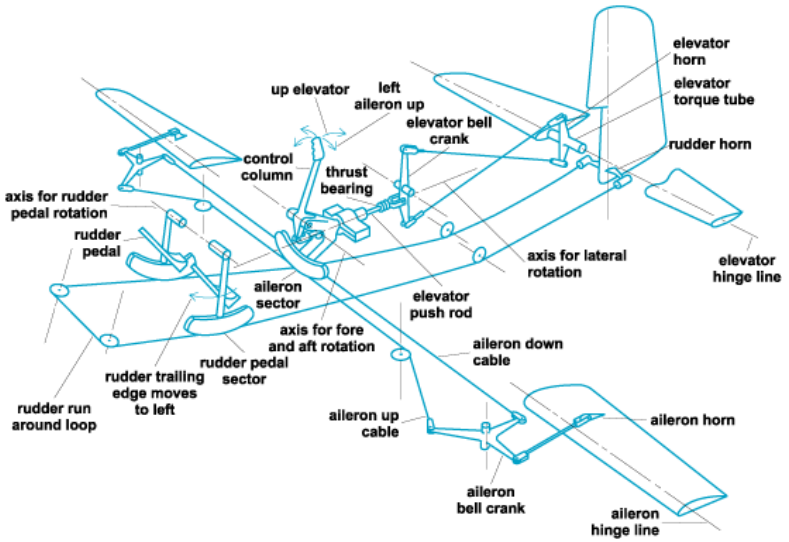




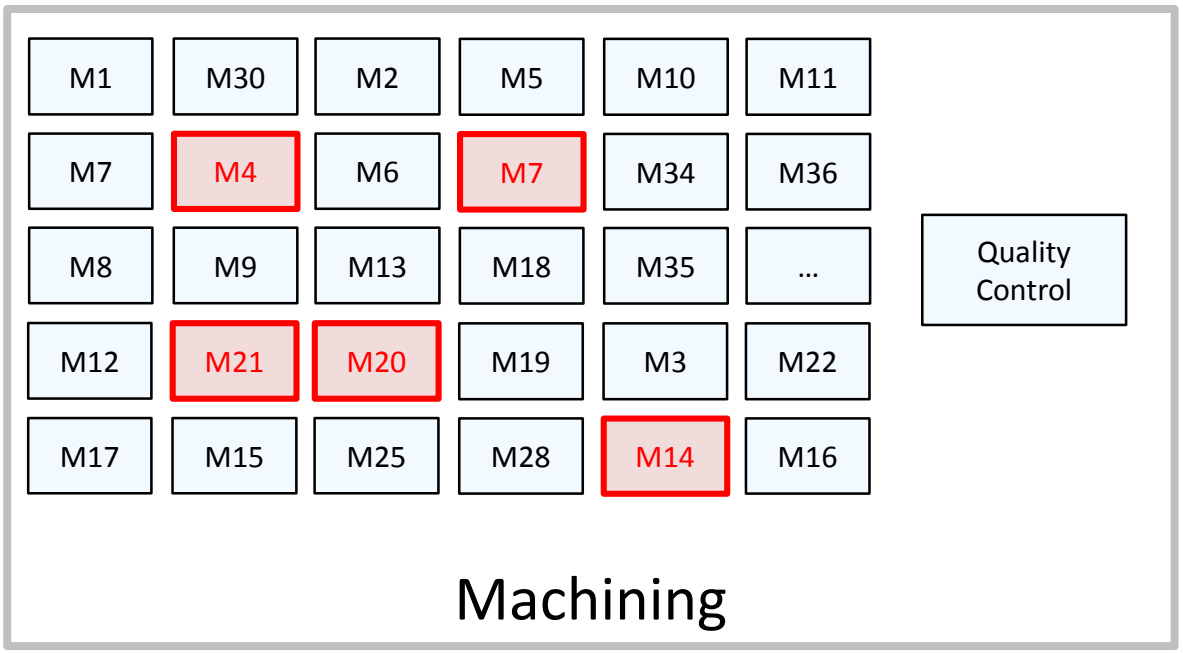
Case A:
Flight Control Systems Equipment Manufacturer

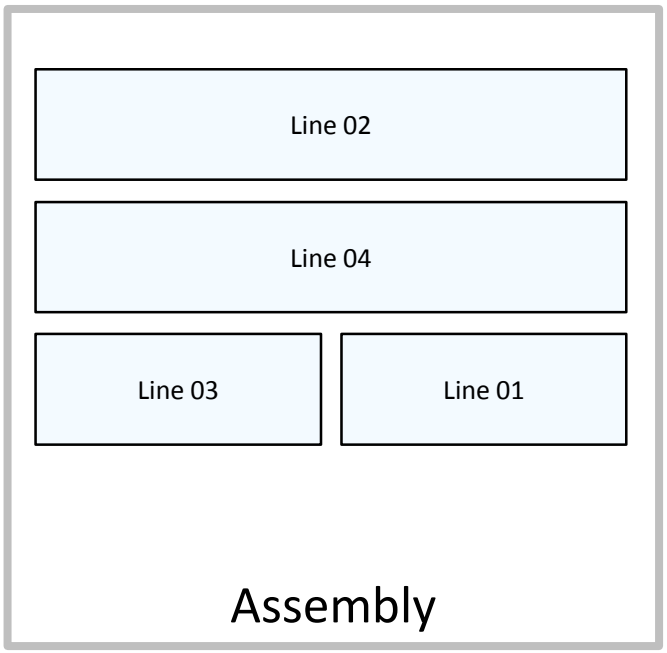
Flight Control Systems Equipment Manufacturer

- A 400 person factory in France. Part of a major >$5 billion, >30,000 people, aeronautical equipments world wide leader.
- **Very poor due date delivery performance of <60% OTIF.** Unacceptable for it's clients (aircraft manufacturers).
- As a result the plant was loosing business year by year. It's future was compromised.



Initially they thought that they had 5 capacity bottlenecks

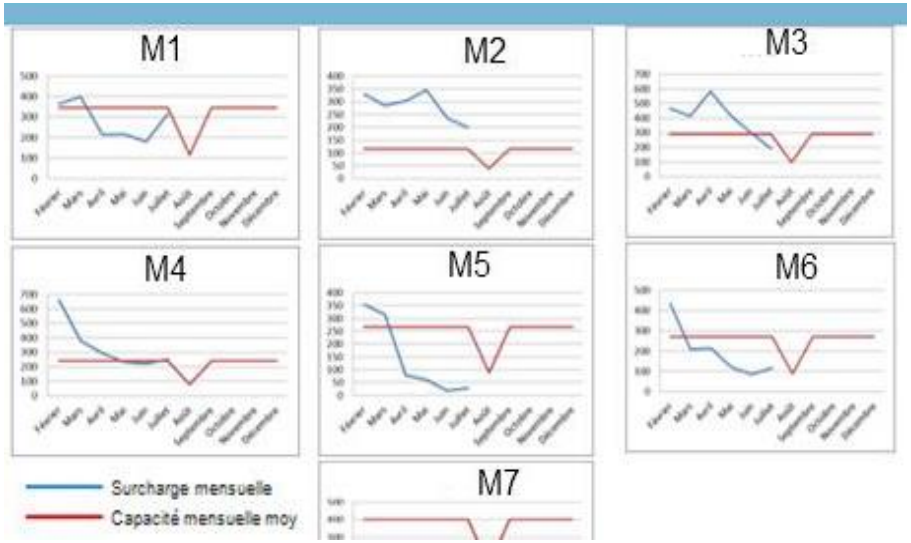




So they increased Operating Expenses accordingly

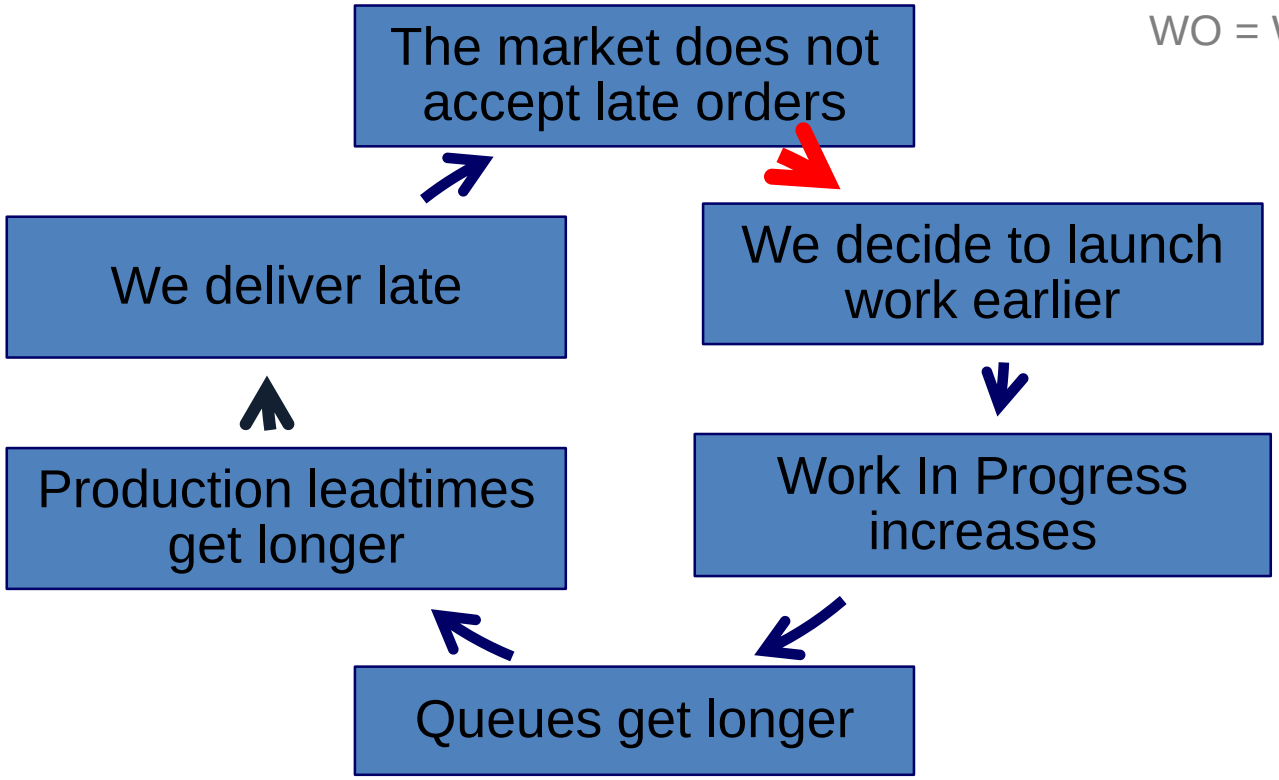
- SAP / ERP confirmed this overload.
- So they had:
  - Overtime,
  - Contract Workers,
  - Sub-contracting,
  - Investments underway,
  - Management attention,
  - Etc.

to reduce the load on the bottlenecks



…and because they delivered late they started launching WOs* earlier

WO = Work Orders

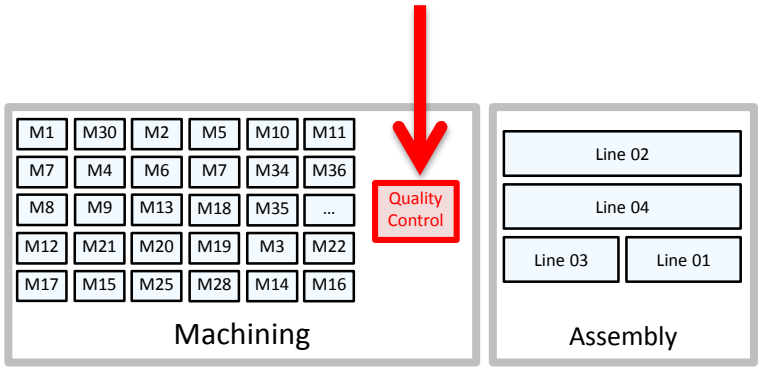


…which gradually increased production lead-times to 9 months

But there were no improvements. Why?

In reality the bottleneck was Quality Control

- Observing the queues of WIP (Work In Progress) easily showed that the constraint was in Quality Control.



We then implemented TOC

- Exploit the constraint
  - Management attention + Silly small investments + Increased Manpower
- Reduce WIP and Lead-times
  - Initially NOT by DBR subordination…
  - …but by implementing the "2 for 1 rule"
  - And 3 months later by reducing the batch by 50%

The "2 for 1" rule

Very successful simple technique
Highly recommended

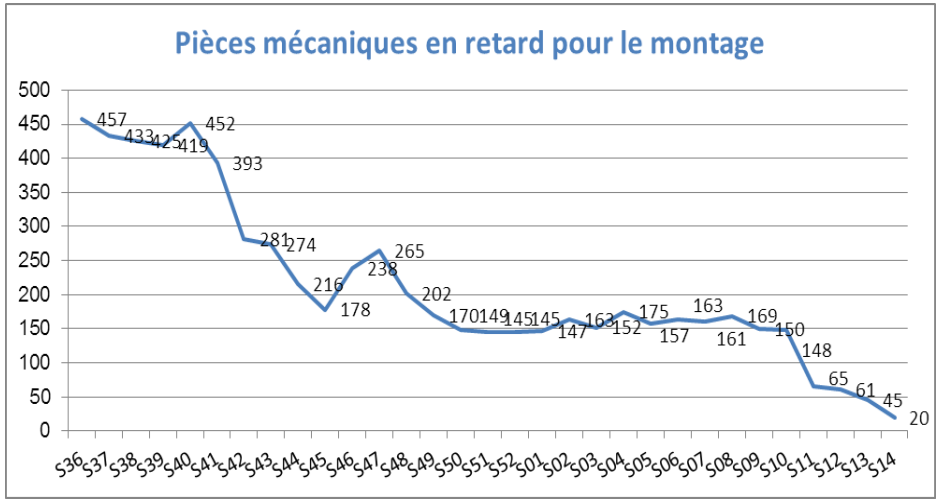
A new Work Order (WO) can only be launched when 2 WOs have been completed

- The choice between several WOs proposed by the ERP/MRP is done manually by the management.

- This technique:
  - Is only pertinent for systems with over 50 WOs in WIP
  - Facilitates the transition to other flow control techniques such as DBR.
  - Is neither TOC, nor Lean

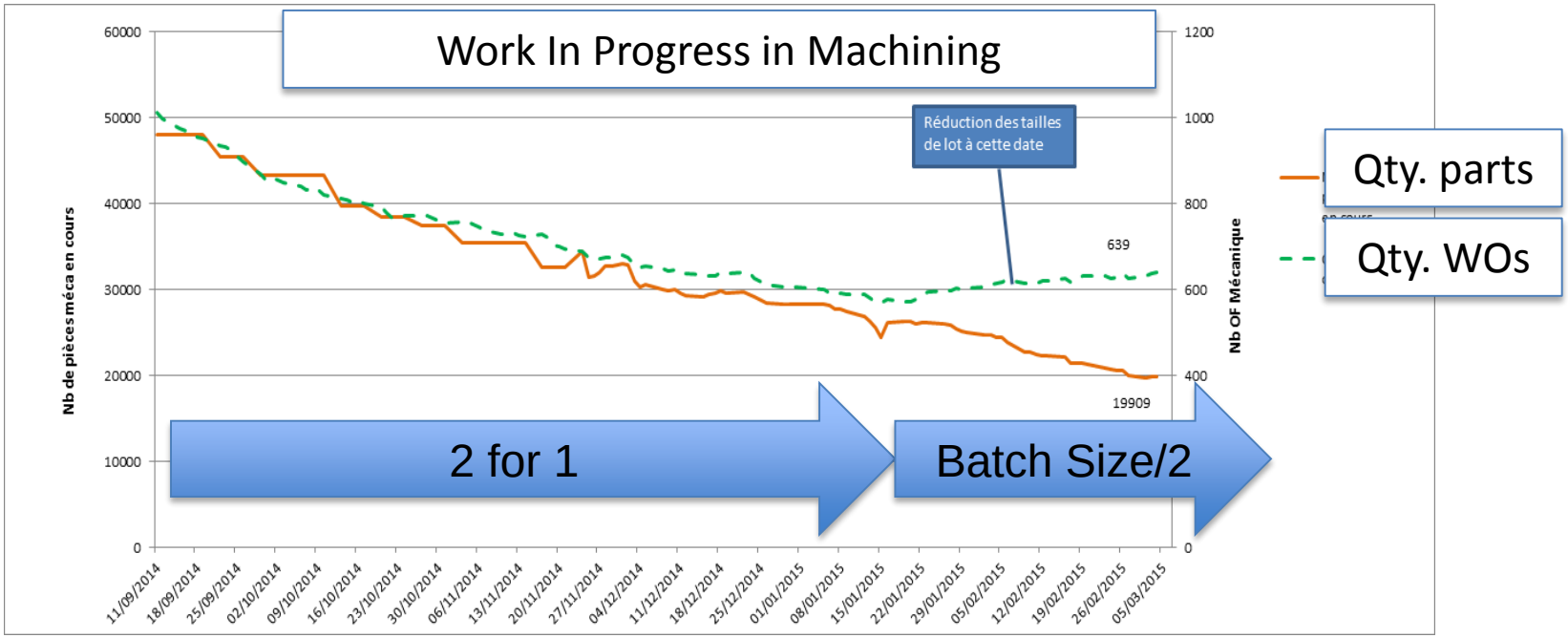
The immediate results were "extraordinaire"

- Within 2 weeks:
  over 30% increase in plant Throughput and Productivity
- Within 2 months:
  95% reduction in the number of parts missing at assembly



The results were "extraordinaire"

- Within 3 months Due Date Performance went from 40% to >80%
- Within 4 months: 70% reduction in WIP and production lead-times
- WIP reduction was over 2.5 M€.
- Factory went from big losses to profits.



Further improvements are now being implemented

- The 3 year target is to reduce the lead-time from the initial 9 months to 3 weeks.
- The Due Date performance target is now 95% and 99% the following year.
- Critical Chain Project Management is being implemented to improve new product development.
- Also: Factory layout improvement + SMEDs + Capability and SPC + Training + Etc.

The TOC Way is spreading in the group

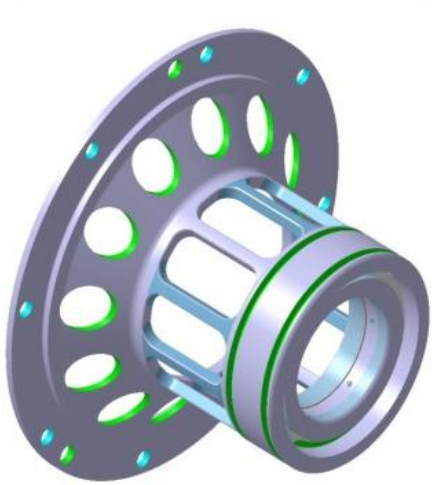

L'usine de redresse la barre

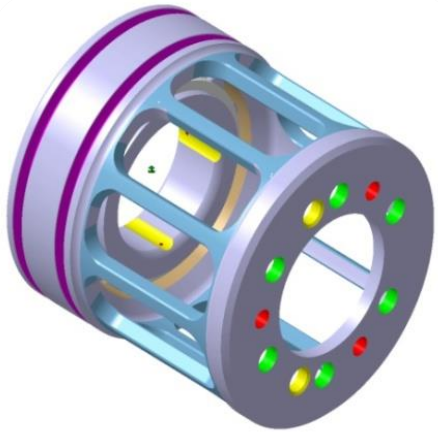
- A 1 day TOC event was organized with 130 top managers from over 40 factories.
- This plant's story was presented in the group's internal magazine.
- Over a dozen TOC initiatives are underway or being launched in various plants.

Case B:
Large Sophisticated Aero Ball Bearings

An aeronautical ball bearing manufacturer

- >400 people plant
- Part of a world leader / multinational
- Manufacturing sophisticated ball bearings for aircraft engines, helicopter rotors, etc.
- Under pressure to:
  - Improve due date delivery
  - Reduce lead-times
  - Reduce costs





Bearings = 2 rings + cage + ball bearings

Outer Ring
Sophisticated
very precise
tolerances

Inner Ring
Sophisticated
very precise
tolerances

Cage
Simple
not precise
tolerance

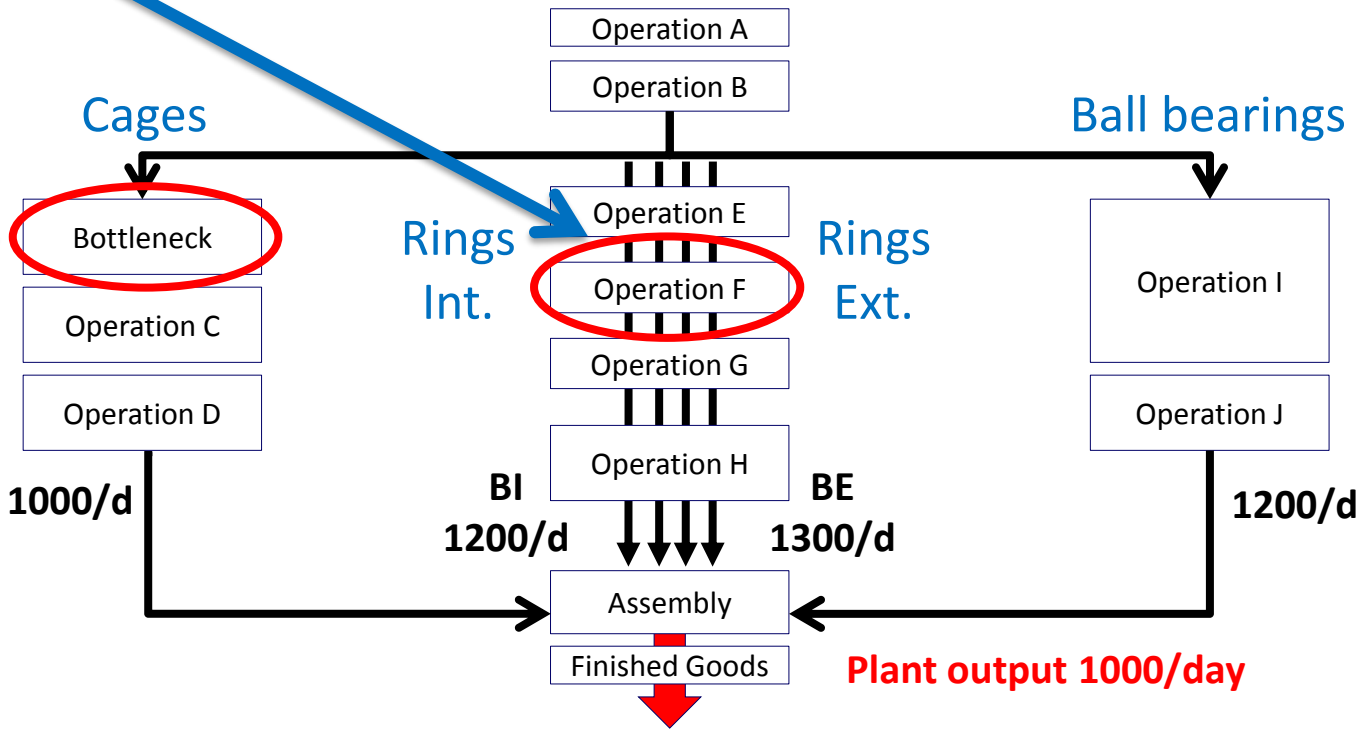
Ball Bearings
Average
complexity

They were wrong about where the constraint was

They thought the bottlenecks were their expensive milling machines

when in fact

it was another machine in another part of the factory



The first 3 steps of the 5 focusing steps were applied

- Step 1: The (real) constraint was identified
- Step 2: The bottleneck was "elevated"
  - Management attention was sufficient!
  - As volumes increased an external sub-contractor (surface treatment) emerged as the next constraint and was dealt with.
- Step 3: The rest of the plant was "subordinated"

The results surprised them

- Global productivity increased significantly.
- The order backlog was dealt with.
- The end of month "hockey stick" was eliminated.
- The "fire fighting" culture disappeared.

The system was then organized around the "best constraint"

- There was agreement that the "best constraints" in the plant were the expensive high precision machines.
- So within 4 months the production flow system was reorganized accordingly.

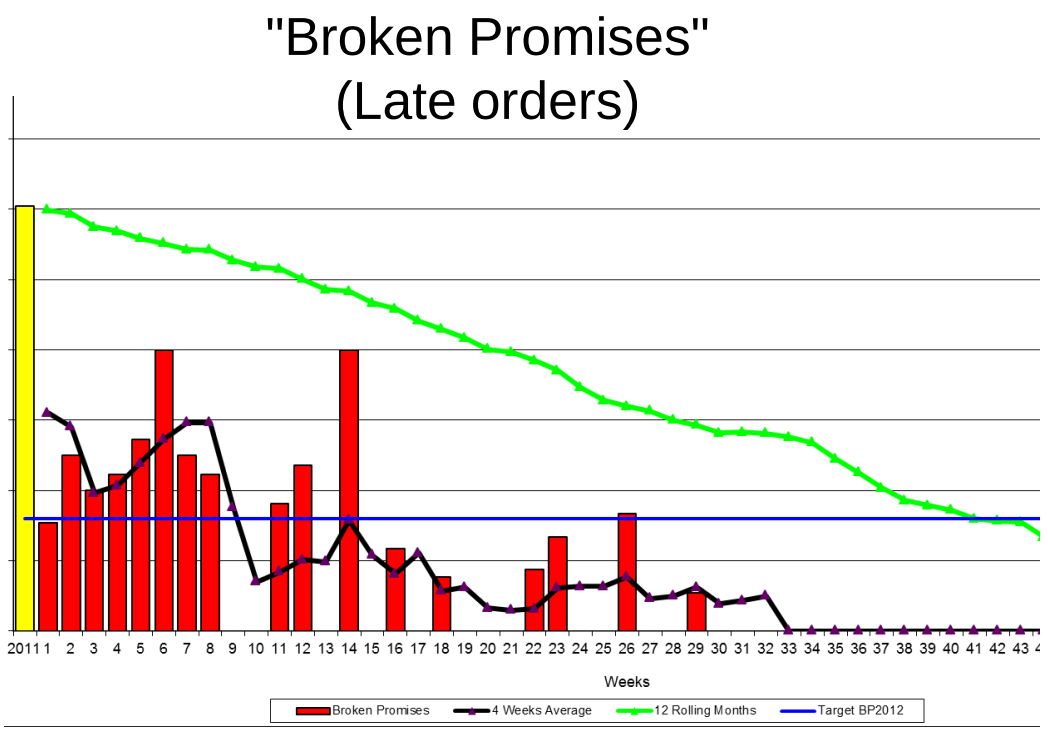
Case C:
Small Aero Ball Bearings

A success story triggered by only 2 days of TOC training

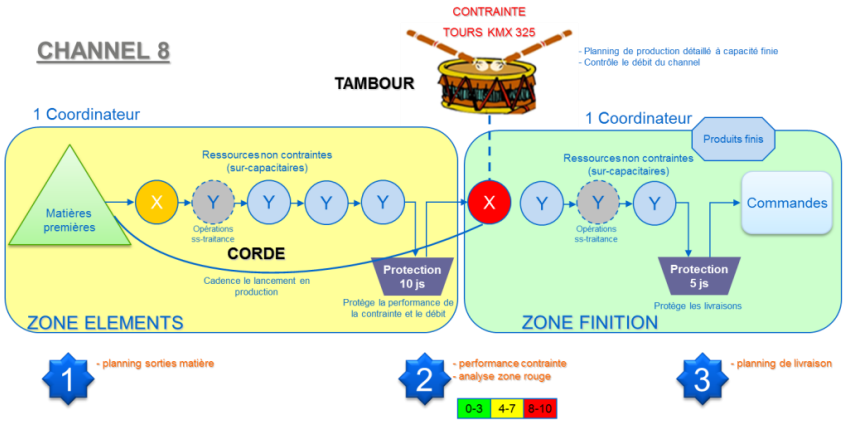
- A production manager followed a 2 day training course about applying TOC in Production and then implemented DBR etc.

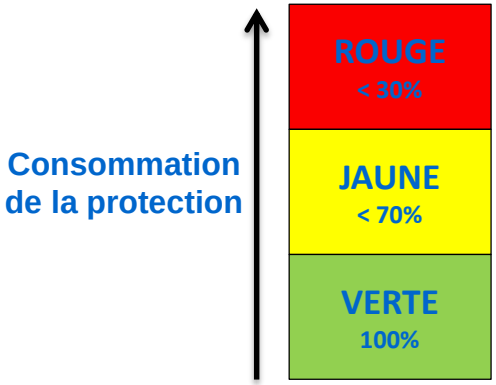
"Standard" TOC results generated new business

- Due Date Performance from 70% to 100.00%
- WIP reduction from -35% to -50%
- Productivity +>20%
- Significant impact on company image & reputation which generated a lot of new business.



Very good buffer management POOGI (Process Of On-Going Improvement)





- **Agir**
- **Suivi - Pas d'action**
- [illegible]

								PUF	> 6 13	3 à 6 22	0 à 3 21	
Code	Désignation article	No OF	Opé.	P.T.	Qté	Fin planif.	Fin réelle	Retard	Arrêt	ANALYSE - retard	Root cause	
631007	BI RE 6,35	1000904371	40	812	150.000	03.09.2014	16.09.2014	10	1	charge recti alesage of mis en rouge 8 jours de pris en surfacage		
630915	BI RE 4,2SA2	1000905130	20	1026	1100.000	04.09.2014	05.09.2014	9	8	of mis en rouge		
631111	BI RL11,11	1000900361	80	880	445.000	04.09.2014	12.09.2014	9	3	of terminé		
632083	BI RL 8RSP1-A	1000900276	70	812	350.000	04.09.2014	03.09.2014	9	10	of en rectif alesage besoin poduit fini au 03.10		
630989	BI WQML19.05RSP2	1000900282	70	811	40.000	05.09.2014	06.09.2014	8	8	of en rectif alesage besoin poduit fini au 22,09 mettre en rouge		
631199	BI BQMAY17	1000900298	100	832	20.000	05.09.2014	16.09.2014	8	1	rect sphere besoin 01,10 rect alesage besoin 22/09		
630930	BI WMA 4	1000900296	50	1026	97.000	08.09.2014	16.09.2014	7	1	a mettre en rouge		
630973	BI RE 5	1000900293	70	812	160.000	08.09.2014	11.09.2014	7	4	rectif alesage besoin 26/09 rouge		
630987	BIB RL 6,35	1000905204	10	828	0.000	08.09.2014		7			attente matiere	
631200	BI RL20	1000904268	70	811	50.000	08.09.2014	10.09.2014	7	5	rectif alesage besoin 29/09	attente matiere	
631227	BI QML22,22	1000904278	10	830	0.000	08.09.2014		7		of pas commencé	relance	
631735	BI QML11,11	1000903622	40	811	200.000	08.09.2014	11.09.2014	7	4	rectif alesage besoin au 09/10		
631143	BI RE14,29	1000902331	70	811	10.000	09.09.2014	10.09.2014	6	5			
631265	BI WQML525,4RSP2	1000900285	90	811	45.000	09.09.2014	10.09.2014	6	5			
631761	BI RE11,11-A	1000902415	70	811	50.000	09.09.2014	11.09.2014	6	4			
631811	BI RE15.87A	1000902416	70	811	50.000	09.09.2014	09.09.2014	6				
633005	CE 101 127 GT	1000897381	50	R108	300.000	09.09.2014	09.09.2014	6				
630987	BIB RL 6,35	1000906027	10	828	0.000	10.09.2014						
631000	BI RL 6	1000902112	60	1021	50.000	10.09.2014						
631325	BI QML14.29SP5-A	1000902140	40	1025	60.000							
631102	BI RE10	1000901838	100	848								
631255	BI RT22,22	1000903593	20									
631292	BI XRT22CP75 CL1	1000										
633012	CE EM/RL 7,94R EMBO											
631020	BI											
631020												
												6
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										26.09.2014		1
										16.09.2014		1
										12.09.2014		3
										16.09.2014		1
										16.09.2014		1
										15.09.2014		2
										16.09.2014		1
631149	BI WMLS15	1000903616	50	R130	64.000	16.09.2014	12.09.2014	1	3			
631788	BI RT 8ACP6	1000897770	170	R215	28.000	16.09.2014	11.09.2014	1	4			
632311	BE X101 126ND SULF	1000905395	20	804	128.000	16.09.2014	16.09.2014	1	1			

Government health warning!
Don't fall asleep on your buffers

Conclusion

TOC and aeronautical manufacturing: a match made in heaven

- In 2015 aircraft manufacturers must:
  - Produce more (increase Throughput)
  - Reduce WIP for speed and $$$
  - Improve efficiency to reduce costs

- The Theory Of Constraints has a great track record of very rapidly:
  - Increasing Throughput
  - Improving flow (& reducing WIP)
  - Improving T/O.E. (Throughput / Operating Expense)

Thank you for your valuable time

Any questions?

Annexes

Marris Consulting's YouTube Channel
(name: marrisconsulting)

2015 TOCICO International Conference – Cape Town, South Africa

(En) Throughput Accounting Workshop by Schragenheim Oc…
63 vues • il y a 2 semaines

(En) TOC + Lean in Manufacturing - Vilnius …
66 vues • il y a 3 semaines

(En) The 2 for 1 rule to reduce WIP
270 vues • il y a 4 semaines

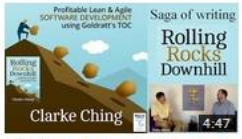
(En + Fr) Marris Consulting YouTube Channel
45 vues • il y a 4 semaines

(En) TOC to boost aero production (3 min. preview of …
37 vues • il y a 1 mois

(En) TOC to boost aero production (30 sec. preview of…
12 vues • il y a 1 mois

(En) Logical Thinking Process: 6-Day training in Paris
42 vues • il y a 1 mois

(En) Logical Thinking Process Course 2015 Participants …
57 vues • il y a 1 mois



(En) Clarke Ching "Rolling Rocks Downhill" book writing saga
39 vues • il y a 3 mois

(En) Executive Summary Tree (TOC / LTP) by Bill Dettmer
227 vues • il y a 3 mois

(En) TOC 5 Focusing Steps Revisited - Clarke Ching …
204 vues • il y a 3 mois

(En) Bill Dettmer introduction to Dec. 2014 Paris video sessions
54 vues • il y a 5 mois

(En) Logical Thinking Process training course June 2015 by …
106 vues • il y a 5 mois

(En) Bill Dettmer about Logical Thinking Process and change …
76 vues • il y a 5 mois

(Fr) Management de projets Chaîne Critique par Eric Robin …
337 vues • il y a 5 mois

(En) Bill Dettmer: "He Said, She Said" book review
55 vues • il y a 5 mois

(Fr) Schéma des cuves et 3 types de contraintes
447 vues • il y a 6 mois

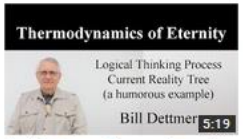
(En) Theory of…, Thinking Processes and Policy …
239 vues • il y a 6 mois

(Fr) Formation Théorie des Contraintes + Lean
208 vues • il y a 6 mois

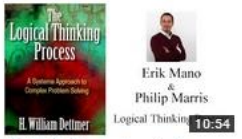
(Fr) Problèmes du management de projets par Eric Robin
665 vues • il y a 7 mois

(Fr) Management Par les Contraintes, TOC Lean et TLS
665 vues • il y a 7 mois

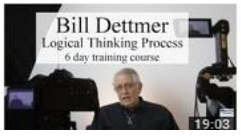
(En) Throughput Based Decision Making by Eli …
845 vues • il y a 7 mois



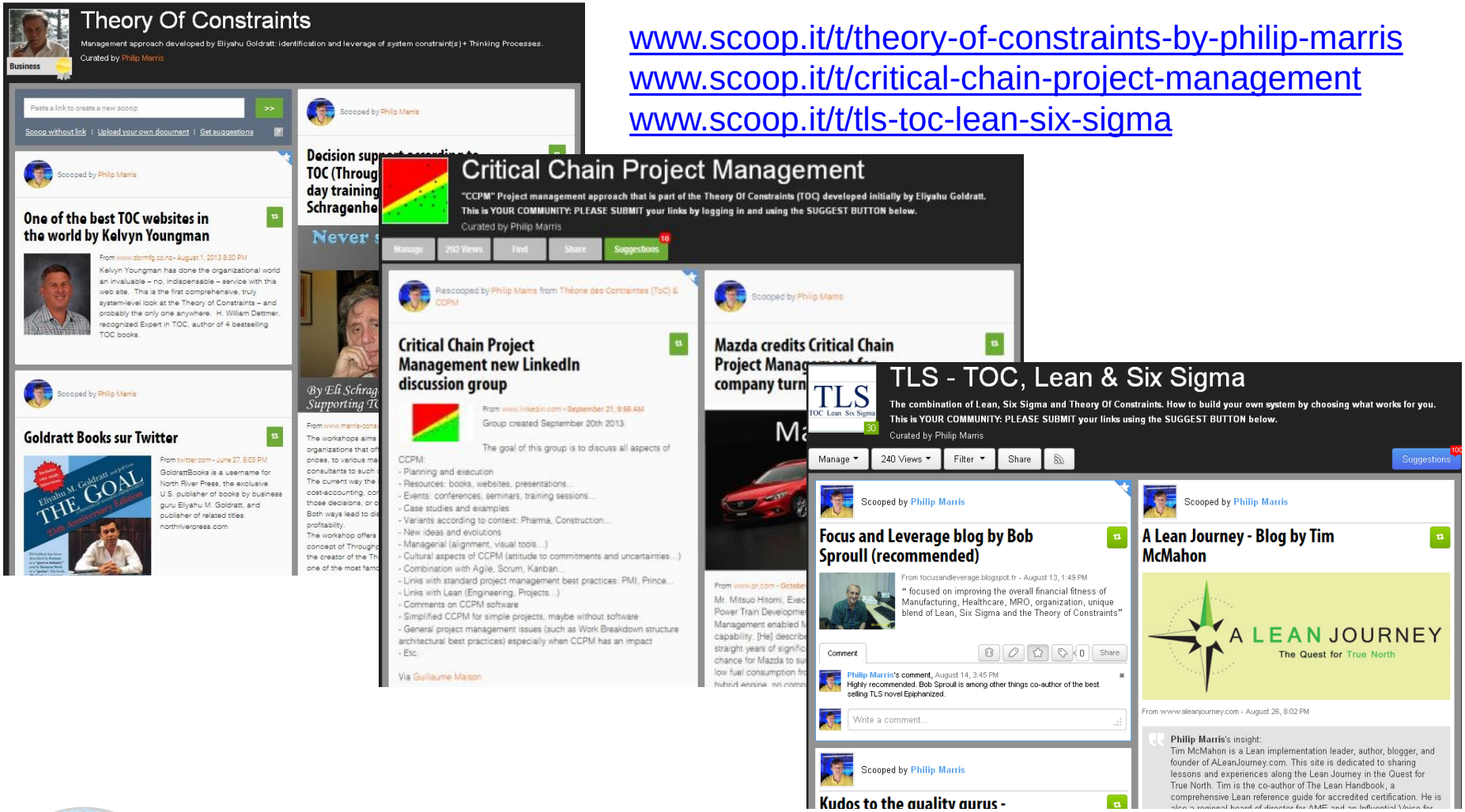
(En) Dettmer - Thermodynamics of Eternity - Thinking Process …
313 vues • il y a 8 mois



(En) Erik Mano - Logical Thinking Process
304 vues • il y a 8 mois



3 permanent news websites dedicated to the Theory Of Constraints, CCPM and TLS



www.scoop.it/t/theory-of-constraints-by-philip-marris
www.scoop.it/t/critical-chain-project-management
www.scoop.it/t/tls-toc-lean-six-sigma

Philip Marris
Biography

Philip Marris is CEO of Marris Consulting, a management consultancy focused on industrial operations based in Paris, France. Over 80% of the firm's projects are based on the Theory Of Constraints.

He is the author of the French reference book *Le management par les contraintes en gestion industrielle*. He is involved in the "TOC + Lean" movement and founder of the LinkedIn "TLS - TOC Lean & Six Sigma" group and 5 Scoop It TOC related information websites.

He has designed, sold and executed over 150 transformation projects.

He is a member of the board of the TOCICO French regional group and is active in increasing the awareness of TOC worldwide.

He started his TOC journey in 1986 when he joined Creative Output France and had the honor and pleasure of working with Eli Goldratt and Issi Pazgal.

Philip Marris was for many years in charge of Manufacturing Operations in large consulting firms.

He has over 29 years of experience in industry and in consulting. Philip Marris started his career as a production engineer in the steel industry. He is English and is bilingual and bi-cultural. He lives in Paris, France.

Full abstract
TOC to boost aeronautical manufacturing performance
Philip Marris

3 different cases will be presented; 3 different factories of large well known actors of the aeronautical industry. In all cases the Theory Of Constraints was the main guiding approach but blended into a Lean or Lean Six Sigma environment.

In factory A, the plant manager had read the Goal and already successfully applied TOC in a previous plant. The 400 person plant suffered from very poor due date performance, quality problems and very poor financial performance. SAP had been used to identify the bottleneck resources; 12 key expensive machines were thought to be the constraints. A 4 hour analysis on the shop floor showed that in fact the bottleneck was elsewhere; in the quality control department. Having identified the constraint it was them exploited. This increased the Throughput and the productivity of the whole factory by over 30% in less than 2 weeks. To reduce the excessive level of WIP the "2 for 1" rule was applied: a new Work Order could only be launched once 2 Work Orders had been completed. This generated a growing list of Work Orders whose launch was overdue. When there were too many, the wait times in the SAP ERP were reduced. The improvement process was to first improve the plant physically and then, afterwards, explain to the ERP what the improvements were. Other actions were: batch sizes were divided by 2, sub-contracted work was reintegrated, the priority system was redefined, the plant was reorganized, the assembly process was re-engineered for one piece flow … The delivery due date performance quickly went from 50% to 85% and the target is now 99%.

In factory B, a manager attended a 2 day course on the Theory Of Constraints in manufacturing and then went away and implemented it alone in his 50 person production unit. The due date performance went from 70% to 100.00% which had a strong impact on obtaining new sales with a major aircraft manufacturer. The production lead-times and the work in progress were divided by 2. Many other improvements were also made. The TOC system was then rolled out to the rest of the 300 person factory.

In factory C, TOC was injected into their pre-existing Lean Six Sigma management system. The management thought that they had identified the bottleneck but in fact the bottleneck was elsewhere. Once the real constraint had been identified it was properly exploited. As a result the plant's Throughput and productivity improved by 10% per month for 4 months in a row. In this period some sub-contractors became bottlenecks and this problem was resolved. A strong monthly hockey-stick phenomenon was eliminated. The "best" plant bottlenecks were then identified and the drum-buffer-rope system was applied to manage the flow of each of the 4 production channels.

To conclude the strengths of the Theory Of Constraints applied to these manufacturing environments will be summarized.

Marris Consulting
Over 150 assignments in over 10 years

Marris Consulting
Paris, France

- Marris Consulting has conducted over 150 engagements over the past 10 years, transforming industrial enterprises in France and around the world.
- Clients: ArcelorMittal, GSK (Glaxo Smith Kline), Valeo, Embraer, Safran, SNCF / French Railways, Veolia, Salzgitter Mannesmann, EADS, Aubert & Duval / Eramet, Autoliv, ABB, Man, Michelin, Bobst, Banque de France, DSS / Kaysersberg Packaging, etc. and over 50 Small & Medium Enterprises.
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- TOC manufacturing & CCPM websites (in French):
  - www.management-par-les-contraintes.com
  - www.chaine-critique.com
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