

DELIVER MORE PROJECTS: faster, better, and at lower cost.

EMBRAER'S CRITICAL CHAIN STORY

Mauricio Martins de Almeida Filho
Engineering VP, Commercial Aviation

CRITICAL CHAIN 2020

NOVEMBER 23 - 24, 2020





ABOUT EMBRAER

A global aerospace company headquartered in Brazil, Embraer has businesses in Commercial and Executive aviation, Defense & Security and Agricultural Aviation.

The company designs, develops, manufactures and markets aircraft and systems, providing Services & Support to customers' after-sales.

Since it was founded in 1969, Embraer has delivered more than 8,000 aircraft and is the leading manufacturer of commercial jets up to 150 seats.



PRESENTER'S BIO

Mauricio Almeida

Vice president of Engineering for Commercial Aviation, responsible for the development of the Ejets-E2 family of airplanes and the product modification and engineering support to all EMBRAER commercial airplanes in operation.

Joined Embraer in 1985 as an engineer and has occupied different leadership positions in engineering, product development and Programs.

Involvement with CCPM dates to 1998, when Embraer started applying its concepts in engineering projects. Since 2012 has been working to improve the implementation of CCPM for the multi-project product modification environment and to new aircraft developments. In this period also led the lean engineering workstream of EMBRAER excellence program.

Contact: malmeida@embraer.com.br



DELIVER MORE PROJECTS: faster, better, and at lower cost.

CONTENTS



Why TOC/CCPM

Implementation - History and
Results



WHY TOC/CCPM



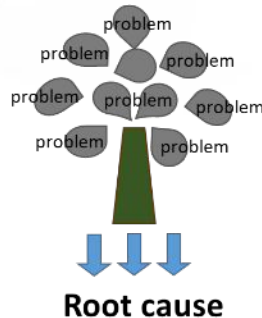
WHY TOC / CCPM

A holistic approach

“all complex systems are governed by inherent simplicity”

Cause and effect

A FEW points MUST be improved



“The chain is only as strong as its weakest link”



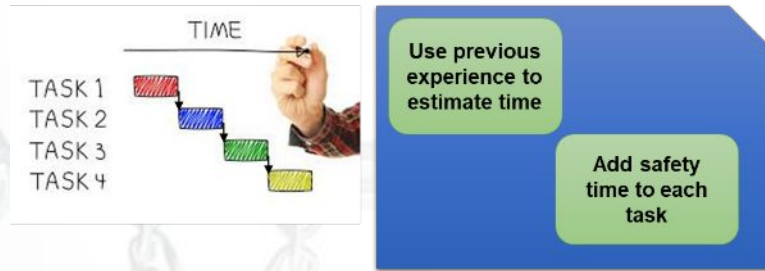
“Do what must be done”



WHY TOC / CCPM

It takes into account human behavior...

Time protection mechanism



Multitasking

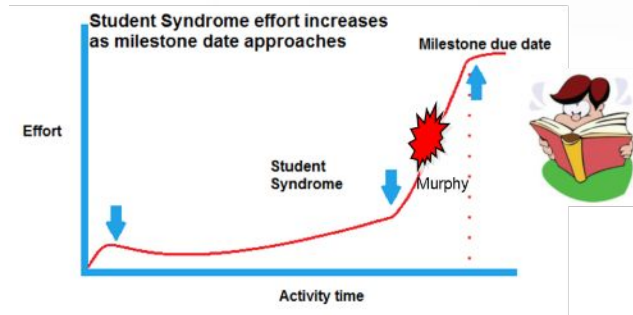


Parkinson's Law

"Work expands so as to fill the time available for its completion"



Student Syndrome



WHY TOC / CCPM

Uncertainties are a fact.



Murphy's Law:

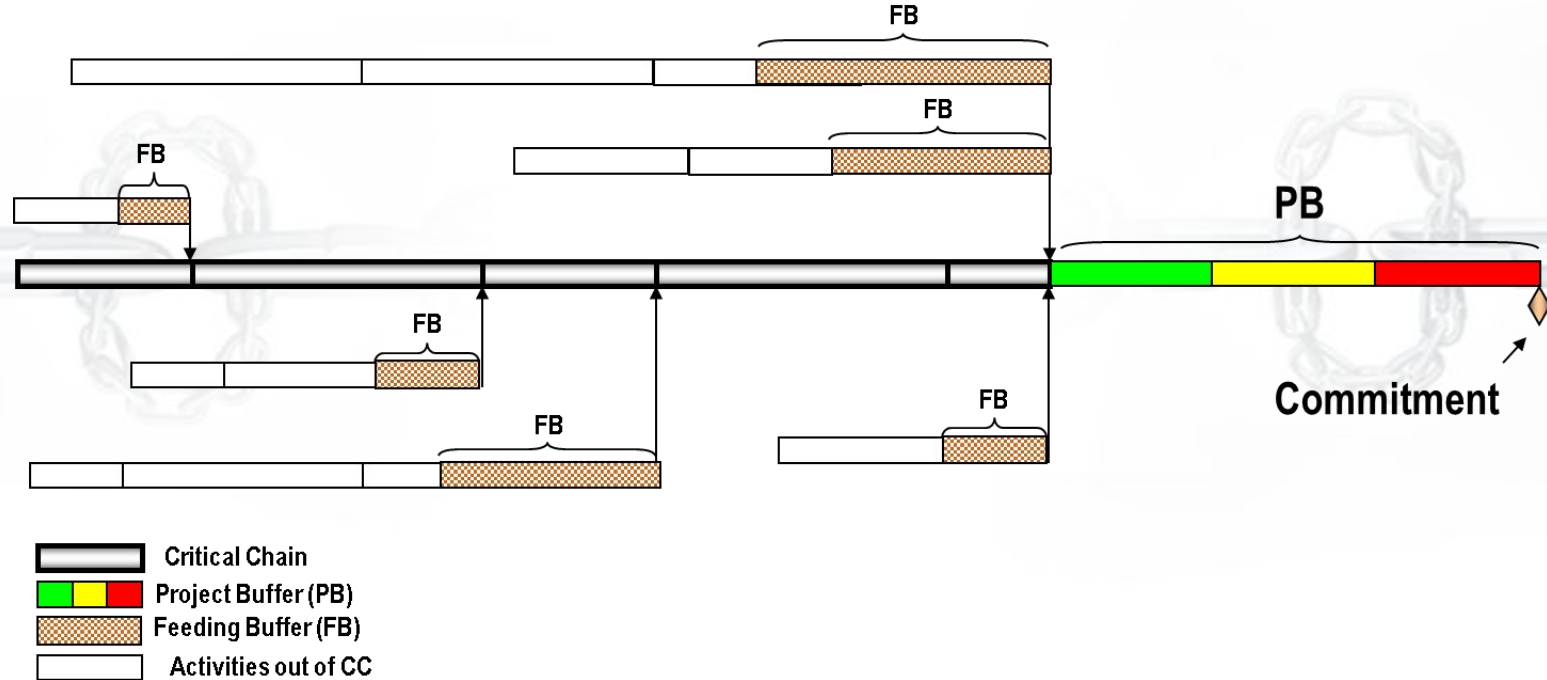
If anything can
go wrong, it
will!

At the worst
possible
moment...



WHY TOC / CCPM

A simple conceptual solution

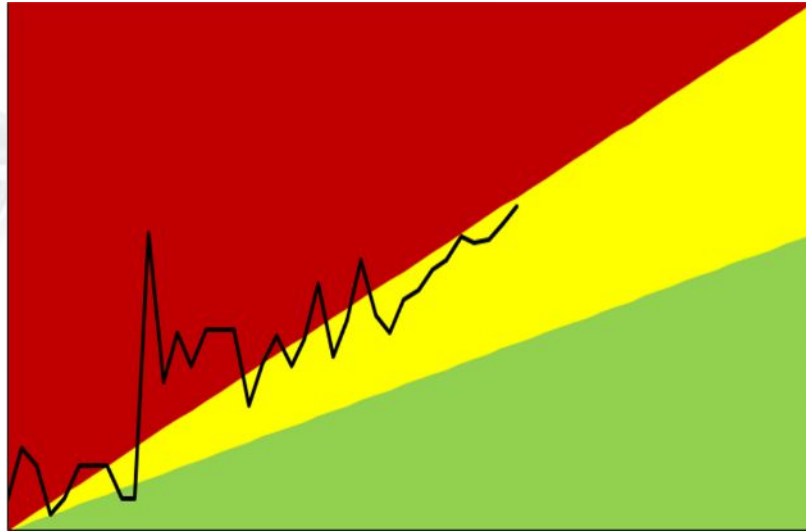


Buffers protect the constraint (the longest path) of the project.



WHY TOC / CCPM

A simple conceptual solution



KPI Status

Procedure



Monitoring



Risk management /
Prepare mitigation
plans



Solve issues /
Implement recovery
plans

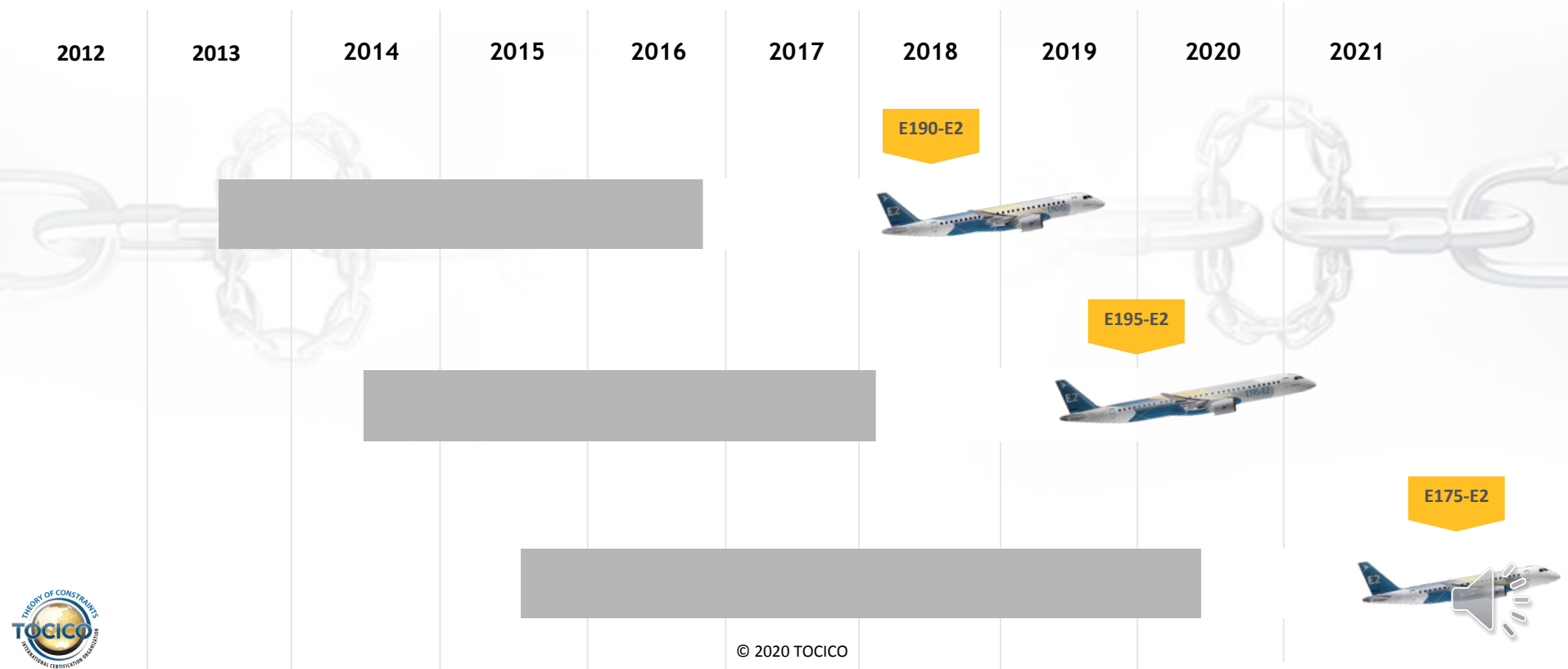
Act according to the buffer consumption.

© 2020 TOCICO



WHY TOC / CCPM

Buffer management protects the schedule without adding margin.



WHY TOC / CCPM

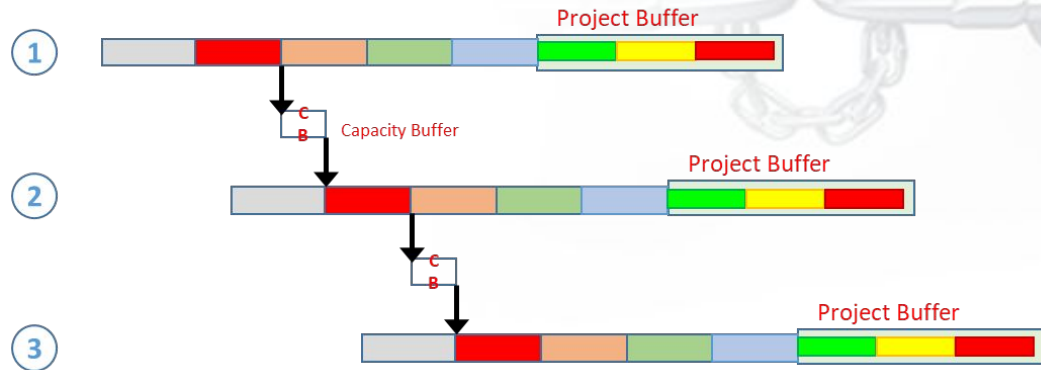
A solution for a single project or a portfolio of projects.

Capacity Constraint Resource – CCR

“The bottleneck that limits the throughput of the entire system.”

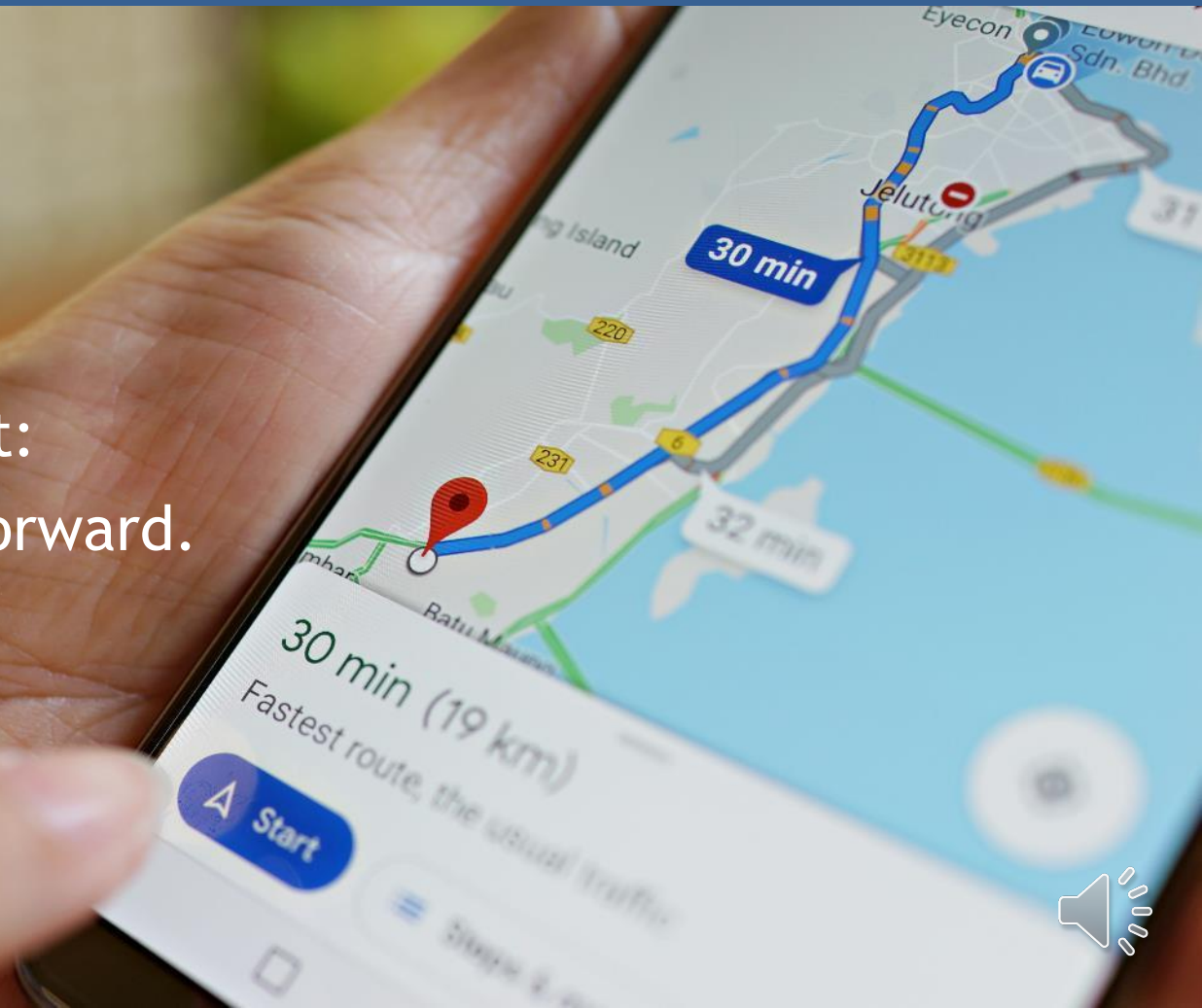


Subordinate project pipeline to CCR



WHY TOC / CCPM

A change of mindset:
FOCUS in the way forward.



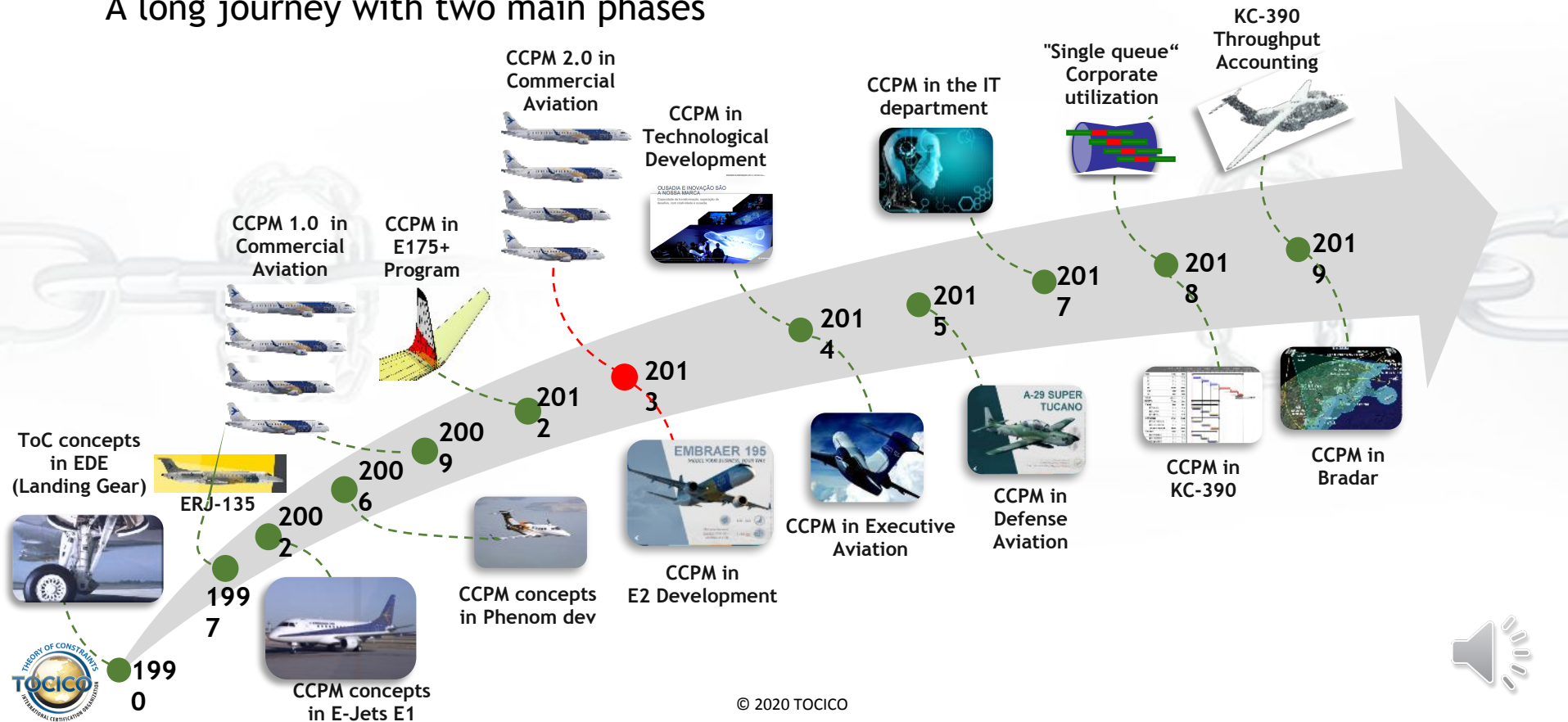


IMPLEMENTATION - HISTORY AND RESULTS



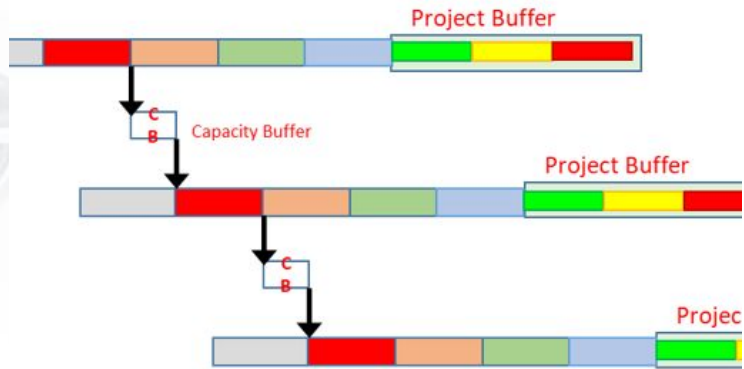
TOC / CCPM IMPLEMENTATION

A long journey with two main phases



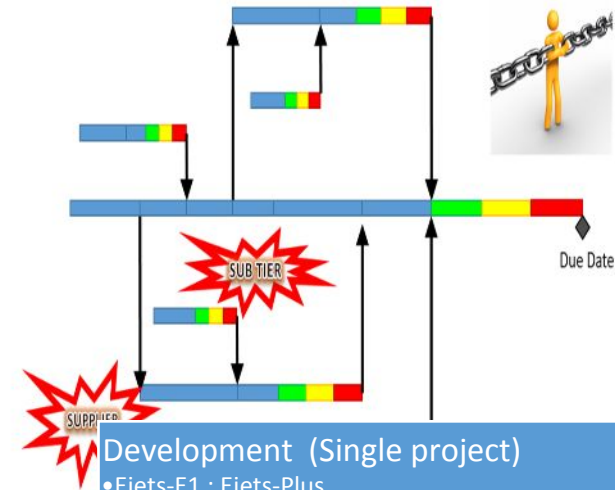
TOC / CCPM IMPLEMENTATION

Two types of applications



Series (Portfolio of projects)

- Commercial aviation
- Executive Jets



Development (Single project)

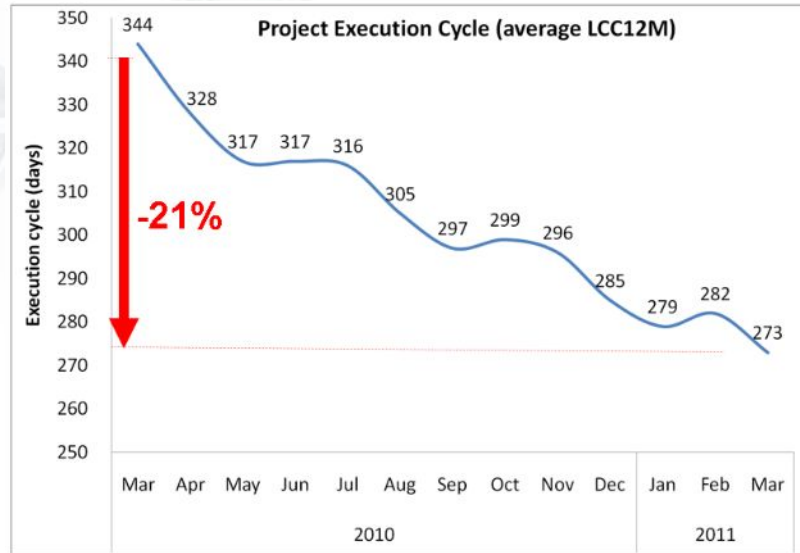
- Ejets-E1 ; Ejets-Plus
- Phenom; Legacy
- KC-390



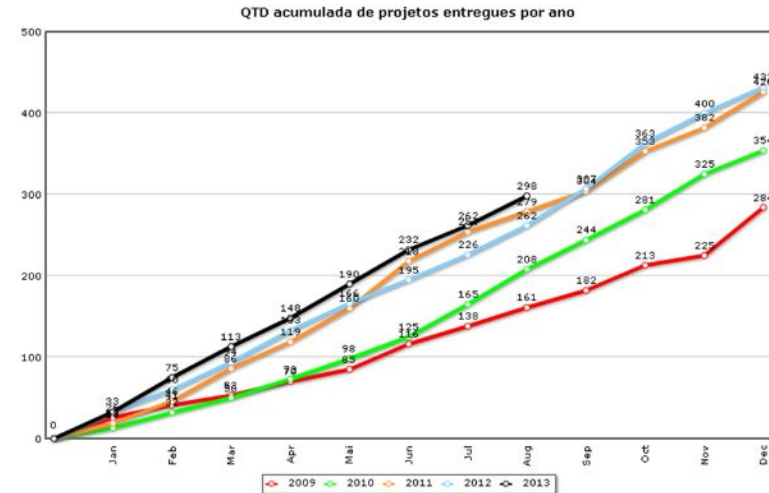
TOC / CCPM IMPLEMENTATION

Initial results (Series)

Cycle time

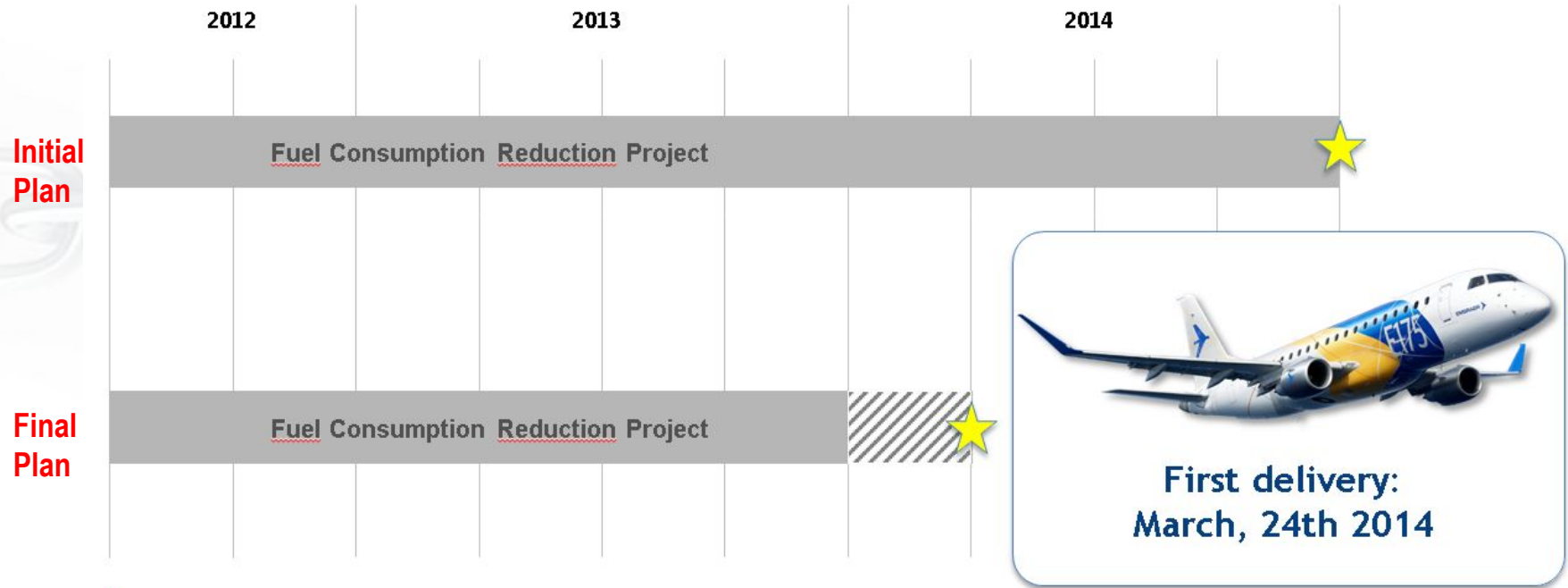


Throughput



TOC / CCPM IMPLEMENTATION

E-Jets Plus development results



TOC / CCPM IMPLEMENTATION

Development results



ERJ-135

ERJ-190/195/175

Phenom 300

E-Jets Plus

ERJ-170

Phenom 100

Legacy 500

Something missing for the first airplane of a family....

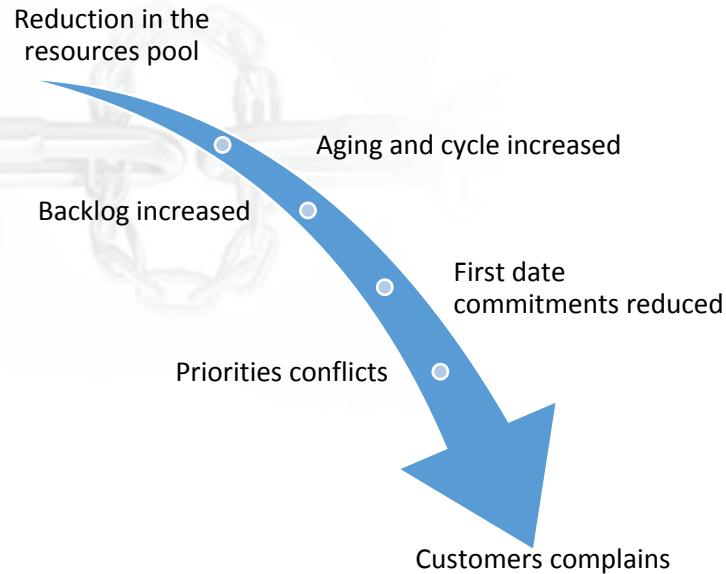


TOC / CCPM IMPLEMENTATION

BUT in 2013 in Commercial Aviation...

Series

Development

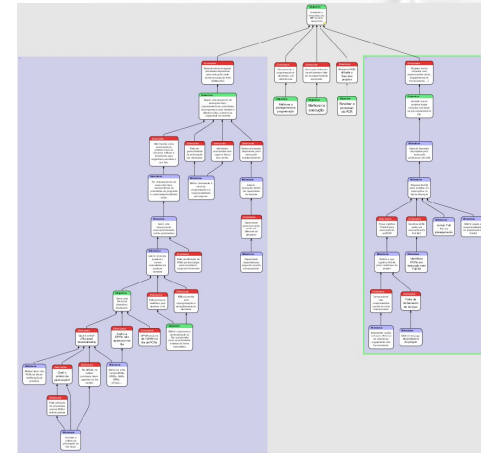
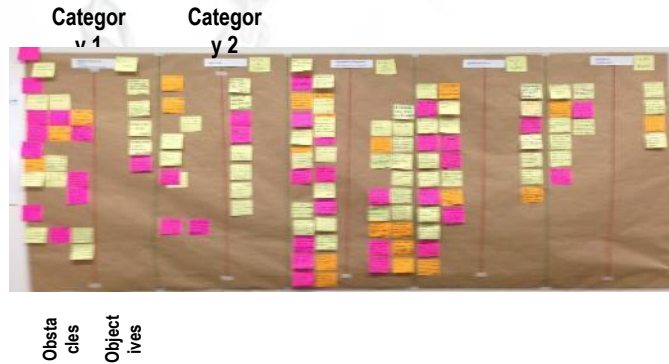


- 190-E2 planning challenges:
- How to expand the buffer management process to all work packages, in a manageable way?



TOC / CCPM IMPLEMENTATION

Improvement plan

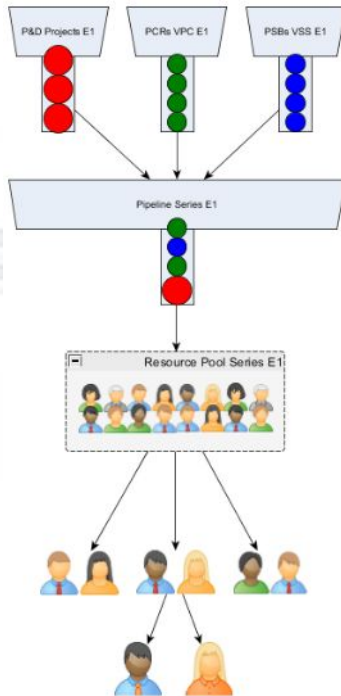


Tools: Current reality tree, Pre-requirements tree, Kaizens, Strategy and Tactics tree, ...



TOC / CCPM IMPLEMENTATION

General concept for planning, execution and management

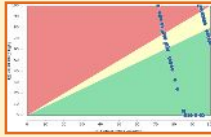


FLOWDOWN



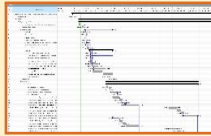
Level 1 – Business Unit

- BU “Contracted Scope”
- Master Phase Plan , Project Progress



Level 2 – Program

- Projects portfolio
- Fever Chart, Commitment pipeline



Level 3 – Project / Work package

- Project plan
- Buffer consumption, critical path



Level 4 – Task

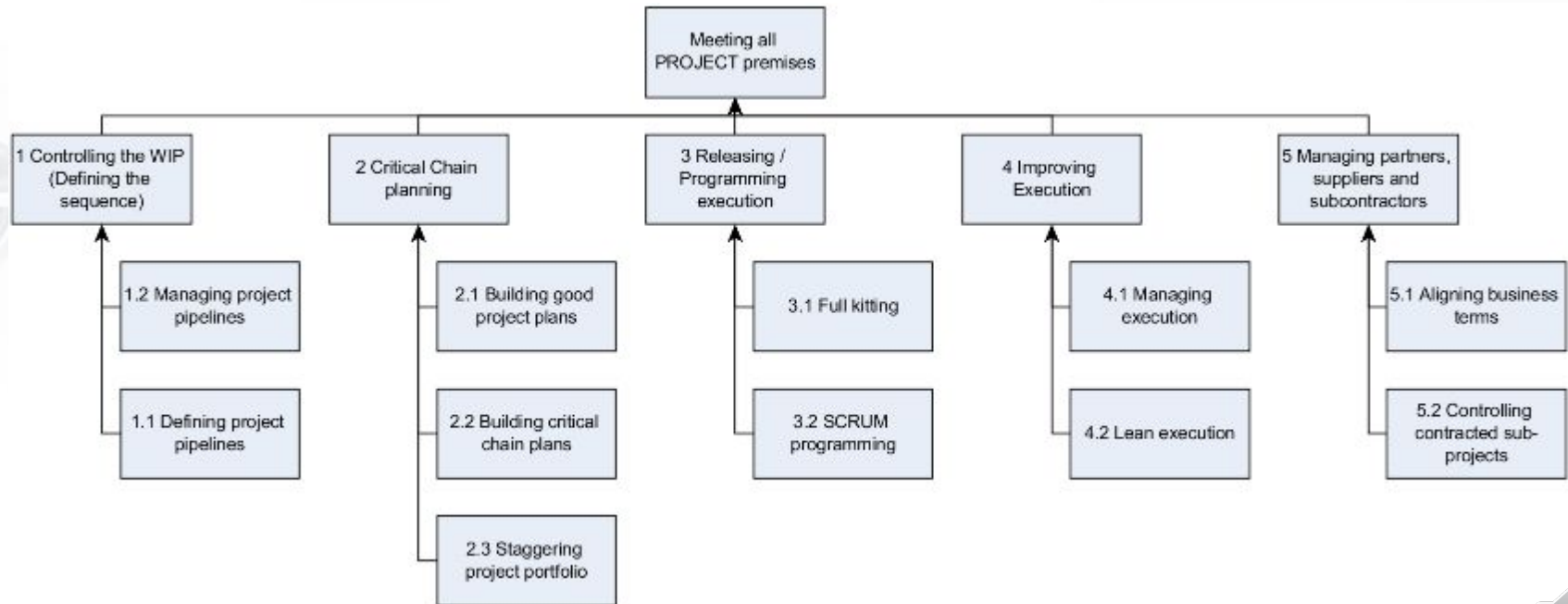
- Tasks programming
- Burn-down (Scrum or Kanban)

FEEDBACK

Planning and programming must flow the sequence from the portfolio to the responsible for execution

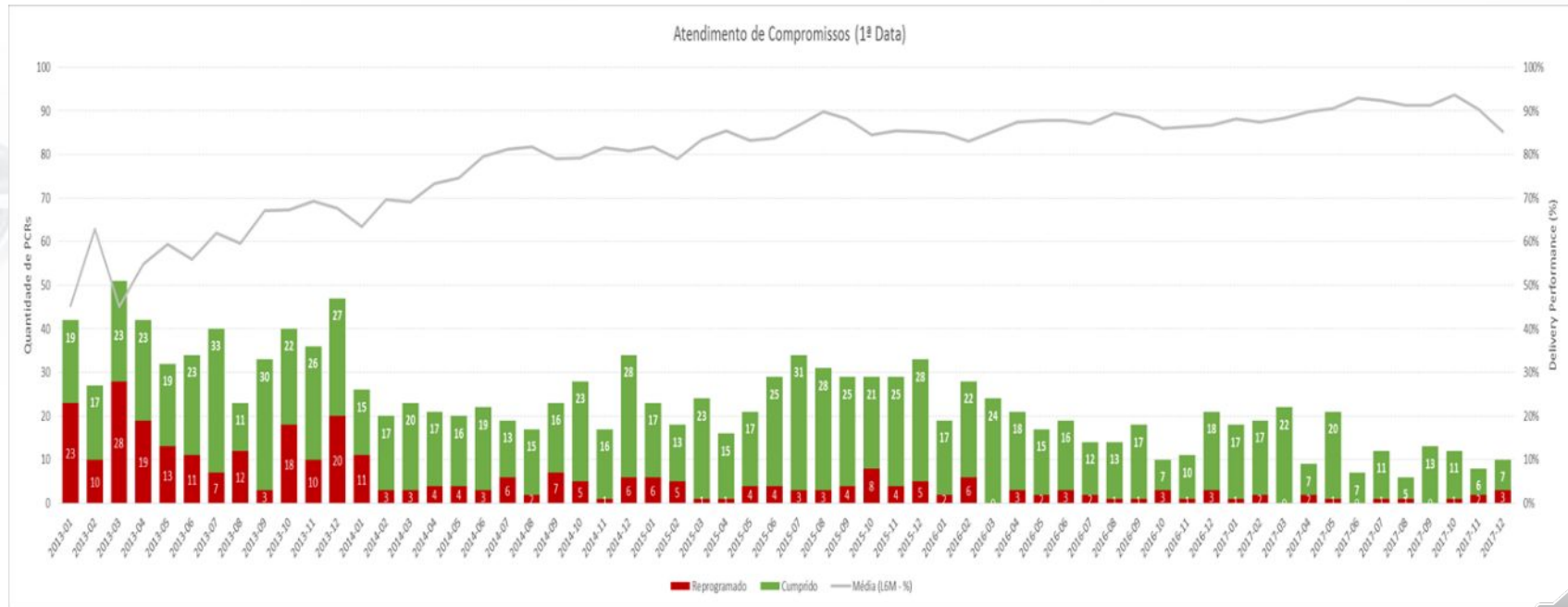
TOC / CCPM IMPLEMENTATION

Strategy and Tactics Tree for continuous improvement



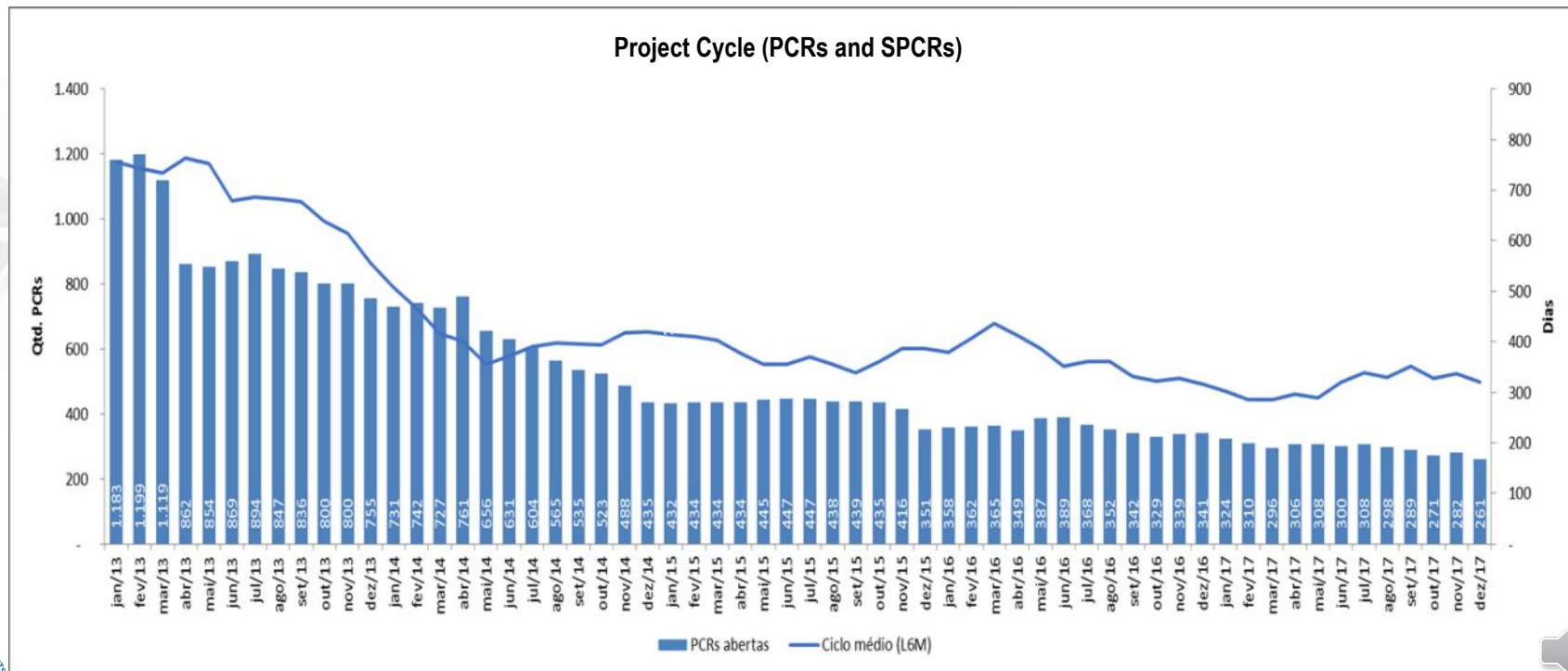
TOC / CCPM IMPLEMENTATION

First date commitments



TOC / CCPM IMPLEMENTATION

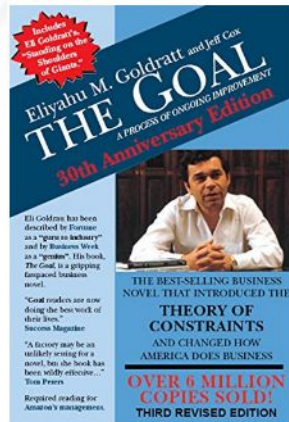
Cycle



TOC / CCPM IMPLEMENTATION

Application of the series model to development

- Series: A portfolio of independent projects sharing resources
- Development: A portfolio of projects with same commitment date, sharing inputs and outputs.



"The idea of this hike is not to see who can get there the fastest. The idea is to get there together. We're not a bunch of individuals out here. We're a team. And the team does not arrive in camp until all of us arrive in camp."

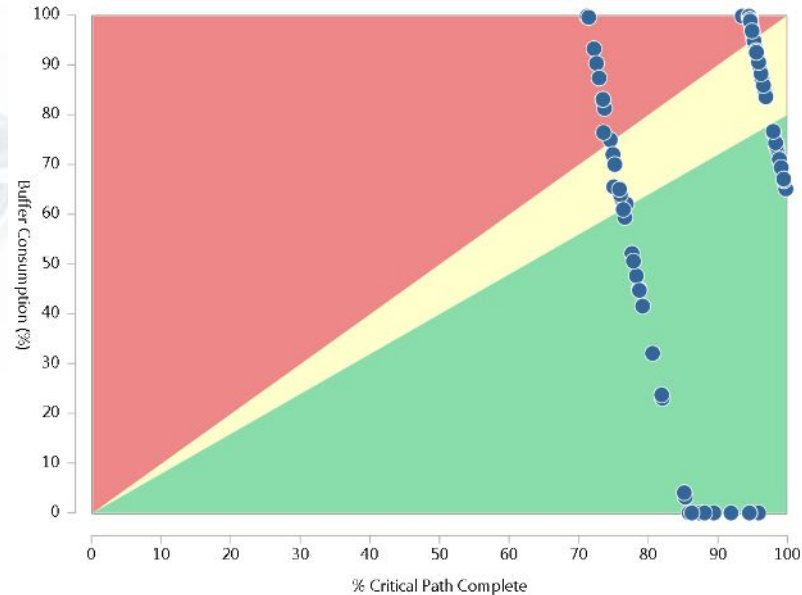
The Goal ([Eliyahu Goldratt](#)) - Chapter 15





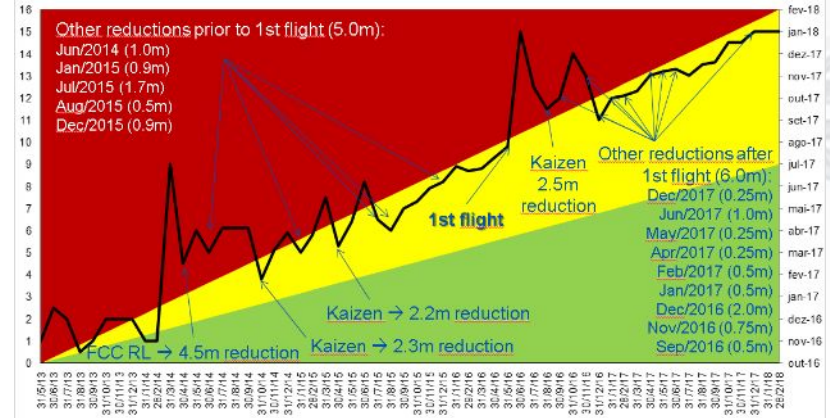
TOC / CCPM IMPLEMENTATION

Portfolio and critical project view



Schedule Management LL – TC (Moog)

EMBRAER
Commercial Aviation

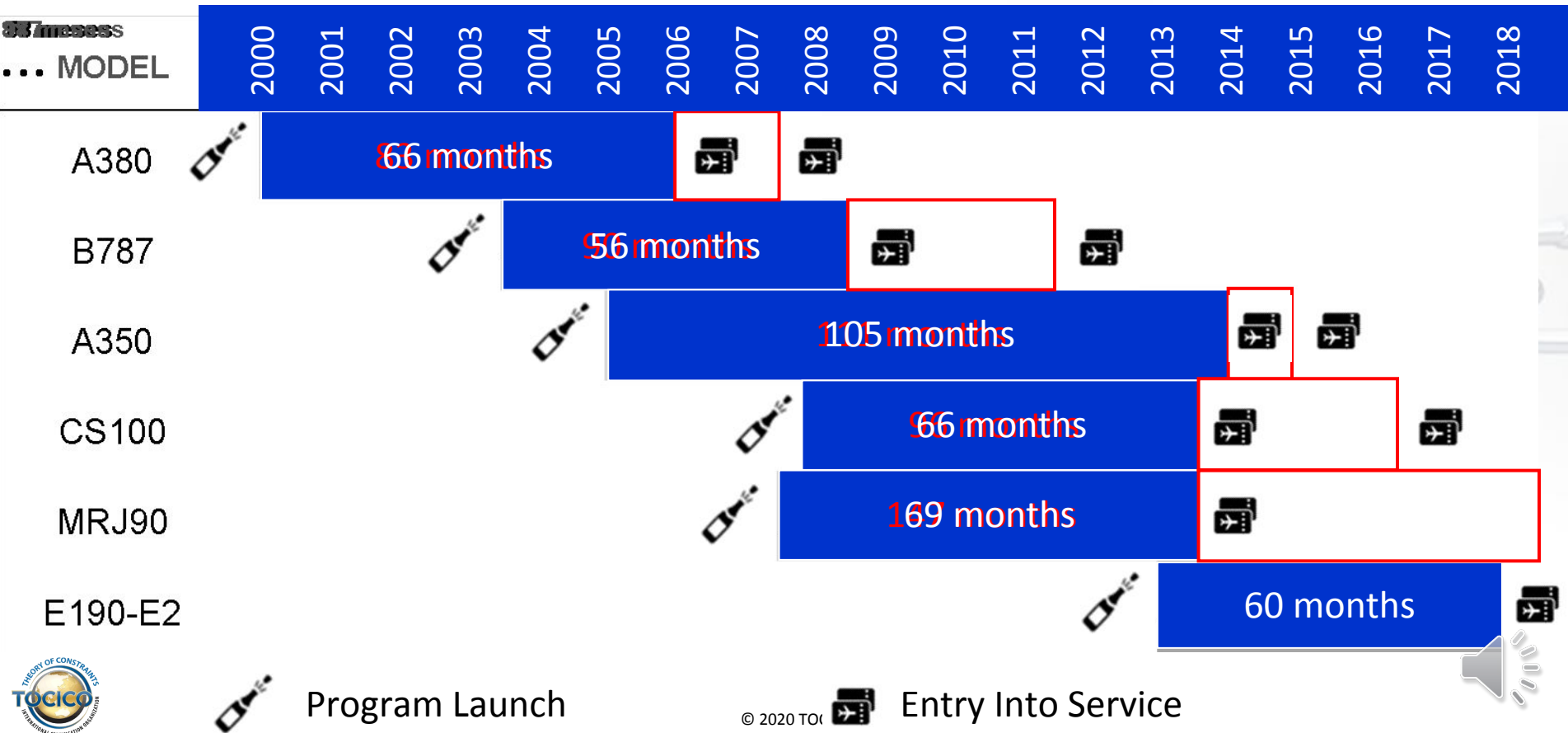


Total schedule reduction of more than 22.5 months →
Type Certificate would be Jan/2020

This information is property of Embraer and cannot be used or reproduced without written permission.



190-E2 DEVELOPMENT



TOC / CCPM IMPLEMENTATION

190-E2 and 195-E2 Triple Certification > on time, over spec and under budget

190-E2: February 29th, 2018



E190-E2 EXCEEDING TARGETS

EVEN BETTER THAN ORIGINAL SPEC



195-E2: April 15th, 2019



E195-E2 EXCEEDING TARGETS

EVEN BETTER THAN ORIGINAL SPEC



TOC / CCPM IMPLEMENTATION

Project management achievements



2018 MundoPM Project of the Year (Brazil)



2019 Aviation Week Laureate & Grand Laureate Awards



2019 ToC Process Ongoing Improvement Award



2019 PMI Global Project of the Year



DELIVER MORE PROJECTS: faster, better, and at lower cost.



THANK YOU

embraer.com

[f](#) [@](#) [v](#) [t](#) [in](#) [w](#) /embraer



©Copyright 2020 TOCICO. All rights reserved.

No part of this recording may be reproduced, distributed, or transmitted in any form by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the TOCICO.

Except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law. Any claim, controversy, dispute or cause of action shall be governed by construed in accordance with the Laws of the United States of America and the State of Washington.

For permission please contact the TOCICO at admin@tocico.org