

## *Special Lecture Series on System Integration III*

*Module:*

# **Project and Program Management:** overview and current challenges in the Aeronautic Sector



MITAC Academy

***Intensive Short Course in Collaborative Program with  
MITAC Academy – September 2021***

***Prof. Artur Henrique Moellmann, Ph.D.***

*Federal Institute of Education, Science and Technology – Brazil  
MITAC Academy advisor*

© MOELLMANN A.H.

This workshop was developed based on recognized bibliographical references and the author's professional and academic experience, in order to lecturing on behalf of the MITAC Academy Program. Neither this document, nor any information in it, shall be used, reproduced, or disclosed to third parties without the prior written consent of MITAC or the author. Any permitted reproduction of this document, in whole or in part, shall include this notice.

### Mission:

- Draw strategies more closely **creating** a **virtuous** and **robust** body of **professionals** fitted in to face the **global challenges** and **competitiveness** presented in **worldwide aerospace sector**.

### Future **Vision** of MITAC Academy Program:

- Support the establishment of a **World Class Aviation Cluster** in Japan.
- Be a **Global** and **Sustainable Entity**.
- Seed the remarkable **Japanese** features of **Quality**, **Efficiency** and **Harmony** into Aerospace in Japan.

### Challenge:

- Propose a new **Human Resource Development Strategy** in Japan Aeronautics to be **conducted** in **parallel** with **current needs in development**:
  - ✓ Collaboration from Universities with Professors, Researchers and Facilities.
  - ✓ Volunteering from experienced Japanese and Global aviation experts.
  - ✓ Transfer of knowledge to young new-graduates engineers, as well as employees.

The Nagoya University & The MITAC Academy Program collaboration is part of several educational initiatives to create a long-term future for the establishment of the aeronautic industry in Japan. Therefore, one of the most important steps for this transformation is the development of human resources, as well as to attract more young professionals.

The purpose is also give to young professionals some practical experience ideas when they enter the workforce and start their new jobs, leveling the knowledge towards to the worldwide aerospace environment curricula, covering subjects suitable for real life in commercial aircraft development, like aerodynamics, propulsion, structures, control, system design, system integration, safety, certification, human factors, flight tests, supply chain management, project management, marketing & business aviation, among others.

In that way, the Nagoya University and MITAC Academy collaboration is an experimental architecture involving Mitsubishi's aeronautical professionals and experts, as well as new-graduates, students and professors.

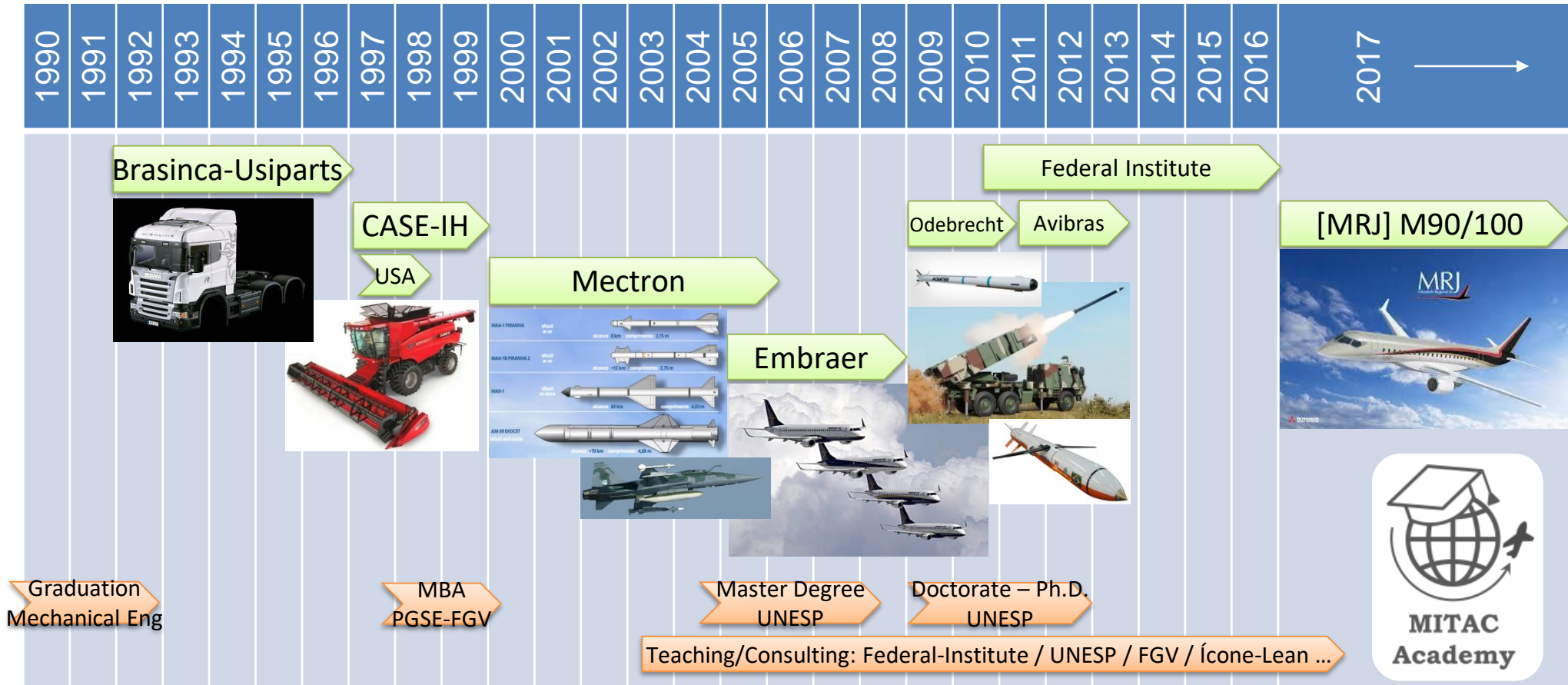
It's also important to emphasize that this collaboration is very unusual and special for Japan, and stakeholders have been recognizing the huge efforts of Mitsubishi's employees and specialists, as well as Nagoya University professors, providing highly motivated and enthusiastic young partners for the program.

## Prof. Artur Henrique Moellmann, Ph.D.

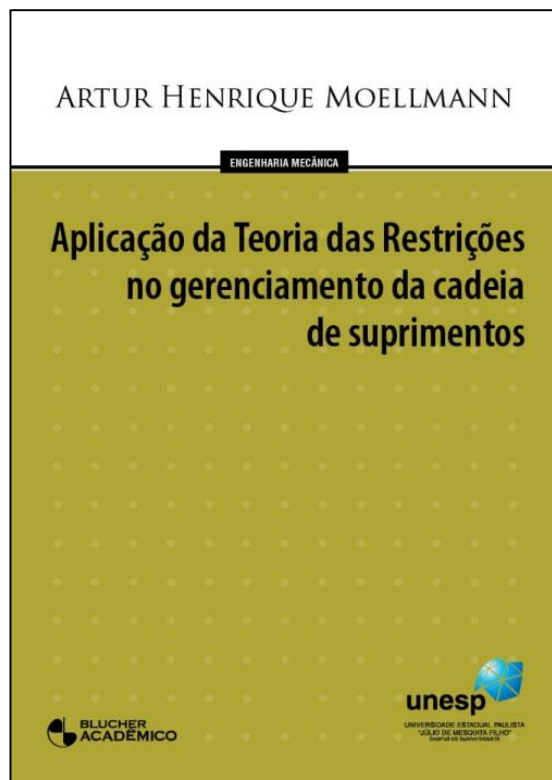
- *Planning Manager* at aerospace companies in Brazil and Japan.
- *MITAC Academy advisor* for Educational and Internship Programs.
- *Professor* of the Federal Institute of Education, Science and Technology – Brazil.
- *Operations Management* Ph.D. and M.Sc.
- MBA in *Entrepreneurial Management*.
- *Theory of Constraints* and *Critical Chain Project Management* expert.
- Black-Belt *Lean-Six-Sigma*.
- *Microsoft Project Professional & Server* expert.
- *Licensed SCRUM Product Owner* by SCRUMINC Japan.
- Consultant in *Multiproject Management*, *Operations Management*, *Supply Chain Management* and *Lean Enterprise*.

26 years of experience in the *automotive, heavy equipment, agricultural machines, electronics, aviation, aerospace and defense, performing in planning, operations management, project management, SCM/logistics, quality and finance.*

### Professional Timeline



#### ***Book: Application of the Theory of Constraints to Supply Chain Management***



MOELLMANN, A. H. ***Application of the Theory of Constraints to Supply Chain Management.*** São Paulo: Blucher Acadêmico, 2008. ISBN 978-85-61209-57-5.

#### **ABSTRACT**

This research presents a real application of the Theory of Constraints (TOC) to the management of a supply-chain, in order to show how this methodology can introduce important improvements to the entire supplying system's performance. These improvements are achieved by decreasing the overall inventory levels, concurrently reducing losses of sales due to lack of goods at sales points (end-customers). The main concepts of TOC, as the thinking process, the drum-buffer-rope scheduling (DBR) and the simplified-DBR, were adapted from the manufacturing environment to a practical use in a supply-chain, providing a better perception of the main dilemmas that constrain the performance of the distribution system. The comprehension of this context enables to achieve a balance between the global gains of Supply-Chain against each suppliers' earnings. Moreover, the vendor-managed inventory (VMI) and the business-to-business (B2B) are strengthened when committed with the TOC process, building a robust system's performance and decreasing, even more, the inventory levels, by minimizing the bullwhip effect. A practical application is presented to evidence the feasibility and the benefits of this proposal, in which the CIS-ERP (Customer Integrated System ERP) run its logistic module integrating VMI to TOC and B2B through the internet. This model operates as an advanced planning and scheduling system (APS), sharing the entire data flow among ERPs from suppliers to the customers.

**KEYWORDS:** Theory of Constraints. Supply Chain Management. Vendor-Managed Inventory. Business-to-Business.

***Doctorate Thesis:***  
***Lean model of Multiproject***  
***Management based on***  
***Critical Chain.***

MOELLMANN, A.H. ***Lean model of Multiproject Management based on Critical Chain.*** Thesis (Stricto Sensu Ph.D.) – Doctorate in Operations Engineering: São Paulo State University, 2013.

#### ABSTRACT

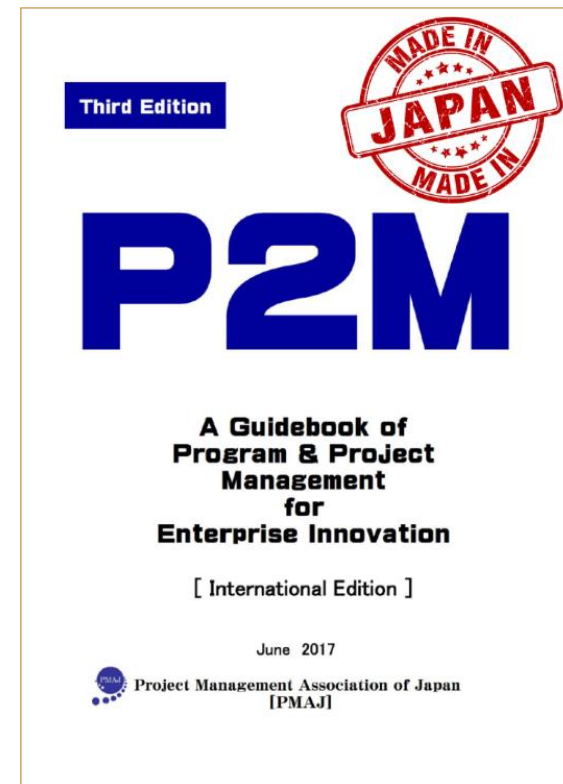
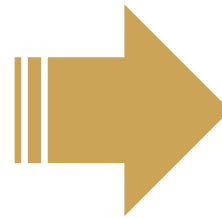
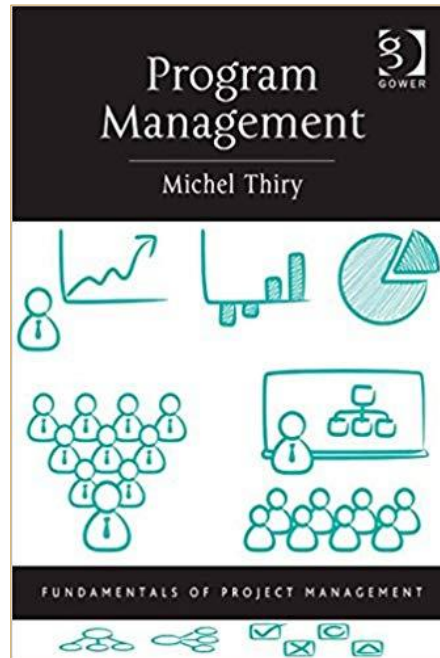
This work aims to present a proposed model of management in environments with multiple simultaneous projects based on Critical Chain (CC) method, also showing how its principles can be complemented with the assumptions of the Lean Product Development System (LPDS), both to the planning as well as management of a project portfolio. This can be achieved by prioritizing and sequencing projects in the planning phase of a company's portfolio, applying the leveling according to the capacity of the constrained and strategic resources, in order to minimize resources' overload and, moreover, reducing waste and variability during the development processes. In addition to this, a proposal for a CC-LPDS model is presented, scaling the stages from portfolio planning to the phase of management and system control, providing a discussion of scenarios, and also emerging delimitations for the application. Following, this research uses the Monte Carlo Simulation in order to quantitatively demonstrate the results of the Critical Chain solution in terms of schedule performance for a hypothetical portfolio of projects, implying possible similar results to the reality of multiproject environments. Finally, there are possible prospects contributions, suggesting future research themes added to other management models.

**KEYWORDS:** Project Portfolio Management. Multiproject Management. Critical Chain. Lean Development. Monte Carlo Simulation.



- THIRY, M. **Program Management – Second Edition**. Farnham: Gower Publishing Limited, 2015.
- PMAJ – Project Management Association of Japan. **P2M: a Guide of Program and Project Management for Enterprise Innovation [International Edition] – Third Edition**. Tokyo: Cyber Publishing Center, Inc., 2017.
- MOELLMANN, A.H. **Lean model of Multiproject Management based on Critical Chain**. Thesis (*Stricto Sensu Ph.D.*) – Doctorate in Operations Engineering: São Paulo State University, 2013.
- ALTFELD, H.-H. **Commercial Aircraft Projects: managing the development of highly complex products**. Abingdon: Routledge, 2010.
- COOLEY, W.T.; RUHM, B.C. **A Guide for DoD Program Managers: 80 percent of what Department of Defense Program Managers need to know to run an effective and efficient program**. Fort Belvoir: Defense Acquisition University Press, 2014.
- BREUHAUS, R.S., FOWLER, K.R., ZANATTA, J.J. **Innovative Aspects of the Boeing 777 Development Program**. Seattle: Boeing Commercial Airplane Group, 1996.
- Association for Project Management – APM. **The Scheduling Maturity Model Guide**. Princes Risborough: Association for Project Management, 2012.
- AEROSPACE RECOMMENDED PRACTICE **SAE ARP4754 – Rev. A. (R) Guidelines for Development of Civil Aircraft and Systems**. Copyright © 2010 SAE International.
- PMI – Project Management Institute. **The Standard for Program Management – Fifth Edition**. Newton Square: Project Management Institute, Inc., 2013.
- KISHIRA, Y. **WA: transformation management by harmony**. Great Barrington: North River Press, 2009.
- RICO, D.F. **Lean and Agile Project Management: for Large Programs and Projects**. Lecture Notes in Business Information Processing, 65 LNBIP, pp. 37-43, 2010.





“I would particularly like to recognise the contribution of **Motoh Shimizu** ... **Motoh shared his thoughts in multiple face-to-face and virtual discussions about the difference of program management approaches in Japan and the Western world** and enabled me to use some of his ideas and concepts in this book.” *[the Author]*

“Each program management standard of **North America, Europe and Japan** has a **different approach** to overcome such **difficulties based on each business cultural background**. The author has made a thorough **analysis of these diverse standards** and **presents common and essential perspectives** thanks to his long experience and deep insights on the subject.” *[Motoh Shimizu, member, The Engineering Academy of Japan; Nippon Institute of Technology, Japan]*

# MITAC-ACADEMY PROGRAM: PROJECT AND PROGRAM MANAGEMENT – SUMMARY

---

## Topics:

- *Benchmarking*
- *Part 1 – Introduction to PROJECT Management (overview).*
- *Part 2 – From PROJECT to PROGRAM Management (includes: Portfolio and Multiproject).*
- *Part3 – Trends in Project and Program Management:*
  - *Critical Chain Project Management.*
  - *Agile Project Management – SCRUM.*
- *Part 4 – Case Studies in Aerospace.*

## *Special Lecture Series on System Integration III*

### Project and Program Management

# Benchmarking



MITAC Academy

***Intensive Short Course in Collaborative Program with  
MITAC Academy – September 2021***

***Prof. Artur Henrique Moellmann, Ph.D.***

*Federal Institute of Education, Science and Technology – Brazil  
MITAC Academy advisor*

© MOELLMANN A.H.

This workshop was developed based on recognized bibliographical references and the author's professional and academic experience, in order to lecturing on behalf of the MITAC Academy Program. Neither this document, nor any information in it, shall be used, reproduced, or disclosed to third parties without the prior written consent of MITAC or the author. Any permitted reproduction of this document, in whole or in part, shall include this notice.

# MITAC-ACADEMY PROGRAM: PROJECT AND PROGRAM MANAGEMENT – BENCHMARKING

10/09/2019

## Embraer's E190-E2 Program Named 2019 PMI Project of the Year

- *extremely complex program.*
- *new airplane.*
- *new production system.*
- *new and more connected airplane and customer support.*
- *new global supply chain spread throughout the US, Brazil, Europe and Asia.*



**Remarkably First Flight:** max mach/speed/altitude, FBW in normal mode.

**Time to TC (E2-190):** Jun-2013 to Feb-2018 (1<sup>st</sup> complex aircraft program to simultaneously receive FAA/EASA/ANAC **triple certification**). 1<sup>st</sup> **delivery:** Apr-2019.

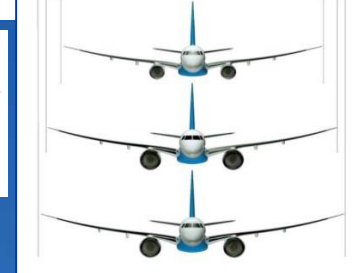
**Investment:** USD 1.7 billion (170/190/195).

Program developed **ahead** of the original **schedule**, under **budget** and better than the original and very competitive spec, using innovative program management model.

# MITAC-ACADEMY PROGRAM: PROJECT AND PROGRAM MANAGEMENT – **BENCHMARKING**

E-JETS E2 OPTIMIZED WING  
FOR EACH AIRCRAFT

115 ft 2 in  
110 ft 7 in  
103 ft



A220 100/300

115 ft 2 in



## A NEW DESIGN ON A PROVEN PLATFORM

AVIONICS

FUSELAGE

NEW INTERIOR

NEW WING

NEW STABILIZER

LANDING GEAR

4<sup>TH</sup> GEN FULL FLY-BY-WIRE

NEW ENGINE

AIRCRAFT SYSTEMS

PILOT COMMONALITY

MINIMIZING TRAINING  
COSTS



Sources:

EmbraerCommercialAviation.com

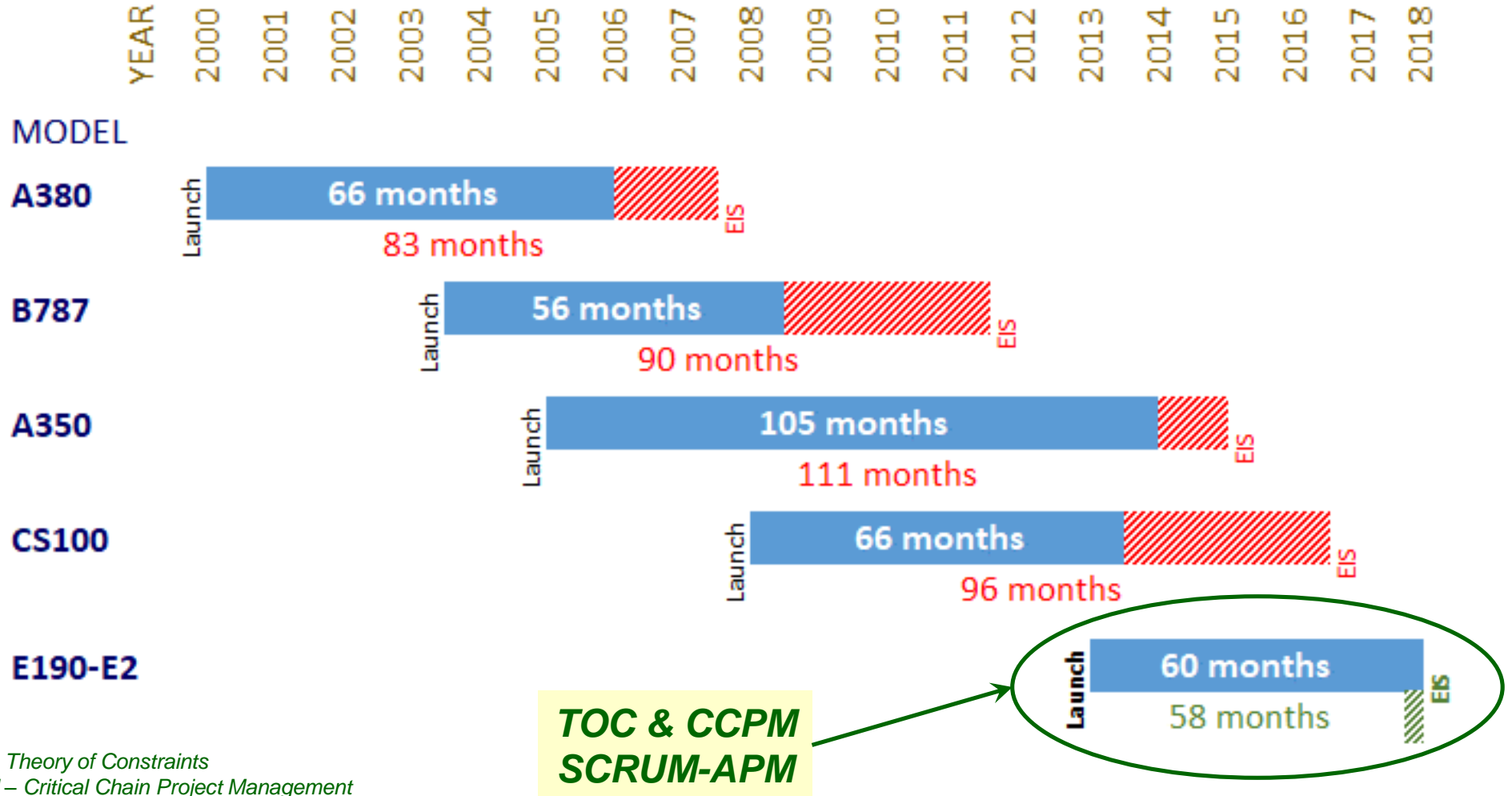
airlinereporter.com

<https://airwaysmag.com/manufacture/e195-e2-world-tour>



# MITAC-ACADEMY PROGRAM: PROJECT AND PROGRAM MANAGEMENT – **BENCHMARKING**

## Time-to-Market:



Source: <https://www.tocico.org>

## *Special Lecture Series on System Integration III*

### Project and Program Management – Part 1

# Introduction to **PROJECT** Management (overview)



MITAC Academy

***Intensive Short Course in Collaborative Program with  
MITAC Academy – September 2021***

***Prof. Artur Henrique Moellmann, Ph.D.***

*Federal Institute of Education, Science and Technology – Brazil  
MITAC Academy advisor*

© MOELLMANN A.H.

This workshop was developed based on recognized bibliographical references and the author's professional and academic experience, in order to lecturing on behalf of the MITAC Academy Program. Neither this document, nor any information in it, shall be used, reproduced, or disclosed to third parties without the prior written consent of MITAC or the author. Any permitted reproduction of this document, in whole or in part, shall include this notice.



# MITAC-ACADEMY PROGRAM:

## INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

### Topics:

- *Definition.*
- *Organizational Influences on Project Management.*
- *PMI – Project Management Institute.*
- *©2017 PMI (PMBOK® Guide 6thed.) – Project Management Body of Knowledge.*
- *The Project Triangle (Triple Constraints):*
  - *Project Scope Management.*
  - *Project Schedule Management (Time and Resources).*
  - *Project Cost Management:*
    - *Earned Value Analysis – EVA.*
- *Project Risk Management.*

## Definition:

### ***What is a Project?***

*“a temporary endeavor undertaken to create a unique product or service”*

“**temporary**: every project has an end date”

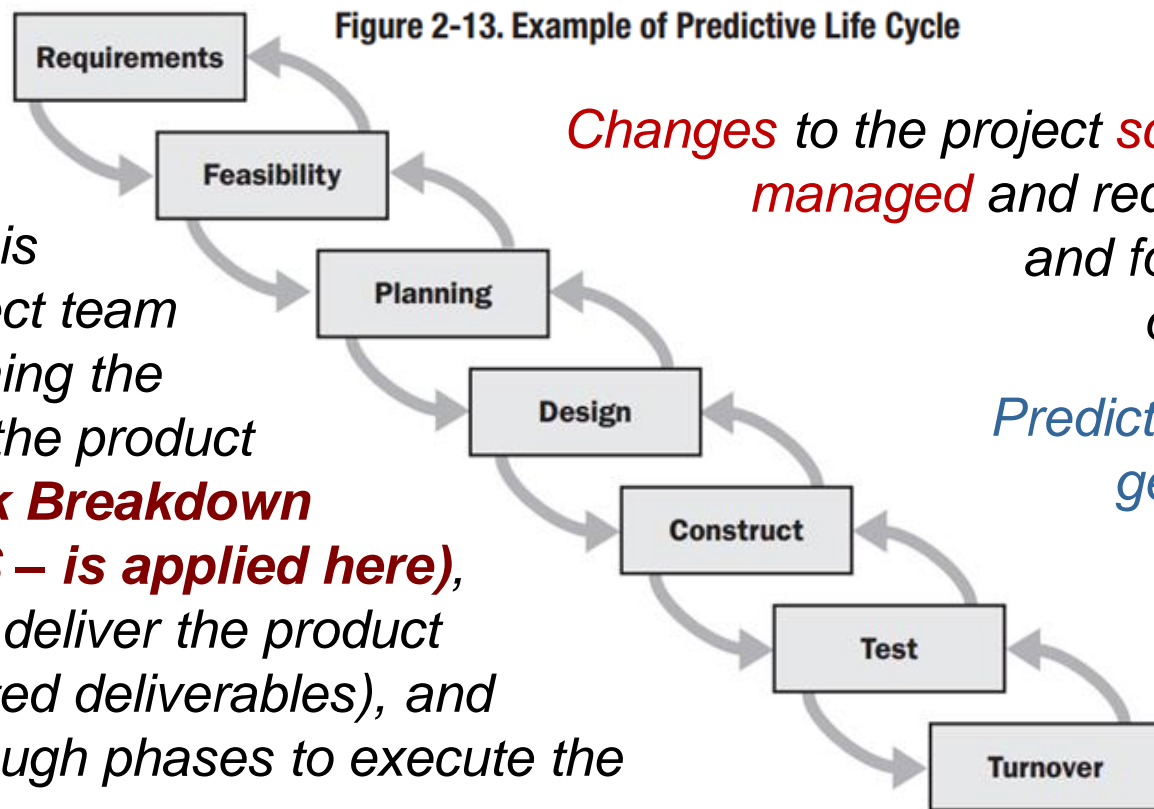
“**endeavor**: resources, such as people and equipment, need to do work”

“successful projects do not happen spontaneously”

“every project creates a **unique product or service**: the deliverable for the project and the reason that the project was undertaken”

## Organizational Influences on Project Management:

- Predictive Life Cycles (*Waterfall Planning*):



*Changes to the project **scope** are **carefully managed** and require **re-planning** and formal acceptance of the new scope.*

*Predictive life cycles are generally preferred when the product to be delivered is well understood.*

*When the project is initiated, the project team will focus on defining the overall scope for the product and project (**Work Breakdown Structure – WBS – is applied here**), develop a plan to deliver the product (and any associated deliverables), and then proceed through phases to execute the plan within that scope.*

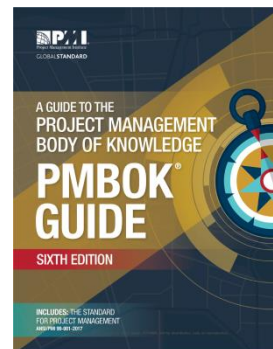
# MITAC-ACADEMY PROGRAM:

## INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

©2017 PMI (PMBOK® Guide 6<sup>th</sup> ed.) – Project Management Body of Knowledge:

- Provides guidelines for managing **individual projects** and defines project management related concepts.
- Describes the project management **life cycle** and its related processes.
- Identifies and describes what is generally recognized as **good practices** (consensus: value, usefulness, that are **applicable to most projects most of the time**).
- Expectation: application of the knowledge based on established norms, methods, processes, skills, tools, techniques and practices can **enhance the chances of success over many projects**.
- Provides and promotes a **common vocabulary** and **concepts**.

**What to do ... not How to do !!!**



# MITAC-ACADEMY PROGRAM: INTRODUCTION TO PROJECT MANAGEMENT – **OVERVIEW**

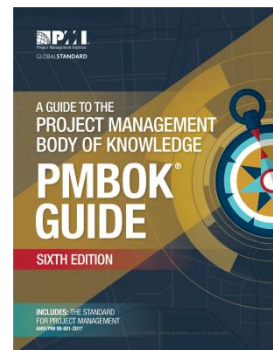
©2017 PMI (PMBOK® Guide 6<sup>th</sup> ed.) – Project Management Body of Knowledge:

## ■ 10 Areas of Knowledge:

- Integration
- Scope
- Schedule (Time and Resources)
- Cost
- Quality
- Resources (Human)
- Communication
- Risks
- Procurement
- Stakeholders.

## ■ 5 Processes Groups:

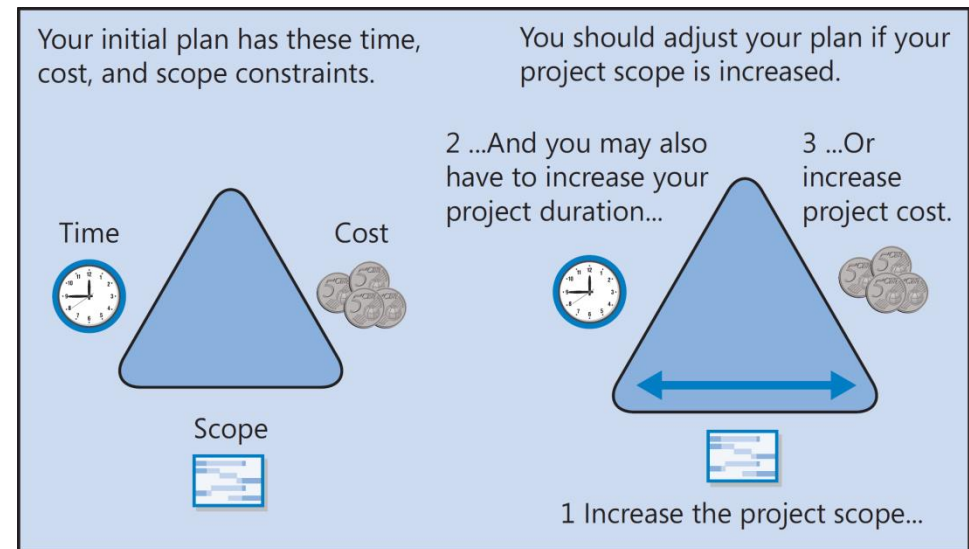
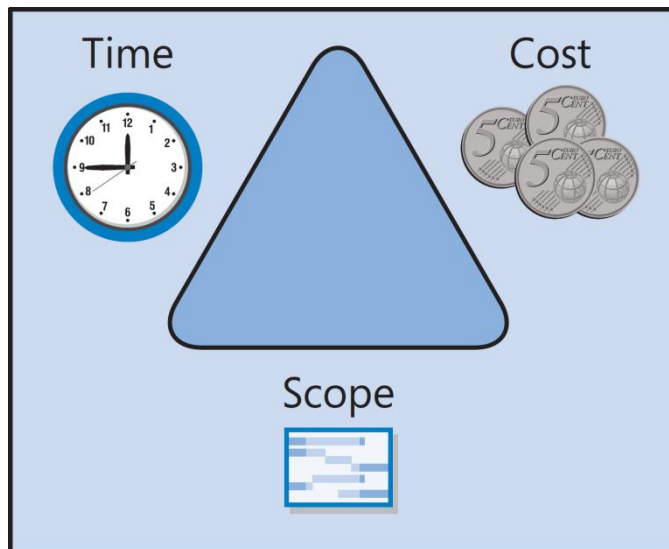
- Initiating
- Planning
- Executing
- Monitoring and Controlling
- Closing



## The Project Triangle\*:

[\*or *triangle* of **triple constraints**]

- Viewing projects in terms of **time**, **cost**, and **scope**.



“every project has some element of a **time constraint**, has some type of **budget**, and requires some **amount of work** (**defined scope**) to complete”

Time, cost, and scope are the **three essential elements** of any project.

# MITAC-ACADEMY PROGRAM: INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

## Project **Scope** Management: DEFINING the RIGHT TASKS for the DELIVERABLES

- Creating a *Work Breakdown Structure* – **WBS**: process of subdividing project **deliverables** and project **work** into smaller, more manageable components.

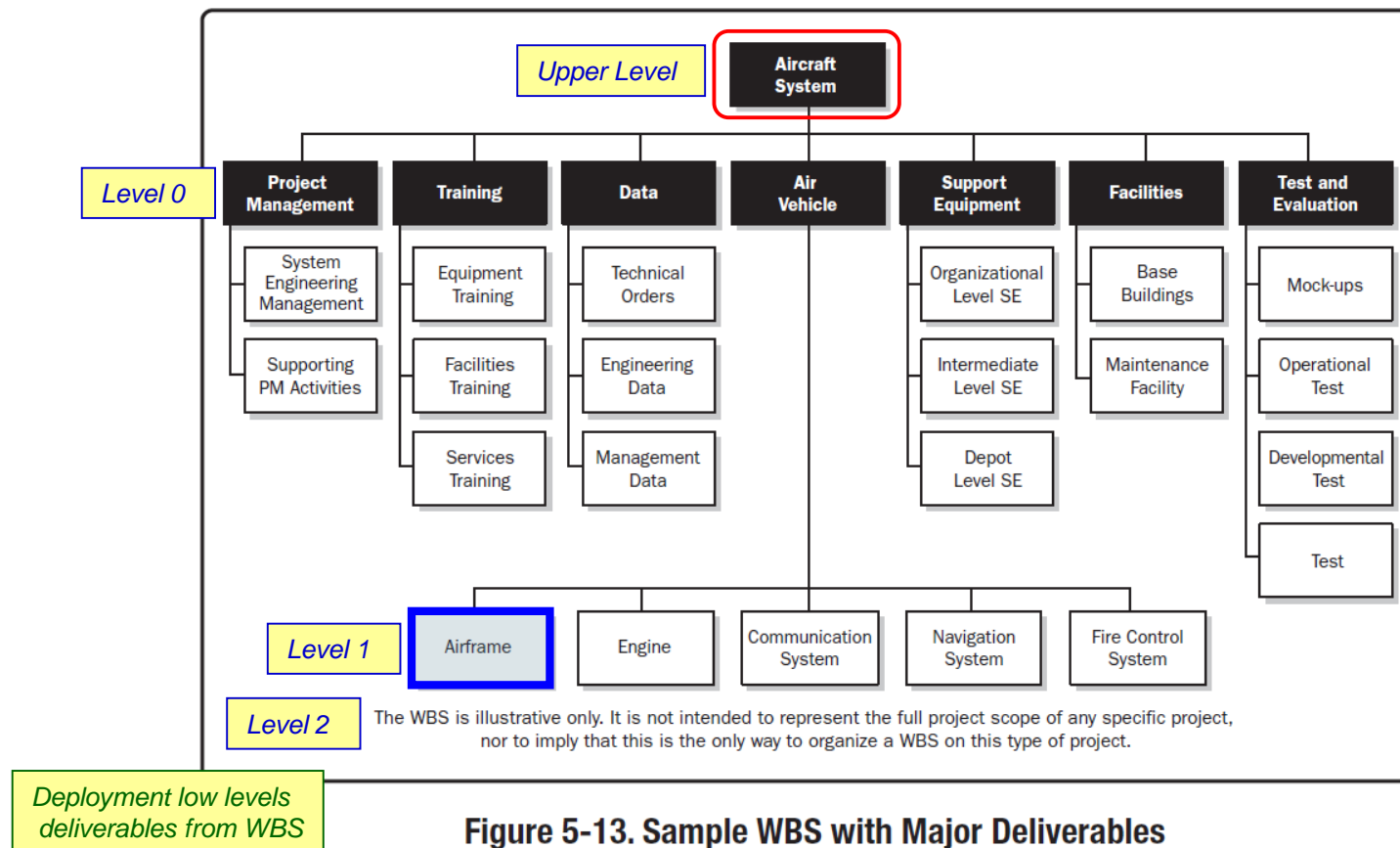


Figure 5-13. Sample WBS with Major Deliverables

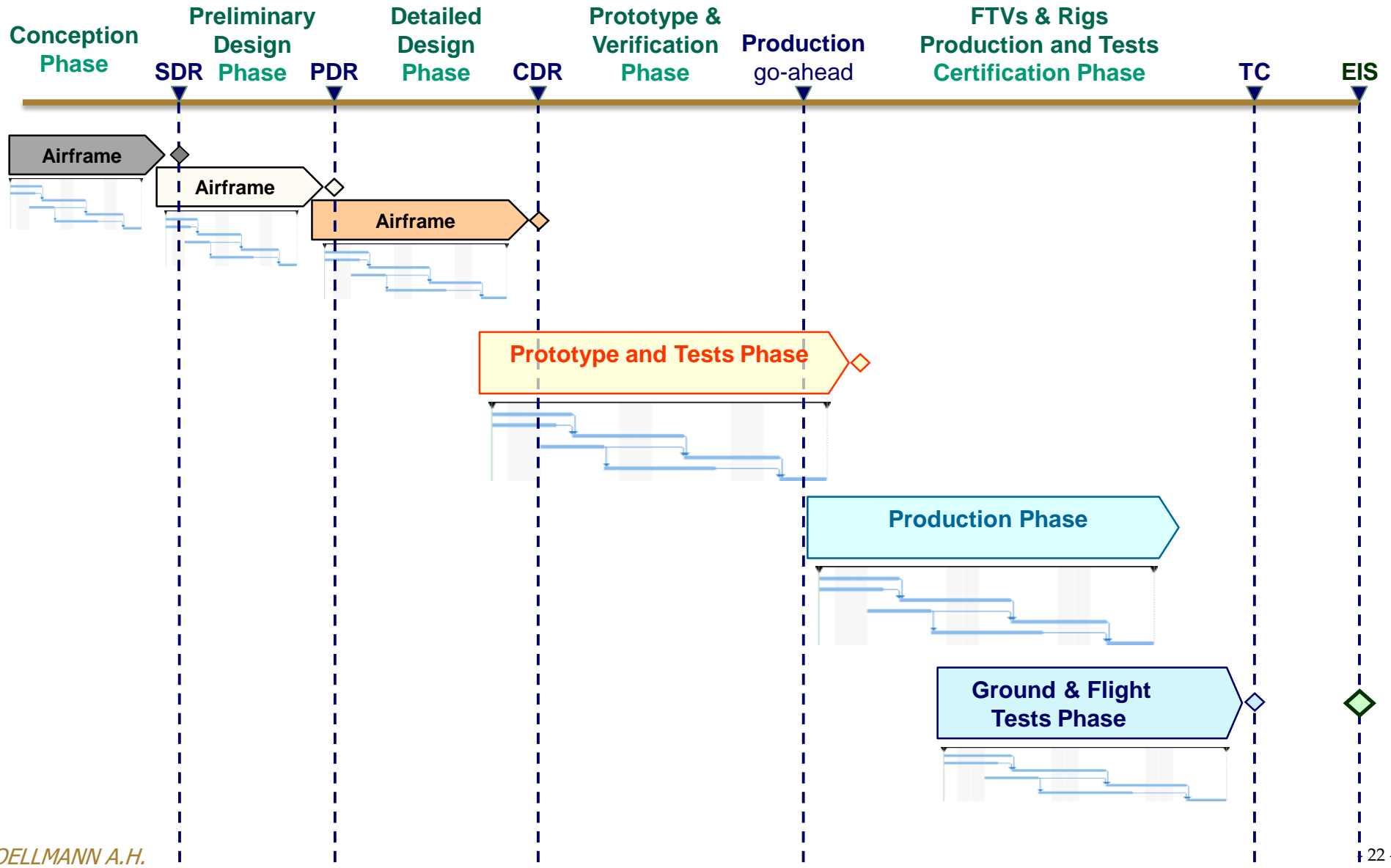
©2013 PMI  
(PMBOK® Guide – 5<sup>th</sup> Ed.)



# MITAC-ACADEMY PROGRAM:

## INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

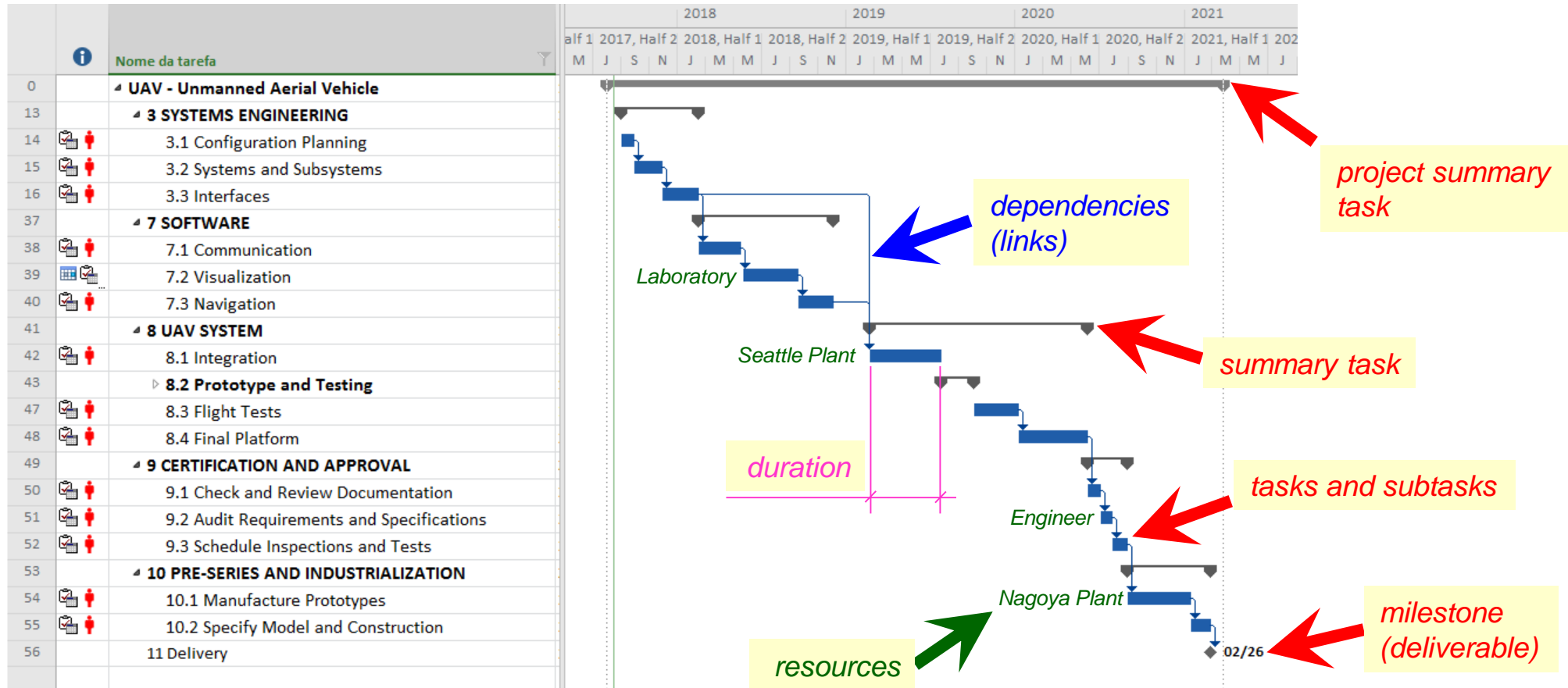
The interaction between **PRODUCT** scope and **PROJECT** scope along Project Lifecycle



# MITAC-ACADEMY PROGRAM: INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

## Project Schedule Management: Time and Resources

- Includes the processes and elements required to manage the timely completion of the project: TASKS (scope), DURATIONS, DEPENDENCIES and RESOURCES.



# MITAC-ACADEMY PROGRAM: INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

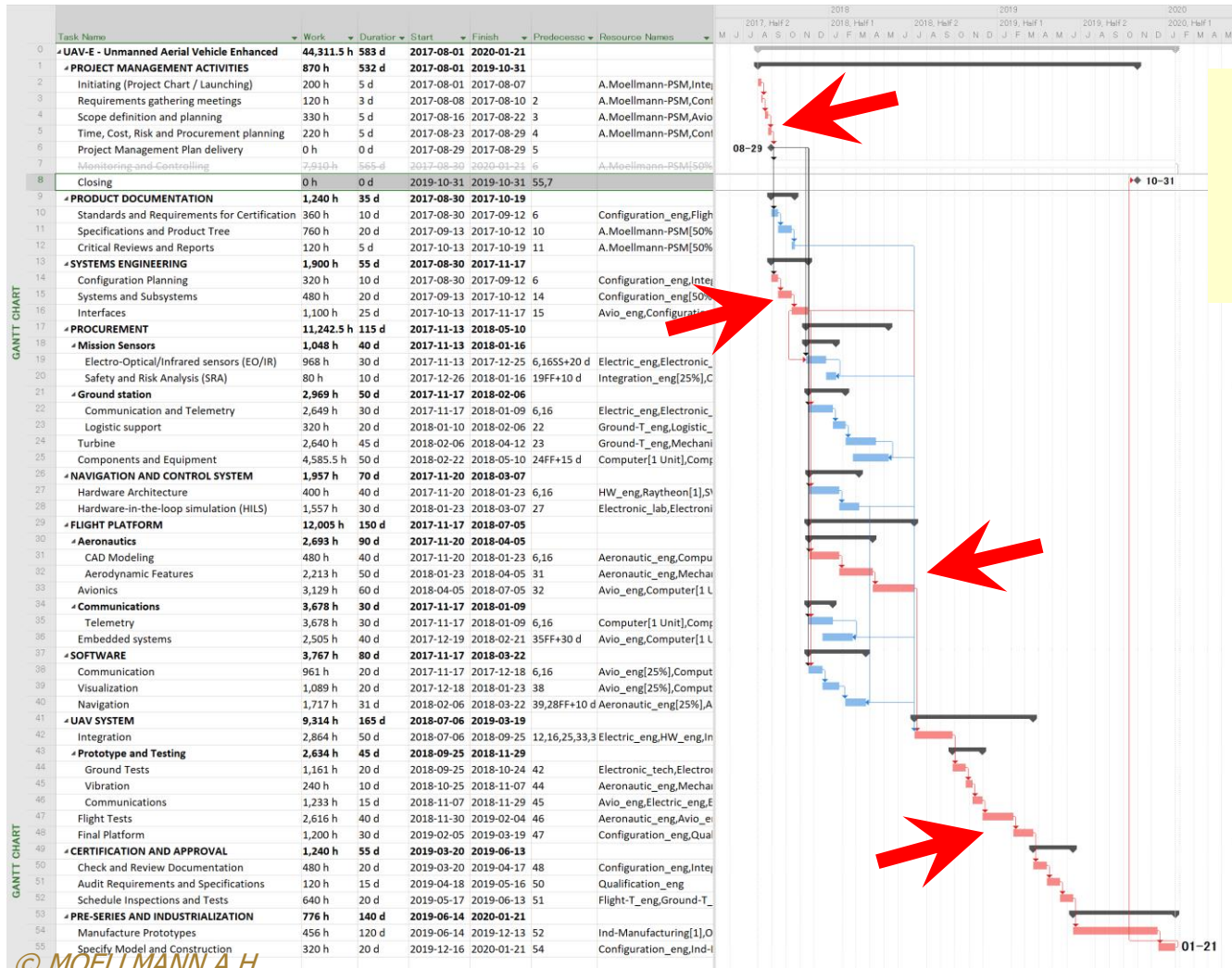
## Project Schedule Management: Time and Resources

- Scheduling: *planning and managing* **CRITICAL-PATH** activities.

The **Critical-Path** is the *series of tasks that will push out the project's end date if the tasks are delayed.*

**Key point:** managing *deadlines* dates.

When addressing schedule problems, *focus your remedies on tasks on the Critical-Path* (also called **Critical-tasks**). These *drive* the **finish date** of the *project*.



# MITAC-ACADEMY PROGRAM:

## INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

### Project Cost Management:

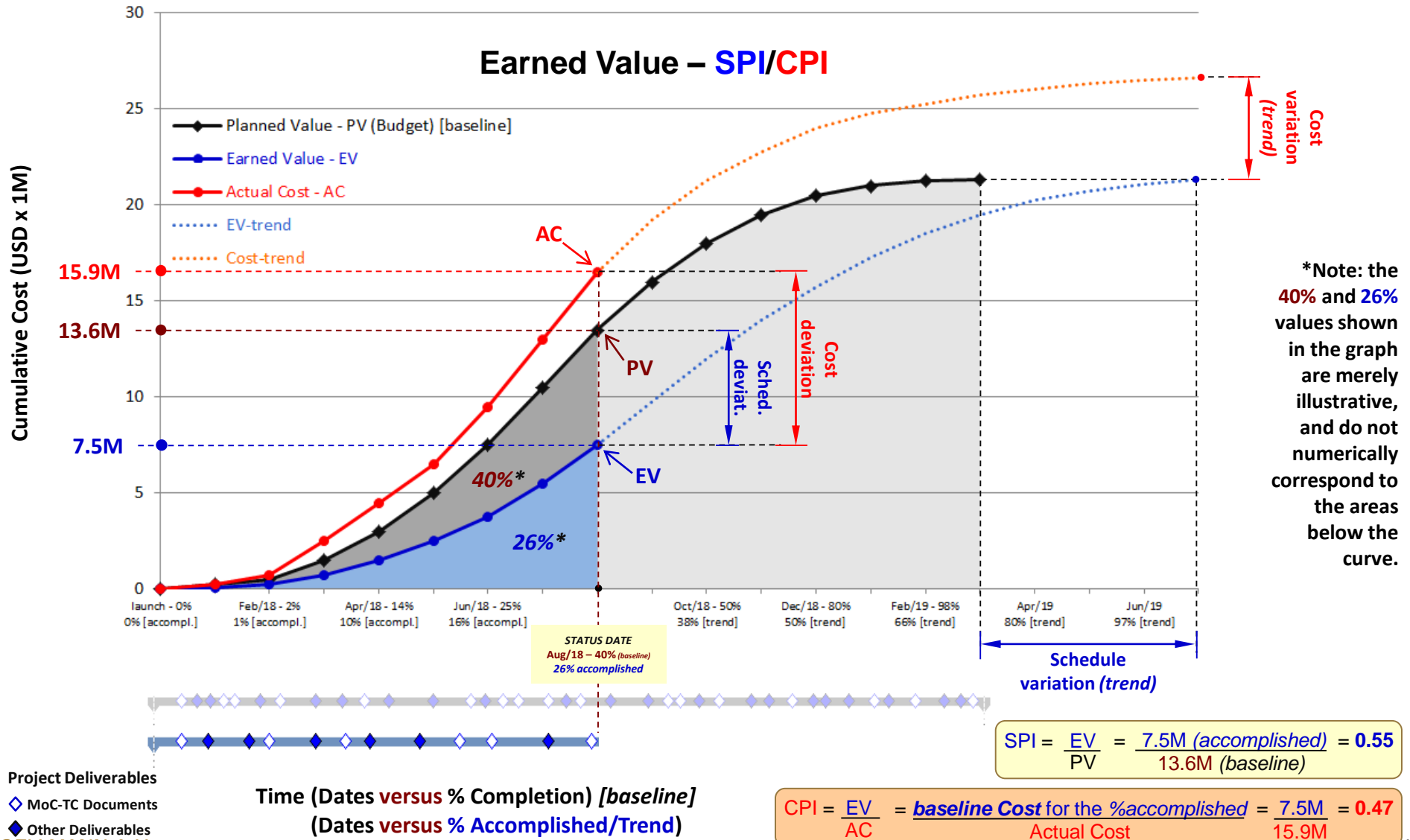
- Includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.
- **Earned Value Analysis – EVA:** combining “scope, schedule, and resource” measurements to assess project performance.

Earned Value Management: weighted performance measuring  
physical progress versus real costs [MOELLMANN, A.H.]

- Three Key Dimensions:
  - **Planned Value (PV):** authorized budget planned for the schedule's work.
  - **Earned Value (EV):** measure of work performed expressed in terms of the budget authorized for that work.
  - **Actual Cost (AC):** is the realized cost incurred in accomplishing the work that the EV measured.

# MITAC-ACADEMY PROGRAM: INTRODUCTION TO PROJECT MANAGEMENT – OVERVIEW

## Project Cost Management: *Earned Value Analysis – EVA*



### Project Risk Management:

- *Program Risks concern **uncertainties** that **affect the whole program**, as well as **several** single projects within the program.*  
*[examples: lack of strategic competences and resources; few suppliers options; competitors strategies]*
- *Risks **assessment** and **management** are about **looking ahead** (and are therefore different from the existing issues and problems).*
- *In **international projects**, such as commercial aircraft development, it is worth remembering that the **way in which people deal with risks depends** on their **individual risk culture**.*
- *Examples of program risks:*
  - ***inexperience** and **lack of knowledge** that arose from Japan's long absence from developing entire aircraft.*
  - ***very long** documentation review process for Type Certification from Japan's Ministry of Transport - JCAB.*

*End of Part 1*  
**INTRODUCTION TO PROJECT MANAGEMENT**



## *Special Lecture Series on System Integration III*

### Project and Program Management – Part 2

## **From PROJECT to PROGRAM Management** (includes: Portfolio and Multiproject)



MITAC Academy

*Intensive Short Course in Collaborative Program with  
MITAC Academy – September 2021*

***Prof. Artur Henrique Moellmann, Ph.D.***

*Federal Institute of Education, Science and Technology – Brazil  
MITAC Academy advisor*

© MOELLMANN A.H.

This workshop was developed based on recognized bibliographical references and the author's professional and academic experience, in order to lecturing on behalf of the MITAC Academy Program. Neither this document, nor any information in it, shall be used, reproduced, or disclosed to third parties without the prior written consent of MITAC or the author. Any permitted reproduction of this document, in whole or in part, shall include this notice.

### Topics:

- Definition: **Multiproject** Management (Program and Portfolio).
- The relationship among **Portfolio**, **Programs** and **Projects**.
- Organizational Influences on Multiproject Management.
- Developing a Commercial Airplane.
- **Systems Engineering** for Commercial Aircrafts:
  - Aircraft Systems Development Integration:
    - “**Configuration Management**” and “**Integrated Product Teams**” (IPTs).
- **Multiproject Scheduling** for Aircraft System Development Integration.
- Multiproject Scheduling PERFORMANCE: **Global Metrics/EVA**.
- Program **RISKS** Mapping and Management.

**MULTIPROJECT** Management:

## *What is Multiproject Management?*

*Multi-Project Management*

*Multiple Projects Management*

*\*Program Management*

*\*Portfolio Management*

Management of many projects simultaneously,  
interrelated or not with each other,  
but generally **sharing** or **competing** for *resources*\*  
concurrently.

*\* ? constrained or limited ? \**

# MITAC-ACADEMY PROGRAM:

## PROJECT and PROGRAM MANAGEMENT – **MULTIPROJECT Nature**

### The relationship among **PORTFOLIO**, **PROGRAMS** and **PROJECTS**:

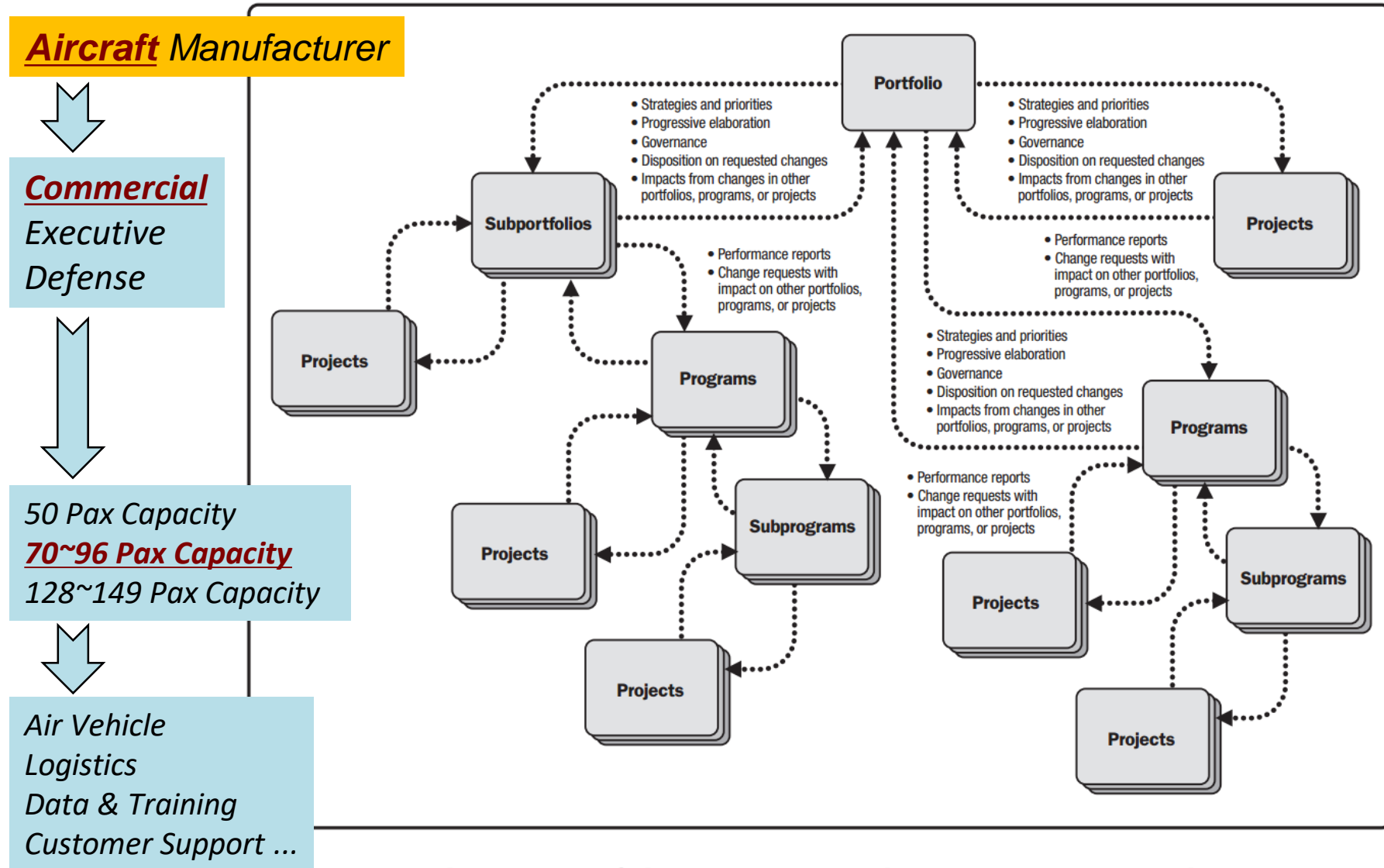


Figure 1-1. Portfolio, Program, and Project Management Interactions

# MITAC-ACADEMY PROGRAM:

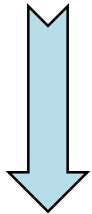
## PROJECT and PROGRAM MANAGEMENT – **MULTIPROJECT** Nature

The relationship among **PORTFOLIO**, **PROGRAMS** and **PROJECTS**:

**Aircraft Manufacturer**



**Commercial**  
Executive  
Defense



50 Pax Capacity  
**70~96 Pax Capacity**  
128~149 Pax Capacity

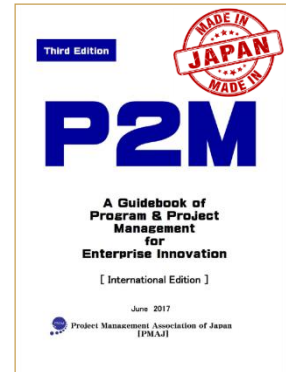


Air Vehicle  
Logistics  
Data & Training  
Customer Support ...



**Multiproject**  
(Product Portfolio)  
Management

## *What is Program Management?*



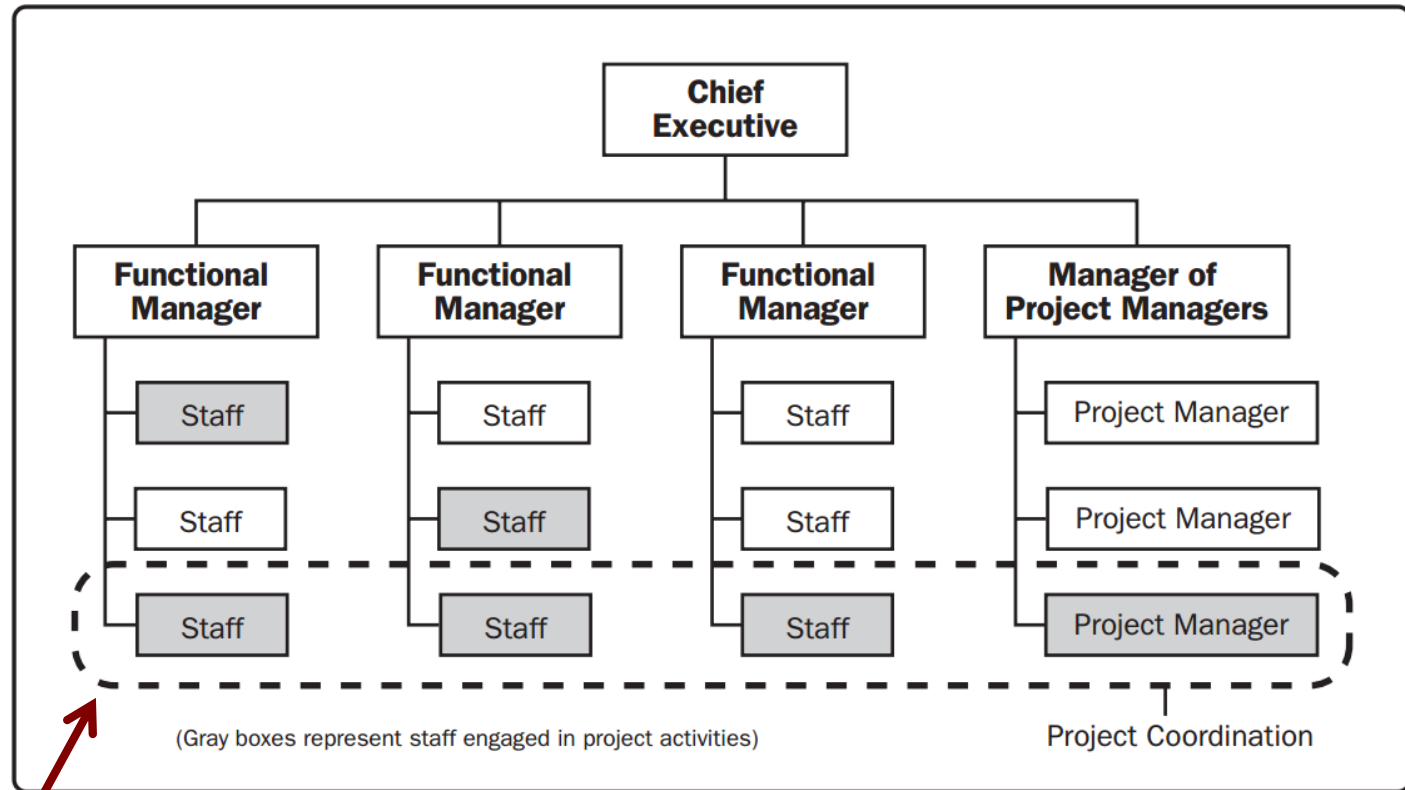
“A collection of projects purposefully grouped together, managed in a coordinated way to realize strategic and/or tactical benefits related to a common objective.”

“The program consists of the integration of all the activities necessary to successfully create value for the organization on the basis of a strategic mission.”

“A **program** is established to carry out the **business strategy**.”

[P2M Japan]

Organizational Influences on Multiproject Management:



Conflicts due to  
**resources dispute**

Figure 2-4. Strong Matrix Organization



## Developing a Commercial Airplane:

“... the period of Detailed Design ... a significant volume of ‘execution’ work at highest possible quality level has to be processed. The **747**, for example, required about **75,000** individual **drawings** to specify<sup>17</sup> [Petrosky, H. (1996), *Invention by Design: How Engineers get from Thought to Thing* (Cambridge: Harvard University Press).] and it took Airbus about **79,000 drawings** to design the **A380**.<sup>18</sup> [Leichter, S., *Airbus*, private communication.] Each drawing needs to be carefully checked and approved by the company’s appropriate signatory authorities prior to release. ...”

This information must be scrutinized!

### Systems Engineering for Commercial Aircrafts:

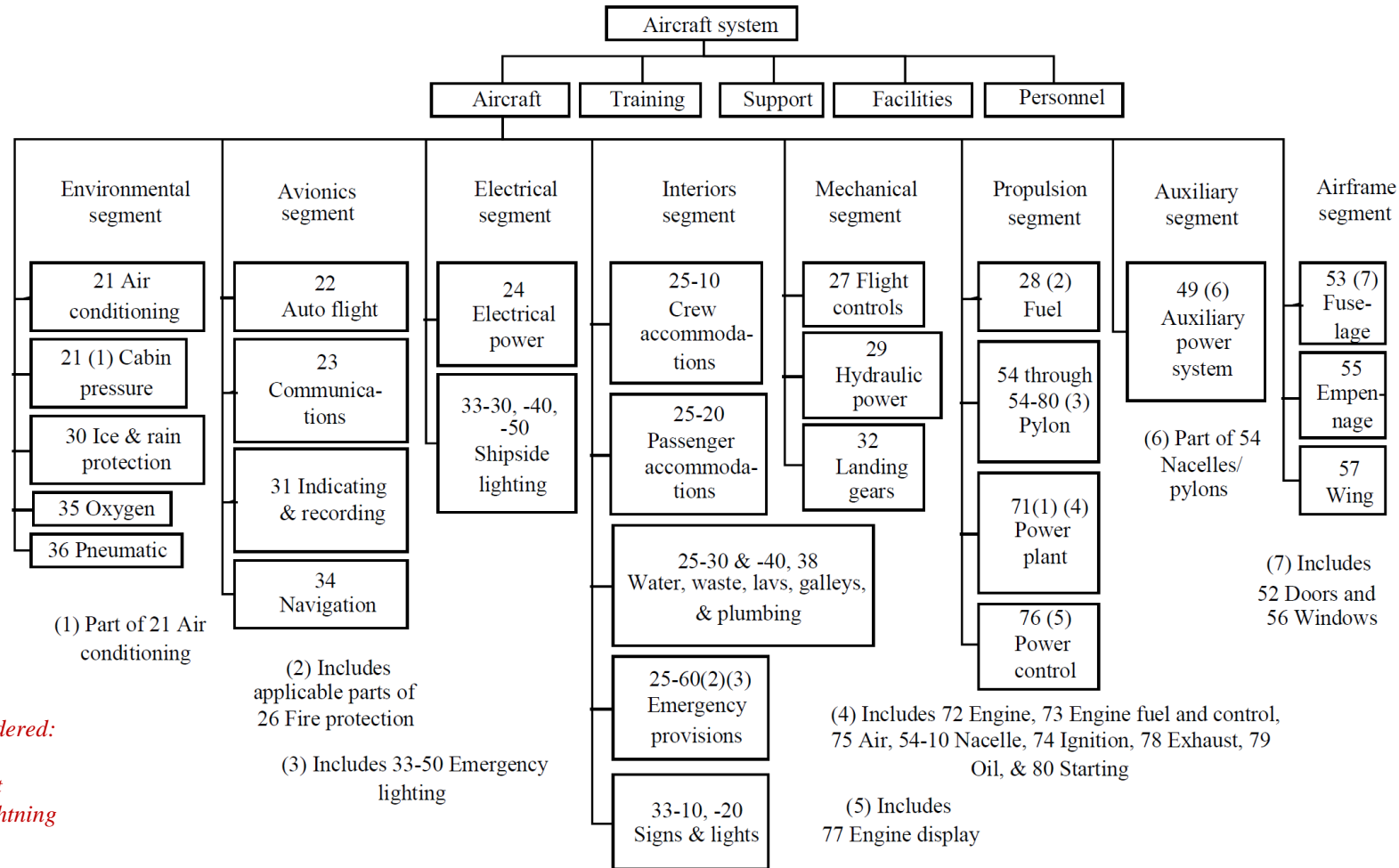


Figure 1. Typical Aircraft System Architecture (and ATA Chapter Correlation)

(Source: Systems Engineering for Commercial Aircraft, Conference Paper. August 1997, DOI: 10.1002/j.2334-5837.1997.tb02151.x, Scott Jackson.)

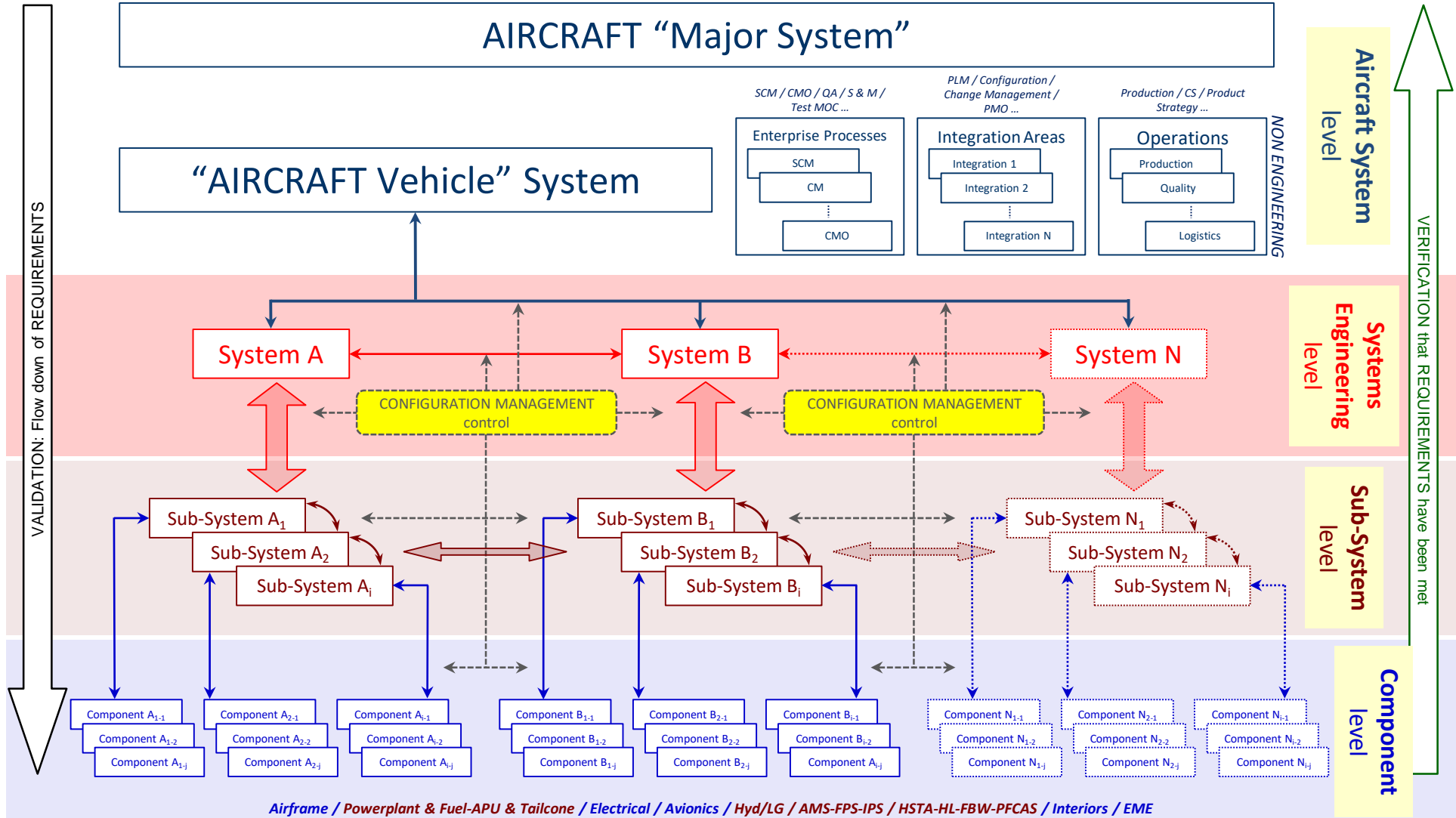
**Systems Engineering:** Configuration, Data and Requirements Management

- Aircrafts are composed of complex “systems of systems”:
  - Changes that affect any of the subsystems can undermine the aircraft’s ability to perform its mission if the changes are not properly designed and implemented.
  - More realistically, subsystems not only support the overall system but interact with one another in ways that are sometimes **difficult to anticipate**.

Example: *If the guidance system may be upgraded as part of an avionics-system, this modification may have unintended consequences on the weapons and sensor subsystems, as well as may create new sources of heat or electromagnetic interference or may require additional power.*

How synchronize the cascade of changes?

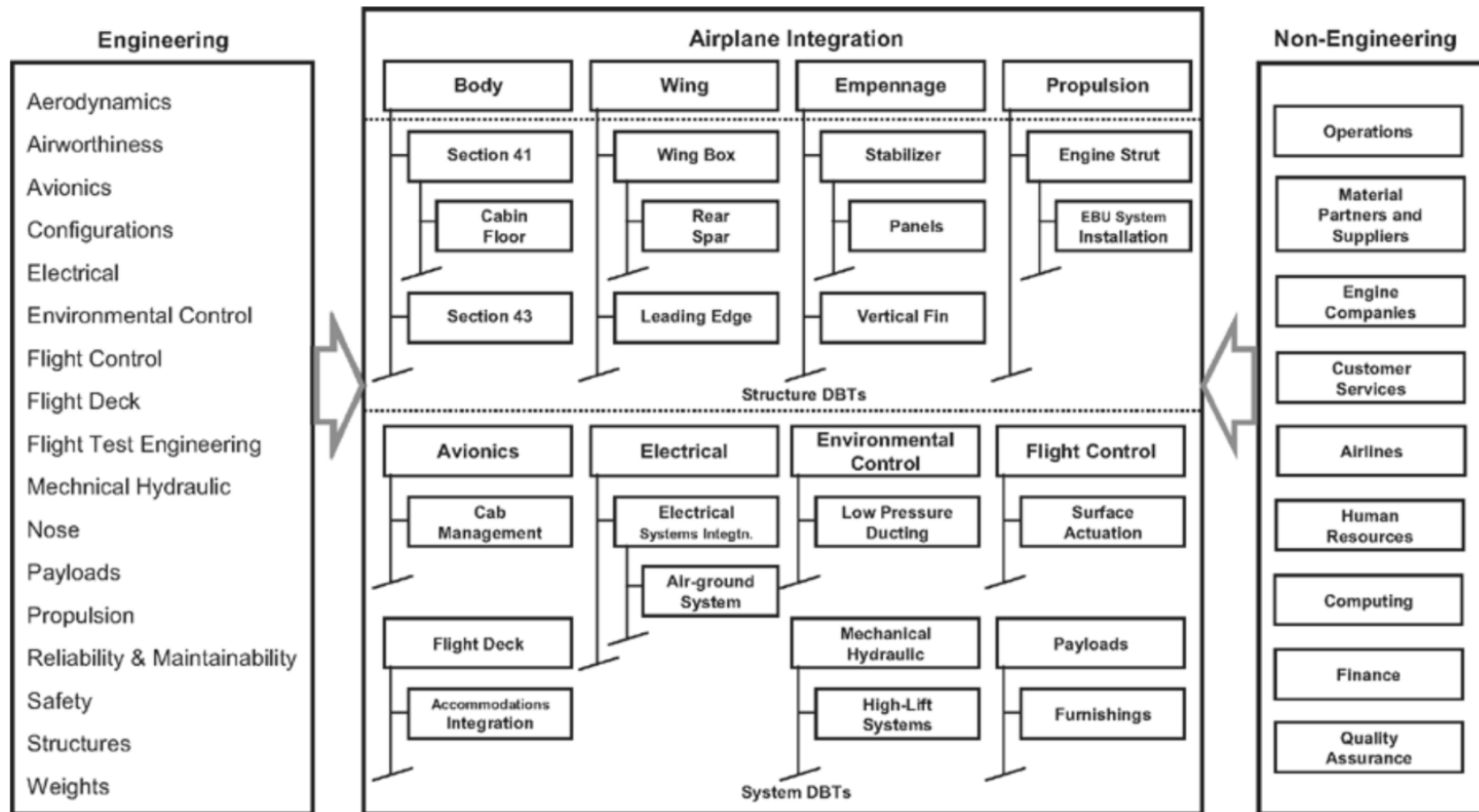
### Aircraft Systems Development Integration:



How synchronize the cascade of changes?

### Aircraft Systems Development Integration: BOEING-777 DBT [IPT]

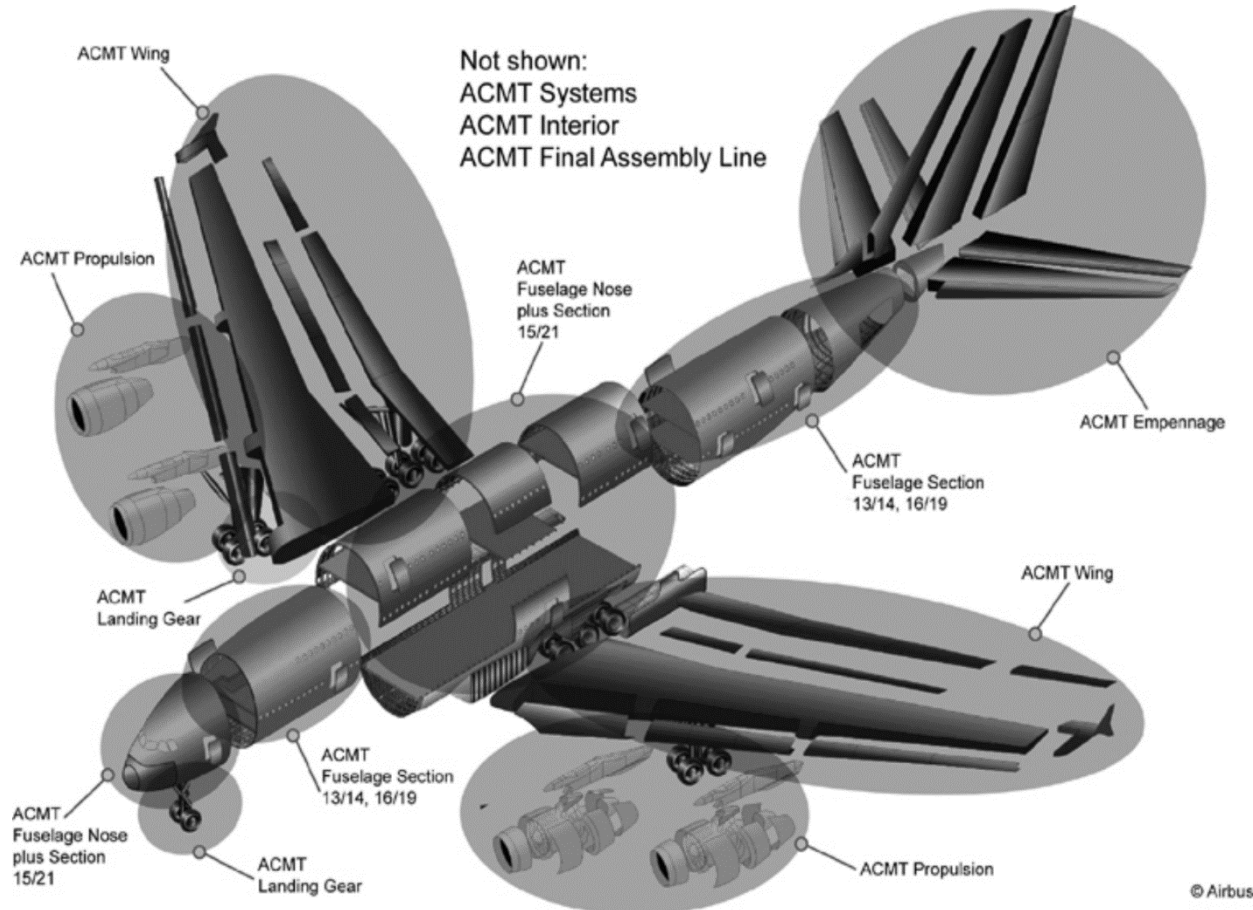
#### Design-Build Team structure for the development of the Boeing 777



**Design-Build Team structure for the development of the Boeing 777** Source: Breuhaus, R.S., Fowler, K.R. and Zanatta, J.J. (1996), 'Innovative Aspects of the Boeing 777 Development Program', ICAS 1996 Proceedings (International Council of the Aeronautical Sciences ICAS-96-0.4), p. LXXVII.

**Aircraft Systems Development Integration: A380 ACMT [IPT]**

**Airbus A380 multi-functional teams (ACMT) on highest organizational level**

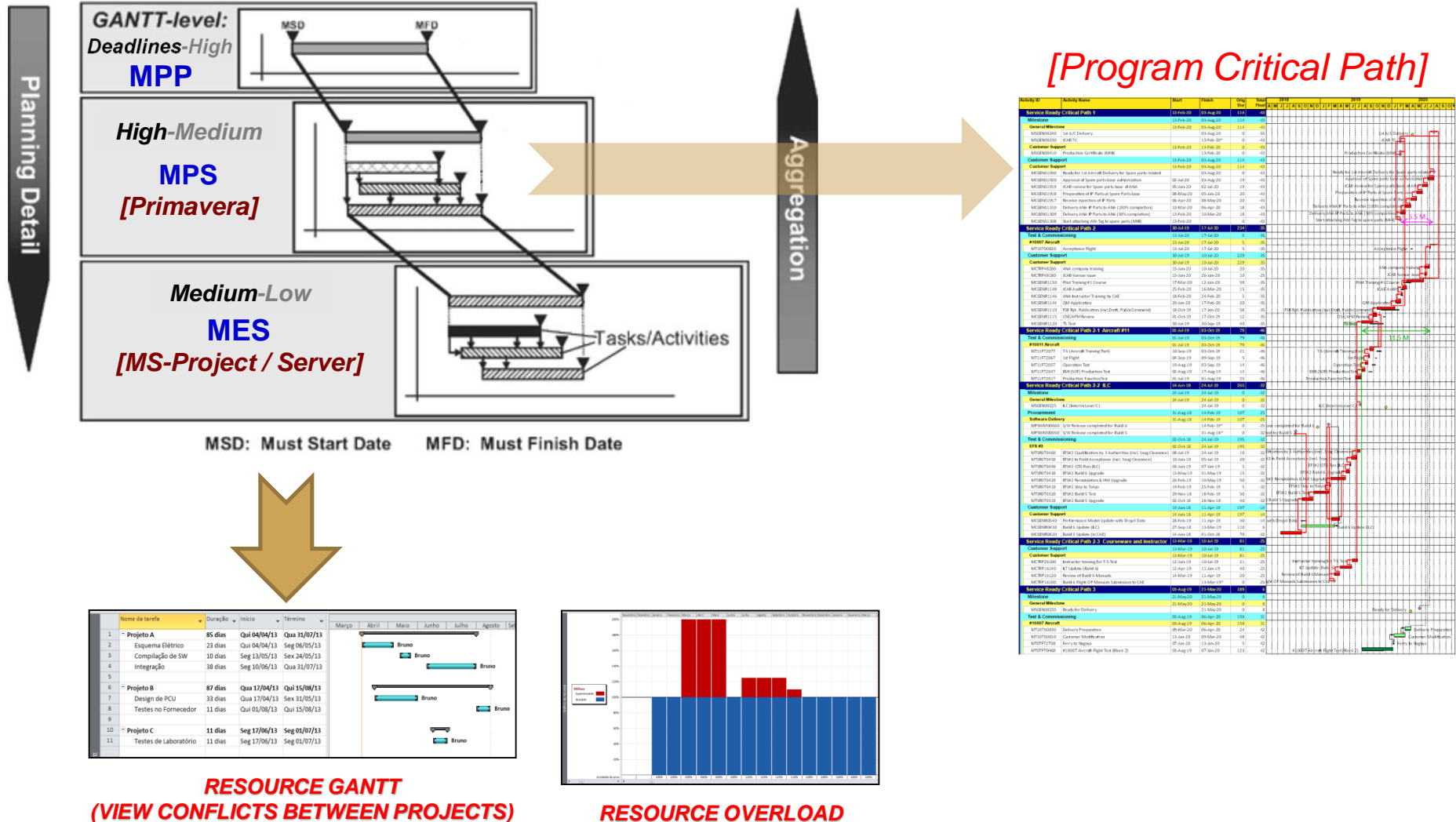


**Responsibility scope for Airbus A380 multi-functional teams on highest organizational level (ACMT: Aircraft Component Management Team)**



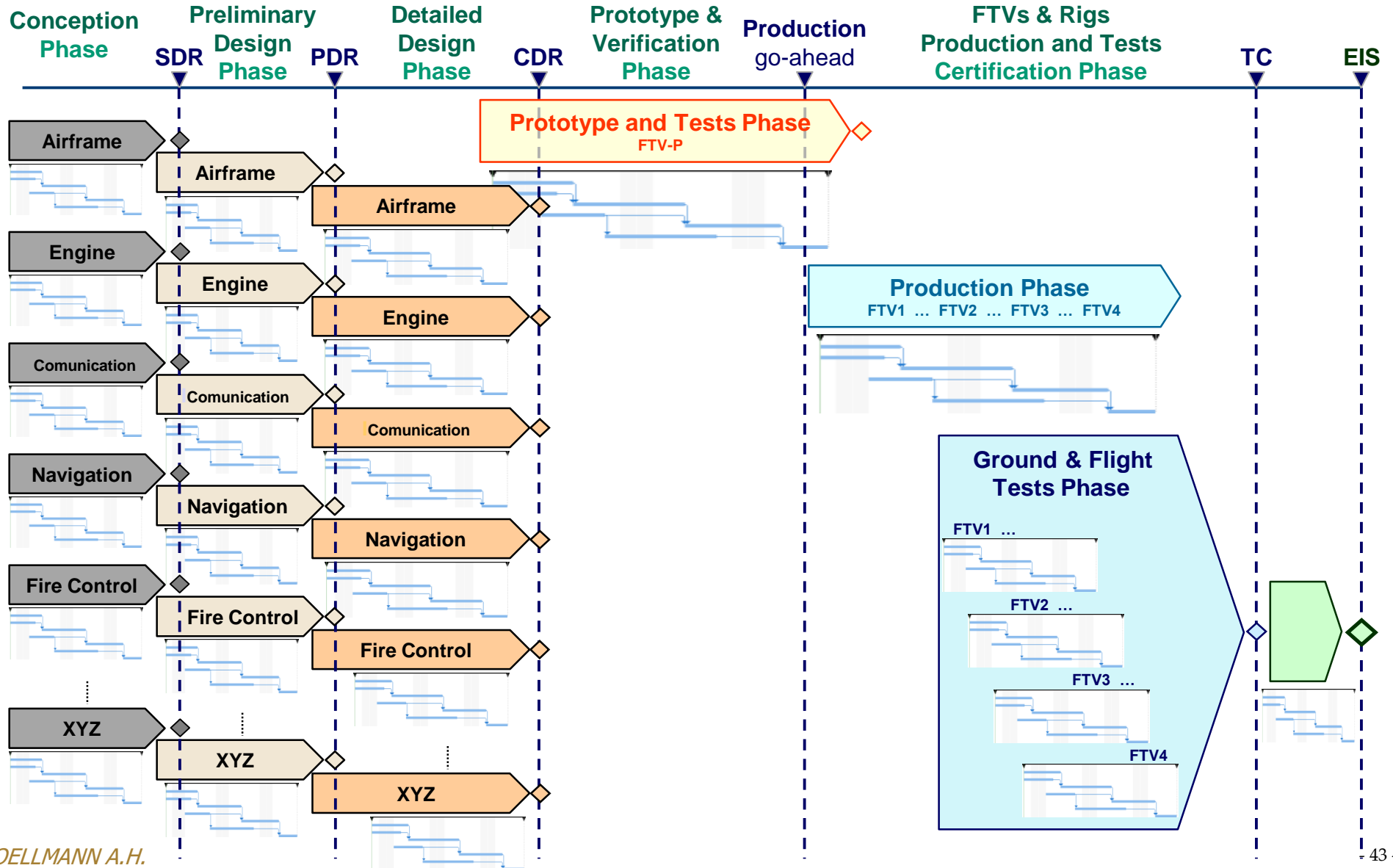
# MITAC-ACADEMY PROGRAM: PROJECT and PROGRAM MANAGEMENT – MULTIPROJECT SCHEDULING

## Multiproject Scheduling: The cascade of GANTT-charts





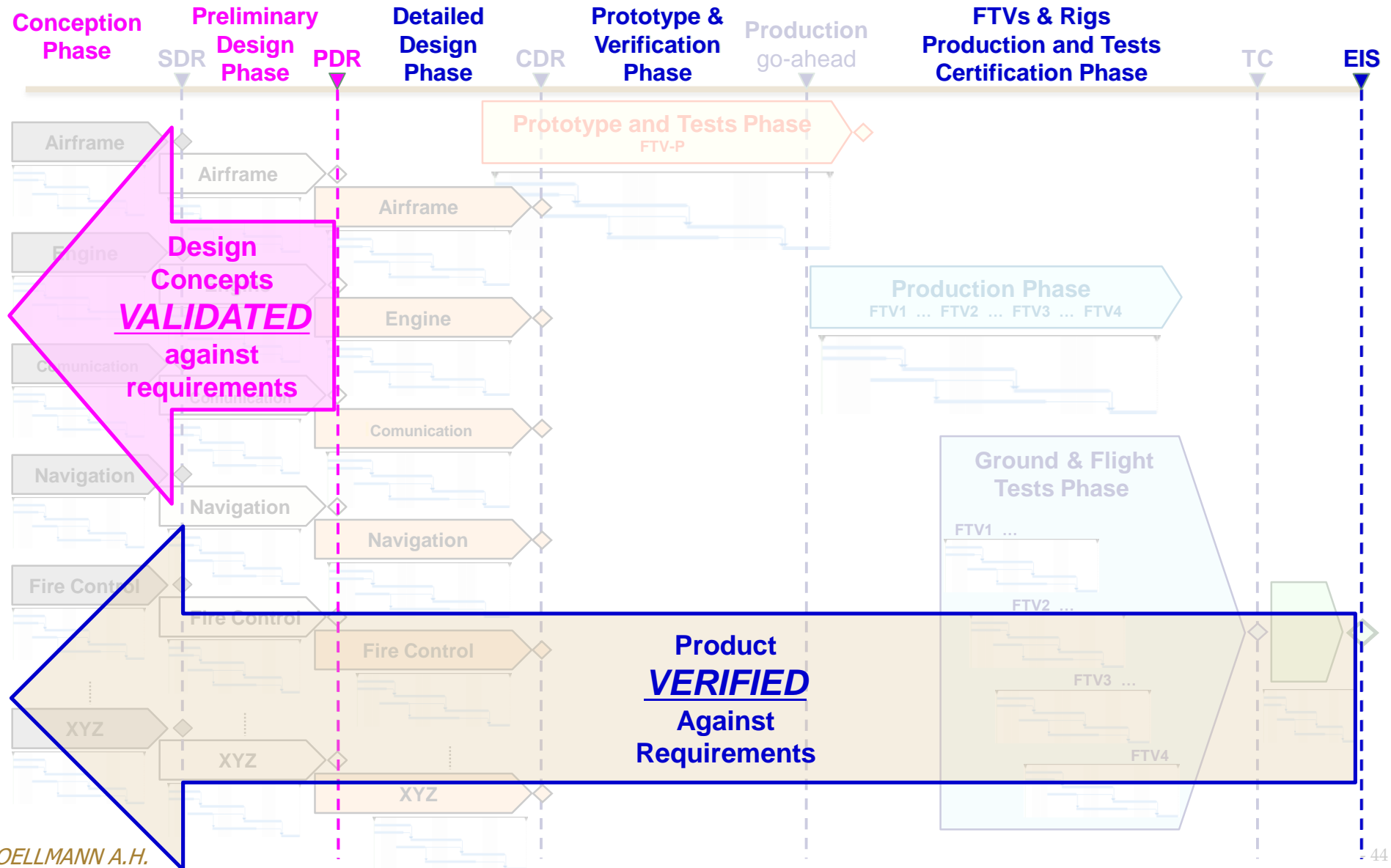
The interaction between **PRODUCT** scope and **PROJECT** scope along Project Lifecycle



# MITAC-ACADEMY PROGRAM:

## PROJECT and PROGRAM MANAGEMENT – MULTIPROJECT SCHEDULING

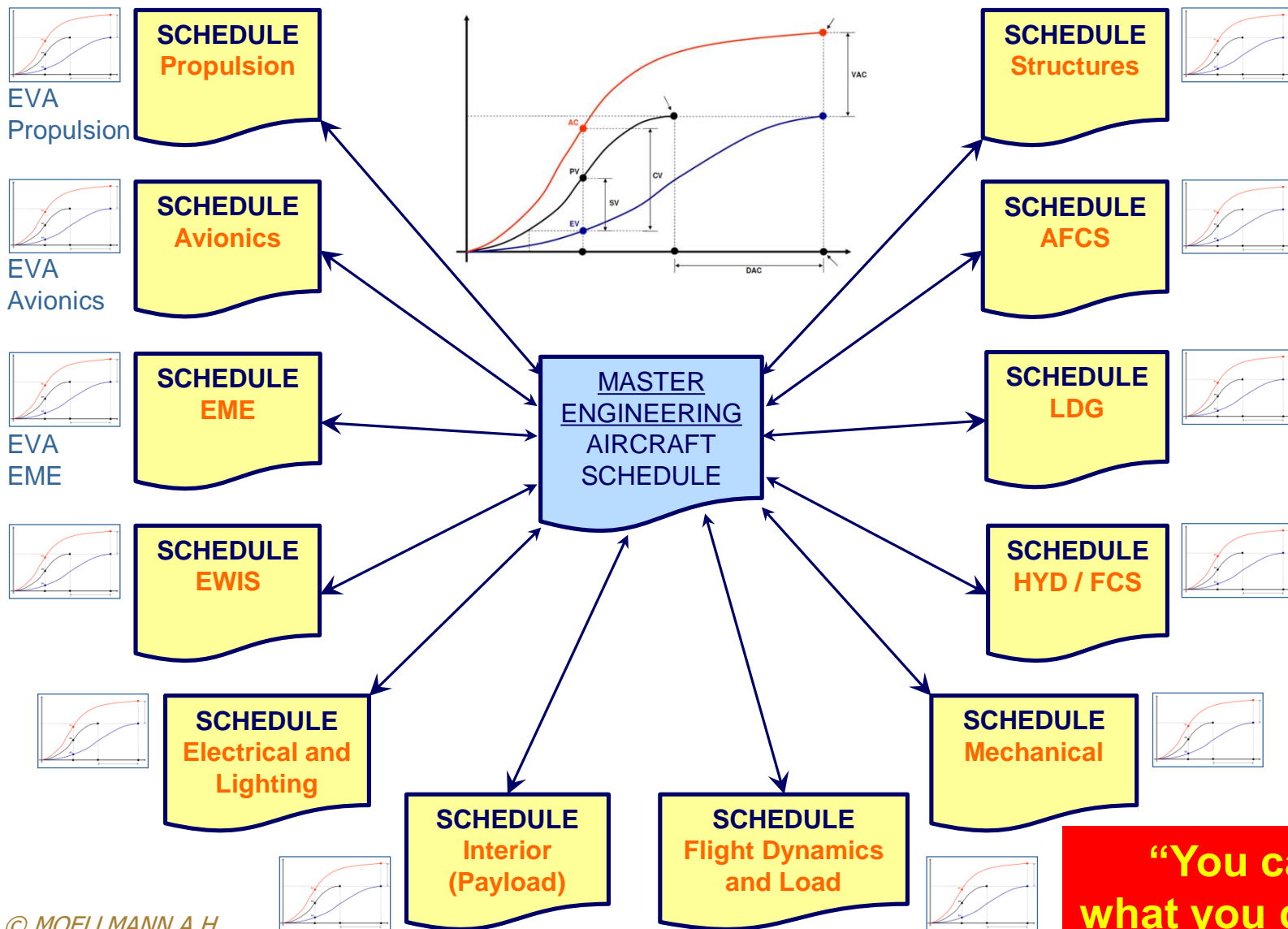
The interaction between **PRODUCT** scope and **PROJECT** scope along Project Lifecycle



# MITAC-ACADEMY PROGRAM:

## PROJECT and PROGRAM MANAGEMENT – PERFORMANCE (Global EVA)

### UPDATING and TRACKING the Multiproject Scheduling PROGRESS:



**“You can not manage what you can not measure!”**

### Program **RISKS** Mapping and Management:

- Program Risks concern **uncertainties** that **affect the whole program**, as well as **several** single projects within the program:  
*[examples: lack of strategic competences and resources; few suppliers options; competitors strategies]*
- **Risk assessment** and **management** is about **looking ahead** (and is therefore **different** from the **existing** issues and problems).
- In **international projects**, such as commercial aircraft development, it is worth remembering that the **way** in which **people deal with risks depends** on their **individual risk culture**.
  - Examples of program risks:
    - **inexperience** and **lack of knowledge** that arose from Japan's long absence from developing entire aircraft.
    - **very long** documentation review process for Type Certification from Japan's Ministry of Transport - **JCAB**.

***Building an worldwide, feasible and sustainable Supply Chain Management:***

■ *Main concerns regarding the development of Strategic Suppliers:*

- **Few suppliers options.**

*In commercial aircraft development there are few and strong competitors.*

*Q.: So how to persuade and gathers current suppliers to join to a new program?*

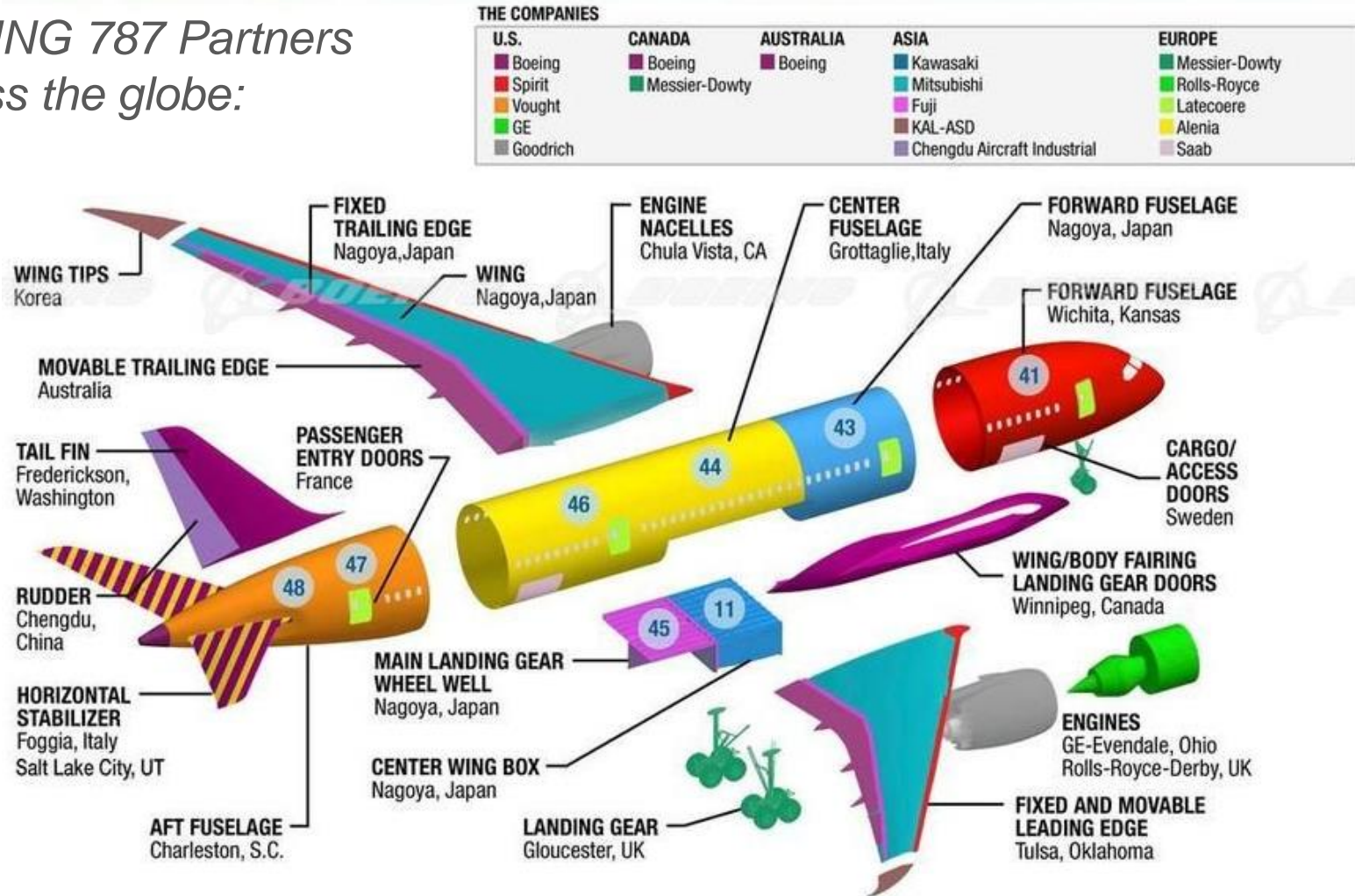
*A.: Risky Partnership!*

- Commercial aircrafts suppliers are not really “trusted partners” ....  
**“basically they want OEMs money!”**

**Special Note:** In real Commercial Aircraft Projects, considering the Procurement area of knowledge, some sub-systems are very critical due to its “technical constraints nature” and “long lead-time”. *For example, depending on the mission of the future aircraft, there are not many options of engines available.* In that way, depending on how critical a sub-system is, the options of available sources of technologies will drive the conceiving of the aircraft, making mandatory to consider the Supply Chain aspects since the beginning.

### *Building an worldwide, feasible and sustainable Supply Chain Management:*

- *BOEING 787 Partners across the globe:*



**IDENTIFY AND BUILD CRITICAL KNOWLEDGE AND COMPETENCES:**

*Building an Aeronautical Curriculum:*

***Question:***

**Who will develop the next generation of  
commercial aircrafts in Japan?**

***“Global Experts”, Japanese Engineers, or both?***



Case Study



*Technological Institute  
of Aeronautics – Brazil*

*Engineering Specialization Program for Aeronautics*

- *Role of the Program:*

To specialize **newly graduated engineers** (aeronautical and non-aeronautical) to work in EMBRAER's engineering departments, **using an accelerated teaching strategy** aligned with the company's needs.

# MITAC-ACADEMY PROGRAM: PROJECT and PROGRAM MANAGEMENT – (HUMAN RESOURCES)

## Case Study



*Technological Institute  
of Aeronautics – Brazil*

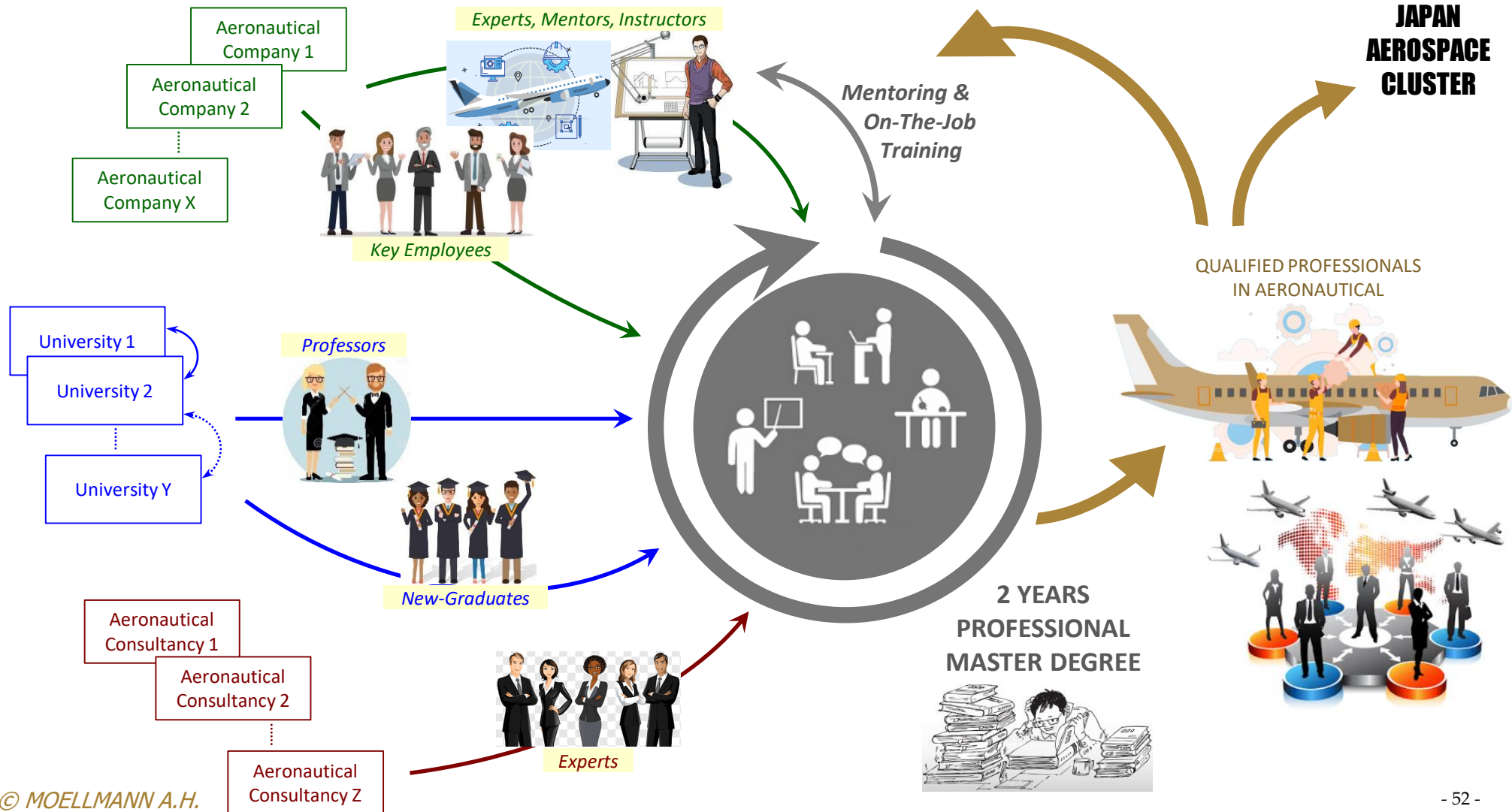
**Final Projects**  
(3<sup>rd</sup> Generation  
of Students)

*Engineering Specialization Program for Aeronautics*

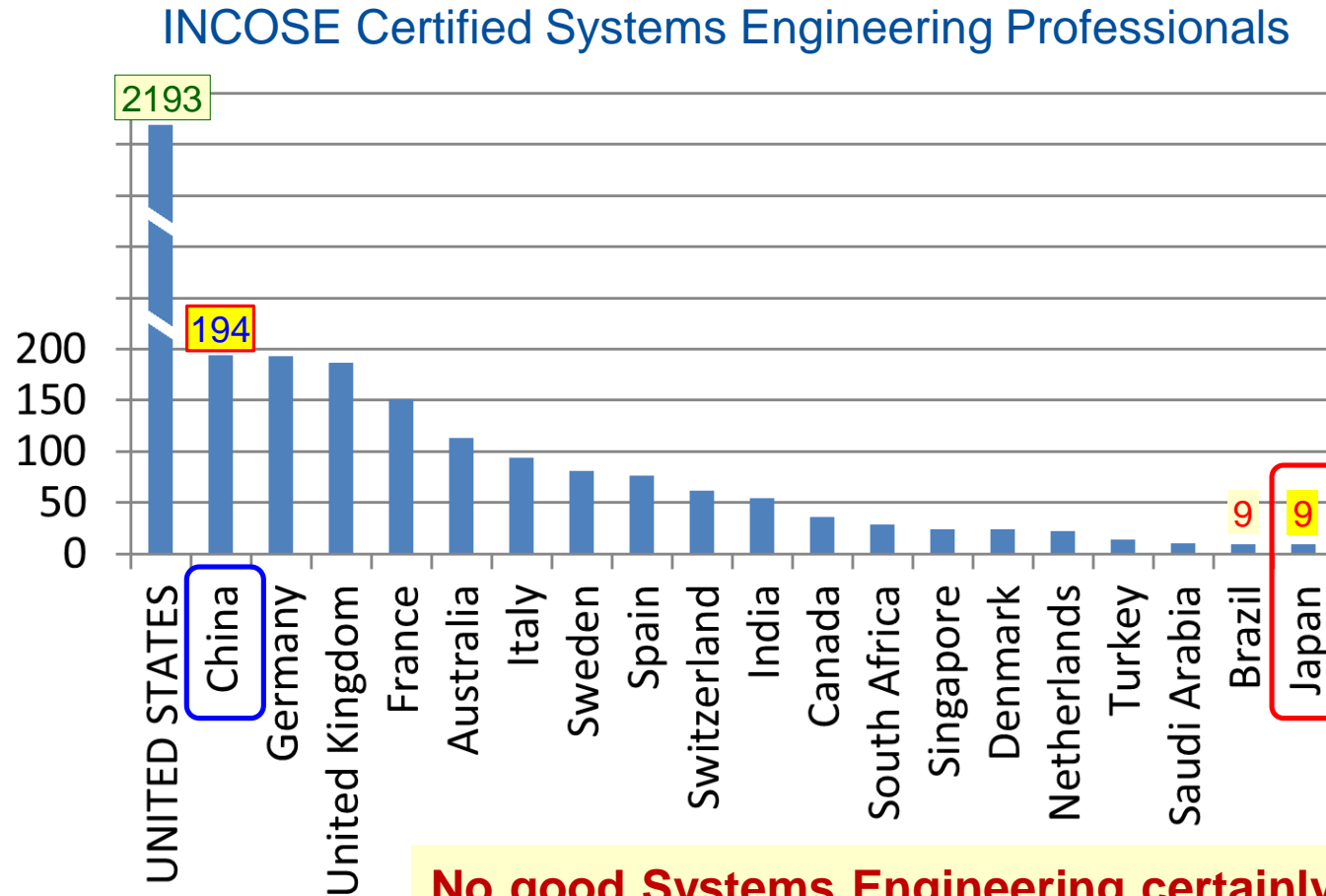


# MITAC-ACADEMY PROGRAM: PROJECT and PROGRAM MANAGEMENT – (HUMAN RESOURCES)

## IDENTIFY AND BUILD CRITICAL KNOWLEDGE AND COMPETENCES: *Building an Aeronautical Curriculum: Educational Alliance (proposal for Japan)*



**IDENTIFY AND BUILD CRITICAL KNOWLEDGE AND COMPETENCES:**  
**Building an Aeronautical Curriculum: International Council of Systems Engineering**



**No good Systems Engineering certainly will impact the performance and effectiveness of the Program!**



## IDENTIFY AND BUILD CRITICAL COMPETENCES and CAPABILITIES:

### News:

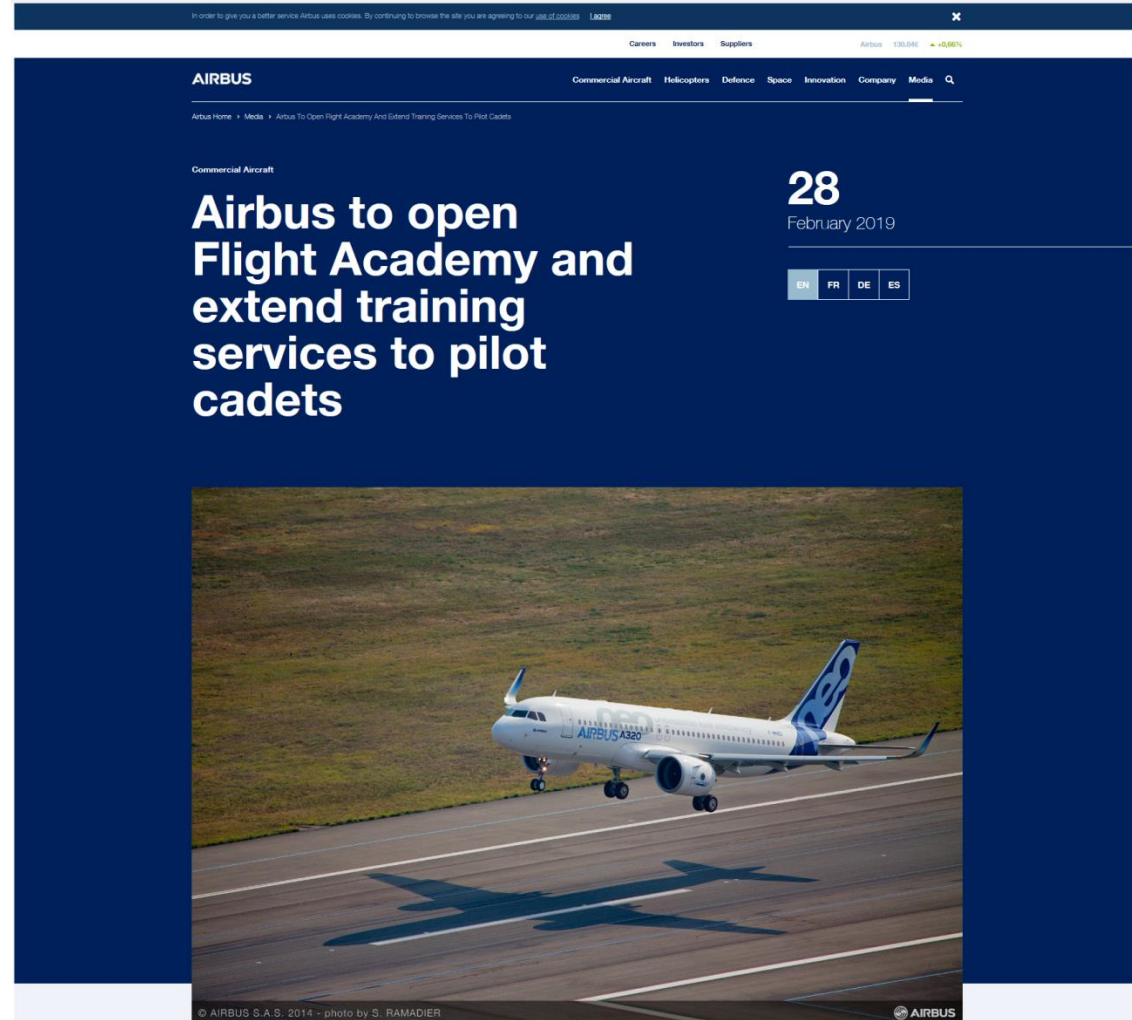
*“Airbus to open Flight Academy and extend training services to pilot cadets”*

(<https://www.airbus.com/newsroom/press-releases/en/2019/02/airbus-to-open-flight-academy-and-extend-training-services-to-pilot-cadets.html>)

### See also:

*“L’ENAC, partenaire technique d’Airbus pour la formation initiale des pilotes”*

(<http://www.enac.fr/fr/lenac-partenaire-technique-dairbus-pour-la-formation-initiale-des-pilotes>)

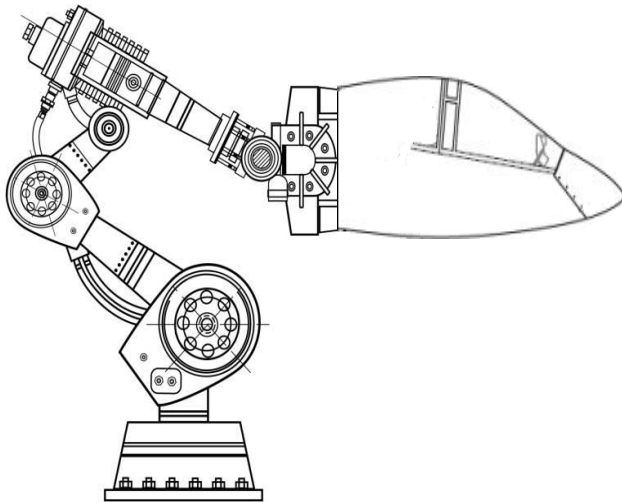


## IDENTIFY AND BUILD CRITICAL CAPABILITIES:

### News:

“Technological Institute of Aeronautics (ITA) and Embraer launch **flight simulation** project”

( <http://www.ita.br/noticias/sivor> )



**INSTITUTO TECNOLÓGICO DE AERONÁUTICA**

# Biblioteca # Fale conosco # Webmail

Digite aqui para pesquisar

Início O ITA Organização Estude no ITA Ensino Pesquisa Extensão

### Inauguração do Simulador SIVOR

No dia **26 de setembro de 2019**, acontecerá, no Centro de Competência em Manufatura (CCM) do ITA, o workshop de inauguração do **Demonstrador Pleno do Simulador SIVOR**, resultado de uma parceria técnica entre **ITA e EMBRAER**, com apoio financeiro da **FAPESP**.

SIVOR é o acrônimo para o Simulador de Voo com Plataforma Robótica de Movimento. O Simulador SIVOR explora o uso de um robô industrial de 6 graus de liberdade e carga útil de uma tonelada como plataforma de movimento para um simulador de alto nível de fidelidade. O objetivo é transmitir ao piloto uma sensação de movimento equivalente àquela experimentada em voo. Para aumentar seu espaço de trabalho e permitir a simulação de manobras que hoje não são comumente executadas num simulador de base móvel, o Simulador SIVOR está instalado sobre um trilho, que adiciona mais um grau de liberdade ao sistema.

#### PROGRAMAÇÃO

- 14h00 - 14h10 Abertura do evento
- 14h10 - 15h30 Apresentação do Projeto SIVOR
- 15h30 - 16h30 Demonstração do Simulador SIVOR

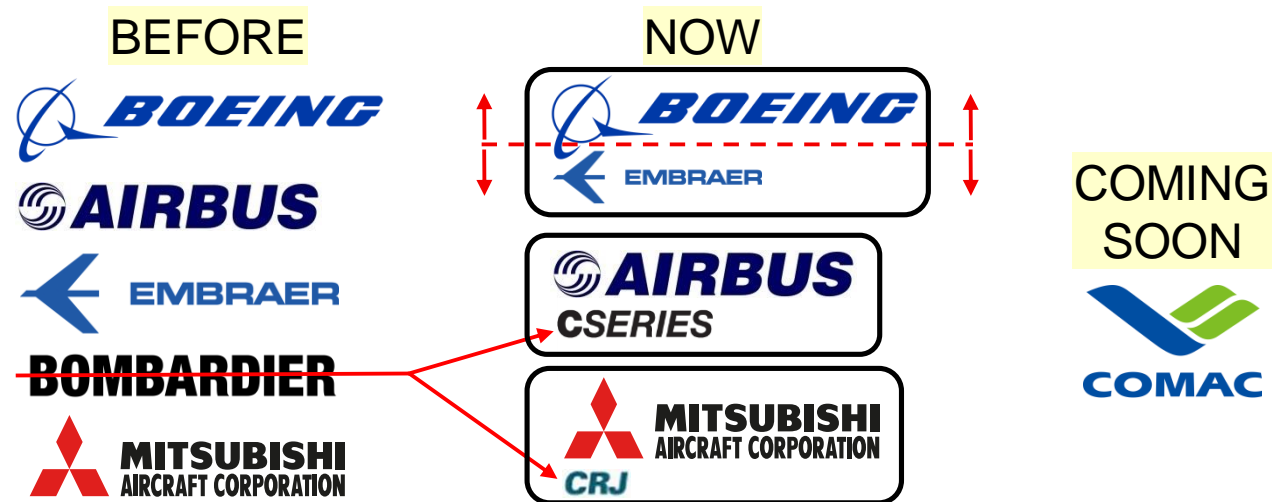
Para confirmar a presença, envie um email para [evilani@ita.br](mailto:evilani@ita.br).

[Tweetar](#) [Curtir 3](#) [Share](#)

**IDENTIFY AND MAP COMPETITORS AND SUPPLIERS MOVEMENTS:**

*Develop robust strategies to protect the program (the business)*

- Find strategies when the competitive environment is undergoing a process of change.
- Executives must behave as decision makers in order to consider how competitors can react to the marketing change, and also against each other.
- Benefit: development of robust strategies, providing the confidence that the decisions are feasible in developing a vision or a strategic plan for the future of the program.





*End of Part 2*  
*From PROJECT to PROGRAM Management*

## *Special Lecture Series on System Integration III*

### Project and Program Management – Part 3

## **TRENDS in Project and Program Management** (ToC Critical Chain – Agile Project Management)



MITAC Academy

*Intensive Short Course in Collaborative Program with  
MITAC Academy – September 2021*

***Prof. Artur Henrique Moellmann, Ph.D.***

*Federal Institute of Education, Science and Technology – Brazil  
MITAC Academy advisor*

© MOELLMANN A.H.

This workshop was developed based on recognized bibliographical references and the author's professional and academic experience, in order to lecturing on behalf of the MITAC Academy Program. Neither this document, nor any information in it, shall be used, reproduced, or disclosed to third parties without the prior written consent of MITAC or the author. Any permitted reproduction of this document, in whole or in part, shall include this notice.

- **CCPM:** Prioritizing and sequencing the Program schedules, applying the **Resource Leveling** to the **Constrained Resource** (“BOTTLENECK”) to minimize overload and scheduling conflicts.
- **BUFFER** management.
- Avoid the source of problems related to the **BEHAVIORAL** aspects:
  - Creating **exceeding safety** on timing estimates.
  - Harmful **MULTI-TASKING**; the “**Student’s Syndrome**”; the “**Parkinson's Law**”.

## **Eliyahu Goldratt [The Goal – Chapter 15]: “The Scouts Hike”**

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

## SCRUM Framework Structure:

### ROLES



Product Owner



Scrum Master



Scrum Team

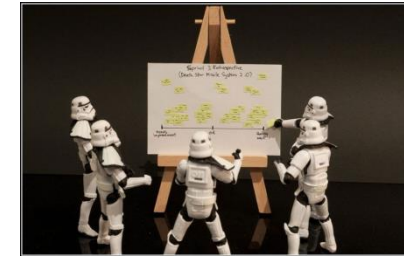
### EVENTS



Sprint Planning

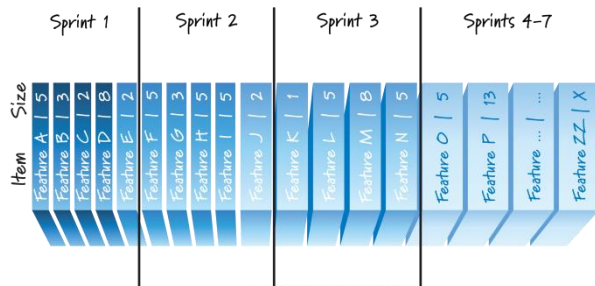


Daily Scrum

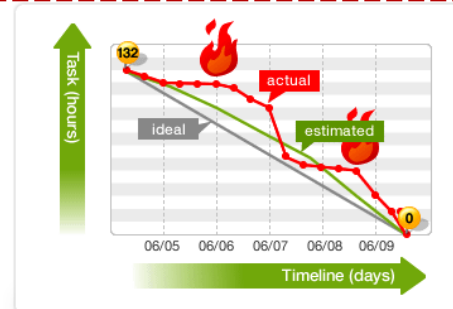


Sprint Review /  
Retrospective

### ARTIFACTS



Product Backlog / Sprint Backlog



Burndown Chart



Product Increment

***End of Part 3***  
***TRENDS in Project and Program Management***

## *Special Lecture Series on System Integration III*

### Project and Program Management – Part 4

## **Case Studies in Aerospace**



MITAC Academy

***Intensive Short Course in Collaborative Program with  
MITAC Academy – September 2021***

***Prof. Artur Henrique Moellmann, Ph.D.***

*Federal Institute of Education, Science and Technology – Brazil  
MITAC Academy advisor*

© MOELLMANN A.H.

This workshop was developed based on recognized bibliographical references and the author's professional and academic experience, in order to lecturing on behalf of the MITAC Academy Program. Neither this document, nor any information in it, shall be used, reproduced, or disclosed to third parties without the prior written consent of MITAC or the author. Any permitted reproduction of this document, in whole or in part, shall include this notice.

# MITAC-ACADEMY PROGRAM: CASE STUDIES IN AEROSPACE – EMBRAER CCPM

EMBRAER “Critical Chain Project Management”

## TOCICO 2019 INTERNATIONAL CONFERENCE

CHICAGO, IL | JULY 14-17, 2019

Embraer and TOC - A Journey of Achievements

<https://www.tocico.org/page/2019AparecidoGuestAttend>

Embraer built a heritage out of challenging the impossible.

The typical cycle of the development of a new Aviation Program is 7 to 9 years.

The E2 Program is not only a new airplane, but also a new industrial architecture, a new supply chain, a new and more connected airplane for passengers, operations and maintenance, a new marketing plan and a new socioeconomic improvement enabler.

The Theory of Constraints has been applied, making effective use of the Critical Chain. Deviations have been reported through a simple color code (green, yellow, and red).

The bike race image has been used so everyone challenged to work a little bit faster and a buffer at the end of the Program accommodated unexpected delays. The Program Management team would focus all of its energy on supporting the last bikes (constraints) always using five steps focusing.

The greatest achievement of the E190-E2 Program was proving that it is possible to deliver a new airliner two months ahead of a very challenging original schedule (5 years from Business Plan Approval/Program Launch to First Revenue Flight), on a very tight budget and better than the most competitive spec in its crossover jet category, with a mature entry into service.



## From best practice to next practice

Would you have the confidence to set project targets that had never been achieved in your industry? And would you know how to make sure they are hit?

IAN HEPTINSTALL  
Course Leader,  
Masters in Industrial Project Management,  
University of Birmingham



[https://issuu.com/mediaplanetuk/docs/project\\_management/12](https://issuu.com/mediaplanetuk/docs/project_management/12)



# MITAC-ACADEMY PROGRAM: CASE STUDIES IN AEROSPACE – EMBRAER “CCPM and APM SCRUM”



Philip MARRIS • 2nd

CEO Marris Consulting - Expert in Lean and Theory Of Constraints

1d ...

Nice coincidence:

The PMI's Project of the year 2019 winner is Embraer's Critical Chain E-Jets E190-E2 product development project. The Project Management Institute has just awarded its prestigious Best Project of the Year Award to Embraer for its incredible performance in developing an airplane using a Critical Chain Project Management (CCPM) approach.

3 minute video by the PMI of the 2019 award winner here:  
[https://youtu.be/VMKS6xbzK\\_0](https://youtu.be/VMKS6xbzK_0)



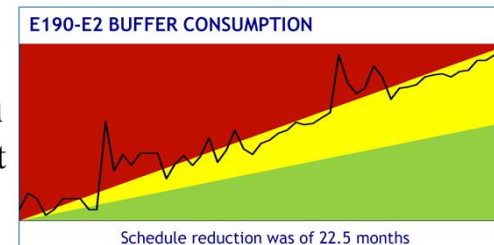
## Best project of the Year 2019 Award



E-Jets E190-E2



Using  
**Critical Chain**  
Project Management  
approach



CCPM addresses the organizational forces and natural human tendencies that conspire to delay projects.

You must invest the time to build a solid precedence network, as well as identify and address fundamental behavior changes that are required to avoid waste and delays, by means of people working in a coordinated manner and focused on the right priorities.

# MITAC-ACADEMY PROGRAM: CASE STUDIES IN AEROSPACE – **BOEING “CCPM”**

## **BOEING** Space and Intelligence Systems “CCPM”

### ■ INTEGRATED DEFENSE SYSTEMS



Space and Intelligence Systems employees Bruce Tomei (from left), Jonathan Fish, Steve Sichi, and Ying Fera plot Critical Chain Project Management strategy.

SALLY ARISTE PHOTO

The **CCPM** approach recognizes that uncertainty and competition for resources are inevitable; so it provides three fundamental rules for managing their effects:

- Limit the amount of work in process.
- Create a buffered schedule.
- Manage daily execution to global metrics.

## Keep the chain **intact**

S&IS speeds work  
on complex programs

By JOEL R. NELSON

BOEING FRONTIERS July 2007

© MOELLMANN A.H.

## BOEING “Lean+ 10X” Concept (CCPM + SCRUM)

# Simple as...

New technique removes complexity and saves millions

By Elaine Brabant  
Photos by Marian Lockhart

**T**he Boeing Company has done it for nearly a century. And very successfully. But developing a new airplane remains an enormously complex task. Now, a new tool in Boeing's how-to arsenal is making that task a little simpler. It's known as **Lean+ 10X**. The concept is so basic it might be easily dismissed in the complex aerospace environment: **Prioritize work and complete tasks without interruption.**

**"It's a notion that's surprisingly simple, but counterintuitive,"** said Charles Toups, vice president of Engineering and Mission Assurance for Boeing Integrated Defense Systems. **"To go faster, with higher quality, you want to limit the number of tasks you are working on at any given time. We tend to think getting everything started is the fastest way to finish, but we end up with too many different tasks at once and actually go slower."**

Introduced last fall by Toups' unit, Lean+ 10X is already paying rewards on programs such as the P-8A Poseidon for the U.S. Navy and the Airborne Early Warning & Control (AEW&C) system planes for international customers.

**"Whoever figures out how to do development work extremely well will own the industry. Why shouldn't that be us?"** said Tony Parasida, then vice president and general manager of Airborne Anti-Submarine Warfare & Intelligence, Surveillance and Reconnaissance Systems (ASW&ISR), the division leading the P-8A and AEW&C programs, and now president of IDS Global Services & Support.

A plane is an incredibly complex system composed of thousands of subsystems, many of them highly complex, which must function flawlessly and be able to work with one another. To that challenge add a fiercely competitive business environment. Customers are focused on affordability, and contractors are under pressure to be even more competitive. Customers hold them accountable with tough penalties for not meeting commitments.

Although these challenges aren't likely to disappear, Boeing leaders agree that the company—in fact, the entire aerospace industry—must become more nimble and responsive in the development stage of products.

That's where Lean+10X has entered the picture. Parasida

**"Whoever figures out how to do development work extremely well will own the industry. Why shouldn't that be us?"**

— Tony Parasida, then vice president and general manager of ASW&ISR and now president of Integrated Defense Systems Global Services & Support

- Establish clear priorities.
- Eliminate bad multitasking – focus and finish.
- Limit the release of work in process to deliver earlier (i.e., **limit the amount that is processed at one time**).
- **Prepare – start to finish.**
- Use checklists to prevent defects and “traveled risk” (mistakes or incomplete work passed on to the next process, which can cause problems later).
- **Face into and resolve issues quickly.**
- **Drive daily execution.**

***End of Part 4***  
***Case Studies in Aerospace***

***Closing:***

*Questions?*

*Discussions!*

*Tips!*

***Thank you!***



**MITAC  
Academy**



# 改訂履歴- Revision Description

RECORD OF REVISION AND APPROVAL				
Rev	Description	Prepared by	Checked by	Approved by
IR	Initial Release – 2020/09/29	ARTUR MOELLMANN/モー ン アーサー	ARTUR MOELLMANN/モー ン アーサー	TAKESHI FUJITA/藤田 健