Challenges of Obtaining/Using PMA

(For the 'PMA' Seminar Organised by HKAIA)

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Agenda:

1) What is PMA?
2) Why are PMA Attractive?
3) What can be PMAed?
4) How many ways to obtain a PMA?
5) Can we use PMA on HKG Registered Aircraft?
6) What is CX's PMA Policy?
7) Issues/Challenges From Perspective of End Users
8) Opportunities for the Potential PMA Suppliers in Hong Kong
9) Expectations from end users
10) Q & A

What is a PMA?

• "PMA" is an acronym for **P**arts **M**anufacturer **A**pproval(零部件制造人批准书).

• PMA regulations are created by the US Federal Aviation Administration (FAA- 美国联邦航空局) in 1955 to provide a method of approval for airworthy modification & replacement parts(改装和替换零部件)

• This regulation responded to a need for replacement parts for out-of-production Military Surplus Aircraft that were being operated as Civil Aircraft.

What is a PMA? (cont'd)

- PMA is one of eleven (11) ways to obtain an FAA Approved part and a way the FAA uses to control and approve replacement or modification parts manufactured for sale and installation on a Type Certificated (TC) Product (已获取型号合格证的产品)following the TC product's initial Airworthiness Approval.

- PMA is a **combined design and production approval** by the FAA for replacement parts for type-certificated aircraft, engines, and propellers.

Why are PMA Attractive?

1) Cost saving: direct and indirect (competition from PMA parts has moderated OEM's price increases)

2) Assurance of supply/Lead time reduction: an alternative to reduce lead time and/or ensure continuous supply of spares to support the operations.

   Example: a Japanese seat manufacturer's approval has recently been suspended by FAA,EASA and JCAB but CX still flies these seats hence spares parts are required to support its operations.

What can be PMA'ed?

•Theoretically the FAA regulations allow a PMA to be developed for ANY type certificated component

•In practice, PMAs are developed for Class II and Class III items only

Definitions:

Class II items: complex parts that are installed into Class I parts such as aircraft, engines and propellers. Examples: wings, fuselages, empennage assemblies, landing gears, power transmissions, or control surfaces, etc

Class III items: simple parts like nuts,bolts, washers etc. which are usually sub-components to class II products.

What Can Be PMAed?

Cockpit/Avionics
- INUs, IRUs
- Display Units
- DGAs
- Instruments
- Autopilots
- Radomes
- Nose Cowl
- Battery Packs
- Cockpit Paper

Fuselage/Interiors
- In Flight Entertainment
- Lavatories
- Seat Parts
- Tray Tables
- Galleys
- Overhead Bins

Wing
- Flight Controls
- Actuation Systems
- Guides

Landing Gear
- Wheels and Brakes
- Landing Gear

Components
- Electro-Mechanical
- Hydraulic Pumps
- ACMs, CSD/IDG
- Batteries
- APUs

Engines
- CFM56
- CF6
- CF34
- PW2000
- PW4000
- V2500
- JT8D
- JT8D
- LM2500/500/600

- Combustion Chambers
- Blades & Vanes
- Fan Exit Guide Vanes
- Shrouds (single crystal & equiax)
- Thrust Reversers
- Acoustic Panels
- Pneumatic/Bleed/Anti Ice Valves
- Heat Shields
- Insulation Blankets

- Fuel Pumps
- Nozzles
- Gears
- Shafts
- Bearings
- Starters
- Rings
- Spacers
- Expendables

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What Can be PMAed?

Cabin Interiors Parts

What can be PMAed?

Meal- Table

What Can be PMAed?

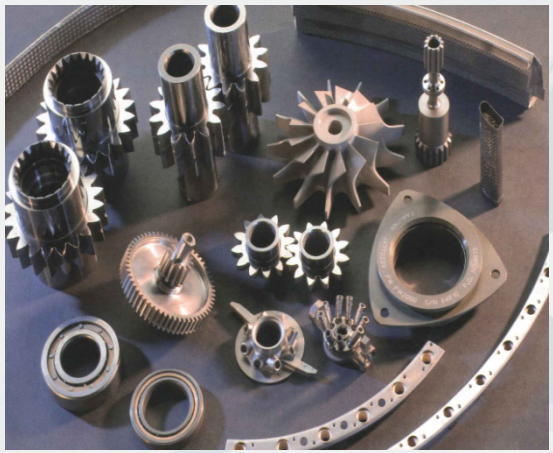
B757 Goodrich
Brake (2-1457) Piston

B737 Main Landing Gear
Axle Sleeve

Courtesy: HEICO

What Can be PMAed?

Low Tech & High Volume PMA



High Tech & Value PMA

High tech repaired parts

Any different acceptance or quality standards between PMA and OEM parts?

- No! The airworthiness requirements are essentially **identical**! In fact, by definition, **a PMA part should be at least as good as, or better than, the OEM parts.**

- A close examination of the relevant PMA approval process and the performance of PMA parts in service show that a PMA part has no more technical risk than the equivalent part provided by the OEM

- Approved PMA parts **are Legal, Safe,** and **Reliable**

How many ways are there to obtain a FAA- PMA?

There are two main ways to obtain FAA-PMA approval under FAA:

-Identicality (等同PMA件), and
-Test & Computations(测绘ＰＭＡ件)

1. Identicality

a. Identicality by Licensing agreement from TC/STC Holders(经过型号合格证/补充型号合格证 持有人授权生产的PMA 件)

b. Identicality by Design: (PMA制造人具有TC/STC持有人相关的所有资料). After World War II this was a common means of application as many "OEMs" no longer supported the products and drawings were freely available to aircraft operators.

c. Identicality by Associative means: PMA件制造人通过相关的PO,运单，专利或其他文件证明该ＰＭＡ件是TC/STC持有人设计的

How many ways are there to obtain a FAA- PMA (Cont'd)?

2. Test & Computation（测绘ＰＭＡ件)= Reverse Engineering(逆向工程)

Must demonstrate compliance with the applicable airworthiness standards in terms of part design including materials (材料), processes (工艺/处理), test specifications(测试规格), system compatibility (系统兼容性), maintenance instructions (维修指引) and part interchangeability (PMA件与OEM件的互换性) . These may be demonstrated through either of the following:

a) Comparative Test and Analysis: To demonstrate the functional design of the proposed part is at least equal to that of the original TC,STC or TSO

b) General Test and Analysis: The applicant may demonstrate that the functional design of the part meets the requirements of all applicable airworthiness standards.

Typical Combination Burn Test for Passenger Seat Cushions

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Can we use FAA-PMA on HKG Registered Aircraft?

a) Yes, based on HKCAD AN17

b) The following **FAA-PMA** parts (PMA parts made under FAA approval) are acceptable without further conditions being imposed:

-Non-Critical Parts
-Any Licensed Parts (critical and non-critical)

*c) **HKCAD granted approval to CX to accept non-structural interior (cabin) parts made under CAAC approval back in 2006***

d) Both CAAC and HKCAD signed a cooperation arrangement agreement in May 2009 to mutually accept all non-critical parts made under CAAC PMA approval and HKCAD PMA approval(“相互接受零部件制造人批准书合作安排”)

e) The Schedule of the Implementation Procedures (SIP) (“实施程序细则”) was signed by CAAC and HKCAD in April 2010.

How many PMA's exist today?

There are over 350,000 FAA Approved PMAs (5% of the total parts market) , most of which are developed through 'Test & Computation'. Also, CAAC has approved quite a lot of cabin parts whereas Hong Kong CAD has approved a relatively small no.

The FAA-PMA database may be found at:
http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgpma.nsf/Frameset?OpenPage

The CAAC PMA database may be found at:

http://safety.caac.gov.cn/unfilter/shsnew/shihang/newsouttextview.jsp?pk=100000043838826

The Hong Kong PMA (HPMA) database may be found at:

http://www.cad.gov.hk/reports/HKAN/AN_Amendment_Issue77.pdf

What is the PMA Policy of Cathay Pacific?

• Basically CX follows the HKCAD AN17 requirements except that all technical docs need to be reviewed/approved by Technical Services and endorsed by CX QA (although by regulations this is NOT required)

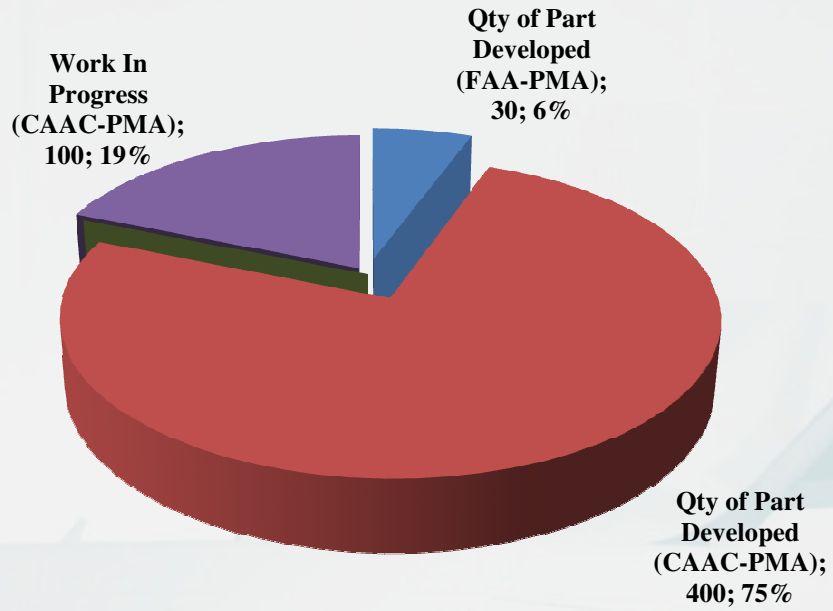
• In addition, ***NO*** PMA parts are allowed on ETOPS (Extended Twin Engine Operations- 双发延程飞行) critical items (ETOPS运行的飞机,而飞机制造商规定为ETOPS敏感的部件一律不得使用PMA件)

• For CX/KA, for the ***cabin*** PMA parts that are already developed, they are manufactured under ***CAAC*** approval.

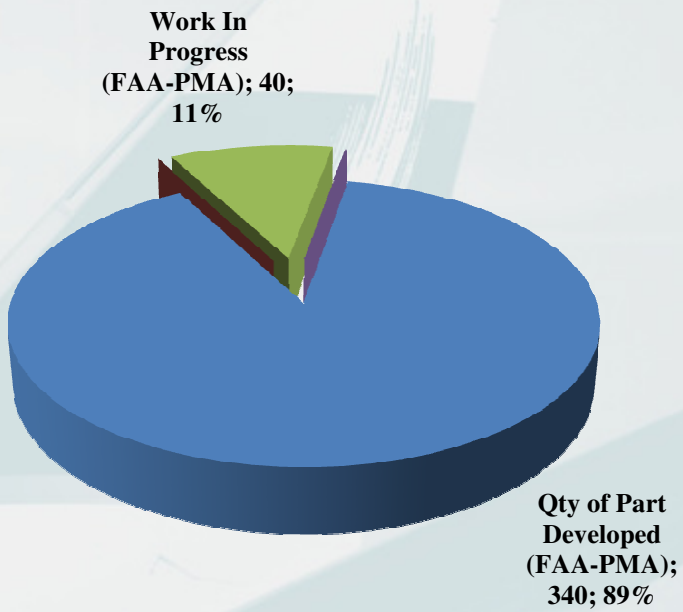
• For ***Non-cabin*** PMA parts developed, they are ***FAA-PMA*** approved.

Where is CX on PMA Utilisation?

Cabin Interiors



Airframe/Avionics/Engines



Issues/Challenges From Perspective of End Users – External Factors

Regulatory Authorities:

FAA-PMA: development cycle for new parts is long: **12-16 months** is typical due to inadequate manpower and increasing no. of parts pending review and approval.

Issues/Challenges From Perspective of End Users – External Factors

TC Holders:

-Issued Operators Information Telex to warn the operators about the potential risks induced by installation of replacement parts, i.e. PMA

Issues/Challenges From Perspective of End Users – External Factors

Aircraft Lessors:

- PMA can block some aircraft transfers because not all regulatory agencies or airlines will accept PMA
- PMA may reduce aircraft value because PMA parts cost less than OEM
- The lessors will request either the PMA parts to be replaced with OEM parts or request for monetary compensations at end of the lease terms

Issues/Challenges From Perspective of End Users – External Factors

OEMs:

- Threatening not to honour warranty if PMA is used on, say, component repair.
- Making claims that PMA parts will never perform as good as OEM parts
- Using the Power-By-The-Hour/fixed price repair agreement, Total Care Package (TCP) or other inventory support packages so as to eliminate market entry
- Introducing more frequent upgrades (usually on engines) which raise the costs of entry for PMA companies

Issues/Challenges From Perspective of End Users– External Factors

Suppliers:

- **FAA-PMA Suppliers:**

a. Long development cycle, bottle-necked by lengthy FAA approval process

- **CAAC-PMA Suppliers:**

a. Misaligned expectations on quality: workmanship, degree of precision, tolerances etc. : Trial fit of the first article on the aircraft before mass production has proved to be extremely useful in minimizing material wastage and delayed parts delivery

b. Require 100% inspection by CX QA for the first few batches of production parts (drain a lot of internal resources)

Note:
CAAC-PMA suppliers have very favorable development cycle time (2-3 months for cabin parts)

Issues/Challenges From Perspective of End Users– Internal Factors

Cathay Pacific Airways:

- Lack of engineering time and resources to approve packages as this is not the priority of the engineers
- Lack of manpower to analyse opportunities: a large development program requires a lot of resources to track and maximise opportunity
- Lack of knowledge towards PMA still hinders PMA growth and lost savings
- Many agreements made with a/c Lessors,MROs, Total Care Package (TCP) and material management agents etc. have precluded the use of PMA parts.

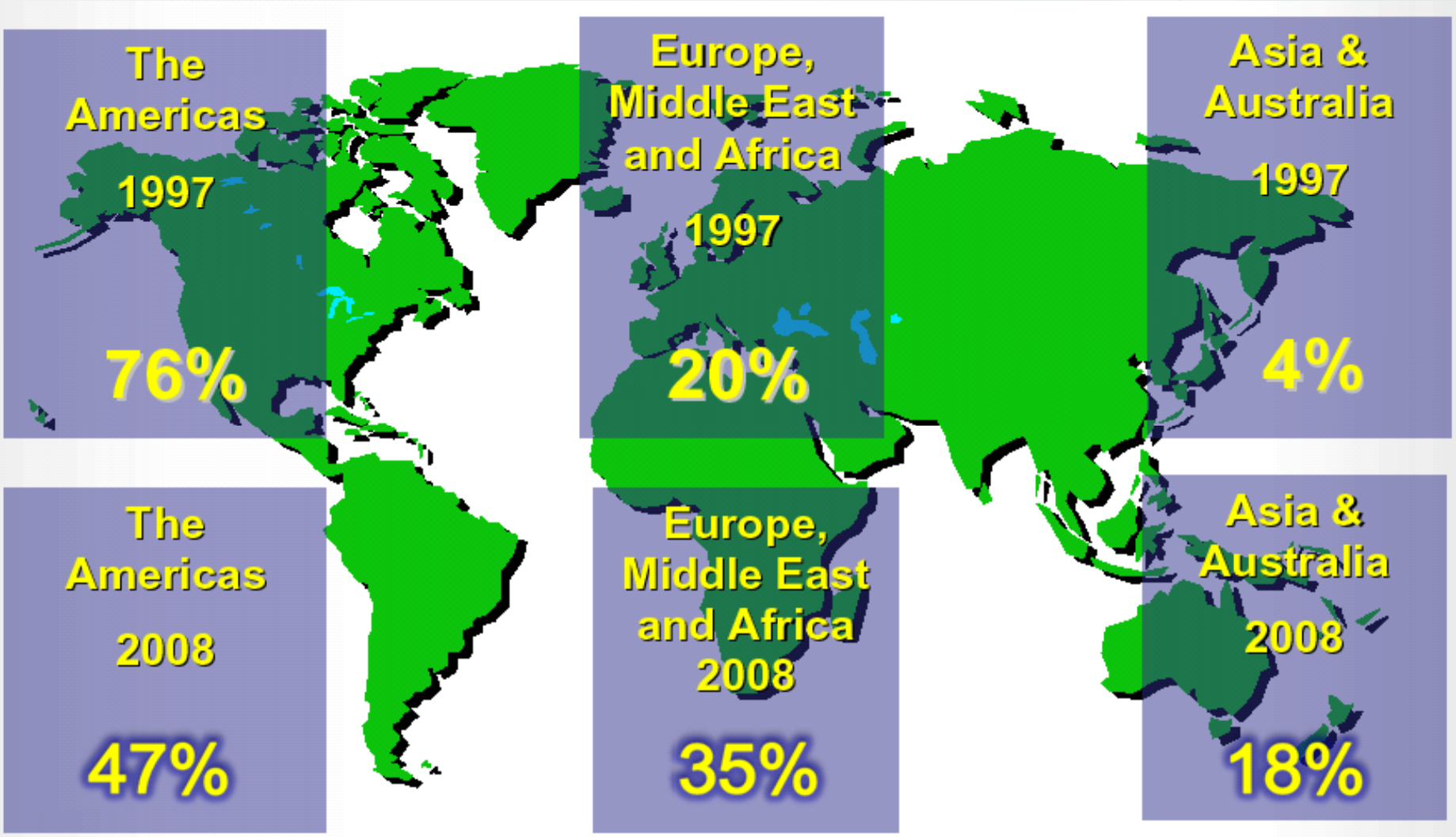
Note:
In theory, based on HKCAD AN17 and the latest 'Cooperation arrangement on mutual acceptance of PMA between CAAC and HKCAD', PMA parts that fall within the aforementioned authority limits can be adopted without limitations.

Opportunities for the Potential PMA Suppliers in Hong Kong

1) From Darryl's introduction, the MRO market, particularly for Asia, will double from 2010 (HKD329B) to 2020. Asia-Pacific and China accounted for 20% of the world MRO market. The PMA market still has much untapped potentials.

2) Increasing acceptance of and interest in PMA parts by the airlines even in the Asia Pacific Region due to cost pressure as well as increased knowledge about PMAs.

Global Distribution of PMA Adoption: 1997 vs 2008



Source: HEICO

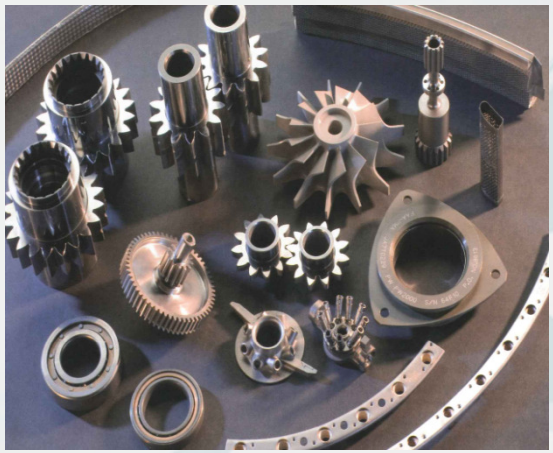
Opportunities for the Potential PMA Suppliers in Hong Kong

3) Signing of the cooperation agreement (相互接受零部件制造人批准书合作安排) , as well as the associated Schedule of Implementation Procedures (实施程序细则), on mutually accepting each other's PMAs has paved the way for the Hong Kong based suppliers to enter the huge aviation parts market, both in Mainland China and Hong Kong, in terms of design and production.

4) Similar 'cooperation agreement' may be signed with other airworthiness authorities to expand the PMA market, both for the benefits of the local airlines and the potential local PMA manufacturers.

Strategies of Potential PMA Suppliers

1) Start with low tech/high volume parts first
2) Collaborate closely with MROs (PMA parts used for component repairs and line/base maintenance because those are where the gold mines lie
3) Look beyond the HKG borders



Start with Low Tech & High Volume PMA

High Tech & Value PMA

High tech repaired parts

Expectations from End Users on PMA

1) Certainly would like to increase the scope of utilisation to contain spend on materials

2) Regulatory authorities must be more open to new market entrants and the parts made by non-FAA PMA manufacturers, e.g. Australian PMA's (APMA)

3) MROs must establish new supply chain management system to cope with the new demands (help source and approve alternative parts to reduce cost on customers)

4) Leasing companies must address issues of transferability and asset valuation

Expectations from End Users on PMA

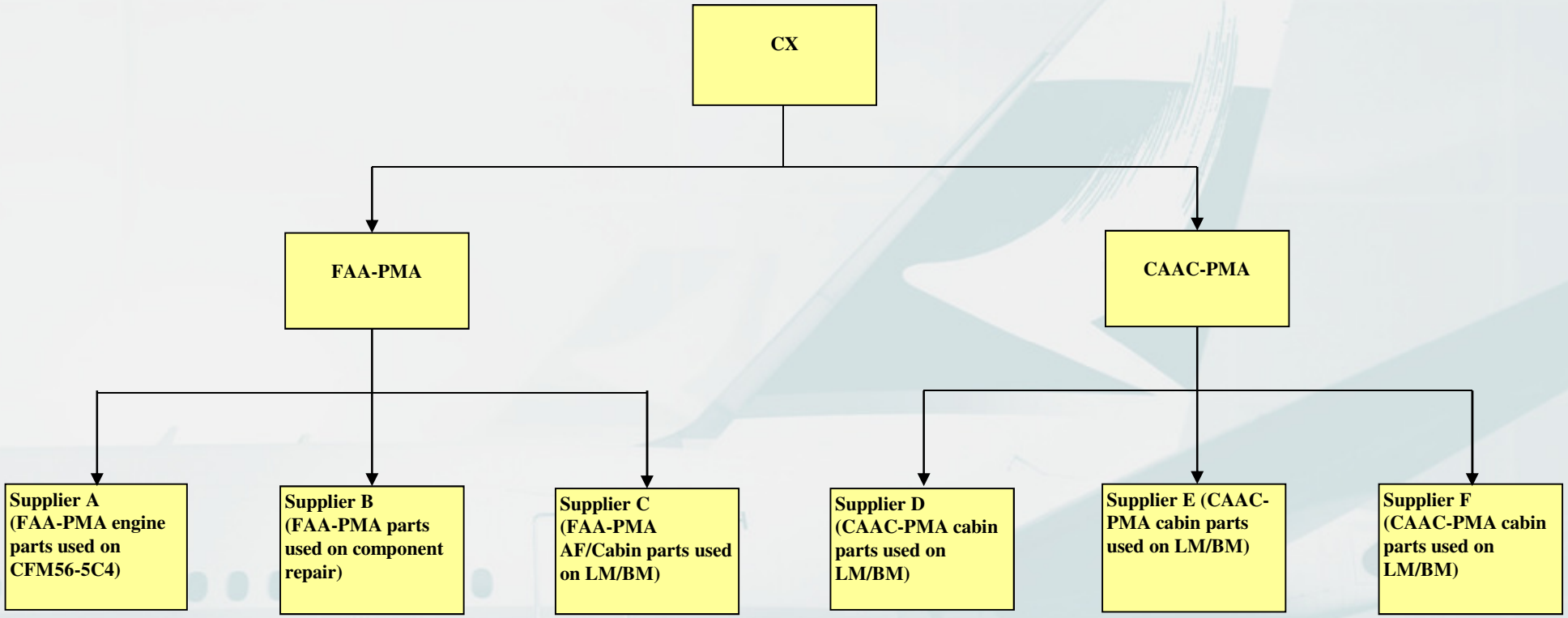
5) PMA suppliers must:

- compete on Cost (selling price), Quality and Development Cycle

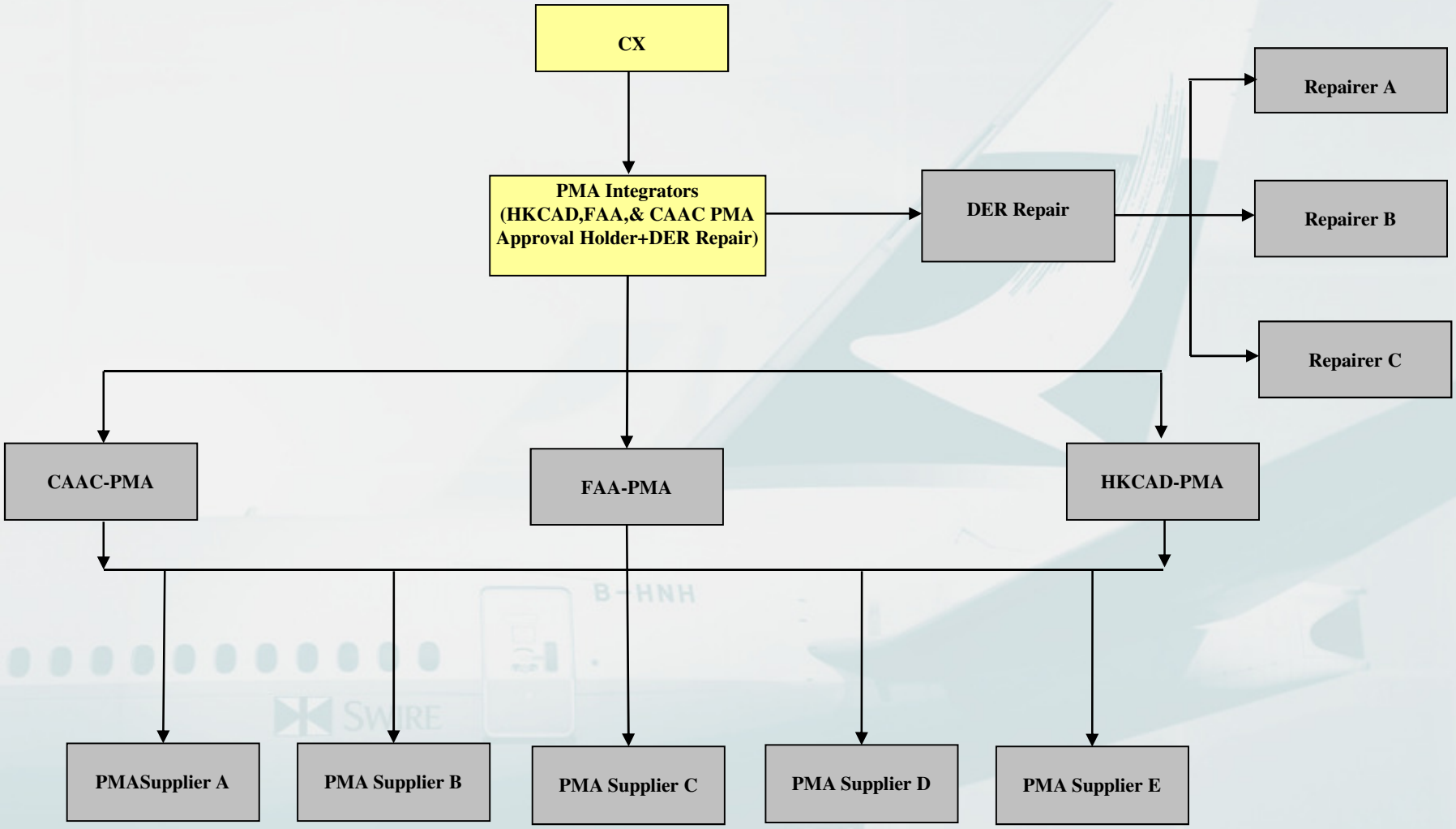
- build up manufacturing capability to fabricate a wider range of PMA parts

- build up capability to manage the PMA program (a one-stop shop) for the customers, or at least a production line, e.g. Cabin Interiors, Airframe or Engine parts.

Current CX PMA Management Model



Ideal PMA Management Model



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