出國報告（出國類別：其他）

參加「發動機委任工程代表修理和替代件使用」研討會

服務機關：交通部民用航空局
姓名職稱：林孝鏗科長、林明慧約聘人員
出國地區：中國大陸
出國期間：中華民國 100 年 3 月 15 日-100 年 3 月 19 日
報告日期：中華民國 100 年 4 月 28 日

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壹、 目的

美國普惠商用發動機（Pratt & Whitney Commercial Engines）公司與中國大陸民航局共同舉辦發動機委任工程代表(DER，Designated Engineering Representative)修理和替代件使用研討會，該會議的目的是讓航空公司維修人員及民航局檢查員了解工程代表修理和替代件使用的方式和合法性，並強調在降低維修成本的同時能兼顧飛航安全。藉由實際之參與研討會，增加與發動機製造廠、航空公司、中國大陸民航局資訊交流及相互合作之機會。

貳、過程

本次行程安排如下:

日期	行程
3/15	台北—杭州
3/16-3/18	會議
3/19	杭州—台北

會議由普惠商用發動機(Pratt & Whitney Commercial Engines)公司 Vice President Mary Anne Cannon主持。中國大陸民航局徐超群副司長及華東管理局副局長吳堅與會致詞。

本局由飛航標準組初始適航科林孝鏗科長及林明慧正工程師參加,中華航空公司也派員參加,與會人員名單如附件1。

會議議程如下:

March 16 - 18, 2011 Hangzhou

March 16 (WED) - Registration

09:00 - 16:30 Registration

18:00 Welcome Dinner

March 17 (THU)

08:30 - 08:45 Introduction & Opening remarks:
- A. Nakano -Chair
- Mr. Xu Chaoqun

08:45 - 09:00 CFM56 Product Line Management Introduction
M.A.Cannon

09:00 - 09:30 UTC/ PW/GSP J. Annibalini

09:30 - 10:00 PW Overhaul Capability S. Vincens

10:00 - 10:30 CFM56 Overhaul Network Review M. Mahonski

10:30 - 10:45 Break

10:45 - 12:45 DER Overview R. Fritsch
- Why PW develops DER repairs
- PW DER repair overview
- DER repair development process
- DER repair application and approvals
- DER repair testing and system testing
- Case study - success stories
- Benefits of DER repairs to customers

12:45 - 14:00 Buffet Lunch

14:00 - 14:30 Global Repair Services Overview J. Nye

14:30 - 15:00 GMS Briefing S. Calibo

15:00 - 16:00 CAAC regulation on DER Repairs CAAC representative
CAAC view on DER Repairs

16:00 - 16:30 Q&A

16:30 - 17:30 Wrap-up Summaries
- Mr. Xu Chaoqun, Deputy Director General of Airworthiness Dept.
- Mary Anne, Vice President of PW

18:00 - 21:00 Reception

March 18 (FRI)

08:00 - 08:45 Depart for Xixi Wetland (Please check out before depart)

08:45 - 11:00 Tour Xi Xi Wetland

11:00 - 14:00 Depart for SEC (Lunch box in the bus)

14:00 - 15:30 Visit SEC

參、會議內容摘要

1.普惠公司的 CFM56 發動機維修中心

奇異公司(General Electrical Co.)CFM56 發動機在全球銷售量龐大，導致該型發動機維修具有廣大的市場。美國普惠商用發動機（Pratt & Whitney Commercial Engines）公司以其發動機製造技術執行奇異公司該型發動機修理並發展該發動機委任工程代表修理(DER Repairs)和替代件使用，以降低維修成本，吸引客戶。

普惠公司在全世界設有三處 CFM56 發動機維修中心：

1.挪威發動機維修中心

2.土耳其發動機維修中心（與土耳其航空公司合資）

3.上海發動機維修中心（與大陸東方航空公司合資）

普惠公司標榜具有發動機製造商工程資源，客戶化的工作計畫，經驗豐富的工程師團隊，零件現場診斷並制定修理方案以減少零件報廢，以滿足不同客戶的需求。其他良好的服務，包括維修時程較短、品質較佳（發動機尾溫的裕度較高）、價格較低，詳見附件 2。

2. 有關委任工程代表(DER)修理的方法

當奇異公司之製造廠修理手冊無法滿足修理廠或航空公司的修理需求時，修理規範是一種變通的修理方法，美國航空總署(FAA)授權委任工程代表執行修理技術文件的核准。

委任工程代表用 FAA 8110-3 表格去單次核准修理方法，該表格證明其修理方法符

合美國法規。

委任工程代表若要執行可重複使用的修理方法的核准需使用修理規範的方法，委任工程代表先用 FAA 8110-3 表格去核准修理方法，最後可重複使用之修理方法是採用具有申請者及委任工程代表簽署之修理規範。

修理規範之委任工程代表需至少五年委任工程工作經驗及三年修理規範相關之專業工作經驗。

普惠公司以製造發動機的技術及委任工程代表核准修理規範的方法來執行不屬於奇異公司 CFM56 發動機手冊範圍之修理。

會議期間與普惠公司 FAA 修理規範之委任工程代表 Benjamin L. Willis 討論執行該工作之資格與方法等，該代表告知詳細內容可參考 FAA NOTICE N8110.11「Authorizing Designated Engineering Representative to Approve Repair Specifications」(授權委任工程代表核准修理規範)，詳見附件 3。

3.有關替代件使用，普惠公司提供 CFM56 發動機全球航材解決方案(Global Material Solutions)

CFM56 發動機修理可進一步細分爲 CFM56-3、CFM56-5、CFM56-7 等三種型號。

普惠公司提供該發動機替代件包括高壓渦輪葉片、低壓渦輪葉片、低壓軸、高壓軸、低壓壓縮輪盤、高壓壓縮輪盤、高壓渦輪輪盤、低壓渦輪輪盤等包括 8 種葉片及 18 種輪盤壽限件。若採用普惠公司的產品，每套壽限件與原製造商奇異公司的價錢比較可節省 65 萬美金，每套高壓渦輪葉片價錢可節省 16 萬美金。

另外若依據原製造廠奇異公司對發動機葉片的修理方式，許多破損的葉片是不可修

理，必須換新，但普惠公司提供修理規範方式修理可節省不少費用。以 CFM56-5/-7 發動機爲例，以普惠工廠修理方式包括高壓渦輪葉片、低壓渦輪葉片、高壓渦輪導片、低壓渦輪導片、遮蓋板等可節省 63.5 萬美金。普惠公司也強調對客戶提供準時交件、快速的修理、24 小時的客戶支援，詳見附件 4。

4. 中國大陸民航局核准-普惠公司 CFM56-3 發動機委任工程代表修理(DER Repairs)和替代件使用的審查

美國航空總署(FAA)及歐盟航空總署(EASA)先對普惠公司製造的 CFM56-3 發動機的替代件，其中 19 種關鍵件(含壽限件)是以補充型別檢定證（Supplemental Type Certificates）方式核准，其他非壽限件(Non-Life Limit Parts)是以零件製造核准(Parts Manufacturer Approval)的方式核准。

中國大陸民航局對普惠公司製造的 CFM56-3 發動機的 19 種關鍵件(含壽限件)是依據其擁有美國航空總署(FAA)補充型別檢定證以認可補充型別檢定證（Validation of Supplemental Type Certificates）方式核准，其他非關鍵件是以零件製造核准的方式核准。

中國大陸民航局對普惠公司審查項目包括：

（1） CFM56-3 發動機逆向工程設計審查。

（2） 技術評估，包括：

幾何及容差測量、材料規範及塗層分析、推力的影響、熱膨脹、振動測試、零件壽命預測、系統安全性分析及失效模式影響、組件互換性等技術評估。

（3） 操作考量：

初期使用期間避免飛機左、右發動機均使用替代件，以確保飛航安全。

肆、心得與建議

1. 普惠（Pratt & Whitney）發動機公司在航空界具有一流的工程技術，參加該公司主辦之技術研討會可提升本局技術人員的工程水準，有助於未來驗證或檢查工作。
2. 航空公司或維修廠爲了節省發動機高額修理費用，以委任工程代表修理的方法和替代件使用來修理發動機是未來發展的趨勢，我民航局應參考歐美先進國家做法，在不違背飛航安全考量下，協助合法業者的申請相關驗證，以便與各國適航驗證做法一致。
3. 普惠公司在全世界設有三處 CFM56 型號之發動機維修中心，該發動機維修中心的維修能量，可作爲本國航空公司送修 CFM56 型號之發動機時選項參考。

伍、附錄

附件 1、與會人員名單

附件 2、普惠公司的 CFM56 發動機維修中心

附件 3、FAA NOTICE N8110.11

附件 4、全球航材解決方案(Global Material Solutions)

Updated on 4/22/2011

Conference on Managing Engine Maintenance Cost and Flight Safety through DER Repairs & GMS
发动机维修成本管理与飞行安全 - 超手册修理和替代件使用研讨会
3/16-18, 2011

Customer List 客户名单

NO.	姓 名	English Name	职 位	Job Title	公 司	Company
1	林龙祥	Lin Longxiang	工程部工程经理	Manager of Powerplant Engineering, Engineering Division	国航工程技术分公司	Air China Technics
2	林孝鏗	Hsiao-Keng Lin	標準組初始適航科科長	Chief of Initial Airworthiness Section, Flight Standard Division	台湾民用航空局	CAA
3	林明慧	Ming-Hui Lin	標準組初始適航科工程師	Engineer of Initial Airworthiness Section, Flight Standard Divisior	台湾民用航空局	CAA
4	徐超群	Xu Chaoqun	适航司 副司长	Deputy Director General, Airworthiness Dept.	中国民用航空局	CAAC
5	吕新民	Lv.Xinmin	飞标司持续适航维修处处长	Director, Certification Division, Flight Standard Dept.	中国民用航空局	CAAC
6	刘薇薇	Liu Weiwei	适航司航空动力审定处	Certification Division, Airworthiness Dept.	中国民用航空局	CAAC
7	刘晓杰	Liu Xiaojie	适航司航空动力审定处副处长	Deputy Director, Certification Division, Airworthiness	中国民用航空局	CAAC
8	沈 洋	Shen Yang	适航司工程师	Engineer, Airworthiness Dept.	中国民用航空局	CAAC
9	顾 新	Gu Xin	适航维修处处长	Director, Airworthiness Maintenance Division	民航华东管理局	CAAC East Regional Administration Bureau
10	黄燕飞	Huang Yanfei	上海监管局适航处长	Director, Airworthiness Maintenance Division, Supervisor Management Office, Shanghai	民航华东管理局	CAAC East Regional Administration Bureau
11	汪 海	Wang Hai	浙江监管局适航处处长	Director, Airworthiness Maintenance Division, Supervisor Management Office, Zhejiang	民航华东管理局	CAAC East Regional Administration Bureau
12	张 剑	Zhang Jian	适航维修处监察员	Inspector, Airworthiness Maintenance Division	民航华东管理局	CAAC East Regional Administration Bureau
13	祝心刚	Zhu Xingang	适航维修处	Airworthiness Maintenance Division	民航中南管理局	CAAC Central Southern Regional Administration Bureau
14	白晓琳	Bai Xiaolin	适航维修处监察员	Inspector, Airworthiness Maintenance Division	民航华北管理局	CAAC North China Regional Administration Bureau
15	崔玉亮	Cui Yuliang	适航审定处监察员	Inspector,Airworthiness Certification Division	民航华北管理局	CAAC North China Regional Administration Bureau
16	李大宇	Li Dayu	适航维修处副处长	Deputy Director, Airworthiness Maintenance Division	民航东北管理局	CAAC Northeast Administration Bureau
17	杨红舸	Yang Hongge	辽宁监管局适航处副处长	Deputy Director, Airworthness Dept. Supervisor Management Office, Liaoning	民航东北管理局	CAAC Northeast Administration Bureau
18	魏 勇	Wei Yong	陕西监管局适航维修处监察员	Inspector, Airworthiness Maintenance Division. Supervisor Management Office, Shaanxi	民航西北管理局	CAAC Northwest Administration Bureau
19	周晓东	Zhou Xiaodong	陕西监管局适航维修处副处长	Deputy Director, Airworthiness Maintenance Division. Supervisor Management Office, Shaanxi	民航西北管理局	CAAC Northwest Administration Bureau
20	汪传志	Wang Chuanzhi	重庆监管局适航处处长	Director, Airworthiness Dept. Supervisor Management Office, Chongqing	民航西南管理局	CAAC SouthWest Administration Bureau
21	胥志德	Xu Zhide	适航处科员	Staff, Airworthiness Certification Division	民航新疆管理局	CAAC Xinjiang Administration Bureau
22	陈新锋	Chen Xinfeng	维修工程室主任	Director, Maintenance Engineering Dept.	中国民航局安技中心	CASTC/CAAC

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NO.	姓 名	English Name	职 位	Job Title	公 司	Company
23	高艳蕾	Gao Yanlei	发动机审定中心筹建办工程师	Aero-Engine Certification Center Engineer	中国民航局安技中心	CASTC/CAAC
24	栗牧怀	Li Muhuai	中国民航科学技术研究院总工程师	Chief Engineer	中国民航局安技中心	CASTC/CAAC
25	杨 彬	Yang Bin	发动机审定中心筹建办工程师	Aero-Engine Certification Center Engineer	中国民航局安技中心	CASTC/CAAC
26	杨海涛	Yang Haitao	维修工程室工程师	Engineer, Maintenance Engineering Dept.	中国民航局安技中心	CASTC/CAAC
27	周燕佩	Zhou Yanpei	适航室研究员、主任	Director, Certification Dept.	中国民航局安技中心	CASTC/CAAC
28	才 思	Cai Si	维修工程部技术助理	Technic Assistant, Maintenance & Engineering Dept.	成都航空公司	Chengdu Airlines
29	代 锐	Dai Rui	维修工程部质量工程师	Quality Engineer, Maintenance & Ehgineering Dept.	成都航空公司	Chengdu Airlines
30	陳松亭	Sung-Ting Chen	動力組組長	Mnanager, Powerplant Engineering	中華航空公司	China Airlines
31	張得利	Tony Chang	發動機修護部經理	Deputy General Manager, Engine & Maintenance Dept.	中華航空公司	China Airlines
32	周 天	Zhou Tian	进口部FB管理	FB Management, Import Dept	中国东方航空进出口公司	China Eastern Aviation Imp. & Exp. Corp
33	李国宏	Li Guohong	发动机控制中心工程师	Engineer, Engine Control Center	中国东方航空公司工程技术公司	China Eastern Engineering & Technic China Eastern Airlines Co.,Ltd.
34	周左成	Zhou Zuocheng	发动机控制中心经理	Manager, Engine Control Center	中国东方航空公司工程技术公司	China Eastern Engineering & Technic China Eastern Airlines Co.,Ltd.
35	朱一康	Zhu Yikang	发动机控制中心工程师	Engineer, Engine Control Center	中国东方航空公司工程技术公司	China Eastern Engineering & Technic China Eastern Airlines Co.,Ltd.
36	冯朝辉	Feng Zhaohui	工程技术副经理	Deputy Manager, Technical Dept.	中国货运邮政航空有限责任公司	China Postal Airlines
37	卢 君	Lu Jun	质量部经理	Manager, QA	中国货运邮政航空有限责任公司	China Postal Airlines
38	王 超	Wang Chao	质量部总工程师	Chief Engineer, QA	中国货运邮政航空有限责任公司	China Postal Airlines
39	季 乐	Ji Le	发动机管理中心工程师	Engineer, Engine Management Center	中国南方航空公司	China Southern Airlines
40	李 明	Li Ming	机务工程部副总经理	Deputy Manager, Maintenance & Engineering Dept.	中国南方航空公司	China Southern Airlines
41	林健莹	Lin Jianying	机务工程部主任	Director, Maintenance & Engineering Dept.	中国南方航空公司	China Southern Airlines
42	刘 宝	Liu Bao	机务工程部主任	Director, Maintenance & Engineering Dept.	中国南方航空公司	China Southern Airlines
43	钟发区	Zhong Faqu	发动机管理中心副主任	Deputy Director, Engine Management Center	中国南方航空公司	China Southern Airlines
44	李 喆	Li Zhe	机务部公司总工程师	Chief Engineer, Engineering Dept	中国联合航空有限公司	China United Airlines Co.Ltd.
45	杨 昕	Yang Xin	机务部发动机工程师	Engineer, Engineering Dept	中国联合航空有限公司	China United Airlines Co.Ltd.
46	景黎明	Jing Liming	工程中心	Engineering Technology Training Center	中国民航大学	Civil Aviation University of China
47	阎国华	Yan Guohua	航空工程学院副院长	Deputy Dean, Aero Engineering College	中国民航大学	Civil Aviation University of China
48	李月灵	Li Yueling	维修工程部总工程师	Chief Engineer, Maintenance & Engineering Dept.	上海金鹿公务航空有限公司	Deer Jet
49	林 飞	Lin Fei	维修工程部质量工程师	Quality Engineer, Maintenance & Engineering Dept.	上海金鹿公务航空有限公司	Deer Jet

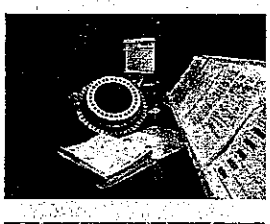
NO.	姓 名	English Name	职 位	Job Title	公 司	Company
50	陆 兵	Lu Bing	工程部总经理	General Manager, M&E Dept	东海航空公司	Donghai Airlines
51	毛 翔	Mao Xiang	维修工程部工程技术处经理	Manager, Engineering and Technical Division, M&E Dept	东海航空公司	Donghai Airlines
52	龚瑞翔	Gong Ruixiang	技术服务部机队经理	Fleet Manager, Technical Service Divison	大新华技术公司	GCA Technik
53	牛旭强	Niu Xuqiang	技术服务部发动机工程师	Power Plant Engineer, Technical Service Divison	大新华技术公司	GCA Technik
54	张志刚	Zhang Zhigang	技术服务部总经理	General Manager, Technical Service Divison	大新华技术公司	GCA Technik
55	刘 永	Liu Yong	工程部发动机工程师	Engineer, Engineering Dept	银河国际货运航空有限公司	Grandstar Cargo International Airlines
56	王桂国	Wang Guiguo	采购部项目主管	Project Supervisor, Purchasing	海南航空公司	Hainan Airlines
57	徐鹏飞	Xu Pengfei	采购部项目主管	Project Supervisor, Purchasing	海南航空公司	Hainan Airlines
58	刘 骞	Liu Qian	维修工程部动力工程师	Power Plant Engineer, Maintenance & Engineering Dept	幸福航空公司	Joyair
59	刘 伟	Liu Wei	副总经理	Deputy General Manager	幸福航空公司	Joyair
60	冯太祥	Feng Taixiang	维修工程部生产控制工程师	Production Control Engineer, M&E Dept	吉祥航空公司	Junyao Airlines
61	侯鹏刚	Hou Penggang	维修工程部发动机工程师	Engine Engineer, M&E Dept.	吉祥航空公司	Junyao Airlines
62	刘建军	Liu Jianjun	维修工程部总经理助理	General Manager Assistant , M&E Dept.	吉祥航空公司	Junyao Airlines
63	皮立坤	Pi Likun	维修工程部发动机工程师	Engine Engineer, Maintenance & Engineering Dept.	奥凯航空有限公司	Okay Airlines
64	孙晓琳	Sun Xiaolin	维修工程部副总经理	Deputy General Manager, Maintenance & Engineering Dept.	奥凯航空有限公司	Okay Airlines
65	童俊达	Tong Junda	工程技术部发动机工程师	Engineer, Engineering Division	山东航空公司	Shangdong Airlines
66	葛忠汉	Ge Zhonghan	机务工程部副总经理	Deputy General Manager, Maintenance & Engineering Dept.	上海航空公司	Shanghai Airlines
67	马克文	Ma Kewen	机务工程部工程技术处发动机主管工程师	Powerplant Engineer, Maintenance & Engineering Dept.	上海航空公司	Shanghai Airlines
68	裴海芸	Pei Haiyun	机务合同部经理	Manager, Maintenance Contract Dept.	上海航空公司	Shanghai Airlines
69	韩德兴	Hai Dexing	维修工程部副总经理	Deputy General Manager, Maintenance & Engineering Dept.	深圳航空公司	Shenzhen Airlines
70	来选迎	Lai Xuanying	维修工程部发动机主管	Powerplant Engineer, Maintenance & Engineering Dept.	深圳航空公司	Shenzhen Airlines
71	邢小军	Xing Xiaojun	维修工程部副经理	Deputy Manager, Maintenance & Engineering Dept.	深圳航空公司	Shenzhen Airlines
72	伍晓江	Wu Xiaojiang	工程部工程师	Engineer, Engineering Dept	四川航空公司	Sichuan Airlines
73	张 亮	Zhang Liang	质量部工程师	Engineer, QA	四川航空公司	Sichuan Airlines
74	陆卫中	Lu Weizhong	维修工程部工程技术室发动机主管	Powerplant Group Manager, M&E Dept.	春秋航空公司	Spring Airlines
75	王志杰	Wang Zhijie	公司副总裁兼总工程师	Vice President & Chief Engineer	春秋航空公司	Spring Airlines
76	徐 康	Xu Kang	维修工程部工程技术室经理	Powerplant Group Manager, M&E Dept.	春秋航空公司	Spring Airlines
77	林育新	Lin Yuxin	发动机管理中心动力工程处经理	Power Plant Manager, Engine Management Center	厦门航空公司	Xiamen Airlines

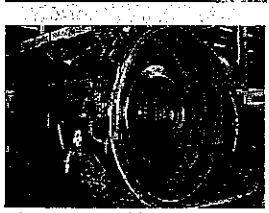
NO.	姓 名	English Name	职 位	Job Title	公 司	Company
78	孙金莉	Sun Jinli	航材分部送修索赔处	Warranty and Repair, Supply Division of M&E Dept.	厦门航空公司	Xiamen Airlines
79	赵建峰	Zhao Jainfeng	质量分部副总经理	Duputy Manager, QA	厦门航空公司	Xiamen Airlines
80	樊家伟	Fan Jiawei	工程部发动机工程师	Engine Engineer, Engineering Dept	扬子江股份公司	Yangtze River Express
81	任百京	Ren Baijing	工程部总工程师	Chief Engineer, Engineering Dept	扬子江股份公司	Yangtze River Express

P&W Global Engine Services

Delivering choice and customer value

- Dependable engine operation
- Engineering innovation
- Culture of quality operating system
- Flexible solutions to meet your needs



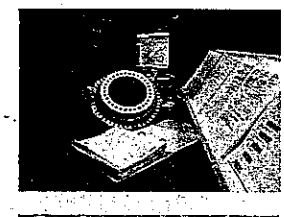


Total lowest cost of ownership

普惠全球发动机服务

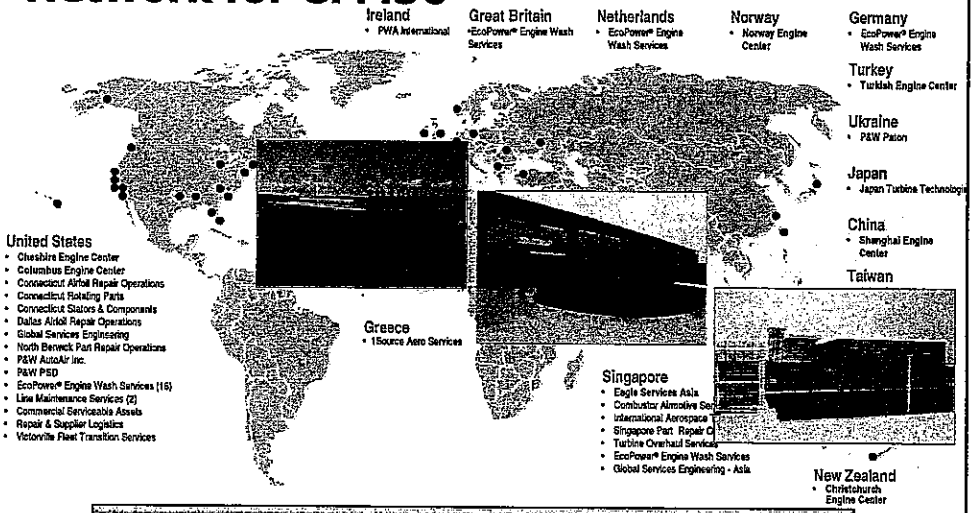
为客户带来更多选择和价值

- 可靠的发动机运营
- 创新的工程理念
- 建立在质量文化基础之上的运营管理系统
- 灵活的解决方案满足客户需求



使所有者的成本降到最低

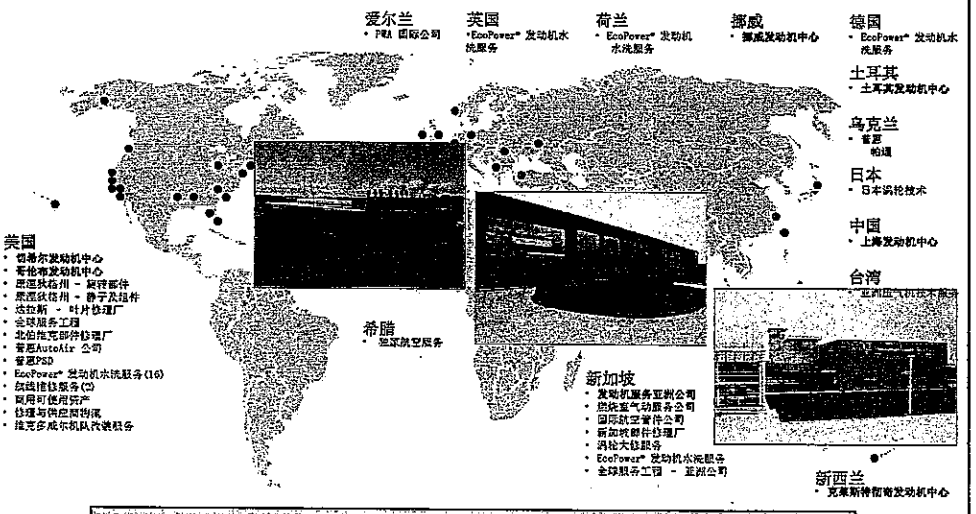
Extensive Global Service Partners Network for CFM56®



75% CFM56 shop visit repair value in network

CFM56 is a trademark of CFM International

遍布全球的CFM56®发动机部件维修网络



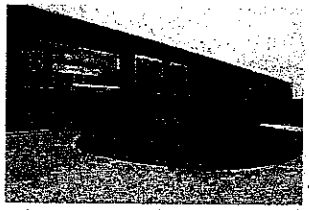
可以涵盖CFM56发动机进场维修的75%需修理部件

CFM56是CFM国际公司的注册商标

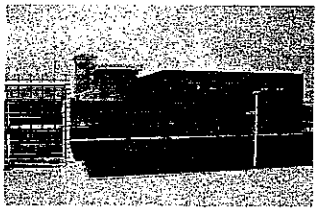
P&W CFM56® Engine Overhaul Centers

Norway Engine Center

Turkish Engine Center
JV with Turkish Technics



Shanghai Engine Center
JV with China Eastern



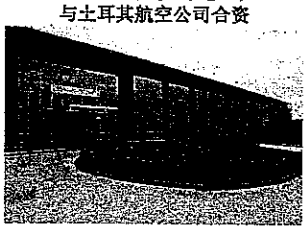
Fully staffed with experienced technicians
State of the art facilities and tooling
Test cell capable
FAA, EASA, CAAC & other local certifications
OEM technical resources

Over 20-year experience with nearly 1,000 overhauls

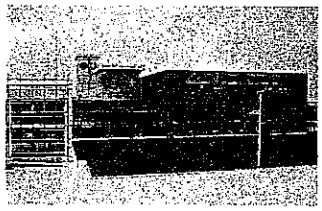
普惠CFM56®发动机维修中心

挪威发动机维修中心

土耳其发动机维修中心
与土耳其航空公司合资

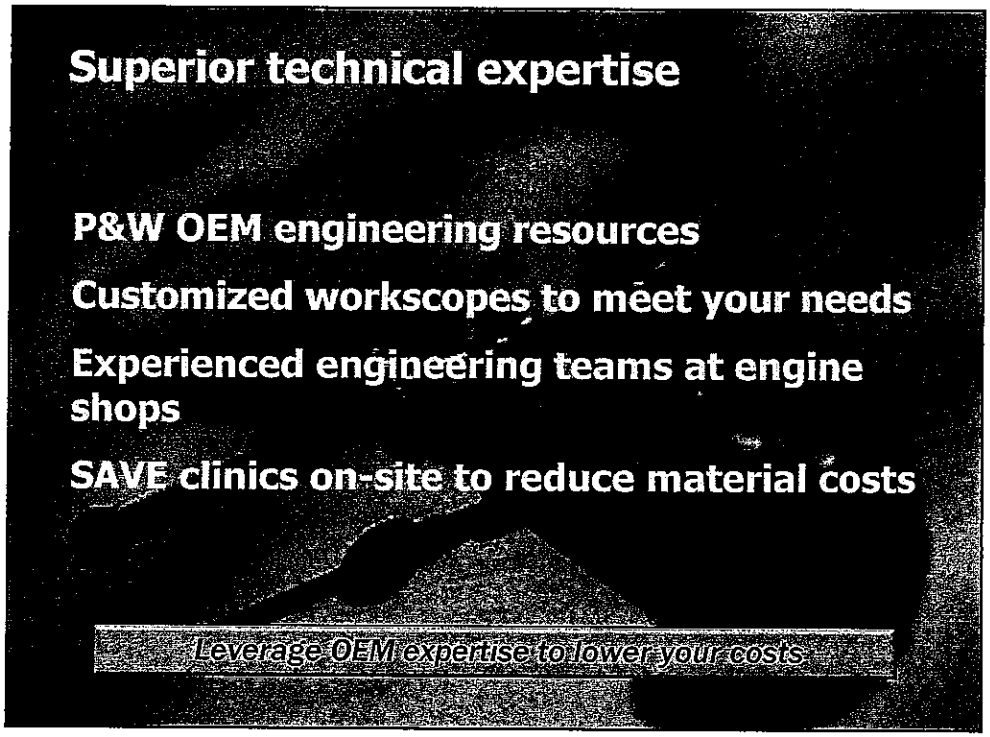


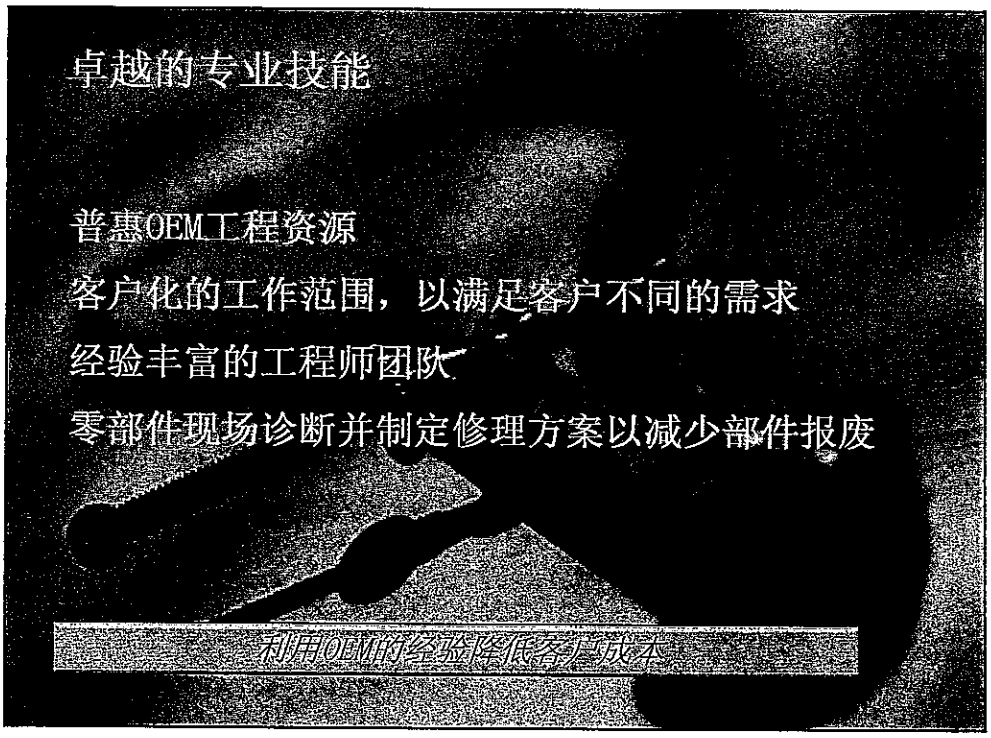
上海发动机维修中心
与中国东方航空公司合资



先进的厂房设计、完备工装和车台设备
经验丰富高素质的维修团队
取得FAA, EASA, CAAC和其他国家民航局的认证
OEM技术资源

超过20年1000多台的发动机维修经验


Superior technical expertise
P&W OEM engineering resources
Customized workscopes to meet your needs
Experienced engineering teams at engine shops
SAVE clinics on-site to reduce material costs
Leverage OEM expertise to lower your costs


卓越的专业技能
普惠OEM工程资源
客户化的工作范围，以满足客户不同的需求
经验丰富的工程师团队
零部件现场诊断并制定修理方案以减少部件报废
利用OEM的经验降低客户成本

Your Unique Situation

Prioritize your key performance indicators (KPIs)

Goals	Resources	Operations
•TAT •Time on wing •Price •Return conditions •Customer support	•Engineering •IT •Purchasing •Line maintenance •Operations	•Utilization •Hour to cycle ratio •Derate •Environment

Customer Requirements + **Customer Alignment** = **CUSTOMER RESULTS**

Defining your KPIs will deliver results

您的特殊地位

我们专注于客户关键性能指标(KPIs)

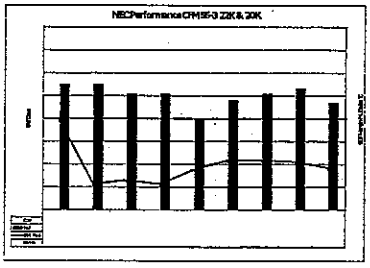
目标	资源	运行
•TAT •在翼时间 •价格 •维修后情况 •客户支持	•工程 •信息技术 •采购 •航线维修 •运行	•利用率 •小时循环比 •减推力 •运行环境

客户需求 + 迎合客户需求 = 圆满结果

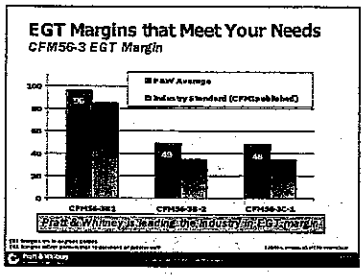
根据客户的主要关注目标就能确定工作的行动方向

Service That's Tailored To Your Priorities

Customer KPI was TAT
(Lessor)
- Industry leading TAT
- Competitive EGT margin & price

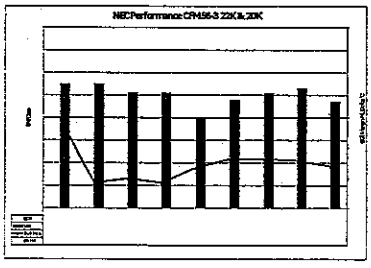


Customer KPI was EGT margin
(LCC with lease return conditions)
- Industry leading EGT margin
- Competitive TAT and price

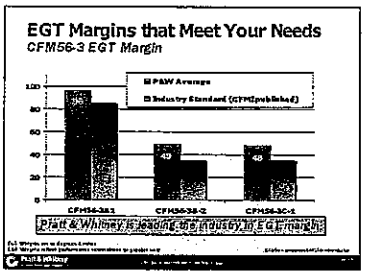


按照客户的关注重点来提供合适的服务

客户关注的性能指标是TAT
(对于出租方)
- 业界领先的TAT水平
- 具有竞争优势的EGT裕度和价格

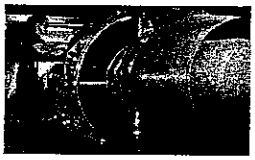


客户的关注的性能指标是EGT裕度
(对于飞机承租方包含退租条件)
- 业界领先的EGT裕度水平
- 具有竞争优势的TAT和价格



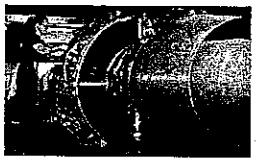
Wide Range of MRO Solutions

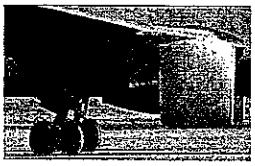
Time & Material Agreement	Maintenance Services Agreement	Comprehensive Agreement
• Short-term flexibility • Labor, material, repair • SBs, ADs • Customer support	• Longer-term coverage included • Program mgt. tools • Health monitoring • Pay at SV	• Long-term coverage included • Full program mgt. • MRO assumes SV risk • Components, LLPs • On-wing services • Off-wing maintenance • Lease pool • Engine exchange (NEW)
Transactional pricing	Guaranteed pricing	Predictable pricing



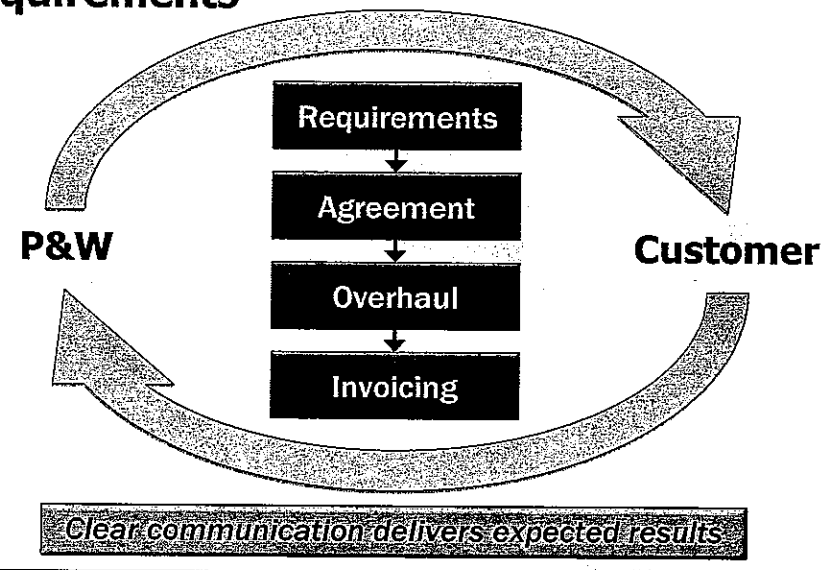
广泛的维修解决方案

工时与材料协议	包修服务协议	全方位的协议
•短期灵活 •工时，材料，维修 •SBs，ADs •客户支持	•长期包修协议 •项目管理 •发动机状态监控 •进厂维修付费	•长期修协议 •全面的项目管理 •MRO承担进场风险 •部件，时寿件 •在翼支援 •地面维修 •客户支援 •发动机交换（新）
实际发生费用	保证价格	可预知的费用



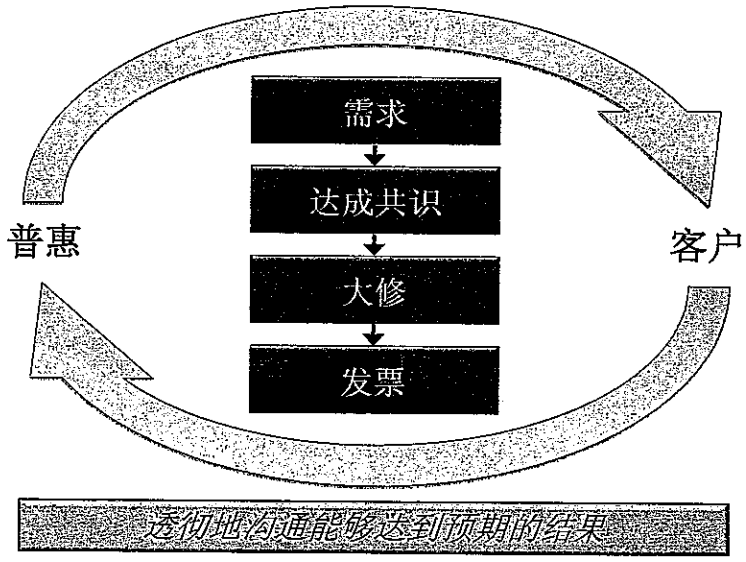


Partnering With You To Meet Your Requirements



Clear communication delivers expected results

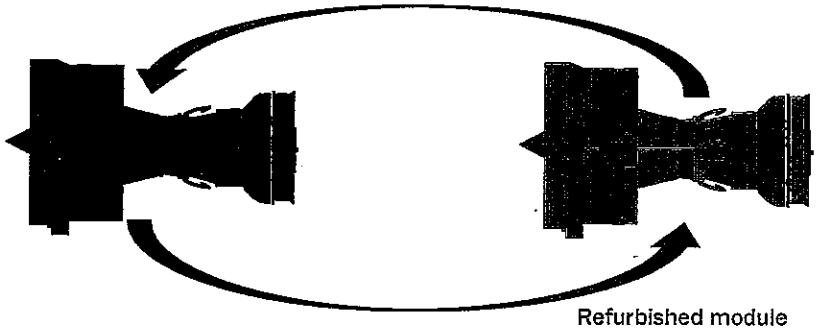
共同协作满足客户需求



透彻地沟通能够送到预期的结果

Innovative Solutions Reduce Your Costs

Customer Engine (unserviceable) — P&W GSP Exchange Engine Pool



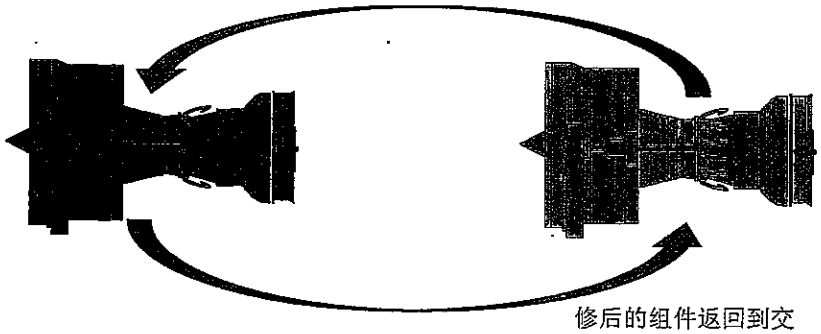
Refurbished module returned to pool

*Save up to $100,000 in lease engine fees utilizing the engine exchange**

* Dependent on exchange engine/core due diligence, and/or workscope requirements.

创新的解决方案降低客户成本

客户发动机（需要修理） — 普惠全球合作伙伴发动机交换库



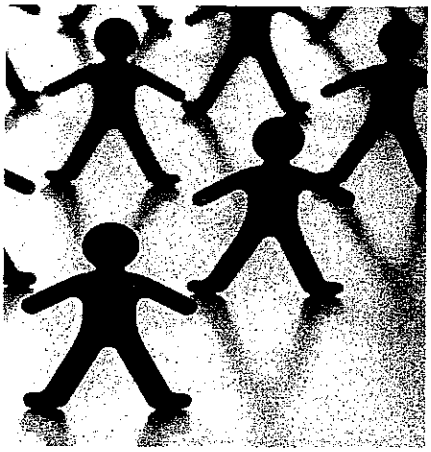
修后的组件返回到交换件库

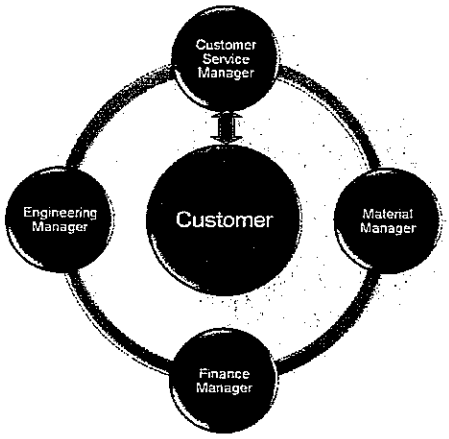
使用发动机交换库可节省高达100,000美金发动机租赁费

* 根据交换发动机/核心机的实际情况或根据发动机的工作范围要求

Expert Customer Service

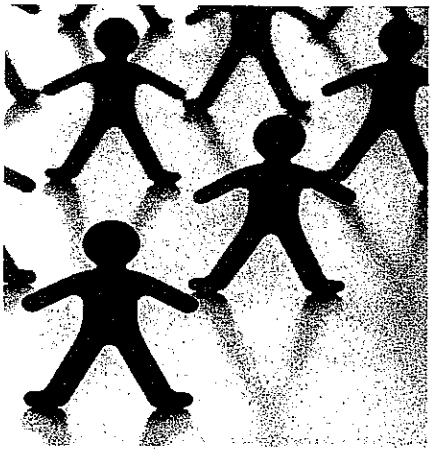
Where you need us, when you need us

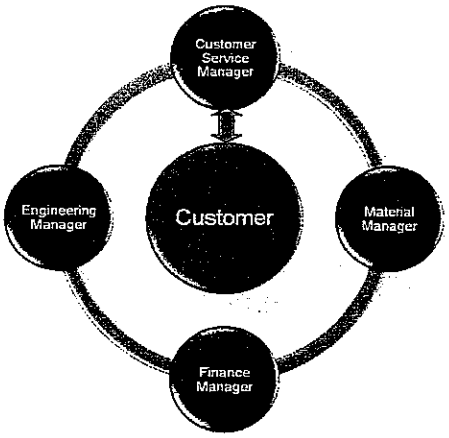




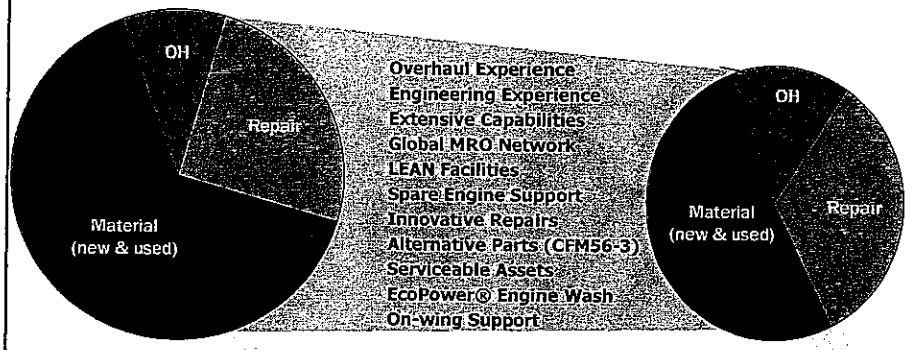
专业的客户服务

随时随地满足客户要求





Customer Value:
P&W Integrated Offering for CFM56® Engines



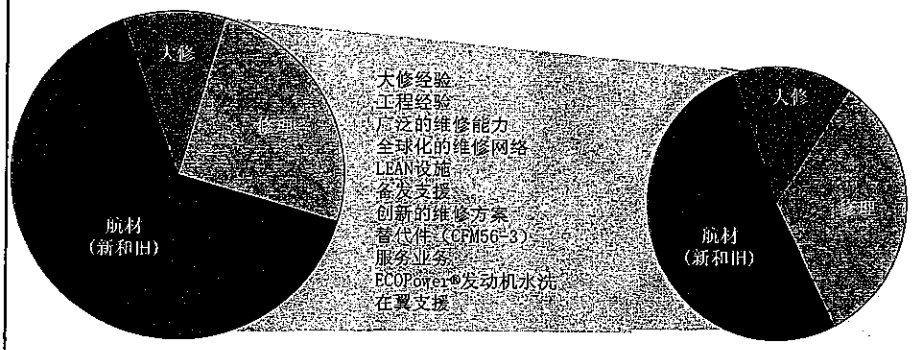
Typical shop visit cost breakdown

Shop visit cost utilizing P&W's integrated offering

Integrated product offering reduces customer's cost

CFM56 is a registered trademark of CFM International

客户价值:
普惠提供整体的CFM56®发动机维修服务



典型的发动机进场维修成本分布

使用普惠整体服务后发动机进场维修成本分布

整体服务降低客户使用成本

CFM56是CFM国际公司的注册商标

NOTICE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

National Policy

N 8110.111

Effective Date:
04/16/2010

Cancellation Date:
04/16/2011

SUBJ: Authorizing Designated Engineering Representative (DERs) to Approve Repair Specifications

1. Purpose of this Notice. This notice specifies the requirements for authorizing designated engineering representatives (DERs) to manage and approve the technical data in repair specifications (RS).

a. This notice is not retroactive. Previous approvals will not be re-evaluated to comply with this process unless obvious regulatory non-compliance is discovered. However, all new repair specifications will be expected to comply with these requirements within 3 months of the effective date.

b. This notice does not affect the way that design approval holder (DAH) data for multiple use, non serial number specific repair data is approved for their products.

2. Audience. We've written this notice for aircraft certification office (ACO) managers, engineers and DERs.

3. **Where to Find This Notice.** You can find and download this Notice on the Federal Aviation Administration's (FAA) Orders and Notices website at:
http://www.faa.gov/regulations_policies/orders_notices/

4. How this Notice Affects Organization Designation Authorizations (ODA) Approvals. Major repair, alteration and airworthiness (MRA) organization designation authorizations (ODA's) can manage the approval of a RS as defined in this notice. For MRA ODA's we, the FAA, will sign the RS, in addition to the ODA statement of completion, when the ODA unit has approved the data and the RS meets the requirements of this notice. It is the MRA ODA administrator's responsibility to ensure that all requirements of this notice are met and the RS is included in the ODA's quarterly activity report or as required by their procedures manual.

5. Background.

Title 14 of the Code of Federal Regulations (14 CFR) part 183 allows us to appoint individuals to represent the FAA. For many years, we've authorized DERs, by special delegation, to approve data for major repairs.

Distribution: Electronic

Initiated By: AIR-140

附件 3

a. The FAA has identified a need to require certain multiple-use, non serial number specific, major repair data to be approved, and authorized in the form of repair specifications. Because of this ACOs may delegate coordination and approval of the technical data in the repair specifications to DERs. The ability to delegate multiple, non serial number specific, major repair data already exists in FAA Order 8110.37, *Designated Engineering Representative (DER) Handbook.* This notice defines the qualifications, roles, and responsibilities of DERs granted this authority. This notice does not apply to DAHs approving data for their products.

b. To support this need for RS approval and authorization, we are:

(1) Creating a new authority for RS under the special delegation for major repairs, and

(2) Changing how specially delegated DERs approve data for multiple-use repairs.

c. DERs granted the specific authority to manage and approve technical data in the repair specifications are called repair specification – designated engineering representative (RS-DERs) in this notice. RS-DERs are not a new type of DER. An "RS-DER" is a shortened name for a DER with the special delegation to approve serial number specific major repair data, non serial number specific major repair data, and manage RS approvals.

d. After this notice is published the *only* way for multiple-use, non serial number specific, non DAH, major repair data to be FAA approved will be via a repair specification.

6. What is a Repair Specification (RS)? Repair specifications provide an alternative to the methods, techniques and/or practices contained in the current manufacturer's manuals, service bulletins, or instructions for continued airworthiness (ICA). They are required when the repair will be used for multiple-use, non serial number specific, non-DAH repairs. They include step-by-step "how to" instructions for performing the repair. In the past this type of data has been referred to by many names including repair specifications, repair procedures, and maintenance specifications.

a. The RS describes:

1) What the specific repair accomplishes,

2) When the repair is applicable,

3) How the repair will be accomplished,

4) How the repair is substantiated,

5) How the repair will be inspected,

6) How the repair must be maintained, and

7) How the repair specification will be kept up to date.

b. An acceptable RS:

1) Results in a consistent, repeatable end state that can be evaluated to show compliance to the applicable airworthiness standards.

2) Provides the technical data for use in approving the aircraft or product for return to service.

3) Is a procedure not listed in the current manufacturer's maintenance manual, ICA or FAA-approved portions of service documents.

4) Is intended to be used repeatedly.

5) Requires FAA data approval.

6) Is authorized for use by the FAA for a specific maintenance entity. This includes maintenance facilities holding a 14 CFR part 145 certificate, and operators having a maintenance program authorized by operations specifications (OpSpecs) under 14 CFR part 121 or 135.

7. Requirements for ICAs. The developer of the RS must determine if the repair affects the ICA or existing maintenance requirements of the affected article. Major repairs may require a change in existing maintenance requirements or inspection intervals. For example, a major structural repair such as a repair to a static engine component could influence the life limits on critical rotating parts or need more frequent inspections. This determination should be performed with special consideration of the repair falling into an alteration category which is beyond the scope of this Notice.

a. The RS must address whether or not the existing ICA are adequate and clearly state that finding.

b. If it's determined that the existing ICA are inadequate because of the proposed repair, the repair specification must contain the appropriately revised ICA. These revised ICA become part of the RS. Subsequent revisions to the ICA will be processed in accordance with the RS revision process. (See, Changes to the Repair Specification, paragraph in appendix A)

c. The DER must not sign on the cover page of the RS until the ICA has been addressed. The DER *cannot* approve/accept revisions to the ICA. Coordination with the appropriate FAA office is required. (See Order 8110.54, *Instructions for Continued Airworthiness Responsibilities, Requirements and Contents*, for additional guidance.) The RS-DER can help an applicant determine the revised ICA content requirements.

8. Authorizing DERs.

a. Existing DERs who are already authorized for serial number specific repairs may continue to make those findings and are not affected by this notice.

b. DERs may ask for, and be authorized, to perform two specific functions in the RS approval process:

(1) To manage the RS project and approve the technical data in the RS, and/or

(2) To approve data in support of multiple-use, non DAH, non serial number specific repairs.

c. A DER must be authorized for at least one of those two specific functions to support RS approvals. Existing DERs who are already authorized for multiple-use repairs can approve data to support RS approvals without any additional specific authorization.

d. Once the RS-DER determines that the RS meets all the requirements, they must sign the cover page with their name and DER number.

9. RS-DER Qualifications. To be authorized to manage RS approval projects, the DER must have appropriate experience and be qualified to manage RS data approvals.

a. A DER must be experienced in both approving repair designs and managing repair data projects. *Managing* projects means ensuring all applicable certification requirements for the repair are identified, overseeing others develop and approve data that demonstrates compliance with the certification requirements, and ensuring that compliance issues resulting from or associated with overlapping of engineering disciplines are resolved. Finally, it means being the primary contact with the FAA, both flight standards district offices (FSDO)/ certificate management offices (CMO)/international field offices (IFO) and ACOs, for all discussions and decisions about repair data approval.

b. ACOs will ensure that the DER has the following experience before authorizing RS authority:

(1) Have at least three years experience as a DER with the special delegation of major repairs, or major repairs and major alterations, (or equivalent experience such as an ACO engineer or ODA unit member), and

(2) Have at least five years experience in at least one of the DER disciplines (or equivalent experience such as an ACO engineer or ODA unit member). A DER may be limited to working on RS appropriate to their experience. For example, we may limit a structures DER to airframe RS. Yet we wouldn't have to limit them if their experience allowed them to manage RS data approvals in other technical areas with the support of authorized DERs in those areas.

10. Responsibilities of an RS-DER. To manage RS approvals the RS-DER performs a role for the FAA similar to an ACO certification project manager for a design approval project. The RS-DER will review the RS to ensure that it complies with the established type certification requirements for the product. They will ensure compliance with each applicable certification regulation has been found. The RS-DER evaluates the RS to ensure the repair design results in a

repair that restores the part or product to an airworthy condition. Managing activities for compliance includes:

a. Managing Data approval. An RS-DER will develop a compliance plan to ensure that all the activity necessary to review and approve individual data items is accomplished as part of the project. This includes design data, reports, analyses, inspection results, test plans, results, and reports. The approved technical data for the RS may originate either from the RS-DER using their own authority or from other DERs with the required authorization of multiple repairs. DERs must be authorized the special delegation of major repairs, and have specific authority to approve data for multiple-use repairs. The RS-DER must review all FAA Form 8110-3s, *Statement of Compliance with the Federal Aviation Regulations*, submitted by other DERs to determine that all necessary findings of compliance have been made.

b. Managing Test Activity. Normally, a repair does not require any testing to substantiate it. However, there may be some cases where testing is required. We authorize the RS-DER to review and approve test plans, coordinate the company's test article conformity, witness tests, and evaluate and make findings on test results. The RS-DER may rely on other DERs for some, all, or none of these tasks. The use of other DERs for structural, electrical, material, and other aspects of the repair are limited to those tasks for which they're authorized.

c. Coordinating Project Activity and Resolving Issues. The RS-DER is responsible to coordinate with the managing FSDO/CMO/IFO and obtain their concurrence that the proposed RS is within the capability of the applicant or that their rating will be adjusted to allow its use.

d. Approving the RS. After the RS-DER finds that the data substantiates the repair design and the repair complies with applicable certification regulations, they indicate that the technical data in the RS is approved for use on multiple products by signing the cover page of the RS with their DER number along with the applicant who plans on using the RS. Copies of the signed cover page of the RS must then be sent to the RS-DERs managing ACO advisor and the FSDO/CMO/IFO principal maintenance inspector (PMI). See appendix A for a sample cover page.

11. FAA Form 8110-3 Doesn't Indicate RS Approval. DERs can use one or more FAA Form 8110-3s to approve RS technical data, but RS-DERs may *not* use FAA Form 8110-3 to show approval of a complete RS. RS approval is indicated when the specification cover page bears all required signatures. The RS is not approved until the title page bears the signature of the applicant, and the RS-DER with their DER number or, if appropriate, the ACO.

12. Limitation on Repairs Affecting Critical or Life-Limited Parts.

a. A RS-DER may manage a RS project affecting critical or life-limited parts, but prior to starting the RS project the RS-DER must coordinate with the managing ACO. The ACO may or may not delegate the approval of the RS. If they do not delegate the approval, the amount of involvement and whether or not the RS-DER recommends approval of the RS is at the discretion of the ACO. In this case the applicant and the ACO must sign the cover page of the RS to indicate the approval.

b. It's the applicant's responsibility to state when the repair affects critical or life-limited parts. If the applicant states critical or life-limited parts are not affected, and any DER believes otherwise, the DER must notify the ACO. The ACO must make a determination and then notify the DER plus the FSDO, CMO or IFO. If the ACO agrees with the DER, the FSDO/CMO/IFO notifies the applicant. If the ACO determines the part is not critical or life-limited, the RS approval process continues.

13. Distribution. Distribute this notice to the branch level in the Aircraft Certification directorates and the Flight Standards Service; to the branch level in the Aircraft Certification offices and the regional Flight Standards divisions; to the FAA Academy and the Regulatory Support Division; to all flight standards district offices; international field offices; international area offices; aircraft certification offices; and manufacturing inspection district and satellite offices.

Susan K.M. Cabler

For David W. Hempe
Manager, Aircraft Engineering Division
Aircraft Certification Service

Appendix A. Sample Title/Signature Page

[Specification Name and/or Control Number (Assigned by Applicant)]
[Revision Number and Revision Date]

Data contained in this specification may be used as approved data when: The repair is accomplished by the Certificate Holder identified below, and the specification title page contains all required signatures.

[Company Name]
[Address]
[FAA Certificate Number and Ratings]

List of applicable products or components:

I certify that the repair described in this document will restore the aircraft or aircraft component, as applicable, to an airworthy condition.

_____ Date: _____

Signature—Certificate Holder's Authorized Representative

_____

Printed Name and Title—Certificate Holder's Authorized Representative

I find the technical data are adequate to substantiate the repair design and the repair is compliant with applicable airworthiness CFRs.

_____ Date: _____

ACO/RS-DER Signature

Office ID/RS-DER ID Number: _____

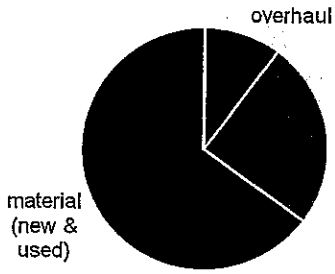
Changes to the Repair Specification. The FAA must authorize any change to the repair specification before the applicant implements the change. The repair specification holder must submit all technical data to support the proposed change. Minor changes that do not differ appreciably from the previously authorized data and having no bearing on safety are permitted provided the FSDO/CMO/IFO is notified of the change.

Global Material Solutions

全球航材解决方案

附件 4

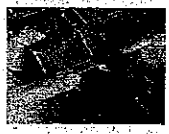
Customer Value: P&W Integrated Offering for CFM56® Engines



Typical Shop Visit
Cost Breakdown

CFM56® Engine Overhaul:
Norway, Turkish, & Shanghai Engine Centers

Repair Capability:
Global Repair Services (GRS)



Material:
Commercial Serviceable Assets (CSA)

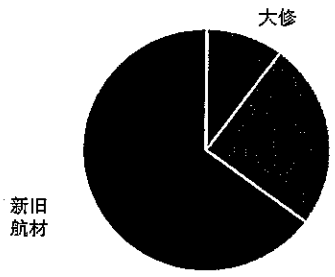
CFM56-3 New Engine Parts:
Global Material Solutions (GMS)

CFM and CFM56 are registered trademarks of CFM International

CFM56 is a trademark of CFM International

客户价值

普惠为CFM56®发动机提供的各种服务



典型的返厂成本分解图

CFM56®发动机大修:
挪威、土耳其和上海发动机中心

修理能力:
全球修理服务(GRS)

航材:
商用可使用资产(CSA)

CFM56-3 新发动机部件:
全球航材解决方案(GMS)

CFM56是CFM国际公司的注册商标

GMS Regulatory Approvals/Validation

Agency	Country / Region	STC Approval	PMA Approval
FAA	USA	Approved	2010
EASA	Europe	Approved	2010
CAAC	China	Approved	2010
DGCA	Indonesia	Approved	2010
CASA	Australia	Approved	2010
DGCA	Turkey	Approved	2010
SCT	Mexico	Approved	2011
SAA	Ukraine	2011	2011
ANAC	Argentina	2011	2011

■ Approved ▨ On Track ▤ All parts not approved for installation

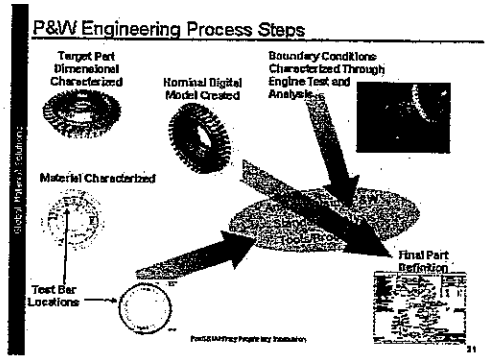
GMS规章批准/认证表

机构	国家/地区	STC 批准	PMA 批准
FAA	美国	Approved	2010
EASA	欧洲	Approved	2010
CAAC	中国	Approved	2010
DGCA	印度尼西亚	Approved	2010
CASA	澳大利亚	Approved	2010
DGCA	土耳其	Approved	2010
SCT	墨西哥	Approved	2011
SAA	乌克兰	2011	2011
ANAC	阿根廷	2011	2011

■ 批准 ▨ 进行中 ▤ 未批准同时安装所有部件

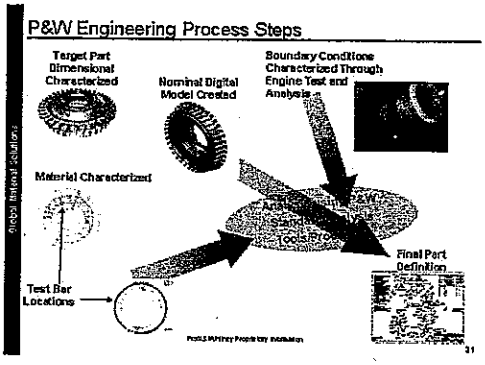
P&W Design Methodology

- P&W quality system requirements applied to GMS
- GMS is another P&W engine program
- Representative elements of quality system include:
  - Engineering standard work
  - Design control
  - Configuration management
  - Material control and testing
  - Procurement
  - Manufacturing control



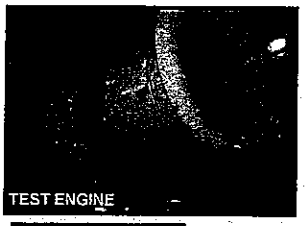
普惠的设计模式

- 普惠的质量管理体系要求运用到GMS设计
- GMS是普惠公司的另一个项目
- 具有代表性的质量体系包括以下内容：
  - 工程标准工艺
  - 设计控制
  - 构型管理
  - 材料管理和测试
  - 获得
  - 制造控制

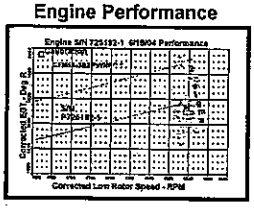


P&W Engineering Process

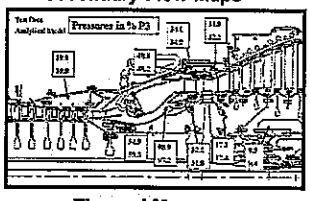
Lifing analysis requires part boundary conditions, material property characteristics (LCF, etc.), duty cycle



Engine Performance

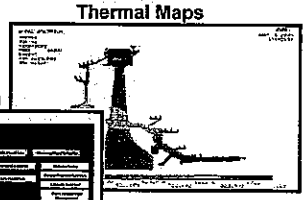


Secondary Flow Maps

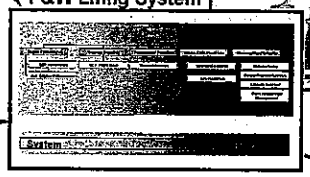


Boundary Conditions

Thermal Maps



P&W Lifing System



Duty Cycle

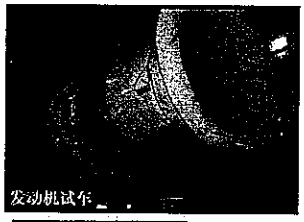
Design Table

ALT	MN	SEGMENT	TIME
0	0.00	TAXI	9.0
1500	0.39	Take-Off	2.0
1500	0.39	BEG CLIMB	1.0
15000	0.70	MID CLIMB	3.2
31000	0.84	END CLIMB	0.6
31000	0.84	CRUISE	80.0
39000	0.84	DESCENT	10.0
1500	0.39	DECEL.	2.0
1500	0.21	APPROACH	2.0
0	0.00	LANDING	1.0
0	0.00	TAXI	5.0

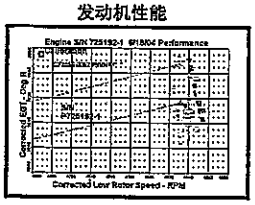
Analytical Life

普惠工艺流程

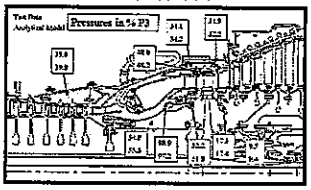
定寿体系分析需要部件工作的边界条件，材料的主要特性(LCF等)，设计循环



发动机性能



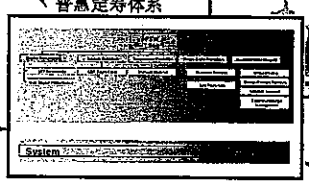
次级气流分布图



边界条件

热力分布图

普惠定寿体系



设计循环

设计图表

ALT	MN	SEGMENT	TIME
0	0.00	TAXI	9.0
1500	0.39	Take-Off	2.0
1500	0.39	BEG CLIMB	1.0
15000	0.70	MID CLIMB	3.2
31000	0.84	END CLIMB	0.6
31000	0.84	CRUISE	80.0
39000	0.84	DESCENT	10.0
1500	0.39	DECEL.	2.0
1500	0.21	APPROACH	2.0
0	0.00	LANDING	1.0
0	0.00	TAXI	5.0

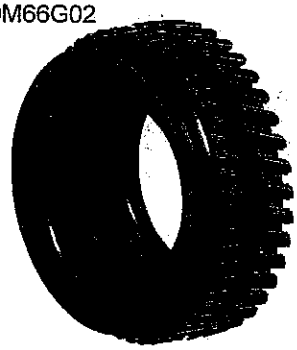
寿命分析

GMS LLP Interface Features

Interface dimensions held within CFM measured data

HPC 1-2 spool:
GMS P/N 880013-01
CFM P/N 1589M66G02

Forward looking aft



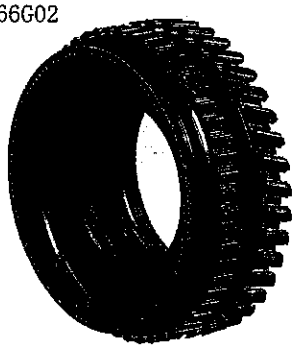
Aft looking forward

GMS LLP接触面特性

接触面几何尺寸与CFM的部件测量尺寸保持一致

HPC 1-2 spool:
GMS P/N 880013-01
CFM P/N 1589M66G02

从前向后视图



从后向前视图

Engine Intermix Validation Testing

GMS parts engine tested with both CFM and GMS LLPs

CFM56-3 Engine Test
- Production Configuration

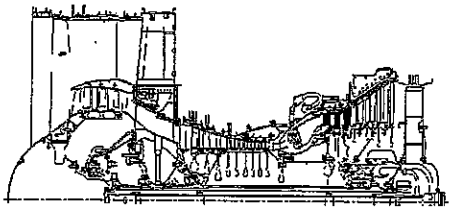
→ **Baseline**
Performance and Vib survey

CFM56-3 Engine Test
- With Mixed wheel GPPs

→ **No change**
Performance or Vib signature

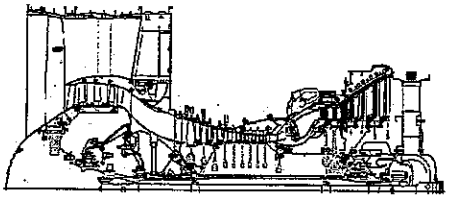
CFM56-3 Engine Test
- With Mixed wheel GMS GPPs & LLP's

→ **No change**
Performance or Vib signature



Company Endurance Test
1000 cycles, 183.5 hours

GPP Parts Engine Tested



FAA Endurance Test
458 cycles, 256 hours

[redacted]

发动机部件混装验证测试

GMS气路部件与CFM寿命件以及GMS寿命件混装的发动机测试

CFM56-3发动机测试
- 原装构型

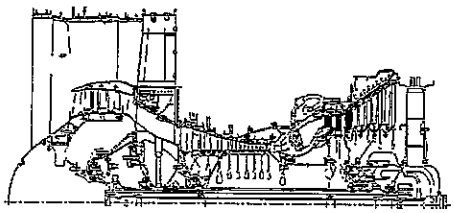
→ **基准**
性能和振动检查

CFM56-3发动机测试
- 混装的气路件

→ **没有变化**
性能或振动特征

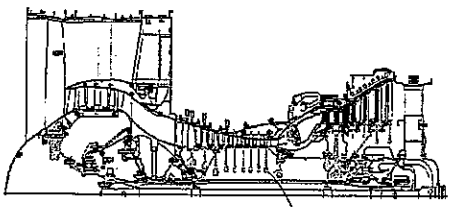
CFM56-3发动机测试
- 混装的GMS的气路件和寿命件

→ **没有变化**
性能或振动特征



公司耐久测试
1000循环, 183.5小时

气路部件发动机测试

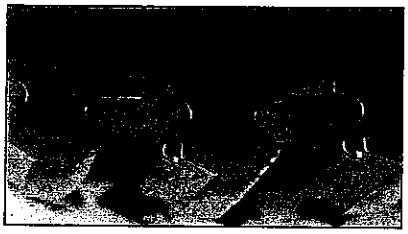


FAA耐久测试
458循环, 256小时

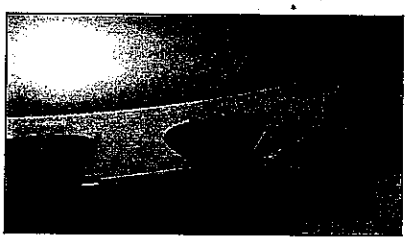
[redacted]

LLP

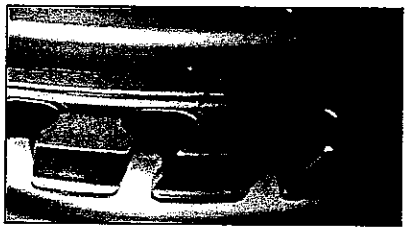
CFM vs. GMS System Level Interaction



CFM (In-Service Part)



GMS (150 hr. Test Part)

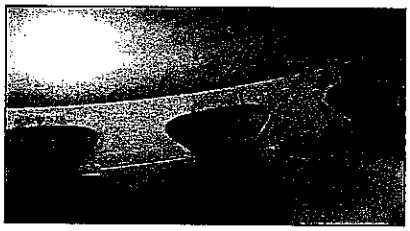


P&W (Experience)

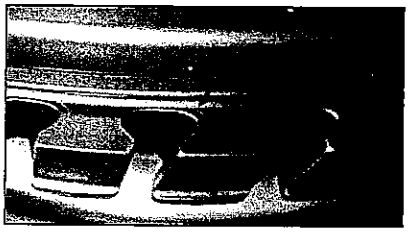
- Typical of engine run hardware
  - Light retainer wear
  - Witness marks
  - Thermal discoloration
- Within P&W historical experience

CFM部件与GMS部件水平方向相互作用受力比较

CFM(已使用部件)



GMS(150小时测试部件)



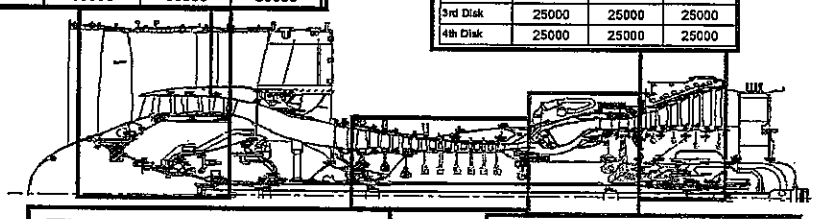
P&W(经验)

- 典型的发动机硬件运转
  - 保持环边轻度磨损
  - 可见的痕迹
  - 热力变色
- 符合普惠的历史经验

LLP Life Status

Fan/ LPC	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1® (23.5K)
Fan Hub	30000	24900	20100
Booster	30000	30000	30000
Fan Shaft	30000	30000	30000

LPT	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1®
Conical	25000	25000	25000
Stub Shaft	25000	25000	25000
1st Disk	25000	25000	25000
2nd Disk	25000	25000	25000
3rd Disk	25000	25000	25000
4th Disk	25000	25000	25000



HPC	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1®
1-2 Spool	20000	20000	20000
3rd Disk	20000	20000	20000
4-9 Spool	20000	20000	15800
Front Shaft	20000	20000	20000
CDP Seal	20000	18000	15000

HPT	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1®
Front Shaft	20000	17300	17000
Rear Shaft	20000	20000	20000
Front Seal	20000	15800	15100
Disk	20000	18500	16600

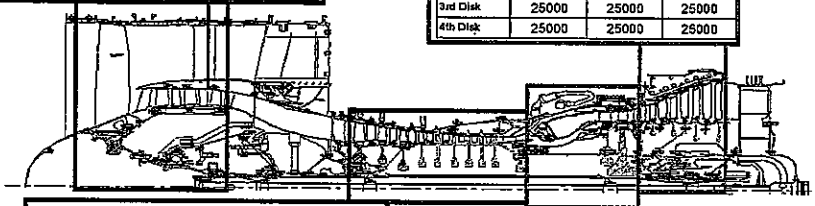
P&W lifing methodology used on GMS LLPs - GMS LLP lives same as CFM

CFM and CFM56 are registered trademarks of CFM International

LLP寿命状况

Fan/ LPC	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1® (23.5K)
Fan Hub	30000	24900	20100
Booster	30000	30000	30000
Fan Shaft	30000	30000	30000

LPT	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1®
Conical	25000	25000	25000
Stub Shaft	25000	25000	25000
1st Disk	25000	25000	25000
2nd Disk	25000	25000	25000
3rd Disk	25000	25000	25000
4th Disk	25000	25000	25000



HPC	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1®
1-2 Spool	20000	20000	20000
3rd Disk	20000	20000	20000
4-9 Spool	20000	20000	15800
Front Shaft	20000	20000	20000
CDP Seal	20000	18000	15000

HPT	CFM56-3B1® (20K)	CFM56-3B2® (22K)	CFM56-3C1®
Front Shaft	20000	17300	17000
Rear Shaft	20000	20000	20000
Front Seal	20000	15800	15100
Disk	20000	18500	16600

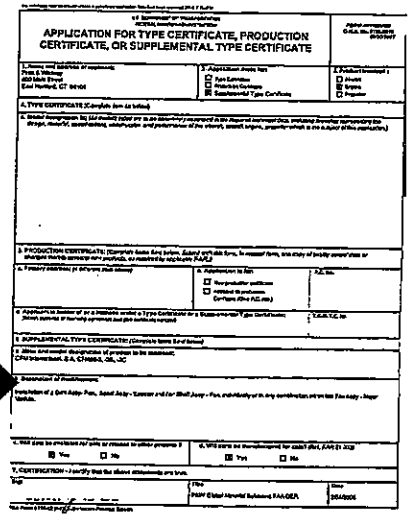
首先采用自己的定寿方式应用到GMS寿命件上，GMS LLP寿命与CFM相同

CFM和CFM56是CFM国际公司的注册商标

FAA STC Replacement Part Incorporation

- Incorporation of one, some or all replacement parts within an STC is acceptable under the STC
- STC application highlights partial incorporation
  - "…individually or in any combination within the fan assembly – major module."
- Partial incorporation of parts is not interpreted as partial incorporation of the STC

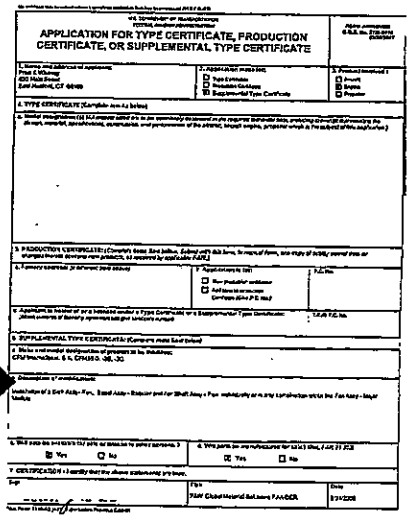
STC Application: Fan/Booster Module


APPLICATION FOR TYPE CERTIFICATE, PRODUCTION CERTIFICATE, OR SUPPLEMENTAL TYPE CERTIFICATE

FAA STC替换件改装

- 运用该STC可以单独使用一个、部分或全部STC部件
- STC 特别指出部分改装的使用
  - "…在风扇组件主单元体中使用单个或任意组合的"
- 部分使用STC部件不能被理解成只执行了部分的STC

STC Application: Fan/Booster Module


APPLICATION FOR TYPE CERTIFICATE, PRODUCTION CERTIFICATE, OR SUPPLEMENTAL TYPE CERTIFICATE

Key Considerations

- Air Worthiness Directives and Service Bulletins (Regulatory)
- On-wing reliability and operational history (MPD inspections).
- Product Improvement
- Warranty/Financial
- Continued OEM support

Risk evaluation and mitigation considered by customer and service provider

主要考虑

- AD和SB（有关的调整）
- 在翼可靠性以及使用历史（MPD检查）
- 产品提升
- 索赔/财务
- OEM的后续支持问题

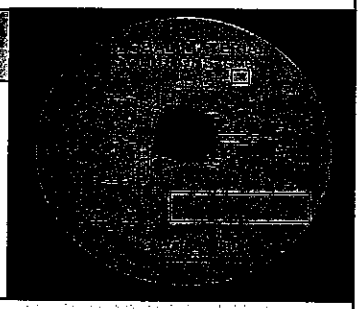
风险评估与问题分担是用户和厂家需要进行认真考虑

GMS STC - Instructions for Continued Airworthiness

The GMS STC Engine Manual includes the following sections:

1. Clean & Inspection Instructions
   - ➢ Part Specific
   - ➢ Enhanced Rotor Inspection
2. Engine – Time Limits {Chapter 5}
   - ➢ Part Specific Service Life Limits

NOTE: Service Bulletins have been issued for each STC Module, for incorporation requirements



The following sections of the OEM manual will continue to be the instructions for Continued Airworthiness:

1.Assembly and Disassembly
   - ✓No change to form, fit or function of parts

2. Engine Test and Troubleshooting
   - ✓No change to form, fit or function of parts

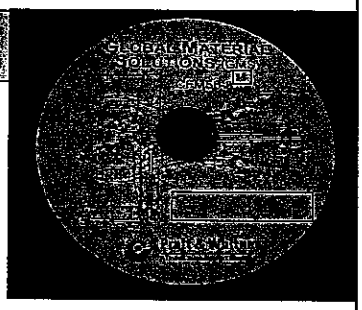
3.Aircraft Maintenance Manual

GMS STC-持续适航说明

GMS STC发动机手册包括：

1. 清洁和检查工艺
   - ➢ 各零部件检查
   - ➢ 深度的转子部件检查
2. 发动机 -（寿命件）给定寿命限制清单{第5章}
   - ➢ 各个寿命部件的寿命限制

备注:对各STC单元体均有对应服务通告，供改装/更换时需要。



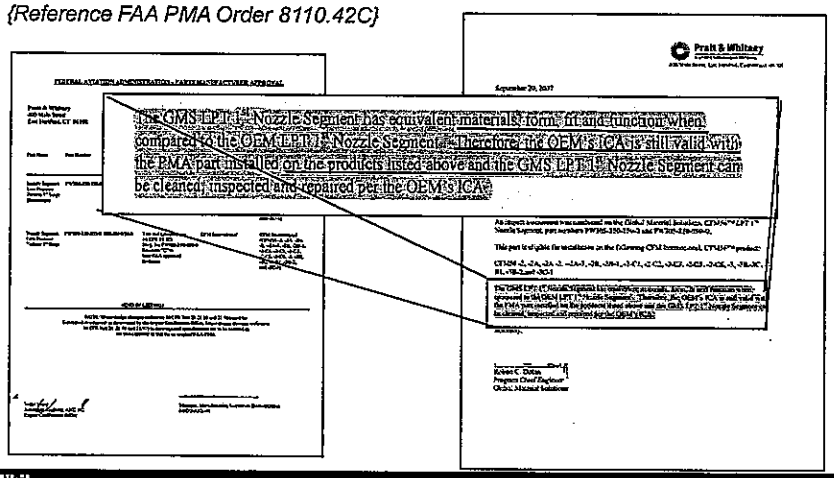
OEM手册中的如下章节作为持续适航说明的内容（维护有效）：

1. 组装和分解
   - ✓（这一部分）的构成，符合性及其功能均无更改
2. 发动机测试和排故
   - ✓（这一部分）的构成，符合性及其功能均无更改
3. 飞机维护手册（AMM）

GMS PMA – Instructions for Continued Airworthiness

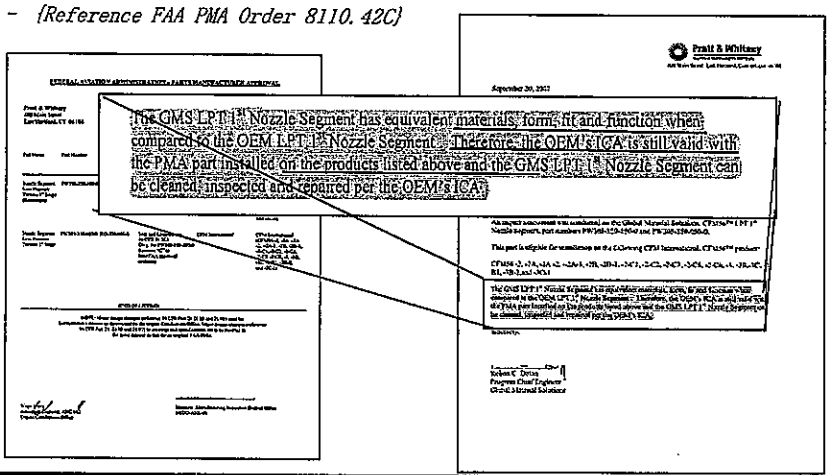
- Part Repair - PMA
  - In accordance with GMS PMA certification, the GMS parts will be repairable per CFMI Shop Manual

{Reference FAA PMA Order 8110.42C}



GMS PMA - 持续适航说明

- 部件维修 – PMA
  - 根据GMS PMA部件的认证，GMS部件可以按照CFMI的发动机维修手册修理。
  - *{Reference FAA PMA Order 8110.42C}*



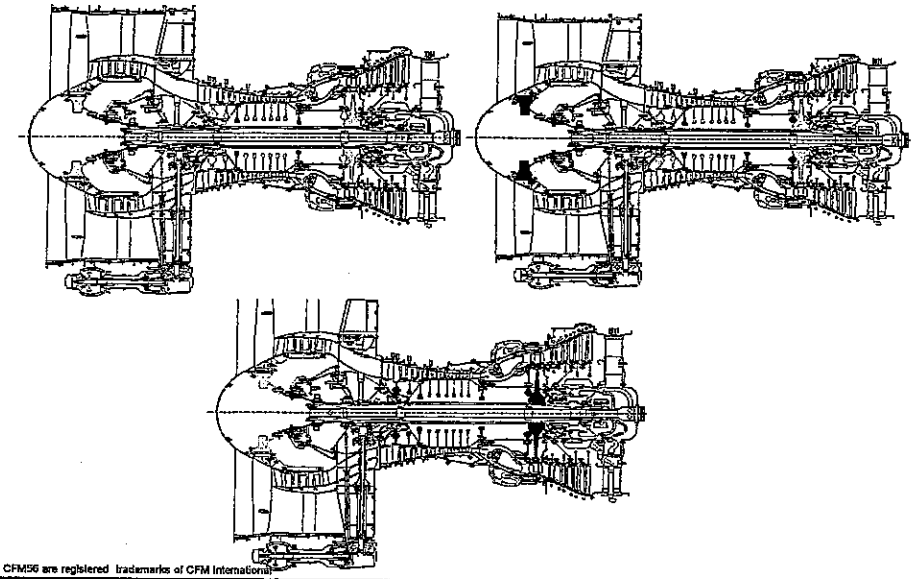
Overall Engineering Conclusion

- All interfaces are maintained for complete interchangeability
- Development testing and field experience have demonstrated GMS performance is identical to CFM performance
- In-service engine experience has shown GMS and CFM intermix is fully transparent to operator

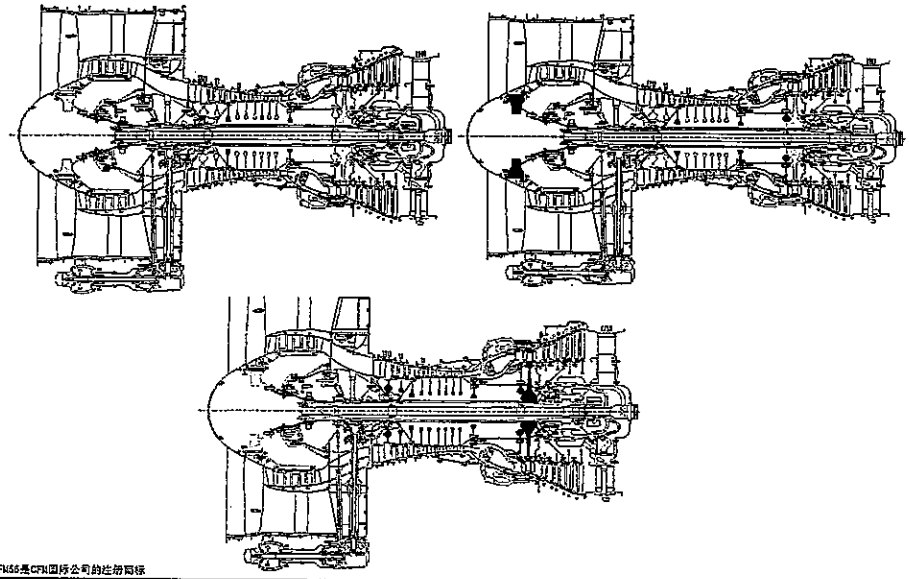
全面工程总结

- 所有的接触面与原件保持一致，可完全互换
- 根据开发测试以及实际验证，证明GMS部件性能与CFM部件性能一致
- 实际运行中的经验显示，GMS部件和CFM部件混装对于用户来说是明确可行的

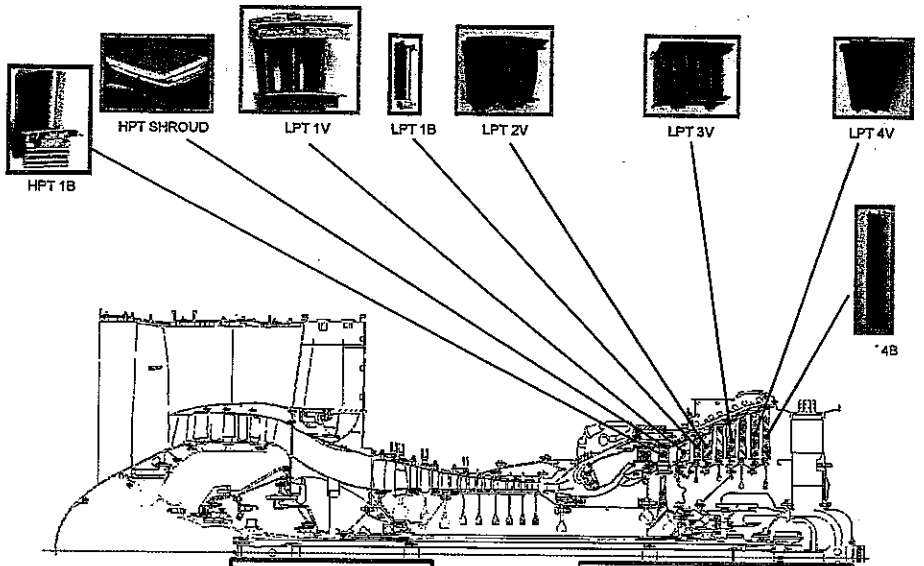
GMS LLP Intermix Examples



GMS LLP混装举例



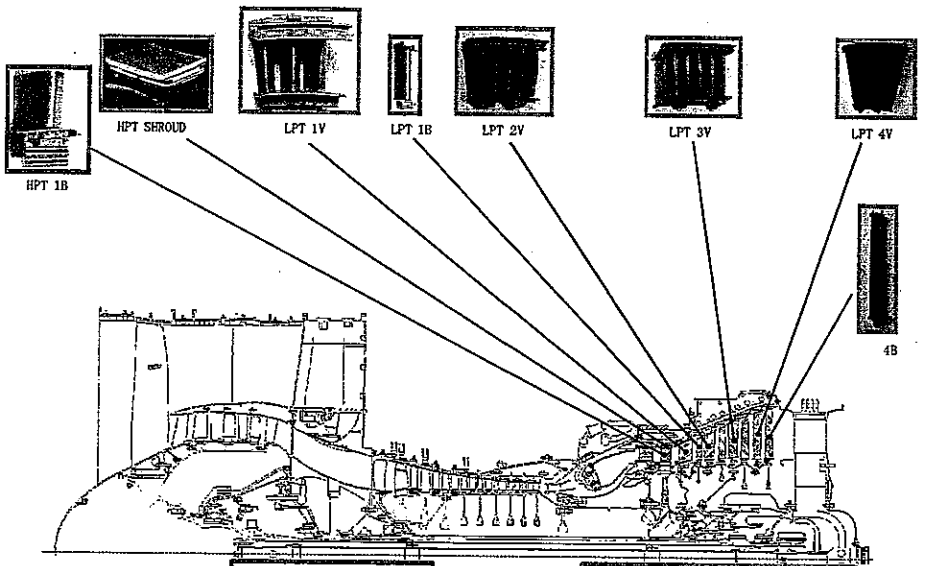
GMS CFM56-3 Gas Path Part Portfolio



4th quarter 2011

Certified and Available

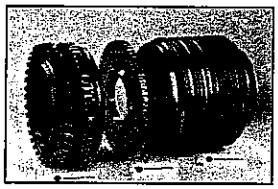
GMS CFM56-3气路部件



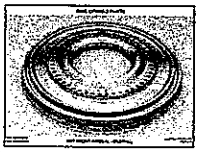
2011年第四季度

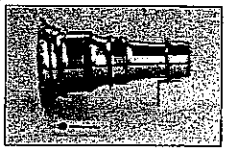
已取证并可以使用

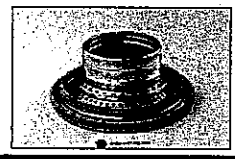
Flawless Service Experience

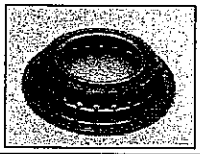


- All certified GMS parts installed and accumulating time in service
- Accumulated performance: >92,000 hours / 57,800 cycles
- High time engine performance: >3,200 hours / 1,850 cycles
- Five customers in three regions operating GMS parts
- Seventeen active customer campaigns

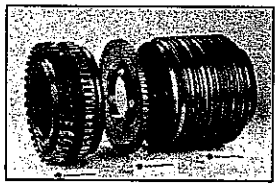


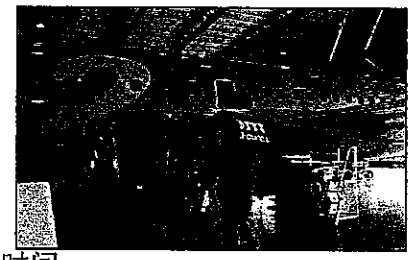




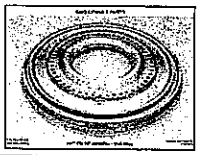


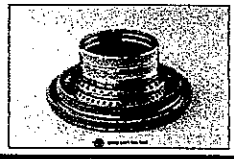
完美的使用经验

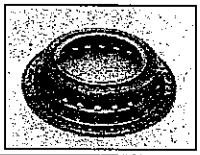




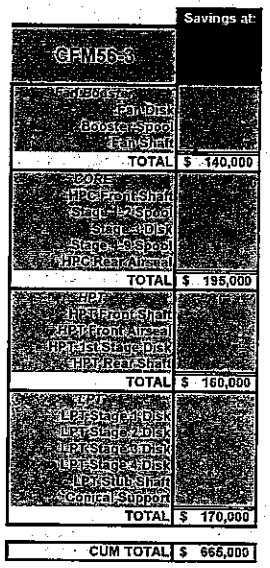
- 所有已认证的GMS部件装机使用累计时间
- 累计的使用表现:>92,000小时/57,800循环
- 最高使用发动机的情况:>3,200小时/1,850循环
- 5个用户在3个地区使用GMS部件
- 有17个用户正在考虑运用GMS部件







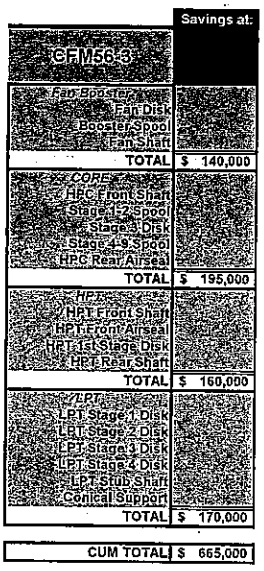
Savings with GMS



CFM56-5	Savings at:
Fan/Booster: Fan Disk, Booster Spool, Fan Shaft	
TOTAL	$ 140,000
CORE: HPC Front Shaft, Stage 1-2 Spool, Stage 3 Disk, Stage 4-9 Spool, HPC Rear Airseal	
TOTAL	$ 195,000
HPT: HPT Front Shaft, HPT Front Airseal, HPT 1st Stage Disk, HPT Rear Shaft	
TOTAL	$ 160,000
LPT: LPT Stage 1 Disk, LPT Stage 2 Disk, LPT Stage 3 Disk, LPT Stage 4 Disk, LPT Stub Shaft, Conical Support	
TOTAL	$ 170,000
CUM TOTAL	$ 665,000

- > $650,000 USD savings per set of LLPs compared to OEM pricing
- > $160,000 USD savings per set of HPT blades
- Additional rebates available
  - Volume rebate
  - First in region rebate
  - MRO service bundle rebate

使用GMS的费用节省



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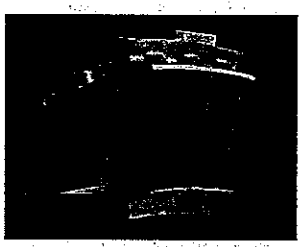
LPT: LPT Stage 1 Disk, LPT Stage 2 Disk, LPT Stage 3 Disk, LPT Stage 4 Disk, LPT Stub Shaft, Conical Support	
TOTAL	$ 170,000
CUM TOTAL	$ 665,000

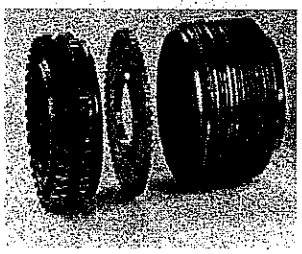
- > 对比使用OEM的LLPs每套价格可以节省650,000美金
- > 每套HPT叶片可以节省160,000美金
- 额外折扣
  - 使用量的折扣
  - 区域领先用户折扣
  - MRO绑定服务折扣

Global Material Solutions

New, lower-cost parts for your CFM56® engine

- Logical expansion to P&W global service network
- Provides choice and promotes competition
- CAAC, FAA, EASA, DGCA and CASA approved
- 18 life limited parts (LLPs)
- 8 gas path parts
- Prices considerably lower than CFM
- Potential savings in the millions





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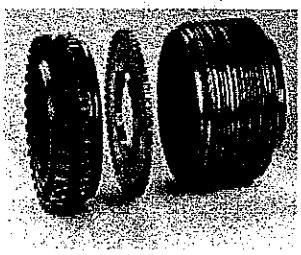
全球航材解决方案

全新的、低成本的部件对于CFM56®发动机

- 扩展普惠全球服务网络
- 给予客户多种选择机会，促进竞争
- 通过CAAC，FAA，EASA，DGCA和CASA资格认证
- 18个寿命件(LLPs)
- 8个气路件
- 价格优于CFM
- 潜在节约百万美元



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