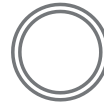


How PMAs improve Safety & Reliability



**MODERATOR: JOSH KROTEC, FIRST AVIATION SERVICES
DEIDRE VANCE, AMERICAN AIRLINES
JEREMY HAHN, JET PARTS ENGINEERING
GIRI AGRAWAL, R&D DYNAMICS
GREG GUIDERA, SEGINUS**

Introductions



- Moderator: Josh Krotec
- Deidre Vance
 - Sr. Engineer, Parts Development Engineering
- Jeremy Hahn
 - Director of Engineering, FAA DER
- Giri Agrawal
 - President & CEO
- Greg Guidera
 - Director of Business Development

First Aviation Services Inc.

American Airlines 

JET PARTS
ENGINEERING, INC.

 **R&D**
Dynamics Corporation

 **SEGINUS**
AEROSPACE LLC

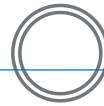
Part “Improvements” via PMA



**HOW PMAS IMPROVE
SAFETY & RELIABILITY**

**CASE STUDIES THAT TARGET SPECIFIC SAFETY
& RELIABILITY ISSUES**

Improved PMA Design



- B737NG Air Separation Module
 - Cobham Engineering



B737NG Air Separation Module

ISSUE: Chronic reliability issues with OEM module resulting in only 1/3 of originally projected service life

SOLUTION: Improved PMA design with unit cost savings of over 50% and 3X service life vs. OEM unit

Since incorporation into fleet no unscheduled removals reported.

Improved PMA Design

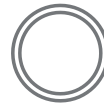


- **JPE HSPOV Switches**

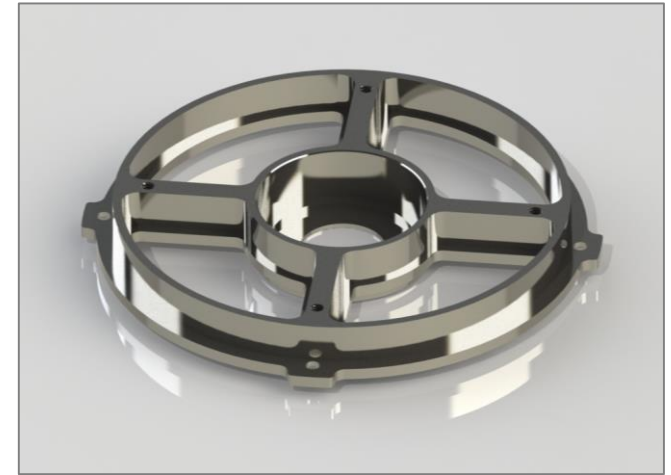
- Problematic OEM part that fails often and requires replacement
 - ✦ High failure rate due to galling & scratching
- OEM vs. PMA performance
 - ✦ OEM failed high temp cycling at 7,300
 - ✦ JPE PMA passed 32,000
- PMA Improvements
 - ✦ Lengthened plunger housing
 - ✦ Improved switch
 - ✦ Lower Cost AND Longer Life



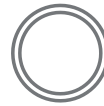
Improved PMA Design



- Hydraulic Pump Upgrade
 - OEM Part Problems:
 - ✦ Frequent bearing failures resulting in costly repairs
 - ✦ Frequent unscheduled down times
 - Seginus PMA Remedy:
 - ✦ Re-engineered endbell housing and upgraded material
 - ✦ Utilize proper bearing size and more suitable grease
 - ✦ Extended warranty to 2 years



Improved PMA Design



- **Flow Diverter Kit**

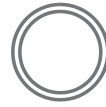
- **OEM Part Problems:**

- ✦ OEM fiberglass layup construction prone to cracking
- ✦ Extremely long lead time for OEM delivery
- ✦ Material prone to clogging

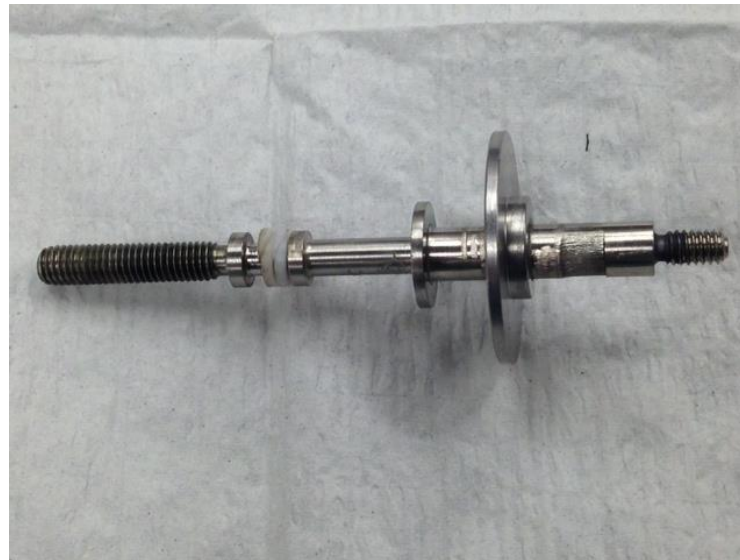


- **Seginus PMA Remedy:**

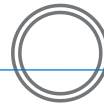
- ✦ Changed construction method to injection molding
- ✦ Lead time negligible
- ✦ Utilized material that is up to 10X stronger than OEM
- ✦ Installation Kit satisfies SB making removal much easier in the field



- Jet Parts FMU Shaft
 - Wear on OEM part led to IFSD
 - Delta Air Lines shop approached Jet Parts to fix issue
 - Jet Parts increased hardness to improve wear resistance
 - PMA cost also allowed Maintenance program change



Improved PMA Design



- B777 Brake Temp Sensor
 - Measure Tech



B777 Brake Temp Sensor

ISSUE: Unusually high spend level noticed for replacement OEM brake temp sensors, due to frequent failures

SOLUTION: PMA development project resulted in improved design, incorporating higher grade thermocouple material that makes the device better able to withstand extreme temp;

**Since incorporation
annual usage
dropped 86%**

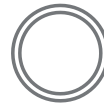
Improved PMA Design



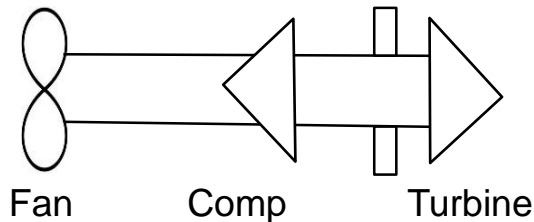
- Jet Parts Capacitors (Temp Control Valve Actuator)
 - Issue: actual operating temperatures exceed OEM expectations
 - ✦ OEM capacitor fails ~275°F
 - ✦ Actual operating environment well exceeds 300°F
 - JPE designed improvements into PMA replacement
 - ✦ Improved Casing
 - ✦ JPE PMA tested up to 345°F
 - ✦ Higher temperature range results in fewer failures
 - Improved Reliability through lower replacement rate



Improved PMA Design



- 737NG ACM Rotating Assembly
 - During Overhaul, OEM fan is replaced 90% of the time
 - Fan is damaged by HCF or FOD
 - Broken fan damages other components such as:
 - ✦ Housing
 - ✦ Bearings & seals
 - ✦ Other rotors

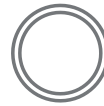


Typical Air Cycle Machine (ACM) Configuration



Steel Axial Fan

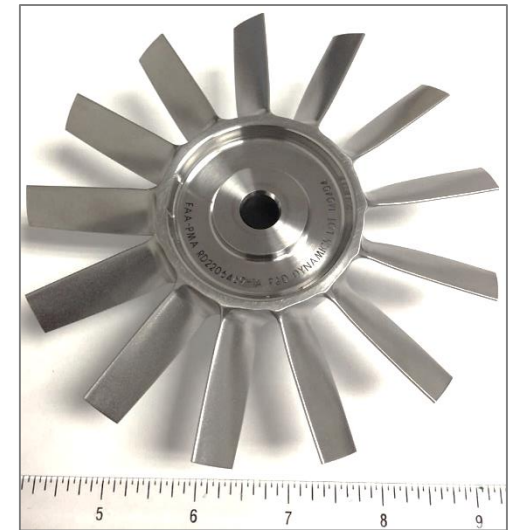
Improved PMA Design



- R&D Dynamics PMA Solutions:

1. Titanium Fan PMA

- PMA titanium fan is available in place of OEM steel fan
- Titanium fan is used on many other ACMs
 - ✦ A300, B767/757, B777 & others
- PMA titanium fan has 300% higher HCF life than OEM steel fan



TITANIUM Axial Fan

2. Steel Fan PMA

- PMA steel fan has been designed with better radius and better finish
- PMA steel fan has 20% higher HCF life than OEM steel fan

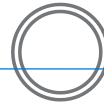
Other non-PMA Improvements



**HOW PMAS IMPROVE
SAFETY & RELIABILITY**

**AMOC
OWNER-OPERATOR PARTS
SYSTEM DESIGN CHANGE**

Improvement Projects



- B767 Packboard Release Mechanism
 - Aviation Component Solutions (ACS)



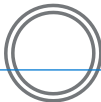
B767 Packboard Release Mechanism

ISSUE: OEM part suffers from corrosion issues, and very long lead times for replacement parts

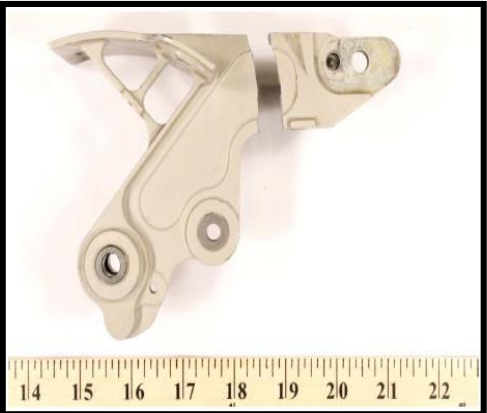
SOLUTION: PMA development with minor design tweaks and corrosion resistant materials to make the part more robust; 29 detail parts comprise the assembly mechanism; FAA approval required slide deployments and AMOC

**Complimented larger
AMOC Slide redesign
project.**

AA OOPP Solution



- A321 Emergency Door Arming Handle
 - Approved Aeronautics
 - Owner Operator (OOPP)

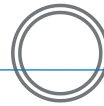


**Reducing removals due to damage during service
Design Enhancement**

A321 Emergency Door Arming Handle
ISSUE: Weak OEM design of door latch handle prone to frequent failure and breakage; costly replacements with long lead times
SOLUTION: Owner-Operator project with design improvements and use of machining processes in place of porous OEM casting; > 75% savings



System Design Change

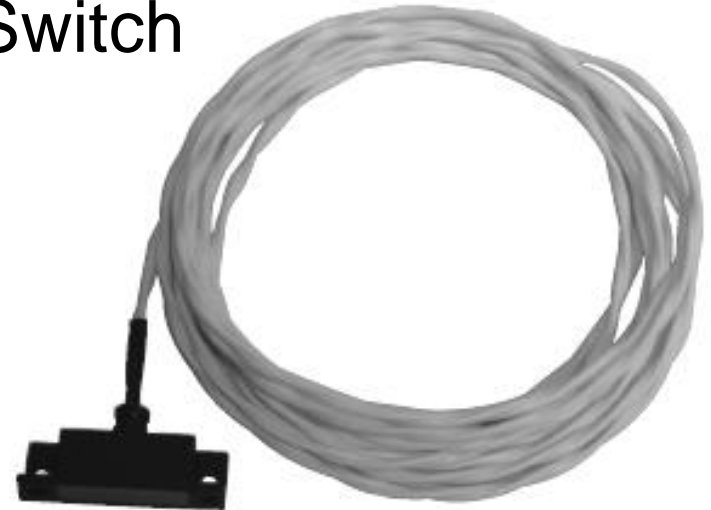


- HEICO B757/767 Fuel Door Switch

Fuel Door Switch

ISSUE: OEM design as well as PMA prone to frequent intermittent and nuance failure indications; high rate NFF, high field maintenance replacement

SOLUTION: Heico's design specialist from Flight Specialties assisted on-site evaluation of the systemic problem present with the OEM part to track down root cause. The Fuel Door Switch was not the root cause but only the sacrifice due to upstream electrical system interactions between flight deck indicating system and Fuel Door Switch



Within two weeks of onsite visit, solution was proposed

The proposed solution was implemented on repeat AC with nuance failure indications and resulted in elimination of nuance indication.

Reliability Improvements via PMA Supply Chain & Economics



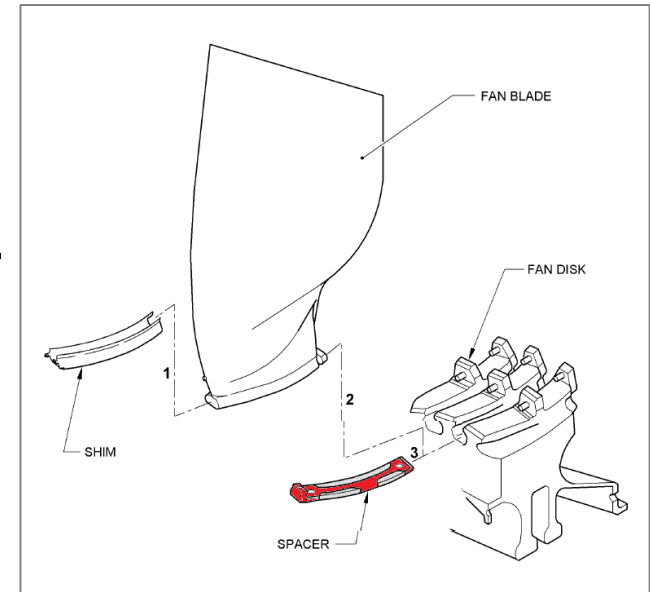
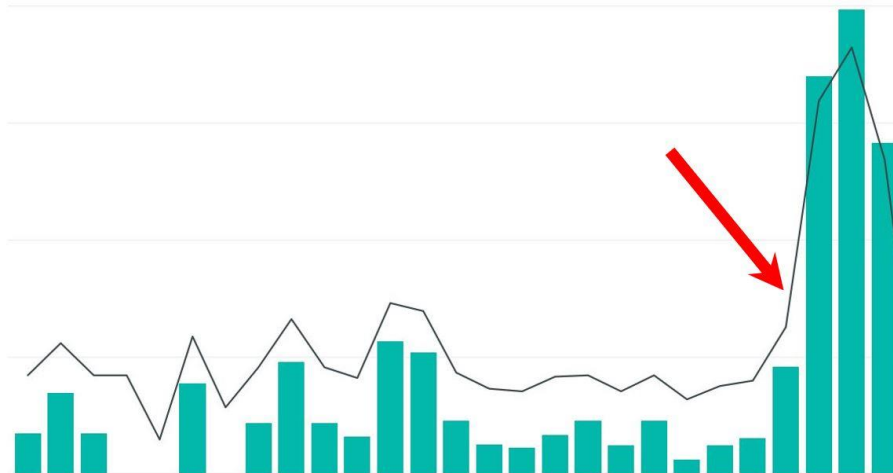
**HOW PMAS IMPROVE
SAFETY & RELIABILITY**

**CASE STUDIES THAT IMPROVE OPERATIONAL
RELIABILITY THROUGH PMA ECONOMICS AND
AVAILABILITY**

Reliability through Availability

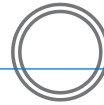


- JPE Fan Blade Spacer (CFM56)
 - PMA provided Rapid Response to post-SWA1380 inspections
 - ✦ 13,000 blades need inspection w/in 9mo.
 - JPE provided new PMA inventory within 3 weeks of AD



P/N 340-001-262JP-0

Reliability through Economics



- Q400 Propeller Deicer
 - “On-Condition” deicer doesn’t need to be replaced at overhaul, but fails shortly thereafter
 - ✦ Propeller TBO (10k hours) vs Deicer MTBF (12k hours)
 - PMA allows 100% replacement at overhaul
 - ✦ OEM deicer (installed) ~\$3,600/blade (~\$43k/shipset)
 - Replace when failed = ~\$3.60/aircraft/FH
 - Potentially, 12 unscheduled removals per TBO
 - ✦ PMA deicer (installed) ~\$2,500/blade (~\$30k/shipset)
 - 100% replacement at Overhaul = ~\$3.00/aircraft/FH
 - ELIMINATE unscheduled removals
 - Dramatically improved reliability (no AOGs / unscheduled events) and >16% direct cost savings



Thank You!



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