DoD Maintenance Symposium
Birmingham, AL October 24, 2005

Superior Products Through Innovation

Advanced Development Programs®

Aging Aircraft Sustainment

LM Aero Legacy Aircraft: Average Ages

- C-130E: 40 H1: 33 H2: 18 H3: 11
- C-5A: 33 C-5B: 20
- P-3C: 25
- F-16C/D: 20
- F-117A: 20

Not Covered: S-3, U-2, C-141

What Are The Issues? A Consensus

- Work Closely With Customer
  - *Identify potential problems*
  - *Engineer and implement solutions*
- Structural Integrity
- Wiring
- Keeping Programs Funded (“Bridging The Gap”)
- Ability To Carry Out Mission
  - *Changing Threats*
  - *New Requirements Drive New Capability Development*
- Obsolescence / DMS
- Field Data Problem: Inconsistent, Inaccurate
- O&S Costs Rising (but why?)

Do O&S Costs Increase With Age?

- **Certainly increase with time**
  - *3 – 7% per year*
  - *F-117 only about 1%*
- **Biggest Drivers Not Age-Related:**
  - *Personnel*
  - *Fuel*
  - *Overhead*
- **Depot costs rising substantially**
  - *Are we buying availability? Probably*
  - *Need to consider "Composite Availability"*

C-130 Hercules:
Tactical Airlift / Multi-role Utilitarian Aircraft

- **Center Wing Box**
  - *Fatigue testing early 90s first hint of problem*
  - *Undetected corrosion led to grounding of approx 50 Es in 02*
  - *SOF E derivative models retrofitted with "SOF" CWB in 90s*
  - *SOF H derivative models aging slower than predicted; service life extended*
  - *Basic E & H models aging faster than predicted; service life reduced*
  - *Challenges: funding, timing, "bridging the gap"*

- **Fuselage Issues:**
  - *Growing uncertainty re: susceptibility to WFD, SCC*
  - *Full-scale fatigue test on C-130A not applicable to E & H*
  - *Can't accurately assess remaining useful life*

Structural Failure (2002): "Firebird" 50 year old C-130A

- **Fleet average age: 48 – 60 years**
- **Wings a problem with C-130As when flown hard**
- **Exact flight history unknown; flown by CIA**
- **Cause of accident: cracks not found in inspection**
- **USFS cancelled contracts with private companies:**

"No adequate way to assess safety of remaining fleet"

Mission Failure: Loss of capability

C-5 Galaxy Strategic Airlifter

- **AFIRM: Aging Fleet Integrity & Reliability Management**
  - ***Web-based access for info by tail number***
  - ***Inspections, operations data, maintenance***
- **LESS: Loads / Environment Spectra Survey**
  - ***Approx. 10% of fleet instrumented***
  - ***Flight data feeds back into model***
- **Risk Management**
  - ***MOI revealed "subterranean" cracks – like disbonds****
  - ***Everything factored into Risk-vs-Time curve***
- **Ongoing Partnership With Customer**
  - ***Consult when unusual events occur***
  - ***RERP underway***

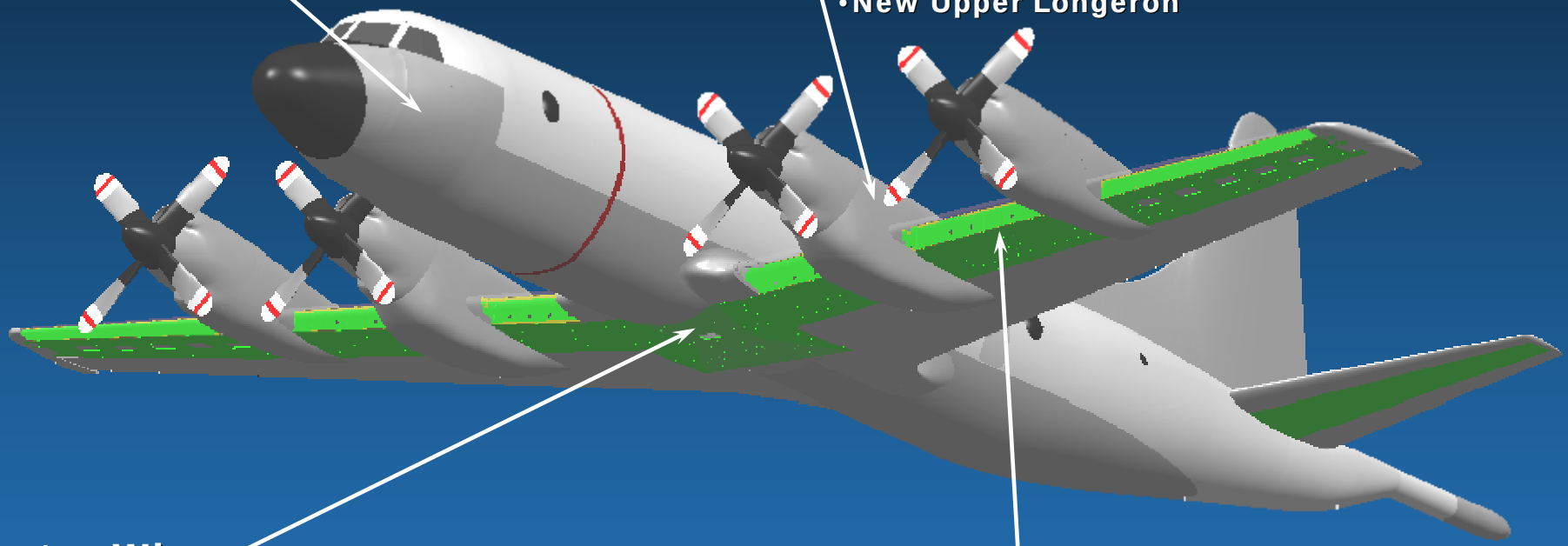
***"Used to we'd see aircraft wear out from fatigue. Now we're flying them so long that the finishes are breaking down, leading to forms of corrosion we've never seen before. ASIP has to adapt."**

- Ed Ingram, LM Aero Structures Engineer & Technical Fellow

P-3 Orion: ASW, C4ISr

- Original Service Life Goal: 7,500 fhrs; current 18 – 20K fhrs
- Recent fatigue test out to 38K fhrs
- Cracks found after testing also found in fleet
- Led to 3 current major efforts:
  - *Large inspect and repair program*
  - *Material replacement for fatigued wing components*
  - *Material replacement with design improvements*
- Biggest issue: fatigue cracking and corrosion
  - *Usage and age*
  - *New, better alloys developed for use in material replacement*
- Have to bridge gap until MMA (~2012)
  - *Sustainment funding a challenge*
  - *"Delicate balance"*
- Similar issues for foreign customers

P-3 Orion: USN Current Improvement Programs



Fwd Fuselage
- BL40 Longeron and Gussets

Inbd Nacelle
- New Upper Longeron

Center Wing
- Lower Surface Assembly
  - Panels 1-9
  - Rib Caps
- Front Beam Lower Cap
- Front and Rear Beam Lower Corner Fittings
- ForceTec Rivetless Nutplates

Outer Wing
- Lower Surface Panels 1-4
- Complete Front Spar
  - Upper and Lower Caps
  - Web, Stiffeners & Nacelle Attach Plates
  - Upper and Lower Corner Fittings
- ForceTec Rivetless Nutplates

Wing Replacement Programs

Completed:

New Zealand

"There's so much life left in this aircraft. The P-3 is growing. There's a lot of time left during which we will be able to depend on this airplane. And that's the case for our nation and for all of the nations here."

Wing Cmdr. Andy Woods, RNZAF

(Oct '04, P-3 Operators Conference)

Planned:

Canada

Norway

F-16 Falcon: Multi-role Fighter

- **Biggest problem: Data**
  - ***Significant unscheduled maintenance miscoding***
  - ***Misleading picture of fleet health***
- **Reductions after analysis of raw records:**
  - ***Total maintenance events: 50%***
  - ***Maintenance man-hours: 36%***
  - ***Inherent failures: 25%***
- **R&M metrics do show gradual degrading trends**
  - ***R&M performance remains at or near top in most categories***
  - ***Major reliability contributors: Avionics and Engine***
  - ***Improving trend in MC Rate in recent years***
    - MC Rate ≥ 75% since 1997 (ACC, PAF, AFE)
    - Currently exceeding USAF standard
- **Contribution of age-related issues difficult to assess**

F-117 Nighthawk

- **Only LM Aircraft Sustained Under TSPR Agreement**
  - *Sacramento ALC closed under BRAC*
  - *LM provides engineering support, spares management, etc.*
  - *Government retains control of budget, requirements, etc.*
  - *Have met 100% of performance goals*
- **What's Not Unique:**
  - *Engine, landing gear, ECS, other systems from other aircraft*
  - *Suffers same DMS & obsolescence issues they do*
- **What Is Unique:**
  - *Plane flown far under design goals*
  - *Housed in climate-controlled environment*
  - *No evidence of fatigue, corrosion, sonic fatigue*
  - *Predicted structural life: 2070*
  - *High maintenance driver: LO materials*
- **Biggest Concern: Parts Which Have Never Failed**

Final Thoughts

"We're having to deal with these aging airplane issues that take an increasing amount of the budget and we need to get on with recapitalizing . . . Of the things that I worry about the most, that's it."

USAF Chief of Staff Gen. John Jumper (August 2005)

"Even if we buy everything we're planning to buy over the next five years, we'll still have the oldest fleet in the history of the Air Force . . . It's something we'll be working on every year . . . And it's something we just have to keep working on."

Acting Air Force Secretary Pete Geren (Sep. 2005)