The Surplus Parts Market
Washington DC - 16 June 2014

Presented by:
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Principal
Today’s Agenda

- Aircraft Retirement Tsunami
- Surplus Parts Market
- Implications

SH&E joined ICF in 2007

AeroStrategy joined ICF in 2011
Aircraft Retirement Tsunami
Four market factors are reshaping aircraft economics and MRO

Fleet Demographics—the 1990 Bulge

Air transport deliveries

Historically High Jet A Fuel Prices ($/BBL)

10-Year US Treasury Bond Yield – though cost of capital is now trending up

New Technology & OEM Production Rates Exacerbate Retirements

Source: ICF International Analysis; FlightGlobal ACAS 2013, ATA, US Federal Reserve
Historically, the aircraft retirements as a percentage of active fleet has increased from one percent to 2.5% in 2012.
In 2013 ~80% of all retirements were aircraft of 1970/80s technology

Historical Air Transport Retirements By Technology

Source: FlightGlobal ACAS, ICF International Analysis
In the last decade ~55% retired aircraft were narrowbodies

Source: FlightGlobal ACAS, ICF International Analysis
Average retirement ages appear to be trending down slightly for certain aircraft...

Source: FlightGlobal ACAS, ICF International Analysis
...and the impending arrival of aircraft with new technology engines will impact retirements for current models

A320-200 (CFM56-5B/V2500-A5) Survivor Curve

- Oldest aircraft approaching 20 years
- Median retirement age appears on track for less than 25 years
- How will the A320neo affect retirements?

Notes: (1) Survivor curves represent delivery-weighted curve fits. (2) Late A320-200 aircraft powered by CFM56-5B and V2500-A5 engines. Source: ICF International Analysis; FlightGlobal ACAS 2013
For the first time, annual retirements are expected to reach over 1,000 aircraft by 2023

Air Transport Annual Aircraft Retirements

# Retirements

% Installed Fleet

ICF International forecast

1990-99 Average 171
2000-09 Average 410
2010-23 Average 751

Includes Turboprops
Source: FlightGlobal ACAS Dec 2013, ICF International Analysis
45-50% of new aircraft deliveries in the next decade will be for aircraft replacements, versus the historical norm of ~20%.

Air Transport Retirements 2014 – 2023

Composition of Demand 2014 – 2023

Retirements historically drive 20% of deliveries

Source: ICF International
Note: includes turboprops and regional jets
Surplus Parts Market
The civil air transport fleet is almost 27,000 aircraft

2013 Global Air Transport Fleet

*(Total = 26,770)*

Aircraft Type

- Regional Jet: 17%
- Narrowbody Jet: 50%
- Turboprop: 15%
- Widebody Jet: 18%

Region

- North America: 32%
- South America: 20%
- Europe: 25%
- Africa: 8%
- Middle East: 5%
- Asia Pacific: 18%

Source: FlightGlobal ACAS September 2013, ICF International Analysis
The current air transport MRO market is ~$61B; Asia Pacific has overtaken Europe for the #2 position.

**2013 Global MRO Demand**

*Total = $60.7B*

**Line**
- Modifications: 6%
- Airframe: 15%
- Components: 22%

**Region**
- North America: 31%
- South America: 26%
- Europe: 27%
- Asia/Pacific: 27%
- Middle East: 7%
- Africa: 4%

Source: ICF International
Forecast in 2013 $USD, exclusive of inflation
Air transport MRO spend is expected to grow to $89B by 2023, at 3.9% per annum

Global Air Transport MRO Spend
2013–2023

CAGR

<table>
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<th>Percentage</th>
<th>2013</th>
<th>2023</th>
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<tr>
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<td>6%</td>
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<tr>
<td>Heavy Airframe</td>
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<tr>
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<td>17%</td>
<td>16%</td>
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<tr>
<td>Components</td>
<td>22%</td>
<td>23%</td>
</tr>
<tr>
<td>Engine</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Average</td>
<td>3.9%</td>
<td>3.9%</td>
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Source: ICF International
Forecast in 2013 $USD, exclusive of inflation

Highlights:

- Average growth is forecast to be 3.9% CAGR to $89B in 2023
- The strongest driver of growth is expected to be the engine market
- MRO growth is greater than fleet growth – driven primarily by fleet demographics
- Upgrade demand drives high modifications growth
Today, spending on air transport surplus parts is ~$3.5B

**Air Transport Surplus Parts Market***

~$3.5 Billion

- **Surplus material for engines predominantly consist of piece parts (e.g., LLPs)**
- **Component surplus are primarily rotable LRU's; Demand is driven by AOGs, BER and provisioning**

Source: ICF International

* Sales to end customers; excludes intra-dealer sales
Surplus dealers now obtain over 80% of their inventory from parted-out aircraft

Supplier Channels for Obtaining Surplus Materials

- 54% Aircraft Part-Out
- 26% Direct Purchase From Airline
- 20% Purchase From Surplus Dealer
- 10% Leaner airline inventories
- 8% Improved material planning (and MRO IT capabilities)
- 8% Increased component pooling agreements
- 10% OEM after-market material control strategies

Source: ICF International
ICF forecasts the surplus market to grow to $6.2B by 2023 – a 5.5% CAGR

ICF International Air Transport Surplus Market Growth Forecast ($B)

- **Airframe**
  - $0.8B in 2007
  - $2.2B in 2023

- **Component**
  - $0.1B in 2007
  - $1.3B in 2023

- **Engine**
  - $1.1B in 2007
  - $3.8B in 2023

**Low Growth Scenario**
- Significant increase in interest rates
- Decrease in fuel price
- Delays in new aircraft introduction
- Successful OEM surplus strategies

**Nominal - Assumed**
- Moderate increase in interest rates
- Fuel prices slightly lower than current
- Minor delays to new aircraft programs
- OEM have limited impact on surplus

**High Growth Scenario**
- Ultra low interest rates
- Fuel price remains high
- Increased retirements
- On time aircraft delivery
- No OEM counter measure

Source: ICF International. Forecast in 2013 constant $.
Several trends are shaping the surplus parts market:

- **Growing demand for integrated Component MRO Solutions (Including Asset Mgt)**
- **Proportion of fleet owned by lessors is increasing**
- **Growing capital market interest**
- **Market penetration & volume of surplus is increasing**
- **Aircraft Retirements (Including younger models)**
- **Leasing & surplus trading businesses are converging; Businesses are integrating across the value chain**
There are many changes in the surplus parts value chain as suppliers pursue broader offerings for their customers.

Source: ICF International Research
Growing surplus usages means cost savings for operators and lumpy aftermarket demand for OEMs

Industry MRO Historical Growth (year-over-year)

- Surplus is one of several factors contributing to “lumpy” aftermarket demand
- Surplus has the largest impact on engines and rotables for mature aircraft

Source: Canaccord Genuity 3Q13, based on a survey of over 100 operators and MROs
The aircraft part-out and recycling business will continue to grow as a result of a confluence of several key factors:

1. Continued increase in aircraft retirements
2. Strong global demand for surplus material
3. Growth and expertise of global parts distribution firms
4. Low cost of capital (low interest rates)
5. Increased demand for raw material (recycled metal)

Example Part-Out Players:

- AerSale
- AAR
- GA Telesis
- VAS Aero Services
- (former Memphis Group)
- AJW
- Universal Asset Management
- Kellstrom Industries
- Aeroturbine
- AAR
- Stewart Industries
- SCA
- Tarmac
- Avocet
- ASI
- U.K.
- Florida
- Arizona
- Oklahoma
- Indianapolis
- Victorville
- France

Source: ICF International Research
Implications
Relations between suppliers such as OEMs, integrators and independent MROs continue to evolve

**Airframe OEMs**
- Drive to grow services revenue
- Competing with integrators
- Key challenge is to demonstrate value/success

**Component OEMs**
- Continued focus of aftermarket
- Increased support in growth regions via licensed service centers
- Competing with integrators for component contracts

**Integrators**
- Increasing competition from all OEMs
- JV opportunities?
- Repair vs. replace based strategies?
- Data access?

**Independent MROs**
- How to secure access to new aircraft IP, data, manuals?
- Partnerships? JVs?
- Surplus/PMA/DER usage?

Source: ICF International
Surplus players are evaluating how to grow beyond ‘trading’ to offer more value added services

Key Surplus Parts Provider Implications

- The oversupply of sunset and some mature products is causing downward pricing pressure
- Whether to add additional services such as MRO (airframe / engine or component) or services such as component leasing / asset management
- Growth opportunities in emerging regions such as Asia
- Consider aligning with OEMs

Source: ICF International
Aftermarket revenue streams of Engine and Component OEMs will continue to be challenged by surplus

Key Engine / Component OEM Implications

- New parts sales reduced by surplus for affected mature aircraft
- Engine OEMs have been the main OEM participants in the surplus market; System OEMs are so far limited - only Honeywell and Rockwell Collins have active surplus trading divisions
- MRO and spares activity for vulnerable aircraft/engines reduced by short-term leases, inventory burn-down and consumption of spares
- New aftermarket opportunity for OEMs – sell surplus / pre-owned parts. Will more system OEMs actively participate in surplus parts?

Source: ICF International
Independent MROs face challenges and opportunities from the new environment

Key Independent MRO Implications

- Adapt capabilities to align with shifting aircraft utilization patterns and demographics
- Migration of fleet to new technology aircraft strengthens position of OEMs
- Downward MRO pricing pressure where in competition with surplus aircraft, components and engines
- Leverage availability of surplus parts to reduce maintenance costs...and prices
- Develop value propositions to help airlines cope with sunset aircraft

Source: ICF International
Airlines are well-positioned to capitalize on the low interest rates and maintenance cost savings opportunities

Key Airline Operator Implications

- Historically low interest rates and easy access to capital resulted in record breaking aircraft orders by airlines in recent years
- New and more fuel efficient aircraft reduces aircraft operating cost
- Airlines can also lower maintenance burden with new aircraft maintenance honeymoon and retirement of older aircraft with higher maintenance requirements
- High retirement rates and the subsequent availability of surplus parts provide airlines with substantial maintenance cost savings opportunities
- Airlines can save 30% or more by acquiring parts, rotables and aeroengines from surplus dealers that salvage components from retired aircraft

Source: ICF International
Thank You!

ICF International’s Aerospace & MRO advisory services include the following:

- M&A Commercial Due Diligence
- MRO Market Research & Analysis
- Aerospace Manufacturing Strategy
- Aviation Asset Valuations & Appraisals
- MRO Cost & Performance Benchmarking
- MRO Information Technology (IT) Assessment
- MRO Strategic Sourcing Support
- Supply Chain Management
- LEAN Continuous Process Improvement
- Military Aircraft Sustainment
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