Airline industry best practices for aircraft decommissioning

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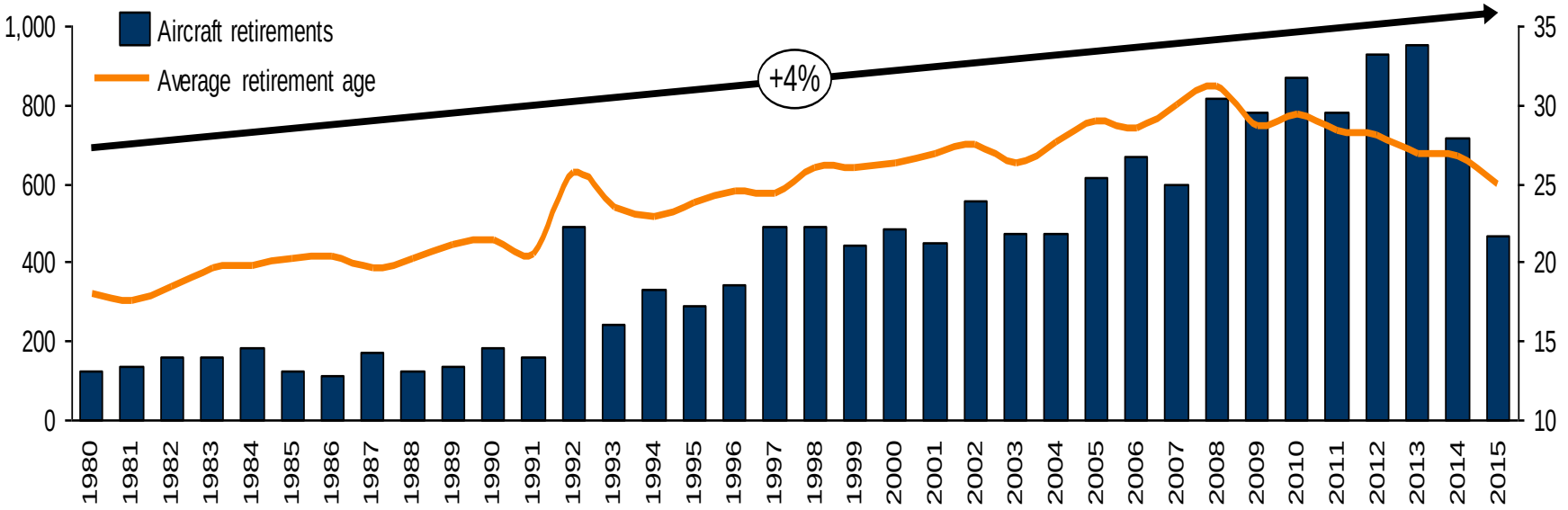
Growing number of aging aircraft

- Steeply rising number of aircraft to be decommissioned
  - More than 3000 commercial aircraft over 25 years old and still in service
  - Average service time of an aircraft 25+ years
    - Significant variability – depending on business model
    - Recent trend to decommission aircraft at lower age
  - 12000 aircraft expected to be decommissioned in the next 20 years
    - How do we – as an industry – address environmental concerns?
    - How do we handle aircraft part-outs properly to manage regulatory requirements?

Aircraft retirement statistics



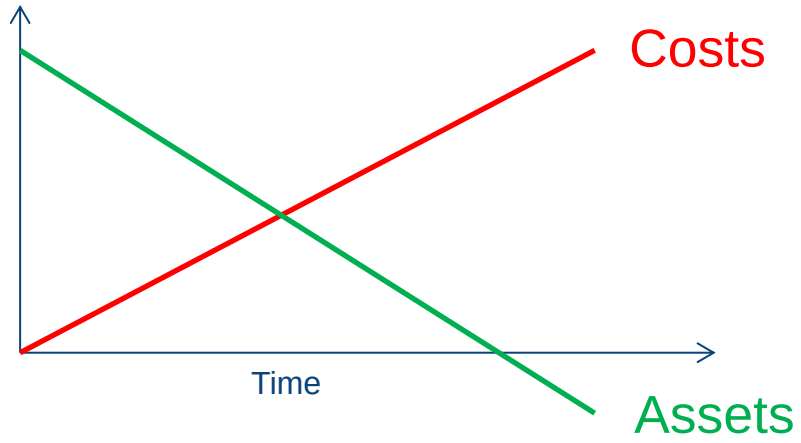
Growth of retirements reflects earlier air traffic growth
Retirement age down again recently
Main reasons: world economic crisis, current overcapacity buildup

Aircraft end-of-life issues

- Safety
  - Re-use of parts/equipment that have lost certification (black market)
  - Aircraft cut up in questionable safety conditions
- Environment
  - Hazardous substances (e.g. hydraulic fluids, electronic waste, asbestos, depleted uranium ballast)
  - Minimizing waste and emissions
  - Recycling of materials (challenges: carbon fiber; fire-resistant cabin furnishing) and re-use of aircraft components
  - Environmental management of dismantling and recycling facilities
  - Lifecycle considerations on GHG emissions for scenarios of decommissioning versus maintaining an old aircraft
- Further risks with stranded aircraft at airfield edges
  - Obstruction of airport areas
  - Reputational risks

Economic aspects

- Airlines should be encouraged to do controlled decommissioning
  - Avoid disincentivising costs (part of target group is financially weak)
  - Optimised re-use / recycling should allow to take best benefit from components' residual value

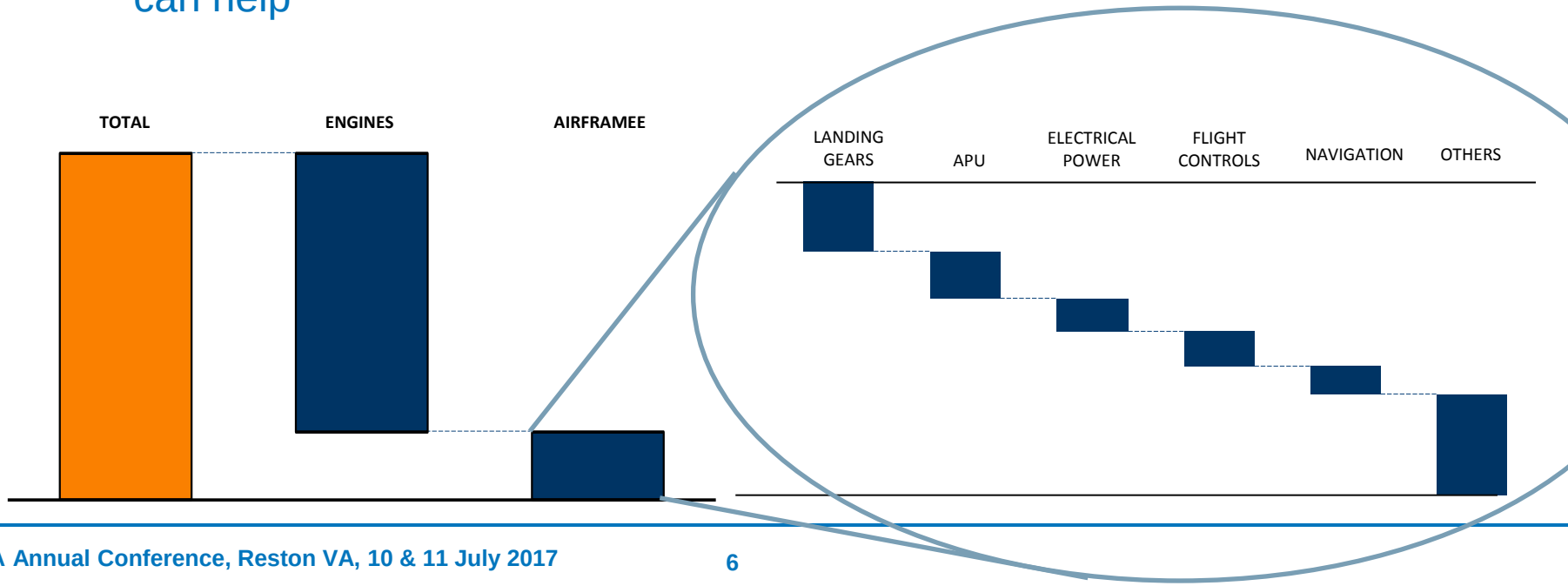


Maintenance
Waste
Parking
Forgone airport utilisation

Residual value:
- Metal, plastics etc.
- Equipment? not if certification lost minus Liabilities

Re-use and recycling

- Many pieces of equipment (engines, avionics, …) can be re-used
  - Represents much higher value than metal structure
  - Avoid equipment losing certification
  - Rigorous safety control needed → new identification systems (e.g. RFID) can help



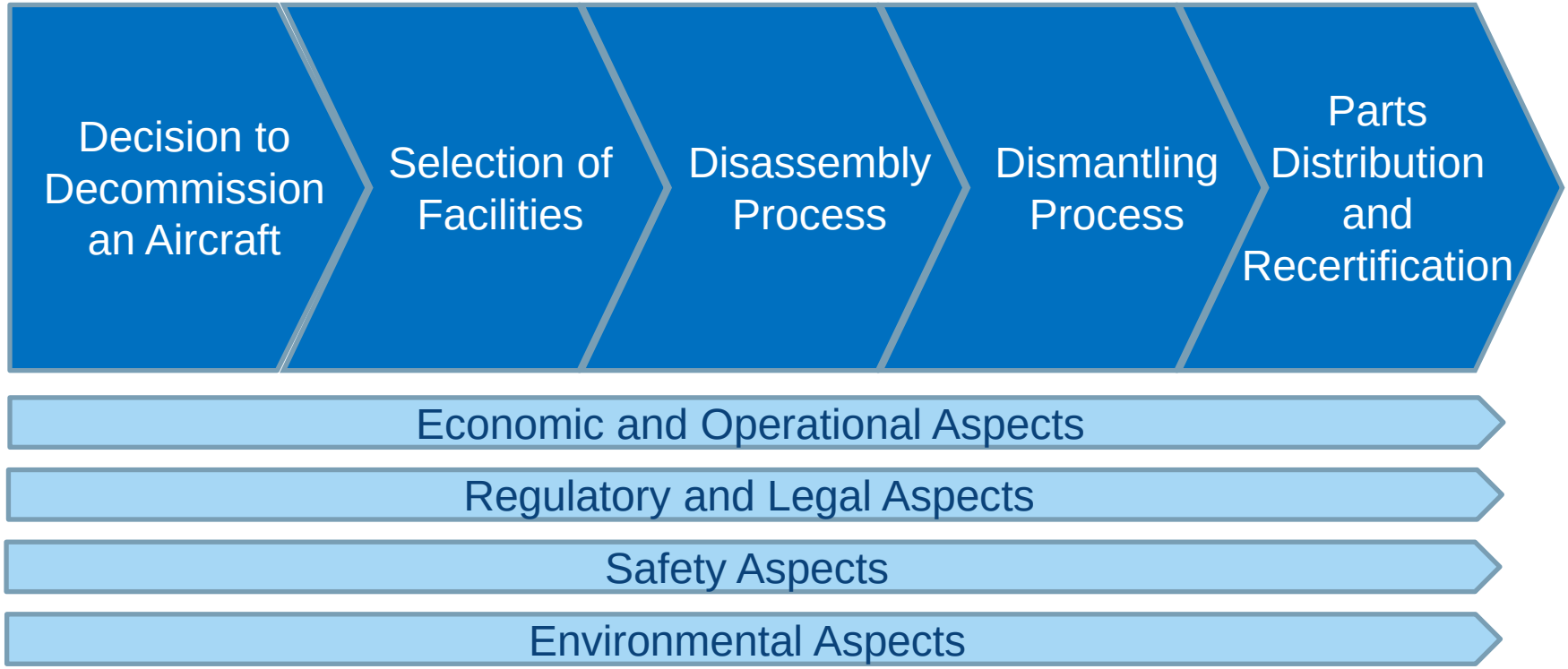
Re-use and recycling

- Various metallic alloys, mainly Al
  - Separated by type?
    → Higher value, but higher separation costs
- Carbon-fibre composites (e.g. tailplanes)
  - Recycling methods under development
- For the future:
  - Increased use of recyclable materials in new aircraft
  - “Design for deconstruction”

Industry Best Practices

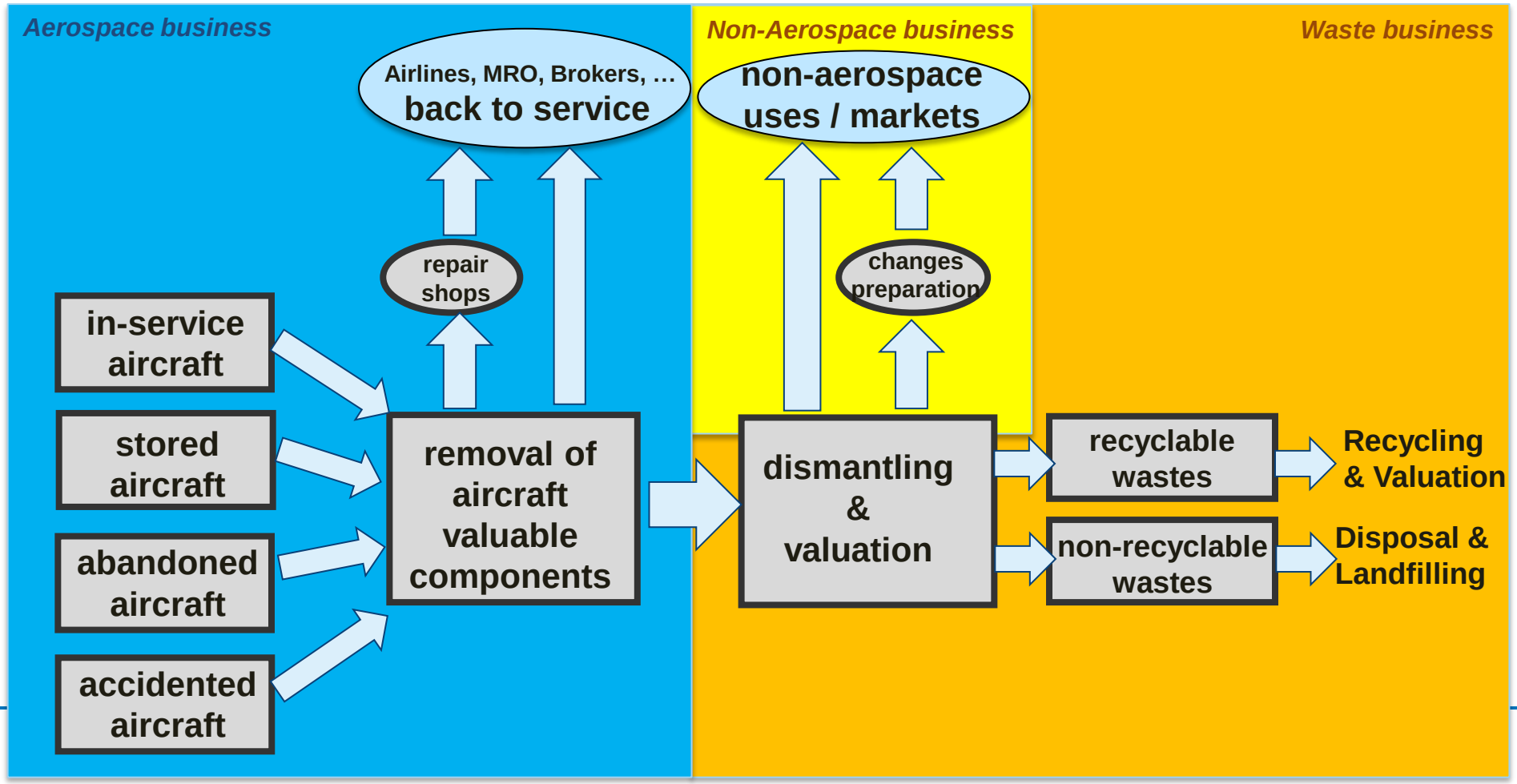
- AFRA has published Best Management Practices
  - for aircraft dismantling/recycling companies
- IATA project: Develop best practices for aircraft owners and operators
  - Helping them how to manage aircraft decommissioning in a controlled process,
  - Considering Safety/Airworthiness, Environment, Economics
  - Being established as an industry group involving airlines, AFRA, dismantling and recycling companies, aircraft and engine manufacturers,
  - Planned to be finalized in early 2018

Industry Best Practices Manual – Structure



Aircraft End of Life Management

Overall picture of the main activities and steps



ICAO involvement

- Since 2016, ICAO's Committee on Aviation Environmental Protection (CAEP) has a task on aircraft decommissioning in WG2 (Airports and Operations)
- CAEP task description:
  - Assess and collate the current best practices on aircraft end-of-life environmental management techniques and recommend guidance material
  - Objective is not to create new international rules or regulations.
- CAEP WG2 invited to provide feedback to IATA best practices manual

Conclusions

- Aircraft retirement numbers are strongly growing, retirement age is going down
- Decommissioning of growing importance for airlines
- Safety, environmental and economic issues related to aircraft decommissioning
- IATA is developing best practices manual
  - Best use of residual value
  - Minimize safety and environmental risks
  - Established in multi-stakeholder industry group
  - In dialogue with ICAO
  - Complementary to AFRA Best Management Practices

Thank you!

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Rough outline (1)

All main phases of aircraft end-of-life to be covered

Phase	Aspects	Examples
Decision to Decommission an Aircraft	Economic and operational	Fleet planning, maintenance cycle, technological improvements, market conditions, accounting principles and considerations on aircraft residual value
	Regulatory and legal	Liability, insurance, customs / taxation
	Safety and environmental	Treatment of hazardous and toxic materials

Rough outline (2)

Phase	Aspects	Examples
Selection of Facilities	Economic and operational	Expenses, saleability of parts, facilities' location and climate, capability and credibility, possibility of aircraft storage
	Regulatory and legal	Protection of ownership rights and applicable tax and customs regulations
	Safety	Facilities' commitment to safety and quality, health and safety code, quality systems, AFRA accreditation, personnel requirements and training
	Environmental	Facilities' environmental compliance, AFRA accreditation and certification by Environmental Management Systems (ISO 14001; EMAS), environmental protection aspects
Disassembly Process	Economic and operational	Realisation of residual value, storage conditions
	Regulatory and legal	Protection of parts ownership rights for parts, parts serviceability (airworthiness)
	Safety	Safety conditions for workers and external persons and product safety and airworthiness
	Environmental	Material management during disassembly

Rough outline (3)

Phase	Aspects	Examples
Dismantling Process	Economic and operational	Realisation of residual value
	Regulatory and legal	Protection of ownership rights for parts, parts serviceability (airworthiness)
	Safety	Safety conditions for workers and external persons, and product safety and airworthiness
	Environmental	Material management during dismantling
Parts Distribution and Recertification	Economic and operational	High-value components, movement speed of components, supply and demand, and related OEM policies
	Regulatory and legal	Bilateral agreements and airworthiness aspects
	Safety	Related to uncertified components and bogus parts
	Environmental	