



# End-of-Life Aircraft

Aviation: the most circular industry in the world

May 31, 2017

Den Haag, The Netherlands



# My journey



## Derk-Jan van Heerden (37)

- BSc Aerospace Engineering
- MSc Aerospace Engineering – Aerospace Management and Operations
- End-Thesis research on aircraft recycling
  - KLM and Boeing
  - Best Graduate Award of the NVvL (Dutch Aerospace Society)
  - Prof. mr. dr. ir. S.C. Santema
- Admitted to YES!Delft incubator in 2006
- Admitted EO Accelerator in 2013
- Admitted EO in 2014
- AFRA board member since 2010 currently holding President function
- In the “40 under Forty” of AviationWeek in 2012

# AELS

- Globally the first AFRA (dual) and ASA certified company



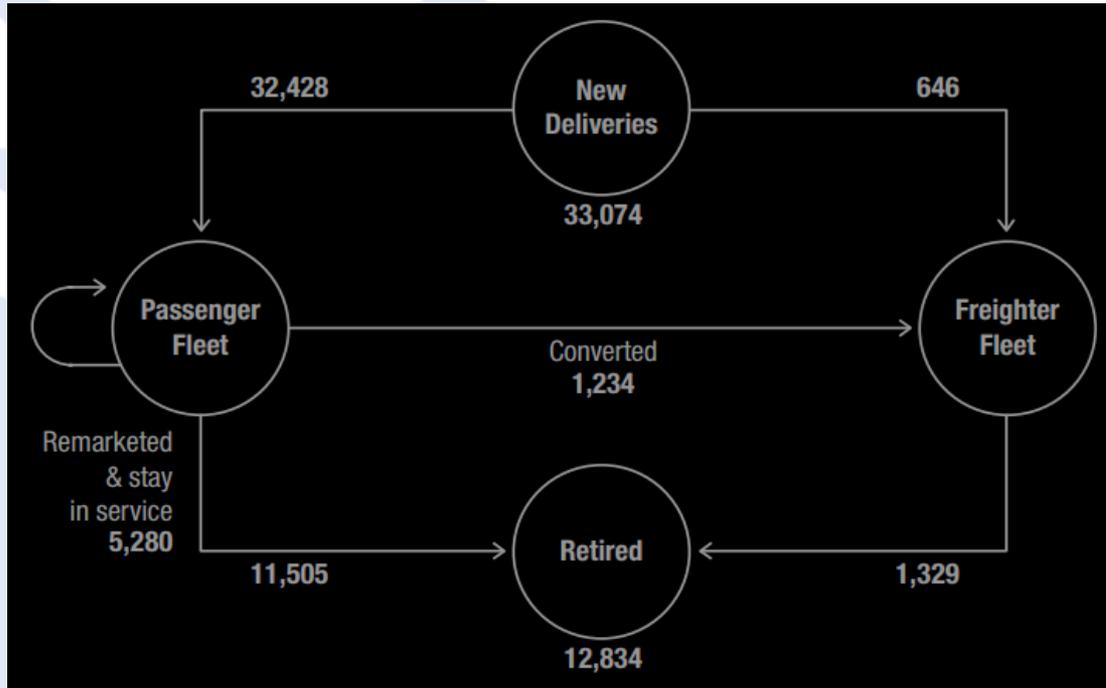
- Processed 50 aircraft
  - From Fokker F27 to Boeing 747
- 12 aircraft bought
- Example customers:
  - KLM
  - Iberia
  - NATO
  - Hamilton Sundstrand
  - AerCap
  - TNT
  - Mid American







# How many?



Expected to be retired in the coming 20 years:

- 2004: 4.297 (24,8%)
- 2006: 5.561 (24,5%)
- 2007: 6.459 (26,6%)
- 2009: 8.453 (33,8%)
- 2012: 9.880 (35,0%)
- 2013: 12.193 (41,7%)
- 2014: 12.355 (39,4%)
- 2015: 13.100 (40,2%)
- 2016: 12.834 (38,8%)

Source: Airbus GMF2016

Passenger aircraft (>100 seats) and jet freight aircraft (>10 tons)



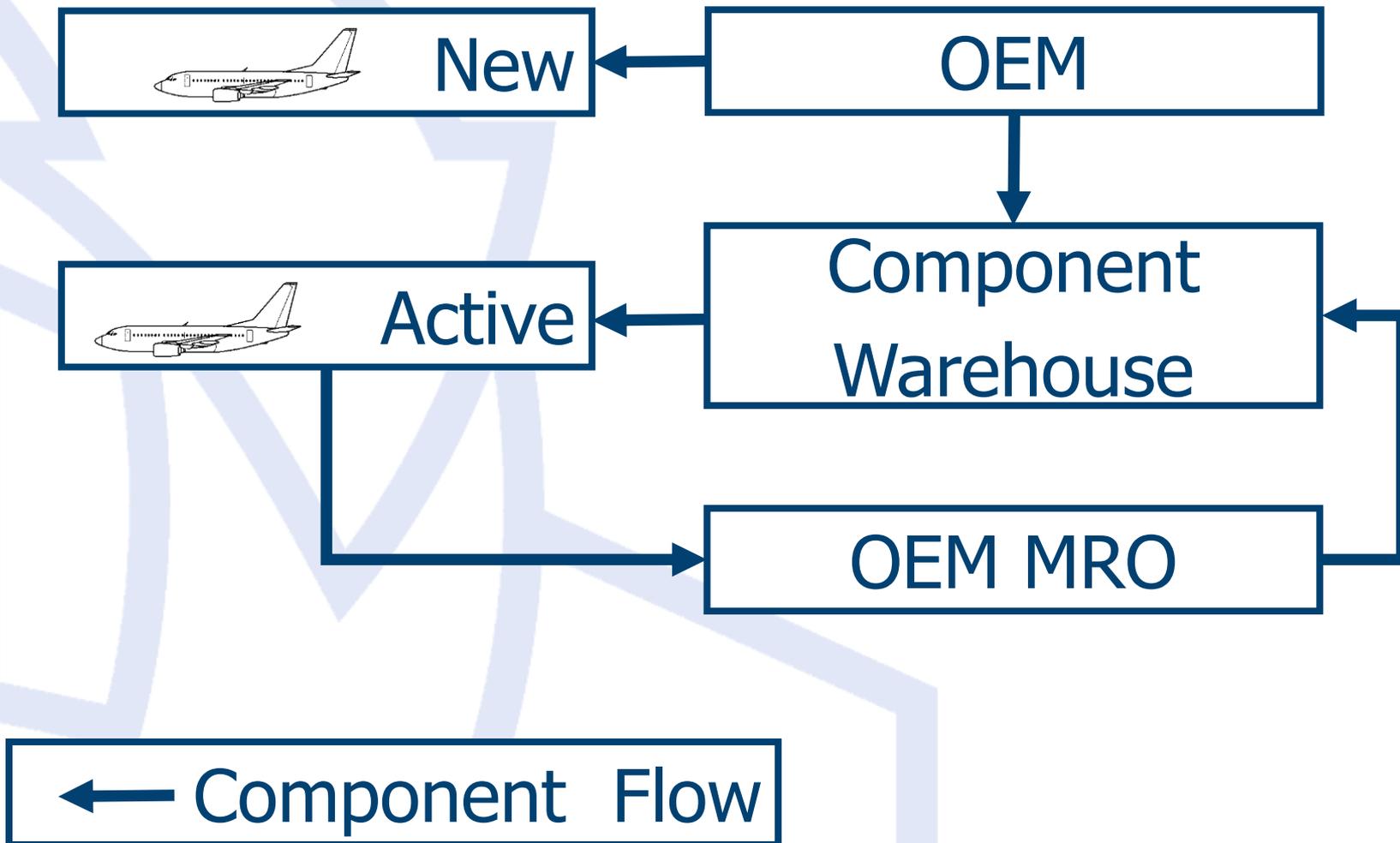


# Content

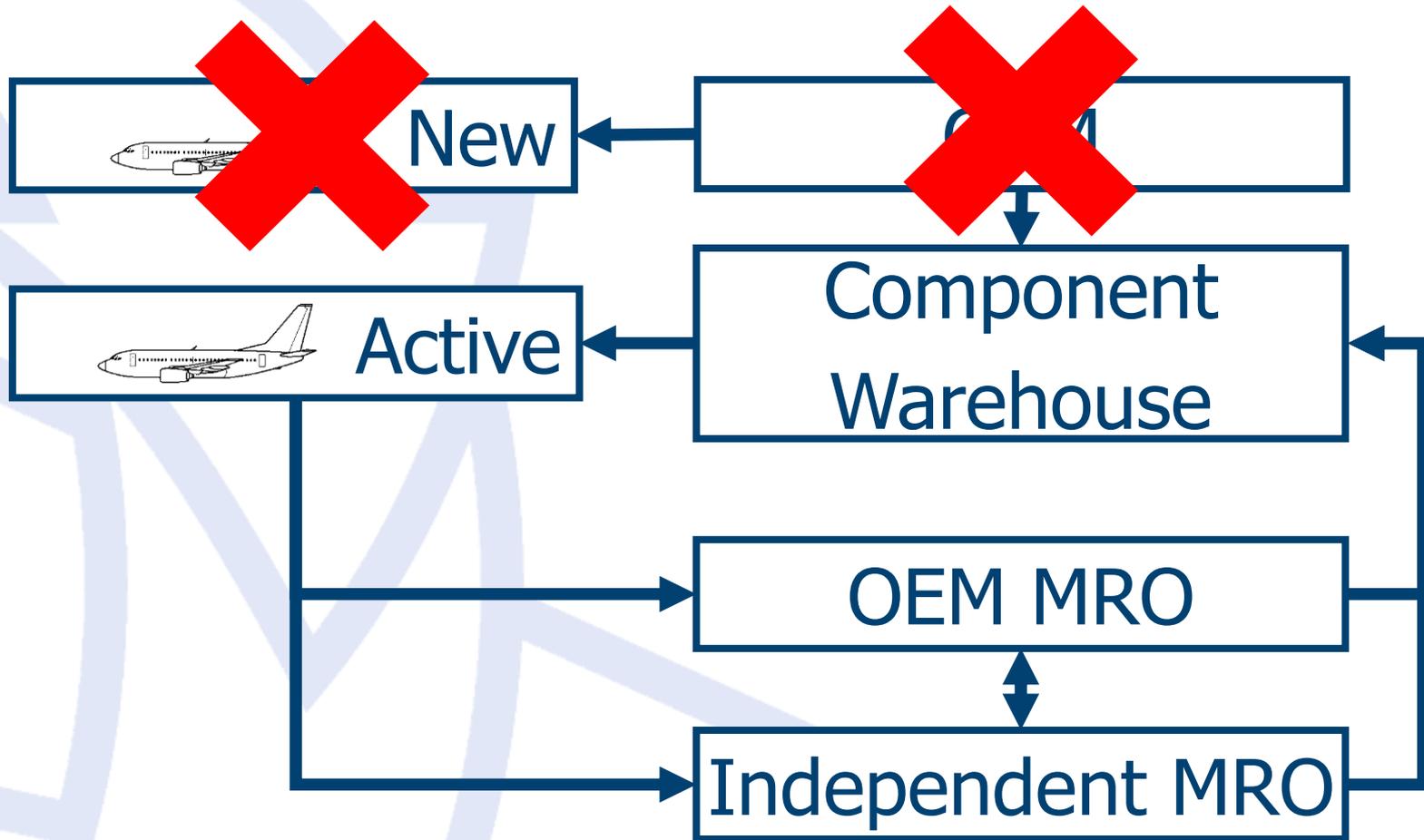
- Components supply chain
- End-of-Life decision
- Disassembly
- Dismantling
- Recycling
- Innovations/Challenges



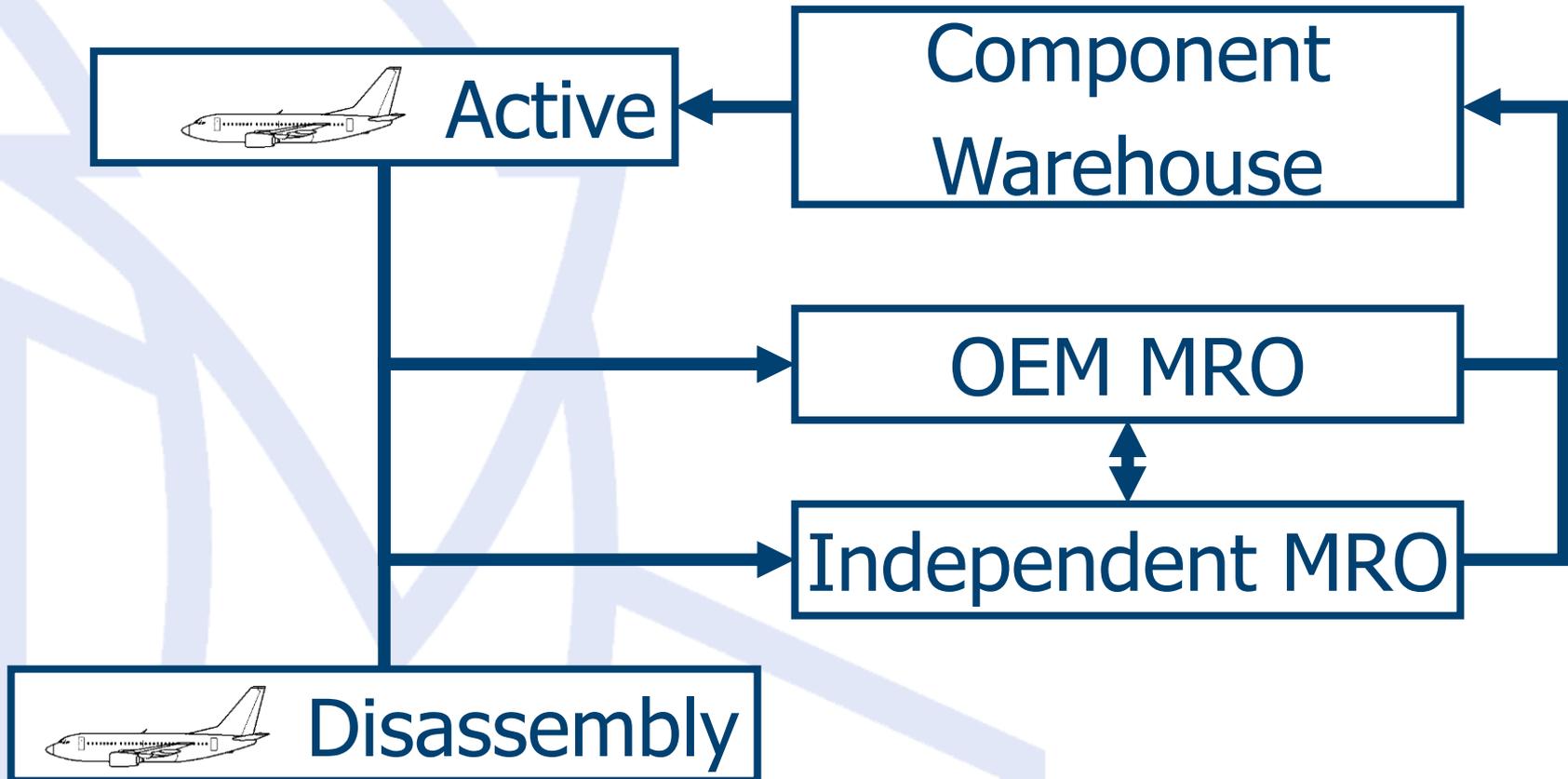
# Begin of life cycle



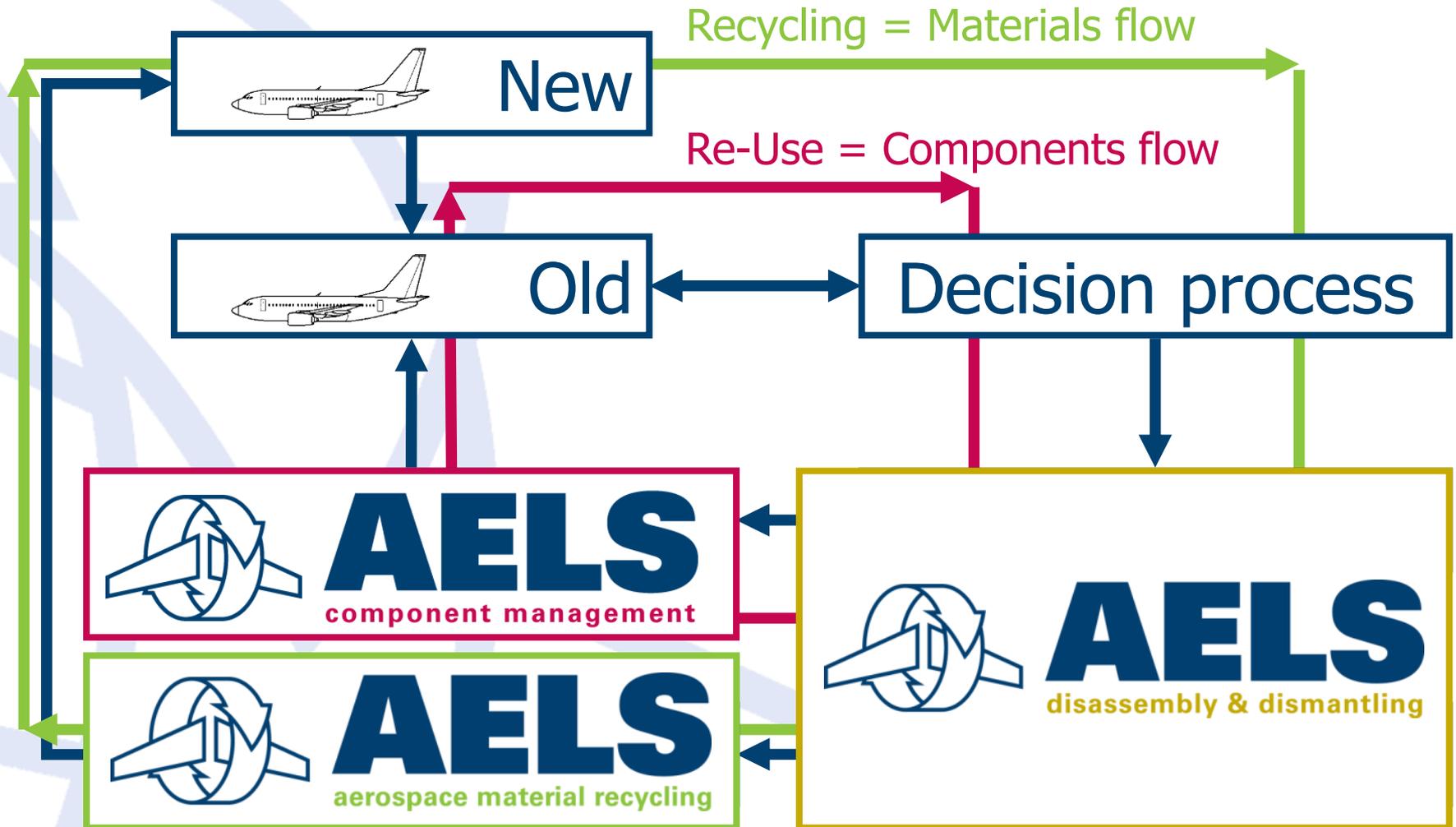
# Fleet increases



# Production stops



# Overview



# The end-of-life decision

- Economic decision
  - Aircraft value vs. Parts value
  - Market fitness
- Book value
- Unexpected impact on demand
- Parking cheaper than disassembly and storing of parts
- 10% of global fleet
- Reputation



# Disassembly

- Removal of high valued parts
  - Strictly bounded by aviation regulations
  - Serviceable or as-is
  - Removal of components is part of trace
- Value from zero to several millions



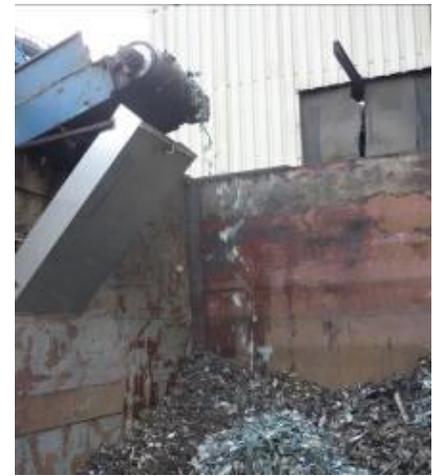
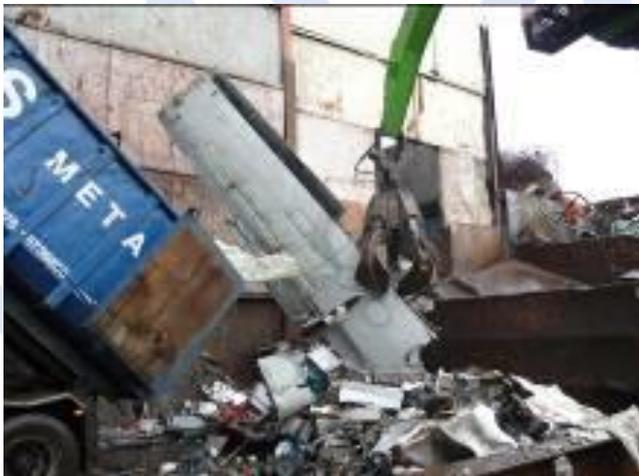
# Dismantling

- No legislation such as ELV directive.
- More a problem than an opportunity.
- Hazardous Materials
  - Fluids, Batteries, Depleted Uranium
- Manual separation of materials (i.e. wiring)



# Material Recycling

- Alloys mixed
- Separation at the source
- Separation after shredder
  - Technically possible, economically?





# Innovations/Challenges

- CFRP recycling
  - Proces, Market, Supply chain
- Organizational innovation
  - Legislation, Industry standards
- Re-use supply chain
  - E-marketplaces, culture change
- Interior Recycling

*"Aviation: the most circular industry in the world?"*

Yes, but we don't realize it.



**KLM**

*Royal Dutch Airlines*

*City of Schiphol*

*AIR FRANCE KLM*



# AELS, your partner in total end-of-life solutions and material recycling



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