What’s new in aircraft materials recycling?

AiMeRe Project
Europe’s largest Aeronautics Research Programme ever
- Environmental objectives, mainly CO$_2$ and noise reduction (from ACARE)
- €1.6B value, split 50/50 between the Commission (cash) and Clean Sky members and partners (in kind)
- 570 participants
- Integrated breakthrough technologies, up to full scale demonstrators
- CleanSky2 is coming…. (€4bn)
AiMeRe Project

- Aircraft MEtals REcycling aimereproject.org
- Eco-Design topic area of CleanSky
- Goals: Assess the dismantling process and propose process improvements, **provide recommendations for Design for Environment**
  - WP1: State of the art
  - WP2: Dismantling process
  - WP3: Processing and metallurgical trials
  - WP4: Potential industrial applications
  - WP5: Dissemination
Aircraft End of Life

- Why recycle aircraft?
  - Prevent image loss
  - Avoid parking costs
  - Minimize env. impacts
  - Make money from part-out and metal sales
  - Create new European industry

- New ‘urban mine’

Materials recovery process
Materials Recovery Process

I. Decontamination
II. Part-out (under EASA Part 145)
III. Transfer to the dismantling platform
IV. Extraction of landing gears
V. Preparation of dismantling
VI. Interior stripping
VII. Customer cuts
VIII. Specific materials extraction
IX. Scrapping
X. Shredding and sorting
Dismantling Process
video

http://www.euronews.com/2013/09/16/aviation-from-scrap-to-eco-design/
Today’s challenges in aircraft recycling

- Manual vs mechanical separation of materials
  - Quality vs cost
- Missing end-use applications
  - Downcycling vs upcycling
- Hazardous materials present in aircraft
- Recycling of EOL avionics and electronics
- Recycling of future alloys (eg Al-Li) and composites
(further) challenges..

- Logistics of end-of-life aircraft
- Business model
  - MRO vs parking vs waste management
  - Metal prices
- No EU/international legislation
  - Best Management Practice Guides by AFRA
Opportunities for Aircraft Recycling

• Increasing number of EOL aircraft
  – Economies of scale
• Improving technologies
  – Investment in research
• Increasing environmental awareness
  – Societal pressure
• Future aircraft: Designed for Recycling?
New Ideas for Problem Areas

• Rivets (notably titanium ones)
  – Recover using a drilling robot?
  – Or through better sorting?
• Toxic paint primer
  – Replace with a non-toxic alternatives?
• Many different alloys and alloy families
  – Use different coloured paint primers to facilitate their identification and separation?
New Ideas

• An information system for aircraft recycling
  – Information from manufacturers on composition etc. for certified recyclers

• Other inspiration from auto industry:
  – Standard for calculation of recyclability and recoverability
  – Use of secondary raw materials
  – Use of renewable materials
New Ideas

• Geographical challenges of aircraft EOL
  – Creation of recycling clusters?
• How to create incentives for recycling?
  – Eco-contribution for recycling?
• Find new imaginative ways to employ aircraft materials
  – Eg design objects, interior decoration, …
Conclusions

• Recycling is not enough
  – Need to work on the development of end use applications
• For future aircraft, need to move from “end-of-pipe” waste management more towards a “closed loop” approach
• Better exploitation of ‘urban mines’ needed in all sectors
  – Aviation needs do its bit (why not lead the way?)
Conclusions

• Re-use applications for recovered materials currently missing
  – Downcycling instead of recycling
• Aircraft aluminium alloys could be used for instance in vehicles, bicycle frames and buildings
  – Potential future applications for EOL aircraft aluminium?
  – What about non-structural aeronautical uses?
Conclusions

• Need to facilitate aircraft dismantling and recycling?
  – Ideally less different materials and material combinations
  – Less (preferably no) hazardous and toxic materials
  – Facilitate recycling through better design
    • Eg less use of glue, more easily removable fasteners
  – Need to provide more information for recyclers on aircraft composition
http://www.green-aviation2014.com/

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