

A low-angle shot of an Airbus A350 wing against a bright, clear sky. The wing is dark and curved, with the 'A350' logo visible in white. The sun is high in the sky, creating a lens flare effect. The wing extends from the bottom right towards the top left.

We make it fly

Creating a better connected,
safer and more prosperous world

Sc-empowered aerospace materials – Scalmalloy® in Airbus

Workshop on critical raw materials data management & the European Scandium inventory

Frank Palm

Airbus Central Research & Technology (CR&T)

26. – 27. Nov. 2018, BAM, Berlin-Adlershof

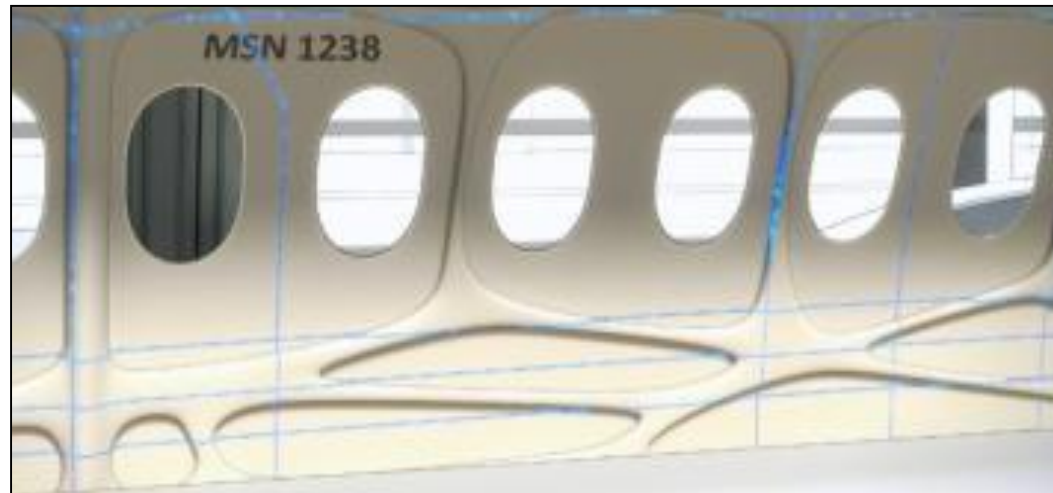
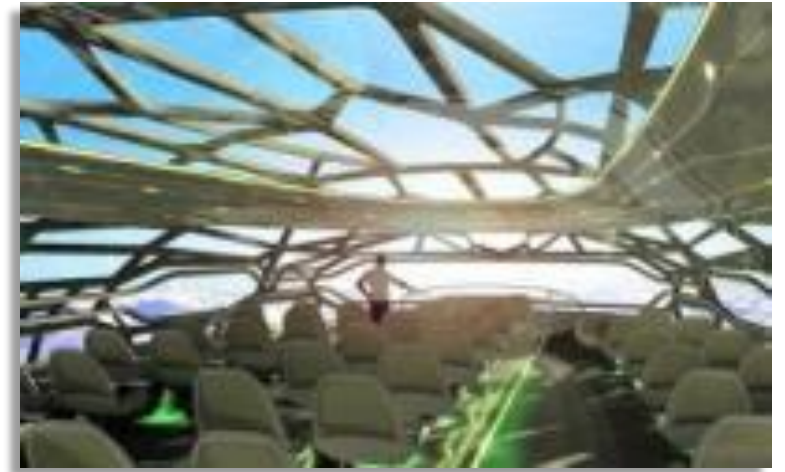
AIRBUS

At a glance

- Sc with respect to AIRBUS aerospace technologies
- Scalmalloy® - 1st tailored Al-material concept for AM
- Sc opportunities in aerospace material research
- How to accelerate Sc usage in AM
- Principal (market) availability & pricing
- Recycling & Re-use (→ closed value streams)
- Other Sc value streams
- Final comments & acknowledgements

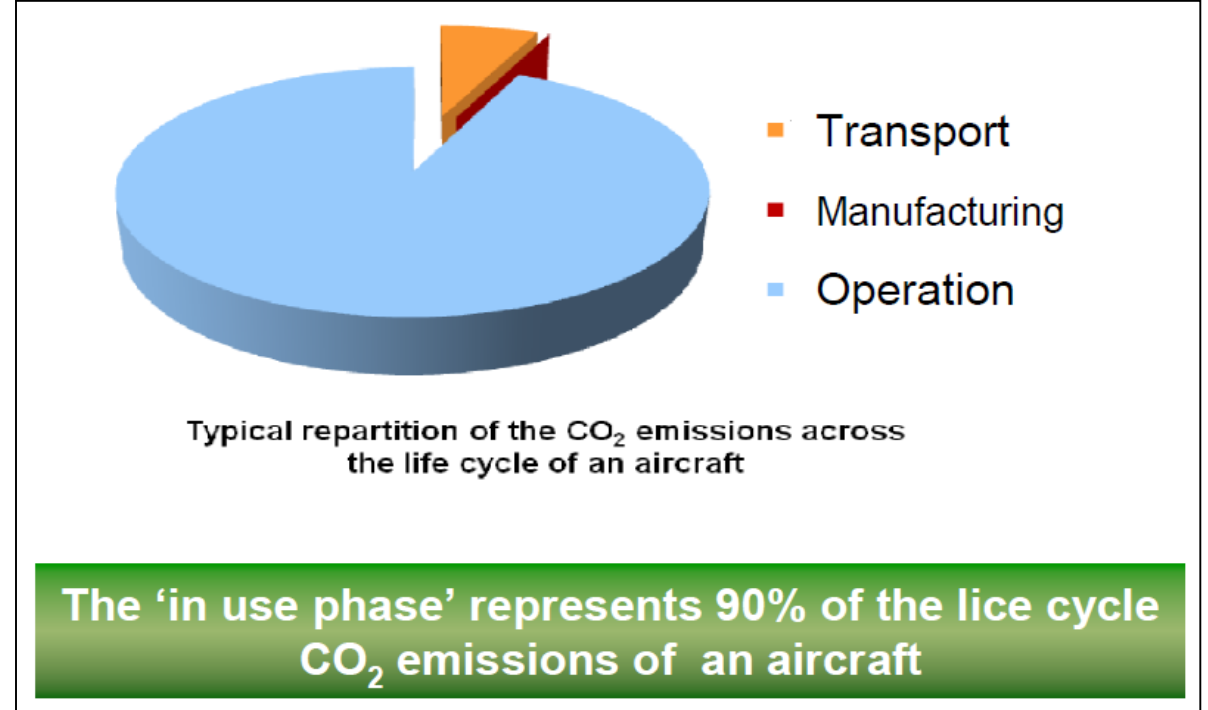
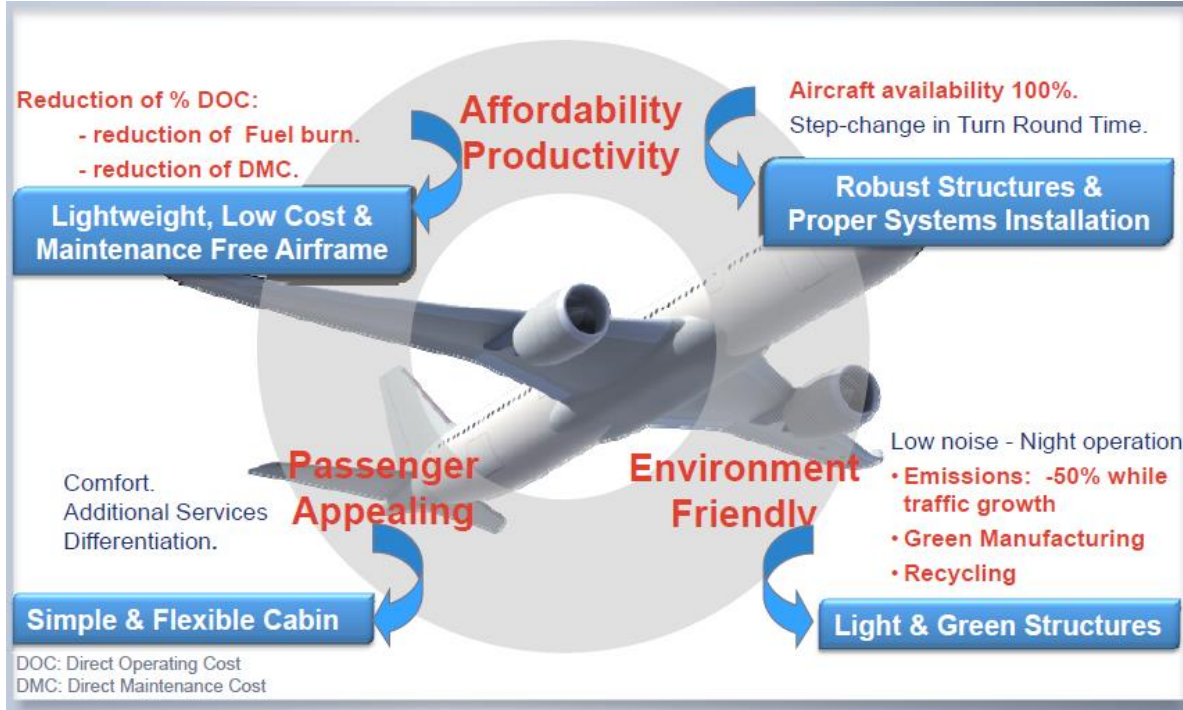
Sc with respect to AIRBUS aerospace technologies

- Upcoming challenges for A/C design & operation → (bionic) topology optimization (Function – weight – etc.)



Sc with respect to AIRBUS aerospace technologies

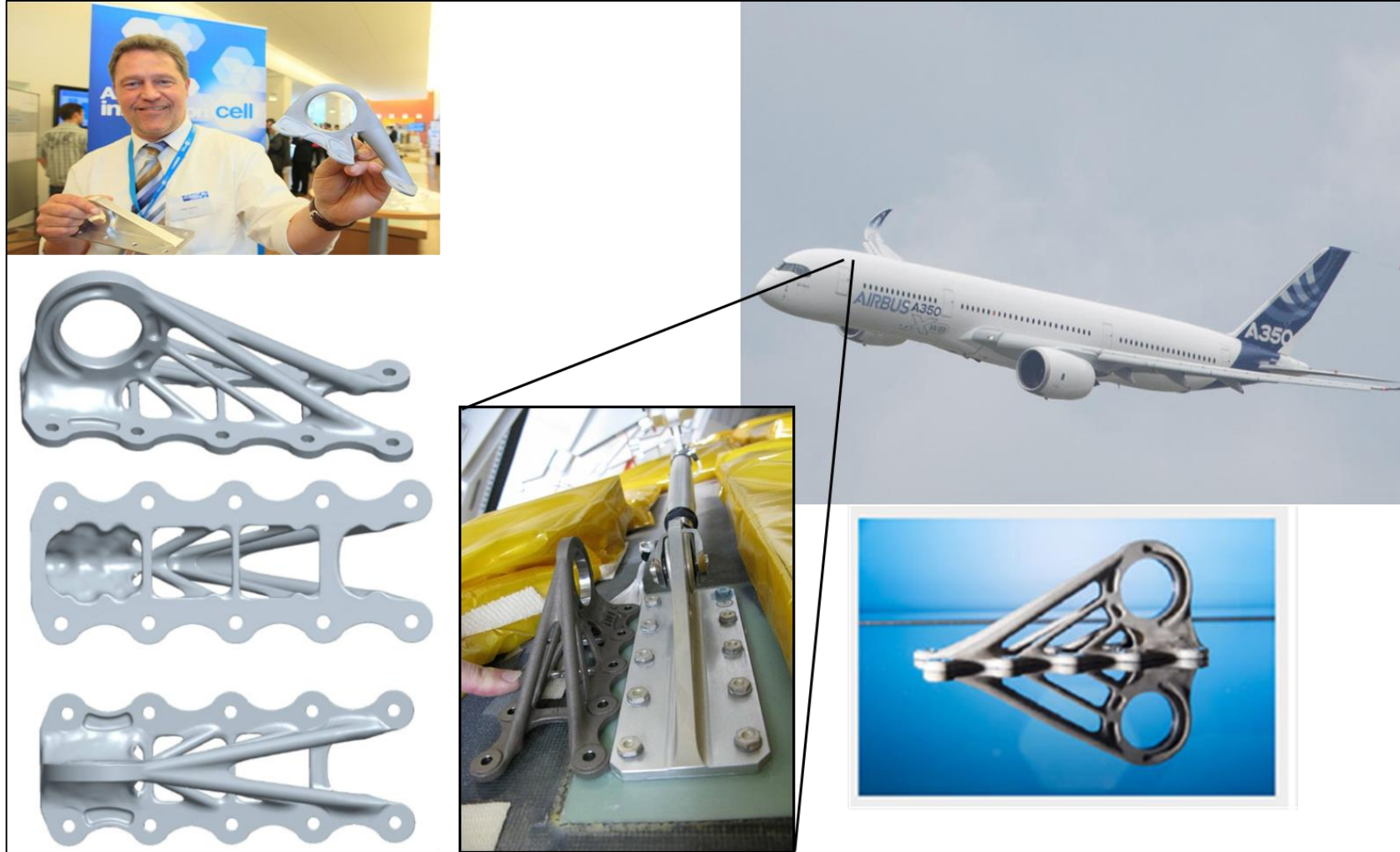
- Upcoming challenges for A/C design & operation



- ➔ Main design drivers & techno-social-economical boundary conditions
- ➔ Current main primary driver in A/C manufacturing are costs (NRCs & RCs)

Sc with respect to AIRBUS aerospace technologies

- Additive manufacturing schemes are offering new opportunities

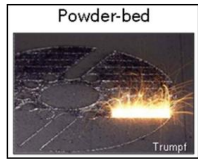


Scalmalloy® - 1st tailored Al-material concept for AM

Scalmalloy® Alloy Concept

ScalmalloyRP®

High strength ALMgSc alloys



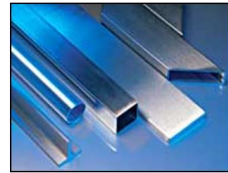
ScalmalloySC®

High performance sheet material
for Airbus A30X



Scalmalloy®

Very high strength Al-profiles



®Scalmalloy, ScalmalloyRP and ScalmalloySC are registered trade marks, ScalmalloySC & ScalmalloyRP are patented manufacturing processes

- Scalmalloy® material concept → currently only AM → Commercialization by AIRBUS APWORKS
- Metallurgically Scalmalloy® means:
 - Rapid solidification (100 – 1.000.000 K/sec)
 - 0.1 wt% Sc → Al₃Sc → ~ 50 MPa strength gain

Maiden run of the Al-3D-printed Light Rider

Airbus Group Chief Tom Anders (“Major Tom”) was the 1st to test it out !



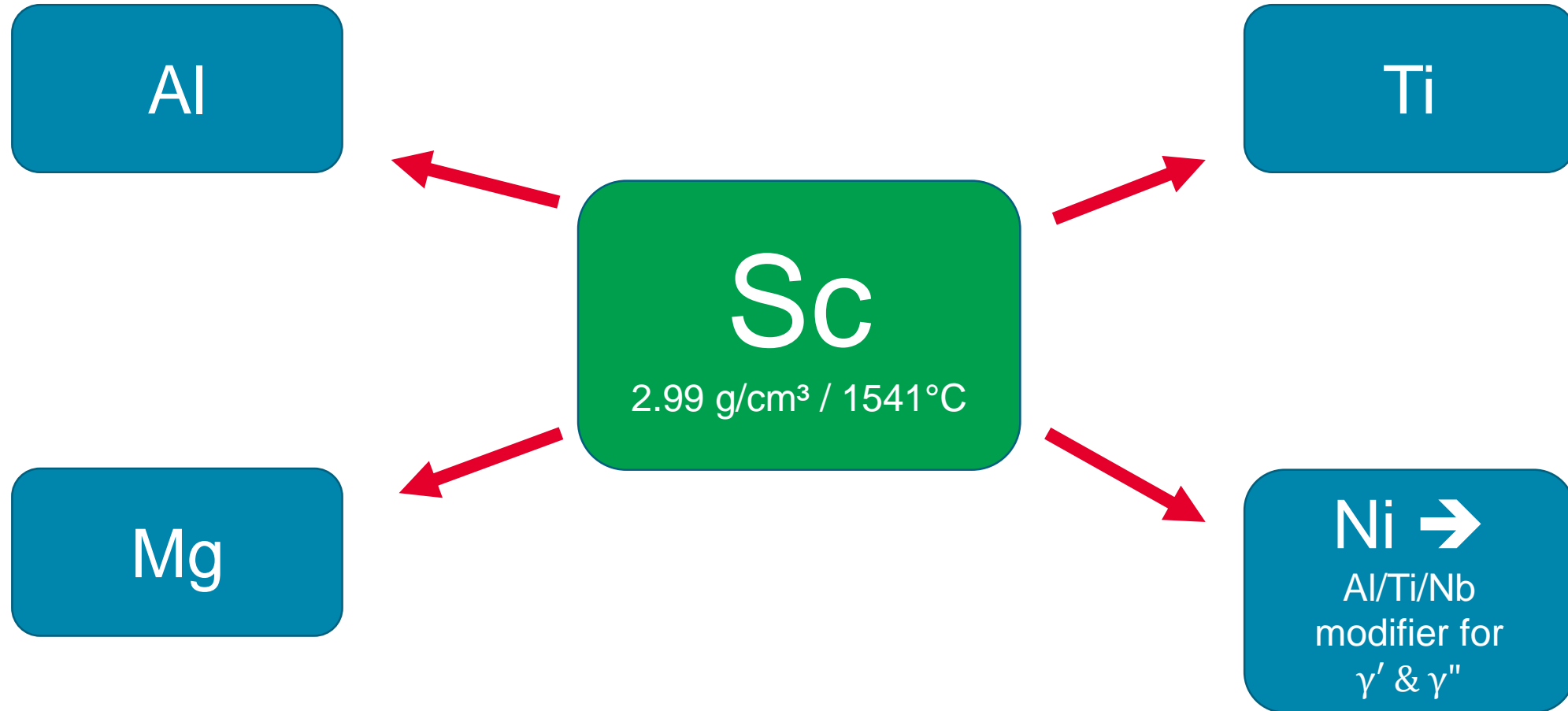
3D-printed Scalmalloy®
frame & suspension

- E-bike with 6kW
- 120 km/h



Sc opportunities in aerospace material research

- Sc as alloying element (0.2 – 5.0%)
- Sc base metallurgy



How to accelerate Sc usage in AM → Principal availability & pricing

- Where could Sc (or Sc compounds like Sc₂O₃) can from ?
- What is the size of the sources ?
- How many potential supplier are available (single source challenge) ?
- How “green” can/will be the Sc supply chain ?
- Are global political effects are influencing the Sc-supply chain (i.e. “coltan” or “blood-diamond” discussion) ?
- Sc₂O₃ price (→ AlSc₂ masteralloy) → ≤ 1000 \$/kg → 500 \$/kg → 250 \$/kg

Recycling & Re-use (→ closed value streams)

- Powder recycling for AM (under- & overspray of powder manufacturing)
- Recycling of used (contaminated) Scalmalloy® powder

Other Sc value streams

- Energy conversion (fuels cells etc.)
- Semi-conductor
-
- ..



**Thank you very much for your attention !
&
I'm here for questions !**

Sc (element 21) → the opportunity for the 21st century