Lufthansa Technik

More mobility for the world

18 April 2012

Challenges and requirements for materials and manufacturing technologies in Maintenance and Repair of commercial Aircraft

The Lufthansa Group and its five business segments

Passenger Transportation

The Group's airlines rank among the world's leading carriers.

Logistics

Lufthansa Cargo –
One of the world's leading cargo carrier in international air traffic.

Lufthansa Technik

Maintenance, Repair, Overhaul

Lufthansa Technik –
Leading supplier of engineering services in the world's airline business.

Catering

LSG Sky Chefs –
World's largest provider of airline catering and integrated in-flight solutions.

IT Services

Lufthansa Systems –
One of the world's leading IT service providers for the airline and aviation industry.

Lufthansa Technik Group: An overview

- **772** customers worldwide
- **2.125** aircraft under exclusive contracts
- **2.236** engines under contract
- **500** jetliners under Total Technical Support TTS®
- **1.700** aircraft inspections per day
- **32** subsidiaries and affiliates worldwide
- **58** line maintenance stations with Lufthansa Technik staff worldwide
- **4.1** billion Euros in revenue*
- **19.822** employees worldwide*

*Lufthansa Technik AG Germany and 20 consolidated companies of Lufthansa Technik Group in 2011.

Requirements towards aircraft manufacturers

- **From Airline perspective**
  - More efficient engines
  - Less weight
  - Better aerodynamics
  - Innovative cabin interior

- **Solution: Introduction of**
  - New, lighter materials
  - New systems and technologies

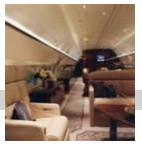
- **From maintenance perspective**
  - Short downtimes for checks
  - High reliability
  - Fast failure detection
  - Easy to repair

- **Sometimes contradictory**

Life Cycle Support





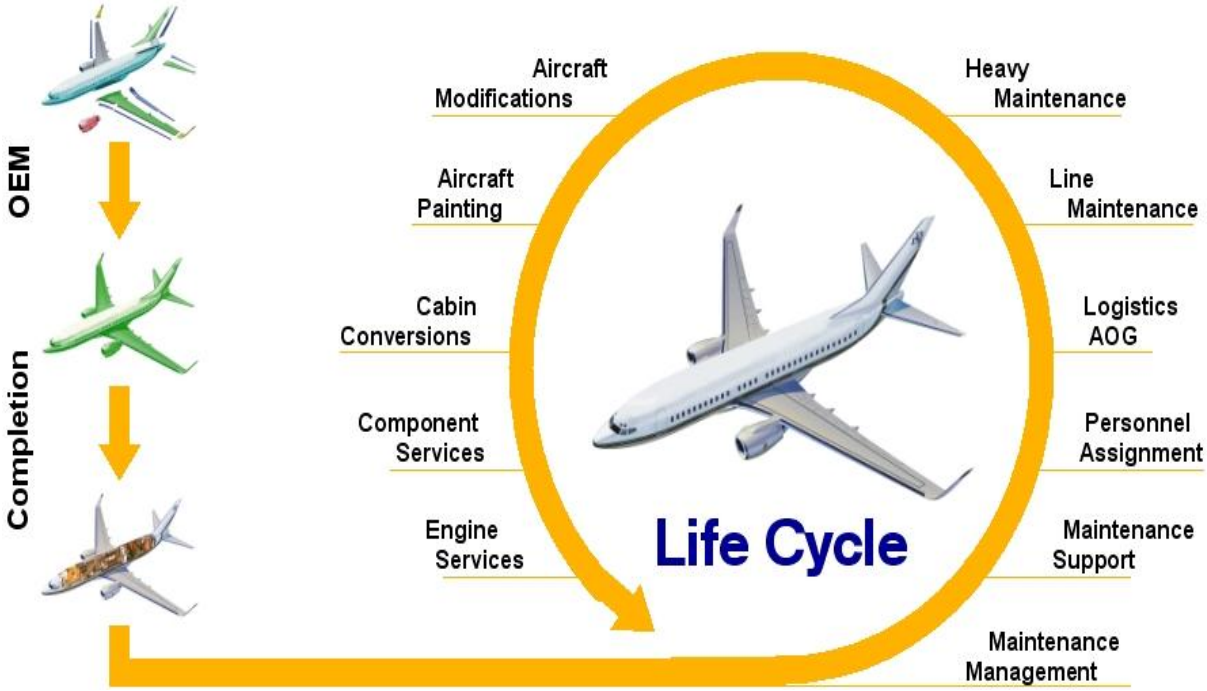



(M) Maintenance

(R) Repair

(O) Overhaul

(M) Modification & Management



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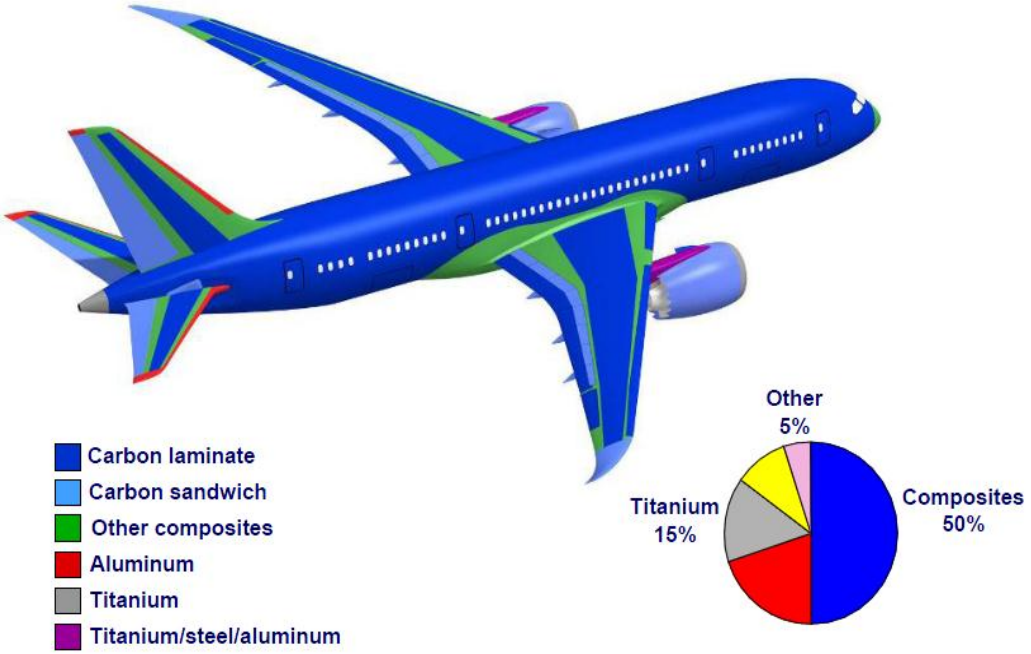
Usage of composite material in aircraft

New Generation of Commercial long range wide body aircraft

- B787 EIS 2011
- A350 EIS scheduled for 2013



- Approx. 50% composite-materials structure

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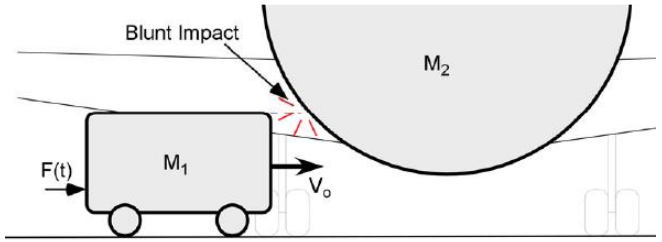
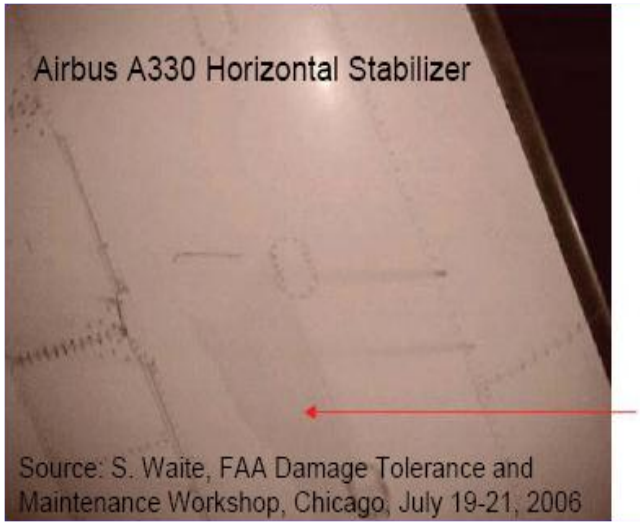
Challenge
Detection

Detection of structural Damages – a Challenge





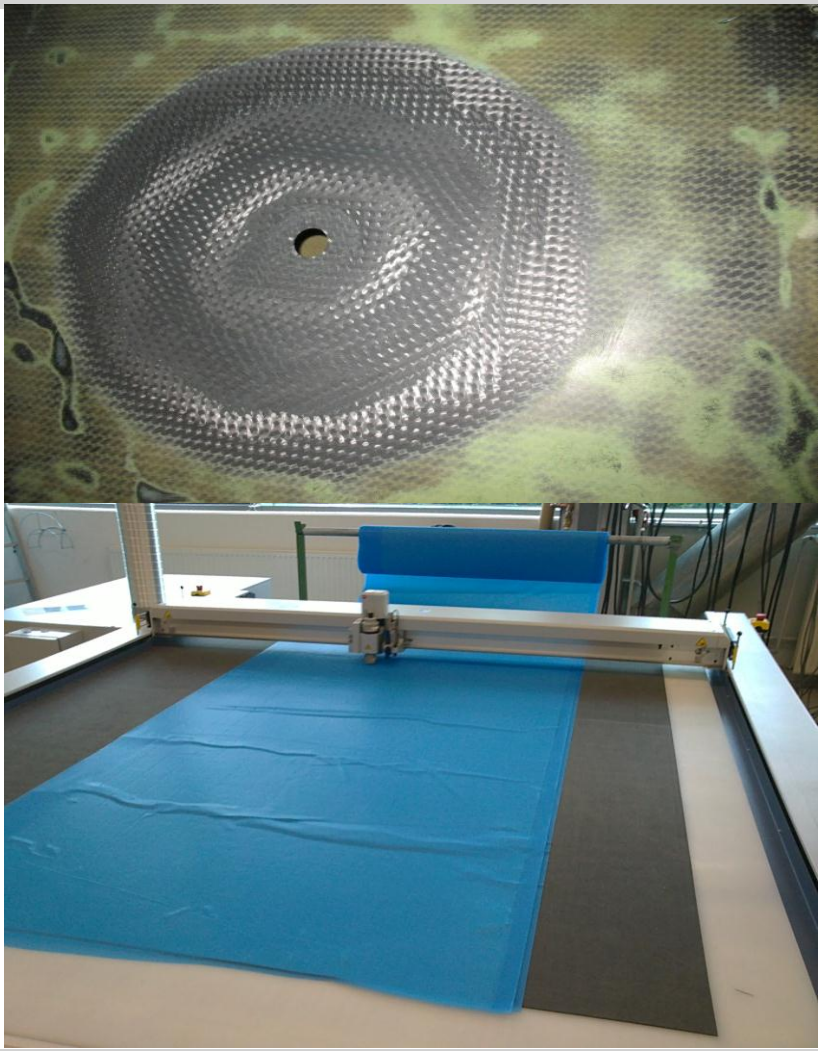
- Hail-, bird- and lightning strike
- Runway debris
- Blunt-impact damage
- Fluid ingression

Risk of severe internal damages, externally invisible

→ Strong need for technique to quickly detect internal damages over wide areas

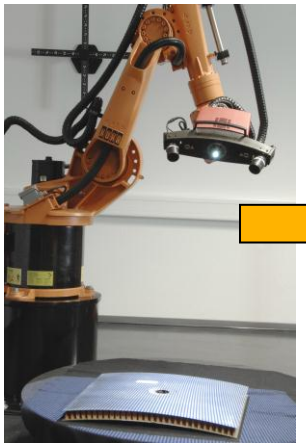
Challenge: Repair of composite structure

- Standardized repairs available only for minor damages
- Quality of a repair is extremely process dependant – manualy preparation of scarfed repair areas is time consuming
- Standardized repairs available only for minor damages
- **LHT has longtime experience on different composite repair techniques**

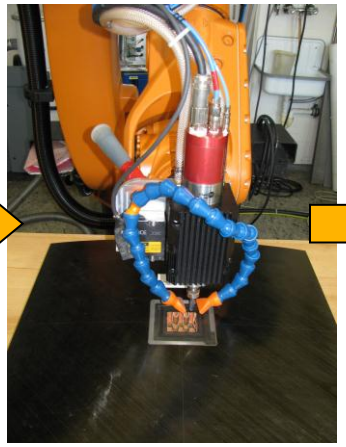


Rapid Bonded Repair Process

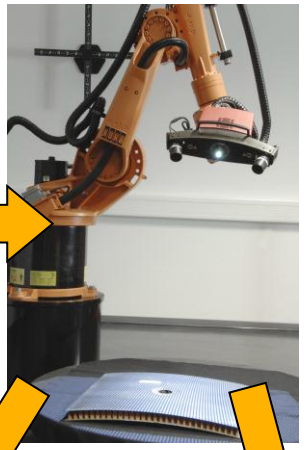
- Automatic process
- High process reliability
- Reproducible scarfing
- Rapid Tooling
- Higher bonding quality
- Precise patches
- out of autoclave curing
- Bonded repairs on primary structures



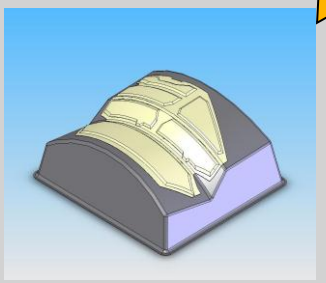
Geometry Scanning
Damage detection



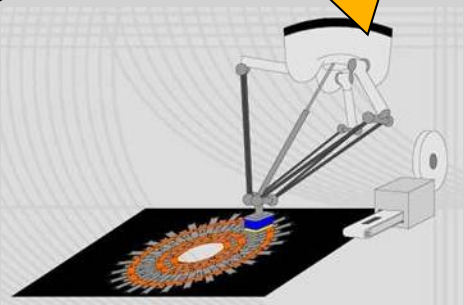
Adaptive Scarfing



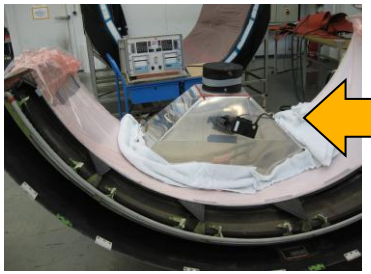
Geometry Scanning



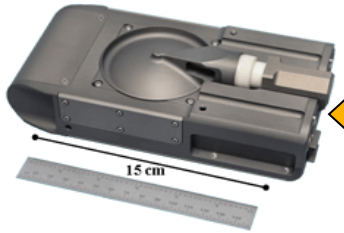
Rapid Tooling



Patch generation



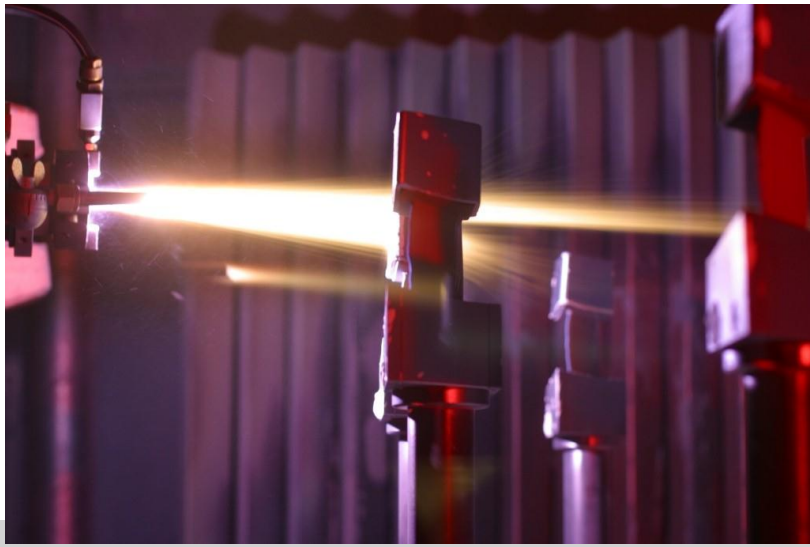
Curing



Surface Contamination
Detection

More efficient engines
Protection coating

- **Problem**
  - huge sign of wear for engines flown in specific environment
- **Target**
  - Reduce drag by developing thin coatings and application procedure
- **Effect**
  - Less performance loss i.e. less fuel burn



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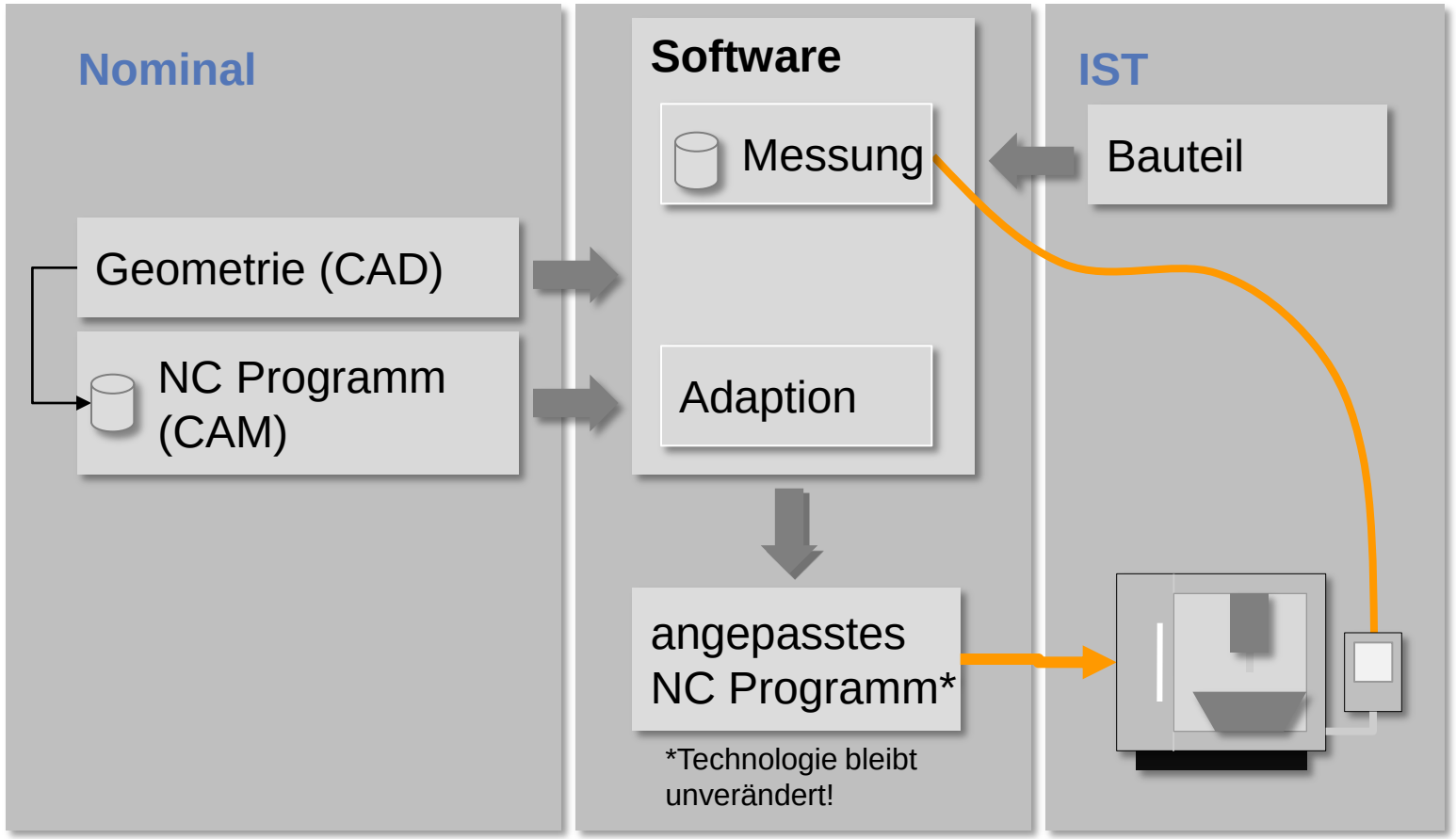
Reduce cost and turn around time for complex repairs challenge…

- **Define and develop appropriate repairs instead of scrapping**
- **Repair of complex parts**
- **Many different detection and repair steps needed**
- **Repair steps performed in different units and locations**
- **Target:**
  - Safe the part
  - Reduce Turn Around Time
  - Minimize material cost

Reduce cost and turn around time for difficult repairs
Adaptive machining



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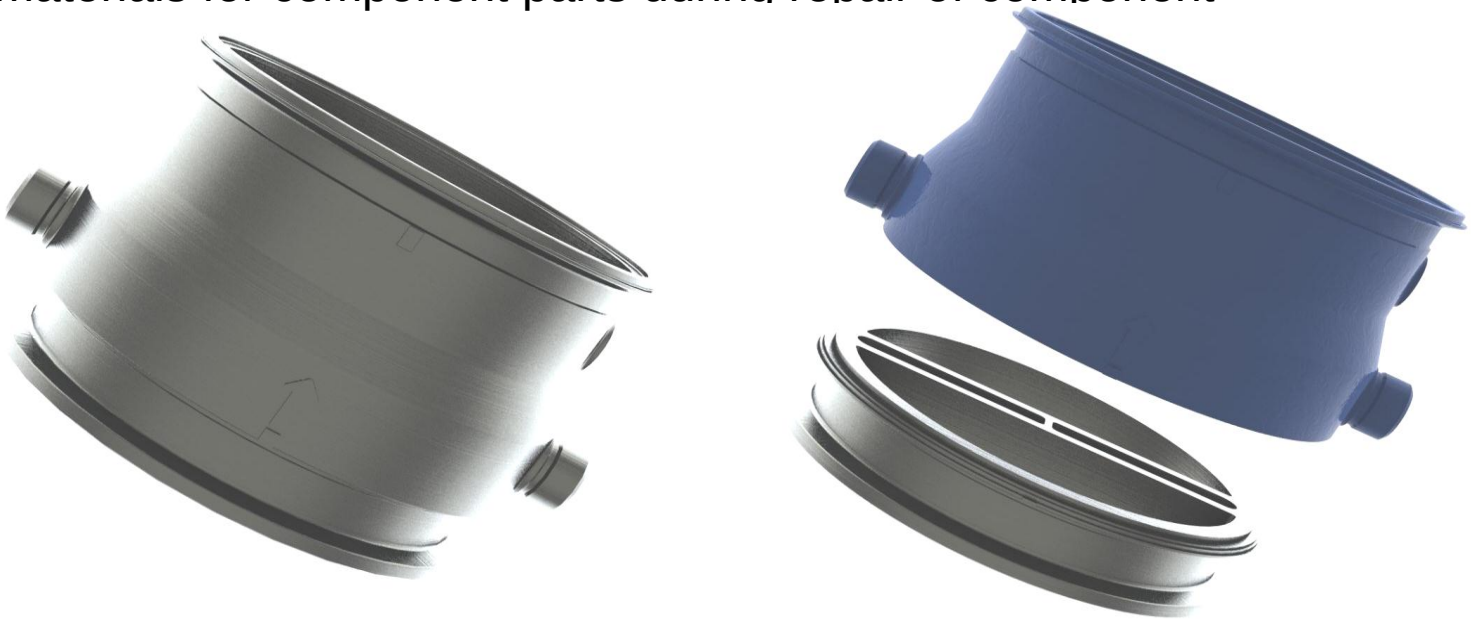
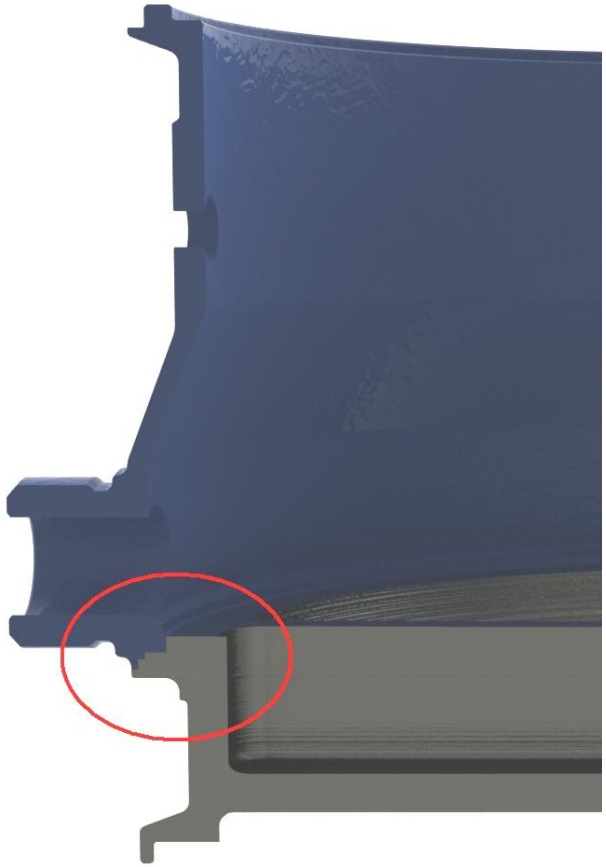
Reducing weight
Use of lightweight material for unit repair (1)

- **Motivation**
  - Materials and production technology of components in actual aircrafts (i. e. 737, 747, A320, A340) reflect technical status of early 80th !!
  - These aircraft will be in use for many more years
- **Target**
  - Weight reduction of aircraft components in actual aircraft by using lighter materials for component parts during repair of component



Reducing weight
Use of lightweight material for unit repair (2)

- **Challenges**
  - Identification of suited material (Polymer, Composites, metallic foams, etc.)
  - Compatibility of different material (corrosion, thermal coefficient, ...)
  - Fitting technologies(welding procedures, other junction techniques, …)
  - component life time
  - new production technologies (i.e. Laser sinter)



Thank you for your attention

Lockheed L1649A "Super Star" der Lufthansa im Flug.

Foto: Deutsche Lufthansa AG D 103-13-4