INTRODUCTION
• Joint needed for use in airplane door attach misaligned shafts
• Desired to ease assembly of door
• High torque and low speed setting (airplane door handle)
• Long lifetime with zero lubrication/maintenance

PROBLEM STATEMENT
Design a joint that can transmit a high torque at a low speed between two shafts that are both radially and angularly misaligned while conforming to the design requirements specified by Latécoère.

CORE FUNCTIONS
• 3mm radial
• 1 degree angular
• Torque:
  • Operating: 50 Nm
  • Limit: 467 Nm
  • Ultimate: 700 Nm
• 20 years, 120,000 cycles
• Zero maintenance
• <15% friction increase

FEATURES
• Semicircular rotation allows for larger angular displacement, with radial movement
• High contact area
• No galling
• Minimal wear

CONCLUSION & FUTURE WORK
• Excels in strength and galling resistance
• Weak in strength to weight ratio (heavy)
• Look into:
  • Wear testing to ensure lifetime on component
  • Additively manufactured materials
  • Internal material reduction to lower weight
  • Lighter, easily machinable materials
    • Low density and high strength alloys

RESULTS/VALIDATION
• Requirement: <15% increase in load at 50Nm torque with up to 3mm axial and 1° angular misalignment
• 50Nm torque applied to joint and resulting friction measured
• Results: Max increase in load was 3.39% at 3mm axial and 1° angular misalignment

Prototype/Analysis
• Two Parts designed: shaft couple, center float
• optimized using FEA to stay within acceptable stress levels under a 467 Nm load

Manufacturing Process
• All parts were manufactured in the ME machine shop
• Shaft couple was made using contouring on a 3-axis CNC mill taking multiple attempts and many hours
• Center float also made on a mill with 2 intersecting reamed holes

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