Operational Liaison Meeting FBW aircraft

Tire Burst
Contents

- Introduction
- A Word on Tire Technology
- Tire Burst at Takeoff
- Pressure Monitoring (TPIS)
- New Developments
- Conclusion
Introduction

- Tire bursting incidents occur regularly.
- The Concorde accident raised the greatest concern.

F-BTSC accident, 25 July 2000, at Gonesse (France)

- Differing tire technologies lead to different bursting behaviors.
- Bursting at takeoff: Airbus recommendations
- New developments
  - MICHELIN NZG

...part of the solutions that bring back the Concorde’s Certificate of Airworthiness
A Word on Tire Technology

- Radial vs. Bias-ply tires
A Word on Tire Technology ...

- Radial vs. Bias-ply tires

- Radial tires used on most Long Range aircraft.
- Radial tires may be used on all Airbus aircraft.
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**Tire Burst at Takeoff: Common Causes...**

- Tires may suffer significant strain.
- Each element may be submitted to about 1000 g’s of centrifugal force.
Tire Burst at Takeoff: Common Causes...

- A standing wave may appear, inducing shear stress and strain, which cause high temperatures.
Tire Burst at Takeoff: Common Causes...

- FOD (Foreign Object Damage)
- Inadequate inflation pressure
- Hot spot
Tire Burst at Takeoff: …and Some Consequences

- Landing gear bay equipment protection:
  - Against overheating: **FUSE PLUG**
  - Against loose tire tread:
    - MLG *braked to a stop before retraction*.
    - NLG *low inertia level at final retraction*. 
Tire Burst at Takeoff: Recommendations

- Maintenance and Exterior Inspection:
  - Daily check
  - Correct tire pressure
  - Thorough walkthrough inspection

- Remember that, for a defective tire...
  - Long taxi distances
  - High taxi speed
  - Heavy takeoff weights

Air pressure building up enough to RUPTURE the TIRE
**Tire Burst at Takeoff: Recommendations ...**

- Takeoff decision
  - FCOM 3.02.10 - page 2: "REJECTED TAKEOFF"

- After takeoff: Assess aircraft status
  - ENG parameters
  - ECAM SYS pages (special attention → FUEL, HYD)
  - Monitor FUEL LEAK
  - Consider SLAT/FLAP visual check before retraction

**NOT before 400 ft!!!**
Tire Burst at Takeoff: Recommendations ...

- **Continuing Flight:**
  - Key point: Structural damage evaluation
  - Consider reducing the landing weight

- **Landing:**
  - Relieve the load on the remaining tires
  - Use MAX REVERSE, as usual *(at MLG touchdown)*

**COMMON SENSE MEASURES**

**MLG affected:**
- Smooth MLG touchdown
- Ready for brake asymmetry: MANUAL BRAKE

**NLG affected:**
- Smooth NLG touchdown
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Pressure Monitoring (TPIS)

- Tire Pressure Indicating System (TPIS)

Normal pressure indication

Advisory

ECAM caution

<table>
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<tr>
<th>WHEEL TIRE LO PR</th>
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<td>Crew awareness</td>
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Pressure Monitoring (TPIS) ...

- Pressure caution cannot be used to confirm a tire burst at takeoff:
  - Inhibited in phases 4, 5 and 8.

- TPIS eases:
  - Damage evaluation
  - Landing preparation
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New Developments

- **Michelin** ‘Near Zero Growth’ (NZG)
  - Radial
  - Same pressure, same dimensions
  - Reduced tread rubber tension
  - Reduced damage risk
- **Michelin** NZG already used on the Concorde.
- To be used on the A340-600.
- NZG could find its way to the A320 FAM, A330, A340 and the A380.
Conclusion

- High elastic + kinetic energy ➔ Severe damage risk
- Tire technologies: Radial / Bias-ply
  - Radial appears to be more reliable
  - Radial burst laterally ➔ Reducing damage risk
- Tires CANNOT burst into the landing gear bay
- Tire burst recommendations:
  - Exterior inspection
  - Common sense measures
- New tire developments (Michelin NZG):
  - New materials, more resistant
  - Lower elastic energy ➔ Lower damage risk