



The Power of Flight



737 MAX / LEAP-1B

# WTT Meeting

October 10<sup>th</sup> – 12<sup>th</sup>, 2023

Ibiza, Spain



## Tail Pipe Fire (TPF)

Pascal Morlot



# Tail Pipe Fire (TPF)

## Agenda

- Tail Pipe Fire (TPF) – Background
- LEAP-1B TPF in Center Vent Tube (CVT)
  - Fleet experience and Root Cause
  - Recommendation and AMM update
  - Data Collection

# Tail Pipe Fire – Background

## Engine Fire

Fire under engine nacelle with fire warning in cockpit

- True engine fire
- Fire indication system issue



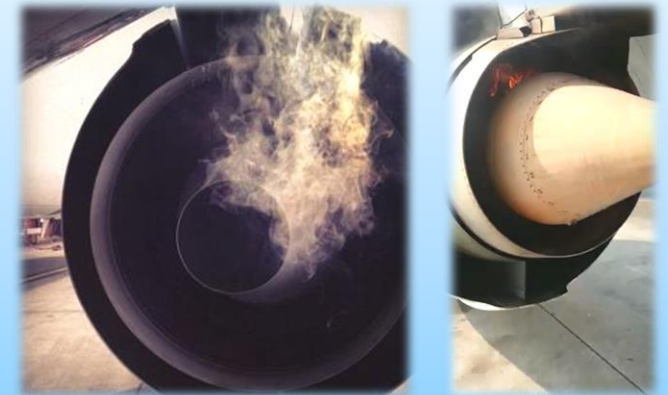
## Tail Pipe Fire

Any event with flames or smoke visible at rear of engine

### Candle fire

Smoke with possible flames inside exhaust plug or exhaust nozzles

After shutdown only



Tail Pipe Fire are sometimes confused with engine fire



# Tail Pipe Fire – Background

Tail Pipe Fire (TPF) refers to any event with flames and/or smoke visible at rear of the engine

- Auto-ignition of fluid (oil/fuel) in gas path/exhaust nozzle, or exhaust plug
- Occurs on-ground at engine starting, taxi or after shutdown
- Self-extinguishing
- Does not result in hardware distress
- Reported by other A/C crew, Air Traffic Control, ground personnel
- If TPF occurs while engine is running, it has no impact on engines parameters

## CFM56-7B experience

- Oil related TPF in exhaust plug within CFM56-7B experience
- Root cause: oil leak in CVT and Aft Sump leak due to seals « ageing » → oil puddling at 06:00 in long exhaust plug (not drained)



# LEAP-1B Tail Pipe Fire in CVT

## LEAP-1B exhaust plug is a dry cavity

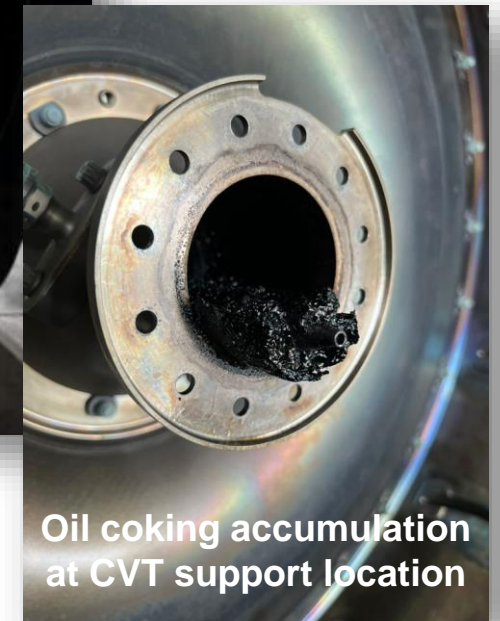
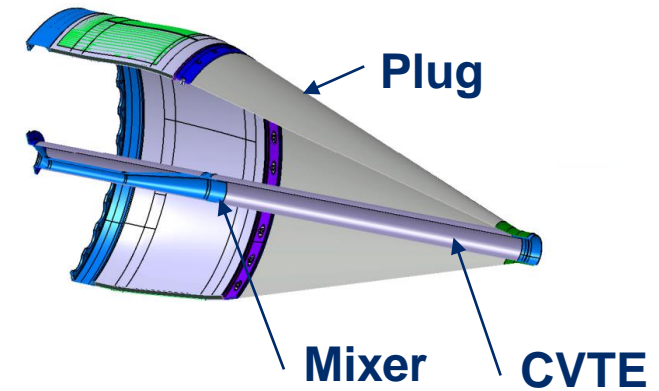
- CVT Extension (CVTE) between CVT support and rear of exhaust plug

## Fleet experience

- 5 cases reported of TPF in CVT since EIS
  - No correlation with engine oil type or ETSN/ECSN
    - 4,000 – 8,000 ETSN / 1,200 – 3,300 ECSN

## Root Cause

- Suspected root cause (to be consolidated in 2024)
  - Oil in the CVT from the A-sump air/oil system travelling through CVT/CVTE
  - Under certain conditions, oil can degrade around CVT support location and self-ignite
  - Oil puddling and coking at CVT support location reported in some cases





# LEAP-1B Tail Pipe Fire in CVT

## Recommendation in case of TPF

- Monitor oil consumption is within AMM limits
  - AMM TASK 71-00-00-800-802-G00 - Engine Operation Limits
- Inspect CVTE/Mixer for oil coking criteria for coking, clean as required
  - TASK 78-11-03-210-801-G00

## AMM update under evaluation to recommend CVTE/Mixer/CVT support inspection for oil coking

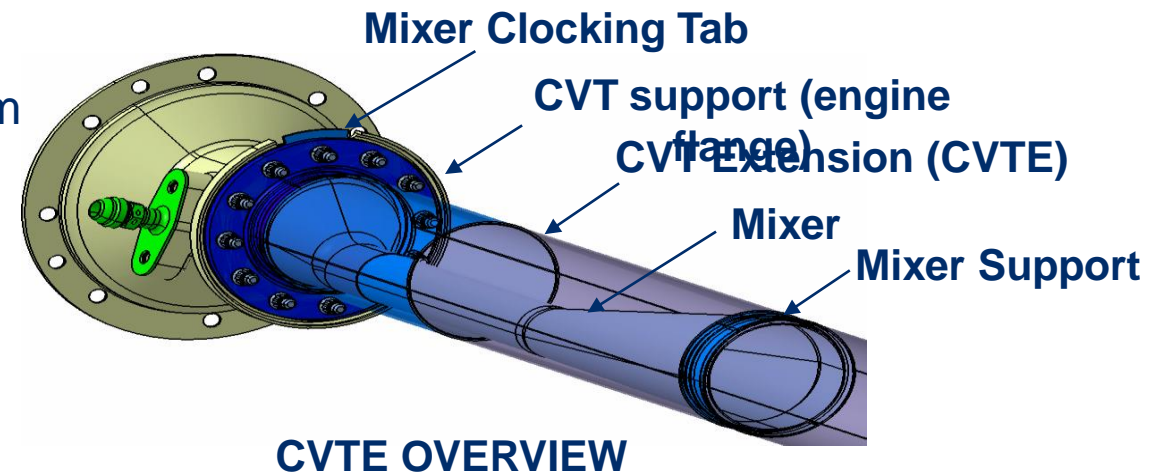
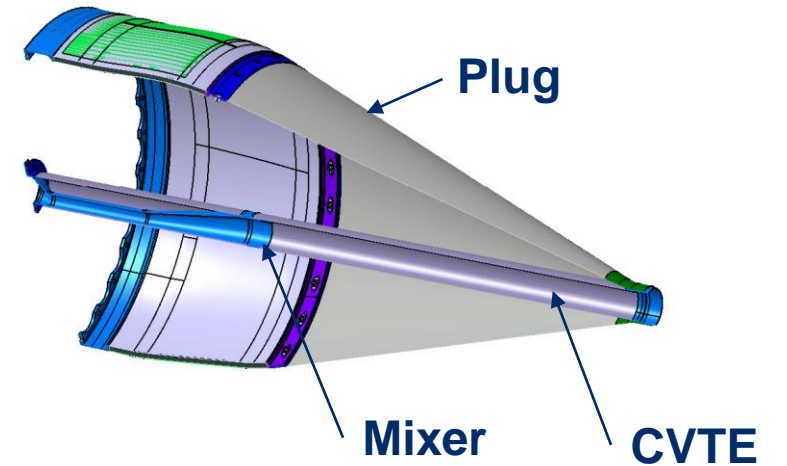
- Create a new section for TPF in AMM TASK 71-00-00-200-801-G00 *Engine Exposure to Fire and Extinguishing Agents Inspection*
- Target for 2024



# LEAP-1B Tail Pipe Fire in CVT/CVTE

## Data collection for TPF in exhaust plug

- Collect and report to CFM the following information (contact your Field Service Engineer or open CSC/Salesforce case)
  - Pictures/videos of the flames/smoke
  - Findings at inspections per AMM TASK 71-00-00-200-801-G00 Engine Exposure to Fire and Extinguishing Agents Inspection, if performed
  - If exhaust plug/CVTE/mixer/CVT support removed from engine after TPF for troubleshooting:
    - Evidence of oil puddling (fluid)?
    - Evidence of oil coking (solid)?
    - Document with pictures/videos
  - Additional information may be requested by CFM



Field data is useful for Tail Pipe Fire root cause analysis



Thank you





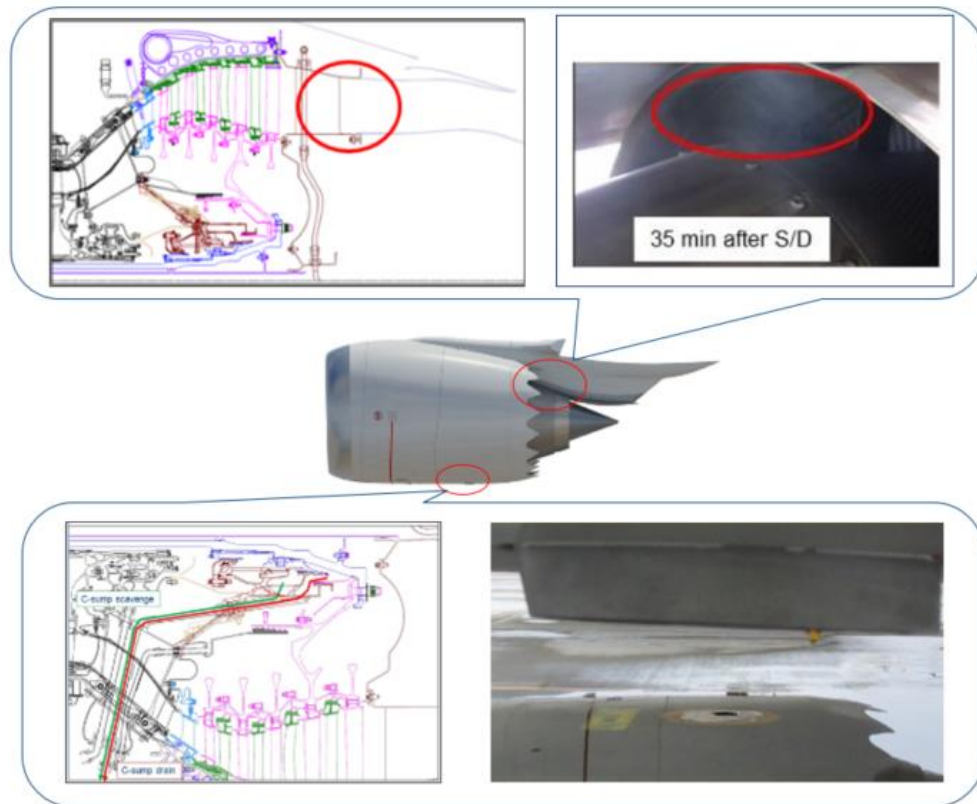
Back-up



# Fumes after engine shutdown at LPT exhaust

Fumes at LPT exhaust after engine shutdown (~30min) are not related to fire in exhaust plug

- Refer to 2022 WTT LPT Module presentation for details



## C-sump/ Fumes after engine shutdown (S/D)



### Description

- Two recurring oil related findings for the C-sump :
  - oil drops from drain, 5 min post S/D
  - oil fumes at LPT exhaust, 30 min post S/D
- No impact on : Operational use & Oil consumption

### Root cause

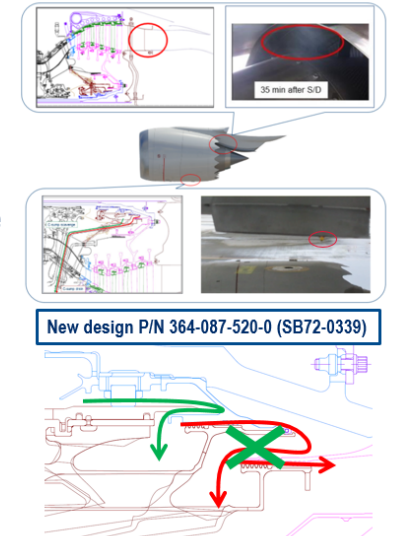
- Happen randomly and linked to flight condition, ground flatness and engine installation (tilt/clocking)

### AMM status

- Oils drops acceptable per AMM TASK 71-71-00-200-801-G00 « Engine Vents and Drains Inspection » : 20 cc (20 ml) max & stopping after 15 min

### Updates and way forward

- New SB72-0339, cat 7E (August 2022) : new design of LPT rear rotating seal preventing leaks in C-sump drains & fumes
- Studies in progress for a CIS prior oil leak rate determination



New design P/N 364-087-520-0 (SB72-0339)

**New design available & AMM update in study for a reduced inspection burden**

CFM and The Boeing Company Proprietary Information subject to restrictions on the cover

737 MAX / LEAP-1B Montréal WTT, Oct 2022

