Docket No. SA-542

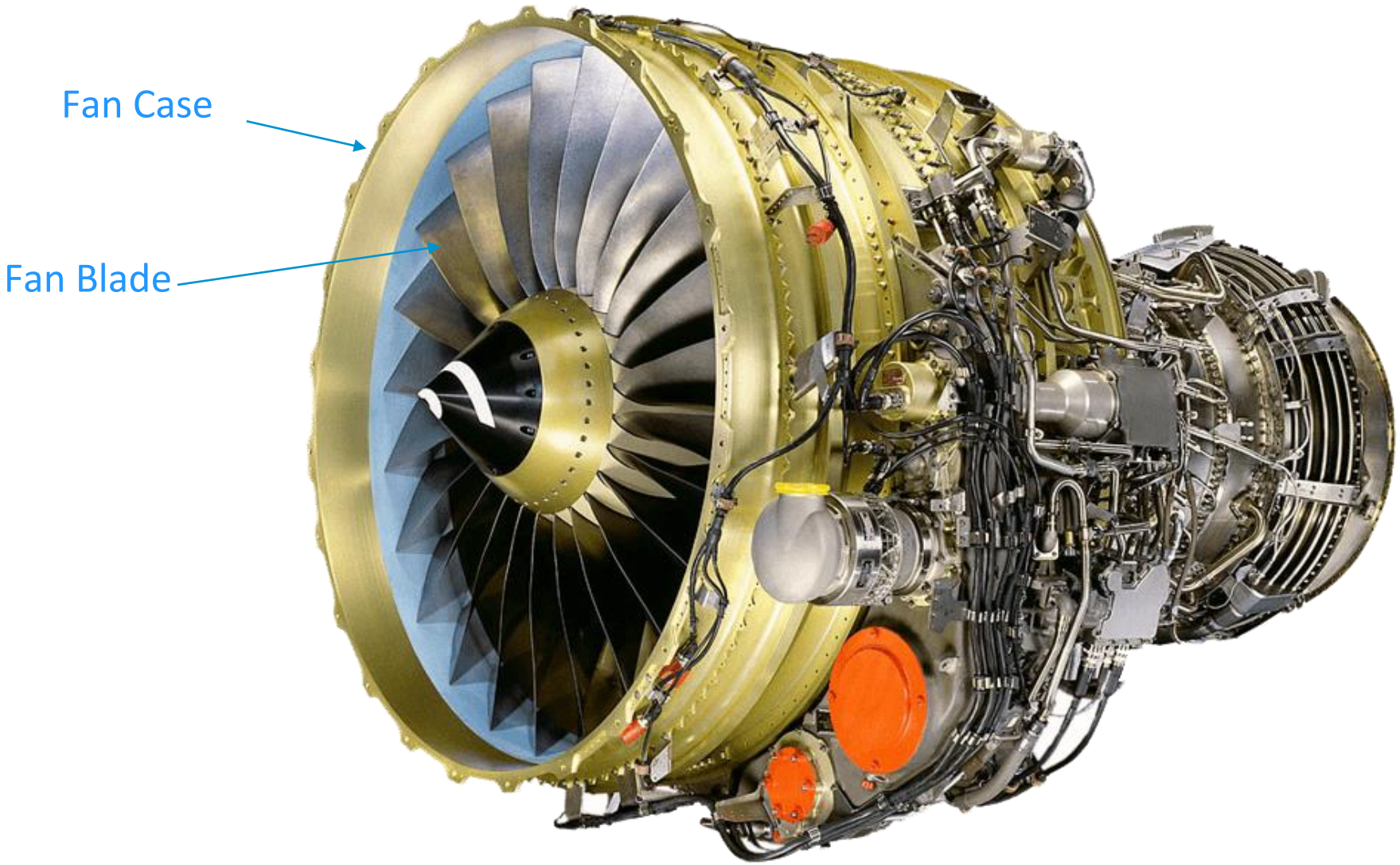
Exhibit No.: 8-B

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

CFM Supporting Material
(13 Pages)

CFM56-7B Engine

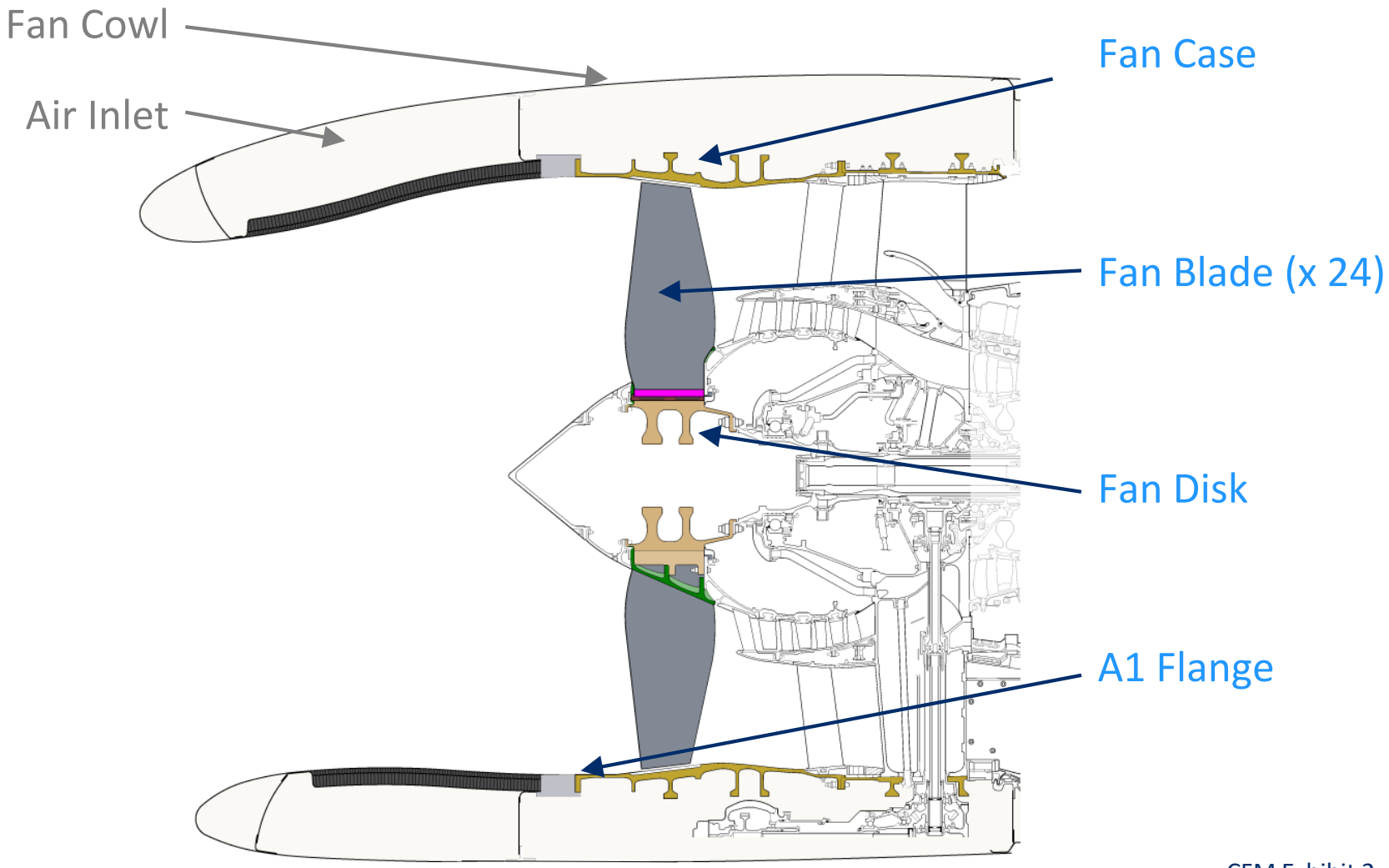


CFM Exhibit 1

Engine and Nacelle Cross-Section Schematic

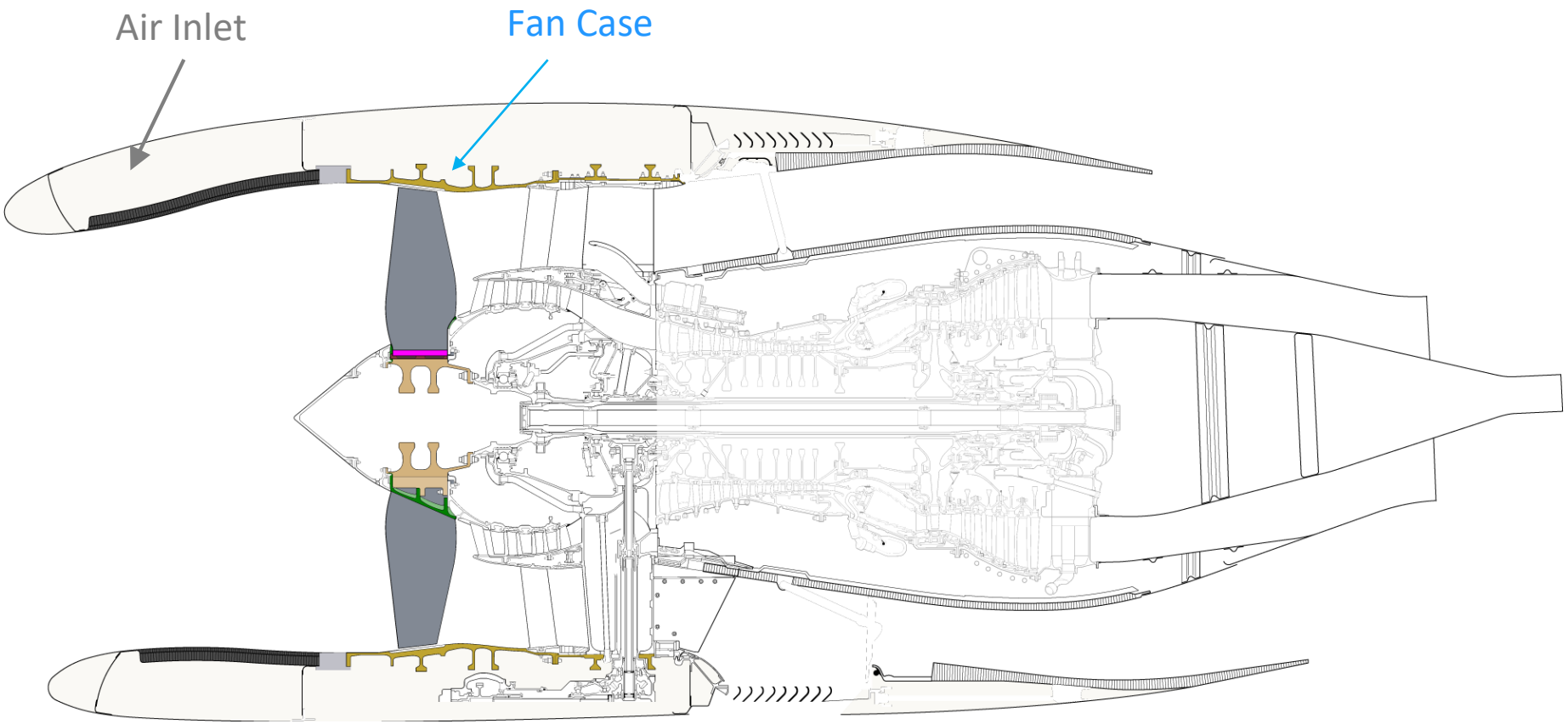
Airframer Hardware

Engine Hardware

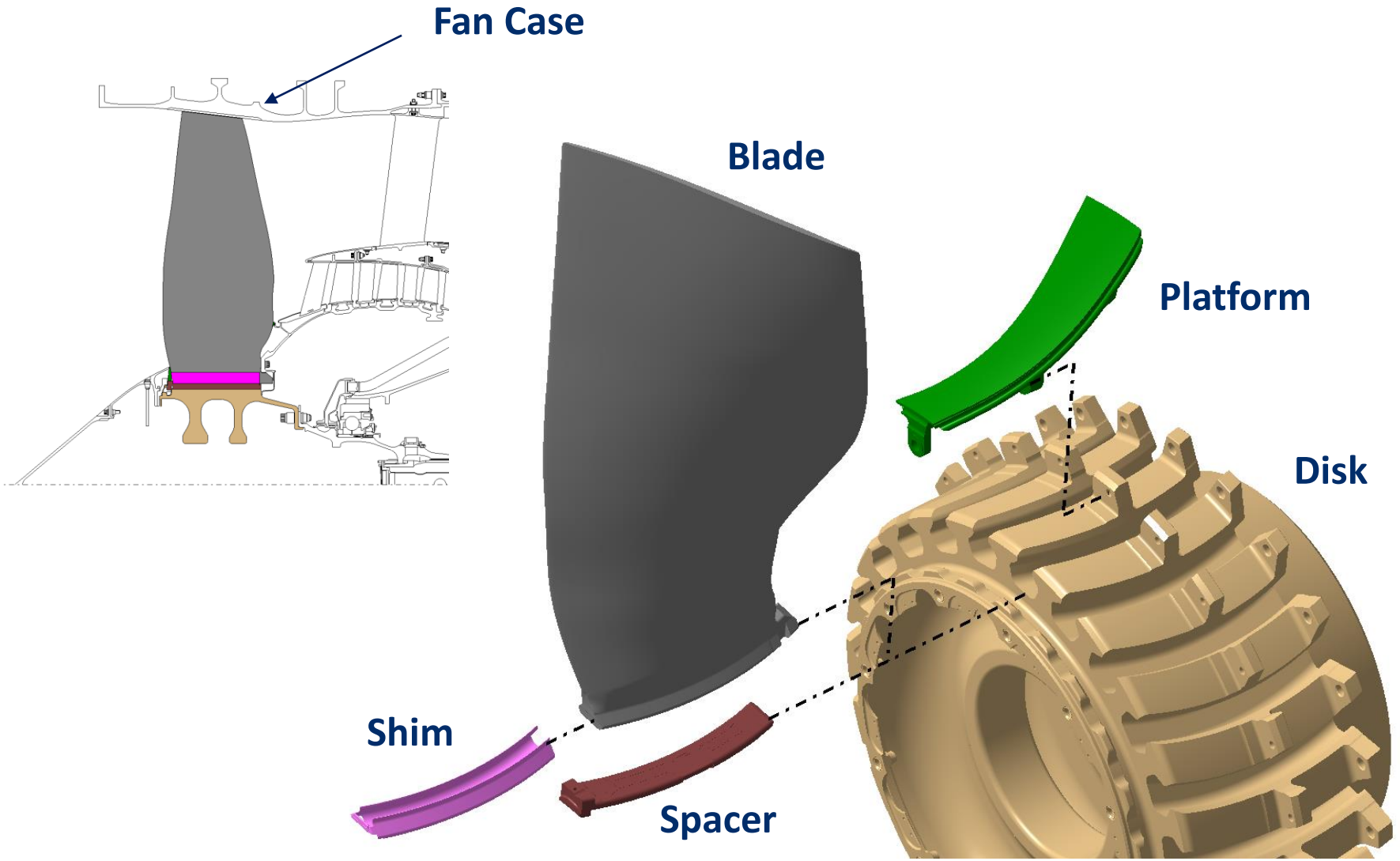


CFM Exhibit 2

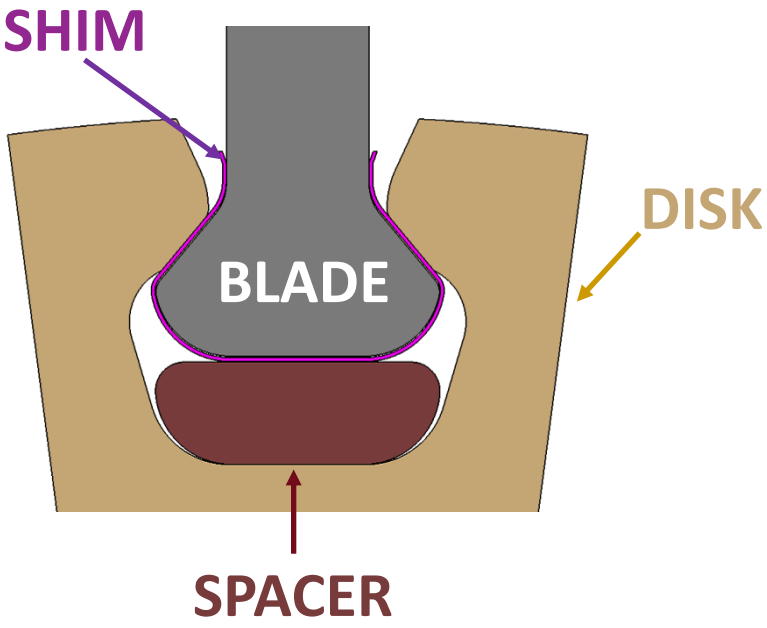
Engine and Nacelle Cross-Section Schematic



Fan Blade / Rotor Assembly

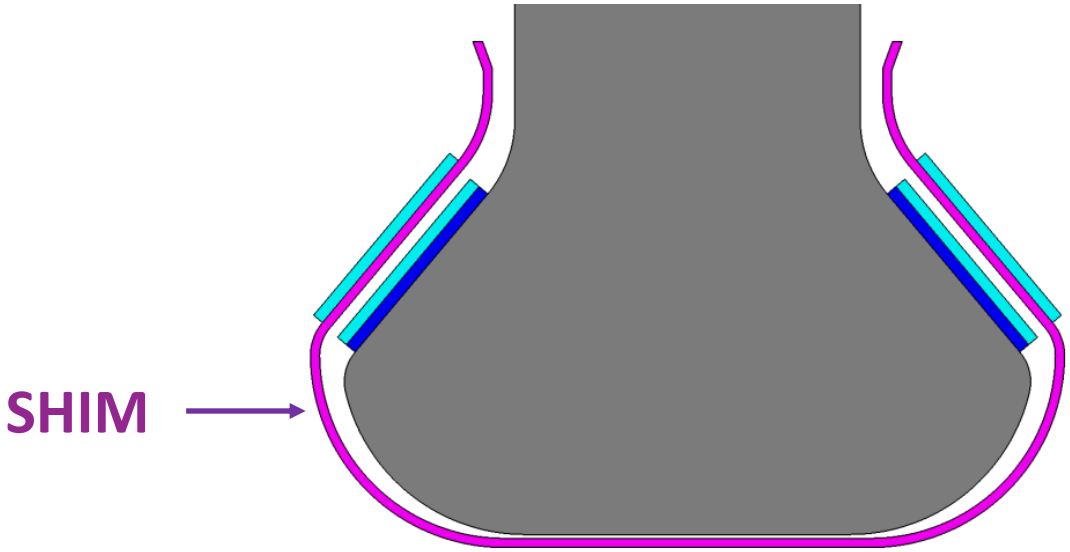


Fan Blade Dovetail System



Lubricant

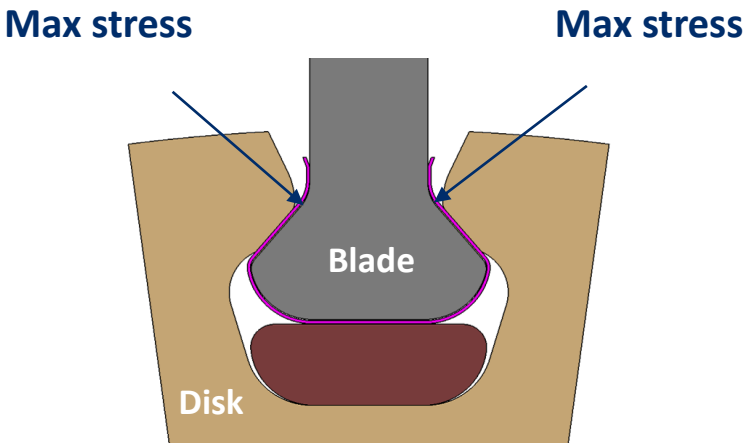
Wear coating



Fan Blade Separation

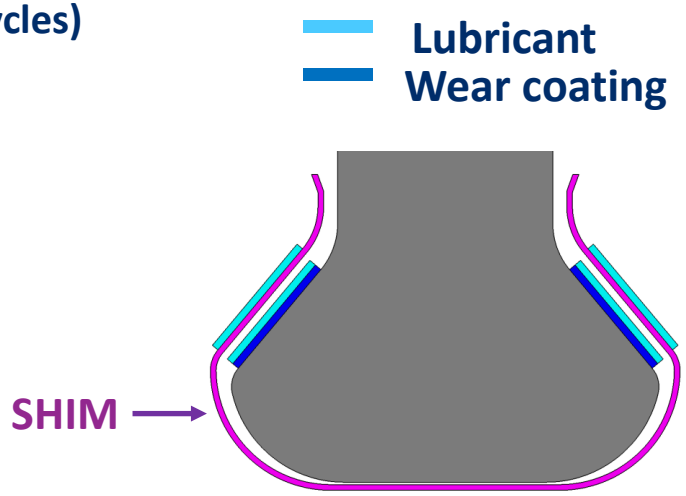
Crack Location

- Maximum stress occurs in root
- Driven by speed & friction



Contributing Factors

- Condition of lubricant & coating
- Material properties
- Length of operating time / quantity of flights (cycles)



Lessons Learned

- Coating durability
- Lubrication interval
- Enhanced inspection at blade dovetail
- Variation in material capability

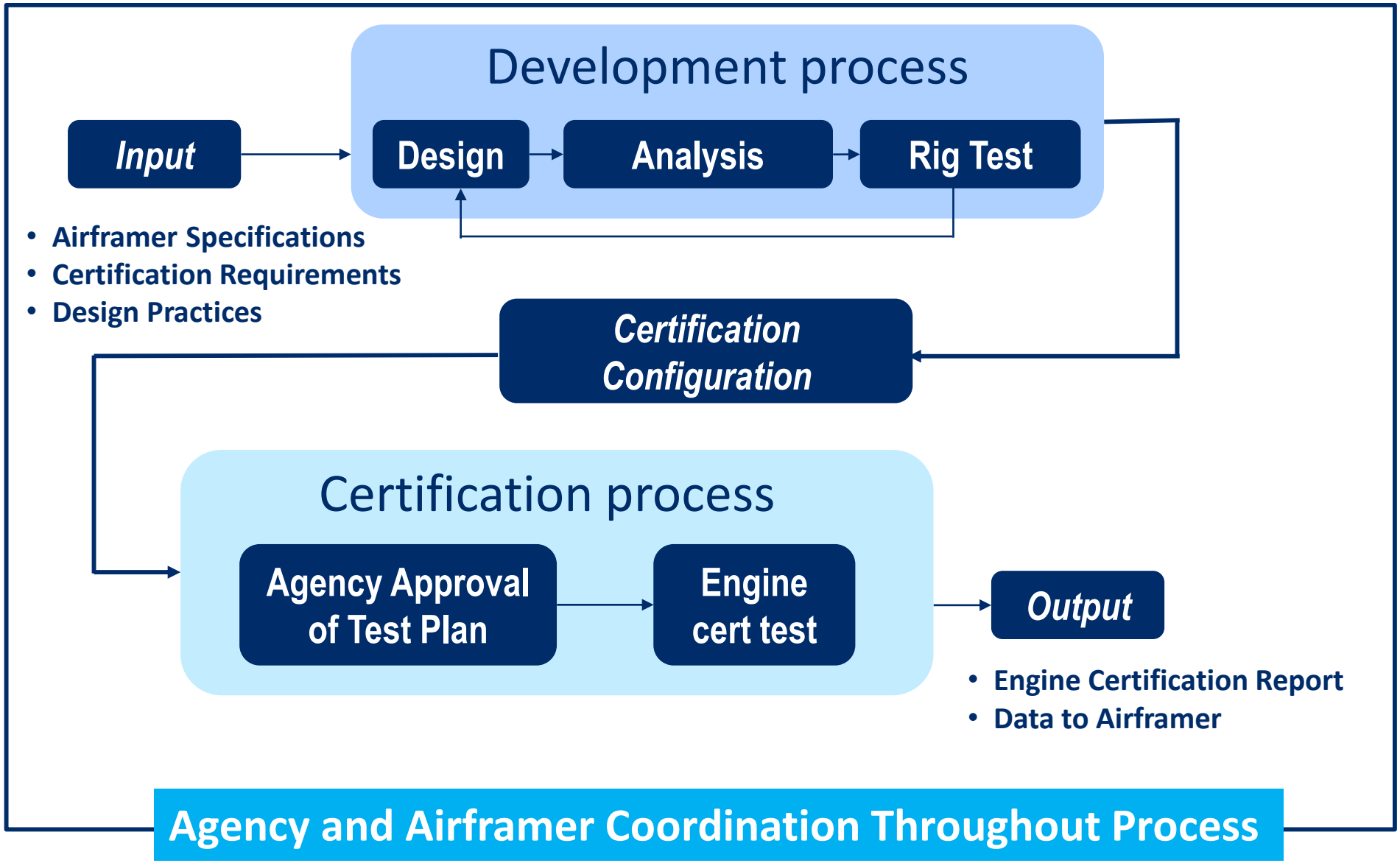
Fan Blade Comparison

Narrow Chord

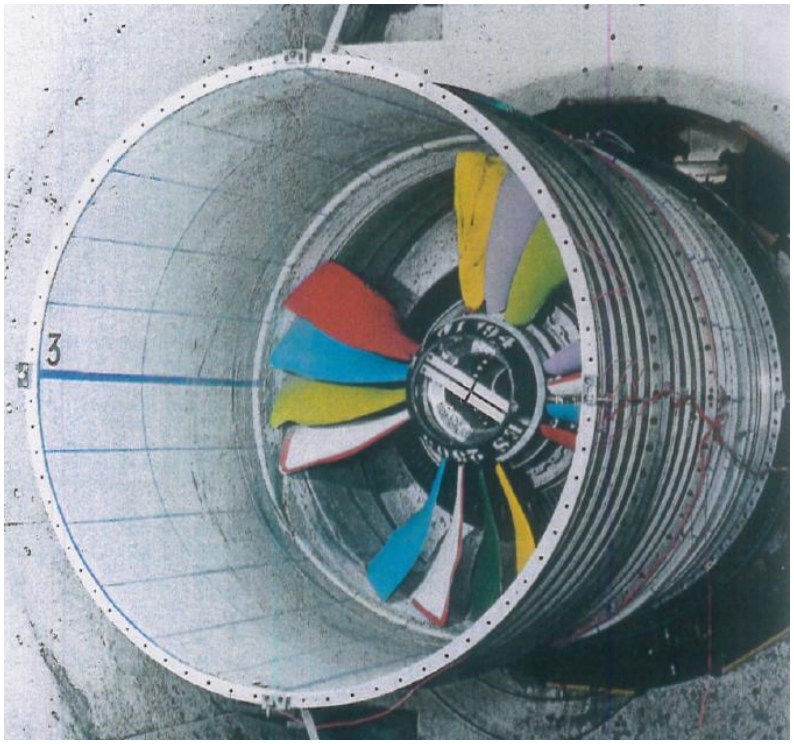
- Improved fuel burn & thrust
- Increased impact capability
- Ease of maintenance

CFM56-7B Wide Chord

Fan Blade Containment Certification Process



Fan Blade Out Rig Test



Test Configuration

- Fan blades
- Fan disk & shaft
- Fan case

Test Conditions

- Electric motor drives the fan
- Run at max speed

Fan Blade Out Certification Engine Test

Test Configuration

- Full engine test
- Certification configuration

Test conditions

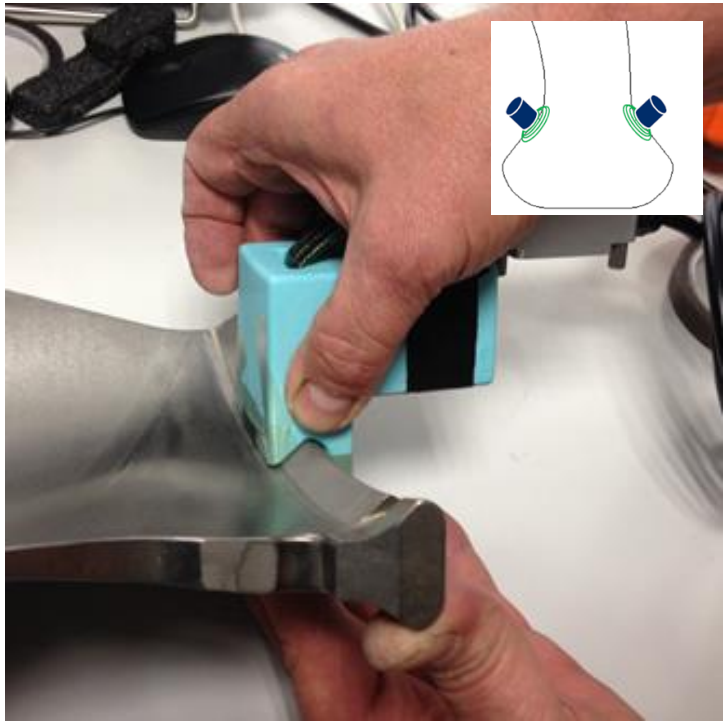
- Engine drives fan
- Run at maximum speed

Fan Blade Inspection Tools

Ultrasonic (UTI)

- Inspected in field
- Blade with coating

Eddy Current (ECI)



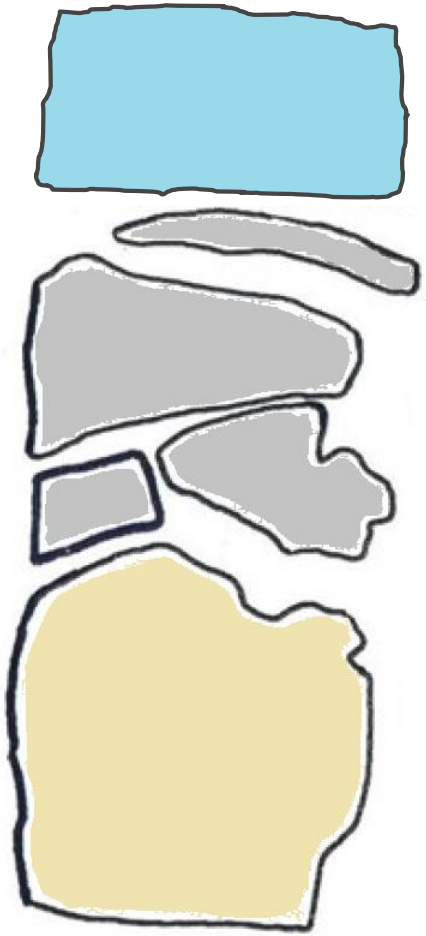
- Inspected in repair facility
- Blade without coating

Fan Blade After FBO Event

TIP PANEL

MID-SPAN FRAGMENTS

ROOT FRAGMENT



Fan Blade After FBO Event

Certification Blade

Philadelphia Blade (Preliminary)