Investigation of Flow Turning in a Natural Blockage Thrust Reverser

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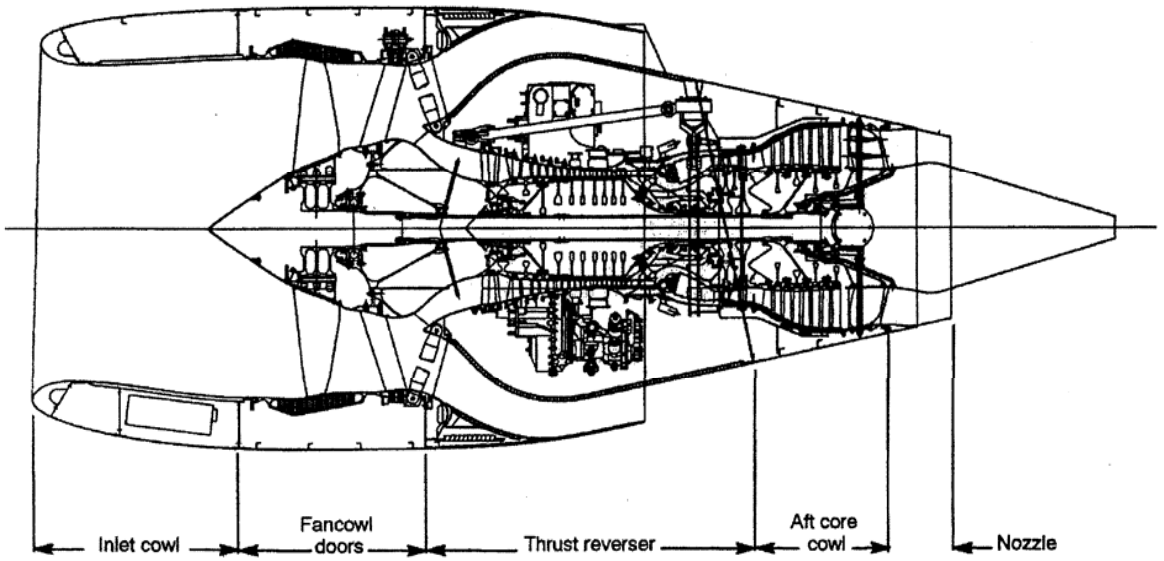
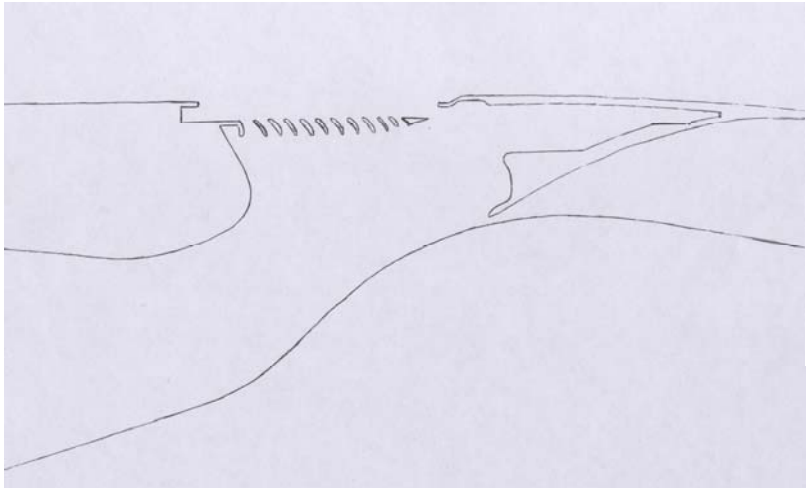
Thrust Reversers are used to :-

- ***Provide extra safety margin during landing and aborted take offs.***
- ***Expedite ground manoeuvring at congested airports.***

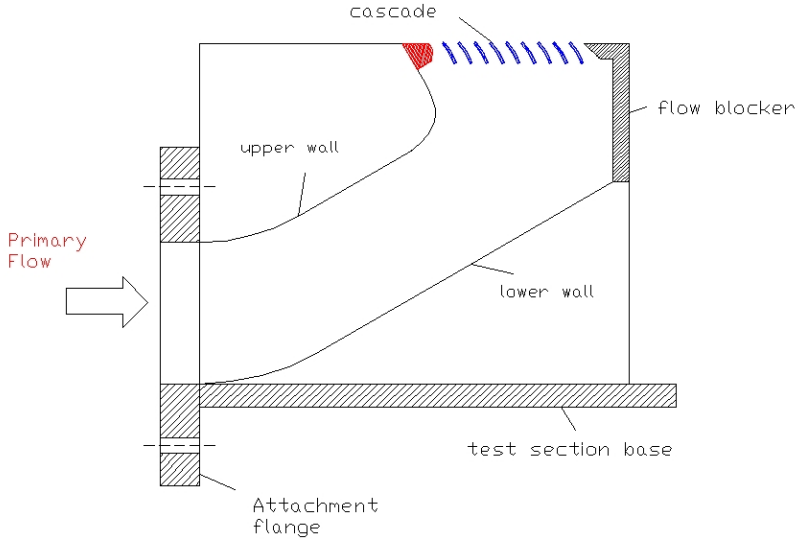
<u>Natural Blockage Cascade Fan Flow Reverser (CF34-8C, CRJ-700)</u>



Model Geometry



CF34-8C (Reverser Deployed)

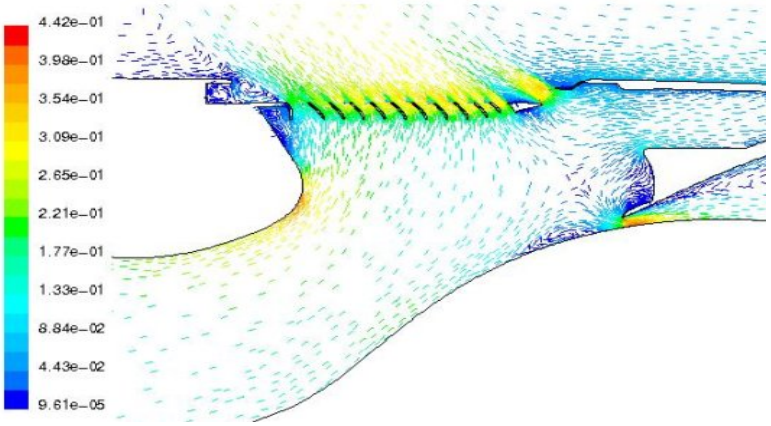


Simplified Model Geometry

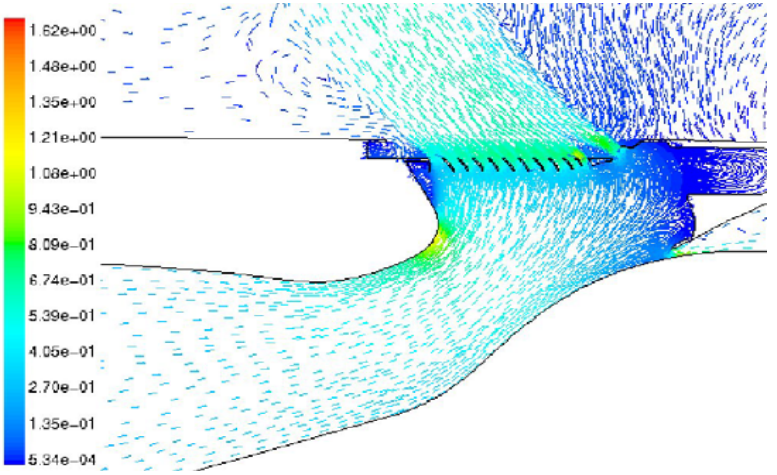
Why Low-Speed Testing?

- ***Testing at full-scale engine conditions is costly and requires sophisticated test facilities and equipment.***

- ***Computational Studies suggest that compressibility effects are not dominant.***

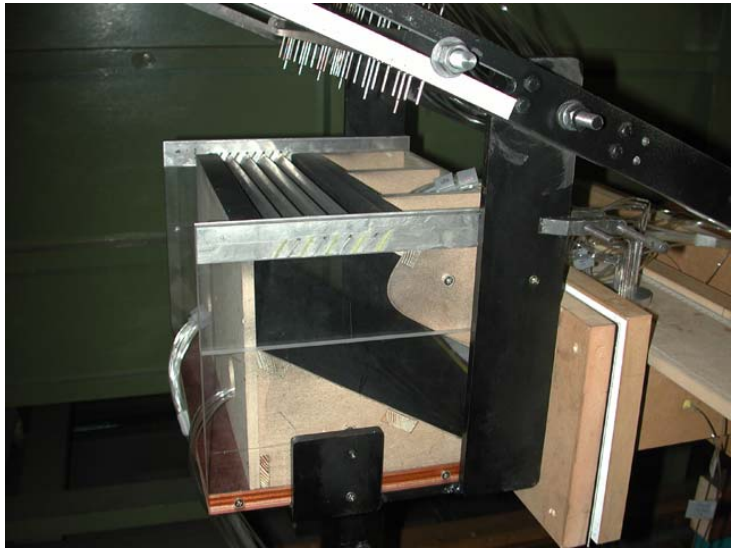


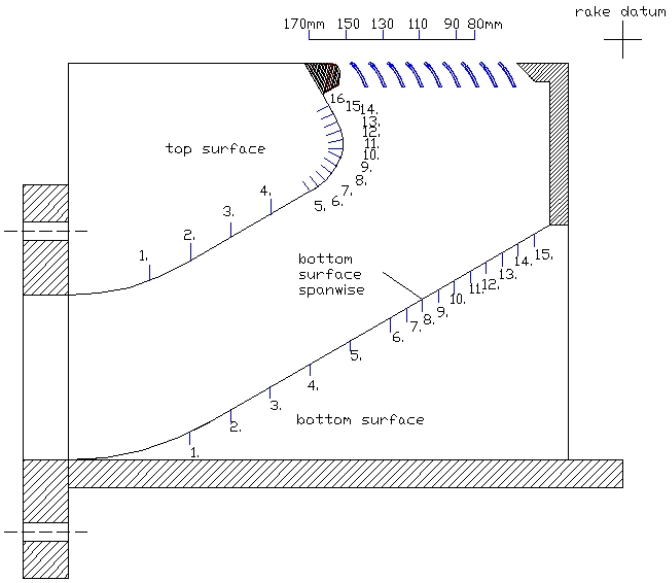
M=0.4



M=0.1

Experimental Model





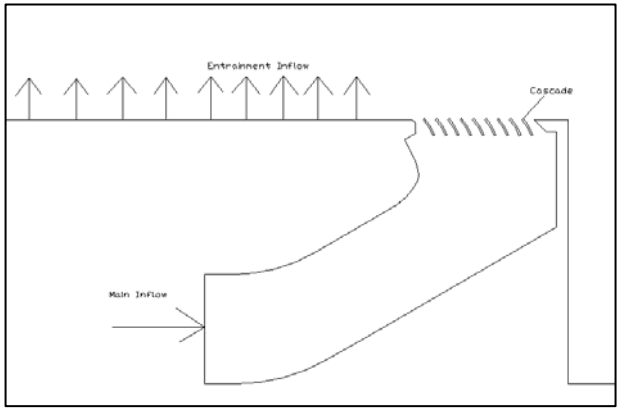
Experiment Features:-

- ***50% scale duct.***
- ***Test Section: 380mm by 89mm***
- ***Max Inlet Vel: 13.3m/s***

Computational Analysis

Computational Model Features:-

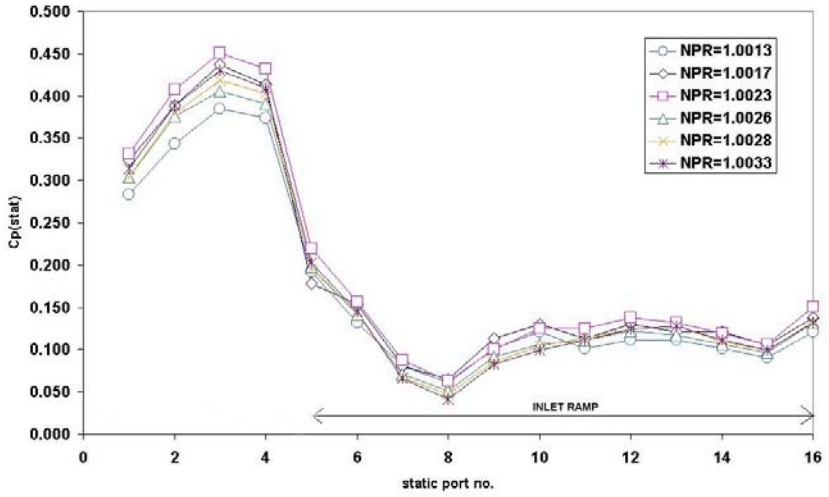
- ***Unstructured mesh (46726 cells)***
- ***Farfield boundaries: 20 model lengths upstream/vertically***
  10 model lengths downstream
- ***Entrainment flow on upstream wall***



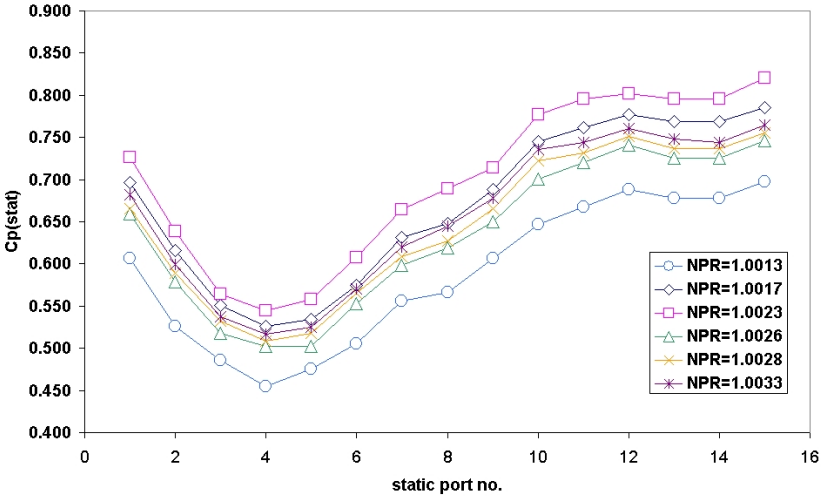
Solution:-

- ***2D, incompressible steady, 1st order***
- ***Reynolds Averaged Navier-Stokes equations (RANS)***
- ***RNG K-ε turbulence model.***

Results for Surface Static Pressure Coefficient



Duct Upper Surface



Duct Lower Surface

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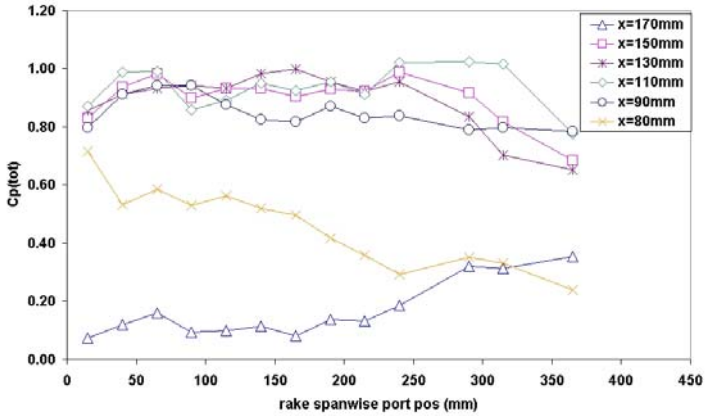
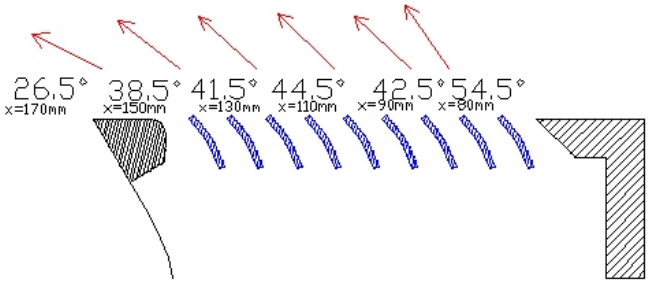
Results for cascade post-exit pressure rake (NPR=1.0033)



Rake total pressure coefficient



Velocity vectors at rake position

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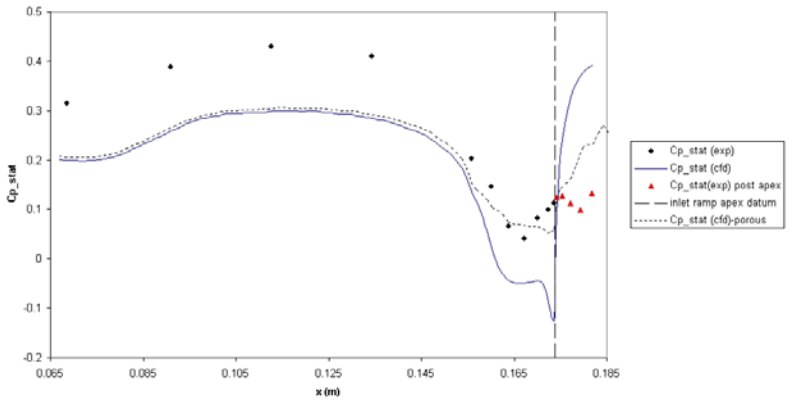
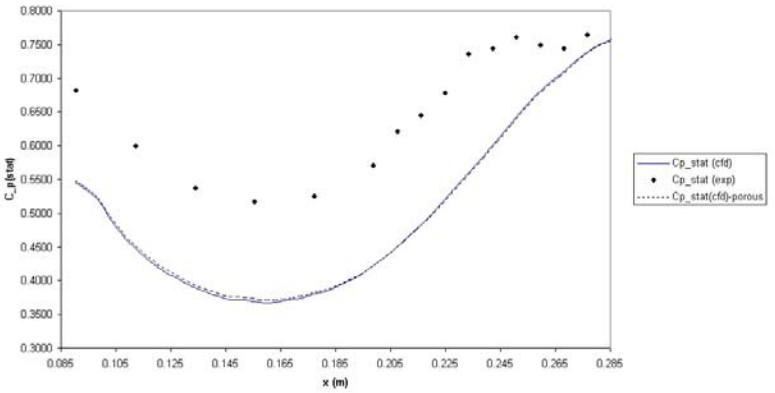
Comparison of Experimental/CFD data

(NPR=1.0033)



Static Pressure Coefficient

Upper Wall



Static Pressure Coefficient

Bottom Wall

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Conclusion

- ***Experiment successfully models qualitative aspects of flow through the reverser despite low nozzle pressure ratios.***

- ***2D CFD results show that 3D effects and flow separation in reverser flow are significant. 3D model simulations recommended.***