

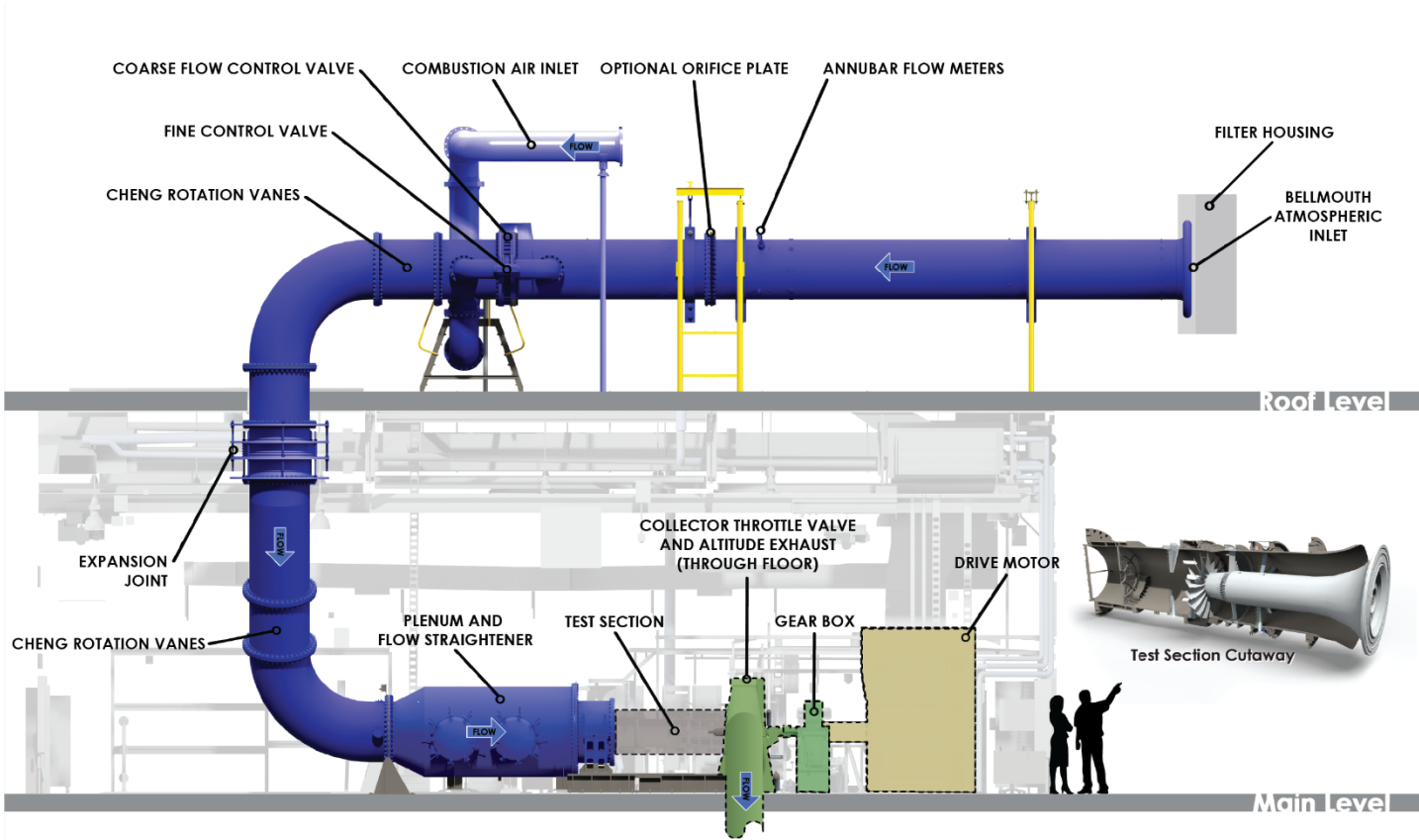


W8 Facility Overview and DTF Test Layout

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NASA Glenn Research Center
Gulfstream Workshop
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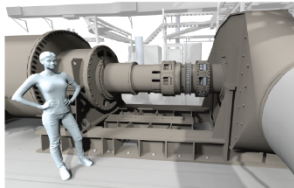
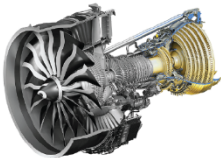
Facility Overview



Driveline Specifications

Drive Motor	7000 hp
Maximum Driveline Speed	14,000-21,000 rpm
Speed Control	±2 rpm
Maximum Mass Flow Rate	100 lb/sec
Maximum Plenum Pressure	5 psig*
Maximum Collector Pressure	22 psig
Maximum Bell Temperature	400° F
Torque Measurement to	22,000 in-lbs
Test Section Length to	88 to 96 in.
Inlet Pipe Size	48 in.
Digital Slip Ring	
360° Rotatable Inlet Distortion Screen	
Bidirectional Shaft Rotation	
Independent Dual Throttle Valves	
Bleed Capability	

* 15 psig with relief valve change-out for combustion air supply capability



W8 Single Stage Axial Compressor and Fan Facility

JOHN H. GLENN RESEARCH CENTER





Facility Upgrades Overview

- History/Major Changes:
 - 2018/19: Facility inlet air piping replacement. New stainless steel piping from the inlet filter housing on the roof to the inlet plenum tank in the test cell. Extended test section, addition of 44”
 - 2018/23: 7000 HP synchronous drive motor replacement due to various issues experienced in 2016/2017 test programs.
 - 2019/23: COBRA steady state data system upgrade from legacy Escort system.
 - 2019/23: Compressor bearing housing and oil system upgrade. Extended 18” copying 9x15 UHB features. Oil mist system integration.
 - 2020/23: Telemetry/slip ring/dynamic balance design, fabrication and checkouts.

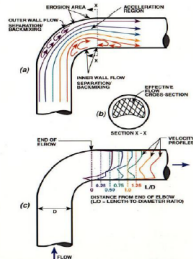
Subsystems

- Air System -

Inlet Air, Plenum and Exhaust System

- 100+ lbm/s steady flow
- Features and capabilities:
 - Filtered bellmouth ATM inlet housing
 - Dual Rosemount Annubar flow measurement capability measurable within +/- 1%
 - Reduced inlet pressure control valving
 - SS piping and flow conditioning via long radius elbows and Cheng Rotational Vanes
 - Modified plenum includes Cheng Large Angle Diffuser (LAD®). Course/fine screens and Honeycomb flow conditioning
 - Dual sleeve/flow path exhaust throttle valve
 - Altitude exhaust capabilities down to 20-26 in Hg

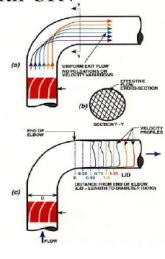
No CRV®



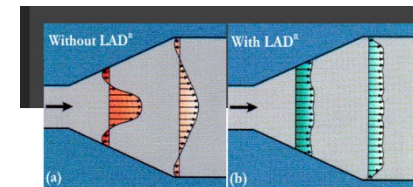
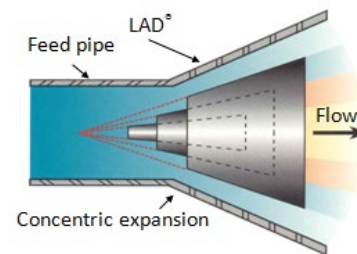
Fluid Separation and turbulence occur in an elbow

Cheng Fluid Systems, Inc.

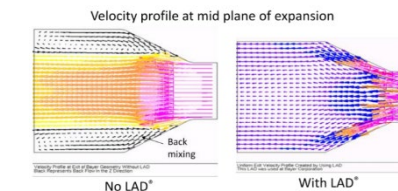
With CRV®



Elbow induced flow turbulence is eliminated with a CRV®



An LAD® creates a uniform exit flow profile and eliminates back mixing of the fluids.

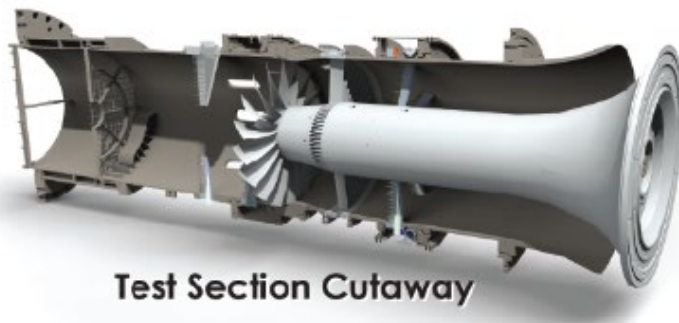


Subsystems

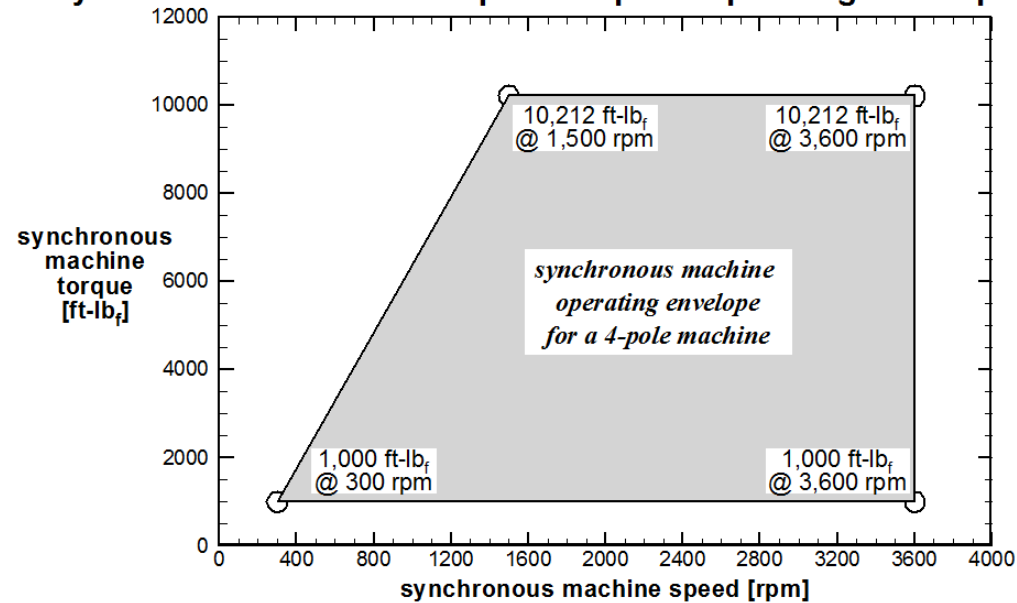
- Driveline -

Drive System

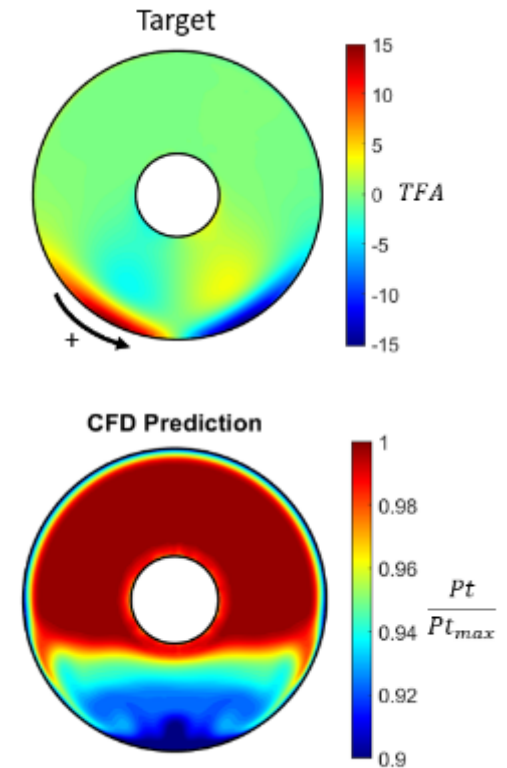
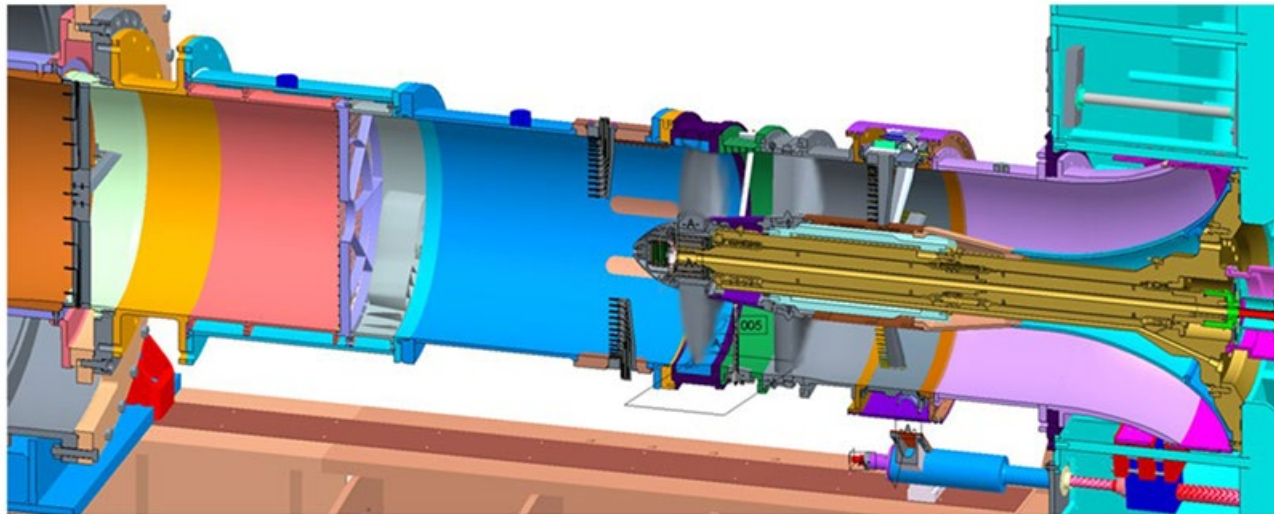
- Features and capabilities:
 - 7000 HP synchronous drive motor and lubrication system
 - 5.91 gearbox (21,240 rpm) and lubrication system
 - Inline Torquemeter (22,000 in-lbs) and lubrication system
 - Compressor bearing housing (14,000 or 21,240 rpm) and lubrication system
 - Digital slip ring
 - Bi-directional shaft rotation



NASA Glenn Research Center - Test Cell W-8
Synchronous Machine Torque vs. Speed Operating Envelope



- BLI2DTF W8 Fan Test (2023, 2024)
 - Fan from 8x6 Test used to checkout and verify W8 performance after all modifications are in place
 - Generate more fan aeromechanics, performance, efficiency, and operability measurements to compare with 8x6 test
 - Ensure Screen Vanes adequately replicate distortions for meaningful tests
 - Data to validate Type 1 BLI fan models for use in simulations
 - Additional testing with non-invasive measurement techniques for enhanced understanding of swirl development and fan flow field influence
- Develop in-house Aeromechanics prediction methodologies (2022-2023)



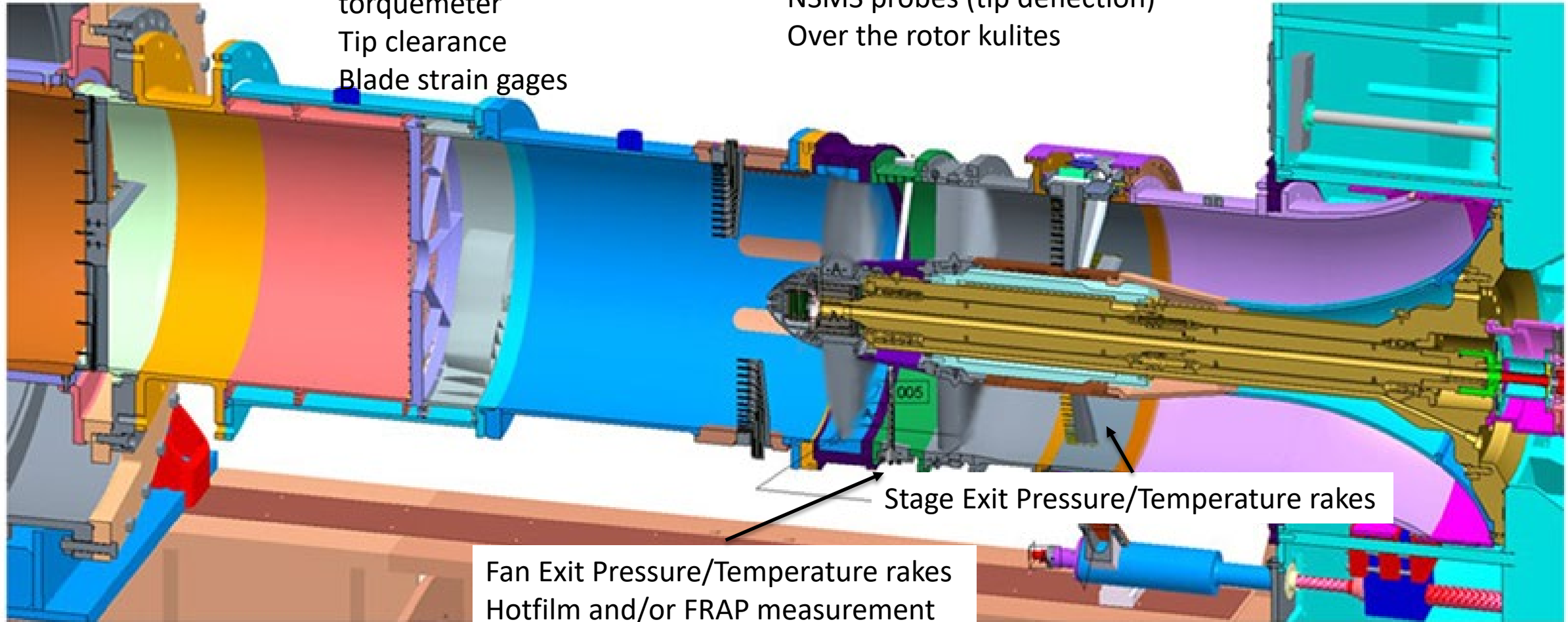
Validate CFD for propulsors and determine more accurate fan efficiency/distortion tolerant performance.

Test Instrumentation summary



Static Pressures every two inches
Two component balance;
torquemeter
Tip clearance
Blade strain gages

NSMS probes (tip deflection)
Over the rotor kulites



W8 ScreenVane(ScV) Checkout Configuration



#5/6

