

The background of the slide is a blue sky with white clouds. Overlaid on this are several aircraft: a white stealth bomber in the top left, a white commercial jet in the top right, a white and orange supersonic aircraft in the center, a white and blue commercial jet in the bottom left, and a green and white commercial jet in the bottom right. A large, semi-transparent "AATT" watermark is centered across the slide.

Core/Combustor-Noise: Preparations for Future DART Tests

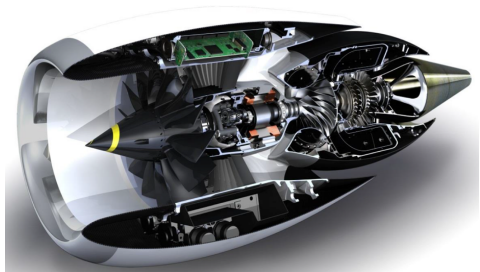
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Acoustics Technical Working Group
Hampton, VA, Apr 10-11, 2018

NASA Advanced Vehicles Program
Advanced Air Transport Technology Project
Aircraft Noise Reduction Subproject

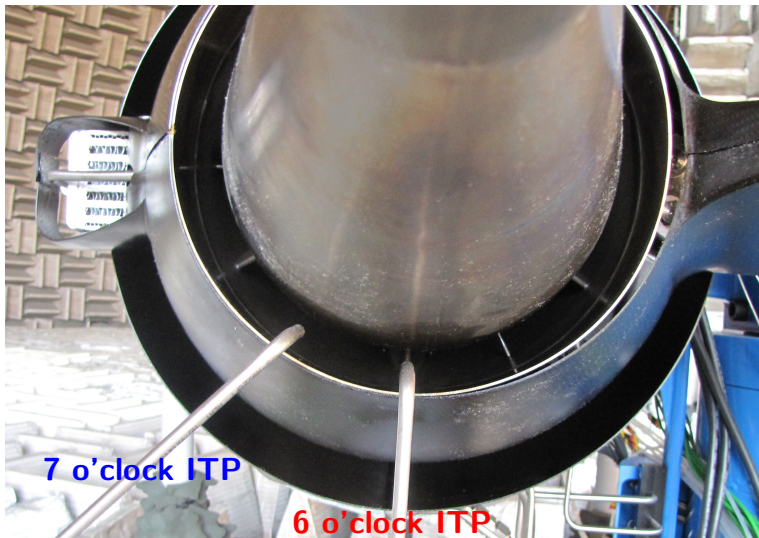
Introduction

- DGEN 380 turbopan engine
 - Two-spool high-bypass geared turbopan
 - Single stage high-pressure centrifugal compressor
 - Reverse flow annular combustor
 - Single stage axial flow HPT and LPT
 - FADEC enables excellent repeatability of test conditions
- Baseline combustor-noise data acquired in 2017



Images (c) Price-Induction, used with permission

DART Test–August 2017

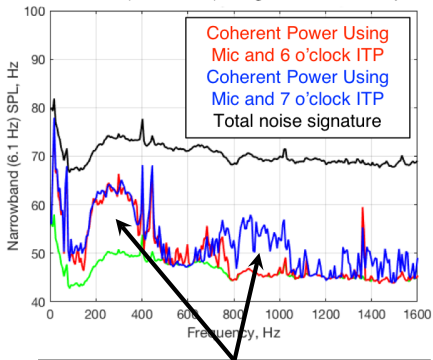


ITP configuration at nozzle exit

2017 DART Test Results, 60% Power

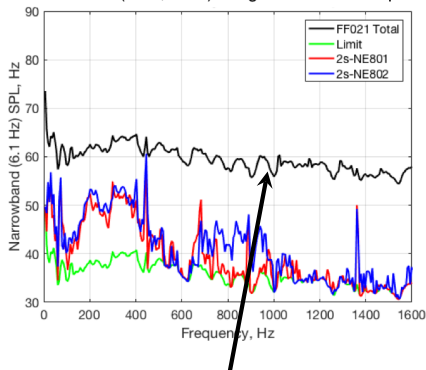


Mid-field (10 ft, 130°) 2-signal coherent output



Broadband combustor-noise component

Far-field (37 ft, 131°) 2-signal coherent output



Total noise signature

Broadband combustor noise ($m = 0$) detected up to 500 Hz with either ITP
7 o'clock ITP also detects second broadband-noise frequency range ($m = \pm 1$)
Presently unclear why second range not detected by **6 o'clock ITP**

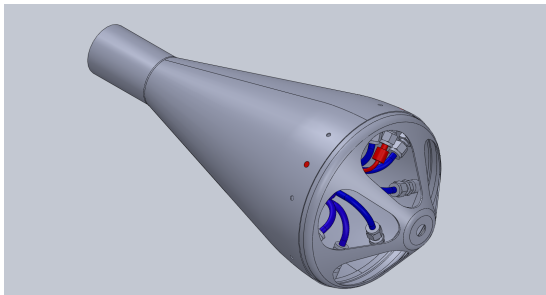
Upcoming Test: Goals and Objectives



Goal: Improve understanding of DART combustor noise

Objective: Make additional circumferential unsteady pressure measurements in core stream

Approach: Replace tailcone with new instrumented part



- 8 equally spaced ITP measurement locations around tailcone circumference
- 2 high-temperature pressure transducers (P8)

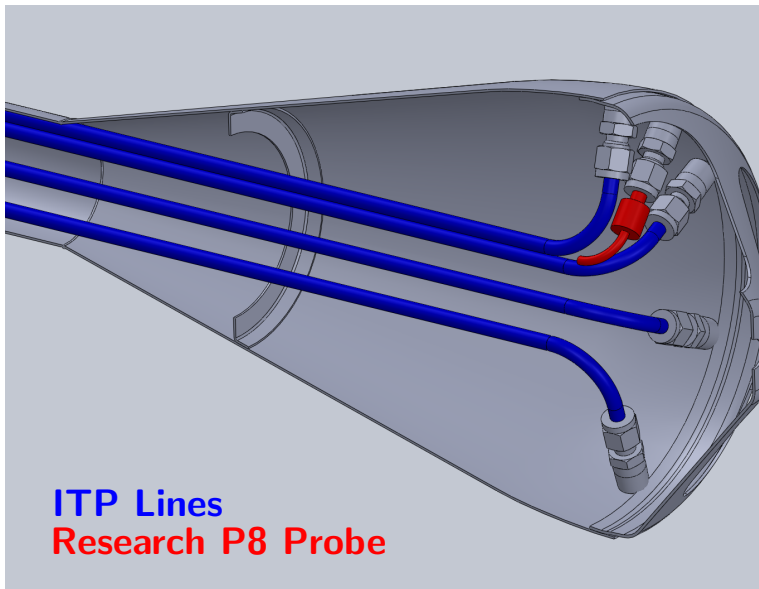


Upcoming Test: Hardware Design

Modified core nozzle centerbody:

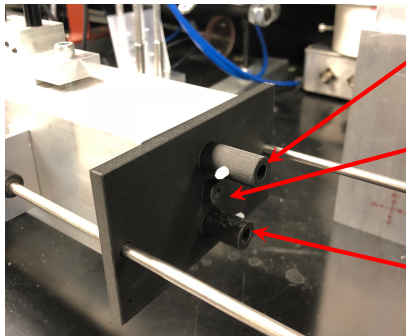
- Integrates desired circumferential array of measurement locations
- Allows “simple” removal for instrumentation access
- Additional research instrumentation integrated (P8 pressure probe)
- Bosses offer options to change configuration of installed instrumentation

Hardware Design (Cont'd)



Characterizing ITP Response

- Using impedance tube to generate known acoustic response
- Determines amplitude and phase relationship between pressure response at measurement location and remote ITP
- Plan to introduce nitrogen or shop air purge flow in later iterations



ITP

Unsteady Pressure Transducer
(Kulite XCS-190D)
(Reference)

1/4" Pressure Field Mic
(GRAS 46BD-FV)
(Reference)

Summary



- Modified core nozzle centerbody will improve knowledge of DART core noise field at nozzle exit with additional circumferential measurement locations
- Proposed testing, in part, will investigate the possibility that azimuthal duct modes $(m, 0)$ are present at DART nozzle exit
- ITP benchtop testing will produce amplitude/phase relationship between remote ITP and measurement location pressure

Questions?

