An Abridged Overview of the National Transonic Facility Geometry

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Overview

- **Summary of previously released NTF test section geometry**
- **Full paper presented at 2025 AIAA AVIATION Conference**
  - Pomeroy, et al. "National Transonic Facility Public Geometry Release and Summary." AIAA 2025-3160
  - Paper and presentation included in NTF geometry distribution
- **Geometry support from many parties**
  - Melissa Rivers, Scott Brynildsen, Norma Farr, Chris Rumsey, Miranda Ertsgaard, Courney Winski, Andy Kwok; NASA Langley Research Center
  - Ben Rider, Boeing Commercial Airplanes
  - Seyedeh Sheida Hosseini, NASA Ames Research Center

Facility Overview

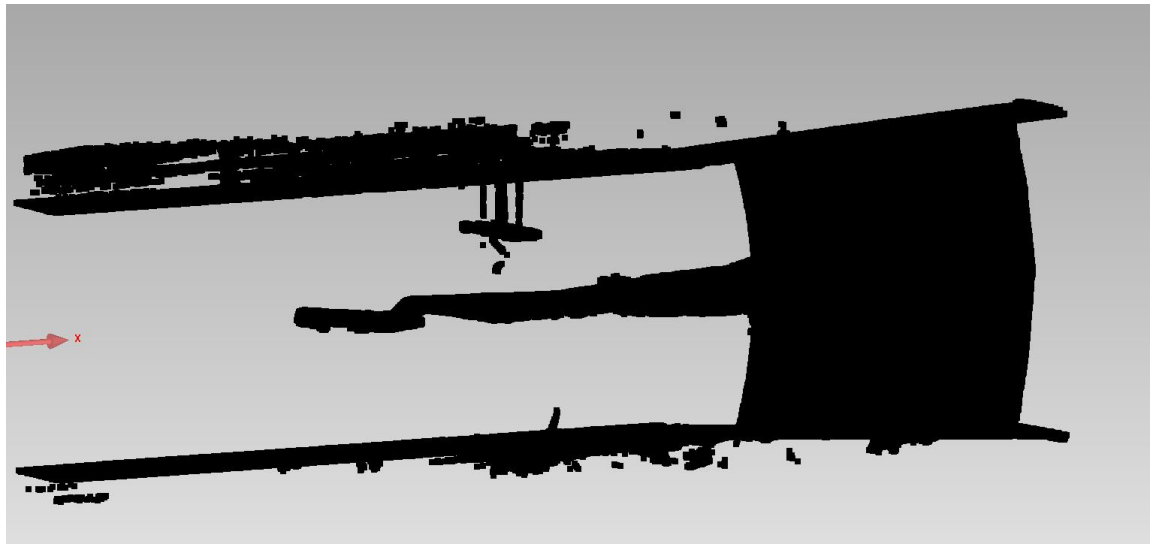
- **Closed circuit, pressurized, cryogenic facility**
- **Located at NASA Langley Research Center in Hampton, VA, USA**
- **Facilitates transonic, flight Reynolds number (Re) testing**
  - Mach 0.1 to 1.2
  - Re 4.0 million to 145 million/foot
    1.2 million to 44 million/meter
  - Temperature -250 to 130 deg F
    (-157 to 54 C; 116 to 328 K)
  - Can operate with dry, ambient air or with gaseous nitrogen

- **Extensive international effort to design and construct the facility**

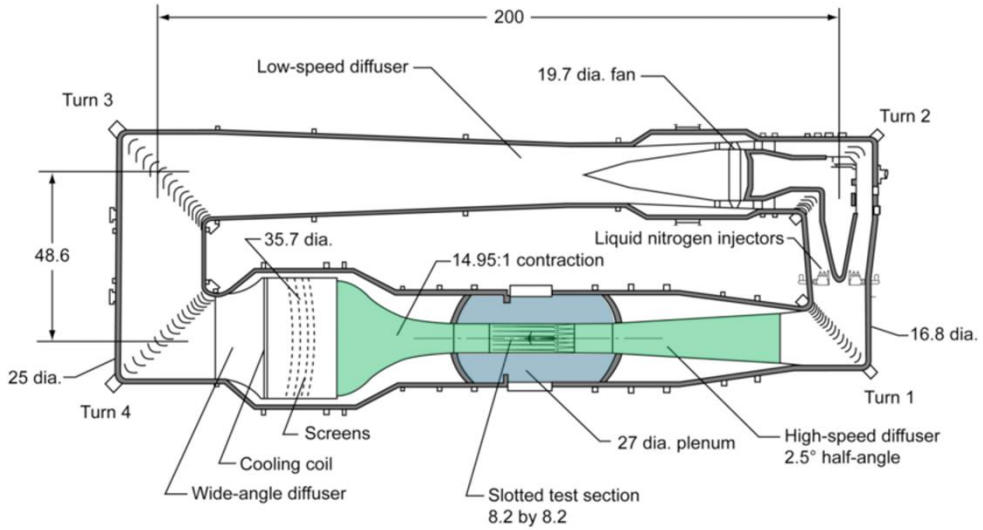
Source [all]: NASA

Facility Digital Model

- **Detailed digital scan of NTF circuit was taken in the mid-2010s**
  - About 250 million points
  - Approximately 80% of the points are in the plenum
  - Significant work with GeoMagic used to generate CFD-ready surface geometry
- **High-speed leg geometry and model support hardware has been released**



Point cloud data



Tunnel circuit, high speed leg (green), and plenum (blue)

Continuous Geometry Improvements

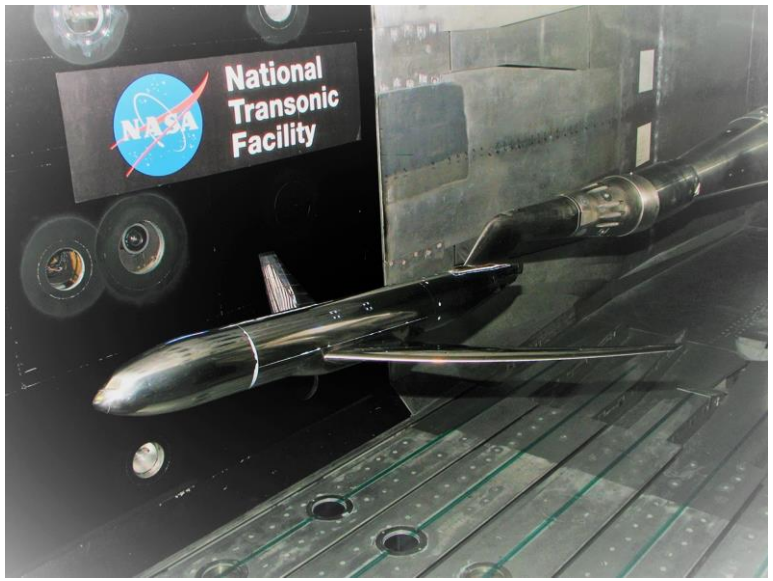
- **Revisions have been made since initial release (current version 1.10)**
  - Improved geometry representation (upper-swept strut)
  - Added of new components (e.g., clamshell)
  - Improved surface representation
  - Increased understanding of coordinate system transformations
- **Community feedback**
  - Merging similar subcomponents into one part
  - Opportunities for surface cleanup
  - Identified gaps and untrimmed surfaces

CRM Mounting Options

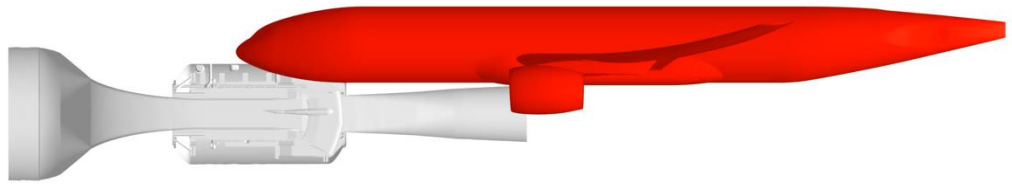
- **2.7% full-span**
  - CRM
  - CRM-HL
  - Upper swept strut
- **5.2% semispan**
  - CRM-HL
  - CRM-NLF
- **2.7% semispan CRM-HL (planned test)**
- **Coordinate transformations provided in the release documentation**

Full-Span 2.7% CRM Coordinate Transformations

- **Equations maintained from previously-listed information for consistency**
- **Transformations included in `how_mounted_2p7.txt` in CAD release**
  1. Scale vehicle
  2. Translate to model origin in the wind tunnel
  3. Rotate arc sector and upper-swept strut around y axis
  4. Rotate arc sector, upper-swept strut, and vehicle for non-zero alpha

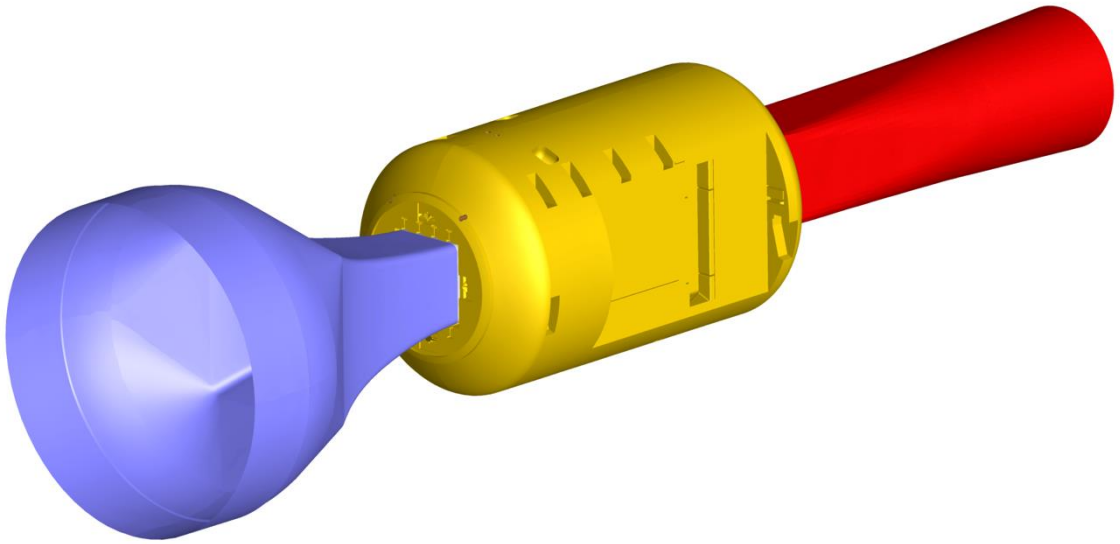


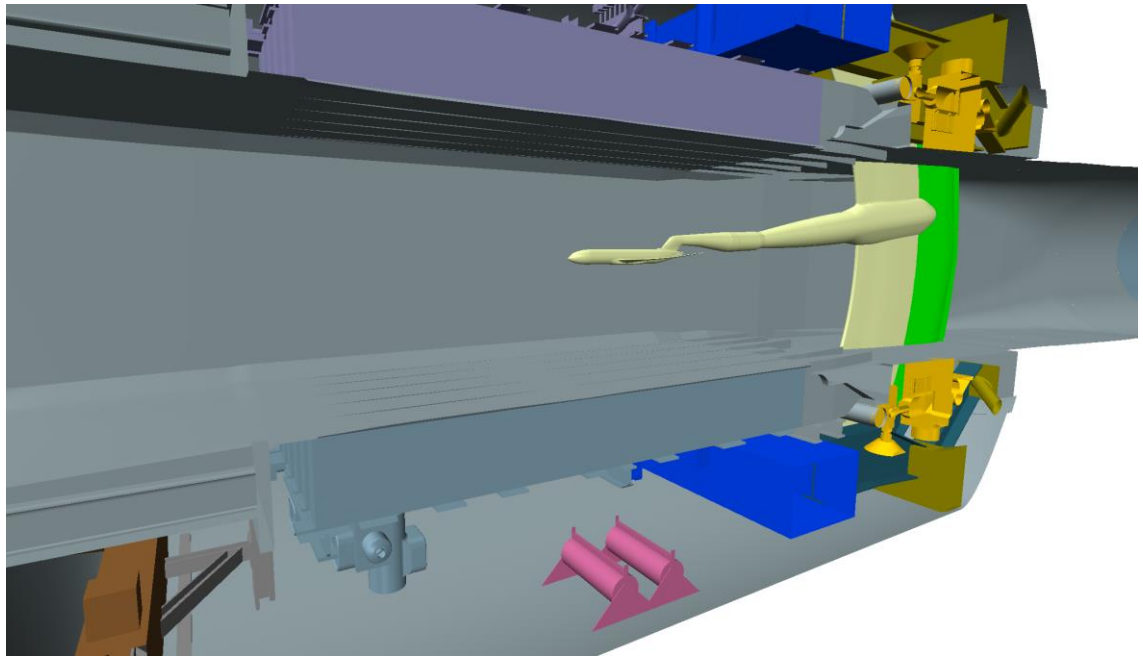
Source: NASA



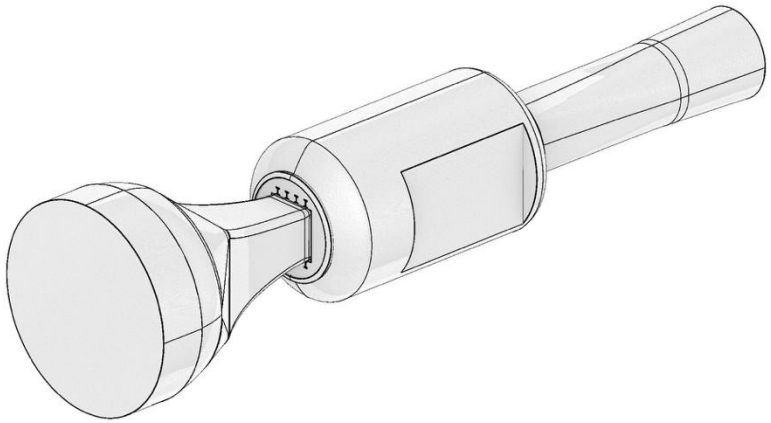
Animation depicting coordinate transformations

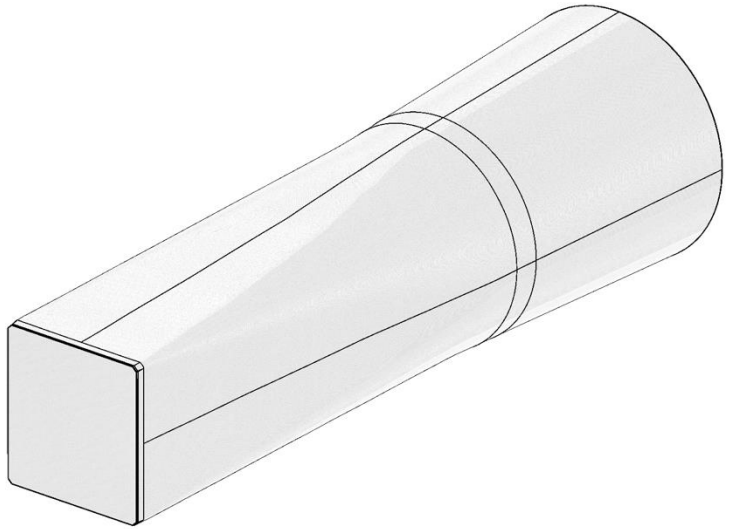
Geometry Overview

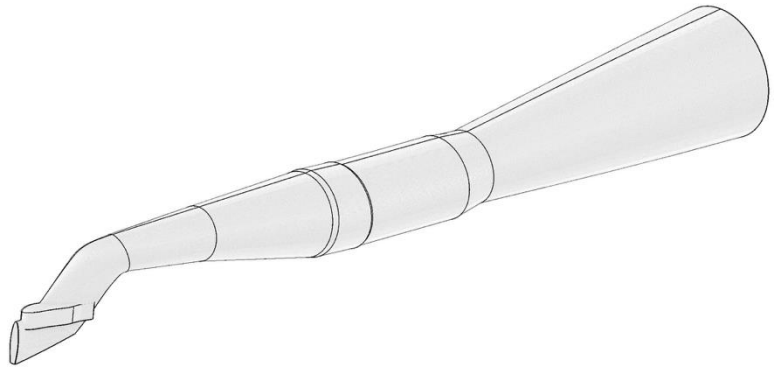


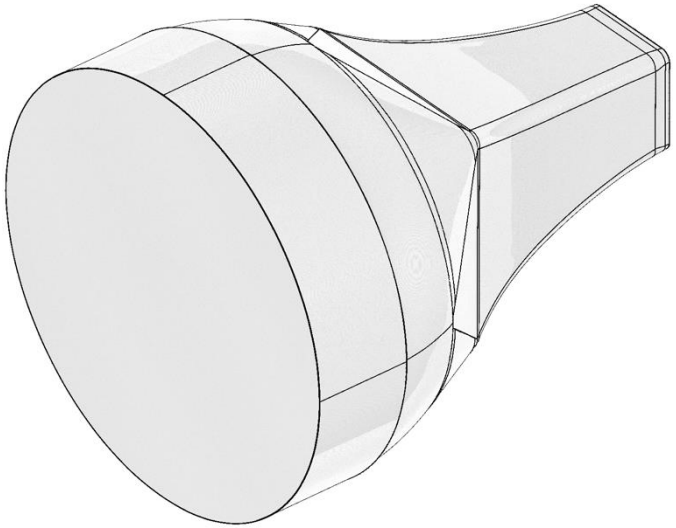


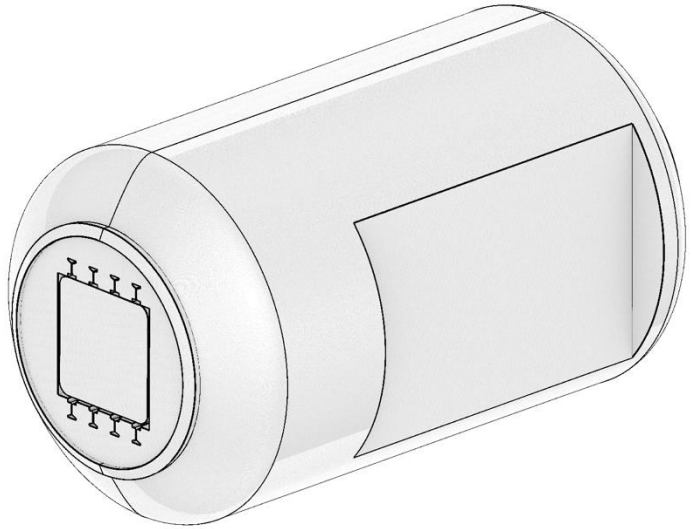
Geometry Files (1/2)





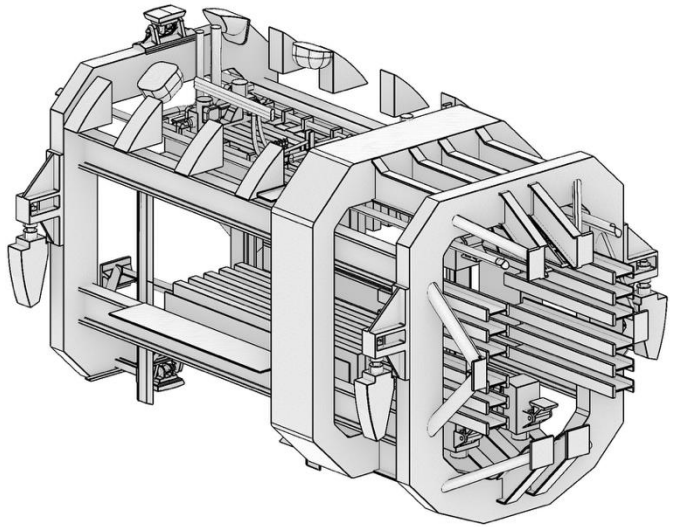


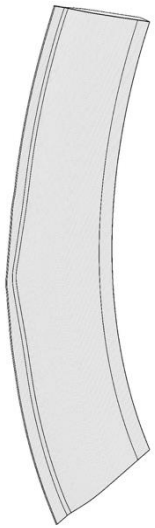


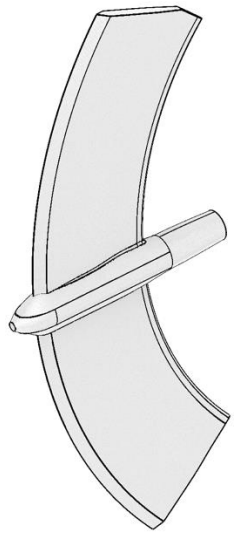


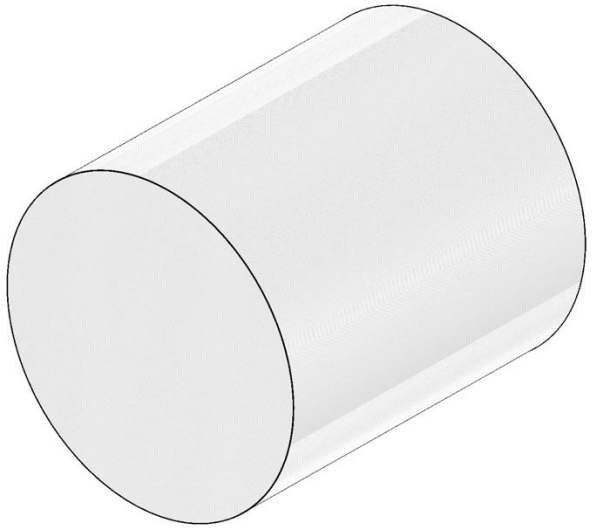
Note: The diffuser extension is not part of the NTF. It is provided in the CAD so boundary conditions can be applied further away from the test section. This may be desired to avoid potential numerical problems at the end of the diffusor. Use is optional.

Geometry Files (2/2)









Questions?