LRC

Variable Density Tunnel

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<th>TR 416</th>
<th>B-15</th>
<th>AR 1921</th>
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Designed by Max Munk
Tech. Asst. of Committee

TR 227 - Munk & Miller - The VDT of NACA II Descrip. of Tun 1926

VDT Initially closed throat. Opened to closed after a fire (alt 1925) converted to open throat.

Weiner Photo List

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<td>3611.1</td>
<td>VDT photo of display</td>
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VARIABLE DENSITY TUNNEL

Test section : 5-ft. dia. (1.52m), closed throat

Circuit/pressure : Annular return / 20 atmospheres

Max. speed : 23 m/s (51 mph)

Max. RNE : $3.3 \times 10^6 \; (e = 5 \text{ inches} ; 12.7 \text{ cm})$

Drive System : 250 HP (187KW) electric motor / fan

In operation : March 1923 *

Current status : Pressure shell only remains.

Special note: (*) Converted to open throat April 1928. Major
remod. Dec. 1930 (closed throat)

* April 23 accord to B-45
Figure 1.—General view of the variable-density wind tunnel

Figure 2.—Diagrammatic longitudinal section of the variable-density wind tunnel

TR 416 (Nov 23, 1931)
TR 227/411 - Suggested by Munk 1921
- Dr. Munk, David L. Bacon, F. W. Miller
were designers.

- $p = 31$ atm. $21 \times 14.47 = 308$ psi.
- plate $t = 2\frac{3}{4}$" (54 cm).
- walls of $15$ of wood.
- CR about $5$.
- fan $7'$ dia.
- power $250$ HP.
- balance ring.

Baylou 4/3/15
1930 - TR 352
30
TN 385
31
TN 386
31
TN 391
31
TN 392

TR 227/410 - Dia = $5'$ (same as No. 1).
- "Furthermore - $5'$ - - -"
- Closed throat.

Jacobs & Abbott - The NACA VDT.

TR 416 (1934) 200KW motor (speed control).

EIR = 1.09 (preferred)

Wall Court
TR 361 - 1930


TR 317 - 1929
Don Baals.

Dr. R.W. Barnwell asked me to respond to your request to provide information concerning the wall thickness of the storage tank housing the old, now extinct, VDT.

There is a cylindrical body portion of 2½-inch steel plate with hemispherical ends 1¼-inches in thickness. The tank is built of steel plates lapped and riveted. This information together with a complete detail description of the VDT can be found in NASA Report TR-227, 1925 PART II "Description of Tunnel" in "The Variable Density Wind Tunnel of the National Advisory Committee for Aeronautics" by Max M. Munk and Elton W. Miller.

William D. Beasley
MS-339
ARG
Eastman Jacobs
Smith J. DeFrance
Harold Turner
VARIABLE-DENSITY WIND TUNNEL
LOCATED AT THE LABORATORIES OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS AT LANGLEY FIELD, VA

GENERAL VIEW SHOWING THE TUNNEL IN OPERATION

INTERIOR VIEW SHOWING A MODEL MOUNTED IN THE TUNNEL FOR A TEST

DIAGRAMMATIC LONGITUDINAL SECTION OF THE VARIABLE-DENSITY WIND TUNNEL

TUNNEL CHARACTERISTICS
This wind tunnel is built within a heavy steel tank in which the air may be compressed to twenty times atmospheric pressure, thus permitting the testing of model airplanes and airplane parts in dense air. The model to be tested is mounted in the airstream on electrically operated balances. The measurements of the air forces on the model are observed through glass windows from outside the tank.

REASON FOR USING COMPRESSED AIR
Aerodynamic tests of a small-scale model in air of normal density are often unreliable as a result of the relatively greater influence of viscous forces on the small model. The viscous forces, like the coefficient of viscosity, are nearly independent of density, but the pressure forces increase with density. In this tunnel the model is tested in compressed, or dense, air in which the viscous forces are increased very little while the pressure forces are increased greatly. It is therefore possible to obtain the same ratio of pressure to viscous forces in the model flow as in the full-scale flow and the dynamic scales, or Reynolds numbers, of the two are said to be equal. Because the flows are then equally affected by viscosity, full-scale results may be derived from tests of a small model in the variable-density wind tunnel. In the determination of the lift and drag characteristics of wing sections the results obtained with this equipment are accepted as standard.