**CHARACTERISTICS OF RESEARCH PROPPELLERS**

**XF-88B PROGRAM**

<table>
<thead>
<tr>
<th>PHASE</th>
<th>( M_d )</th>
<th>( \frac{h}{b} ) TIP</th>
<th>( \frac{h}{b} ) SPINNER</th>
<th>( \sigma )</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Pi_a )</td>
<td>2.0</td>
<td>0.9</td>
<td>0.02</td>
<td>0.03</td>
<td>4</td>
</tr>
<tr>
<td>( \Pi_b )</td>
<td>2</td>
<td>0.9</td>
<td>0.02</td>
<td>0.06</td>
<td>3</td>
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<tr>
<td>( \Pi_c )</td>
<td>2</td>
<td>0.9</td>
<td>0.02</td>
<td>0.15</td>
<td>2</td>
</tr>
<tr>
<td>( \Pi )</td>
<td>2.0</td>
<td>0.95</td>
<td>0.02</td>
<td>0.16</td>
<td>3</td>
</tr>
<tr>
<td>( \Pi_a )</td>
<td>3.2</td>
<td>0.95</td>
<td>0.02</td>
<td>0.16</td>
<td>3</td>
</tr>
<tr>
<td>( \Pi_b )</td>
<td>1.7</td>
<td>0.9</td>
<td>0.02</td>
<td>0.16</td>
<td>3</td>
</tr>
<tr>
<td>( \Pi_c )</td>
<td>1.7</td>
<td>0.9</td>
<td>0.02</td>
<td>0.16</td>
<td>3</td>
</tr>
<tr>
<td>( \Pi_d )</td>
<td>4</td>
<td>0.82</td>
<td>0.02</td>
<td>0.2</td>
<td>4</td>
</tr>
<tr>
<td>( \Pi_e )</td>
<td>4</td>
<td>0.82</td>
<td>0.02</td>
<td>0.07</td>
<td>4</td>
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</tbody>
</table>

\[ \text{INCHES} \]

\[ \text{3600 RPM} \]

\[ 1700 \]

- Spin test at WADC, Dayton, OHIO

- \( \checkmark \) means test results obtained & published
### Characteristics of Research Propellers

<table>
<thead>
<tr>
<th>Phase</th>
<th>J</th>
<th>( M_d )</th>
<th>((h/b)_{TIP})</th>
<th>((h/b)_{SPINNER})</th>
<th>( \sigma )</th>
<th>( B )</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>2.0</td>
<td>0.9</td>
<td>0.02</td>
<td>0.03</td>
<td>0.16</td>
<td>4</td>
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<tr>
<td>III</td>
<td>2.0</td>
<td>0.9</td>
<td>0.02</td>
<td>0.11</td>
<td>0.16</td>
<td>4</td>
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<tr>
<td>IV</td>
<td>2.0</td>
<td>0.9</td>
<td>0.02</td>
<td>0.11</td>
<td>0.16</td>
<td>2</td>
</tr>
<tr>
<td>Va</td>
<td>2.2</td>
<td>0.95</td>
<td>0.02</td>
<td>0.08</td>
<td>0.154</td>
<td>3</td>
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<tr>
<td>Vb</td>
<td>3.2</td>
<td>0.95</td>
<td>0.02</td>
<td>0.08</td>
<td>0.154</td>
<td>3</td>
</tr>
</tbody>
</table>

\( \checkmark \) means test results obtained & published
Test apparatus - Propellers

Propellers, Supersonic

Propellers - Aeroproducts

Instruments - Torque meters

Airfoils - NACA 16-series

Airplanes - McDonnell F-88B

Author

The NACA propeller research vehicle, the McDonnell XF-88B airplane, is described. Results of flight investigation made with this vehicle to determine the aerodynamic characteristics of a supersonic propeller at the design Mach number of 0.95 and the design advance ratio of 2.2 are presented. At these design conditions the propeller efficiency was determined to be 79 percent. At the maximum test Mach number (M = 1.01 the propeller efficiency was measured to be 78 percent.

1959

Sound - Propellers

Sound - Propellers - Pressure

Propellers, Transonic

Propellers, Supersonic

Sound - Engines, Turbo-propeller

Propellers, Three-blade

Propellers - Speed

NASA MEMO 4-18-59L

NOISE SURVEY UNDER STATIC CONDITIONS OF A TURBINE-DRIVEN TRANSONIC PROPELLER WITH AN ADVANCE RATIO OF 4.0. Max C. Kurbin.


NASA CC-L-170

Author

Overall sound-pressure levels and frequency spectra of the noise emitted from a three-blade, 6.85-foot-diameter propeller have been measured. The results are compared with similar results obtained from a supersonic propeller having an advance ratio of 2.2 and from a modified supersonic propeller having an advance ratio of 3.2. The effects of power changes on the noise levels and spectra are also shown.

1959

Sound - Propellers

Sound - Propellers - Pressure

Propellers, Transonic

Propellers, Supersonic

Sound - Engines, Turbo-propeller

Propellers, Three-blade

Propellers - Speed

NASA RM L55I21.

CONFIDENTIAL


NACA RM L55I21.

(M = 0.6 to 0.9; advance ratio = 2.2; power

coefficient = 0.26; & forward M = 0.95; altitude = 20,000 ft.)

638
Propellers, Supersonic

Overall sound-pressure levels and frequency spectra of the noise emitted from a 10-foot-diameter, 1,700-rpm, three-blade modified supersonic propeller mounted on a turbine-powered airplane have been measured under static conditions around a circle with a 100-foot radius about the propeller hub. The results are compared with the results from a supersonic and a conventional subsonic propeller. The effects of power and rotational speed change on the noise levels and spectra are also shown. (Test vehicle is the XF-88B).

Propellers, Three-blade

NACA 1958

Propellers - Characteristics
Propellers - Vibration
Propellers - Stresses
Propellers - Aerodynamics
Airfoils - NACA 16-series


Authors (2)

Results of a flight investigation of a modified supersonic propeller at the design Mach number of 0.95 indicated a propeller efficiency of approximately 79 percent. The departure from optimum angle of advance has a small effect for the advance ratios investigated.

Propellers, Supersonic

1958

Effect of compressibility

Airfoils - Propeller sections
Airfoils - Thickness
Propellers - Pitch
Propellers - Aerodynamics (mod.)
Airplanes - McDonnell F-88B (Amer.)
Propellers, Supersonic


NACA TN 2851.

Design considerations of the propellers and equipment for the XF-85 propeller flight research vehicle, by L. A. Hine. June 3, 1953. 14 p., illus. LAL RESTRICTED

Contract AF-33(03)-11861.
Flight tests show the aerodynamic performance of a supersonic propeller to be good, the propeller efficiency being about 80% at the design conditions & only slightly less at M = 1.0. This good performance is obtained with no penalty in structural capability but with greater noise production, the noise level being roughly equivalent to a turbojet. When equated into terms of propulsive efficiency it is shown that the supersonic propeller turbine has 3/4 higher propulsive efficiency at a M = 0.9 than a turbojet assuming the same thermal efficiency of gas generators. This would show up as a direct improvement in fuel economy so that when long-range operation is considered, which must of necessity be at Mach numbers below the drag rise, the supersonic propeller turbine must be considered in analyzing the propulsive system requirements.