LV MEASUREMENTS WITH AN ADVANCED TURBOPROP

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Nonintrusive measurements of velocity about a spinner-propeller-nacelle configuration have been made at a Mach number of 0.8. A laser velocimeter (LV) specifically developed for these measurements in the NASA Lewis 8 × 6 Foot Supersonic Wind Tunnel was used to determine the flow field of the advanced swept SR-3 propeller (fig. 1). The LV system development was previously discussed by J. P. Greissing and D. L. Whipple and by R. J. Freedman (papers 26 and 27 of this compilation). The data will be used to study the flow and to verify computer prediction codes. The purpose of this presentation is to demonstrate the usefulness of the LV data in detecting flow anomalies and to substantiate the data quality.

Some typical results are shown in figure 2. Mach number profiles at the entrance of the propeller are compared with theoretical predictions. The LV data is in excellent agreement with the axisymmetric, compressible, inviscid theory (without blades) ahead of the propeller except near the hub. The data indicate blade blockage near the spinner. Blade to blade variations in axial velocity for four radial positions at the propeller exit are also shown. The large apparent wake near the hub is associated with the hub choking.

Measurements were also made within the blades. An example is shown in figure 3. The blade to blade variation of axial velocity ahead of a shock within the blade passage is shown. This shock was not predicted by the current lifting line propeller analysis.

This data set represents the first opportunity to study the flow field within and about an advanced swept propeller while operating at design operating conditions. The system described by J. P. Greissing and D. L. Whipple and by R. J. Freedman has provided repeatable and consistent data and work is continuing on the application of this data to propeller research.

Figure 1.- SR-3 propeller installed in NASA Lewis 8 × 6 Foot Supersonic Wind Tunnel.

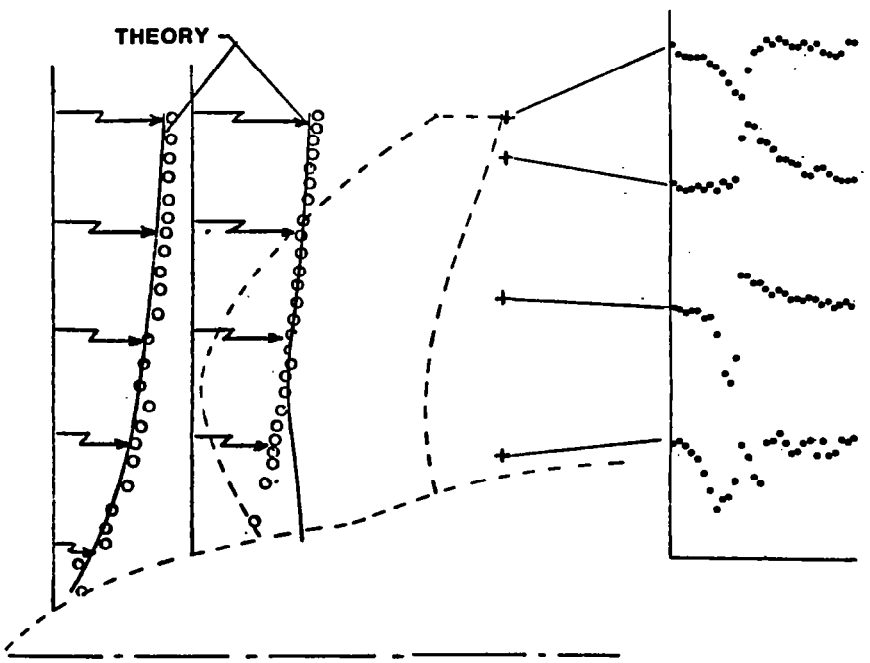

Figure 2.- SR-3 LV velocity measurements.

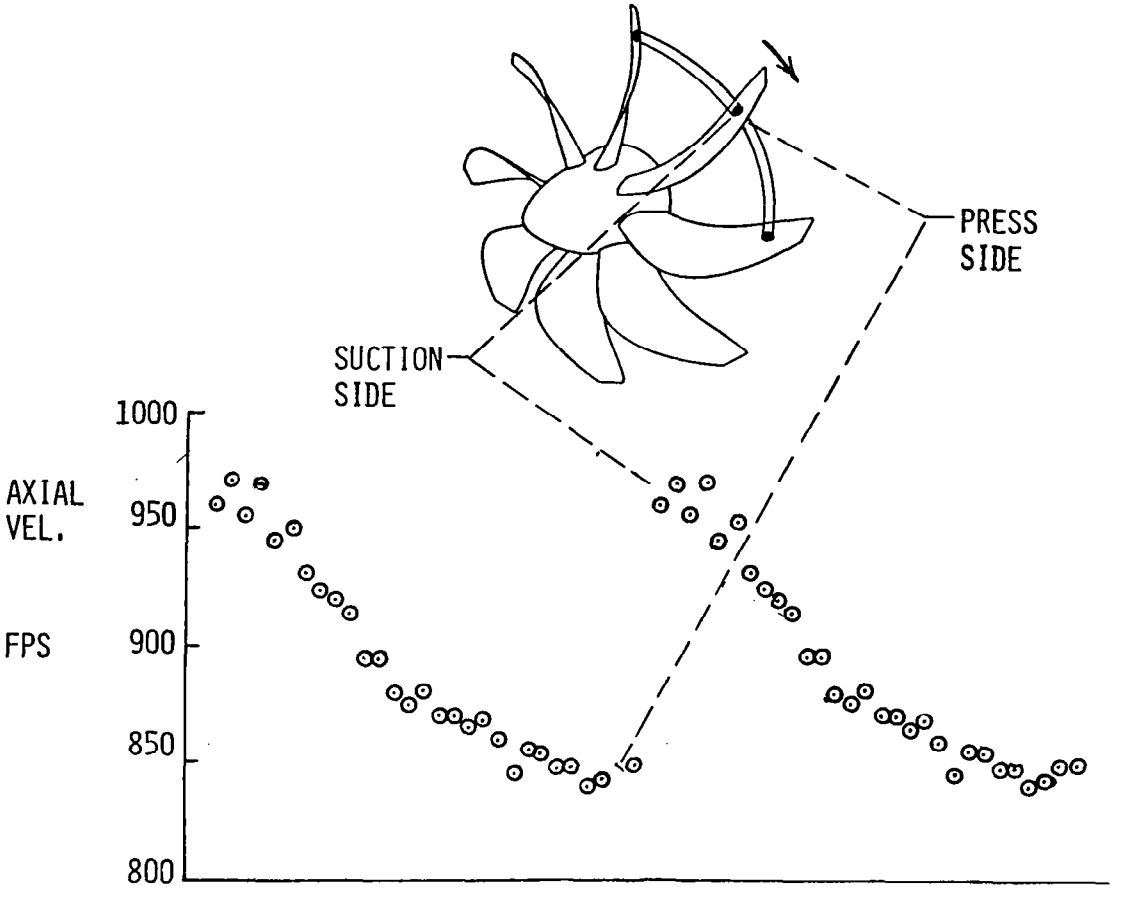

Figure 3.- Laser intrablade velocity for SR-3 propeller. M = 0.8; C_p = 1.8; J = 3.06.