Technical Comments

Comment on "Aerodynamic Measurements About a Rotating Propeller with a Laser Velocimeter"

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LEPICOVSKY and Bell[1] showed very interesting results of a propeller velocity field survey by means of a laser velocimeter.

In the text, the authors state that there is a negative "prewhirl" in front of the propeller blade very close to the leading edge. The commentators think that this stems from the leading-edge stagnation flow and subsequent high flow velocity toward the suction side; therefore, it should be taken as propeller-induced local flow rather than prewhirl. This kind of flow appears typically as a velocity jump type variation in the tangential and/or axial component of velocity, as indicated in Fig. 8 at $x/D = -0.038$. To get a clearer idea, reference is made to the attached Fig. 1 in which the flow near the leading edge of a blade section is schematically shown. From this figure, the variation of velocity components can be qualitatively reconstructed as shown on the bottom of Fig. 1.

At the David W. Taylor Naval Ship R&D Center (DTNSRDC) there have been propeller velocity field measurements conducted by laser velocimeter, using model marine propellers in a circulating water tunnel, and similar results were obtained[2] (see Fig. 2). These measurements indicate the high spatial and frequency resolutions of a laser velocimeter. The reader is also referred to Ref. 3 for the velocity field measurement in the propeller slipstream.

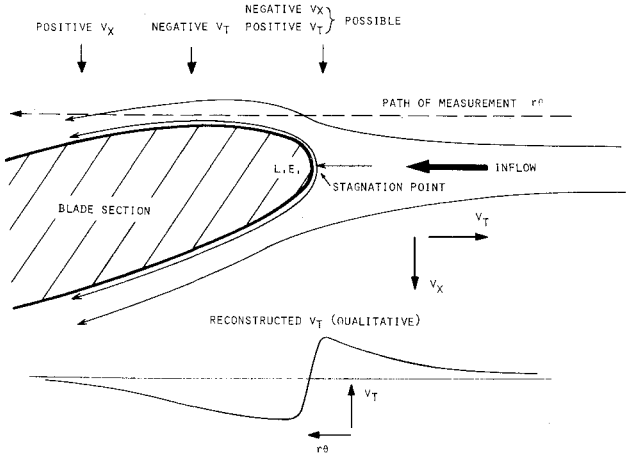

Fig. 1 Local flow near the blade leading edge.

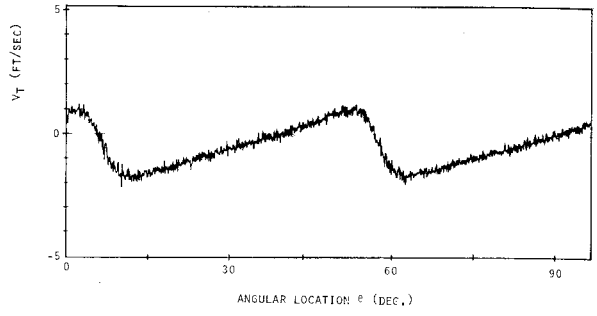

Fig. 2 Tangential velocity component measured very close to the leading edge of a marine propeller.

[1]Lepicovsky, J. and Bell, W. A., "Aerodynamic Measurements About a Rotating Propeller with a Laser Velocimeter," *Journal of Aircraft*, Vol. 21, April 1984, pp. 264-271.

[2]Jessup, S. D., Schott, C. G., Jeffers, M. F., Jr. and Kobayashi, S., "Local Propeller Blade FLow in Uniform and Sheared Onset Flows Using LDV Technique," *Proceedings of the 15th ONR Symposium on Naval Hydrodynamics*, Hamburg, Federal Republic of Germany, Sept., 1984.

[3]Kobayashi, S., "Propeller Wake Survey by Laser-Doppler Velocimeter," *Proceedings of International Symposium on Applications of Laser Anemometry to Fluid Mechanics*, Lisbon, July, 1982, see also *Laser Anemometry in Fluid Mechanics*, Ladoan-Instituto Superior Técnico, Lisbon, 1984, pp. 195-209.

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Reply by Authors to S. Kobayashi and S. D. Jessup

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WE would like to thank Kobayashi and Jessup for their interest in our work and for their valuable discussion. We think that their comment is correct. The flow pattern in the vicinity of the blade leading edge should be taken as propeller-induced local flow as indicated in Fig. 2 of the Comment. The reconstruction of the velocity field in the vicinity of the blade leading edge, as they recommended, is actually made in the form of vector plots in Fig. 5.9 a-j of Ref. 14 in the original paper.

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