TITLE: Feasibility Study of a Procedure to Detect and Warn of Low-Level Wind Shear

RESEARCH INVESTIGATORS: Walter Frost
FWG Associates, Inc.
Tullahoma, Tennessee 37388

Dennis W. Camp
ED42 Atmospheric Sciences Division
NASA/MSFC
Marshall Space Flight Center, AL 35812

SIGNIFICANT ACCOMPLISHMENTS TO DATE IN FY-83:

The results of the previous three years of contract efforts relative to understanding and modelling wind shear and detecting wind shear with radar were summarized into a final report. Because much of this effort had culminated into the JAWS program and 1982 and 1983 funds were directed toward JAWS, the effort under the NAS8-33458 contract was directed toward monitoring the JAWS field program and toward providing guidance and technical support in terms of the aircraft performance.

FOCUS OF CURRENT RESEARCH:

The wind shear program is now directed toward investigating the effects of wind shear on aerodynamic performance. Combining the JAWS wind shear data with the B-57B gust gradient data, the transient scales of motion involved in wind shear aircraft accidents or mishaps are being identified. The effect of variable winds having these time scales on the aerodynamic coefficients of moist airfoils has not been fully investigated. Transient and spatial variation of flow over the airfoil may cause premature stall or hysteresis effects which significantly impact the lift and drag (i.e., aerodynamic coefficients). Analysis of airfoil performance subject to 4-D variable flows will be carried out.

PLANS FOR FY-84:

Determine the effect of a highly varying velocity gradient on the drag coefficient (C_D), lift coefficient (C_L), moment coefficient (C_M), and pressure coefficient (C_p) for airfoil configurations of generic types of aircraft.

Repeat the Frost and Hutto (1974) analytical study on the influence of wind shear on aerodynamic lift and drag and on roll and yaw moments of typical aircraft using experimental gust gradient data obtained in the NASA B-57B Gust Gradient Program and the JAWS project.

Study the effect of lateral and longitudinal gust gradients on flow separation and and reattachment (separation bubble) on the wing of typical aircraft and develop the necessary theory and governing equations to proceed with computer program development.

LIST OF PUBLICATIONS:

1. Walter Frost: "Flight in Low-level Wind Shear," NASA CR3678; March, 1983.

2. Walter Frost: "Low-Level Wind Variability Effects on Aircraft Performance," presented to National Academic of Science Committee on Wind Shear.

3. Walter Frost and Enice Hutto: "The Influence of Wind Shear on Aerodynamic Coefficients," Proceedings of the Sixth Conference on Aerospace and Aeronautical Meteorology of the American Meteorological Society; November 12-15, 1974; El Paso, Texas; Am. Met. Soc., Boston, Mass.