

TITLE: Low-Level Flow Conditions Hazardous to Aircraft

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SIGNIFICANT ACCOMPLISHMENTS TO DATE IN FY-83:

Low-level flow conditions known to be hazardous to aircraft during takeoff/climbout and approach/landing operations are turbulence, wind shear, and vertical motion. These conditions can and frequently do occur separately and in combinations.

The identification and selection have been completed of representative data cases to determine magnitude, frequency, duration, and simultaneity of occurrence of turbulence (gustiness and gust factor), wind shear (speed and direction), and vertical motion (updraft and downdraft), along with temperature inversions.

New representations of temporal and spatial variations in the atmospheric boundary layer have been developed.

Efforts continue relative to low-level flow conditions where published results imply strong vertical shear with virtually no horizontal shear and where order-of-magnitude analyses of the equations of motion for an aircraft illustrates that low values of horizontal shear (along the flight path) are much more hazardous than larger values of vertical wind shear (altitude).

Other areas where efforts are continuing are relative to:

- (1) research to resolve the magnitude of maximum downdrafts and the heights at which they occur, and
- (2) measurements of low-level wind shear and turbulence in stable flows as typically found during the nighttime.

FOCUS OF CURRENT RESEARCH ACTIVITIES:

Recognition of hazardous conditions during the critical landing and takeoff phases of flight has mandated studies to detect and measure these conditions. But relatively little high-resolution data from meteorological towers and/or aircraft are available to determine realistic values. The 150- and 18-meter towers at the Ground Winds Tower Facility located midway between Launch Complex 39B and the Space Shuttle runway at Kennedy Space Center, Florida, are unique sources of high-resolution wind and temperature profile measurements to be fully exploited.

World Meteorological Organization recommended practices will be adhered to when possible, viz., for aviation climatology: wind-averaging periods not exceed 10 minutes, gust-measuring periods be at least 5 seconds, temperature measurements be at 1.25 to 2 meters above ground level, etc.

PLANS FOR FY-84:

Statistical summaries and descriptions of low-level flow conditions from data recorded at the KSC Ground Winds Tower Facility will be prepared. These summaries and descriptions will be used for information, comparisons, and flight simulation purposes. It is expected that these statistics will provide some insight into all aspects of the various wind shear conditions that affect flight through the atmosphere.

RECENT PUBLICATIONS:

Significant Events in Low-Level Flow Conditions Hazardous to Aircraft, Margaret B. Alexander and Dennis W. Camp, NASA TM-82522, January 1983.