TITLE: B-57B Gust Gradient Program

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SIGNIFICANT ACCOMPLISHMENTS TO DATE IN FY-83:

Analysis of data obtained from the Joint Airport Weather Studies (JAWS) Flights 6 and 7 is underway. Data from Flight 7 indicate that the B-57B encountered the upper portion of an outflow feature (microburst) at an altitude of 400 meters above ground level. Horizontal wind vector plots along the flight path have provided clues concerning the meteorological setting of the flights. In addition to suspected outflow features, wavelike variations of the horizontal wind vectors were observed.

Statistical studies of gust gradients were undertaken with the goal of fitting probability density functions to the data. As expected, the density functions were highly non-Gaussian. Spectral analyses are proceeding and several spectral models for the gust gradient data are being investigated.

FOCUS OF CURRENT RESEARCH ACTIVITIES:

The ultimate goal of the Gust Gradient Program is to provide models useful for aeronautical vehicle design and flight simulation. Recently, a new method of atmospheric turbulence simulation was proposed, which provides a framework for utilizing JAWS data for flight simulation. The technique provides a framework for using the JAWS data and is particularly suited for Doppler radar data.

Additional efforts consist of preparation for data flights at MSFC in conjunction with the Eight Tower Array and the NASA Lidar, and for flights at the National Severe Storm Laboratory (NSSL) at Norman, Oklahoma. The NSSL flights will be in conjunction with the Spring Storm Observations Program.

PLANS FOR FY-84:

Development of the mathematical details of the 4-D wind simulation model are being completed. During the remainder of FY-83 the mathematics and a demonstration computer code will be developed and documented.

Spectral analysis of the gust gradient data will continue with analysis of additional JAWS data, and some data obtained at the NASA Dryden Flight Research Facility.

Correlations of flight data with JAWS radar tapes are planned. Some tapes have already been received from the National Center for Atmospheric Research for use in these correlations.

Additional data flights are planned in May at MSFC and at NSSL. The Gust Gradient team will go to each of these locations for the tests.

RECOMMENDATIONS FOR NEW RESEARCH:

The 4-D wind model requires certain inputs from the JAWS data. The model may require a slightly different slant on the JAWS data analysis. Some effort should be made to determine the most efficient way to interface the model with the JAWS data analysis.

Gust gradient data can provide extremely useful inputs to the model. The flight data should be analyzed to provide these inputs. The required type of analysis has been reported in the literature and is available at minimal cost using slight modifications of currently available computer codes.

LIST OF PUBLICATIONS PREPARED SINCE JUNE 1982:

1. Campbell, Warren and Walter Frost: "NASA's B-57B Gust Gradient Program," presented at the NASA/MSFC FY-82 Atmospheric Processes Research Review, October 19-21, 1982.

2. Campbell, Warren: "A Cursory Glance at Results from NASA's B-57B Gust Gradient Program," presented at the Sixth Annual Workshop on Meteorological and Environmental Inputs to Aviation Systems, October 1982.

3. Camp, Dennis, Warren Campbell, Walter Frost, Harold Murrow, and Weneth Painter: "NASA's B-57B Gust Gradient Program," Presented at the AIAA 21st Aerospace Sciences Meeting, Reno, Nevada, January 1983 and accepted for publication in Journal of Aircraft.

4. Campbell, Warren, Dennis Camp and Walter Frost: "An Analysis of Spanwise Gust Gradient Data," to be presented at the AMS/AIAA 9th Conference on Aero-Space and Aeronautical Meteorology at Omaha, Nebraska, June 1983.

5. Frost, Walter, and Dennis Camp and Warren Campbell: "Spanwise Turbulence Modeling," to be presented at the AMS/AIAA 9th Conference on Aerospace and Aeronautical Meteorology at Omaha, Nebraska, June 1983.

6. Campbell, Warren: "A Conceptual Framework for Using Joint Airport Weather Studies (JAWS) Data for Flight Simulation," submitted as a NASA Technical Publication, March 1983.