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SIMULATOR MANUFACTURERS' REQUIREMENTS

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Introduction

As simulator manufacturers, we must continue to provide to our customers the latest wind shear models available for pilot training. The release of the JAWS data package enabled us to provide a much more realistic wind shear package to our customers rather than just the standard six SRI wind shear profiles currently in use. In this brief presentation, the steps taken in implementing the JAWS data into our FAA 727 simulator are highlighted.

Implementation of the JAWS Data Package

The entire data set was loaded into one of our development computers to conduct some preliminary testing. We decided to select a subset of the JAWS data for the simulator since we did not believe that it was necessary to have the whole data set available on the simulator.

We were provided with time histories of a standard three-engine missed approach flown on our United Airlines 727 simulator (see Figures 1 and 2), which the FAA requested us to use as a baseline for evaluating the severity of the microburst data. Choosing the origin of the microburst as shown in Figure 3 and placing this origin at the touchdown point, several missed approaches were tried along the suggested flight paths. The effects of the microburst on altitude, airspeed and pitch angle are shown in Figure 4. Since there was no corrective action taken by the pilot, and there was no provision for altering the initiation of the go-around procedure, these results clearly do not imply that ground contact is inevitable in this case, but only that this microburst is severe enough to indicate that standard procedures are not sufficient to survive this encounter.

After demonstrating several of these automated missed approaches to the FAA, it was decided to implement the entire region shown in Figure 3, which measures 6.6 km^2, into the simulator. We feel that we are providing the FAA with a reasonably large region of the JAWS data to evaluate which includes severe, moderate, and weak wind shear flight paths.

Instructor Station Control of the JAWS Data

In order to provide flexibility to the instructor, the data has been implemented in such a way that the origin of the microburst (whose default position is centered at the touchdown point and orientation along the runway heading) may be translated relative to the touchdown point, and the orientation of the data block may be rotated, facilitating the task of evaluating the various flight paths (see Figure 5). In addition, although physically unrealistic, the FAA requested that the base altitude of the microburst be adjustable if necessary so as to inhibit ground contact during evaluation and training.

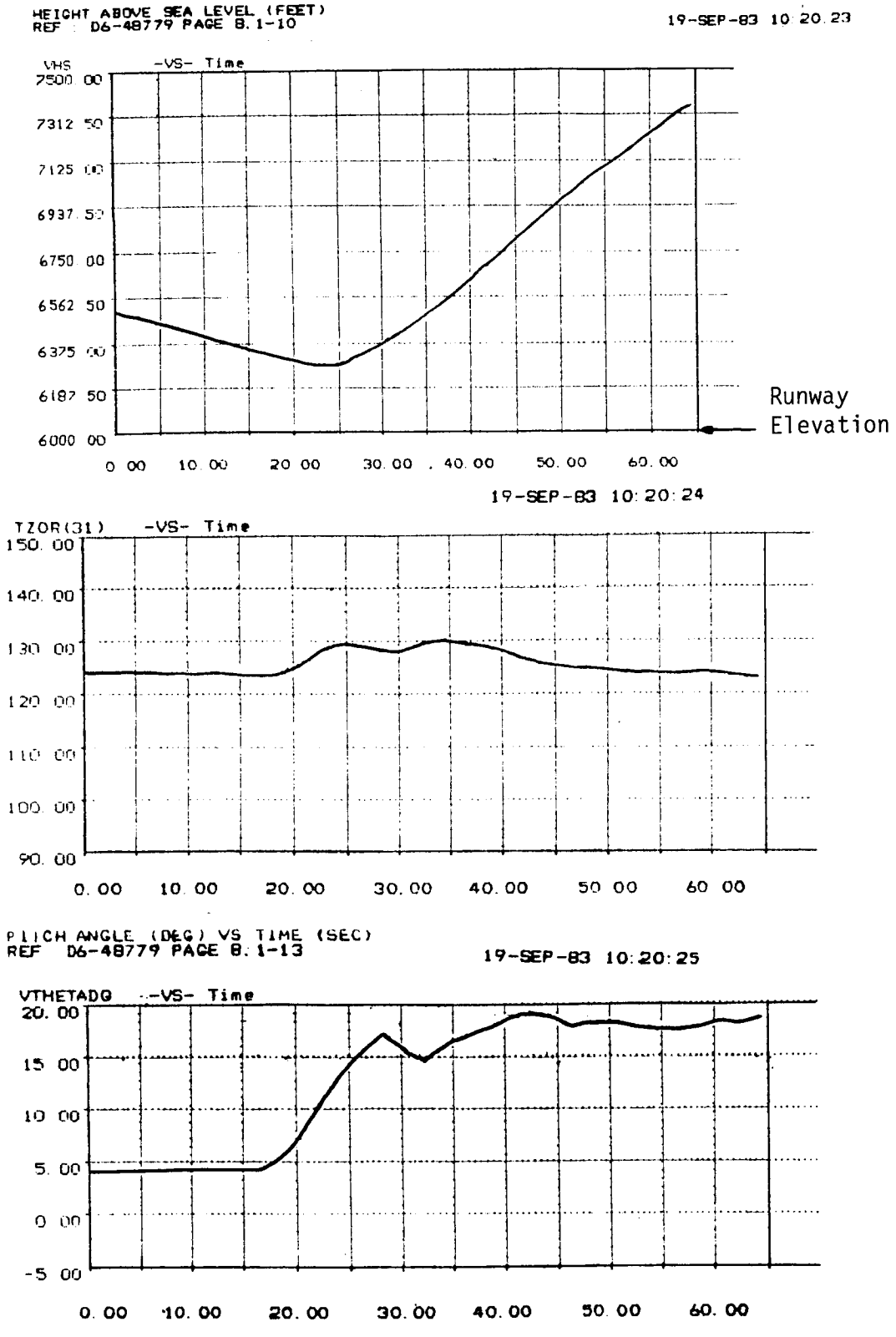


Figure 1. Altitude, airspeed, and pitch angle time histories of a standard three-engine missed approach.

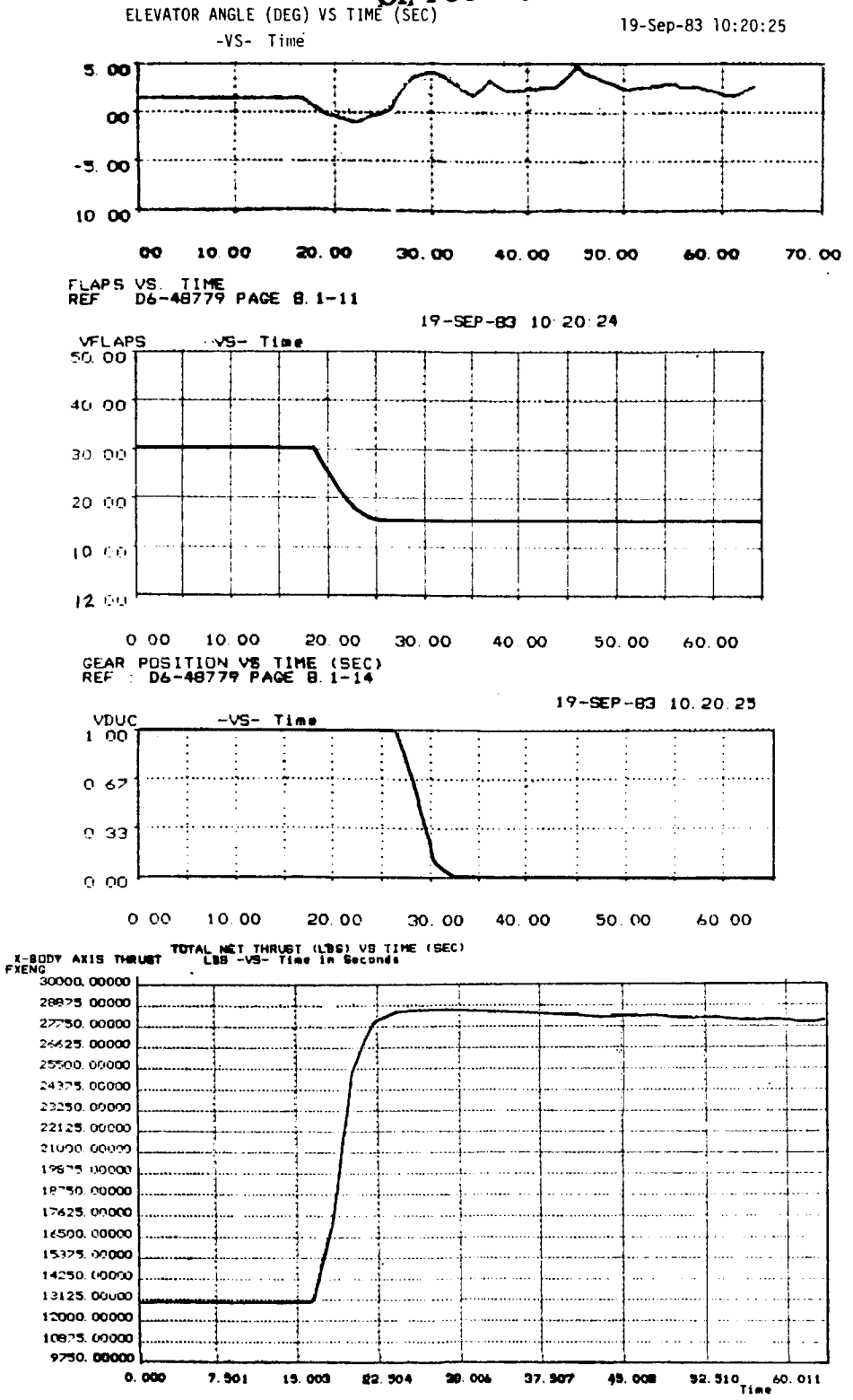


Figure 2. Elevator, flap, gear, and thrust time histories of a standard three-engine missed approach.

FLIGHT PATHS OVERLAID ON HORIZONTAL WIND SPEED VECTORS

WIND FIELD AT GROUND LEVELS

August 5, 1982 Data Set

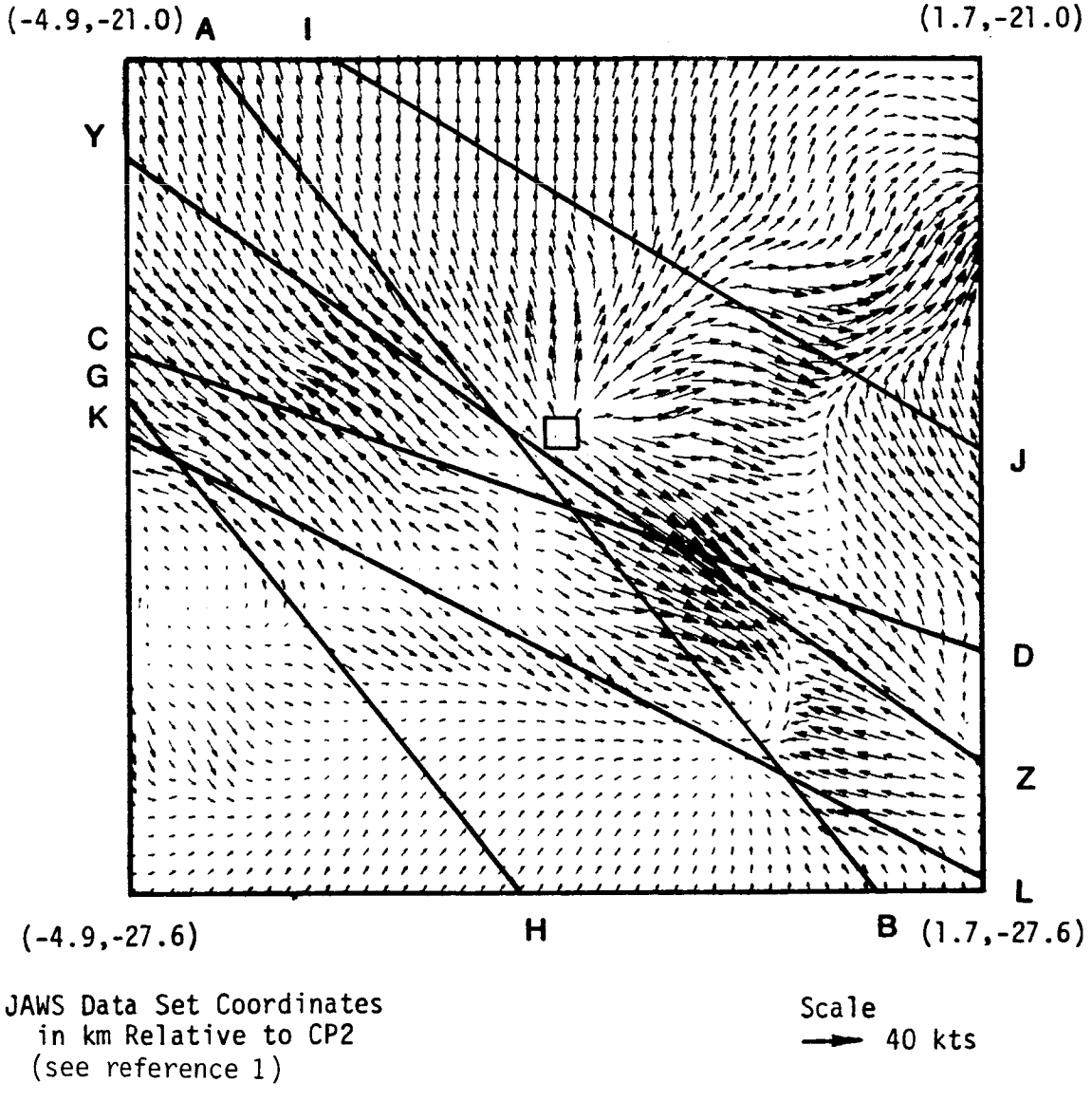


Figure 3. Region of JAWS data used in the simulator.

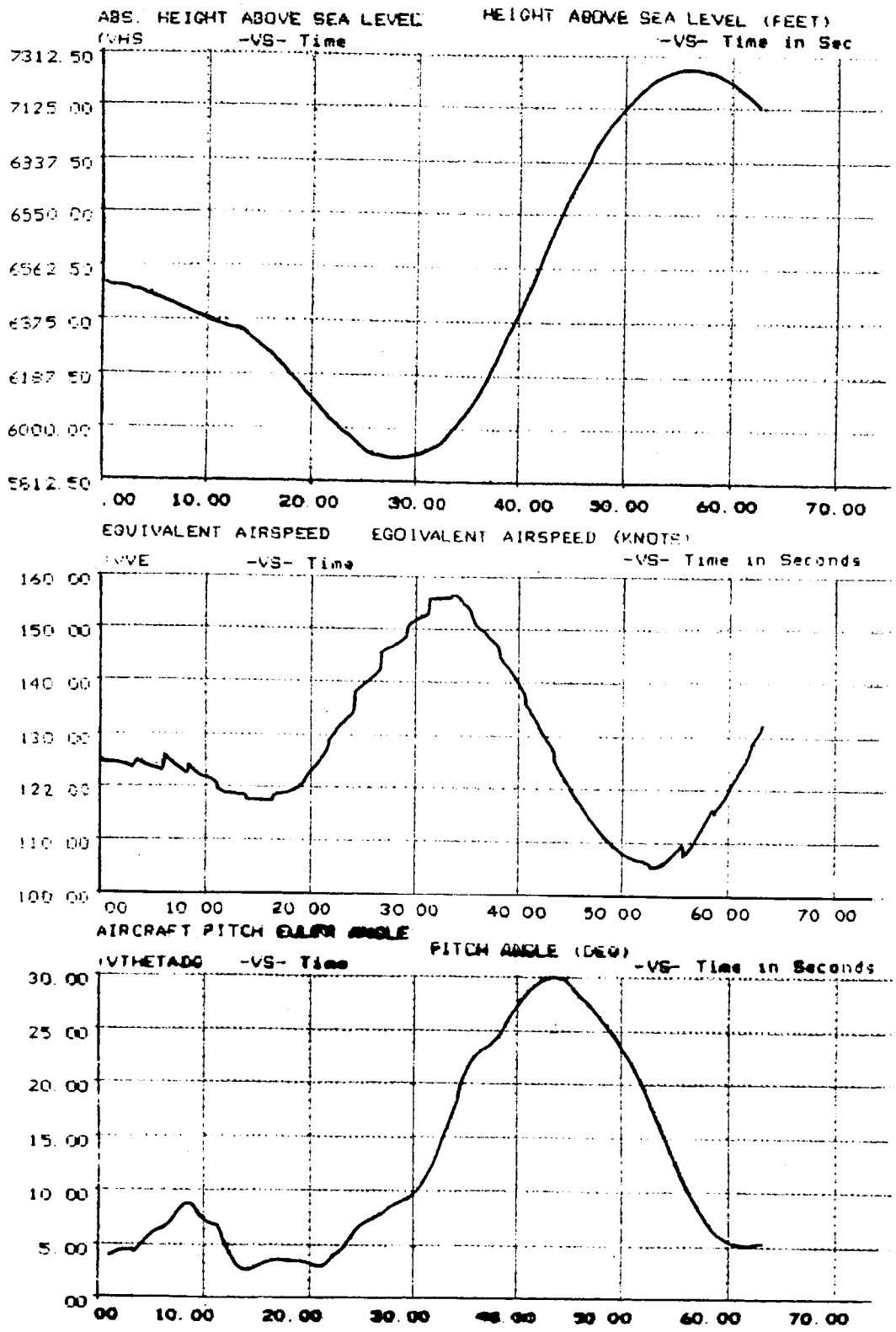
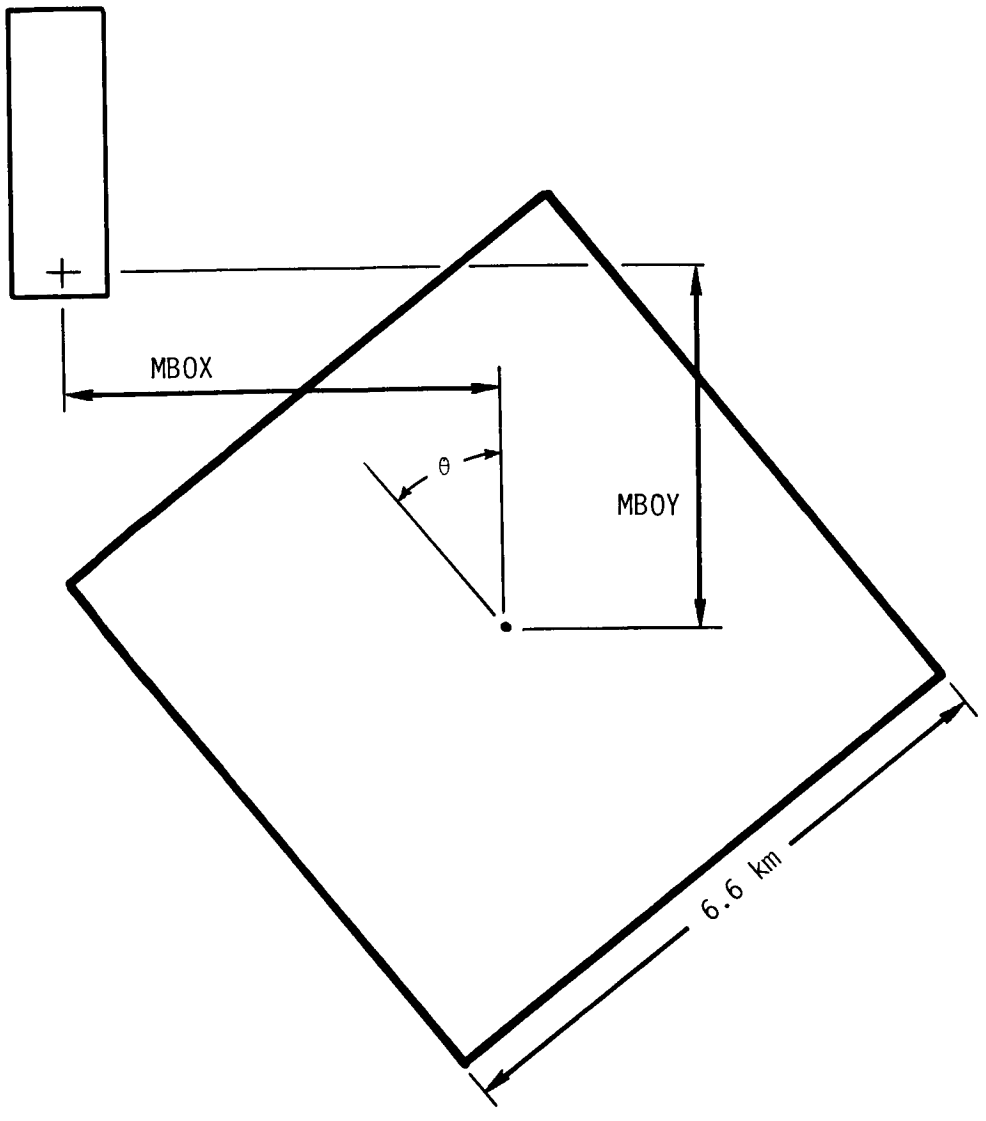


Figure 4. Altitude, airspeed, and pitch angle time histories of a standard three-engine missed approach flown through the center of the microburst.



MBOX - Microburst origin lateral offset

MBOY - Microburst origin longitudinal offset

θ - Angle of rotation with respect to runway heading

Figure 5. Parameters used to modify microburst location and orientation.

To further the evaluation of pilot performance during approach and landing, it will also be possible to superimpose a plot of the microburst region on the ILS graph as shown in Figure 6. The instructor may then monitor the entry into the microburst, the glidepath and localizer deviation and airspeed while flying through the microburst and on through to touchdown or go-around. A hard copy may then be obtained for further study.

Summary

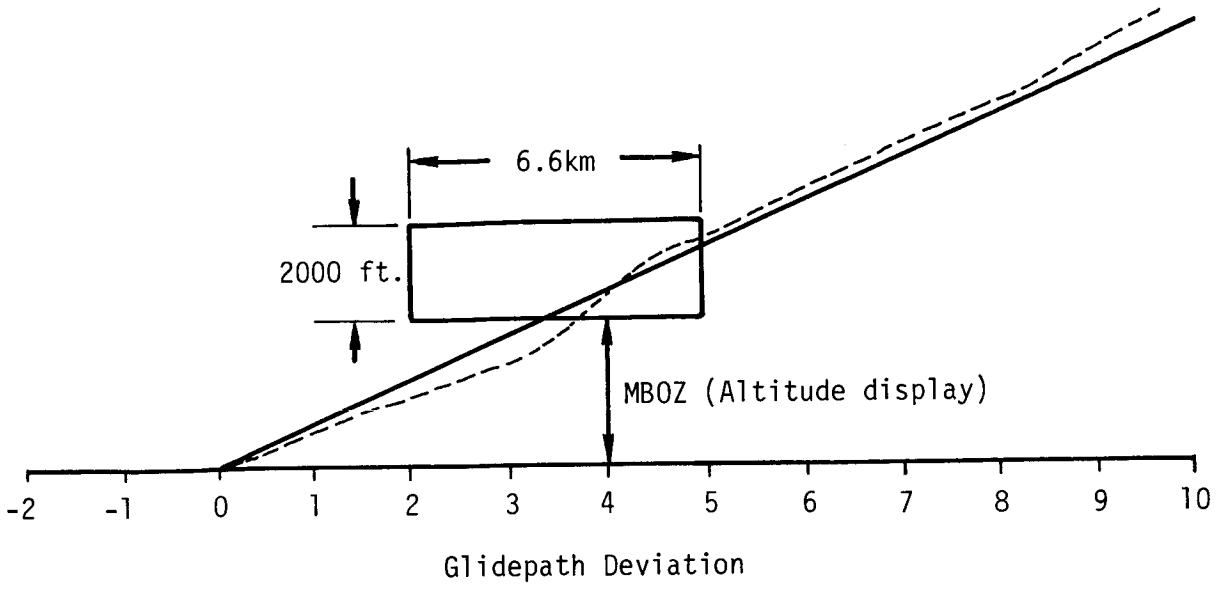
Although we have no feedback from pilots as of yet, we feel that the JAWS data set will provide far more realistic and difficult wind shear profile encounters than what is presently used and should, therefore, provide better training value. From a manufacturers point of view, the major questions to be answered are:

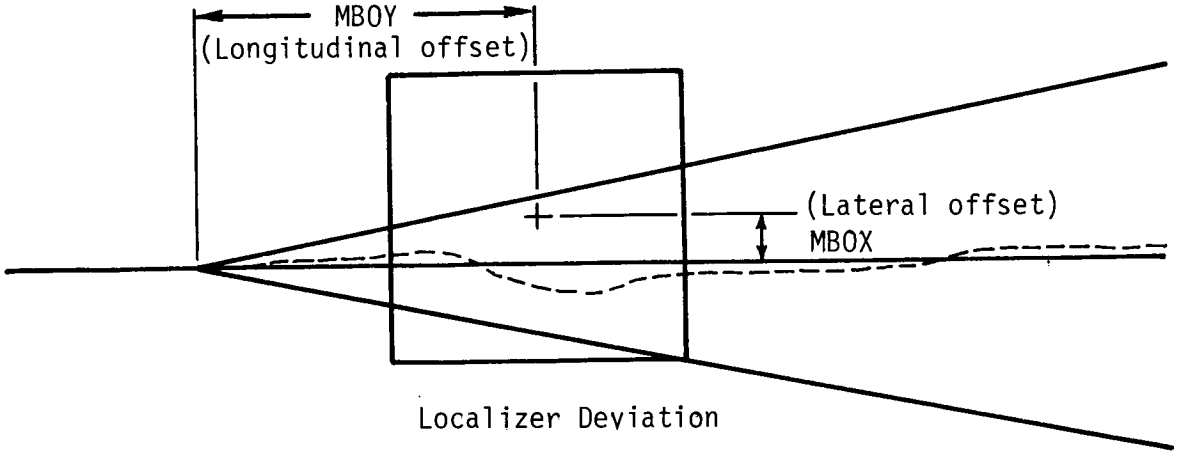
1) Would an analytical model of a microburst which is under our control be more useful in pilot training than the JAWS data?

2) Are much simpler models, which would still require similar flight path control measures, sufficient for training purposes?

REFERENCE

1. JAWS Project Operations Summary 1982. National Center for Atmospheric Research, Boulder, CO, 1983.





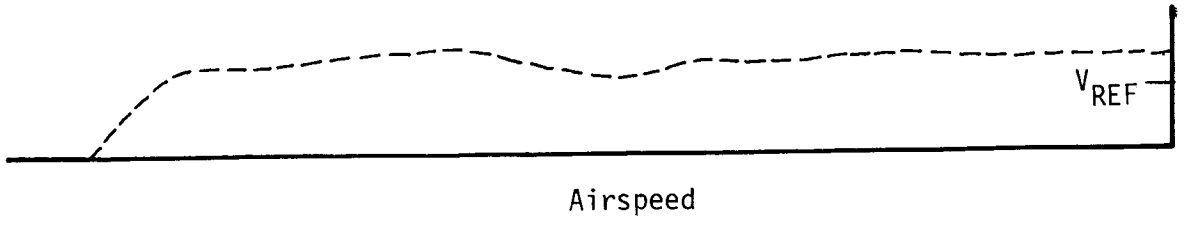


Figure 6. Example of the ILS approach plot with the microburst region displayed.