



# AEROSPACE INFORMATION REPORT

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 Lexington Ave., New York, N. Y. 10017

AIR 771

Issued 10-31-66

Revised

## VISUAL SIMULATION FOR GENERAL FLIGHT SIMULATOR/TRAINER ATTACHMENT

### FOREWORD

In order to provide a useful guide for designing a visual attachment for a flight simulator consistent with the training requirements imposed by modern commercial operations and the state of the simulator art, a group of knowledgeable specialists in training and equipment simulation were called upon. The following information report is based on their experience in both the equipment and training areas and represents the best statement they believe currently possible. As more objective learning data becomes available and the state-of-the-art in simulation advances, it is the intention of this committee to continue to pursue this area to up-grade these recommendations.

The committee recognizes that "perfect visual simulation" is not currently possible. In preparing this information report only those variables are included which are considered critical to visual flight for the specified conditions. The recommended performance values are minimums. They should, if possible, be exceeded. It is the considered opinion of the committee that designs falling below these minimums will seriously compromise the simulator's use for learning the desired skills.

If visual attachments to flight simulators are to improve in value, it is essential that objective data be obtained as learning aids to demonstrate the contribution they make. Only through objective assessment can appropriate design changes be incorporated in follow-on designs.

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JUN 1992

## 1. REFERENCES

- 1.1 AIR 837-A Guide For Training Equipment Development. \*
- 1.2 Buddenhagen, T. F., and Wolpin, M. P.: A Study of Visual Simulation Techniques for Astronautical Flight Training, WADD Technical Report 60-756, ASTIA Document AD 260093, March 1961.
- 1.3 Connant, J. E., Smith, G. D., and Jeffries, N. T.: Final Report, Design Study - VFS-2; for National Aeronautics and Space Administration, Flight Research Center, Melpar, Inc. Report SS1211, 4 October 1962.
- 1.4 Molnar, Andrew R., and Lybrand, William A.: Basic Development Accomplished on Wide-Angle, Non-Programmed, Visual Presentations, Volume I, Technical Report: ASTIA Document No. AD 227192, and Volume II, Technical Report: ASTIA Document No. AD 227193.
- 1.5 Muckler, F. A., Nygaard, J. E., O'Kelly, L. L., and William Jr., A. C.: Psychological Variables in the Design of Flight Simulators for Training WADC TR 56-369, ASTIA Document No. AD 97130, January 1959.
- 1.6 Altes, S. K., and Chu, J. H.: Feasibility Study in Wide Angle TV Displays: ASTIA Document No. AD 273486, 14 November 1956, Reprint, 1 February 1962.
- 1.7 Clay, B. R., Kidd, M. C., Whistler, Rand, Wendt, H. W.: Investigation of 360-Degree Non-Programmed Visual Presentation, U. S. Naval Training Device Center, Technical Report: NAVTRADEVCEEN 1053-1, ASTIA Document NO. AD 291468, 5 June 1962.

## 2. INTRODUCTION

- 2.1 The purpose of this visual simulator attachment in conjunction with the aircraft flight simulator is to indoctrinate, train, and/or check transport crews in coordination and emergency procedures over a range of altitudes during all-weather day and night operation. Procedures such as listed in paragraph 4.1 of this document would require a range of altitude primarily oriented to that flight regime of landing and take-off.
- 2.2 The visual simulator is to provide those important visual cues of the real world to flight personnel operating flight simulators/trainers in training programs. The major contributing characteristics are appropriate relative motion, image size, detail resolution, and the outside world with respect to the vehicle, resulting from operator control of the simulated aircraft.

## 3. GENERAL REQUIREMENTS OF VISUAL SIMULATOR ATTACHMENT (See AIR 837)

- 3.1 The visual simulator, as an attachment to various flight simulators, should be capable of presenting what the crew sees out the window of a cockpit: specifically, as viewed, a display of large angle and correct image size. Scene brightness shall be varied at a rate that will be imperceptible to the crew. Contrast must be sufficient to maintain a realistic ratio between light and dark objects over the brightness range of these scenes.
- 3.2 The visual attachment when used in conjunction with a flight simulator is to include means for making a holding pattern\*\* and approach to an airport under conditions of minimum ceiling and visibility.

\*Published by Society of Automotive Engineers, Inc., 485 Lexington Avenue, New York, N. Y. 10017

\*\*As defined by FAA Traffic Rules