An Investigation of General Aviation Problems and Issues: An Integration of Pilot-Cockpit Interface Research

FINAL REPORT

Cooperative Agreement NCC2-942

Western Aerospace Laboratories, Inc
Los Gatos, CA

Michael R. Bortolussi
Principal Investigator

Submitted to:
NASA Ames Research Center
Moffett Field, CA
Vernol Battiste, Technical Monitor

November 17, 1997

Introduction

The General Aviation (GA) industry has suffered a ten-year decline in the number of airplanes sold. This decline is due mainly to the increase cost associated with purchasing, insuring, maintaining, operating, and pilot training a GA airplane. In response to this decline the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) developed a program (Advanced General Aviation Transport Experiments- AGATE) to address these issues. The purpose of AGATE focused within this report is to reduce the costs to acquire and maintain instrument-flight-proficiency. The AGATE program defined four elements to necessary to accomplish these goals: 1) new and intuitive cockpit displays and controls, 2) situation technologies for weather, traffic, and navigation, 3) expert systems for system monitoring, and 4) reduced cost training methods.

One recognized need for the GA pilot and airplane is to provide cockpit displays and systems already available to transport category airplane. These displays such as Electronic Flight and Instrument System (EFIS), graphic weather and traffic displays, and flight management systems. However, it is important to note that converting GA airplane and pilot to use the "glass cockpit" will not necessarily "fix" the problem. In fact research in transport category airplane suggest that the problem merely shifts from one area to another. But it is also recognized that to improve GA, this type of technology must be introduced. However, it is important to note that the transport category and GA pilots differ in training and experience. Thus, caution is needed when attempting to transfer cockpit technology.

The goal of this grant was to develop the AGATE GA Display Evaluation Workstation as a tool to test these existing and emerging technologies in the GA environment.

Elements of the GA Simulator

Flight and Navigational Requirements

An important step in the develop a cockpit which could be transformed to any configuration. This cockpit had to be configured to resemble a contemporary GA airplane or an advance "new generation" cockpit, Figure1.

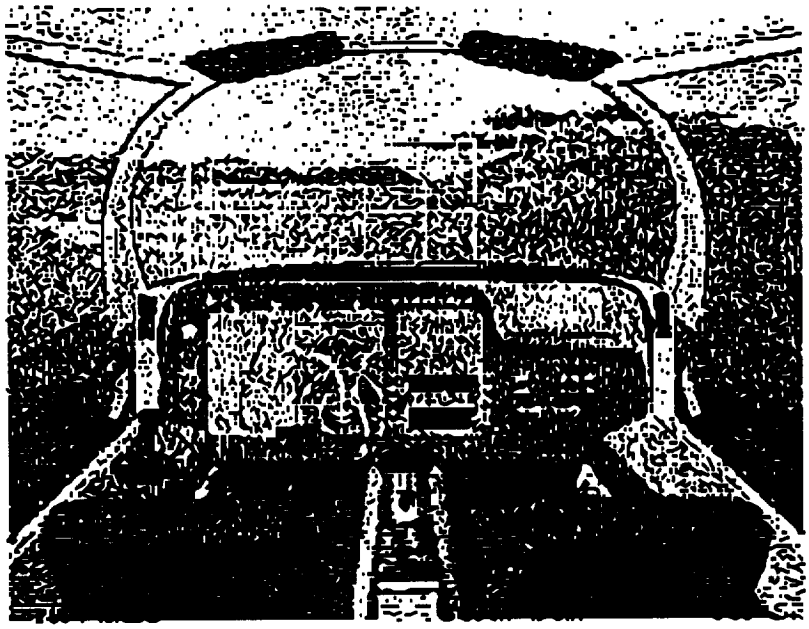

Figure 1. Conceptual drawing of the AGATE Cockpit.

Guidance and Control

The controls and flight model of the simulator were designed to be simple. Standard controls and generic decoupled flight model made the workstation easy to fly and thus, simplified to research model.

Although it is recognized that auto-flight will play a huge role in the advance GA flight platform, the implementation was deemed too costly for this workstation.

GA Display Evaluation Workstation final configuration

The GA Display Evaluation Workstation is comprised of a Cirrus Design SR-20 Cockpit Shell, Figure 2, outfitted with a 12.1" color flat panel display with touch-panel capabilities. The displays and generic flight model is driven by a Silicon Graphics Extreme 2XL. The flight controls consist of a high fidelity dampened/self-centering yoke, rudder pedals, and a single-lever power controller.

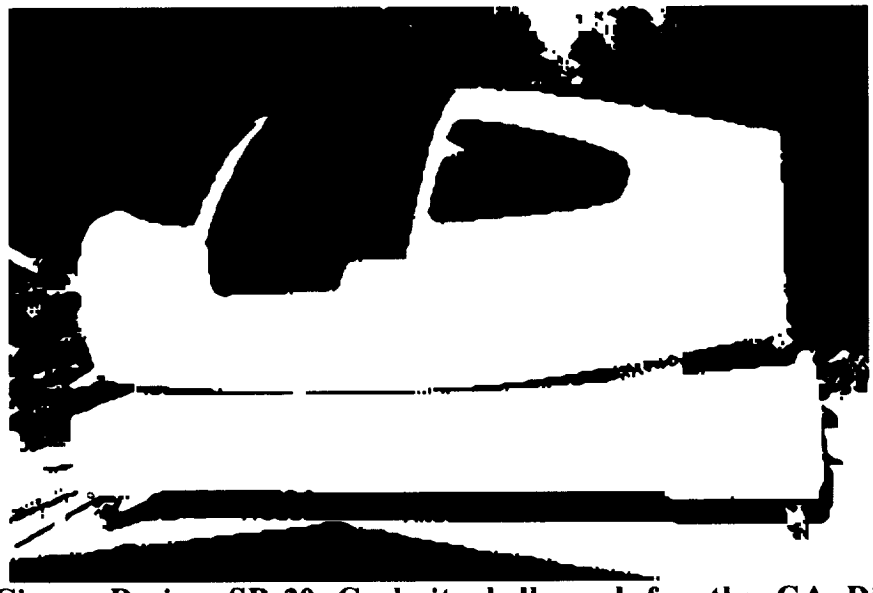

Figure 2. Cirrus Design SR-20 Cockpit shell used for the GA Display Evaluation Workstation.

The workstation was delivered to NASA and was flyable at the end of performance period.

Note: No patents were developed from this grant.