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Letter to Editor **Open Access**

Interface Design In an Automobile Glass Cockpit Environment

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For over thirty years, the flight industry has used electronic displays to relay critical information to pilots. Due to the complex nature of an aircraft, the glass cockpit environment has been an essential component in reducing the vast amount of flight data and presenting it in a comprehensible way. Years of intense research and the constant improvements in computer hardware have resulted in a widespread acceptance of the glass cockpit concept in all types of aircraft, ranging from massive commercial airliners to small private aircraft. In comparison, the automobile industry has fallen far behind the flight industry both in the usage of glass cockpit technology and simulator-based design. However, in recent years several manufacturers have begun introducing advanced computerized systems for relaying information to the drivers. These systems involve touch screens, head up displays and other information displays combined with some sort of input device. Much is still to be done and the full potential of the glass cockpit in an automobile environment has not by far been reached.Today, the number of functions combined with the amount of information that the driver has to handle increases with every new model. The introduction of GPS-navigation and the broadening of the in-vehicle media systems are flooding the driver environment.This development can in some ways be compared to the pre-glass cockpit age of aircraft, in its demand for new and innovative solutions.

The purpose of this thesis was to apply the glass cockpit concept to a greater extent in an automobile environment, and at the same time, show the industry the potential benefits of simulator-based design and virtual prototyping as concept development tools. At Linköping University, where this thesis was conducted the facilities hold a virtual reality simulator in form of a car simulator. With this tool at our hands we wanted to challenge the, in many ways outdated and conservative, automobile industry into thinking in new innovative terms when it comes to introducing new technology. One of the project goals was to highlight the fact that with new technology comes new possibilities. This means showing the potential of the glass cockpit and the possibilities of simulator-based design to improve safety and enhance the driving experience in future automobiles.

The concept of the glass cockpit was born in the flight industry in the 1970's. The aircraft cockpits of that time were crowded with over a hundred controls, indicators, symbols and crossbars. Limitations in available cockpit space and pilot attention called for new solutions. NASA started doing research on electronic displays that could present flight data information in an easily understood graphical representation of the aircraft flight situation. The success of NASA's research became evident when Boeing, in 1982, introduced its model 767.
The 767 cockpit used electronic flight displays resulting in improved safety and better pilot understanding. (Wikipedia, 2007) However, in military aviation electronic displays had been introduced in the seventies, for instance, to support navigation and flight control. The glass cockpit concept is nowadays well established in the flight industry, but according to Alm almost unknown in the automotive business (Alm, 2007). The basic idea of the glass cockpit concept is to replace static controls and instruments with glass displays and by doing so creating an updatable and mode based driving environment that adjusts the display information when needed. In the field of aviation this has simplified the cockpit environment enormously and has allowed the pilots to focus on the most essential information. Today, the glass cockpit is standard equipment in airliners, business jets and military aircraft. Even basic aircraft like the Piper Cherokee, PA 31 and Cessna 172 can be delivered with glass cockpits. This is something that has revolutionized the aviation field and is highly appreciated among pilots and aircraft companies.

Glass cockpits originated in military aircraft in the late 1960s and early 1970s; an early example is the Mark II avionics of the F-111D (first ordered in 1967, delivered from 1970–73), which featured a multi-function display. Prior to the 1970s, air transport operations were not considered sufficiently demanding to require advanced equipment like electronic flight displays. Also, computer technology was not at a level where sufficiently light and powerful circuits were available. The increasing complexity of transport aircraft, the advent of digital systems and the growing air traffic congestion around airports began to change that.

The average transport aircraft in the mid-1970s had more than one hundred cockpit instruments and controls, and the primary flight instruments were already crowded with indicators, crossbars, and symbols, and the growing number of cockpit elements were competing for cockpit space and pilot attention.[2] As a result, NASA conducted research on displays that could process the raw aircraft system and flight data into an integrated, easily understood picture of the flight situation, culminating in a series of flights demonstrating a full glass cockpit system. The success of the NASA-led glass cockpit work is reflected in the total acceptance of electronic flight displays beginning with the introduction of the MD-80 in 1979. Airlines and their passengers alike have benefited. The safety and efficiency of flights has been increased with improved pilot understanding of the aircraft's situation relative to its environment.

The improved concepts enable aircraft makers to customize cockpits to a greater degree than previously. All of the manufacturers involved have chosen to do so in one way or another—such as using a trackball, thumb pad or joystick as a pilot-input device in a computer-style environment. Many of the modifications offered by the aircraft manufacturers improve situational awareness and customize the human-machine interface to increase safety.