Preface

In a conversation several years ago with a DARPA Program Manager, I was asked, as part of an informal poll, what I thought the next "big thing" in avionics would be. Without hesitation, I replied "Smarter avionics!" Over time, I have come to realize that the first step to smarter avionics is a more natural interface. Buttons, keypads, touchscreens, and knobs may seem natural to us today because of the computer revolution, but this is not how we learned to communicate as young children. Furthermore, remembering how to display a particular chart or checklist using key sequences may be problematical during a stressful event. This is especially so in single pilot operations.

The most natural communication interface for technical information during duress is spoken language and graphics. One might argue for written word documents, but these require some interpretation, even if the documents can be located and displayed quickly. Asking the avionics for a vector to the nearest airport, or if a particular airport is within range during an engine out emergency, is very much like having a Virtual Copilot on board.

By now the reader is thinking, or should be, of HAL in the film "2001, A Space Odyssey". Indeed, sans the paranoia, HAL would make an excellent virtual copilot. Technology has not progressed to quite this point yet, although the debut of IBM's Watson on Jeopardy was very impressive. But even if Watson's performance were comparable to HAL's, there are few aircraft that could carry the room full of computer servers that Watson requires. (As a side note, Watson has no understanding of spoken language. The questions were provided in electronic format.)

On modern commercial transport aircraft, a limited amount of aural speech warnings are available. One of the earliest examples is the Terrain Avoidance Warning System's sharp announcement "Pull Up!" accompanied by a warning horn. Later the simple advisory prompts for minor deviations from altitude, airspeed, heading, etc. were implemented. These came to be known amongst pilots as "Chatty Cathy's", along with other less printable names.

Automatic Speech Recognition has made remarkable progress in the past ten years. It is now at the point where it can be used in a limited way in avionics. Indeed, Garmin has recently released the GMA 350 Audio Panel with some voice control capability - http://www.Garmin.com. VoiceFlight has a system for entering waypoints into the Garmin GNS430W/530W using voice - http://www.VoiceFlight.com. And, the F-35 Joint Strike Fighter will have some voice control of systems - http://en.wikipedia.org/wiki/Lockheed_Martin_F-35_Lightning_II. Furthermore, automobile manufacturers now have systems that far exceed the limited capability of aircraft systems. A notable example is the Ford Sync System. Indeed, the system to be described shares much of the general architecture of the Ford Sync System. There is a speech recognition module, a text to speech module, a natural language parser, a vehicle system interface, and a means to display requested graphical information. The automobile designers are leading the way. One can hope that avionics manufacturers will leverage their successes into "smarter avionics".

This book presents an overview of the software (and some hardware) required to implement a first generation system for General Aviation aircraft. The software framework of a functional system may be found on the accompanying CD-ROM.