



STAR Caster[®] **Automated Text-to-Speech System**

StarCaster[®] is a PC-based software system that offers a fully automated, superior quality Text-to-Speech capability. StarCaster is designed to meet the needs of agencies and corporations that provide timely information to the public via telephone or radio broadcast. The StarCaster system was originally developed for the complex requirements of weather broadcasting, meeting the established requirement for rapid conversion of weather text to a natural, high-quality voice ready for broadcast. StarCaster offers a cost-effective automated solution for information providers, while allowing easy access to essential information to the public.

StarCaster uses a "speech concatenation" process to automatically convert text information into a natural voice for audio transmission. The resulting speech is a much higher quality than that of existing text-to-speech (TTS) synthesis systems, which typically have a "robot-like" sound that is not suitable for high-profile applications. The TTS component of the system uses a pre-recorded digitized voice database to produce the high-quality voice output. The optional telephony capability provides standard Interactive Voice Response (IVR) features. The system can guide callers to the right information using prompts from a voice "menu tree". Voice information is played in response to the caller's touchtone commands. When finished, callers can select other information or menus, leave messages or be transferred to a live operator.

Applications where StarCaster is currently used include: automated air terminal information systems, pilot weather advisory services, and marine navigation system support. With the introduction of new applications, new processes for scheduling and user interfacing are added to the StarCaster system. The latest addition to the system is an optional third-party speech recognition system, which can be integrated with the IVR capabilities to assist users in making requests for specific information over the telephone. The StarCaster system easily adapts to new applications, such as providing detailed municipal transit information in response to user requests over the telephone.

The software for the StarCaster system has been designed to allow for optimum flexibility. The StarCaster system uses hardware components that are all commercial off-the-shelf (COTS) items, and will work with telephony cards, and sound cards (USB or PCI). The system runs on a Windows-based basic PC; other hardware components vary depending on the application being used.

Proven Performance of the StarCaster Text-to-Speech System:

The StarCaster system was first deployed in 1991 for use by Environment Canada's Atmospheric Environment Services (AES), and is now operating in 13 Weather Centers across Canada, where it provides high-quality voice output for automated telephone answering services and Weather Radio broadcasts. Environment Canada estimates that the StarCaster system saves them \$7M per year in the cost of delivering public and marine weather information.

StarCaster technology was integrated with the Australian Bureau of Meteorology's computerized forecasting system and is installed at eleven sites across the continent.

The regional office of the U.S. National Weather Service (NWS) in Anchorage, Alaska, uses a StarCaster system for generating marine and public weather information. This system produces recordings of weather forecasts for the Alaska Weather Information Line, which provides weather information by telephone throughout the state of Alaska.

The US Federal Aviation Administration (FAA) has STR's StarCaster VOLMET system installed at the Automated Flight Service Stations in both New York and Honolulu. The StarCaster VOLMET system produces aviation weather broadcasts for aircraft in flight.

DND Canada also has a StarCaster VOLMET Automation System installed at CFB Trenton in Ontario, used by the military to broadcast continuous aviation weather to military aircraft across Canada and several European sites.

The U.S. FAA has installed and deployment a StarCaster TWEB system in the Alaska Region. The system automatically generates TWEB (Transcribed Weather Broadcast Service) forecasts, which are broadcast to aircraft in flight by the FAA at Automated Flight Service Stations (AFSS) in Alaska. Installations at the Kenai, Fairbanks and Juneau AFSSs were completed in April 2005.

STR has partnered with ARINC Inc. to install the StarCaster ATIS System at Air Force Bases and Army Airfields across the U.S.

The StarCaster ATIS System is also operational at Civil Aviation Airports across the U.S.

STR worked with Lockheed Martin for the FS21 (Flight Service for the 21st Century) Modernization Project to provide HIWAS/TIBS broadcasts at AFSS sites across the U.S.

Overview of the StarCaster-Speech Concatenation Process:

The StarCaster system produces its high-quality speech output by accessing a voice database that contains digitized units of speech, known as "intonational phrases". Intonational phrases are words or phrases that are determined through the analysis of various speech pattern aspects of a particular language. Speech concatenation systems that do not employ the expertise that takes these phonetic aspects into account will produce an output that sounds "choppy" or disjointed.

The speech concatenation process involves the selection of the appropriate words or phrases from the database and uses digital processes to link them together to form the spoken message, which is either written to a digitized speech file for scheduled access and output, or sent directly to the digital-to-analog converter. Processes are also in place for accessing the text and producing the concatenated speech message according to predefined conditions or schedules, without saving the files to disk.

During text to speech processing, the selection of the appropriate "intonational phrases" depends upon the analysis of the corresponding text string through text parsing and processing rules. These rules are responsible for selecting the words and phrases from the database that contain the correct stress and intonation patterns required to produce a smooth and natural speech message.

In a speech concatenation process, a string of text may be produced that does not match any text held in the voice database. Because new speech items cannot be generated on the fly by a speech concatenation system, the StarCaster strategy is to flag the unknown text string as a missing vocabulary item. The operator is then presented with a list of alternatives from which to construct an equivalent message. Given a large and comprehensive voice database such as one used in weather broadcasting, an alternative term is usually available. However, rules can also be developed to allow the system to skip the unknown word and continue broadcasting the message.