Objective: The objective of this engineering project is to develop our prototype unit into a user-friendly, portable, computer-automated audiometer-like device that performs individualized ototoxicity early identification using the evidence-based 1/6th octave sensitive range for ototoxicity methodology.

Research Design: This project seeks to develop the prototype unit into a second-generation device. Key elements to successful completion of this project include: 1) hardware improvements to the prototype circuitry; 2) development of custom software to perform time-efficient and user-friendly ototoxicity early identification; 3) development of computer-based data collection and reporting; and 4) field testing of the device in various environments such as sound attenuation booths and the hospital ward.

Methodology: The work proposed will include: 1) prototype device upgrading, which will include upgrading hardware of the prototype device with support for computer-controlled output range switching, ambient noise measurement, performance verification support, and storage; 2) software application development, which will include improving existing software for ototoxicity testing, in addition to completing support for ambient noise measurement, performance verification and storage; and 3) data collection and system reliability and sensitivity verification in various test locations.

Findings to date: The device that was developed to accomplish the objectives of this study consisted of a handheld computer, a custom module, and headphones. The unit operated using an application that has been programmed to generate pulsed, pure-tone stimuli, provide pen-enabled, touch-pad operated control of frequency selection, calibrated sound level selection, in addition to on-screen recording and saving of data. Three software applications were developed for the device that enabled the audiologist to calibrate the device and execute the protocol for ototoxicity monitoring. Data collection has been completed with subjects in the sound booth and on the ward while using the ambient noise measurement subsystem, which automatically monitored background noise levels during testing. The data revealed that data collected on normal-hearing and hearing-impaired subjects with the OtoID device and with the conventional high frequency audiometer were comparable. Additionally, data sets collects with the OtoID device using normal-hearing and hearing-impaired subjects in the sound booth and on the hospital ward yielded comparable results. Finally, the OtoID device was used to evaluate 20 subjects receiving ototoxic medications on the hospital ward and these data demonstrated that the device was both reliable over test sessions and sensitive to ototoxic changes in hearing. Subject experiences were very positive. These data validate this portable ototoxicity monitoring device as an effective tool to monitor ototoxic-induced hearing loss. Funding for this project has ended, however based on this work a new engineering project to automate the unit and to develop telemedicine reporting capability has been approved for funding and is currently underway.

Relevance to VA Mission: Results from this project will facilitate the development of the second generation OtoID device which will have an automated software program allowing the testing to be administered by non-trained personnel, including the subjects themselves. The development of a data transfer system will allow the device to be used in remote locations allowing ototoxicity monitoring to be accomplished through telemedicine, therefore making it available to many more Veterans receiving potentially ototoxic medications.