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Gentlemen:

Allow me to take this opportunity to thank you for the voice enabling project we have just completed. Your organization was easy to work with, professional in their demeanor and very precise, efficient and technologically adept. We appreciate all the interaction with your team and remain very positive about the possibilities of voice enabling applications for the Department of Agriculture and the Forestry department in the future.

As we have closed out the pilot for the FSScaler application and have received some preliminary findings on its capabilities, we wanted to respond and provide insight as to how we can improve the hardware limitations that currently exist with the device and the lack of headsets - specifically for USB connectivity in high noise environments.

Below are the notes that Matt Oberle provided us for the final testing of the solution in the field. Vangard truly appreciates the detail of this input and will use the information to continue to improve its offerings. In the spirit of cooperation, we have responded to the notes from a perspective of moving towards a fully functional, usable solution in the future. Matt's notes below are in black with the Vangard insights in **purple type**.

Sincerely,

Bob Bova
CEO
Vangard Voice Systems

VANGARD VOICE SYSTEMS®

General notes:

- The final round of evaluations consisted of three office tests (the first by myself and the last two by Chuck Morris and I via phone/screen sharing) and one field test.

- Background noise (in this case wind) while testing in a log yard brought the system from marginal to near zero usability/accuracy. Wind, as well as other loud background noises from machinery is the norm in log yards. A throat microphone similar to what military and law enforcement use would likely perform a lot better. **The hardware device only allowed a USB connection for a microphone/headset. This SIGNIFICANTLY reduced the quality and choices available for state of the art noise cancellation technology to be utilized for voice input. Vangard will continue to look for USB connected headset technology that could perform adequately in this environment as this was THE CRITICAL ISSUE for the project to move ahead in a production phase roll out.**

- Multiple tests in the office found additional voice recognition problems such as no recognition/action, misinterpretation/typo or random navigation in the data table. These problems were noted and recognized as probably fixable, but for time's sake, I chose not to go through another repair cycle with Vangard. **Vangard agrees; minor changes, very fixable.**

- Single digit numbers were especially problematic for the voice recognition. For example, "enter nine" would result in a 99 entered nearly every time in a quiet office environment. Similarly "enter eight" would always result in 82 and "enter five" would frequently result in 51. Perhaps switching to a military phonetic would help, e.g. ze ro, wun, too, tree, fow er, fife, six, sev en, ait, nin er. **We agree…single digits are always the most difficult, especially with the reduced capability microphone. Military phonetic would significantly increase recognition.**

- Vangard's technique of "mapping" voice commands to activate specific software controls and functions is relatively simple, clever and a good approach. Thank you, Vangard agrees.

- The ability to adjust/modify a script file and compile it for use with voice activation software is a double-edged sword: it provides a lot of flexibility to the mobile software developer, including accommodating different situations, speech accents and even different languages. However, this could add another layer of maintenance to every mobile application using voice activation and would likely require additional staffing. **The additional staffing would only be needed if changes were constant. Once the application works as intended, there is very little needed for changes…plus Vangard could provide these services at a significantly lesser cost than hiring full time staffing.**

- While we didn't test this system with timber cruising or timber inventory field data collection software, I feel they would experience similar or worse problems due to background noises (wind, driving rain, heavy breathing, two-way radios, crew communication, cracking branches, etc.) **The hardware device only allowed a USB connection for a**

microphone/headset. This SIGNIFICANTLY reduced the quality and choices available for state of the art noise cancellation technology to be utilized for voice input. Vangard will continue to look for USB connected headset technology that could perform adequately in this environment as this was THE CRITICAL ISSUE for the project to move ahead in a production phase roll out.

- Voice recognition technology has advanced a generation in the two years we've been wrestling with this system. **It is getting better and better with the introduction of real noise cancellation headsets.**

Test procedure details:

The final round of evaluations can be broken into four stages:

1) I tested the system in my office. After a few software repair and calibration cycles between myself and Vangard, I felt the system was mostly useable with simple 3P scaling and carefully enunciated commands in a quiet office environment. There were some remaining voice recognition problems that I made note of and recognize as possibly fixable, but chose not to go through another repair cycle with Vangard. **This would have been fixed quickly**.

2) I exercised the system in my office twice while teleconferencing with Chuck Morris in Spearfish, S.D. Chuck could see my Allegro Mx screen on his computer monitor and could hear my voice commands. He could not hear the voice feedback from FScruiser, but I repeated it to him. Chuck pointed out additional problems: several were voice recognition-related and one seemed to be related to the programming/implementation of the voice activation technology into FScruiser (while returning to the log table from the defect table, a random number is called again and a new hit code designated, overwriting the previous ones). We discovered that the system had an especially difficult time recognizing single digit numbers, such as would be commonly used for KPI's in 3P scaling. For example, every time I would say "enter nine", a KPI of 99 would be entered. Every time I would say "enter eight", a KPI of 82 would be entered. Chuck and I understood both issues may be fixable, but chose not to go through another repair cycle. **We agree…single digits are always the most difficult, especially with the reduced capability microphone. Military phonetic would significantly increase recognition.**

3) After receiving the Allegro Mx, Chuck tested it in his office. After familiarizing himself with the operation of FSscaler's voice activation and recognizing the issues he and I had previously discovered, Chuck was ready for the field test.

4) The field test was at a log yard on a sunny, warm morning with the typical light to moderate wind. The background sound of the wind made FSscaler voice activation virtually unusable:

- Voice recognition accuracy decreased dramatically in the wind, nothing being recognized, incorrect values entered and/or random navigation to a previous log record.
- Chuck tried adjusting the microphone closer to his mouth, speaking louder, enunciating more clearly, cupping his hand over the microphone and turning his body so the wind was at his back, etc. Other than getting completely out of the wind by getting into his truck, nothing seemed

to help. Chuck tested inside and outside his truck repeatedly and confirmed that the system operated marginally well out of the wind and not at all in the wind.

While the inherent hardware deficiencies (only a USB port was available for headset connectivity, no initial driver for voice support whatsoever) and the industry lack of noise cancellation headsets utilizing a USB connection were the key factors to detrimental performance, the Vangard voice enabling technology worked as Forestry required. As we continue to do research on better USB connected headsets, we expect the issues to disappear. When we find a headset that that can conform to these noise cancellation expectations Vangard will provide it to Forestry and provide any and all assistance to assure a better recognition result.

We appreciate all the time and resources expended on this pilot project. We look forward to serving The Forestry Department in the future with any of their voice user interface projects.