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Forest Service

**Technology &
Development
Program**

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9824 1203—SDTD



VOICE DATA RECORDERS

For Scaling and Crusing



VOICE DATA RECORDERS

For Scaling and Cruising



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May 1998

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PROJECT PROPOSAL
USDA Forest Service
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SDTDC solicits input from the field for suggestions for future projects. Your suggestions are important to us, so please take a few moments to complete this form and return to the address provided.

Project Originator: _____ Name _____ Date _____

Title _____

Unit _____

Mailing address _____

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Project Title: _____

Current Problem/Need

Describe how work is currently being done; current problem/need, location; why improvement is needed.

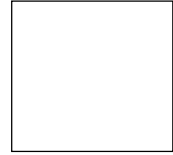
Proposed Solution

Describe your concept of the end product, i.e., new equipment design, video production, handbook, etc.

Potential Benefits

Describe how this product will improve safety, resource management; increase efficiency, customer satisfaction, productivity; reduce cost, time.

- affix here -



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User Feedback Survey

User Name (optional) _____

_____ Title

_____ Unit

Voice Data Recorders—For Scaling and Cruising 9824 1202—SDTDC

Benefits	Yes	No	Amount
Saves money	_____	_____	_____
Saves time	_____	_____	_____
Increases efficiency	_____	_____	_____
Other	_____	_____	_____

How effective or relevant is this information?

What would you change?

General comments:

This publication describes field portable voice recorders, and discusses their potential use in scaling and cruising applications. Work continues at the San Dimas Technology and Development Center (SDTDC) to develop this new technology. In FY 98 we are developing a software interface to download Talkman cruise data into NatCruise.

Projects to test new technology are initiated by the Forest Management/Sales Technology Committee. This committee meets annually to discuss field needs ranging from initial sale layout tot the transportation of products. Work is prioritized and future projects are developed to address needs that appear to be multi-regional in scope.

Field personnel are encouraged to contact their regional representative on the committee if they see a need for the distribution of information, the application of new technology, or have ideas for new product development.

The current Forest Management/Sales Technology Committee representatives are:

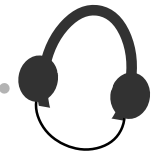
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BACKGROUND

The objective of this project was to evaluate voice data recorders as a potential improvement over handheld data recorders in log scaling and timber cruising applications. Potential performance benefits such as increased safety, speed and accuracy were investigated.

A market search was conducted to find available test units. At the time of the search voice technology was rapidly developing and specifications on the products were changing frequently. Several companies offered promising voice recognition products, however, not all the companies had hardware available. There were only a hand full of voice data recorders on the market when the test units were selected. Test units selected were Talkman™ by Vocollect, Inc. and Phoenix II by Phoenix Group, Inc. Other companies such as CompuSpeak Laboratories, Khyber Technologies Corporation, and Speech Systems, Inc. also offered products. However, project constraints and the rapidly changing state of the technology, limited the selection to only two data recorders. It was felt the two selected systems represented the two distinct directions voice technology was headed. Appendix A contains manufacturer data on both test units.

Log scaling and timber cruising data entry tasks were selected to run field trials. Only Talkman was used for the log scaling application; the Phoenix II hardware was not yet available at the time. Both units were used for the cruising application.

The voice data recorders were evaluated by programming them for the data collection task, collecting data using both the voice data recorder and the conventional method, and then comparing the two methods.

INTRODUCTION

For voice data recorders to be a viable replacement for handheld data recorders, the units must show an improvement over the existing method. It is proposed that voice data recorders could improve on the existing process in the areas of safety, speed, and accuracy.

Safety

By using voice or speech as a data entry method, the eyes are free to do other tasks such as scanning for potential hazards. The scaler or cruiser must visually confirm entries to a handheld data logger by watching the keyboard entry and reviewing the display. During data entry the user stops scanning for hazards visually. It also has been observed that some users enter data while walking. By using voice data entry, the users have their eyes free to recognize and identify hazards.

Speed

A scaler or cruiser typically carries many items such as a logger or diameter tape, scaling sticks, paint gun, relaskop, and clinometer. The user has to juggle these devices when entering data into the handhelds. Taking data would be faster if the operator could record measurements directly into a voice data recorder. The current procedure requires that the user place the recorder in a pocket, take the measurement, take the recorder out, then key in the data. The four step process is reduced to two steps using voice data collection.



The user could also safely walk to the next log or tree, or take another measurement while entering data verbally.

Accuracy

Two types of accuracies were investigated, recognition and data input. Recognition accuracy is the number of words misunderstood by the data recorder. For example, the user says "four five" and the data recorder interprets the speech as "five five". Data input accuracy is a measure of data entered incorrectly by the user. Data errors are usually transpositional. For instance, the user meant to type in 32, but transposes the two numbers and types in 23. Transposition error is reduced with voice recorders because the user speaks the data directly into the data recorder.

SPEECH RECOGNITION PRIMER

Voice data recorders rely solely on the speaker's voice for data entry. A microphone is used to convert sound to electronic signals which are processed by an internal computer to recognize certain patterns. The patterns are translated to text that represent commands or data. This process is called speech recognition. Two types of speech recognition software are available: speaker independent and speaker dependent. Both speech recognition types can use either: discrete speech, limiting the user's utterances to one or two words for each data field; or continuous speech, allowing the speaker to input many words in a natural cadence.

Speaker Independent

Speaker independent voice recognition technology means the user can use the data recorder out of the box. This is similar to using a keyboard out of the box without the need to program the definition of each keystroke. The computer uses a library of speech patterns that would be typical of a speaker. The computer selects a word

which most likely resembles the speaker's utterance. The advantage of the speaker independent approach is that the product can be used by many users without having to build a voice pattern library for each of them. There are voice systems using speaker independent voice technology that have had success in high background noise (90 dBA), however the typical system is designed for office use.

Speaker Dependent

Speaker dependent voice recognition requires the user to create a template of their voice patterns using specific words to train the computer to recognize the speaker, rather than relying on an average or typical speech pattern. The "train words" are dependent on the data collection task. The creation of the voice template adds an additional step to the setup process and may require the user to retrain the computer on other words while being used. Making a voice template typically takes 10 to 20 minutes.

Operation

There are basically two modes of operation, batch mode and radio mode. When operating in batch mode, data is stored within the voice data recorder and downloaded to a personal computer (PC) after the task is complete and access to a PC is more convenient. When operating in radio mode, data is transmitted via radio link to a remote PC. The prerequisites are that the data recorder is equipped with a radio link and be within a specified line of sight distance to the receiving PC. The distance varies with radios and terrain. A more sophisticated radio capable voice data collector switches to batch mode when the data link or transmission is poor.



SCALING TRIAL

The trial was conducted at the Sierra Pacific lumber yard in Lincoln, California with scalers from the Tahoe, the Stanislaus, and the Eldorado National Forests.

Equipment

Talkman (see figure 1) was selected for the scaling trial. Talkman is a speaker dependent and discrete speech voice data recorder. For this trial Talkman was operated in batch mode.



Figure 1. Talkman.

Talkman was first used with a hard-hat headset and the headset blocked most of the noise around the scaler. With this headset, the scaler could only rely on vision to identify hazards. To increase the scalers ability to also listen for hazards, the headset was eventually replaced by a smaller headset covering only one ear, and worn underneath the hard-hat. The most delicate part of Talkman is the headset. The headset is protected when worn underneath a hard-hat or rain gear and by using an appropriate wind screen. It is important to use a wind screen in cold and wet weather to protect the microphone. Excessive moisture buildup or formation of ice on the windscreen changes the voice patterns, thus spare windscreens must be carried to avoid this situation.

Programming

A limited version of the cubic scaling program was developed for this trial. The simplification was to minimize programming costs. This did not affect the results as the objective was to evaluate voice recognition technology in a scaling environment and not the scaling software.

When scaling, data was entered for each log sequentially. The following was collected for each log before moving to the next log: species, large diameter, length, small diameter, and percent deduction. To reduce the complexity of the task only two deduction methods were used: percent and length.

Method

Three scalers were used (see figure 2), each scaling the same four loads. There were 11 to 15 logs per load. Each scaler was equipped with a voice activated tape recorder and a noise dose meter(see figure 3). The tape recorder captured actual speech utterance. The noise dose meter recorded background noise levels. The scalers were videotaped from start to finish to record time and motion.



Prior to scaling, each of the users created a voice template. To determine whether the environment where the template is created effects the accuracy of the machine, one scaler created two templates; one in an office setting and the other outside the scale shack with heavy equipment running nearby.



Figure 2. Scaling while wearing Talkman.

Scaling Results

Background Noise

Talkman worked well in a high background noise environment. More importantly Talkman worked well in a varying background noise environment. Most of the background noise was generated by heavy equipment working around the deck. Airplane overflights, wind noise, and people talking contributed to the background noise. Noise with frequencies near the frequencies of the speaker's voice will interfere with speech recognition the most. The background noises experienced in this trial were typical for a log scaling operation.



Figure 3. Equipment used in the trials—Talkman, tape recorder, and densimeter.

Table 1 summarizes background noise levels for each scaler for all four loads. The average background sound level for the three scalers was 74 dBA. The average level is an arithmetic average of the pressure levels. Normal conversation at a distance of 1 meter falls in the range of 60 and 75 dBA. Figures 4, 5, and 6 provide graphs of background sound pressure levels for each scaler.



Table 1. Background noise levels for each scaler for all loads.

Scaler	Average Level (Lav) (dBA)	Max Level (dBA)
1	74	104
2	77	96
3	68	98

Some voice data recorders require that the voice template be made in the conditions or background noise levels at which the recorders will be used. The voice templates for this trial were done in a quiet office. The sound pressure level in a quiet office would fall between 35 and 40 dBA. During the field trial, an additional voice template was made at an average background sound level of 81dBA and a maximum level of 88 dBA. Average street traffic falls between 80 and 90dBA. The operator used the template made in an environment with high background noise levels with no difference in accuracy from the voice template made in a quiet office.

Accuracy

Data input accuracy was obtained by comparing the data recorded by the voice data recorder to the reference data. Data input accuracy was 100 percent. There were no discrepancies between the data recorded by Talkman and the reference data. The reference data was created by comparing all the data collected for each log by the three handheld data recorders.

The recognition accuracy of the machine was established by comparing the total number of words uttered to the total number of words not recognized by Talkman. The voice data recorder echoes back each utterance allowing the operator to correct any entries not recognized correctly. So recognition accuracy should not effect the accuracy of the final data collection, but the time involved for the operators to correctly input the data. Table 2 shows the total number of words spoken and the total number of words missed. The comparison data was obtained from a tape recorder attached to the scaler while scaling with Talkman. Recognition accuracy ranged between 53 percent and 96 percent with an average of 79 percent. The closer the voice template matches the users normal speech pattern, the more accurate the voice recognition. In the case of scaler 2, the difference between the voice template which the recorder was looking for and the voice pattern the recorder heard is attributed to the use of chewing tobacco while scaling. Scaler 2 also had trouble recognizing the echo back from Talkman. For example, when Talkman was echoing back "9" the scaler heard "1".

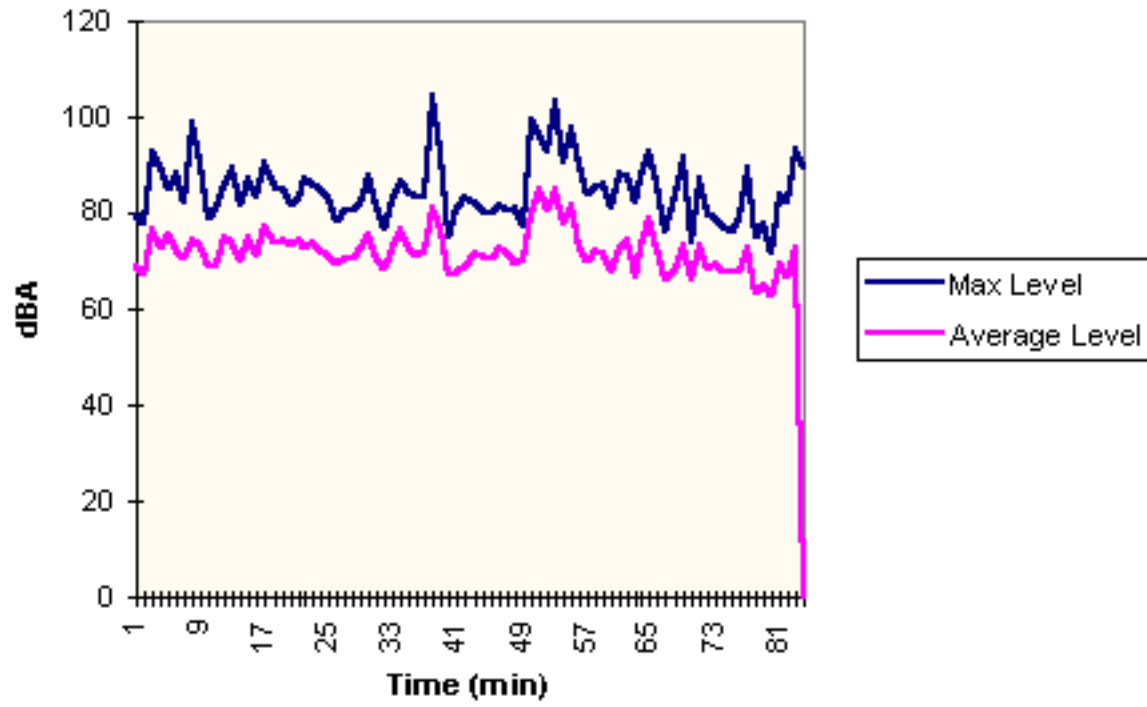


Figure 4. Background noise levels for scaler 1.

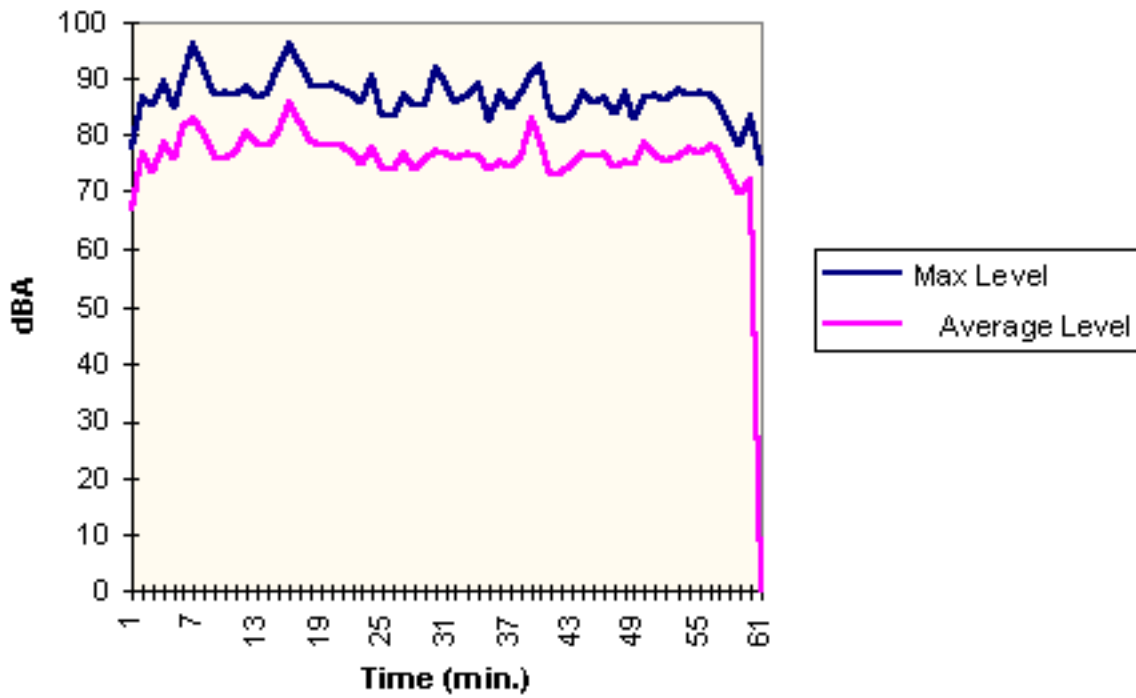


Figure 5. Background noise levels for scaler 2.

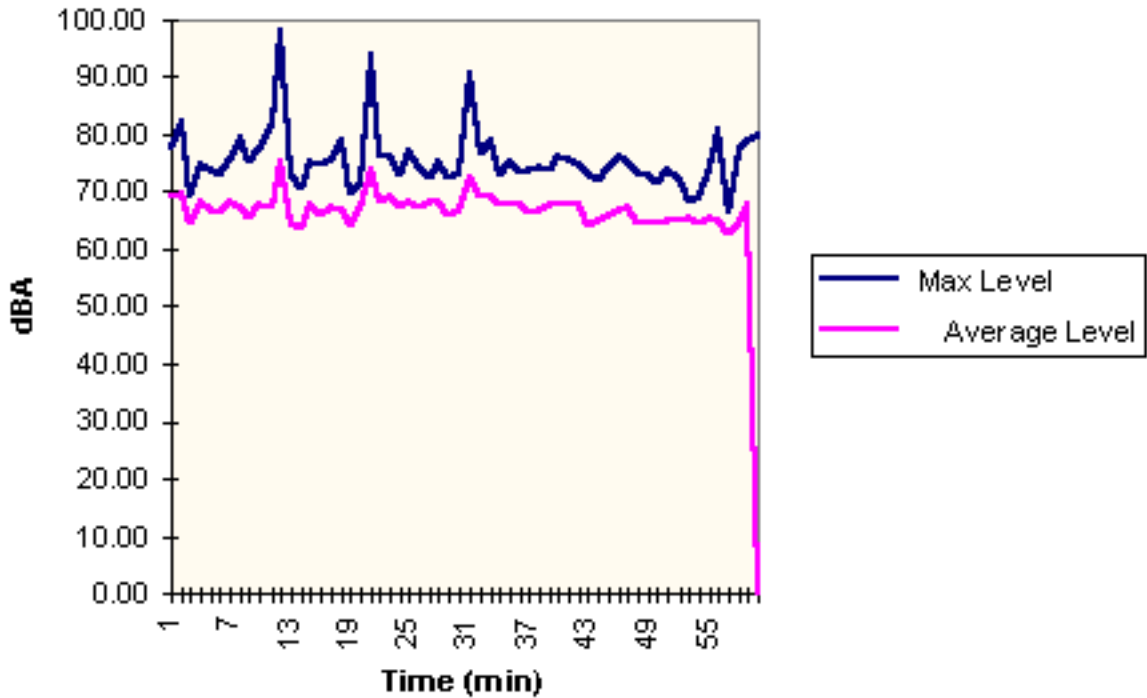


Figure 6. Background noise levels for scaler 3.

The recognition accuracy improved as Talkman was trained in the field. This is evident by scaler 3. Scaler 3 trained Talkman during the first load and attained greater accuracy during the last three loads.

Speed

Each scaler was video taped while using Talkman and while using the Corvallis MicroTechnology MC5 (CMT). Three independent measurements were used to determine the time required to scale: video tape counter, audio tape counter, and noise dose meter clock. The average time to scale a load using Talkman was 15 minutes. This time included walking to each load and any time used to train or update the voice template. The average time dropped to 9 minutes per load when only measuring the logs and entering the data in the voice data recorder. The average time for scaling the same load using a handheld data recorder was 7 minutes. Although the time required using Talkman was more than the conventional method, the time will drop as proficiency increases. This was the first time the scalers had used voice recognition and were still unfamiliar with the equipment. Also, the "talk ahead feature" was not used in the trial. The scalers waited for Talkman to echo back each response before moving on. Tasks can be streamlined to remove prompts used in this trial.



Table 2. Total number of words spoken and total number of words missed.

Operator	Load No.	Total Words	Words Repeated	First Pass Recognition Accuracy
Scaler 1	1	148	28	82
	2	196	32	84
	3	166	16	90
	4	212	64	67
Scaler 2	1	250	117	53
	2	245	102	58
	3	243	94	71
	4	231	90	71
Scaler 3	1	276	36	87
	2	167	7	95.8
	3	140	9	93.6
	4	159	9	94
Total	12	2433	604	
Average		202	50	79

User Feedback

At first the users were intimidated by Talkman. Speaking “normally” when creating the voice template the first time was difficult. The user’s became frustrated when Talkman did not recognize an utterance. Frustration affected their voice pattern, and thus increased the variation between the voice template and the “frustrated” speech patterns. Yelling at Talkman only changes the voice patterns and does not make Talkman recognize the word. The Talkman was initially used with a “hard-hat headset” making it difficult for the user to hear heavy equipment operating. The users liked the modification to the headset which allowed one ear to remain uncovered. Being able to look around or walk while entering data was a feature the scalers liked. The scalers also suggested a small display would be helpful only for reference when they lost their place in data entry of a load.

CRUISING TRIAL

The cruising trial was conducted on the Seward Ranger District, Chugach National Forest in Alaska.

Equipment

Two units, Talkman and Phoenix II, were to be tested. Talkman is a dedicated voice data recorder. The same unit was used as in the scaling trial. The Phoenix II is a wearable PC with a 80486 processor and a four-column, four-line liquid crystal display. The Phoenix II with Verbex Listen for Windows as the speech recognition software was used as a data recorder.



Programming

A basic data entry task was written. To tailor the program for a specific Region, the user simply had to add the unit, strata, species, and sample frequencies valid for that Region. The basic task was limited to the following fields: species, diameter breast height (dbh), class code, and percent defect. Other fields can be added by individual units.

To adapt the task to the preference of the local district, fields were added for a dead code and the presence of beetle. The unit numbers and the corresponding sample frequency were also customized.

Training

A crew of four was briefed on the operation of both units. Each crew person made a separate voice template for both Talkman and Phoenix II. (See Figure 7.) Each person went through a dry-run, entering data to become familiar with the operation of the data recorders.



Figure 7. Making voice templates.

Method—Day 1

The area to be cruised was a spruce stand with medium to heavy brush. Moisture level was high due to rain and wet brush. To protect Talkman from excessive exposure to moisture, the unit was worn underneath rainwear. Phoenix II worked well in the office but had problems recognizing the operator in the field. The problems could not be corrected and testing of the unit was aborted.

One person in the crew was designated as the tally person. The three other crew members marked and cruised trees. The tally person also marked while taking data using the Districts usual paper and pencil method as well as with the voice data recorder. Each crew member was able to use the voice data recorder for at least half a day. Header information had been set before the start of data collection. Talkman automatically validated this information which included the cruiser identification number and strata/unit combination and automatically used the pre-assigned sample frequency for that combination which had been calculated as 1 in 30 for unit 22. The tally person entered the following data: species, height, diameter, product type, deduction, and presence of beetle.

Each of the cruisers yelled out "TREE" signifying a tree was marked. The tally person said "SPRUCE" into the data recorder when a tree was called out then acknowledged by yelling "GOT IT" to the crew. The voice data recorder randomly selected the cruise tree within the sample. The voice data recorder would either prompt for another species entry or a diameter. The "diameter?" prompt meant the last tree entered is a cruise tree.



Table 3. Data collected on trees cruised on Day 1.

Tree No.	CruiserID	Strata	Unit	Species	DBH	Height	Class	Dead Code	Beetle	Deduct
25	55555	1	22	spruce	10	52	1	0	no	3486
48	55555	1	22	spruce	17	71	1	1	yes	3
70	55555	1	22	spruce	9	56	1	0	no	27
114	55555	1	22	spruce	12	60	1	0	no	0
122	55555	1	22	spruce	9	59	3	1	yes	0
174	55555	1	22	spruce	10	47	1	1	yes	0
202	11111	1	22	spruce	11	66	1	0	yes	9
229	11111	1	22	spruce	15	78	1	0	no	6
254	11111	1	22	spruce	11	63	1	0	yes	25
287	11111	1	22	spruce	18	79	1	0	no	9
323	11111	1	22	spruce	10	58	1	0	no	3
346	11111	1	22	spruce	10	64	2	2	yes	0
362	11111	1	22	spruce	14	68	1	0	no	593
397	11111	1	22	spruce	9	65	1	0	no	18
445	11111	1	22	spruce	12	63	1	0	no	0
449	11111	1	22	spruce	15	74	1	0	no	7

Results—Day 1

Cruising was slower than normal. This was attributed to both the new data recorder and unfamiliar procedure and low speech recognition due to non-optimized voice templates or the difference between the voice template and the “normal” speaking voice pattern of the user. Recognition improved after retraining Talkman on some phrases.

Although determining sample trees with Talkman worked well, it was a bottleneck. The tree markers marked faster than the tally person could enter data from a cruise tree. The slowdown was not due to the data recorder but due to the time required to make the measurements. The use of the voice data recorder to determine sampling placed a strain on the tally person because they could not tally more trees until the measurement data was entered. The tally person had to listen for the measurements, enter the data, listen for and acknowledge each of the markers as they called out a tree and remember the number of trees called out while a cruise tree was being measured. To make things more difficult, the tally person had one ear covered by the headset and often could not determine where the voice was coming from. This made it difficult to always distinguish each markers voice. To reduce the tally persons work load, the markers were told not to call out trees until all measurements for the cruise tree had been entered. The markers kept track of the number of trees they marked and called out the total number. This reduced the tally persons workload and sped up the process. The solution to this problem was to enter only the cruise tree information on Day 2 and not every tree marked. The data was easily downloaded into the PC after cruising. Table 3 shows the data collected on trees cruised on Day 1.



The deduction on tree number 25 and tree number 362 are the only errors which occurred. The potential for this type of error was eliminated on Day 2 by modifying the task to allow only a two digit entry for that column. The total number of trees cruised was 451. The data was formatted using an Excel macro created to facilitate downloading and formatting. During the first day, Talkman cued the tally person when a tree was to be measured based on sample frequency. The raw data files included all non-cruise trees. A filter was used to remove non-cruise trees.

Table 4 shows the results when the filtered data was transferred onto an Excel worksheet used by the District. This was the biggest time saver for the District. The normal operation required a day or two to enter the cruise data into the spreadsheet. With the data from Talkman already in an ASCII file, the data formatting and transfer only took minutes.



*Figure 8.
Tally person wearing Talkman.*

Method—Day 2

The remainder of unit 22 was cruised during the morning of the second day. Unit 23, with a sampling frequency of 1 in 50 was cruised in the afternoon. The task was modified to reflect lessons learned from the previous day. The graphical interface of Talkman's task builder allows for easy modification of the task on an office PC. Besides changing the program so that only cruise trees needed to be entered and to change defect to accept only two digits, as previously mentioned, the following additional changes were made:

1. Diameter and height prompts were modified to accept more than two digits. This was to allow for larger heights. Prior to this change if a measurement in these fields was greater than two digits Talkman would enter into a transmit node once it had recorded the two digits it was programmed to look for. Once a transmit node has been traversed the operator can not backup to the previous node.
2. A small external speaker was attached to Talkman and used in place of the head phones. This was to correct the differential hearing problem.

As in Day 1, the tally person used both the conventional method and Talkman to keep track of data. Over the course of the day all four crew members were designated as the tally person (See Figure 8).

Results—Day 2

Cruising went significantly faster than Day 1 due to the changes in procedure. Cruise trees were determined using a mechanical tallymeter. The tally person only entered cruise trees into the data recorder. Recognition accuracy was approximately 80 to 90 percent. As in the scaling trial, recognition accuracy was calculated from the number of words spoken and the number of words recognized. An 80 percent accuracy level does not mean 20 percent of words are entered incorrectly but 20 percent of the words are repeated by the speaker.

Table 4. Data after running an Excel macro used by the Seward Ranger District.

SALE NAME :		Palmer-Resurrection							
UNIT # :		22							
		(All volumes are in board feet)			TREE	EXPANDED			SQUARED
			GROSS	DEFECT	DEFECT	NET	EXPANSION	NET	NET
<u>TREE #</u>	<u>DBH</u>	<u>HEIGHT</u>	<u>VOLUME</u>	<u>PERCENT</u>	<u>VOLUME</u>	<u>VOLUME</u>	<u>FACTOR</u>	<u>VOLUME</u>	<u>VOLUME</u>
1	10	52	47.7556	3	1.432668	46.32293		0	2145.814
2	17	71	200.4814	3	6.014442	194.467		0	37817.399
3	9	56	37.9042	27	10.23413	27.67006		0	765.63248
4	12	60	79.52641	0	0	79.52641		0	6324.4497
5	9	59	38.46446	0	0	38.46446		0	1479.5145
6	10	47	45.2911	0	0	45.2911		0	2051.2837
7	11	66	70.28309	9	6.325479	63.95762		0	4090.5766
8	15	78	171.6039	6	10.29623	161.3077		0	26020.16
9	11	63	67.78928	25	16.94732	50.84196		0	2584.9045
10	18	79	258.2167	9	23.23951	234.9772		0	55214.302
11	10	58	50.713	3	1.52139	49.19161		0	2419.8145
12	10	64	53.6704	0	0	53.6704		0	2880.5118
13	14	68	126.4058	5	6.320289	120.0855		0	14420.525
14	9	65	39.58498	18	7.125296	32.45968		0	1053.6308
15	12	63	83.13202	0	0	83.13202		0	6910.9336
16	15	74	161.5758	7	11.31031	150.2655		0	22579.716

Table 5. Data collected on trees cruised Day 2.

date	time	user no.	strata	unit	Species	DBH	Height	class	dead	beetle ?	deduct
7/23/97	10:29:56	88888	1	22	spruce	13	75	1	0	no	0
7/23/97	10:46:09	88888	1	22	spruce	18	74	2	1	yes	0
7/23/97	10:58:33	88888	1	22	spruce	13	65	1	0	no	0
7/23/97	11:09:00	88888	1	22	spruce	18	75	1	0	no	9
7/23/97	11:26:45	88888	1	22	spruce	15	68	1	0	no	0
7/23/97	11:47:24	88888	1	22	spruce	14	63	1	0	yes	2
7/23/97	12:11:01	88888	1	22	spruce	16	66	1	0	no	0
7/23/97	13:45:42	66666	1	23	spruce	12	60	1	0	no	0
7/23/97	13:59:45	66666	1	23	spruce	14	75	1	0	no	0
7/23/97	14:10:15	66666	1	23	spruce	9	60	1	0	no	40
7/23/97	14:39:51	66666	1	23	spruce	13	71	1	0	no	0
7/23/97	15:01:28	66666	1	23	spruce	15	84	1	0	no	0
7/23/97	15:12:21	66666	1	23	spruce	21	89	1	0	no	0
7/23/97	15:41:25	66666	1	23	spruce	14	65	1	0	yes	2
7/23/97	15:50:19	66666	1	23	spruce	13	70	1	0	yes	7

Using the external speaker corrected the differential hearing problem encountered the first day. The tally person was able to recognize and acknowledge the person calling out a tree. Comparing the data from Talkman did not show any discrepancies. Table 5 shows raw cruise data.

Table 6 shows final cruise data after Excel calculations. The raw data was copied directly to an Excel spreadsheet used by the District for volume calculations. The old method required that the data be retyped into the spreadsheet. This is a potential source of error. Using a voice data recorder eliminates the need for manual data entry and saves time.

Table 6. Final cruise data after Excel calculations.

SALE		Palmer-Resurrection							
UNIT # :		23							
		(All volumes					TREE	EXPANDED	SQUARED
		GROSS	DEFECT	DEFECT	NET	EXPANSION	NET	NET	
TREE #	DBH	HEIGHT	VOLUME	PERCENT	VOLUME	VOLUME	FACTOR	VOLUME	VOLUME
1	13	75	118.5159	0	0	118.5159		0	14046.014
2	18	74	237.7057	0	0	237.7057		0	56503.992
3	13	65	102.4689	0	0	102.4689		0	10499.878
4	18	75	241.8079	9	21.76271	220.0452		0	48419.883
5	15	68	146.5336	0	0	146.5336		0	21472.107
6	14	63	116.207	2	2.324141	113.8829		0	12969.314
7	16	66	161.6702	0	0	161.6702		0	26137.261
8	12	60	79.52641	0	0	79.52641		0	6324.4497
9	14	75	140.684	0	0	140.684		0	19791.992
10	9	60	38.65121	40	15.46048	23.19073		0	537.80978
11	13	71	112.0971	0	0	112.0971		0	12565.759
12	15	84	186.646	0	0	186.646		0	34836.744
13	21	89	414.8178	0	0	414.8178		0	172073.78
14	14	65	120.2865	2	2.405731	117.8808		0	13895.884
15	13	70	110.4924	7	7.734468	102.7579		0	10559.192



Figure 9. Crew downloading data.

CONCLUSION

The objective of the trial was to determine whether voice data recorders would be an acceptable replacement for hand held data recorders. In order to be a feasible alternative, voice data recorders have to show improvements in safety, accuracy, or speed. The trial revealed that Talkman, with very new users, was not faster than the CMT MC5 handheld data recorder with experienced users. The scalers familiarity with the CMT allowed them to operate much faster.

Although Talkman did not show an improvement in speed over the handheld data recorder, Talkman's deficiencies can be corrected. Most of the deficiencies were due to the users unfamiliarity with the data recorder. The recognition accuracy and speed should improve when the user becomes comfortable with the machine. It is felt that if the bias of experience were eliminated, Talkman should provide an increase in speed. This has been demonstrated in other applications.

Talkman showed great potential for being safer than the handhelds. The main advantage of the Talkman when compared to a handheld data recorder is the voice data recorder allows hands- and eyes-free operation. This allows the user to walk and move freely while taking data, with no compromise in safety. Handheld data recorders require the user to take the measurement, put away the measuring tape—or hold it in the same hand as the recorder—and then enter data. The user has to look at the handheld data recorder display to verify input.



The data shows that Talkman had 100 percent input accuracy due to the echo back function of the device. The user had instant feedback and could correct errors immediately. Recognition accuracy ranged from 75 to 90 percent. This is attributed to the difference in the speech pattern when creating the voice template and the speech pattern while taking data. When first created, the voice template varied significantly from the normal speech pattern. This is because when making the template the user often tries to speak correctly and then when inputting data into Talkman they use their natural voice. There is no match because Talkman is looking for a speech pattern different than was originally input. This could be corrected by modifying and optimizing the voice template in the field through training. Training Talkman in the field provides a more accurate voice pattern.

Like the handheld data recorders, voice data recorders use an ASCII file format for the data. This allows the data to be readily used in large variety of PC software applications.

Like the other field data recorders, Talkman could be used for other data collection applications. With the graphical interface the marking crew were able to create their own tasks after just a few hours of training.

Appendix A

TALKMAN VOICE DATA RECORDER

Manufacturer: **Vocollect, Inc.**
701 Rodi Road
Pittsburgh, PA 15235
(412) 829-8145

Vocollect has had three generations of Talkman terminals over the past eight years. Talkman, Talkman-HR, and Talkman VTC-303. Talkman HR was used for these scaling and cruising trials. The two basic configurations of the Talkman units are batch and radio. The batch system consists of the Talkman unit (including battery) and the headset. The radio Talkman is the same as a batch unit with a Telxon unit mounted internally. The primary physical difference between the unit used for the trial and the newer VTC-303 is packaging. The older unit had a separate battery unit mounted on the belt. The VTC-303 replaces Model HR in one integrated package. The specifications for the newer model are shown below.

Talkman is connected to a personal computer (PC) to upload tasks and voice templates or to download data and update voice templates. Talkman uses an optical pod connector which connects to a serial port on the PC. The newer unit uses an standard I/O port.

Specifications

Model: VTC-303

Weight: Less than 2 pounds (907g)

L/W/H: 9x5x3 inches (23cm x 13cm x 8cm)

Battery life: 4–10 hours

Software

Task Builder

Task builder creates the “program” which Talkman follows to collect data. The task in Talkman is similar to a flowchart which documents the steps and conditions of data collection. Talkman uses a graphical interface to represent the task. The task is made up of nodes and links. The nodes (circles) indicate an interaction with the operator, where the questions are asked by the voice data recorder. The links (arrows) are the valid responses to the links. For example, a node would contain the question “Please enter diameter.” The corresponding link would contain all the valid responses which are digits 0...9 and an exit word such as enter. Figure A.1 is a task showing the nodes and links. Figure A.2 shows the node elements, and figure A.3 shows the link elements.

Appendix A

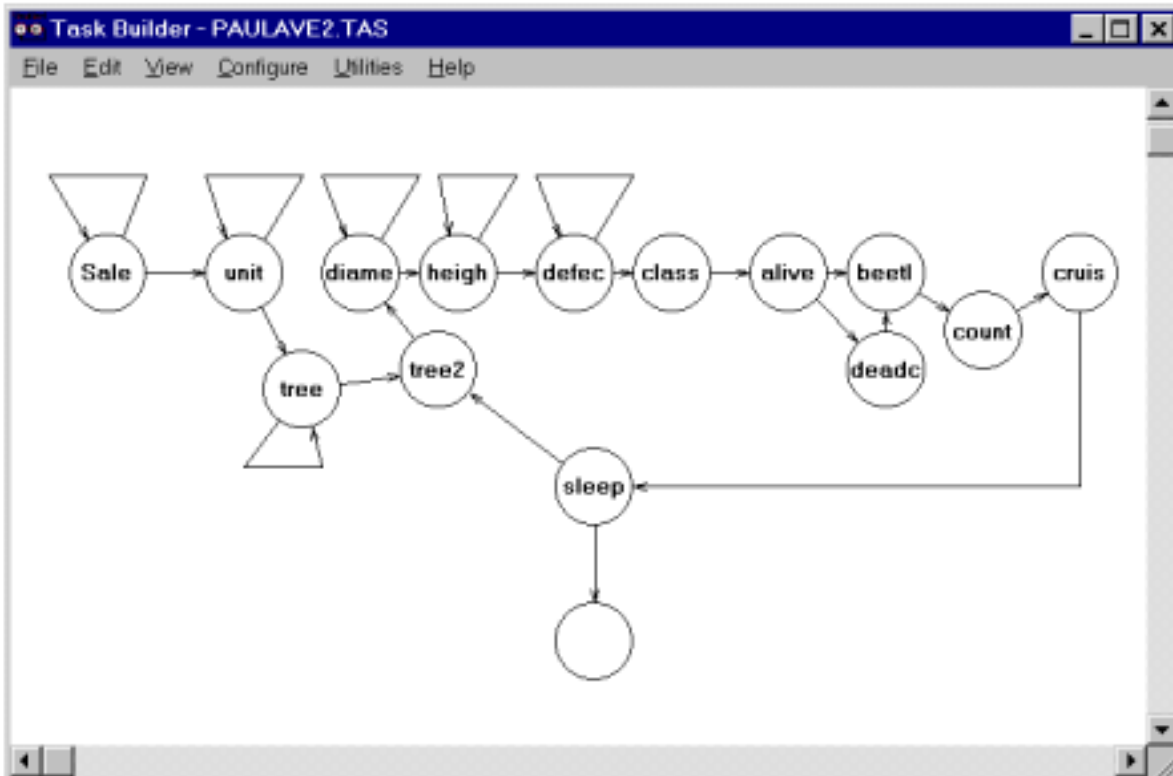


Figure A.1. Nodes and links in Task Builder.

The "Node Elements" dialog box contains the following fields and options:

- Name:** A text box containing "diameter".
- Question:** A text box containing "diameter?".
- Help Message:** A text box containing "enter d b h in inches." with a checkbox for "Standard Help" (unchecked).
- Assigned Value:** An empty text box.
- Start Node:** A checkbox (unchecked).
- "Pause" Node:** A checkbox (unchecked).
- Buttons:** "OK" and "Cancel".

Figure A.2. Node elements in Task Builder.

Appendix A

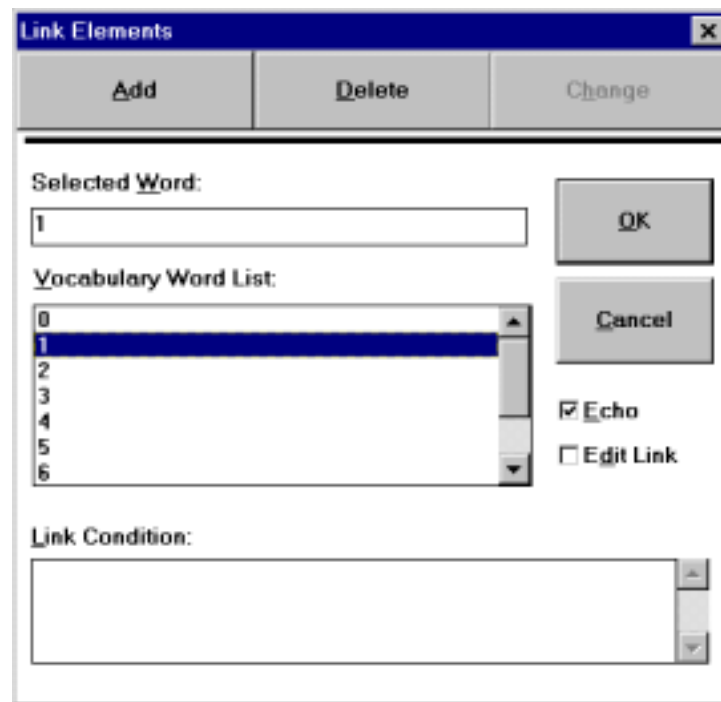


Figure A.3. Link elements in Task Builder.

Task Manager

Task Manager controls the interface between the PC and the Talkman. Voice templates, initial training, uploading and downloading tasks, adding users and uploading voice templates are all done in Task Manager.

PHOENIX II PC WITH VOICE RECOGNITION SOFTWARE

Manufacturer: **Phoenix Group, Inc.**
204 Terminal Drive
Plainview NY 11803
(516) 349-1919

The Phoenix II is a wearable PC. The test unit came equipped with a wrist mounted keyboard and a Heads-Up Display (HUD). The HUD was integrated with the microphone and speaker in a headset. The HUD interfered with comfortable operation due to a vibrating mirror in the unit. When worn for extended periods the operator got a headache from the low level hum and vibration. A four-column, four-line Liquid Crystal Display (LCD) was used in place of the HUD and worked better. The wrist mounted keyboard was useful when data entry via keyboard was necessary. However, the keys were too small and hard to operate when wearing gloves. Similarly, the mouse is located in an awkward location when the unit is worn.

Appendix A

The packaging of the unit was not as claimed. Although an attempt was made to make the unit water resistant, some ports on the underside are exposed. A number of connector cables in the unit are exposed and may snag when worn in the field.

Specifications

Computer: Intel SL Enhanced 486DX-33 w/ co-processor

Hard drive: 40 MB Internal

Display: Heads-Up (720x280 Pixels)

Keyboard: Mini wrist mounted

Slots: PCMCIA, type 2 & 3

Ports: Serial, Parallel, SCSI-2, VGA, HUD, Mouse and ISA

Weight: 5 pounds 12 ounces (2.6kg)

Battery life: 4-8 hours

