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Conducting a Sound Sweep - Instructions to Search Teams

by

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Introduction:

The Sound Sweep is an efficient form of grid-searching that utilizes sound to help find a missing person. Recent Sound Sweep field experiments (ref 1,2,3) have shown that there is a high probability of searchers finding a missing persons at three to four times the searcher spacing required for a normal, summer visual grid search. This means that search teams may cover a three to four times larger search area if they employ sound while conducting their grid search.
Compared to earlier historical data (ref 4) the Sound Sweep area coverage is up to 6 times greater in dense coniferous forest in summer, 9 times greater (at a low voice-response volume) in winter and 23 times greater in sub-alpine forest in winter. The Sound Sweep therefore is an important new tool for field teams to employ, both for area searching and as they conduct their initial hasty (trail) searches.

Limitations:

The Sound Sweep technique is based upon the presumption that a missing person will respond with sound, usually by shouting, if he/she hears a loud sound generated by the searchers. For the technique to work the Sound Sweep must be conducted while the missing person is responsive and still capable of an audible (typically, shouted) response. This means that Sound Sweeps should be conducted within the first few days, and preferably within the first 24-48 hours, of search notification.

Procedure:

Base Radio Operation

A base radio is set up in a location that will have good coverage of the search area or route. A radio operator will repeatedly broadcast the following radio prompt to all the searchers: "Four, Three, Two, One, *Blast*...". This prompt will be re-broadcast typically every one or two minutes - for the entire duration of the Sound Sweep.
(An assistant radio operator is usually required to relieve with the radio-prompt duties).
See the attached table for the required prompt intervals.

Alternatively electronic ‘beeper’ devices have been built that automatically insert four short warning tones then one long (‘blast’) tone into the base radio transmissions, to automatically prompt the searchers to perform their whistle-blasts at the required prompt intervals.

Note: These radio-prompt broadcast intervals, for both area and trail searching, have been chosen from the POD search data to ensure there is a 100% probability that searchers will *hear* an audible voice-response from a missing person. These radio-prompt intervals correspond to a distance travelled betweens whistle blasts of not more than:
18m (59ft) in Dense Coniferous Forest - in summer or winter
60m (197ft) in Open Sub-Alpine Forest - in winter.

Sound Sweep Field Operation

Sound Sweep Area Searching:

Every searcher in the team is equipped with a VHF radio, a map, compass and a loud whistle. (The Fortron Fox40 whistle is recommended).

The search team members are spaced out at very wide spacings, as specified in the accompanying Sound Sweep Probability of Detection (POD) tables, along the search area baseline. At these spacings the searchers will often not be able to see each other and so radio communication will have to be used to maintain contact between the team members.

Each searcher, upon reaching his/her starting location along the search area baseline, should identify and flag this location and then radio to base that he/she is commencing the Sound Sweep. There is no need to the searchers to start their sweeps simultaneously.

The searcher shall follow the compass bearing assigned by the search manager. Occasional brief radio communications with other team members, and the team leader, should be maintained, to ensure team safety.

Every time the searcher hears the Base radio warning prompts commencing he/she shall stop, place the whistle in the mouth and perform a simultaneous loud whistle blast on hearing the radio "*Blast*" prompt. (To preserve hearing it helps to plug the ears during the whistle-blast).

Following the whistle-blast maintain five seconds of radio silence. During this period the searchers stop and carefully listen for an audible voice-response from the missing person. If no audible or visual response is received then the searchers continue travelling until they receive the next radio prompt. The searchers repeat this base-prompted whistle-blast procedure, and listening for an audible response, while they travel the entire search area.

The search manager may request that additional Sound Sweeps be performed, preferably at right-angles to the previous sweep.

These additional sweeps are necessary if the missing persons probability of detection has to be increased.

Sound Sweep Trail Searching:

A Sound Sweep trail search, for a normal voice-response person, approximately doubles to triples the width of the trail-searched 'corridor' compared to standard visual searching. This Sound Sweep corridor has a bell-shaped POD profile which starts at 100%POD on the trail, and tapers down to 20%POD at the far edges of the corridor. This sound-swept corridor is approximately 270m(886ft) wide in dense coniferous forest under summer conditions, and 560m(1837ft) wide in dense coniferous forest, or open sub-alpine forest, under winter conditions.

Sound Sweep trail searching uses exactly the same Sound Sweep procedure of regular base-radio prompts, searcher whistle-blasts and listening for an audible voice-response from the missing person, as the team follows its trail or route. Because the team is moving together on the trail only one radio per team is usually required. (Of course the previous area searching instructions of searcher-spacing and following compass bearings do not apply for Sound Sweep trail searching).

The Sound Sweep radio-prompt interval is usually more frequent for trail searching than area searching due to the normally faster travel speeds of searchers on the trails. While the trail search teams may find the frequency of these whistle-blast prompts somewhat inconvenient it is not advisable to extend the period between whistle-blasts much longer than specified in the Sound Sweep Radio-Prompt table, doubling these prompt intervals will drop the probability of hearing a normal voice-response from 100%POD down to approximately 85%POD.
One possible option is to have each member of the trail search team take turns in performing the whistle-blast, and perhaps not stopping while listening for the subject's voice-response.

The default recommended Sound Sweep Trail Search radio prompt intervals are:
Every **20 seconds** on trails through dense Coniferous Forest, (in summer or winter).
Every **1 Minute** on trails through open Sub-Alpine Forest (in winter).

Sound Sweep
Radio-Prompt Intervals

Search Speed	**Dense Coniferous Forest - Summer or Winter**	**Open Sub-Alpine Forest - Winter Conditions**
Typical Area Search Speeds	**Default Interval**	**Default Interval 2 Minutes**
0.40 Km/hr 0.25 miles/hr	**2 Minute Interval**	8 Minute Interval
0.62 Km/hr 0.39 miles/hr	2 Minute Interval	5 Minute Interval
0.86 Km/hr 0.53 miles/hr	1 Minute Interval	4 Minute Interval
1.00 Km/hr 0.62 miles/hr	**1 Minute Interval**	3 Minute Interval
Typical Trail Search Speeds	**Default Interval 20 Seconds**	**Default Interval 1 Minute**
2.00 km/hr 1.24 miles/hr	30 Second Interval	1 1/2 Minute Interval
3.00 km/hr 1.86 miles/hr	20 Second Interval	1 Minute Interval
4.0-5.0 km/hr 2.5-3.1 miles/hr	15 Second Interval	45 Second Interval

Note: Doubling these prompt intervals will reduce the POD of hearing a normal voice-response from 100% POD down to approx. 85% POD.

Sound Sweep Trailhead Searching

Searchers in vehicles and trailheads can also apply the Sound Sweep technique to their search efforts. A radio-equipped vehicle parked at a trailhead or boundary of a search area may perform horn-blasts on cue from the base-radio prompts, simultaneously with the searching field teams. The louder sound generated by the vehicle horn may awaken or alert the subject, who may not have otherwise heard the whistle blasts, particularly if they were asleep or close to noise sources, such wind or rushing streams.

Sound Sweep Road Searching

The Sound Sweep may be used by radio-equipped vehicles searching from a road within the search area. For example, using four radio-equipped vehicles:
The four vehicles are driven along the road until they are exactly 1km or 1 mile apart (depending on whether the odometer reads in kilometers or miles). On hearing the base-radio prompt each vehicle then simultaneously sounds its horn and the driver then listens for an audible response from the subject. If no response is heard the convoy then drive exactly 0.1km (or 0.1miles) along the road using the vehicle odometer to track their distance travelled. The vehicles then stop, wait for the base-radio prompt and then repeat their simultaneous horn-blast. Again the drivers listen for an audible response from the subject, if none is heard the vehicles are then driven another 0.1km (or 0.1 miles) and the simultaneous horn-blast and listening procedure is repeated.

This drive/blast/listen process is repeated until each vehicle has driven exactly 1.0km (or 1.0 miles) i.e. until they have reached the original starting location of the vehicle in front. At this time the 4-vehicle convoy then travels 4km (or 4 miles) further up the road, i.e. until the last vehicle reaches the final finishing position of the first vehicle. At this time all the vehicle drive forward another 0.1 km (or 0.1 miles) and the whole procedure is repeated for another 1km (or 1 mile) and the convoy then moves forward again. Using this procedure a fairly large area adjacent to a road can be searched quickly with minimum manpower.

The POD at 0.1km (100m, 328ft) driving intervals i.e. up to 0.1km either side of the road for normal voice response, is 42% for dense coniferous forest in summer and 62% for sub-alpine forest in winter. For a quiet voice response in subalpine forest in winter the POD is 42%.

The POD at 0.1mile (528ft) driving intervals i.e. up to 0.1miles either side of the road for normal voice response, is less than 5% for dense coniferous forest in summer and 34% for sub-alpine forest in winter. For a quiet voice response in subalpine forest in winter the POD is also less than 5% Clearly a shorter driving interval, such as the 100m, 328ft interval above is preferable to avoid the subject's voice response from becoming inaudible.

Sound Sweep comments:
As the Sound Sweep relies heavily on radio communications uneccessary radio-chatter should be kept to a minimum.
Having large numbers of searchers, all operating radios, raises the possibility that the radio prompt, and particularly the important following five seconds of radio silence, will be masked by radio communications.
Radio communications between the radio-prompts is acceptable but no transmissions should be permitted during the radio-prompt and the following five seconds of radio silence.

The searchers should occasionally perform a radio check with base, especially if they have difficulty hearing the repeated radio-prompts. The searchers may have moved out of good radio contact with base as they travel through the search area or route.

If radio communication becomes poor then the base radio will have to be relocated. This may happen when searchers start, with good communication, on top of a ridge, but lose communication as they move down to the valley bottom. If necessary, plan to have an alternate base radio location in place, ready to restore communication as the searchers move through the search area.

RECOMMENDED SWEEP SEARCH CONDITIONS
--- For SOUND SWEEPS ---

Area Sound Sweep Search Conditions:

Search Type:	**High Probability of Detection**			**Low Probability of Detection:**			**Large Area Search Lowest POD**		
Sound Sweep Conditions:	%POD	# of Sweeps	Searcher Spacing	%POD	# of Sweeps	Searcher Spacing	%POD	# of Sweeps	Searcher Spacing
Dense Coniferous Forest - in Summer *for Normal Voice Response*	80%	3	210m 689ft 286 paces	40%	1	210m 689ft 286 paces	40%	1	210m 689ft 286 paces
Dense Coniferous Forest or **Open Sub-Alpine Forest - in Winter** *for Normal Voice Response**	80%	1	136m 445ft 184 paces	40%	1	300m 984ft 408 paces	28%	1	480m 1574ft 652 paces
Dense Coniferous Forest or **Open Sub-alpine Forest - in Winter** *for Quiet Voice Response***	80%	1	73m 240ft 99 paces	40%	1	230m 755ft 313 paces	40%	1	230m 755ft 313 paces

Typical Summer Area-Search Speeds in Dense Coniferous forest:
0.4Km/hr ((0.25 miles/hr) in rough mountain forest with moderate to heavy bush,
Sound Sweep whistle-blast every 2 minutes.
1.0Km/hr ((0.62 miles/hr) in fairly level forest with light to moderate to bush,
Sound Sweep whistle-blast every 1 minute.

Typical Winter Area-Search Speeds on firm snow with most of the bush buried.
Dense Conifereous forest: 0.62Km/hr (0.39 miles/hr)
Open Sub-Alpine forest: 0.86Km/hr (0.53 miles/hr)
*Sound Sweep whistle-blast every 1 minutes.
**Sound Sweep whistle-blast every 2 minute.

% POD vs Searcher Spacing
raw data for a single SOUND SWEEP

Sound Sweep **Probability of Detection**	**Dense Coniferous Forest - in Summer** *(Normal Voice Response)*	**Dense Coniferous Forest** or **Open Sub-Alpine Forest - in Winter** *(Normal Voice Response)*	**Dense Coniferous Forest** or **Open Sub-Alpine Forest - in Winter** *(Quiet Voice Response)*
100%	18.1m 59ft	60.0m 197ft	15.0m 49ft
95%	24.4m 80ft	80.0m 263ft	34.1m 112ft
90%	31.2m 102ft	106m 347ft	48.2m 158ft
85%	38.7m 127ft	120m 394ft	59.5m 195ft
80%	47.0m 154ft	136m 445ft	69.9m 229ft
75%	56.4m 185ft	152m 498ft	79.9m 262ft
70%	67.2m 220ft	167m 549ft	89.9m 295ft
65%	80.1m 263ft	182m 596ft	100m 328ft
60%	96.3m 316ft	197m 646ft	111m 364ft
55%	118m 387ft	218m 715ft	124m 407ft
50%	151m 495ft	240m 787ft	139m 456ft
45%	188m 617ft	267m 876ft	160m 525ft
40%	216m 709ft	300m 984ft	235m 771ft
35%	235m 771ft	354m 1161ft	263m 863ft
30%	249m 817ft	429m 1409ft	275m 902ft
25%	261m 856ft	550m 1804ft	284m 932ft
20%	271m 889ft	560m 1837ft	- -
15%	280m 919ft	570m 1870ft	- -
10%	288m 945ft	580m 1903ft	- -
5%	295m 968ft	- -	- -
0%	- -	- -	- -

Meters x 1.36 = single paces Feet x 0.425 = single paces

References :
(1) 'New Concepts for Gridsearching' 1991, (2) 'The Sound Sweep, - A New Tool for Search Teams' by Martin Colwell. 1991 (3). 'Planning the Gridsearch' 1994 all by M. Colwell. Emergency Response Institute, Olympia, Washington.
(4) An Experimental Analysis of Gridsearching, Jon Wartes, 1972