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TECHNICAL REPORT #74-04

# EVALUATION OF VOICE RECORDERS FOR AIRCRAFT

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Communications & Electronics Branch

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U. S. ARMY LAND WARFARE LABORATORY
Aberdeen Proving Ground, Maryland 21005

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The U. S. Army Land Warfare Laboratory evaluated existing tape recorder/reproducers for use as voice monitors in Army surveillance and observation aircraft. It was concluded that none of the tested recorders are capable of meeting the DA Approved Performance Characteristics for "Recorder, Voice for Surveillance and Observation Aircraft". However, development of a suitable recorder is well within the state-of-the-art.

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## INTRODUCTION

At the request of the U. S. Army Office of the Chief of Research and Development, USALWL evaluated two models of miniature tape recorders. The objective was to determine if they could meet the DA Approved Performance Characteristics for "Recorder, Voice for Surveillance and Observation Aircraft".

The first tape recorder evaluated was a commercial unit, the Sony Model TC 50. This recorder was selected from a group of nineteen candidate, commercial recorders. Selection was based upon a comparison of available specifications against several "Essential Operational Characteristics" defined by the U. S. Army Combat Developments Command. Although the Sony recorder appeared to meet most of the electrical performance requirements, it was obvious that it was neither designed for nor capable of meeting reliability needs in terms of ruggedness and environmental protection. Consequently, no further testing was performed on this model.

The second tape recorder evaluated was a Canadian model being developed by the Canadian Defense Department. Initially, two developmental models were borrowed by LWL through the USA Standardization Group, Canada. Subsequently, improved early production models, nomenclatured Recorder-Reproducer Set, Sound, AN/PSH-2(XLW-1) were purchased and tested. This report describes the results of operational tests with these Canadian recorders.

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## DESCRIPTION OF EQUIPMENT

The Recorder-Reproducer, Sound, AN/PSH-2(XLW-1) (see Figure) was designed by the Canadian Army for use by ground forces in the field to permit the recording of verbal information and for subsequent preparation of reconnaissance/intelligence reports. It is intended to be carried in a large pocket, a pouch for belt or rucksack mounting, or a special harness to be hung from a shoulder.

The basic unit, including recorder, handset, and batteries weighs approximately 4.5 lbs. The recorder is contained in a sealed aluminum case approximately 7 inches x 5 inches x 2-1/2 inches. Six batteries, type BA-3042, "C" cells, providing 10 hours of use are housed in a separately sealed compartment in the lower main case. The recording tape used is a 1/4 inch polyester-base type contained in a cartridge (MA-28/PSH-2-XLW-1). The recorder reproducer is designed to operate on two tape tracks (channels), one at a time, with a total recording time of 60 minutes (30 minutes per track). Change-over from track 1 to track 2 is accomplished by reversing the cartridge in the recorder. A digital tape counter, illuminated by two tritium light sources, is incorporated in each cartridge and aids location

FIGURE

RECORDER-REPRODUCER SET, SOUND AN/PSH-2(XLW-1)

of specific messages on the tape. Selection of the desired functions, i.e., Record, Playback, etc., is accomplished by means of a spring-loaded, self-locking, single-level control. The condition of the batteries can be checked by means of a push-button operated "Good-Bad" indicator light. The handset H-309/PSH-2(XLW-1) incorporates a start-stop switch to control the recorder in either the Record of Playback modes of operation, and a microphone pre-amplifier. In Playback, the handset serves as a low-volume, hand-held loudspeaker. The recorder employs a volume-compressor circuit to automatically provide adequate recording levels at low voice volume and prevent distortion at very high voice volume. It serves as an automatic loudness control.

## EVALUATION RESULTS

### Developmental Models

The developmental (Mark I & Mark II) model recorders had been tested by the Canadian Army and found to meet requirements for reliability and environmental protection. No tests specifically directed towards these performance aspects were conducted by LWL.

In testing of electrical recording and playback performance, the recorders were found to be deficient in the following respects:

1. The recorders performed properly with the microphone input. However, when used with an aircraft intercommunications system, the volume-compressor circuit did not provide adequate control and high levels of distortion occurred.

2. Because of the finite response time ("attack" and "recovery" times) of the volume compressor circuit, it was not able to compensate for rapid variations in signal level with resultant distortion on high amplitude sound peaks and poor control of volume.

It was recommended to the Canadian Defense Department and the manufacturer that the volume compressor circuits be redesigned to permit recordings over a 50 dbm volume range fed from a 600 ohms voice line. In addition, it was recommended that signal clipping elements be incorporated in the recording circuits to maintain signal overshoots (high amplitude peaks) within 50% of the average volume level. Both of these improvements were designed into a later model (Mark III) tape recorder.

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### Improved Models

Improved models of the recorder, nomenclatured AN/PSH-2(XLW-1), were purchased and evaluated by LWL. After confirming that the above deficiencies had been corrected, the tape recorders were used in helicopter aircraft as verbal notebooks during otherwise unrelated test operations. This provided

a realistic operational test. The results of the test are given in the Appendix.

An evaluation of recorder characteristics and test performance indicates that the recorder is unsuited for use in Army aircraft for the following reasons:

1. It is not small enough or light enough to be carried comfortably in the pockets of standard military flight suits.

2. It does not provide sufficient uninterrupted recording time (only 30 minutes per tape track).

3. The tape recorder provides no specific indication of end-of-tape. The footage counter is inadequate since its monitoring involves undesirable distraction of aircraft personnel.

4. Without an auxiliary amplifier, the recorder does not provide sufficient playback volume.

5. Under operational conditions, the crew of an aircraft has many manual tasks to perform. Given the choice, crew members are likely to turn on a recorder when it is needed and let it run, rather than turn it on and off for each transmission. This leads to two additional shortcomings:

a. Background noises are continually recorded. This is very annoying when monitoring the tape in playback.

b. There are large amounts of dead space on the tape. In view of the short recording time per track, this is intolerably wasteful of recording time. In addition, it makes for difficult listening in playback.

The use of a voice-operated switch circuit (VOX) would significantly reduce the above two shortcomings by permitting the recorder to function only when there is a voice input.

6. The tape cartridge used with this recorder is excessively complex and costly.

## CONCLUSIONS

1. Neither the commercial recorder evaluated nor the Canadian Recorder-Reproducer AN/PSH-2(XLW-1) are capable of meeting the requirements of the DA Approved Performance Characteristics for "Recorder, Voice for Surveillance and Observation Aircraft.

2. Development of a suitable recorder is well within the state-of-the-art. It is judged that only an engineering design effort directed toward the objective is required.

# APPENDIX

## OPERATIONAL TEST OF RECORDER-REPRODUCER SET, AN/PSH-2(XLW-1)

MEMORANDUM FOR RECORD 10 August 1971

SUBJECT: Voice Recorder for Surveillance and Observation Aircraft, Task 11-E-68

THRU: Chief, MOD
Chief, DED

TO: Chief, C&E Branch

1. Four PSH-2 Recorder Reproducer Sets, Serial Numbers 1 thru 4, were taken to Eglin AFB, Florida on 18 July 71, for use during the Pre-Masster XM-3/HELNAVS test. The recorders were utilized in the following aircraft - UH-1D, OH-58A, and OV-1.

2. The tape recorders performed as designed, however, due to the following operational deficiencies, they were not utilized in the UH-1D and OH-58A after the first week of testing. OV-1 testing was accomplished during the 3rd week of the test:

a. Low Amplification - It is difficult to utilize the recorders in the play back mode when compiling data due to the low volume of the sound produced through the microphone. The microphone must be held directly against the ear in order to hear the recording. An amplifier should be included in the system to provide for ease in monitoring the tape.

b. Aircraft Noise - Recorder picks up noises generated by the aircraft radio/electrical system. This noise is cut out when there is a recording on the tape; however, it is very annoying to monitor the tape with a constant high frequency noise present. A noise filter should be incorporated in the system.

c. Warning Device - There is not any means to warn the operator when the tape has been filled or exhausted. A pilot or observer when engaged in normal flight activities does not have the time to constantly monitor the tape. An audio warning device should be included that will signal the end of the recording period.

d. Dead Space on Tape - The recorder operates continuously when installed in the aircraft. This results in a large amount of dead space on the tape. The recorder should function only when a microphone is activated aboard the aircraft. This would delete the need to change the tape every thirty minutes, unless the recorder has been in continuous operation.

Incl 1

MEMORANDUM FOR RECORD 10 August 1971
SUBJECT: Voice Recorder for Surveillance & Observation Aircraft, Task 11-E-68

e. Weight and Size - The recorder is too heavy and large to be carried in the pocket of a flight suit. Even though the recorder will fit in the lower pockets of a flight suit, it is too heavy and bulky to be comfortable. I received a bruise on my right leg after walking for five minutes with the recorder in the lower pocket of my flight suit. It was also virtually impossible to fly the OH-58A with the recorder in the same pocket, as it interfered with normal control actions. The control cord also becomes entangled in the flight controls and pilot's flight gear when the recorder is utilized in this configuration. A carrying case should be constructed for the system.

f. Play Back - On three separate occasions the recorder played back at a faster speed than recorded. It sounded like a 33 1/3 RPM record being played at 78 RPM. Reseating of the cartridge corrected this deficiency in two cases.

g. OH-58A - The following additional discrepancies were apparent when the recorder was utilized in the OH-58A:

(1) Cable Length - The length of the Y cord was too long for use in the OH-58A. It became entangled in the collective pitch control unless it was stuffed in the map case.

(2) Mounting - The map case is not an acceptable location for mounting the recorder in the OH-58A due to the fact that the cockpit is cramped and it takes two hands to reverse the tape. The location behind the pilot and observer requires that they both use one hand to change the tape. This is an unsafe condition as the pilot must take one hand off of the controls and divert his attention from flying the aircraft.

3. Recommendation - That the PSH-2 Recorder Reproducer not be offered for evaluation in RVN until the following deficiencies are corrected:

a. Low amplification.

b. End of tape warning.

c. Continuous operation.

d. Lack of carrying case.

RICHARD J. BURTNETT
MAJ, GS
Operations Officer (Avn)

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