USAARL Report No. 2000-04

Flight Evaluation of the Communications Earplug in the OH-58D Helicopter

Part 1. Research Report

By

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Aircrew Protection Division

October 1999

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U.S. Army Aeromedical Research Laboratory
Fort Rucker, Alabama 36362-0577

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Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release, distribution unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) USAARL Report No. 2000-04	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Aeromedical Research Laboratory 6b. OFFICE SYMBOL (If applicable) MCMR-UAD	7a. NAME OF MONITORING ORGANIZATION U.S. Army Medical Research and Materiel Command
6c. ADDRESS (City, State, and ZIP Code) P.O. Box 620577 Fort Rucker, AL 36362-0577	7b. ADDRESS (City, State, and ZIP Code) Fort Detrick Frederick, MD 21702-5012
8a. NAME OF FUNDING / SPONSORING ORGANIZATION US Army Medical Rsch Acq Act 8b. OFFICE SYMBOL (If applicable) MCMR-AAA-A	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DAMD17-93-C-3101
8c. ADDRESS (City, State, and ZIP Code) 829 CHANDLER STREET Fort Detrick, MD 21702-5009	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 63787A PROJECT NO. 3016287A878 TASK NO. OF WORK UNIT ACCESSION NO. DA36347

11. TITLE (Include Security Classification)
Flight Evaluation of the Communications Earplug in the OH-58D Helicopter, Part 1: Research Report (U)

12. PERSONAL AUTHOR(S)
Barbara A. Murphy and Ben T. Mozo

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM TO	1999 October	38

16. SUPPLEMENTAL NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Aviators assigned to OH-58D helicopter operational units participated in an expanded field assessment of the communications earplug (CEP). Characteristics of the CEP have been determined through laboratory and field testing over the past several years. Results of the laboratory studies showed that aviators were protected and provided with speech communications capability. The CEP is a low-cost and simple approach that is readily available for immediate fielding. During FY 98, Project Manager-Aircrew Integrated Systems (PM-ACIS) purchased enough CEPs to outfit all aviators currently assigned to OH-58D operational units. The objective of the purchase was to form a large sample of users for evaluating the effectiveness of the current CEP configuration in solving the problems associated with hearing protection and communication in the OH-58D helicopter. The acceptability of the CEP was assessed by comparison with the helmet systems currently used in the OH-58D helicopter. Comments and responses provided by the volunteers show that the CEP, with some modifications, is a substantial improvement over current systems. With improved cockpit communications, flying becomes

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Chief, Science Support Center	22b. TELEPHONE (Include Area Code) (334) 255-6907	22c. OFFICE SYMBOL MCMR-UAX-SS

DD Form 1473, JUN 86 *Previous editions are obsolete.*

SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

19. Abstract (continued):

less fatiguing and stressful. The CEP performs well during daily missions and is considered a viable solution to the problem of inadequate speech clarity and understanding in the Kiowa Warrior helicopter. Over 90 percent of the participants rated the CEP as having greater overall operational value than the aviator helmet as it is currently used. Aviators view the CEP as a viable solution to the communications problem and feel it should be fielded to all aviation units. Part 1 of this study presents the principal findings in summary form. Part 2 contains the data-set necessary to allow close inspection of individual subject responses.

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Introduction

Noise levels inside military helicopters generally exceed the noise exposure limits established by DOD Instruction 6055.12, Hearing Conservation, and sometimes exceed the capability of helmets to provide adequate hearing protection for crewmembers. Voice communication is also compromised because of inadequate speech signals reaching the ear. Use of combination protection, earplug in addition to the helmet, provides the necessary hearing protection, but further compounds the problems associated with communications capability. The communications earplug (CEP), a device which incorporates a miniature earphone with a foam earplug, can be worn in combination with the aviator's helmet (Figure 1). The CEP can provide hearing protection that is equivalent to the yellow foam earplug, is adequate for extremely high noise levels, and enhances voice communication intelligibility (Mozo and Murphy, 1997).

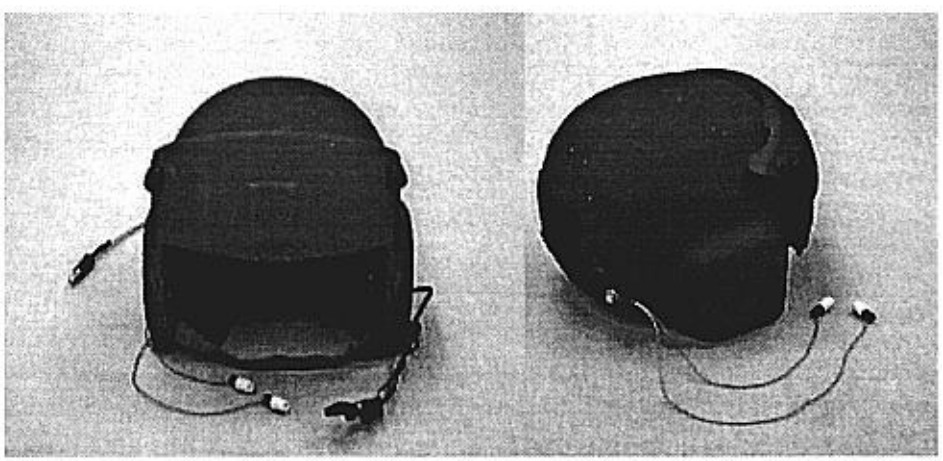

Figure 1. CEP integrated into HGU-56/P aviator helmet.

Characteristics of the CEP have been determined through laboratory and field testing over the past several years (Ribera, Mozo, and Murphy, 1999 and Staton, Mozo, and Murphy, 1997). Results of studies of the U.S. Army Aeromedical Research Laboratory (USAARL) have shown that aviators can be protected and provided with speech communications capability at levels better than thought possible 10 years ago with the CEP.

In FY97, Project Manager-Aircrew Integrated Systems (PM-ACIS) purchased enough CEPs to outfit all aviators currently assigned to OH-58D operational units. The objective of the purchase was to form a large sample of users for assessing user acceptance and reliability of the current configuration of the CEP. This report (Part 1) contains a report of the survey research while Part 2 (Mozo and Murphy, 1999) contains the data-set necessary to allow close inspection of individual subject responses. Figure 2 depicts the CEP used in this evaluation.

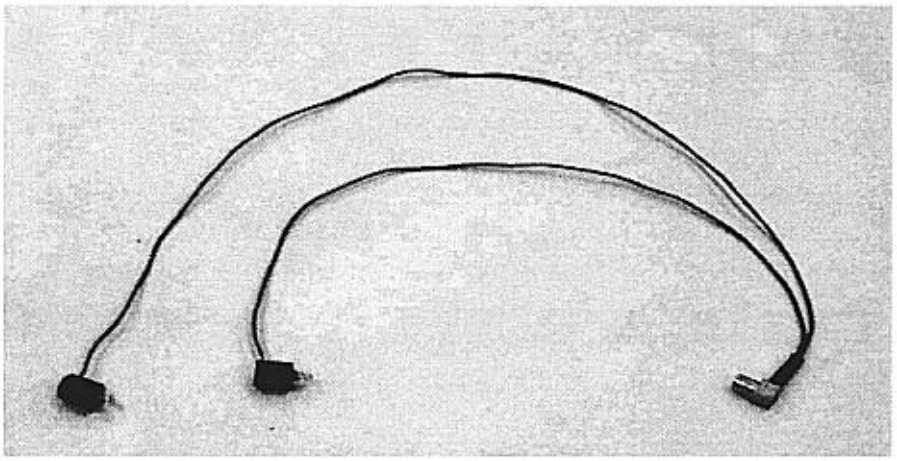

Figure 2. Communications earplug (CEP) used in this study.
Manufactured by Production Products Mfg. & Sales.

Methods

Subjects

During the time the survey was conducted (1997-1998), the PM-ACIS office estimated that there were approximately 700 OH-58D aircrew in the U.S. Army. Beginning August 1997, the CEPs were installed into HGU-56/P helmets under the direction of the PM-ACIS, with assistance provided by this Laboratory. The targeted return rate for the questionnaire was 80%. Names and/or social security numbers of aviators were not requested in the questionnaire since the collected data have no bearing on the individual from whom it was collected.

Questionnaire

The USAARL provided questionnaires to be administered at a minimum of 6 months after CEP installation into the aircrew's HGU-56/P helmet. This questionnaire was designed to measure the aviator's subjective assessment of the CEP when compared to helmets he/she had normally used in the past (Appendix A). There were over 500 questionnaires sent to aviation units where the CEPs were installed. The primary areas of interest were comfort, compatibility, communications performance, noise reduction, utility and overall value added. In general, the questionnaire used either direct response questions or seven discrete point rating scale questions. Ample opportunity was provided for comments from the volunteers. The rating scale was based on a comparison between the CEP/helmet combination and the helmet normally used by the volunteer with the midpoint (4) indicating no difference between the two. A rating of 7 indicated the users' highest CEP preference value while a 1 indicated the users highest helmet preference value.

_____7_____	:_____6_____	:_____5_____	:_____4_____	:_____3_____	:_____2_____	:_____1_____
Significantly better	Moderately better	Slightly better	Same	Slightly worse	Moderately worse	Significantly worse

Results of the preference questionnaire responses were used to determine the extent of problems identified by the aircrew and to assess the acceptability of the device for use in completing OH-58D missions.

Procedure

A quality control inspection by USAARL personnel was performed on approximately 70% of the test devices prior to CEP installation. Repairs were made accordingly (e.g. reattach screw-tips to housing) before installation into the HGU-56/P helmet. The field installation of the CEP into the helmet was performed by personnel from USAARL, PM-ACIS or unit Aviation Life Support Equipment (ALSE) technicians by inserting an interface wiring harness into the earcup in order to connect the CEP to the communication circuit. The interface harness included a subminiature coaxial (SMB) jack, compatible with the SMB plug on the CEP, and was mounted into an adapter placed in the unused blown-air port on the rear right quadrant of the helmet, as shown in Figure 1. The communications provided by the CEP runs parallel to the system used in the HGU-56/P helmet. The sensitivity of the CEP was adjusted to a level similar to the HGU-56/P helmet using an external divider network that is a part of the interface harness.

The ALSE officer at each unit was provided guidance and instructions (video and printed material) from the USAARL or PM-ACIS on the installation and use of the CEP. These guidelines include proper insertion, replacement of and washing earplug tips, limiting the volume level at startup, donning and doffing the helmet and procedures to be used should an unexpected malfunction of the CEP occur. Proper sizing of earplug tips for each volunteer was determined by the size (color) of V-51R or triple flange earplug that subjects had been previously issued.

The ALSE officer located at each of the fielding units distributed the questionnaires. Confidentiality was not violated since names were not associated with the returned forms. Potential subjects were given the questionnaire to complete and return to the USAARL by mail for analysis. Descriptive statistics were completed on the returned questionnaires. An analysis of the responses was completed to determine the relationship of the CEP and helmet from the users subjective opinions. Due to the nature of this study, no additional statistical analysis was considered necessary.

Results

The complete database showing each response by each subject is contained in Part 2 of this report (Murphy and Mozo, 1999). The following sections will present the principal findings of the study in summary form. Numbers with a Q prefix indicate the question number from the questionnaire shown in Appendix A. Of the 500 questionnaires sent out to OH-58D units, 152 were returned to USAARL (30%).

Personal Data

The CEPs were installed into HGU-56/P helmets at the following locations with parentheses () indicating the number of returned questionnaires (not the actual number of helmets modified). An asterisk (*) denotes two groups at this location.

Fort Bragg (43)*	Fort Campbell (17)	Fort Drum (25)*
Fort Hood (10)	Fort Polk (23)	Fort Rucker (17)
Fort Stewart (16)	Korea (1)	

Most respondents were male and a wide range of flight experience was represented (Tables 1 and 2). All the volunteers were first-time CEP users, but not all were first time HGU-56/P users (Table 3). The fielding of the HGU-56/P helmet coincided with this study.

Table 1.
Respondent gender.

(Q3) Gender.

	Male	**Female**	**No response**
Gender	146	3	3

Table 2.
Respondent aviation experience.

(Q4a) Experience as an aviator (years),
and (Q4b) approximate number of flight hours.

	Mean	**Min**	**Max**
Experience (years)	6.4	1	30
Flight hours	1347	200	10,500

Table 3.
Respondent flight hours.

(Q5) Number of flight hours wearing HGU-56/P helmet (prior to CEP installation).
(Q6) Number of flight hours wearing CEP.

	Mean	Min	Max	No response
HGU-56/P	205.3	1	2300	3
CEP w/HGU-56/P	129.4	1	400	51

Most respondents indicated their CEP was still functioning properly. Causes of malfunction are noted in Table 4 and Part 2 of this report.

Table 4.
CEP still operational.

(Q6b) Is the CEP still functioning properly, and if not,
(Q6c) describe the malfunction.

	Yes	No	No response	Malfunction
CEP still working	126	23	3	Broken screw-tips and broken wire at the transducer housing

The most commonly used foam tip size with the CEP was the standard tip (Table 5). The subjects (Table 6) used the left and right aircraft seats equally. Most respondents reported normal hearing and did not wear spectacles (Tables 7 and 8).

Table 5.
Foam tip size.

(Q7) CEP foam tip size.

	Standard	Slim	Short	Combination	No response
Foam tip size	103	23	17	2	7

Table 6.
Seat position.

(Q8) Seat position during most flights.

	Right	Left	R/L equal	Other	No response
Seat position	40	33	58	11	11

Table 7.
Hearing loss.

(Q9) Do you have a waiver or information only (IO) letter for a hearing loss?

	Yes	No	No response
Waiver or IO	7	135	0

Table 8.
Eyeglasses and temple type.

(Q10) Do you normally wear eyeglasses when flying, and
(Q10b) what type temples are on the glasses you normally wear?

	Yes		No
Wear eyeglasses	17		135
Eyeglass temples	Bayonet	Wire	
	5	9	

Personal Hearing Protection

A large majority of the respondents wear earplugs with their flight helmet (Table 9) and did not have any noticeable discomfort problems with earplugs or helmets prior to CEP installation (Table 10). All respondent reasons for not wearing earplugs or the discomfort from wearing earplugs or helmets are noted in Part 2.

Table 9.
Earplug/helmet combination usage prior to CEP installation.

(Q11) Prior to CEP installation, did you wear earplugs in conjunction with your flight helmet?

	Yes	No	No response
Wear earplugs	121	29	2

Table 10.
Earplug/helmet discomfort.

(Q12/13) Did you frequently experience discomfort with your earplugs/helmet?
(Q12b/13b) how long does it take before you feel discomfort, and
(Q12c/13c) describe the discomfort?

	Earplugs			Helmet		
Discomfort experienced	Yes	No	NR	Yes	No	NR
	26	110	16	26	120	6
Onset of discomfort	<1 hr.=9	>1hr.=8	NR=9	<1 hr.=17	>1hr.=9	
Type of discomfort	Pain or itching			Headaches		

Fitting

Most respondents did not have difficulty fitting the CEP and did not experience discomfort when inserting the earplug (Tables 11 and 12). The reasons given for difficulty in fitting the CEP were trouble finding the correct size foam tip and keeping the earplugs seated when donning the helmet. All respondent observations are noted in Part 2 of this report.

Table 11.
Difficulty fitting CEP.

(Q14) Have you had any difficulty in fitting the CEP?

	Yes	No
Difficulty fitting CEP	35	117

Table 12.
Discomfort inserting CEP.

(Q15) Was there any discomfort when inserting the earplug?

	Yes	No
Discomfort inserting CEP	51	101

Most of the respondents did remark that CEP wires pulled on the earplug when turning their head causing some movement of the earplug during flight (Tables 13 and 14). The predominant reasons noted by the subjects for the earplug slipping from the ear canal were due to excessive

sweating and the earplug not being fully seated within the ear canal before flight. All respondent observations are noted in Part 2 of this report.

Table 13.
CEP wire tension.

(Q16) Do the wires pull on the CEP when turning your head?

	Yes	No
CEP wire tension	114	38

Table 14.
CEP movement in flight.

(Q17) Does the CEP move or slip out of the ear during flight?

	Yes	No
CEP slips during flight	71	81

Approximately one-half of the respondents indicated that the CEP wire lengths (right and left side) were of reasonable length (Table 15). This question was asked to determine if the wire lengths listed in the specification (Table 16) would accommodate the majority of the aviation community or if it should be adjusted.

Table 15.
CEP wire lengths.

(Q18) Wire lengths of the CEP.

	Just right	Too long	Too short	No response
Short wire (right side)	85	6	61	20
Long wire (left side)	75	37	18	22

Table 16.
Specification for wire length and wire lengths of sample CEPs.

	Wire length	
	Right	Left
Specification	12 inches	17 inches
CEP samples	10.75 – 11.75	15.75 – 16.75

It was unfortunate that the wire lengths of the CEP samples measured were not adhered to. If specifications were met, perhaps the problems noted would have been less.

Most of the respondents did not indicate any problems with CEP during night flights (Table 17). Equipment interference with CEP wires inside the cockpit was noted by one-half of the respondents but it did not interfere with their job performance (Table 18).

Table 17.
Night flying problems.

(Q19) Were there any problems associated with CEP during night flights?

	Yes	No	No response	Primary reason(s)
Night flight problems	40	109	3	Wire occasionally tangles on NVG battery pack or other cords on back of helmet.

Table 18.
CEP interference.

(Q20) Does the CEP catch on other equipment or interfere with job performance?

	Yes	No	No response
CEP interference	78	72	2

Most respondents were satisfied with the location of the CEP/helmet connector in the unused blown-air port at the back of the helmet (Table 19).

Table 19.
CEP helmet connector location.

(Q21) Is the orientation or location of the connector convenient?

	Yes	No	No response	Reasons stated
Convenient connector location in unused blown-air port	118	28	6	Relocate to side of helmet, make one on each side, or make bigger connector.

There was considerable variability in the frequency and method of foam tip cleaning (Tables 20 and 21). Most respondents denied problems with cerumen accumulation in the foam tip (Table 22).

Table 20.
Foam tip maintenance.

(Q22) After how many flight hours did you clean or change foam tips?

	Not changed or never cleaned	Change/clean after <25 hours	Between 25-100 hours	No response
Clean/change foam tips	46	46	45	15

Table 21.
CEP cleaning methods.

(Q23) How did you clean foam tips?

	Launder with flight suit	Replace when dirty	No response
Cleaning method	91	39	18

Table 22.
Occurrence of wax build-up.

(Q24) Was there a problem of wax build-up in the CEP foam tip?

	Yes	No	No response
Wax build-up	37	111	4

Comfort

Most respondents complained of ear canal discomfort of some degree (Table 23), while the majority denied external ear discomfort or CEP-related hot-spots (Tables 24 and 25). Only 25 of the respondents with ear canal discomfort rated their degree of discomfort. The majority of the discomfort noted was from the earphone, inside the earcup, pushing on the CEP or the hard, sharp plastic housing pressing into the outer portion of the ear canal or pinna.

Table 23.
Ear canal discomfort.

(Q25) Does the CEP cause any discomfort in your ear canals?

	Yes			No	No response
Ear canal discomfort	81			69	2
Type of discomfort	Itching and/or pain after Long flights				
Degree of discomfort	Mild	Moderate	Extreme		
	12	12	1		

Table 24.
External ear discomfort.

(Q26) Does the CEP cause any discomfort to your external ear?

	Yes	No
External ear discomfort	29	123

Table 25.
CEP hot-spots/discomfort.

(Q27) Are there any hotspots associated with CEP?
(Q28) When did you first notice discomfort?

	Yes			No	No response
Hot-spots	13			138	1
Onset of discomfort	.5 hrs	1.0 hrs	>2.0 hrs		
	28	17	12		

The aviators gave CEP an average rating of 4.6 with respect to the overall fit and comfort of the CEP compared to their personal helmet (Table 26).

Table 26.
CEP overall fit and comfort.

(Q29) With respect to overall fit and comfort, compare the CEP device with your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	24	19	15	57	13	4	9	
% of total	<<<<<<<<<	38	>>>>>>>>>		<<<<<<<<<	17	>>>>>>>>>	

(Shaded areas represent a percentage of the total responses (ex. 38% rated the CEP/helmet combination as being better than their personal helmet while 17% rated the CEP/helmet combination as being worse than their personal helmet).

Donning and Doffing

With the addition of CEP, most respondents did notice a difference in their normal donning/doffing routine, but the additional step was insignificant in terms of completing their mission (Tables 27 and 28).

Table 27.
Helmet donning differences.

(Q30) Does the addition of the CEP result in differences in the helmet donning procedure?

	Yes	No	No response
Differences in donning helmet	121	31	0

Table 28.
Extra-step problem.

(Q31) Does this extra step pose a significant problem in completing your mission?

	Yes	No	No response
Extra step problem	12	139	1

There appeared to be some difficulty in donning/doffing the CEP with gloves on for most of the respondents (Table 29). However, there did not appear to be a significant problem if they forgot to disconnect the CEP before removing their helmet (Table 30).

Table 29.
Donning/doffing with gloves.

(Q32) Do you have a problem donning/doffing the CEP with gloves on?

	Yes	No	No response
Donning/doffing with gloves	102	48	2

Table 30.
CEP disconnection problems.

(Q33) If you forgot to disconnect the CEP when doffing, was there any discomfort or difficulties when the CEP was removed?

	Yes	No	No response
Forgetting to disconnect from helmet	36	111	5

The aviators gave CEP an overall average rating of 3.7 with respect to donning/doffing compared to their personal helmet (Table 31).

Table 31.
Rate donning/doffing.

(Q34) With respect to donning/doffing, compare the test device to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	7	9	6	58	41	13	6	12
% of total					<<<<<<<<	43	>>>>>>>>	

Speech Clarity/Understanding

The aviators gave CEP an overall average rating of 6.6 with respect to the intercommunication system (ICS) speech clarity/understanding compared to their personal helmet (Table 32).

Table 32.
Rate ICS speech clarity/understanding.

(Q35) Rate the difference in ICS speech clarity/understanding when compared to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	115	20	10	5	0	0	2	0
% of total	<<<<<<<<<<	89	>>>>>>>>					

The aviators gave CEP an average rating of 6.3 with respect to speech clarity/understanding of male talkers, an average rating of 6.2 to female talkers and an overall average rating of 6.5 when compared to their personal helmet (Tables 33 and 34).

Table 33.
Rate speech clarity/understanding of personnel based on gender of the talker.

(Q36) Rate the difference in speech clarity/understanding of personnel based on gender of the talker when compared to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count (male)	91	33	10	14	0	0	1	3
% of total	<<<<<<<<<	90	>>>>>>>					
Count (female)	82	34	8	18	0	0	1	9
% of total	<<<<<<<<<	87	>>>>>>>					

Table 34.
Rate overall speech clarity/understanding.

(Q37) Rate the difference in overall speech clarity/understanding when compared to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	105	27	10	6	0	0	1	3
% of total	<<<<<<<<<<	95	>>>>>>>>					

Noise Reduction/Attenuation

When compared to their personal helmet, the aviators gave CEP an overall average rating of 5.6 with respect to reducing noise levels at the ears and a 6.2 rating for hearing navigational and caution/warning signals (Tables 35 and 36).

Table 35.
Noise level reduction.

(Q38) With respect to reducing noise levels at your ears, compare the CEP to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	60	32	15	32	9	2	1	1
% of total	<<<<<<<<<	71	>>>>>>>>					

Table 36.
Rate hearing navigational and caution/warning signals.

(Q39) With respect to allowing you to hear navigational and caution/warning signals, compare the CEP to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	89	25	12	14	2	0	4	6
% of total	<<<<<<<<<	86	>>>>>>>>					

The aviators gave the CEP an overall average rating of 4.6 with respect to hearing and monitoring noise generated by the aircraft and a 5.3 rating for reducing noise levels at the ears during weapons firing when compared to their personal helmet (Tables 37 and 38).

Table 37.
Rate ability to monitor aircraft noise.

(Q40) With respect to your ability to hear and monitor noise generated by the aircraft, compare the CEP to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	28	21	15	47	29	6	1	5
% of total	<<<<<<<<<	44	>>>>>>>>					

Table 38.
Rate noise reduction during weapons firing.

(Q41) With respect to reducing noise levels at your ears during weapons firing, compare the CEP to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	36	33	21	35	6	3	1	17
% of total	<<<<<<<<<<	67	>>>>>>>>>					

General Issues

A minority of respondents identified problems with the CEP (Table 39). Durability of the CEP and the extreme loudness of aircraft warning signals were frequent concerns. Specific comments are summarized in Tables 40 and 41. Actual comments are reproduced in Appendix B-D.

Table 39.
Adverse effects of CEP performance.

(Q42) Were there any adverse effects of CEP performance?

	Yes	No	No response
Adverse effects of performance	27	118	7

Table 40.
CEP problems encountered.

(Q43) Please elaborate on any problems you may have encountered while wearing the CEP.

Observations	N
Durability - wire/screw-tips breaking	17
Catching on other equipment	12
Ear canal sensitivity	11
No problems	10
Fitting earplugs, incorrect foam size	9
Warning signals too loud	7
Foam tips don't hold shape, don't last long	4
Don't like earplugs	3
No comments noted	79

Table 41.
CEP experience.

(Q44) General comments about your experience with the CEP.

Observations	N
Vast improvement, excellent system	74
Great system, but needs minor fixes	26
Toss it and use ANR	2
Don't like it, don't wear it	4
Benefits not worth the effort	2
Helmet problems, not CEP	2
Fix the initial problem, not add more equipment	8
No comments	34

The aviators gave the CEP an overall average rating of 6.3 when compared to their personal helmet (Table 42). Note that 93% of respondents preferred the CEP to their existing helmet system.

Table 42.
Rate CEP overall value added.

(Q45) Based on your flying experience, rate the overall value of the CEP when compared to your personal helmet.

	7 Significantly better	6 Moderately better	5 Slightly better	4 Same	3 Slightly worse	2 Moderately worse	1 Significantly worse	No Response
Count	92	30	15	1	4	2	3	5
% of total	<<<<<<<<<	93	>>>>>>>>					

Discussion

One hundred and fifty-two completed questionnaires were received at USAARL resulting in a return rate of 30%. Aircrew availability when questionnaires were dispensed, time constraints, training missions, permanent change of station, and individual aircrew decision not to complete the questionnaire, are probable causes for not receiving more completed questionnaires. While higher compliance would be desirable, aircrew having significant problems with the CEP may have been more likely to respond to the questionnaire, making our estimates conservative.

Personal Data. The "typical" respondent in this research study was male with 6.4 years experience as an aviator and approximately 1,347 flight-hours. He did not wear spectacles when flying and did not have significant hearing loss. He has worn a functional CEP for 129

flight-hours while wearing the HGU-56/P helmet. Prior to this study, he was an earplug user and did not experience undue discomfort with his personal hearing protection (earplug) or his helmet.

Personal Hearing Protection. Eighty percent of the aircrew wore some type of earplug prior to wearing the CEP. A small portion of this population (17%) reported some discomfort (e.g. pain, itching or headaches) with their previous earplug and/or flight helmet.

Fitting. The majority of the subjects did not experience any difficulty in fitting the CEP. The problems that did arise were failure to select the proper size foam tip and once the earplugs were in place and/or dislodging them when the helmet was donned. Experience at USAARL has shown that training is critical in properly fitting the CEP. If it is not rolled down (i.e., compressed) and inserted correctly, the CEP may be perceived as being no better than any other earplug worn with a standard helmet. The foam tip must be rolled into the smallest diameter possible before inserting into the ear canal. Failure to do so would expose the plastic insert in the center of the foam tip, which in turn could scrape the walls of the ear canal and cause discomfort. The authors have repeatedly observed users inserting the earplugs without compressing them even when time is not a critical factor in completing their mission. For the more difficult cases, one-on-one instructions by the local hearing conservationist or audiologist may help.

Participants reported numerous occurrences (75%) of CEP wires catching on shoulder straps, vests and other miscellaneous equipment. To some degree this is unavoidable but seldom critical. Possible reasons why the CEP wires pull when turning the head include not maintaining wire close to the head, not allowing any slack in the earcup after donning helmet, or reversing left side earplug (long wire length) for right side earplug (short wire length). Since the CEP connection to the helmet is located on the right rear of the helmet, the right earplug wire was designed with a shorter wire length. The fitting instructions refer to "long on the left" to help facilitate earplug insertion. We recommend once the earplugs and helmet are in place, users move the head from side to side to ensure the wires are not too tight. To maintain the wires close to the head, users can add a small piece of Velcro midway the length of the long wire and attach it to the back of the helmet. This should minimize wires catching on other objects in the cockpit plus it keeps the wires off the neck. If there is tension on either earplug (right or left) take a small loop of wire on the problem side and tuck it up into the earcup to reduce the tension.

Comfort. The majority of the discomfort with CEP was of two types: pressure and mild pain. Pressure was attributed to the earphone inside the earcup pushing on the CEP causing excessive pressure in the ear canal. This usually results from insufficient earplug insertion into the ear canal or the overall length of the CEP being too long (e.g., poor quality control). The second type of discomfort was external ear pain. This resulted from the hard edge of the housing pressing into the outer portion of the ear and was probably caused by the edges of the housing not being smooth. The data don't show if the discomfort was just an initial problem (i.e., until fitting technique was better) or if it persisted. The plastic screw-tip in the foam earplug should be checked periodically for cerumen (wax) build-up.

Donning and doffing. While the addition of the CEP does add an extra step, after a short period of time the fitting procedure becomes second nature. Ninety-one percent of the subjects did not think the additional step of donning had any effect on completing the mission. Fitting the CEP takes no more time than required to properly fit a normal earplug. Connecting to the helmet can be time consuming initially. Forgetting to disconnect the CEP before doffing the helmet is a minor annoyance to the naïve user but is generally learned quickly. Of those who expressed problems, slight pain was the most frequently noted. Though it is not a requirement to insert the CEP into the ear canal or connect the CEP to the helmet with gloves on, it can be done.

Speech Clarity/Understanding. A majority of the participants indicated the overall speech clarity/understanding using the CEP to be "moderately" to "significantly better" when compared to their current helmet (Table 34). Regardless of the gender of the talker, most subjects ranked CEP as "moderately" to "significantly better" compared to their current helmet. Several subjects noted in general that higher pitched female voices were perceived easier to understand with the CEP.

Noise Reduction/Attenuation. Most aircrew indicated that the reduction of noise levels at the ear was "moderately" to "significantly better" with the addition of CEP (Table 35). The remaining minority of aircrew (29%) who indicated that the CEP was the same or worse, may not have fitted the CEP adequately, but this is impossible to verify. The ability to hear navigational and caution/warning signals utilizing the CEP was "moderately" to "significantly better" for the aircrew when compared to their current helmet (Table 36). Previous studies have shown that the radio and ICS volume control levels can be reduced from one-third to one-half the original level with the addition of CEP to the helmet ensemble. One potential complication is that with the outside noise levels being reduced significantly, the fixed auditory level of the warning system may become very loud or startling to some aircrew. This problem has been referred to the aircraft proponents. Seventy-three percent of the aircrew indicated the ability to hear and monitor noise generated by the aircraft as being "slightly better" or the "same as" their current helmet when using the CEP (Table 37). The addition of the CEP may cause subtle changes in the characteristics of the noise generated by the aircraft or rather how the aviator perceives the noise. This now becomes a relearning process for the aviator. The reduction of noise levels at the ears during weapons firing for most of the subjects is perceived to be "slightly better" with the CEP than with their current helmet (Table 38).

General Issues. In general, 52% of the aircrew did not encounter problems associated with the CEP. A durability problem with the CEP (e.g., screw-tips breaking off and the wire breaking or shorting at the earplug housing) was the main concern for some of the aircrew. During the course of this study several changes have taken place to improve the overall durability of the CEP. These include changes to the wire characteristics and a better manufacturing technique for attaching the screw-tip to the transducer. The wire remains coaxial but was changed from a copper conductor to an alloy to reduce breakage at the earplug from wire flexion. Lesser problems include CEP wires catching on other equipment in the cockpit, ear canal sensitivity and finding/fitting the correct size foam tip. The inability to obtain repair parts or replacement CEPs

was of great concern to those aviators who now rely on the CEP for improved communications capability. Ear canal sensitivity has been noted in some cases when flights are longer than 3 hours in duration. This is also noted initially with non-earplug users.

The large majority (90%) of the OH-58D helicopter aircrew rated the CEP as having a greater overall operational value than the aviator helmet as it is currently used. Aircrew responses verify that the CEP is viewed as a workable solution to the communications problem and should be fielded to all aviation units. About 12% of the participants did not like the CEP and thought the benefits not worth the effort or just wanted the initial problem with the aircraft fixed instead of adding additional equipment. Only two participants were in favor of abandoning CEP and replacing it with an active noise reduction (ANR) system.

Conclusions

Aviator helmets used by the Army have been optimized to provide passive hearing protection, but helmet performance is marginal for some of the noise environments found in Army aviation. Currently, many Army aviators use earplugs that provide additional hearing protection; however, voice communication performance is severely impaired. Voice communications improvement, while reducing noise exposure for the aviator, is the primary purpose of the CEP.

This study shows that, in the opinion of the aviators responding, the CEP provides improved noise reduction and exceptional communications capability. The respondents claim their performance has improved significantly while reducing their workload and stress levels. While a small group of users within this sample have indicated some difficulties (less than 10 percent) the vast majority found that the CEP integrates into their operational activities very well.

The issue of comfort that was identified by about 20 percent of the respondents may, in large part, be attributed to improper fitting techniques. This study was accomplished by simply fielding the device with instructions as to proper fitting, but there was no follow-up to determine if the aircrews were using the CEP properly. Based on some of the individual comments (see USAARL Report 99-xx, Part 2), there is an apparent misunderstanding by some of the users on how to properly fit the CEP. A series of written and pictorial instructions may be required in order to reduce the discomfort effect for most of the affected users.

This study provides strong user endorsement of the CEP in the OH-58D helicopter. Procurement agencies and safety personnel should find these results useful as they seek to provide aircrew the most cost effective solution to the problem of increasing noise and poor speech intelligibility in the modern helicopter cockpit.

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Appendix A.

Questionnaire.

EVALUATION OF THE COMMUNICATIONS EARPLUG IN THE OH-58D HELICOPTER ENVIRONMENT

INSTRUCTIONS: You have been asked to wear the Communications Earplug (CEP) in conjunction with your aviator helmet during your daily mission to evaluate its operational effectiveness and comfort. Please complete the following questionnaire. Most questions are self-explanatory with room for comment. Please try to be as precise as possible when making your comments. Some questions will require you to mark on a continuum between extremes. Your responses should be indicative of the strength of your feelings. **Note**: Please bear in mind that all comparison questions are between the helmet you normally used in the past and the CEP.

Personal data:

1. Unit location: _____

2. Today's date: _____

3. Sex: __M __F

4. Experience as an aviator: _____years. Approx. No. Flight hours: _____

5. No. flight hours wearing HGU-56/P helmet (prior to CEP installation): _____

6. No. flight hours wearing CEP: _____
   Is the CEP still functioning properly? __Yes __ No
   If no, describe the malfunction _____
   _____

7. CEP foam tip size: ___ Standard ___Slim ___Short __Combination

8. Seat position during most flights: _____

9. Do you have a waiver or information only (IO) letter for a hearing loss?
   ___Yes ___No ___ Not Sure If Yes, how long have you been on waiver? _____

10. Do you normally wear eyeglasses when flying? ___ Yes ___ No
    If yes, what type temple arms are on the glasses you normally wear? (examples: bayonet temples, wire frames etc) _____

Personal Hearing Protection:

11. Prior to CEP installation, did you wear earplugs in conjunction with your flight helmet?
    __Yes __No If No, skip next question.

12. Did you frequently experience discomfort with your earplugs? __Yes __No
    If yes, how long does it take before you feel the discomfort? _____
    Describe the discomfort (example: itchiness, pain etc) _____
    _____

13. Prior to CEP installation, did you frequently experience discomfort with your helmet while flying? __Yes __ No
    If yes, how long does it take before you feel the discomfort? _____
    Describe the discomfort (examples: hot spots, headache etc) _
    _____

Fitting:

14. Have you experienced any difficulty in fitting the CEP? __Yes __No
    If yes, please explain _____
    _____

15. Was there any discomfort when inserting the earplug? __Yes __No
    If yes, please explain _____
    _____

16. Do the wires pull on the CEP when turning your head? __Yes __No
    If yes, please explain _____
    _____

17. Does the CEP move or slip out of the ear during flight? __Yes __No
    If yes, please explain _____

18. Wire lengths of the CEP: SHORT wire was __ too short __ too long __ just right.
    LONG wire was __ too short __ too long __ just right.

19. Were there any problems associated with CEP during night flights? __Yes __No
    If yes, please explain _____

20. Does the CEP catch on other equipment or interfere with job performance? __Yes __No
    If yes, please explain _____

21. Is the orientation or location of the connector convenient? __Yes __No
    If no, where would be your preference on the helmet? _____
    _____

22. After how many flight hours did you clean or change foam tips? _____

23. How did you clean foam tips? _____

24. Was there a problem of wax build-up in the CEP foam tip? __Yes __No

Comfort:

25. Does the CEP cause any discomfort in your ear canals (itching, pain etc)? __Yes__No
    If Yes, was it :_____:_____:_____:

Mildly uncomfortable	Moderately uncomfortable	Extremely uncomfortable

26. Does the CEP cause any discomfort to your external ear? __Yes __No
    If yes, please describe _____
    _____

27. Are there any hot spots associated with CEP? __Yes __No
    If yes, please explain _____
    _____

28. If you experienced discomfort with CEP during your flight, when did you first notice the discomfort? Please circle the appropriate time below.

    1/2 hr 1 hr 1-1/2 hrs 2 hrs 2-1/2 hrs 3 hrs 3-1/2 hrs 4 hrs

29. With respect to overall fit and comfort, compare the CEP device with your personal helmet.

_____	_____	_____	_____	_____	_____	_____
Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse

Donning and Doffing:

30. Does the addition of the CEP result in differences in the helmet donning procedure?
    __Yes _No If yes, please explain _____
    _____

31. Does this extra step pose a significant problem in completing your mission? __Yes __No
    If yes, please explain _____
    _____

32. Do you have problems donning/doffing the CEP with gloves on? __Yes __No
If yes, please explain _____

_____

33. If you forgot to disconnect the CEP when doffing, was there any discomfort or difficulties when the CEP was removed? __Yes __No
If yes, please explain _____

_____

34. With respect to donning/doffing, compare the test device to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
____	____	____	____	____	____	____

Speech Clarity/Understanding:

35. Rate the difference in ICS speech clarity/understanding when compared to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
____	____	____	____	____	____	____

36. Rate the difference in speech clarity/understanding of personnel based on gender of the talker when compared to your personal helmet.

Male Voice

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
____	____	____	____	____	____	____

Female Voice

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
____	____	____	____	____	____	____

37. Rate the difference in overall speech clarity/understanding when compared to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
____	____	____	____	____	____	____

Noise Reduction/Attenuation:

38. With respect to reducing noise levels at your ears, compare the CEP to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
_____	_____	_____	_____	_____	_____	_____

39. With respect to allowing you to hear navigational and caution/warning signals, compare the CEP to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
_____	_____	_____	_____	_____	_____	_____

40. With respect to your ability to hear and monitor noise generated by the aircraft, compare the CEP to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
_____	_____	_____	_____	_____	_____	_____

41. With respect to reducing noise levels at your ears during weapons firing, compare the CEP to your personal helmet.

Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse
_____	_____	_____	_____	_____	_____	_____

General Issues:

42. Were there any adverse effects of CEP performance? __Yes __No
If yes, please explain _____
_____
_____
_____
_____

43. Please elaborate on any problems you may have encountered while wearing the CEP.
_____
_____
_____

44. General comments about your experience with the CEP.
_____
_____
_____

45. Based on your flying experience, rate the overall value of the CEP when compared to your personal helmet.

_____	_____	_____	_____	_____	_____	_____
Significantly Better	Moderately Better	Slightly Better	Same	Slightly Worse	Moderately Worse	Significantly Worse

Appendix B.

Actual comments listed alphabetically concerning adverse effects of CEP performance.

- Aircraft audio tones extremely loud.
- Can't hear as well.
- Cautions/warnings too loud.
- Caution/warning tones were too loud. I am used to yellow foam earplugs while flying - caution tones just right.
- Caution and warning tones cannot be turned down and are too loud for use with CEP.
- Caution warning and advisory signals are always full volume. I do not wear CEPs during contact training for this reason.
- Caution warning advisory signals extremely loud.
- CEP offers better hearing of radio traffic. A wider range of earplug portions and stronger cord. They are too fragile. Mine broke after roughly 25-30 hours of use and my ALSE technician was not trained or probably equipped to repair the items.
- Connection to plug screw portion would greatly increase the lifetime of these plugs. Aviators are very rough on equipment. Build them to survive.
- Discussed it in earlier questions.
- During engine start, I cannot hear the igniters pop or hear the engine light off.
- Easy to lose.
- Foam tips fall apart after second wash and cannot stay compressed to insert in ear.
- Hard to hear aircraft noise, i.e., engine etc.
- I no longer use CEP for two major reasons: 1. They are too uncomfortable. 2. To adjust the ICS to hear radios and cockpit communication, the aircraft caution and warning audio becomes entirely too loud.
- It blocks out all aircraft noise.
- It takes some time to get used to. It's not as easy as just putting on a helmet. However, after it is used for a while you get used to donning and doffing procedure and the sequence you must go through to get it on.
- Not a big problem, but just one more thing to add to a long list of small inconveniences.
- Only that the CEPs would sometime operate intermittently, but nothing significantly.
- Overall clarity/noise reduction was not improved only amplified. The CEP does not correct deficiencies in the OH-58D ICS system.
- Stem failure - earplug stuck in ear during flight.
- They are uncomfortable.
- They broke within 75 hours, very uncomfortable. Maybe I was sized wrong.
- They are not built to handle serious wear and tear.
- The only problem is that they are made too flimsy. They need to be hardened some way. As I said, I'm on my third pair.
- The installation portion. Soldering wires together makes weak wires and eventually will break.

- They are too fragile. I love the CEP. They take a little extra time to install but the benefits are worth it.
- The wire harness is difficult to lay around the ear properly. It will cause some minor discomfort if harness is not properly routed around the ear.

Appendix C.

Actual responses listed alphabetically concerning problems encountered while wearing the CEP.

- Advisories too loud.
- All problems were addressed in the questionnaire.
- Availability of parts--we don't have enough helmets or CEPs. Sometimes the wires can get over my ear and between earcups and cause discomfort.
- Better quality.
- Broke less than 75 hours and not comfortable.
- CEP's make caution/warning signals way too loud.
- Continuous use (4 days in a row of 4-hour flights each day) results in ear canal sensitivity.
- CWA too loud!
- Difficulty getting them to stay in ear canal and some ear canal pain because of pushing them in hard so they will stay in when donning helmet.
- Doesn't stay in my ear well.
- Don't use. Don't like it.
- Donning the helmet with CEP can't be done with flight gloves on.
- During extended periods of wearing the CEPs they make the ear canal ache.
- Earpiece wires seem way too flimsy--they break at earpiece commonly. I was very careful not to put undo pressure/stress on system, and after 100 hours of flying, one wire reached its useful life and broke at ear piece.
- Foam inserts do not last very long. Wires are prone to breakage at the earplug.
- Foam tips not durable after first wash.
- Forgetting to unhook before doffing.
- Have not worn CEP long enough.
- I cannot use the foam earplug without significant modifications. I always had to use the rubber triple flange earplugs, due to problems fitting the foam ones. The foams wear out too fast and pose a problem in replacement.
- I do not like wearing earplugs so my opinion is biased.
- I had a wire break at the CEP when removing my helmet. I really like them.
- I think the more durable parts are the way to go when making this final CEP because they go through a lot in the field and we need an inexpensive, more durable unit to provide to pilots to improve communications between aircrews, ground elements, ATC, & Commanders.
- I've gotten spoiled and hate flying without them.
- If the ear piece were smaller, it would be more comfortable. If the foam plugs were firmer, they would be easier to insert.
- In reference to monitoring noise generated by the aircraft, blocks out A/C noise and you can't hear engine and rotor noise.
- It slides out too easily. Need smaller but more snug earplugs.
- Long wire caught on vest and pulled CEP out of ear. While trying to adjust this the wire broke.

- Make the foam stiffer.
- Mild pain in the ear canals after 2-hour flights. Donning procedure requires a sequence that must be followed or CEP will be pulled out. Basically the CEP must be donned just prior to helmet use.
- Mine have broken right at the ear foam, where the wire connects to the foam.
- My left ear canal is now tender from everyday use, resulting in just placing the CEP device near my left ear for now.
- No major problems.
- No problems encountered so far.
- None that have not been discussed earlier.
- Once the wires are strengthened the device will be better.
- Only problem is the slight "hot spot" mentioned in Q26.
- Poor construction of CEP. The CEP needs to be more durable.
- Problem getting the right size foams.
- Slight discomfort after 3-4 hour flights. Ears get a bruised feeling occasionally.
- Snags when putting the helmet on and taking it off.
- Some ear pain is associated with the insert but will change to a smaller size when available.
- Sometimes. Hot spots will develop inside the ear canal if plugs are inserted too far in.
- Sore ear canals.
- The CEPs were not made durable enough for ARMY aviation. The wires, the tips, and the harness assemblies have all had major failures within the first 3 months. Some tips broke on initial issue to the user, causing what I think should be a QDR issue.
- The cord catches on things and will dislodge from the ear. It is very difficult to install them in-flight.
- The foam changed after washing. It no longer holds its reduced size to insert.
- The foam inserts in the helmet push on the CEP earplugs, which cause ear pain.
- The only problem I have is the wire getting caught and pulling on the earplugs when I turn my head.
- The only problem I have with the CEPs is that over time, extended mission over 2 hours, the CEPs tend to slip out of your ears. Also the center post tends to dig into your inner ear over long missions which makes them uncomfortable.
- The only problems I had were noted on the cover sheet (1 and 3). Wire breakage at transducer and screw tip breaking off.
- The problems I have encountered you have already addressed.
- The speaker end of the wires would be more comfortable if they were smaller, or if they were formed and fitted for each ear.
- The Velcro on the left wire will drive you nuts when it falls off the Velcro in the back of your helmet. The threaded stud needs to be flexible so as to conform to the inner ear canal.
- The warnings are extremely loud, but that is not a CEP problem.

- The wires tend to snag on harnesses and connector within the cockpit. There is a need for ICS performance. The CEP is a good interim fix, but it is fragile and easy to lose. It takes extra time to don helmet especially when using NVGs.
- They are not very durable overall.
- They fall out.
- They pull out when donning, extremely uncomfortable, can't hear as well, do not reduce noise as well.
- Tones are too loud.
- Very delicate.
- Wax in the plug canal, broken wire right plug, uncomfortable after a period of time.
- Wire laying on outer ear causes hot spots, wire is too long and gets caught in shirt, seat belts, vest, etc.
- Wire pulls CEP out of ear.
- Wires easily caught on objects and pulled out of ears. When foam tips are hot and moist they will not stay collapsed long enough to insert into ear canal.
- Wires getting caught on other items strapped to my head or body. I have had CEPs for close to a year with no foam replacement. Mine are no good.
- With all noise/radio/ICS levels in a comfortable range a CWA message/tone in an OH-58D is extremely loud and annoying.
- With doors off aircraft has significant noise.

Appendix D.

Actual comments listed alphabetically about experience with the CEP.

- A/C needs voice activated ICS due to workload and the need for cockpit communications.
- After getting used to them I have found them to be an outstanding product.
- After using CEPs exclusively and then having them break, I had to go back to yellow earplugs with great reduction in hearing performance. I had gotten very used to being able to hear communications clearer.
- All ICS and radio communications are significantly better. Crew coordination is better - radio management is much easier since the pilot doesn't have to have all radios turned all the way up in order to hear anything. The numbers of "say again" and "what did you say" have significantly decreased.
- Although there are some minor problems with the CEP, it has significantly enhanced my ability to communicate within the cockpit and over the radios. I have absolutely no desire to give up my CEP and go back to my old helmet system.
- An excellent system that improves ICS communication and reduction in noise. I would not want to fly without the CEP after flying with it.
- Aviation is a noisy environment so most people wear earplugs on the flightline during pre-flight, etc. and this requires removing one set of plugs and replacing them with others. I like being able to hear, but the donning/doffing procedure stinks. It pulls out a lot, which I can't stand. After a while you rig it so this doesn't occur. A lot of people do not use it for this reason. But in the end when all on correctly - hearing is great!
- Best thing to come along for 58Ds, increases ability to hear everything.
- Bulk of the transducer.
- CEPs are great! I was really upset when mine broke. Can't wait to get another pair.
- CEPs work well in clarifying speech and being able to communicate in the cockpit.
- Communication is much more easily understood while using CEPs; however, if you use CEPs for 50 more hours and then revert back to yellow earplugs, you can hear almost nothing!
- Concerned about lack of maintenance or replacement. I will be seriously disappointed when my CEPs are no longer serviceable and there will be no replacement.
- Correct piece of equipment.
- Definitely needed device. Just come up with a better design.
- Do not use.
- Don't like it.
- Drastic improvement over using foam ear plugs. Clear communications. You don't have to turn radios up full blast. The word is a hassle and time consuming but I still wouldn't be caught without my earplugs. Suggestion: make two connectors, one in each earcup. This will eliminate the cord catching on seatbelt and goggles.
- Due to the task load of the CPO in the OH-58D, the CPO must use "hot mic" on the ICS. This degrades the level of audio clarity. This aircraft must have "voice activated" (VOX)

ICS, as a minimum at the CPO station. This will greatly improve the communication clarity of the aircraft. I have used these at Ft Rucker and was well pleased with them.

- Even with the added time and some discomfort, the CEPs are far superior to the older helmets.
- Excellent.
- Excellent product! I do not think I could fly without it now.
- EXCELLENT! Need to field all units, back fill others. This has improved crew safety and communications immeasurably.
- Extend the length of the helmet chinstrap to ease helmet donning with earplugs installed and shorten slightly the length of the tube inside the foam on the plug itself to ease ear canal pain. The CEP has greatly increased the safety of flight in the OH-58D. Do not take it away. I can hear the radios and my co-pilot at all times now.
- Foamy does a good job with noise levels. It is a pain in the **** by getting caught where vest and collar meet. It would pull the CEP slightly from the ear. Plus the CEP is cheaply built. The cost is extremely high.
- Generally do not like HGU-56. Poorly engineered. Should not have to have modification.
- Getting to the point of too many wires on the head: helmet, ODA, goggles and neck strap, CEP and lip light.
- Good compromise/low cost alternative to actually fixing the OH-58D ICS system.
- Good idea, ergonomically not the best product.
- Good item if wires and foam tips are improved. Use same material as yellow foam earplugs.
- Good noise attenuation during gunnery but needs to be a little more durable.
- Great addition especially in the OH-58D (I) Kiowa Warrior.
- Great addition to aviation flight aids even with the minor problems. We need this device.
- Great device but need more replacement foam inserts!
- Great device. You may not have it back.
- Great idea - Needs a better design. We already have up to three wires hanging off our helmets. Adding another wire with the CEP does not help things.
- Great idea but poor design in durability.
- Great product. Continue to improve and field to everyone.
- Great system, however the wire keeps breaking from the earplug.
- Great system.
- Great system. Just make wiring system more durable (most pilots wash their earplugs with flight suit).
- Great! Used to wear earplugs occasionally resulting in hearing difficulty in the cockpit. I wear CEPs all the time now. I hear perfectly and I am also protected from outside noises.
- Great. Help hearing co-pilot over noise of aircraft/radios. I would consider this essential to good cockpit crew coordination and communication. This is common to everyone I know who uses these plug phones. Also, I never pulled the CEP's from ears by the wires. Please provide durable plugs ASAP.
- Greatly improves volume levels in the OH-58D, sometimes the FM radios are impossible to hear without CEP.

- I do not want to fly without my CEP. Since wearing the CEP I can now hear everything in the cockpit. My overall rating for the CEP is excellent.
- I have had experience flying/testing with an Active Noise Reduction system. I prefer that system because it removed or reduced unwanted noise.
- I hope I never have to go back to flying w/out CEPs or something like them. The benefits far exceed the discomfort I have to put up with. If they were made more comfortable they would be better yet.
- I like it. It works well.
- I like it. Need more durable product.
- I like the CEP much better then the old SPH-4 but the shape leaves a little to be desired. The SPH-4 was a better-looking helmet.
- I like the system despite the added steps. I can now actually turn down the volume on the ICS control.
- I like the system, but the problem I have found is if I use plain foam earplugs, I cannot hear the ICS as well. If I wear the CEP everything sounds fine. Another concern of mine is that I hear a lot more acft noise wearing the HGU-56 and CEP system.
- I like them.
- I like them a lot. The difference between not wearing them and wearing them is night and day.
- I like them! Make the plastic tube a bit shorter and more flexible.
- I like them. They improve hearing significantly!
- I love them. Try to improve.
- I refuse to fly without them. It makes the job much easier. It's really obvious when flying with a pilot w/o the CEPs. I'll understand a radio message while the other pilot is saying "say again".
- I think it's a great product or piece of equipment that is very much needed for the OH-58D(I).
- I think there is a world of difference with the CEP. Noise is reduced and clarity over the radio is so much better.
- I used to wear yellow foam earplugs all the time. Once I started using CEPs I got addicted to being able to understand the radios. But they are so painful after prolonged periods that now I don't use any additional hearing protection. But I still don't use them except for gunnery.
- I would like a more durable and sturdy product. I am always afraid of breaking them.
- I would like to see rubber styles. They would last longer and fit easier. I love the increased audio clarity of the CEP, and I feel it is a must in the OH058D. However, it breaks too easy and the foam sizes are too restrictive and wear out too fast.
- I would rather the original problem be fixed instead of giving me another piece of equipment. Fix the ICS problem and throw out your temporary fix. While you are at it, give me a helmet with active noise cancellation. The computer in the aircraft will tell me of any problems prior to me hearing any change in engine noise anyway.
- ICS is definitely better, however the fragility of the systems lends itself to breaking.

- Improvement.
- Improves the internal and external communications. Allows me to monitor not only the radios but also copilot/student communication.
- Infinitely better.
- It does reduce noise level, but it is more of a pain to maintain and use in a time critical environment.
- It has been a pleasure, especially when flying from the right seat. It has added a significantly wider volume range. I can turn a radio volume knob all the way down and still adequately hear and understand speech on those radios. I never advocate crewmembers pulling their ICS pins, and do not have to when utilizing the CEP. It makes flying with doors off much more pleasurable.
- It is a great idea! I use the CEP always. If the speaker was smaller and the wire stronger it would be a better product. Also the foam plug portion would be better if it held its form when compressed like yellow foam plugs do.
- It looks goofy with the large ear cuffs.
- It would have been nice to have an ICS setup so one would not need a CEP. I still have a difficult time understanding what is said because of the static.
- Just purchase the BOSE headsets and put them into our helmets, it's a superior proven product. Good idea but poor design! Too cumbersome when doing exercises. Cannot put helmet on and go. You are required to "fiddle with it."
- Love them!
- Love them! Keep improving them and get them in the supply system immediately. One just must figure out which order to put on the equipment, goggles, CEP, helmet.
- Makes a big difference in hearing radios and internal comms.
- Much easier hearing crewmembers as well as the radios.
- Need to be more rugged.
- No big problems yet. Haven't flown with them much yet.
- Other than the wire getting caught on the vest and other equipment, I thought the CEPs were a great improvement over just the helmet. I couldn't wear yellow earplugs because I could not hear at all. This is a great improvement.
- Outstanding, even with the minor problems.
- Overall CEPs are a valuable asset. They only have a few minor problems but overall they improve our ability to accomplish out mission.
- Overall it is a good system but it needs to have a more durable wire and connection. Must be a stronger wire.
- Overall much better.
- Really improves the ability to keep out outside noise from the aircraft.
- Reorder problem- PCS of pilots caused severe shortage of CEPs available to new arrivals. CIF was making ALSE turn in the helmets as a complete kit with CEP installed. Can't get through normal supply but as GSA item causing problem due to lack of funds. Once I punch a hole through the back of the earcup black plastic liner, that condemns the helmet for turn-in procedures - again causing a reorder problem for the ALSE maintainers. I would like to see

an improved earphone assembly, such as the BOSE system in the HGU-56/P instead of an additional item to be maintained, taught, installed, and stocked. 60% of the original pilots have gone and new pilots do not have CEPs. Significantly improved cockpit communication.

- Slightly better hearing protection, slightly better quality audio. Benefits aren't really worth the hassle of use. Plugs leave ear canals feeling they have been bored out with a cleaning brush.
- Sometimes it gets hung up when turning head, which could distract pilots at critical times during flight. It enhances mission performance when you can actually hear what is being transmitted over the ICS and radios.
- The ARMY has finally purchased a piece of equipment that not only is functional, but also doesn't burden the soldier with its use. Thanks!
- The benefits greatly outweigh the time and difficulty putting them on.
- The CEP has improved the ICS systems clarity and radio clarity 100%. Especially with doors off. I think the CEP is a good improvement for OH-58D pilots.
- The CEP is long overdue. Excellent! My first CEP broke but I was able to acquire another by someone leaving and I have taken better care of it.
- The CEP works great, but it is a bit too fragile the wires are too weak and the location needs to be moved.
- The commo. clarity is excellent - the improvement is worthwhile. We need just minor fixes.
- The entire Army should have them.
- They need to be more accessible and should be fielded to all helicopter pilots.
- The speaker assembly should be smaller so it doesn't rub on the ear cup foam. The size of it causes extra pressure on ear canals. Suggest a molded type earplug such as those used with racecar helmets.
- These earplugs seem to me a bandaid over the larger problem. Rather than investing any more money, time or equipment on these earplugs how about putting some better ICS boxes in the aircraft. The aircraft at Fort Rucker had VOX boxes in the aircraft. Those boxes were more than adequate. I used both my SPH-4B and HGU-56 with earplugs with the VOX box and had plenty of volume in all flight modes.
- These have completely revolutionized aviation. It is terrific. The ability to hear everything is a critical part of aero-scouting and this has enhanced it greatly. I love them and I pity anyone without them.
- They are awesome! The ability to hear everything is so much better with these CEPs I can live with a little discomfort. The safety benefit of being able to hear the other pilot is also a giant plus. Doors-off flying is so much better now.
- They are great - you just really need to take care of them.
- They are great but break easily.
- They make hearing great. So much better than flying with earplugs but they are a hassle to put on. I only used them on real mission and just tolerated the lack of being able to hear the rest of the time. Bell needs to fix the aircraft so we can hear. CEPs need to be more comfortable like the ones the NASCAR drivers use.
- They significantly increase the clarity of radio traffic.

- This is one of the Army's best ideas. The radios in the OH-58D (I) are hard to hear without the CEPs. The CEPs help dramatically in the ability to hear and comprehend the radio traffic. You don't have to focus all your attention on the radios with the CEPs in. This is a great product.
- This is the absolute best thing that R&D have added to the aircraft-Pilot interface I have seen. I can hear everything I need to without sacrificing my inner ear. The safety margin has been greatly increased now that ICS is clear and concise. Radio traffic is easily monitored. It is worth the slight amount of discomfort. I would personally buy my own set if not issued.
- Though not comfortable, I could definitely hear all radios and ICS better.
- Very good device.
- Very little. I don't like it.
- Very nice increase in hearing ability of ICS radios. The caution/warning tones are excessively loud now.
- Very, very fragile.
- Viable product. I endorse it.
- We absolutely need them! They could be a little louder.
- Why didn't somebody think of this before?
- Works well, can hear radios well, reduces aircraft noise.
- Worthwhile.