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Fitting Issues Survey for the AH-64 Integrated Helmet and Display Sighting System

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Aircrew Health and Performance Division
and
Aircrew Protection Division

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Introduction

The Integrated Helmet and Display Sighting System (IHADSS) (Figure 1) is the current helmet used in the AH-64 community, and has been in use for over 20 years. Although the IHADSS helmet was designed to be lighter in weight and to provide improved impact protection over the then widely used SPH-4 series helmet, it presented a unique set of issues. (While the Helmet Gear Unit 56/P [HGU-56/P] replaced the Sound Protection Helmet – 4 [SPH-4], the Army's standard aviator helmet (in 1995), the IHADSS helmet has been the sole aviator helmet used in the AH-64.)

Fitting the SPH-4 series helmets was usually accomplished within thirty minutes, and once fit was established, it was relatively easy to maintain. In addition, aviators were able to carry their SPH-4 series helmets with them throughout their careers. The current general aviation helmet, HGU-56/P, which uses Thermal Plastic Liners (TPLsTM), has been equally easy to fit. Fitting the IHADSS helmet, however, has been and is significantly more complicated. The main reason is that the IHADSS serves as a platform for a Helmet-Mounted Display (HMD) that provides pilotage and fire control imagery and flight symbology. The IHADSS has an intricate system of straps, ties, pads and liners, which must be adjusted so that the exit pupil of the HMD aligns with the aviator's eye. When aligned properly, the IHADSS provides a proper, customized, repeatable fit that is required in order to maintain the exit pupil position and to optimize the resulting full field-of-view (FOV). Fitting of the IHADSS helmet typically takes several hours to complete. This fitting process must be repeated every time aviators are transferred to a new duty station, as the IHADSS helmet is considered an aircraft component and not a piece of Aviation Life Support Equipment (ALSE) maintained by the individual aviator.



Figure 1. The Integrated Helmet Display Sighting System (IHADSS).

The unique fitting method and stringent alignment requirements of the IHADSS helmet, coupled with the need to refit with each aviator's reassignment, have resulted in a number of complaints from the Apache community. Since HMDs are becoming a mainstay in U.S. Army aircraft, data concerning aviator fit satisfaction for the IHADSS, the Army's first integrated helmet and HMD, may provide insight and guidance in the design of future HMD systems. To acquire these data, AH-64 aviators were requested to complete a four-page questionnaire that primarily addressed fit issues to include stability, FOV, exit pupil alignment, etc.

Data gathered from this survey will be beneficial in providing suggestions for design improvements in future helmets. This study also will help Commanders and Flight Surgeons to formulate and execute training systems that will enhance individual and unit readiness and performance. In addition, data obtained from this study will be compared to data obtained from the ongoing fielding of the Westland AH Mk1 version of the U.S. AH-64D in the United Kingdom.

Background

The IHADSS is the only fielded helmet currently compatible with the AH-64 Apache Attack Helicopter and is used by all Apache aircrew. Over the years, in the U.S and more recently in the U.K, a number of anecdotal reports from Apache Aircrew describing dissatisfaction with IHADSS helmet fit have been received from the field. These reports consist of a multitude of complaints, including headaches and hot spots, poor fit, decreased FOV, poor sound attenuation and ringing in the ears.

Over the past several years, a number of studies has been conducted on the performance and design of the IHADSS (Hale and Piccione, 1989; and Rash, 2000). Additionally, a significant amount of research has been performed regarding the visual issues of the system (Behar et al., 1990; Rash et al., 2001, Hiatt et al., 2001). However, a limited amount of research has focused on IHADSS helmet fit user satisfaction with the exception of a study performed early in the fielding of the original IHADSS helmet (Rash et al., 1987). This earlier study addressed fitting techniques.

Due to the lack of recent data or baseline values of phenomena such as helmet user satisfaction, it is difficult, beyond anecdotal data, for commanders and flight surgeons to determine if training, flight safety, performance or operational readiness are at increased risk. This study was designed to provide IHADSS satisfaction feedback from the AH-64 aviation community, as well as input for future helmet designs that incorporate HMDs.

A parallel survey on the issue of IHADSS user satisfaction was completed in the U.K. in coordination with the fielding of the AH Mk1.

Research procedures and methodology

Experimental design

The design for this study consisted of a combined objective and subjective (respondent comments) approach. A four-page survey questionnaire was used as the instrument for data collection. Participation was limited to AH-64 aviators. Questionnaire items were developed primarily to investigate aviator satisfaction of the IHADSS helmet fit, comfort, visual protection and use, noise protection and man-machine interface. This study is a two-prong joint study between the U.S. and the U.K.

Population

The U.S. population of interest was AH-64 (A and D model) rated aviators and aviators in the Aircraft Qualification Course (AQC) for these aircraft. Both active duty and National Guard aviators were included. These populations are located at diverse Army posts around the world, with high concentrations at Fort Rucker, Alabama (U.S. Army Aviation Center); Fort Hood, Texas; and Fort Campbell, Kentucky.

It is estimated that there are currently 874 AH-64A and 265 AH-64D aviators in both active duty and National Guard units. This survey had 244 respondents.

The U.K. population of interest was AH Mk1 (analogous to AH-64D model) rated aviators. Because the U.K. is in its earliest stages of fielding the Apache helicopter, there are only 24 rated AH Mk1 aviators, mostly located at Middle Wallop, U.K.

Data excluded from the study

One U.S. submitted questionnaire was removed from the study due to the level of completeness. This participant responded to only 10 questions in the entire survey. All other questionnaires were at least 90% complete. Illegible, irrelevant and blank responses were treated as missing data.

One U.K. submitted questionnaire was discarded from the study due to the level of completeness. This respondent only answered 29 questions on the survey. Other questionnaires submitted were at least 90% completed. Illegible, irrelevant and blank responses were treated as missing data.

Instrument

The instrument used was a paper questionnaire developed by researchers at the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL. The questionnaire was based on a questionnaire design developed in the UK for their parallel study. Individual questions were evaluated for validity by USAARL research aviators and a subject matter expert Apache aviator. A copy of the U.S. questionnaire is provided in Appendix A.

The questionnaire consisted of demographic, helmet fit satisfaction, helmet comfort, visual protection and use, noise protection, and man-machine interface sections and was 55 questions in

length. Questions in each section were generally objective in nature, based on yes/no, selection or Likert-scale responses. Some questions were open-ended in nature where respondents were asked to provide comments or additional explanations.

The questions on helmet fit satisfaction were designed to determine if the aviators' initial and current IHADSS fittings have been, and are, satisfactory, how often their IHADSS helmet fit has required adjustment, how often aviators had to exchange helmets, and assessment of current and past ALSE support of IHADSS fitting.

Helmet comfort questions attempted to determine the aviators' comfort level with their current helmet fit, as well as to identify any major sources of discomfort. Also included in this section were questions pertaining to visor, ear cup and skullcap (comfort cap) usage. Helmet fit as affected by cleaning and the availability of helmet replacement components also was addressed.

The questions on visual protection and use were designed to examine the extent to which vision correction and protective devices, such as contact lenses, spectacles and laser protective spectacles, were used. Difficulties with the IHADSS visors were also examined, as well as the ability to achieve and maintain a full FOV. And, lastly, frequency of use of Night Vision Goggles (NVGs) was queried.

The noise protection section asked about the existence of current hearing loss, as well as the type and quality of hearing protection currently being used. Aviators were also asked to indicate whether or not they experienced tinnitus or muffled hearing, and if so, to specify the duration of these symptoms.

The final section, man-machine interface, focused on several ergonomic issues. The first issue was of the presence and cause(s) of any communications difficulty in the aircraft. The second issue addressed Helmet-Mounted Display (HMD) stability and frequency of inadvertent release. One question asked aviators to indicate their experience with breakage or other malfunctions with the various components of IHADSS, e.g., microphone, cables, ear cups, chinstrap, etc.

The final question in the questionnaire was open-ended in nature and requested aviators to provide comments on any previously addressed or unaddressed aspect of their experience with the use of the IHADSS helmet.

Data collection

In the U.S., questionnaires were distributed via two mechanisms. The most extensive distribution was accomplished by mailing questionnaires to aviation unit safety officers at aviation posts both within and outside of the continental U.S. Safety officers were requested to disseminate the questionnaires to AH-64 aviators during monthly safety briefings.

The second distribution mechanism was via the annual U.S. Army Forces Command (FORSCOM) Aviation Safety Officers' Conference held in Atlanta, GA, in March 2002. Attendees were briefed on the scope and purpose of this study and were requested to carry additional questionnaires back to their respective units.

Since the data gathered were the result of a voluntary survey rather than a random sample, readers are cautioned about applying specific findings to the general population. Nevertheless, the sample demographic data described below seem representative of the population, and the authors have no knowledge of systemic deviations of the sample from the population.

In the U.K., questionnaires were distributed during a single mass safety briefing.

Method of analysis

The primary purposes of this study were to determine the level of aviator satisfaction with IHADSS helmet fit and function and to identify problem issues that may exist. Data analysis consisted primarily of descriptive statistics, accompanied by tables and histograms where useful. A complete presentation of data graphs and tables for U.S. respondents is available in Appendix A, and a listing of open-ended question comments is provided in Appendix B. For U.K. respondents, data and comments are presented in Appendices C and D, respectively.

Sample demographics

A total of 243 U.S. respondent questionnaires were analyzed. Complete sample demographics are provided in Appendix A. Male aviators (>96%) dominated gender demographics. The median and modal age group was 25-29 years. None of the respondents reported ages of "under 20;" 1 respondent reported age of "over 49." The most represented duty station was Fort Campbell, Kentucky (24%). The predominant aviator rank was CW2 (39%). Total flight hours (including simulator time) ranged from 121-8000 with a mean of 1259 and a median of 705; AH-64 flight hours ranged from 40-5000 with a mean of 808 and a median of 450. Approximately 51% of respondents had completed Initial Entry Rotary Wing (IERW) training within the last five years (1998-2002). Of the 243 respondents, 92 (39%) indicated that they were trained in the D-model of the Apache.

A total of 20 U.K. questionnaires were analyzed. Complete sample demographics are provided in Appendix C. Each respondent was male, with the median and mode age group being 35-39 years. None of the respondents were within the "20-24" or younger age groups. The most representative duty station was Middle Wallop, U.K. (90%). The two dominant aviator ranks were CPT (35%) and MAJ (35%). Total flight hours (including simulator time) ranged from 1300-10,000, with a mean of 4183 and a median of 4200. AH-64 flight hours ranged from 60-1500, with a mean of 367 and a median of 160. A significant number of respondents indicated flying prior aircraft such as the Gazelle (85%), the Lynx (80%), and the Squirrel (50%). Of respondents, 13 (65%) indicated being trained in the D-model of the Apache. All U.K. Apache aviators received initial A-model training at Fort Rucker, AL.

Data and results from U.S. survey

Data were collected for five areas of interest (i.e., helmet fit satisfaction, helmet comfort, visual protection and use, noise protection and man-machine interface). A final question allowed an opportunity for respondents to provide additional remarks regarding previously unaddressed issues associated with the IHADSS helmets. Where appropriate, representative responses from the open-ended questions are provided in the discussion. All of the responses to open-ended questions are presented in Appendix B. Occasionally, responses were edited slightly to improve fragmentary responses, verbal lacunae, or misspellings. Places where this occurred are indicated with square brackets [].

Helmet fit satisfaction

The helmet fit satisfaction section consisted of 12 questions (questions 13-24a), both objective and subjective in nature. Results from this section are summarized in the following paragraphs. Complete respondent data are provided in Appendix A.

An overwhelming majority of respondents (81%) indicated they received their initial IHADSS helmet fitting at Fort Rucker, AL (question 13), which is consistent with the training role of Fort Rucker. Fort Rucker is the location of all Army AH-64 training. Responses of initial fittings at alternate locations may be due to aviators confusing the initial fit of a new or different helmet with their original helmet issued at Fort Rucker during Aircraft Qualification Course (AQC). It is also possible that some aviators received IHADSS fitting at Boeing in the late 1970's and early 1980's.

Approximately two-thirds (69%) indicated they were satisfied with their initial fit (question 14). However, it is noteworthy that almost one out of three were not satisfied. Of the respondents who indicated that their initial fit was unsatisfactory, the majority reported that their IHADSS was refit less than 5 times (84.2%). When the satisfaction rate was investigated by location, Fort Rucker had a satisfaction rate of 71%, slightly above average; for all other locations collectively, the satisfaction rate was much lower at 52%; the satisfaction rates for the alternate locations ranged from 0-100%, but are based on too few respondents to make these rates meaningful. However, an overall conclusion would be that obtaining an initial fit at Fort Rucker is preferable.

When asked to indicate whether or not their current fit was satisfactory (question 15), approximately 70% of respondents reported "Yes." When asked to rate the quality of their current helmet fit (question 18), the majority of respondents reported a satisfactory rating (46%), with an additional 30% indicating a good or excellent fit. It is worth noting that a significant number of respondents (21%) expressed their current fit as poor or unsatisfactory.

Respondents who indicated their current IHADSS fit was not satisfactory generalized major areas of dissatisfaction. Some respondents felt that the helmets they were issued were improperly sized. In addition, some respondents stated there was a lack of experienced ALSE technicians who were able to provide adequate assistance in fitting the IHADSS. The three most

evident complaints were hot spots, a loss of a portion of the HDU FOV, and ear cup discomfort. Representative comments were:

- During long flights, lose accurate picture in HDU.
- Cannot see the entire picture.
- Uncomfortable, loose, unable to see all symbology with proper sizing, centering.
- Difficulty in seeing left side of HDU display (i.e., torque, airspeed).
- Losing forward-looking infrared (FLIR) imagery and symbology when turning my head every now and then.
- Consistently have to readjust helmet to see through HMD.
- Helmet sags repeatedly, requiring adjustments.
- No one in our unit can fit my helmet properly.
- Unit did not have correct size helmet when I arrived...
- Inexperienced ALSE personnel.
- ALSE could not get the fit correct. Because of that, I have not been able to get a good picture while using FLIR.
- Constantly self-changing to fit right.
- It took about 6 months to get it fitted properly.
- Too loose, tightening straps results in hot spots.

The entire list of comments is provided in Appendix B.

A common source of dissatisfaction was frustration at having to change helmets due to PCS moves. A significant proportion of respondents (22%) indicated that they have changed IHADSS helmet size following a PCS move (question 16). When asked how often respondents were required to change helmets in these circumstances (question 17), 34% indicated changing helmets only once, while 84% indicated having to change helmets up to 5 times. Comments imply that any change in helmet size was often due to size availability and not size requirement. However, the majority of respondents (91%) indicated they feel they are currently wearing their correct helmet size. This finding was validated in a later question (question 21), where 91% reported they needed no change in their helmet size. However, 5% and 3% desired a smaller or larger helmet size, respectively.

Respondents who indicated they had to change IHADSS helmet size following a PCS move (question 16a) gave the following reasons:

- Because this was the only helmet that was available.
- Was not available in my size (unit did not have).
- No IHADSS in my size available.
- Medium could not be adjusted to allow full view of symbology.
- Availability of sizes in units is unsatisfactory.

The entire list of comments is provided in Appendix B.

Most respondents (33%) reported that their current IHADSS was last fit over 1 year ago (question 19). Of the remaining respondents, most indicated the last fit of their IHADSS was 6 months to 1 year ago (25%), followed by 3 to 6 months ago (23%). The majority of respondents (51%) indicated that the quality of their current fit was the same as fittings done at other posts (question 20); 22% indicated they received a “worse” quality fit. The aviators who indicated their current fit was worse were asked what they have done to improve the fit. The following are examples of typical responses:

- Removed some Velcro from the ear section.
- I have made multiple trips to ALSE, however the fit when I leave ALSE doesn't seem as good in the [aircraft].
- Replaced/removed Velcro.
- Sat down with ALSE officer numerous times to fit.
- Used Velcro pads around the ears.
- Gone to ALSE many times, working for better fit.
- Attended ALSE school.
- Put a Kevlar pad in my helmet.
- Adjusted HDU mount.
- Inserted spacers, pads.
- Received a helmet that fit rather than using padding of a larger helmet.

The entire list of comments is provided in Appendix B.

The majority of aviators (90.5%) indicated that their current ALSE shop was military, versus Department of Army Civilians (DAC) or contract (question 22a.). Almost half of the respondents (48%) rated their current ALSE shop as satisfactory in relation to fitting capabilities (question 23); another 31% rated their ALSE as good or excellent. And, 23% rated their ALSE shop as poor or unsatisfactory in this area. Almost half (49.4%) of respondents indicated that they would rate their current ALSE shop as being “the same” as prior shops (question 24). Of the remaining respondents, 24.3% rated their current shop as “worse”, while 18.9% rated it as “better” than prior ALSE shops. When asked to explain why their current ALSE was better or worse than prior shops, respondents gave answers similar to the following:

Better

- Personalized - not a “number”- get in line mentality.
- Worked with you rather than assume you are a uniformed trainee.

Worse

- They are not school trained to fit helmets.
- They don't get necessary support or money.
- Seemed like they just wanted to push me through; did not do an HDU fit.
- Not enough equipment to repair IHADSS.
- Tech is not trained to fit helmets well, not interested in the job.

Neutral

- Better people, [but] just far, far too busy and stretched too thin additional duties.

The entire list of comments is provided in Appendix B.

Almost half of all respondents (48%) indicated that aside from ALSE personnel, they have had their IHADSS helmets modified or adjusted (question 22), mostly doing the adjustment themselves (48%).

Helmet comfort

The helmet comfort section consisted of 12 questions, both objective and subjective in nature (questions 25-36). Complete respondent data are provided in Appendix A. Results from this section are summarized in the following paragraphs.

When asked to rate the comfort of their current IHADSS helmet (question 25), the majority (51%) indicated comfort was "satisfactory", while 24% rated comfort as "good" or "excellent", and 23% rated comfort as "poor" or "unsatisfactory."

When asked to indicate type(s) of discomfort encountered (question 26), respondents reported hot spots (43%), headaches (23%), and neck pain (14%) as their primary complaints. Respondents reported a variety of causes for the discomfort (question 26a.), with the most often indicated cause being ear cups (40%), improper fit (23%), and center of gravity (16%); the "other" types of discomfort included glasses and HDU. It should be noted, however, that although ear cups were indicated as the most frequent source of discomfort (40%), 60% of respondents (question 35) indicated that their ear cups were comfortable. To alleviate discomfort (question 26b), 58% of respondents reported self adjusting the fit as the most frequent step taken, with a fit modification through ALSE as the second most frequent. However, due to possible intersection or overlapping of allowed responses, conclusions for this question should be tempered.

The majority of respondents (77%) indicated they wore their visors in a down position (question 28). Approximately 78% indicated that their visors were trimmed to fit individual HDU placement (question 29), and 91% indicated their visors did not adversely rub their noses or face when extended (question 34).

Question 27 asked respondents about their preference between a clear or tinted visor for normal use. However, the choice of allowable answers did not properly complement the question. Therefore, concise conclusions regarding this question should be avoided. However, 63% (153) of the respondents did clearly indicate a visor choice in response to this question. Of these 153 respondents, 91% indicated a preference for a tinted visor.

When respondents were asked to indicate whether or not they were satisfied with the liners of the inner helmet components (question 30), only 69% (168) provided a response. Of those 168

responding, 66% (111) indicated being satisfied. Below is a summary of the comments provided by respondents who were not satisfied with the helmet liners.

- Very uncomfortable.
- Not comfortable.
- Useless ...

The cleaning (washing) of the fabric-based components of the IHADSS helmet was addressed in questions 31 and 32. When asked about frequency, 10% indicated they washed their components on a monthly basis; 30% washed every 6 months; and over half (55%) indicated cleaning periods of 1 year or more. This inclination to not routinely clean (wash) these components is obviously not based on a fitting issue since the majority of respondents (66%) indicated that cleaning these components did not affect the fit. Those respondents who indicated cleaning did affect the fit gave the following comments:

- Messes up the fit.
- Never, to do so messes up the fit.
- Have to refit.
- Afraid that it would [affect fit].
- Anytime you adjust your liner, you throw your fit off.

The entire list of comments is provided in Appendix B.

When asked if replacement helmet components (pads, liners, straps, etc.,) were readily available in the unit's ALSE shop (question 33), 71% indicated such availability. Comments helped to identify specific missing components.

Sample comments provided by aviators include:

- Visors are scratched with no replacement.
- They even have a hard time getting helmets.
- Funding levels do not permit "excess."
- Short availability of liners and straps.

The entire list of comments is provided in Appendix B.

To maintain proper alignment of the IHADSS HDU, a stable helmet fit is required. During flights in which a chemical environment may be encountered, AH-64 aviators wear a nuclear/biological/chemical (NBC) mask under the IHADSS helmet. Proper fitting involves fitting the aviator with a "skullcap" which is intended to simulate the thickness of the NBC mask. Question 36 asked respondents if they routinely wore the skullcap with their helmet. Less than half (42%) indicated doing so.

Visual protection and use

The visual protection and use section consisted of 8 questions (questions 37-44), both subjective and objective in nature. Results from this section are summarized in the following paragraphs. Complete respondent data are provided in Appendix A.

Of the respondents, a vast majority (84%) indicated that they did not wear any type of vision correction, glasses or contacts, during flight (question 37). Eight percent of the respondents indicated wearing glasses, 5% wore contacts, and 2% alternated between glasses and contacts.

Questions 38 and 39 address the use of laser protective spectacles. Such devices would be required on the firing range and, operationally, in defined hostile environments. When surveyed as to whether or not respondents used the spectacles on the firing range, 85% indicated that they did not. Of those respondents who identified that they did wear the spectacles, 35% reported they wore them "always" or "almost always," and approximately 29% reported wearing them "almost never." When asked if laser spectacles inhibited HDU use (question 39), 45% indicated "Yes."

When fitted and worn properly, the Apache aviator should be able to view the entire 30° vertical by 40° horizontal imagery displayed on the HDU. However, achieving this full FOV has been a long-standing problem with the IHADSS (Rash, 2000). Of the respondents, 55% indicated that they were able to achieve a full FOV when flying. However, a significant portion, a remaining 41% indicated at least some reduction of FOV. Respondents who indicated that they did not achieve a full FOV when flying were primarily unable to view the four corners and the periphery (question 40a). (See question 40 in Appendix A for representative depictions of FOV losses.)

In addition, over one-third (35%) indicated that their FOV changed as they moved their heads (question 41). These respondents gave the following explanations of what they were unable to view (question 41a):

- Move my head right, right edge becomes lost; move my head left, left edge becomes lost.
- Torque [and] airspeed.
- Torque, ends of compass rose, navigation info[rmation].
- When I turn my head all the way [to the] left or right (+/-90 degrees), I cannot always see the full FOV.
- When looking left or right, [I lose] torque, airspeed....

The entire list of comments is provided in Appendix B.

Questions 42 and 43 revisited the issue of visors, but from a protection point of view. The overwhelming majority of respondents (85%) indicated that their visor extends down far enough to provide adequate eye protection (question 42). A previous study (Rash et al., 1998) had shown inadvertent visor retraction to be a significant problem with the IHADSS helmet. When asked to indicate the frequency that the visor inadvertently retracted (question 43), 74% of respondents reported "never" or "rarely", while 18% indicated "sometimes."

When asked to indicate the extent that supplemental NVGs were used with the IHADSS, which is not a common usage, respondents generally answered that they “never” (47%) or “seldom” (23%) used them; only approximately 18% reported that they either “often” or “always” use them.

Noise protection

The noise protection section consisted of 5 objective questions (questions 45-49). Results from this section are summarized in the following analysis. Complete respondent data are provided in Appendix A.

Most of the respondents (93%) indicated that they did not have a then current hearing profile (question 45). A total of 6 respondents (2%) had either H-2 or H-3 profiles. Nine respondents (4%) were not sure. The H-2 profile is based on audiometric hearing levels for each ear not more than 30 decibel (dB) at 500, 1000 and 2000 Hertz (Hz) with no individual level greater than 35 dB at these frequencies, and a level not more than 55 dB at 4000 Hz; or audiometer level of 30 dB at 500 Hz, 25 dB at 1000 and 2000 Hz; and 35 dB at 4000 Hz, in the better ear. (Poorer ear may be deaf). For an H-3 profile, speech reception threshold in better ear not greater than 30 dB hearing level (HL), measured with or without hearing aids; or acute or chronic ear disease (Army Regulation (AR) 40-501). Of respondents indicating a then current hearing profile, the majority have had their profile for years or longer (question 45a).

Approximately 61% of respondents indicated that they wore double hearing protection (question 46). The most preferred types of supplemental hearing protection were foam earplugs (53%), followed by Communication Ear Plugs (CEPs) (7%). When asked to rate the quality of noise protection available (e.g., helmet alone or helmet with extra protection) (question 49), approximately 54% of respondents indicated “satisfactory.” A rating of “good” or “excellent” was indicated 32% of the time, while “poor” or “unsatisfactory” were indicated 13% of the time.

A noteworthy proportion of respondents (15%) indicated they experience tinnitus (ringing in the ears) during or immediately after flight (question 47). Of these respondents, 27% reported an onset of 30-60 minutes into flight; followed by 24% stating the onset was greater than 60 minutes into flight (question 47a). There were also a number of respondents (16%) who indicated that tinnitus was present during preflight. When asked to specify the length of time tinnitus usually lasted, approximately 43% of the responses were that it lasted less than 2 hours after flight (question 47b). Eighteen percent indicated that tinnitus lasted up to 1-4 days after flight, while 8% indicated the condition lasted more than 4 days.

Approximately 20% of respondents indicated that they experienced muffled hearing immediately after flight (question 48). The majority (35%) indicated that this condition persisted for up to 30 minutes after flight, 25% indicated the duration was less than 10 minutes after flight, and 25% stated it lasted up to 1 hour or more after flight (question 48a).

Man-machine interface

The man-machine interface section consisted of 5 questions (questions 50-54), both objective and subjective in nature. Results from this section are summarized in the following paragraphs. Complete respondent data are found in Appendix A.

Approximately 37% of respondents indicated that they have had communications difficulty in the aircraft (question 50). When asked to specify causes of this difficulty (question 50a), the most frequently reported causes were radio quality/clarity (20%), radio volume (15%) and engine noise (12%). When asked what techniques respondents used to improve noise difficulty (question 50b), representative comments were:

- Adjust volume continuously.
- Tighten chinstrap to an almost unacceptable level to eliminate noise.
- Toggle radios on and off.

The entire list of comments are listed in Appendix B.

The HDU clamps into a receiver clip on the right side of the IHADSS helmet and is held in place by friction. When asked if the HDU had inadvertently released during flight (question 51), 55% responded "Yes." When asked how frequently inadvertent releases occurred, (question 51a), 42% said "Seldom," and 12% said "Occasionally." Only 1 respondent indicated that inadvertent release was a frequent problem.

From flight to flight, aviators usually do not fly the same aircraft. When asked if the HDU position remains the same from aircraft to aircraft (question 52), 67% of the respondents said "Yes" and 30% said "No." Of those responding "No," typical comments (question 52a) were:

- Helmet position/seat position.
- Visor cannot fit properly over HDU.
- Image rotation collars do not have the same travel.
- Cable length.
- Combiner lens angle differs.

The entire list of comments are listed in Appendix B.

Because the IHADSS incorporates an optical sighting system, helmet stability during flight is important. When asked to rate the stability of the helmet in reference to slippage (question 53), the most frequent rating was "Average" (52%). Thirty-one percent indicated "Average" or better than average stability, and 15% indicated a less than "Average" stability.

Respondents were asked to identify any and all IHADSS components with which they had experienced breakage, binding, slippage or any other malfunction (question 54). The most frequently reported malfunction was associated with the electronics cable (40%). Other relatively high frequency malfunctions included the microphone boom (34%), the microphone (30%), and the visor (28%).

Additional comments

The final question (question 55) provided respondents the opportunity to express any other opinions or information regarding their experience with the IHADSS helmet. Representative comments were:

- The IHADSS needs to be a permanent issue item that is maintained from unit to unit.
- IHADSS should be issued like a normal flight helmet and should go with the aviator. Personal helmets would reduce the frequency of fit problems.
- Need ALSE personnel trained to properly fit the IHADSS. Once fitted properly, the helmet should be hand carried during Permanent Change in Station (PCS).
- I should be able to keep my own IHADSS instead of turning it in at every PCS move. The time involved in refitting, flying, and adjusting a new helmet can be alleviated. Some units don't have my size, delaying the relocation process.
- More training for the ALSE reps on the IHADSS in school. PCSing with the IHADSS helmet (as a part of central issue facility) will reduce much problem for fitting.
- It is a good helmet, but people should be trained to properly fit it and take the time to fit it.
- I would like to see more sizes available.
- Provides little or no noise protection.
- My biggest concern is not being able to see the entire picture and not getting all the information available in the HDU.
- Often has rubbing that causes irritation on neck from chinstrap. Not as easily cleaned as I would like.
- Make the visor cover lower to keep from hitting the canopy.
- I have had electronics cable cannon plug pins bend/break, and multiple helmet internal speakers fail.
- I typically have minor problems that are quick fixes. Usually on the spot that do not affect the mission. I have seen a lot of communication problems, however. The single [monocular] HDU design was a poor design from its inception. We need a better display system that incorporates both eyes.

Complete respondent data are provided in Appendix B.

Summary and discussion

While two thirds of the respondents indicated satisfaction with their initial IHADSS fit, it is a significant finding that one out of three respondents were dissatisfied. Through repetitive refits, apparently the level of fit was improved since 75% of respondents indicated that their current fit quality was "satisfactory" or better. A satisfactory fit is important for an optical sighting system where stability and maintenance of alignment are crucial. The success of the initial fitting was found to be less when fitted at locations other than Fort Rucker, AL.

Unsurprisingly, helmet comfort correlates highly with current fit satisfaction. Seventy-five percent of respondents rated the comfort of their current IHADSS helmet as "good" or better.

Major types of discomfort included hot spots and headaches, attributed most often to ear cups and improper fit.

The IHADSS helmet has a unique visor configuration. The helmet has separate visor housings for the clear and tinted visors, i.e., only one visor can be mounted on the helmet at any given time. Visor use is an important safety issue (Reynolds et al., 1998). Fortunately, 77% of the respondents indicated they wore their visors in a down position. In 1998, USAARL investigated visor use among U.S. Army rotary-wing aviators (Rash et. al., 1998) to include 34 Apache AH-64 aviators who filled out surveys regarding visor use, compatibility and quality. Approximately 79% indicated that they had the tinted visor installed on their helmet. In the current study, 91% of respondents who indicated a choice of visor use preferred the tinted visor.

While 71% of respondents indicated that replacement helmet components were readily available in the unit's ALSE shop, respondent comments indicated that visors, liners, and straps were often unavailable.

The NBC environment is an ever-present threat. AH-64 aviators require a special chemical mask that fits under the IHADSS helmet. Proper fitting involves simulating the thickness of this mask via the use of a skullcap (comfort cap). Unfortunately, less than half of the respondents (42%) indicated the routine wearing of the skullcap. If an aviator was not fit initially with the skullcap, then when they don their chemical mask, they must suffer from increased hotspots and other discomforts. If an aviator was fit initially with the skullcap but is not wearing the skullcap during normal (nonNBC) flight environments, they must suffer from a loose or unstable fit.

While approximately one third of U.S. Army aviators use some type of vision correction, only 15% of respondents in this study indicated using glasses (8%), contacts (5%) or alternated between these two types of vision correction (2%). Due to the presence of the HDU and its limited physical eye relief, the requirement to wear vision correction results in a serious incompatibility issue (Rash, Kalich and van de Pol, 2002). This incompatibility extends to specially modified laser protective spectacles, which must be worn in a hostile laser environment and during weapons practice when the AH-64's laser designator is in use. Unfortunately, only 15% of the respondents indicated they wore these spectacles on the firing range. Anecdotal information suggests that the physical incompatibility issue of the laser protective spectacles with the IHADSS HDU is a primary reason for their lack of use.

In a night environment, Apache aviators fly using pilotage imagery generated by a nose-mounted FLIR sensor, which is presented on the HDU in a 30° by 40° FOV. Any compromise in the initial helmet fitting, which is most often of an anthropometric cause, will result in a reduction of this full FOV. This problem is well documented (Rash, 2000). Of the respondents in this study, only approximately one half (55%) indicated that were able to achieve a full FOV. The typical reduction in the FOV can take on one of several patterns. Perhaps the most typical type of FOV loss is that of one corner or one side of the FOV. A classic FOV reduction would be a symmetrical loss around the entire periphery, a phenomenon similar to the knot-hole effect. The typical reduction patterns reported by the respondents are presented in Appendix A, under Question 40. In addition, over one third (35%) indicated that their FOV changed as they moved their heads.

One small, critical issue raised was that of inadvertent release of the visor during flight. While 74% of respondents reported “never” or “rarely,” 18% reported this as having occurred more than once.

Noise in rotary-wing aircraft is an established and prevalent problem. Noise levels found in military helicopters exceed noise exposure limits established within the Department of Defense and the Department of Army (Rash, 2000). The wearing of double protection, in the form of some type of earplug in combination of the helmet, is both recommended and standard procedure for all aviators. Sixty one percent of respondents indicated that they wore double hearing protection, with the most preferred types being foam earplugs (53%) and CEP’s (7%). The CEP uses passive sound attenuation, an earplug in combination with the helmet ear cup, to achieve noise reduction. The earplug is attached to a miniature transducer that delivers sound directly into the occluded portion of the ear canal through a small channel built into the earplug, which improves speech communication. When asked to rate the quality of noise protection provided by their choice of protection, 13% of respondents indicated “poor” or “unsatisfactory.” Coincidentally, 15% of respondents indicated that they experienced tinnitus (ringing in the ears) during or immediately after flight. When asked to specify the length of time this condition usually lasted, 43% cited a period of up to 2 hours.

It is reasonable to assume that the issue of noise protection (or reduction) is associated closely with difficulty in hearing communications. In this survey, 37% of respondents indicated they experience such problems with communications. When asked to specify causes of this problem, the most frequently reported causes were radio quality/clarity (20%), radio volume (15%) and engine noise (12%). Particularly disturbing are the techniques respondents cited to improve communication difficulties. These techniques included: 1) adjust volume continuously, 2) tighten chinstrap to an almost unacceptable level, and 3) toggle radios on and off. The two techniques of constantly adjusting volume and toggling radios on and off increase workload and, very likely, distract aviator attention from flight responsibilities. The third technique of over-tightening the chinstrap to increase the pressure on the ear cups most certainly contributes to helmet discomfort, increasing stress and producing a constant distraction.

As stated above, during night operations, the aviator receives his pilotage video via the HDU, which is clamped into a receiver clip on the right side of the helmet. Any inadvertent release of the HDU during flight could have catastrophic results. Of great concern should be the finding that 55% of respondents indicated that they had experienced an inadvertent HDU release. When asked how frequently such releases had occurred, 12% said “occasionally.” One respondent indicated that inadvertent release was a frequent problem.

In summary, quality and satisfaction of fit for the IHADSS helmet is acceptable for the majority of respondents. Based on comments, many of the problems experienced by those respondents reporting a less than satisfactory fit or comfort level are associated with two factors. The first factor is the current Army policy requiring aviators to turn in their issued helmet when changing duty stations. This policy requires a new helmet fitting, which according to the data reported herein, results in a lower quality of fit. Both respondent data and anecdotal reports from the field state that units are limited to issuing helmets only in sizes that are available in the unit,

and Apache pilots do not necessarily receive and fly with the appropriate sized helmet, which is clearly a safety concern.

The second factor is that when the refit occurs at the unit level at the new duty station, there is less availability of experienced ALSE personnel. The U.S. Army Aviation Life Support Equipment Specialists Course at Fort Rucker, Alabama concentrates on the HGU-56/P helmet, the standard helmet for Army crewmembers. The school currently does not have the IHADSS helmet component or visor assets, or course schedule time, to properly address the articulated fitting procedures required for an appropriate IHADSS effort. Therefore, the school provides a cursory IHADSS fitting and maintenance overview. ALSE personnel usually learn the fitting skills at the unit level without any measure of required expertise for control of the process. It has been suggested that a separate syllabus be initiated to address the AH-64 unique fitting requirements, but there is no definitive path at this time. In the past, manufacturer contract support was available for fitting; currently only Fort Rucker has any formal nonmilitary fitting support.

Data and results from U.K. survey

The same questionnaire used for U.S. aviators was used for the survey of U.K. aviators. Therefore, data were collected for the same five areas of interest (i.e., helmet fit satisfaction, helmet comfort, visual protection and use, noise protection and man-machine interface), with a final question allowing an opportunity for respondents to provide additional remarks regarding previously unaddressed issues associated with the IHADSS helmets. Where appropriate, representative responses from the open-ended questions are provided in the discussion. All of the responses to open-ended questions are presented in Appendix D. Occasionally, responses were edited slightly to improve fragmentary responses, verbal lacunae, or misspellings. Places where this occurred were indicated with square brackets [].

Helmet fit satisfaction

The helmet fit satisfaction section consisted of 12 questions (questions 13-24a), both objective and subjective in nature. Results from this section are summarized in the following paragraphs. Complete respondent data are provided in Appendix C.

The majority of respondents received their initial AH-64 training in the U.S. at Fort Rucker, AL. It is therefore not surprising that 70% of respondents indicated receiving their initial fit at Fort Rucker, AL (question 13). Four (5%) were initially fitted in the U.K. and two aviators were fitted at the Boeing aircraft facility at Mesa, Arizona.

Approximately 55% indicated that they were satisfied with their initial fit (question 14). Of the respondents who indicated dissatisfaction with the initial fit, 73% reported having to have five or less refits to achieve satisfactory fit. When the satisfaction rate was investigated by location, the Fort Rucker satisfied fit rate was the lowest (43%); however, caution must be exercised in the percentages for the other two locations due to the low frequencies of

respondents. Eighty percent of respondents indicated that their current fit was satisfactory (question 15).

In the U.K., aviators do not turn in their helmet when changing duty station. This is reinforced by the fact that 85% of respondents did not change helmet size following a PCS move (question 16). At least two of the three respondents who indicated they did change helmet size (most likely based on return from AH-64 training at Fort Rucker, AL to the U.K.) attributed this change to variation in U.K. sizing criteria (question 16a), and gave the following reasons:

- U.K. [re]issue.
- U.K. sizing said L[arge] instead of X-L[arge].

When asked to rate the quality of their current IHADSS fit (question 18), 15 respondents (75%) indicated a quality rating of “Satisfactory” or better; two (10%) indicated a less than satisfactory rating. When asked if they thought they had the properly sized helmet (question 21), 90% (with two “No” responses) felt their current size was correct.

The majority of respondents indicated their current IHADSS helmet was fit within the last 3 months (67%). Compared to fittings at other posts (previous post in most cases was Fort Rucker, AL), 87% of respondents reported the current fit as “better.” No respondents reported having a “worse” fit.

All respondents indicated their current ALSE shop was military (question 22a), who in the U.K. are Royal Air Force (RAF) safety equipment specialists. Eighty percent of the respondents rated the quality of the ALSE shop (question 23) to be “Satisfactory” or better, and 15% reported the ALSE to be “Unsatisfactory.” When asked to compare their current ALSE shop to that of their previous post (in most cases Fort Rucker, AL), 40% said current shop was “Better,” 15% said “Same,” and 20% said “Worse.” When asked to explain, the following comments were provided:

Better

- Smaller community to deal with, better customer service.
- The British ALSE equivalent [is] “by far” better trained and more competent than the USA version.
- Better trained technicians.
- More professional.
- Pay more attention to detail in fitting and HMD location [optical alignment].

Worse

- No [video] for HDU.
- Poor service/lack of knowledge.
- They have no test kit. The operators are very good though.

Helmet comfort

The helmet comfort section consisted of 12 questions, both objective and subjective in nature (questions 25-36). Complete respondent data are provided in Appendix C. Results from this section are summarized in the following paragraphs.

When asked to rate the comfort of the current IHADSS helmet (question 25), 85% indicated the comfort was "Satisfactory" or better; 10% of respondents reported comfort to be less than satisfactory.

When asked to indicate the type of comfort encountered (question 26), the most frequently reported discomforts were hot spots (50%), chaffing (20%), neck pain (15%) and headache (10%). Two respondents reported the helmet to be loose. When asked to indicate the cause(s) of the discomfort (question 26a), 30% reported an improper fit, 20% reported ear cups, 15% reported chinstrap and 10% reported center of gravity. To alleviate the discomfort (question 26b), the majority of respondents (55%) indicated having their fit adjusted.

Question 35 further investigated ear cup comfort. Seventy percent of respondents indicated that their ear cups fit comfortably. The 30% of respondents who reported having uncomfortable ear cup fit in this question correlates reasonably well with the 20% of respondents who reported ear cups as a cause of discomfort in question 26.

All respondents (100%) reported wearing their visors in a down position (question 28), and having their visors trimmed to fit individual HDU placement (question 29). All respondents (100%) reported experiencing no difficulties with the visor adversely rubbing their noses or face when extended (question 34).

Question 27 asked respondents about their preference between a clear and tinted visor for normal use. However, the choices of answers given did not complement the question asked. Consequently, concise conclusions in regards to this question should be avoided. However, 75% (15) of the respondents did clearly indicate a visor choice in response to this question. Of these 15 respondents, 93% (14) indicated a preference for a tinted visor.

When asked whether or not they were satisfied with the liners of the inner helmet components (question 30), only 65% (13) provided a response. Of those 13 responding, 92% (12) reported being satisfied with the clear liners.

When asked about frequency of cleaning (washing) of the fabric-based helmet components (question 31), only 75% provided a response. Of those responding, 40% reported cleaning monthly, 20% every 6 months, and a third reported cleaning only yearly. When asked if cleaning affected helmet fit (question 32), only 60% (12) provided responses, with 75% (9) indicating "Yes."

When asked if replacement helmet components were readily available in the unit's ALSE shop (question 33), 55% indicated components were available. However, 45% indicated replacement

components were not readily available. Comments concerning replacement component availability were as follows:

- Liners not issued, but should be.
- Usually taken from “serviceable” helmets in stores.
- Spares shortage.
- No helmet liners in the system.

With regard to the wearing of the skullcap designed to simulate the thickness of the chemical mask during fitting (similar in design to U.S. skullcap), 75% indicated they do routinely wear a skullcap; the remaining 25%, indicated they do not wear a skullcap.

Visual protection and use

The visual protection and use section consisted of 8 questions (questions 37-44), both subjective and objective in nature. Results from this section are summarized in the following paragraphs. Complete respondent data are provided in Appendix C.

Respondents were asked if they wore corrective eyewear (i.e. glasses or contact lenses) during flight (question 37). Thirteen (65%) indicated wearing no eyewear during flight. Of the remaining respondents, five (25%) reported wearing contact lenses; one (5%) indicated wearing glasses; and one (5%) indicated wearing either glasses or contact lenses.

Questions 38 and 39 addressed the use of laser protective spectacles. Such devices would be required on the firing range and, operationally, in defined hostile environments. However, at this phase of training/fielding, the U.K. has not initiated range firing using the AH-64's laser target designator. Therefore, it is not surprising that 17 (85%) indicated that they do not wear laser protective spectacles. For the same reason, there was insufficient response to question 39, which inquired if wearing the laser spectacles inhibited HDU use.

When fitted properly, the Apache aviator should be able to view the entire 30° vertical by 40° horizontal imagery displayed on the HDU. Of the respondents, thirteen (65%) indicate achieving a full FOV (question 40). The five (25%) respondents, who indicated they did not achieve a full FOV when flying, were primarily unable to view one or more of the four corners (question 40a). (See question 40 in Appendix C for representative depictions of FOV losses.)

Over half (60%) of respondents indicated that their FOV did not change when moving their head from left to right (question 41). However, 40% indicated experiencing an FOV loss and gave the following explanations of the resulting losses (question 41a).

- Bottom left corner.
- Four corners.
- Top left corner.

The entire list of comments is provided in Appendix D.

Noise protection

The noise protection section consisted of 5 objective questions (questions 45-49). Results from this section are summarized in the following analysis. Complete respondent data are provided in Appendix C.

The majority of respondents (45%) indicated that they did not have a then current hearing profile (question 45). A total of 4 respondents (20%) had either H-2 or H-3 profiles. Seven respondents (35%) were not sure.

Only 15% of respondents indicated that they wore double hearing protection (question 46). The only type of supplemental hearing protection identified was foam earplugs. When asked to rate the quality of noise protection used (i.e., helmet alone or helmet with foam earplugs) (question 49), approximately 65% of respondents indicated "Satisfactory" or better.

One-fourth of respondents indicated they experienced tinnitus (ringing in the ears) during or immediately after flight (question 47). Of these respondents, 80% reported an onset of within 1 hour into flight; one respondent indicated that tinnitus was constantly present. When asked to specify the length of time tinnitus usually lasted, 40% of respondents indicated a period of less than 2 hours after flight, and 60% indicated a period of more than a day.

Approximately 20% of respondents indicated that they experienced muffled hearing immediately after flight (question 48).

Man-machine interface

The man-machine interface section consisted of 5 questions (questions 50-54), both objective and subjective in nature. Results from this section are summarized in the following paragraphs. Complete respondent data are found in Appendix C.

The majority of respondents (70%) indicated that communications difficulty was not an issue (question 50). The 30% who indicated they have had communications difficulty were asked to specify the cause(s) of the difficulty (question 50a). The causes given were the standard radio system (5%), tempest radio system (5%), and other (15%). When asked what techniques respondents used to improve noise difficulty (question 50b), representative comments were:

- Replace[d] microphone.
- [Increase] volume in CIU [Communications Interface Unit].
- Place mike hard against my lips.
- Turn up the IC [intercom] and radios.

The entire list of comments is provided in Appendix D.

When asked if the HDU had inadvertently released during flight, (question 51), seven respondents (35%) indicated that such a problem had been encountered. When asked how often release had occurred (question 51a), six respondents (87% of those who had encountered

inadvertent release) indicated that the frequency was "Seldom" and one respondent (14%) reported "Occasionally."

Aviators do not usually fly the same aircraft from flight to flight. Respondents were asked if the HDU position remains the same from aircraft to aircraft (question 52). Eighty percent indicated "Yes." Those respondents who indicated "No" gave the following explanations:

- Size and centering often incorrect at [Fort] Rucker.
- Used by many aircrew.

The entire list of comments is provided in Appendix D.

When asked to rate the stability of the helmet with respect to slippage (question 53), 80% of respondents indicated "Average" or better. Four respondents (20%) indicated less than average.

When asked to identify IHADSS components with which they had experienced breakage, binding, slippage, etc. (question 54), respondents identified the electronics cable and microphone as the most frequent problems. Microphone boom, HDU mount and chinstrap were additional components frequently cited.

Additional comments

The final question (question 55) provided respondents the opportunity to express any other opinions or information regarding their experience with the IHADSS helmet. Representative comments were:

- Microphone boom is prone to loosening over time therefore [and] falling away from face. Needs constant tightening.
- Overall, it is quite comfortable. I am very concerned over hearing protection. Also quality control. The mics [microphones] are poor as are IR [infrared] harnesses in [the] moist i.e., U.K. conditions.
- Chin strap used to rub. I have had the MK4 chin strap cover fitted to my IHADSS chinstrap and velcro attached to the strap. Result [equals] comfort and no slip of the chinstrap. Otherwise, most comfortable helmet I have.
- I believe from experience that the standard UK helmet has a better fit than the IHADSS helmet.
- [I] like it. Most comfortable helmet that I have worn.

Summary and discussion

At the time this survey was completed in the U.K., there were only 24 rated Apache aviators. Therefore, the sample size of 20 approached the population size. This large sample response was due primarily to the fact that the survey was conducted very early in the initial fielding of the AH-64 in the U.K. and virtually all AH-64 aviators were concentrated at a single location, Middle Wallop, U.K.

Seventy percent of the U.K. respondents received their initial IHADSS fitting at Fort Rucker, AL, which served as the training center for the U.K. aviators. Overall, only 55% of respondents were satisfied with their initial fit. While care must be taken based on the small number of respondents, both respondents who were fit at the Boeing facility expressed satisfaction with their fit; three out of four respondents who were fitted at Middle Wallop, U.K., were satisfied; but, only 43% of those receiving their initial fit at Fort Rucker, AL, were satisfied. When asked to rate the quality of their current fit, 75% indicated a quality rating of "Satisfactory" or better, and the majority (90%) felt they were wearing the proper sized helmet.

Eighty percent of the respondents expressed satisfaction with the quality of their current fitting facility and personnel, although a few respondents commented on the lack of real-time video for use during the alignment of the HDU.

The U.K. respondents expressed relatively high satisfaction with the comfort level of their current fit. However, reports of hotspots and chafing were frequent. Ear cup comfort also was generally acceptable. However, 30% of the respondents did cite them as a comfort issue.

Of respondents expressing a preference in visor choice, the majority exhibited a preference for the tinted visor. The importance of visor use seemed evident with 100% of respondents reporting that they wore their visor in a down position. All of the respondents expressed satisfaction with the trimming of their visors to accommodate HDU placement, and no complaints of the visors coming in contact with their noses or face were reported.

Approximately one third of respondents indicated use of corrective eyewear, with contact lenses being the most frequent choice.

Approximately two thirds of respondents indicated being able to achieve the full 30° by 40° FOV, with loss of one or more of the four corners being the most prevalent. Forty percent of respondents indicated head motion as an additional contributor to FOV losses.

Of concern was the reporting of approximately one fourth of the respondents having experienced tinnitus, with the majority of episodes lasting for periods of a day or more. Only 65% of respondents indicated that hearing protection, even with supplemental foam earplugs, was "Satisfactory" or better. The low proportion (15%) of UK aviators who reported wearing supplemental noise protection is most likely a reflection of a cultural bias. Approximately one out of five respondents reported experiencing muffled hearing immediately after flight.

While approximately three out of four respondents indicated that communications difficulties were not an issue, a significant proportion (30%) did raise this as an issue.

The inadvertent release of the HDU during flight, which can lead to serious safety implications, was reported by 35% of the respondents; however, only one respondent reported experiencing this difficulty as more than an infrequent event.

In summary, based on specific responses to questions and final comments offered, the IHADSS system appears to be acceptable to the majority of U.K. aviators. However, a small,

but significant proportion of users, have experienced difficulties with one or more aspects of the system. Two of the most important areas of concern are hearing protection and communications difficulties. The fitting program in the U.K. was reported to be quite acceptable, with the only fitting deficiency identified being the lack of availability of supplemental fitting test equipment such as the provision of real-time imagery during HDU alignment.

Contrast and conclusions

In comparing the demographics between the U.S. and the U.K. samples, there were generally only two similarities. The first similarity was gender, with 96% of the U.S. sample and 100% of the U.K. sample being male. The second similarity was the location of initial fit, which was predominantly Fort Rucker, AL, where virtually all U.S. and U.K. Apache aviators were trained.

However, considerable differences existed between the samples for most other demographics. First, the U.S. sample of 243 respondents represented approximately 21% of the estimated 1139 U.S. Apache aviators. Because the U.K. is at the beginning of their initial fielding of the Apache, the U.K. sample size of 20 represented 83% of the 24 U.K. aviators. The U.S. sample was considerably younger with a median and mode age group of 25-29 years versus 35-39 years for the U.K. This differential existed also with flight experience. The mean U.S. total flight hours were 1259, as compared to 4143 for the U.K. However, the U.S. AH-64 sample had a higher level of AH-64 experience, with a mean of 808 hours as compared to 367 hours for the U.K. The age and flight experience differences are explained by the current phase of Apache fielding within the two countries. Just as happened in the U.S. in the early 1980s, the U.K. are purposefully selecting older, more experienced pilots as the first pilots to transition into the Apache.

As stated above, the vast majority of both samples (80%) received their initial IHADSS fitting at Fort Rucker, AL. While the percentage of U.K. aviators (55%) who were satisfied with their initial fit was less than for their U.S. counterparts (69%), this difference was not statistically significant ($p=.192$). When viewed across all initial fitting locations, Fort Rucker, AL, had the highest satisfaction rate (71%) among U.S. respondents and the lowest satisfaction rate (43%) for the U.K. respondents. While most aviators, U.S. and U.K., who were dissatisfied with their initial fit required typically up to five refitting attempts, approximately 75% of both U.K. and U.S. aviators indicated a satisfaction rating of their current fit to be "Satisfactory" or better. However, the percentage of U.S. respondents who reported their current fit to be "Poor" or "Unsatisfactory" was twice that of U.K. respondents. U.S. respondents identified sources of dissatisfaction, which included improperly sized helmet, lack of experienced fitting personnel, hot spots, and ear cup discomfort.

Fitting support was a major issue for U.S. respondents. Currently, U.S. Apache aviators are required to turn in their helmets when moving to a new duty station and have to be refit with a new helmet. The fitting of the IHADSS helmet in the U.S. is not a dedicated occupational specialty, but is considered an "additional duty." The opposite is true in the U.K., where identified RAF personnel are given extensive training and are dedicated to IHADSS fitting responsibilities. However, surprisingly, the proportion of U.S. respondents (75%) and U.K.

respondents (80%) rated their satisfaction with the current fitting capability as "Satisfactory" or better.

While the 85% of the U.K. respondents who reported helmet comfort as "Satisfactory" or better was larger than the 75% value for U.S. respondents, this difference was not statistically significant ($p=.311$). Both U.S. and U.K. respondents identified hotspots as the primary source of discomfort.

Whether due to preference or command emphasis, 100% of U.K. respondents reported wearing their visors in a down position, in comparison to only 77% for U.S. respondents. The IHADSS uses two separate visor housings, one tinted and one clear, and the aviator must make a choice of installing one of these housings with visor prior to flight. The overwhelming visor preference for both the U.K. and U.S. respondents was the tinted visor.

There was no clear evidence that routinely wearing a skullcap correlated with comfort. There was a significant discrepancy between the 75% of U.K. respondents who routinely wear a skullcap and the 42% value for U.S. respondents. It would be expected that aviators who were initially fit with a skullcap and continue to wear a skullcap would have less fitting difficulty and inherently less discomfort.

As would be expected from the difference in sample ages, a larger proportion (35%) of U.K. respondents used some type of vision correction during flight than that for U.S. respondents (15%). Proportionally, U.K. respondents preferred contact lenses as the choice of vision correction.

To provide protection against the AH-64's own laser target designator, Apache aviators are issued laser protective spectacles. These spectacles use KG-3/5 glass lenses that are mounted in a modified spectacle frame. The modification consists of a rather drastic redesign of the right portion of the frame in order to accommodate the need to interface with the HDU, which sets directly in front of the right eye. These modified laser protective spectacles are known for their incompatibility with the HDU. (In this survey, 45% of U.S. respondents indicated these spectacles inhibited HDU use.) Respondents from both the U.S. and U.K. indicated that approximately 85% do not wear these laser spectacles on the firing range or as otherwise required. The high lack of use reported by the U.K. respondents is understandable, since, at the time of this survey, the U.K. had not initiated range-firing training. However, U.K. respondents who had been trained at Fort Rucker should have been provided these spectacles. The high lack of use reported by the U.S. respondents should be of great concern, since laser protection has been a priority safety issue within U.S. Army aviation.

Pilotage of the AH-64 Apache at night is achieved using FLIR imagery displayed on the HDU. The FOV's of the FLIR sensor and the HDU display are both 30° vertical by 40° horizontal, providing a one-to-one correspondence. Due to the short optical relief of the IHADSS (10 millimeters) and variation in facial anthropometry, achieving the full FOV has been an ongoing problem (Rash, Kalich and van de Pol, 2002). In this study, approximately only one half of both U.S. and U.K. respondents reported achieving a full FOV. Reported losses of FOV typically occurred in one or more corners or along one complete side of the display.

The cockpits of rotary-wing aircraft are noisy environments. Maintaining the necessary hearing protection, while providing optimal performance of voice communications, is an important requirement for all aviation helmets. However, hearing loss is a continuous concern in the military aviation environment. Hearing loss is a common cause of medical disqualification among Army aviators, even though many aviators with hearing loss continue to fly (Mason, 1995). Almost two thirds (61%) of U.S. respondents indicated wearing double hearing protection, supplemental foam earplugs or CEPs beneath standard helmet ear cups. This contrasts sharply with the extremely low (15%) value reported by U.K. respondents. However, 86% of U.S. respondents rated the quality of their noise protection (helmet plus supplemental) as "Satisfactory" or better; only 65% of U.K. respondents reported similar satisfaction. While 15% and 25% of U.S. and U.K. respondents, respectively, reported experiencing tinnitus (ringing in the ears) during or immediately after flight, this difference was not statistically significant ($p=.169$).

Since at night the primary source of visual information for the Apache aviator is the imagery provided on the HDU, any sudden and unexpected loss of this information could be catastrophic. Therefore, the proportions of respondents, both U.K. and U.S., who reported having experienced an inadvertent release of the HDU during flight, should be considered as a major safety concern. Approximately one half (55%) of U.S. respondents and one third (35%) of U.K. respondents reported such releases. This concern is somewhat mitigated by the fact the frequency of reported inadvertent releases was predominately "Seldom." However, while low in reported frequency, 5% of U.K. respondents and 12% of U.S. respondents reported inadvertent releases as occurring "Occasionally." It may be speculated that an underlying factor may be the location of the attachment point used for the HDU cable. If this point is located too low on the torso, undue tension may be placed on the HDU, which may contribute to the inadvertent releases.

Since the IHADSS helmet serves as a platform for the pilotage and weapons sighting systems, the importance of helmet stability is elevated. Achieving and maintaining the FOV requires that the aviator's right eye be aligned at the exit pupil of the IHADSS and that this alignment not be compromised by helmet slippage. Factors that influence the stability of the helmet include quality of fit and head anthropometry, with quality of fit encompassing proper helmet size, fitter capability, availability of appropriate fitting tools, and the use of the skullcap to mimic thickness of NBC protective mask. Eighty percent of U.K. respondents rated the stability of their IHADSS helmet as "Average" or better, however only 40% rated stability as above average. For U.S. respondents, 52% rated helmet stability as "Average" or better, with only 31% rating stability as above average.

In summary, the very nature of the IHADSS helmet as a sighting platform and the primary source of pilotage imagery (at night) makes fit quality and comfort important issues. The IHADSS has been fielded in the U.S. for "20 plus" years. The U.K. is in its first year of fielding this system in the Westland version of the AH-64. Operational history has shown the AH-64 and the IHADSS to be a highly functional and successful design, overall. However, many human factors and visual performance issues have been continuously identified as sources of complaints and can be assumed to degrade performance to various degrees (Hale and Piccione, 1989; Behar et al., 1990; Rash et al., 2001). This survey confirms many previously identified issues

associated with the fitting of the IHADSS but goes one step further in identifying specific elements. It must be recognized that a proper helmet fit is not just one that is comfortable but one that optimizes FOV, hearing protection, and communications.

In conclusion, quality and satisfaction of fit for the IHADSS helmet is acceptable for a majority of both U.S. and U.K. respondents. However, for virtually all of the issues discussed above, a noteworthy (however small) proportion of respondents are dissatisfied. Considering the importance of the IHADSS helmet to the pilotage of the AH-64, the problems indicated by the dissatisfied proportion need to be addressed. Based on this survey, the primary issues of concern for the U.S. Apache community are: Training of qualified fitters, being allowed to carry a fitted helmet to next duty station, availability of replacement helmet components, emphasis on utilization of skullcap during initial fitting and its continued use during flights, and command emphasis on proper wearing of laser spectacles and visors (in the down position). For the U.K. Apache community, the survey identified only one primary issue of concern, availability of fitting tools (e.g., simulated or real imagery during HDU alignment).

Recommendations

For the U.S. Apache community:

- Place command emphasis on the wearing of laser protective spectacles on the firing range and as otherwise required.
- Place command emphasis on the use of supplemental hearing protective devices.
- If the policy regarding turn in of helmet at time of PCS was modified to allow aviators to retain currently fitted helmet, issues of availability of proper helmet size, number and quality of refit(s), and comfort and stability would be improved.
- Improve training for ALSE personnel for the specialized additional duty of IHADSS fitting.
- Emphasize use of skullcap during initial fitting and continuous use during flights.
- Investigate modifying design of HDU mount and receiving bracket in order to reduce frequency of inadvertent HDU releases.

For the U.K. Apache community:

- Attempt to procure simulated or real image sources to be used during HDU alignment. While not widespread, a device that consists of a flashlight and target reticule and simulates the IHADSS' miniature cathode-ray-tube (CRT), was developed by Honeywell, Inc., and provides the capability to maximize HDU alignment and resulting FOV.
- When training reaches the point where the AH-64's laser designator is in use, command emphasis should be placed on the wearing of laser protective spectacles.
- Place command emphasis on the use of supplemental hearing protective devices.
- Reinforce the necessity for qualified and dedicated fitting specialists for the IHADSS helmet.
- Investigate modifying design of HDU mount and receiving bracket in order to reduce frequency of inadvertent HDU releases.

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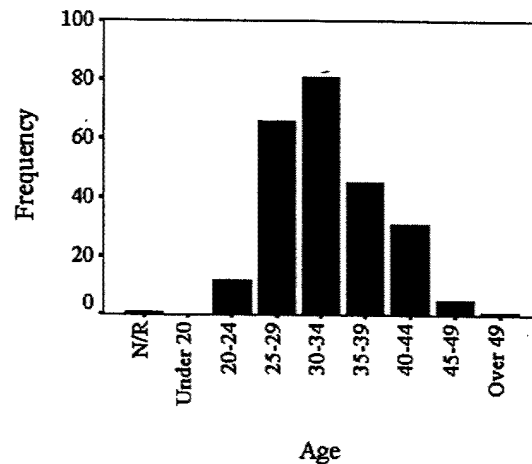
Appendix A.

Questionnaire: Apache Attack Helicopter Integrated Helmet and Display Sighting System (IHADSS) U.S. User Satisfaction Survey.

This appendix includes the questions on the questionnaire and a report of the responses to those questions by aviators in the U.S. The values in the tables correspond to the number of times each rank was reported by the respondents. The bar graphs in the main text converted these numbers to percentages.

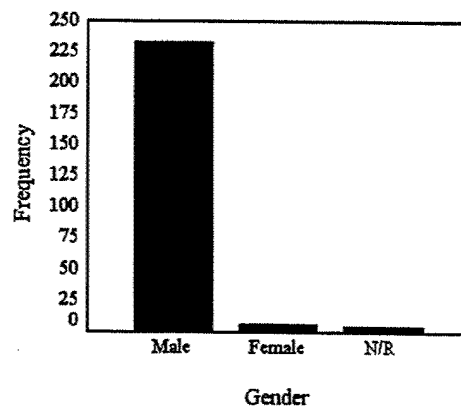
Demographic Information:

1. Age (circle one): Under 20 20-24 25-29 30-34 35-39 40-44 45-49 Over 49



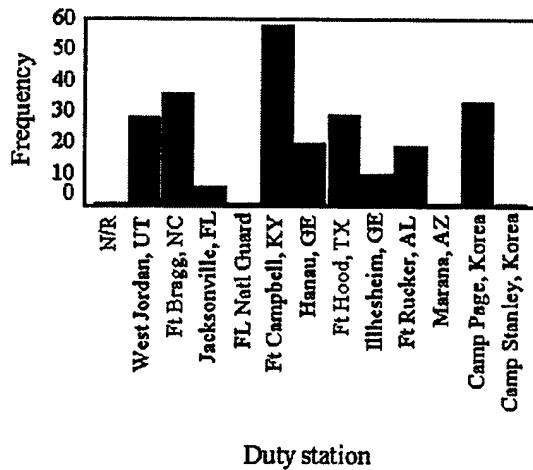
	Under 20	20-24	25-29	30-34	35-39	40-44	45-49	Over 49	N/R
Respondents	0	12	66	82	45	31	5	1	1

1a. Gender (circle one): Male Female



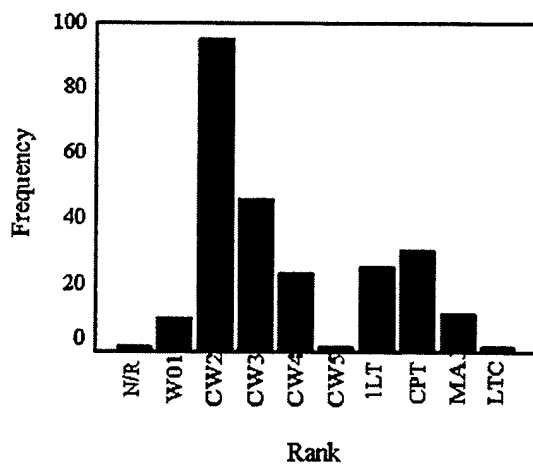
	Male	Female	N/R
Respondents	233	6	4

2. Current Duty Station:



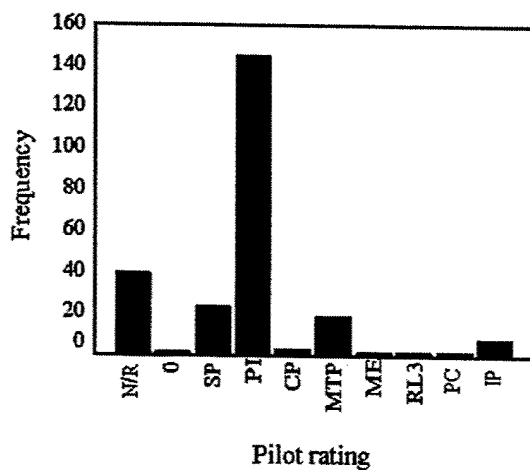
Current duty station	Frequency
West Jordan, UT	28
Ft. Bragg, NC	36
Jacksonville, FL	6
Florida Nat'l Guard	1
Ft. Campbell, KY	58
Hanau, Germany	20
Ft. Hood, TX	29
Illhesheim, Germany	10
Ft. Rucker, AL	19
Marana, AZ	1
Camp Page, Korea	33
Camp Stanley, Korea	1
N/R	1

3. Rank: WO1 CW2 CW3 CW4 CW5 2LT 1LT CPT MAJ LTC COL



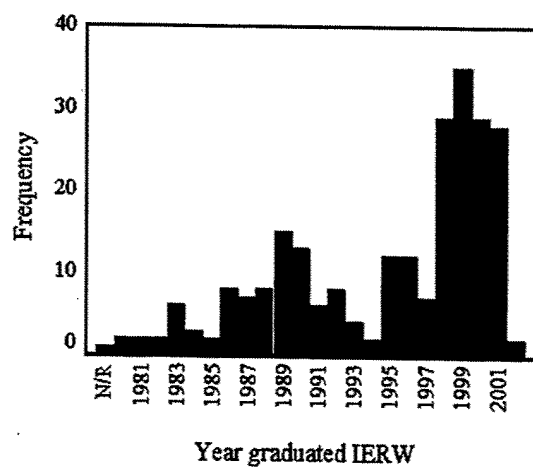
Pilot rank	Frequency
W01	10
CW2	95
CW3	47
CW4	23
CW5	1
2LT	0
1LT	25
CPT	30
MAJ	11
LTC	1
COL	0

4. Pilot Rating: SP OE PI CP MTP ME Other (specify)

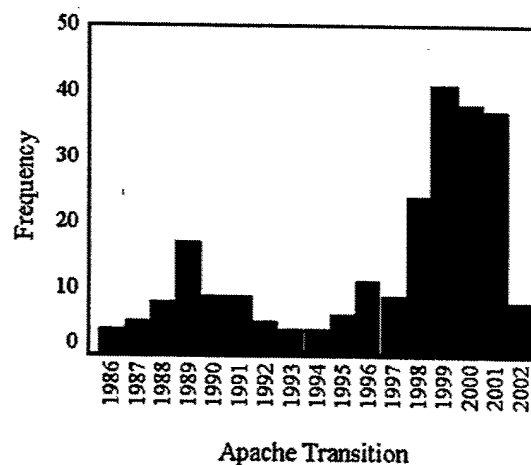


Pilot rating	Frequency
SP	23
OE	0
PI	145
CP	3
MTP	19
ME	2
Other	8
N/R	43

5. Year graduated from flight school:

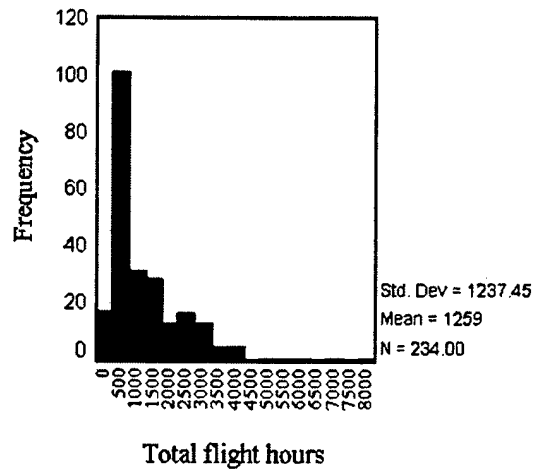


Year graduated Apache transition:



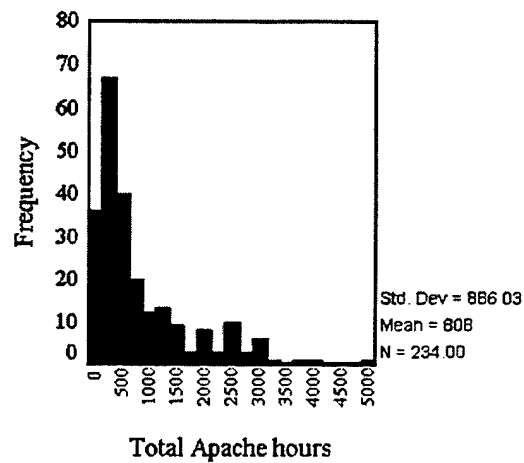
	Minimum	Maximum	Mean	Std Dev	Median
Yr Graduated Flight School IERW	1980	2002	1987	128	1998
Yr Graduated Apache Transition	1986	2002	1997	5	1999

6. Total number flight hours (include simulator time):



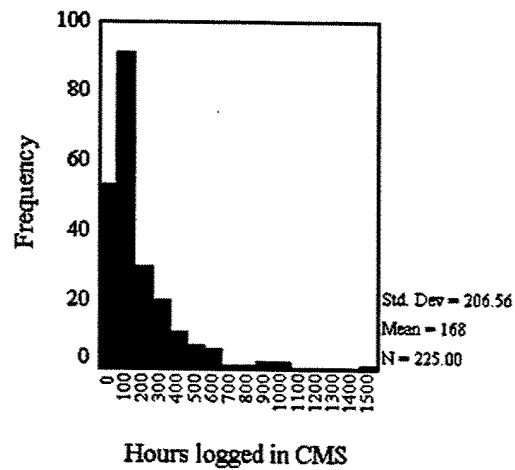
	Minimum	Maximum	Mean	Std Dev	Median	N/R
Total Flight Hours	121	8000	1259	1237	705	9

7. Total number of Apache flight hours (include simulator time):



	Minimum	Maximum	Mean	Std Dev	Median	N/R
Total Apache Flight Hours	40	5000	808	886	450	9

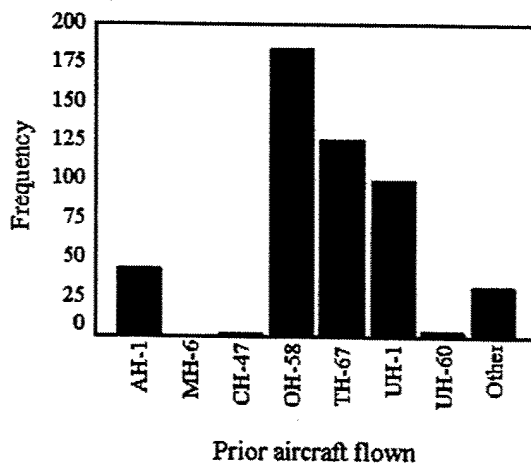
8. Approximate number of Apache hours logged in the CMS:



	Minimum	Maximum	Mean	Std Dev	Median	N/R
Approximate Apache hours logged in CMS	1	1500	168	207	100	18

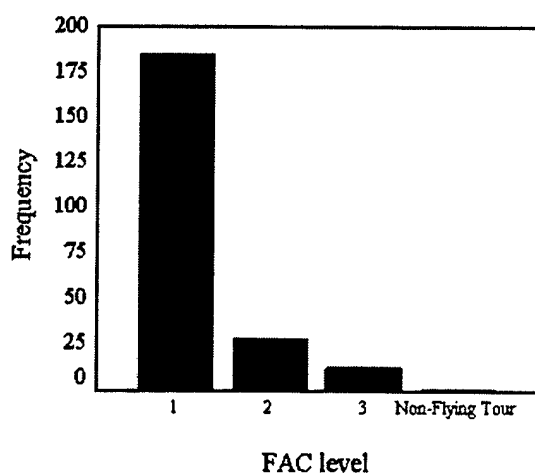
9. Military airframes flown prior:

AH-1 MH-6 CH-47 OH-58 TH-67 UH-1 UH-60 Other (specify)



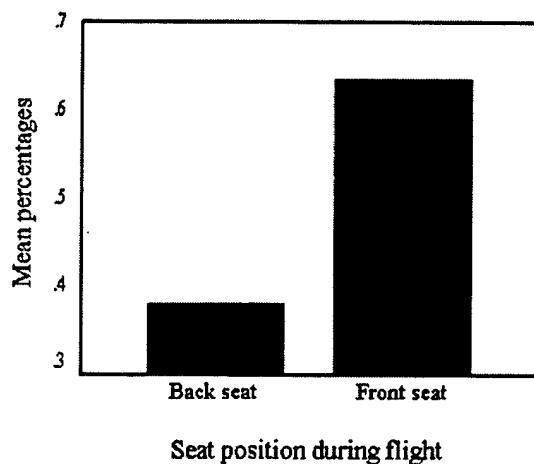
Airframes flown prior to Apache	Frequency
AH-1	43
MH-6	1
CH-47	2
OH-58	184
TH-67	126
UH-1	100
UH-60	3
Other	32

10. Current FAC Level (circle one): 1 2 3 non-flying tour



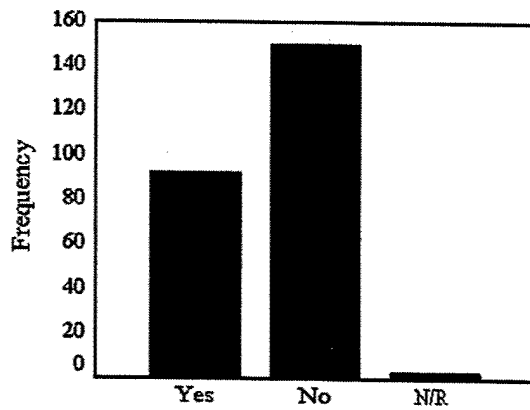
Current FAC level	Frequency
1	185
2	28
3	12
Non-flying tour	1
N/R	17

11. Percent of time flying AH-64 in front seat (CPG): back seat:

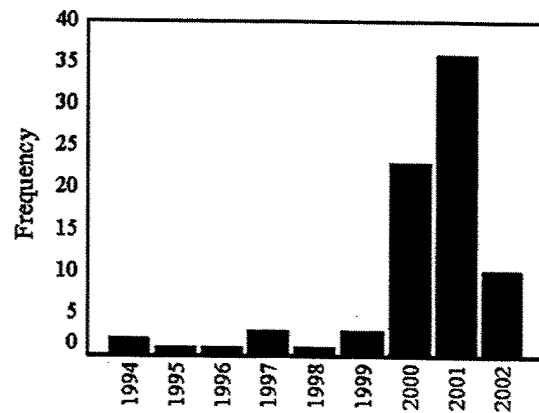


	Mean	Std Dev	Median	N/R
Percent time flying in front seat	64	.32	70	9
Percent time flying in back seat	36	.32	28	9

12. Are you D model trained? (circle one): Yes No If yes, what year?



D model trained

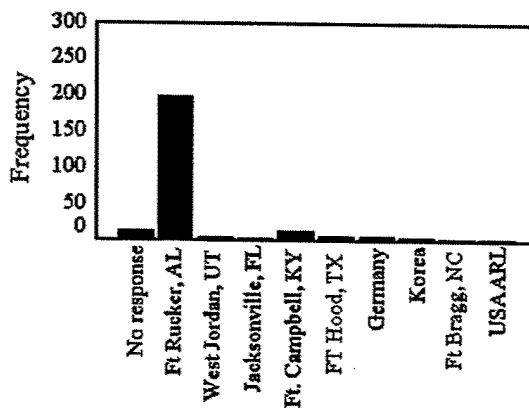


Year D model trained

	Yes	No	N/R
D-model trained	92	150	1

Helmet Fit Satisfaction

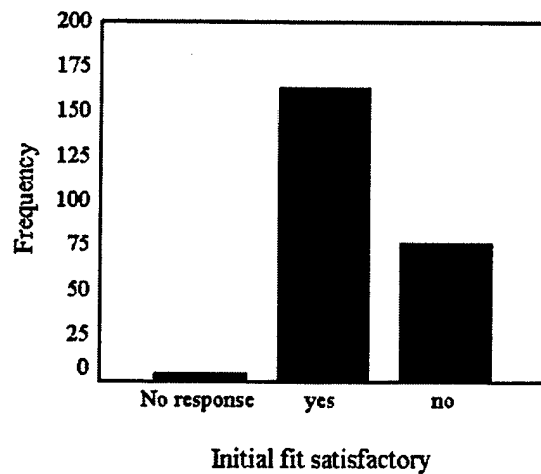
13. Location of initial IHADSS fitting:



Initial location of IHADSS fitting

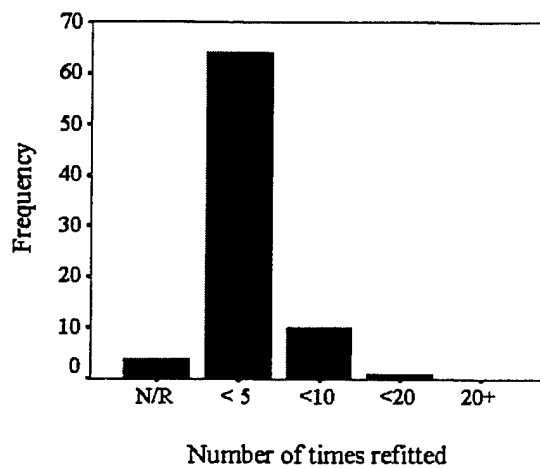
Location of initial IHADSS fitting	Frequency
Ft. Rucker, AL	197
West Jordan, UT	3
Jacksonville, FL	2
Ft. Campbell, KY	12
Ft. Hood, TX	5
Germany	6
Korea	3
Ft. Bragg, NC	1
USAARL	1
N/R	13

14. Was this initial fitting satisfactory? (circle one): Yes No



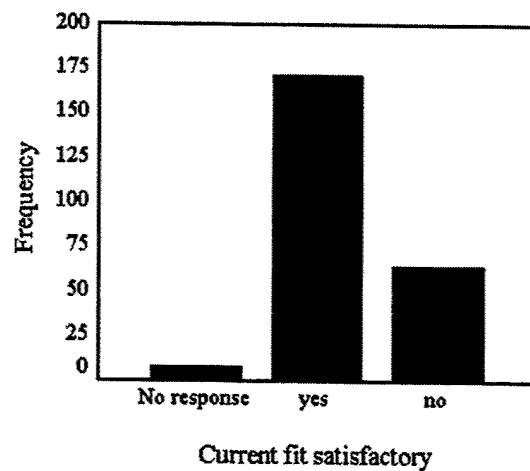
	Yes	No	N/R
Initial Fitting Satisfactory	163	76	4

14a. If no, how many times did you go back for refitting?: <5 <10 <20 20+



	<5	<10	<20	20+	N/R
Number of times refitted	64	10	1	0	1

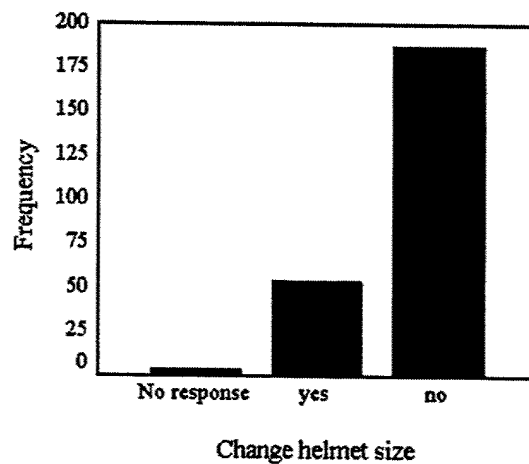
15. Is your current fit satisfactory? (circle one): Yes No



	Yes	No	N/R
Current Fit Satisfactory	171	64	8

If no, please explain: All comments are provided in Appendix B.

16. Have you changed IHADSS helmet size following a PCS move? (circle one): Yes No

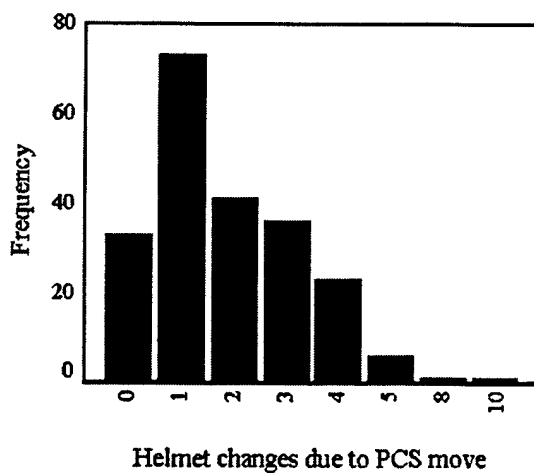


	Yes	No	N/R
Change Helmet Size	53	187	3

- 16a. Why?

All comments are provided in Appendix B.

17. How many times have you had to change your helmet due to PCS moves?



Number of helmet changes	0	1	2	3	4	5	6	7	8	9	10
Number of respondents	33	73	41	36	23	6	0	0	1	0	1

18. Please rate the quality of your current IHADSS fit (circle one):

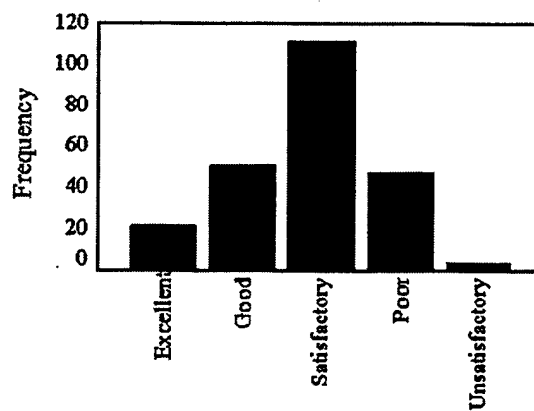
1
Excellent

2

3
Satisfactory

4

5
Unsatisfactory

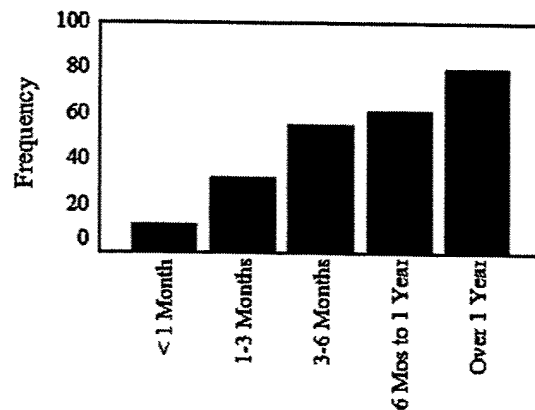


Quality of current IHADSS fit

	Excellent	Good	Satisfactory	Poor	Unsatisfactory	N/R
Quality of current IHADSS fit	22	51	111	47	4	8

19. When was the last time your current IHADSS was fitted? (circle one):

< 1 month ago 1-3 months ago 3-6 months ago 6months – 1 year ago Over 1 year ago

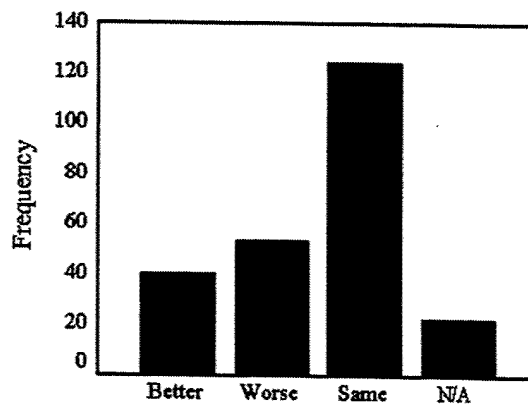


Last time current IHADSS was fit

	< 1 month ago	1-3 months ago	3-6 months ago	6 months – 1 yr ago	> 1 yr ago
IHADSS last fit	12	32	55	61	80

20. Compared to prior fittings at other posts, would you rate the current fit as (circle one):

better worse same n/a



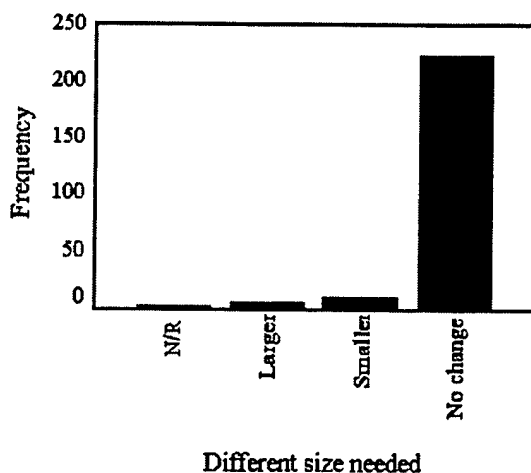
Current fit compared to fittings at prior posts

	Better	Worse	Same	N/A	N/R
Quality of current IHADSS fit	40	53	124	22	4

- 20a. If worse, why and what have you done to attempt to improve the fit?

All comments are provided in Appendix B.

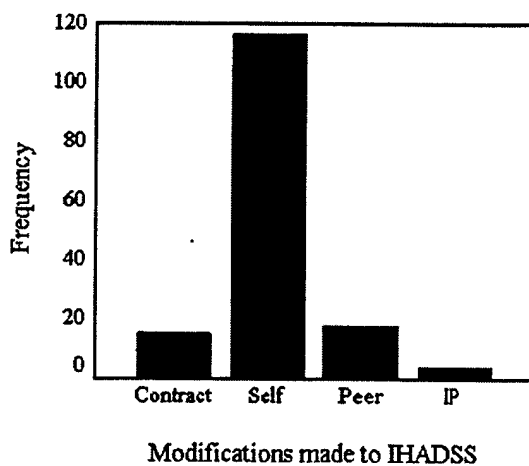
21. Do you feel that you need a different size? (circle one): Larger Smaller No Change



	Larger	Smaller	No Change	N/R
Need different size	7	11	220	5

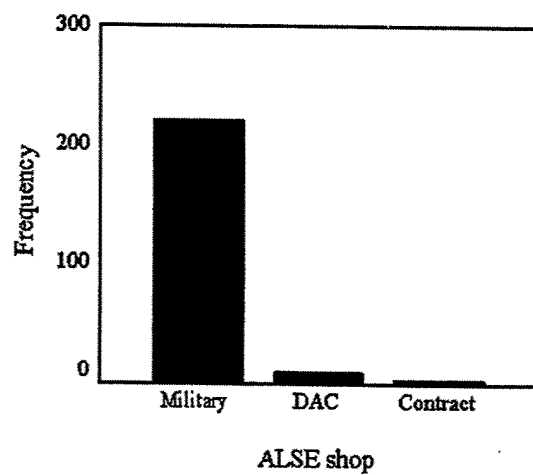
22. Has anyone modified or adjusted your IHADSS aside from your ALSE shop? (circle all that apply):

Contract Maintenance Self Fellow Aviator IP Other (please specify)



	Contract Maintenance	Self	Fellow Aviator	IP	Other
Modified/adjusted IHADSS	15	116	18	4	11

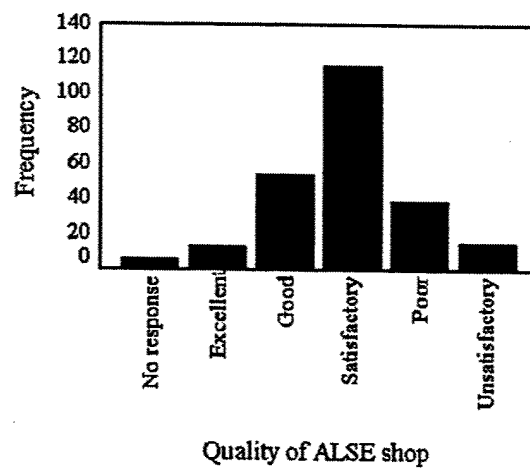
22a. Is your ALSE shop (circle one): Military DAC Contract



	Military	DAC	Contract	N/R
ALSE Shop	220	7	3	13

23. Please rate the quality of your current ALSE shop relating to fitting capabilities (circle one):

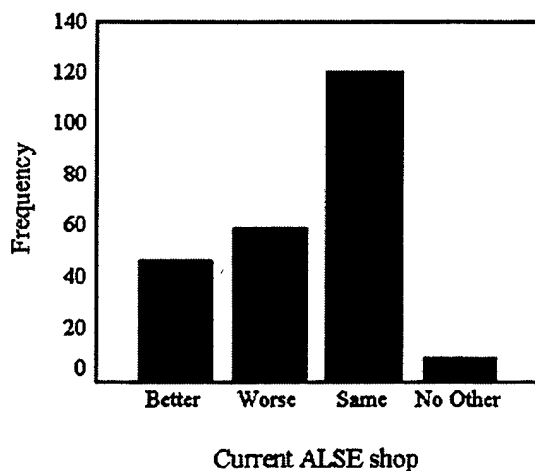
1 2 3 4 5
 Excellent Satisfactory Unsatisfactory



	1	2	3	4	5	N/R
Quality of Current ALSE shop	13	54	116	39	16	5

24. Compared to prior ALSE shops (if applicable), would you rate the current ALSE as (circle one):

better worse same I have not been fit at other ALSE shops



	Better	Worse	Same	Not fit at other shops	N/R
Quality of Current ALSE shop	46	59	120	9	9

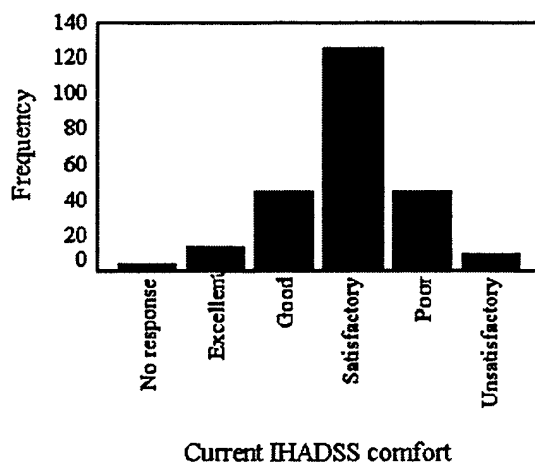
24a. If better or worse, why?

All comments are provided in Appendix B.

Helmet Comfort

25. Please rate the comfort of your current IHADSS (circle one):

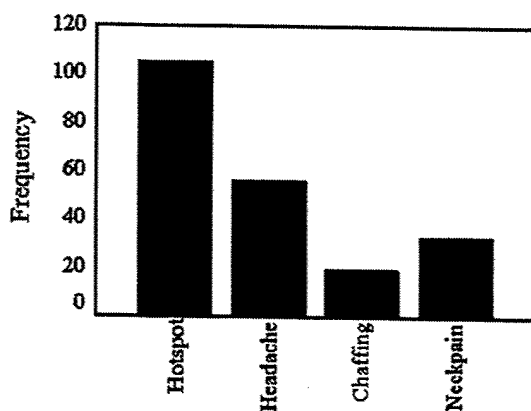
1 2 3 4 5
Excellent Satisfactory Unsatisfactory



	1	2	3	4	5	N/R
Current IHADSS comfort	14	45	125	45	10	4

26. Please indicate type of discomfort, if any? (circle all that apply):

hot spots headache chaffing neck pain other

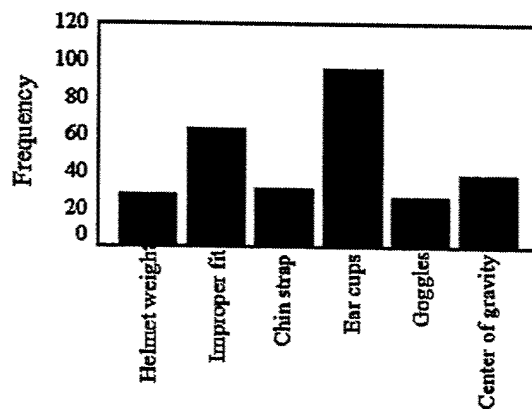


Discomfort

	Hot Spots	Headache	Chaffing	Neck Pain	Other	N/R
Type of discomfort	105	56	19	33	26	4

26a. What causes the discomfort, if any? (circle all that apply):

helmet weight improper fit chin strap ear cups goggle use
center of gravity other (please specify)

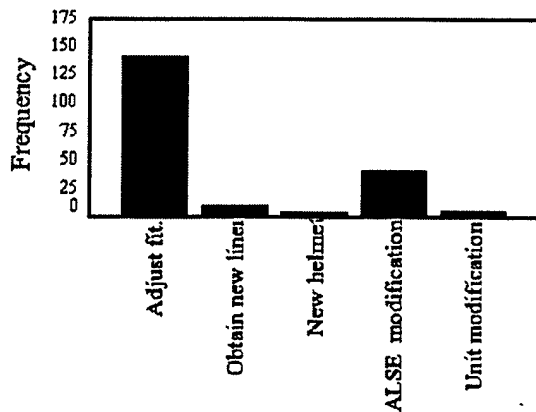


Causes of discomfort

	Helmet weight	Improper Fit	Chin Strap	Ear cups	Goggles	Center of gravity
Causes of Discomfort	29	64	32	96	27	39

26b. If you experience discomfort, what do you do to alleviate it? (circle all that apply):

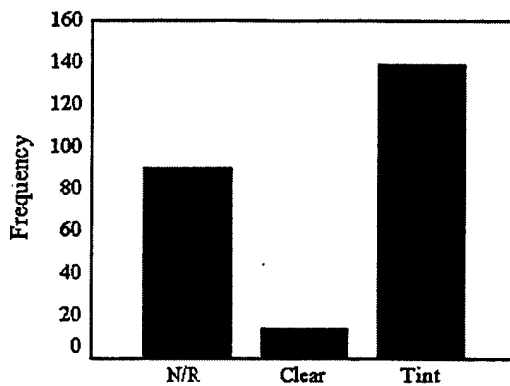
adjust fit obtain new liner(s) get new helmet fit modification through ALSE
fit modification through unit other (specify)



NOTE: Caution should be used in drawing conclusions from this question due to possible intersection or overlapping of allowed responses.

	Adjust fit	Obtain new liner	New helmet	ALSE modification	Unit modification	Other
Alleviate discomfort	141	9	3	40	4	33

27. Do you prefer your clear or tinted visor for normal wear? (circle one): Yes No



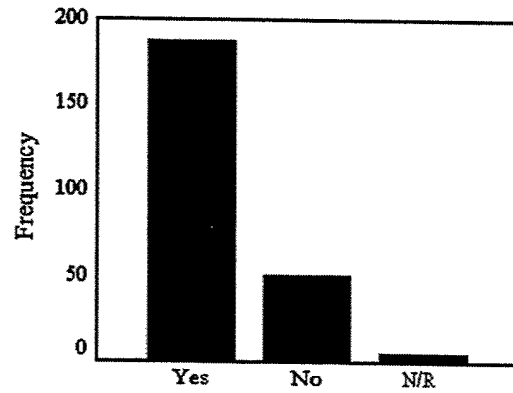
NOTE: Caution should be used in drawing conclusions from this question due to possible intersection or overlapping of allowed responses.

	Clear	Tinted	N/R
Clear or tinted	14	139	90

28. Do you wear your visor down on a regular basis? (circle one):

Yes

No



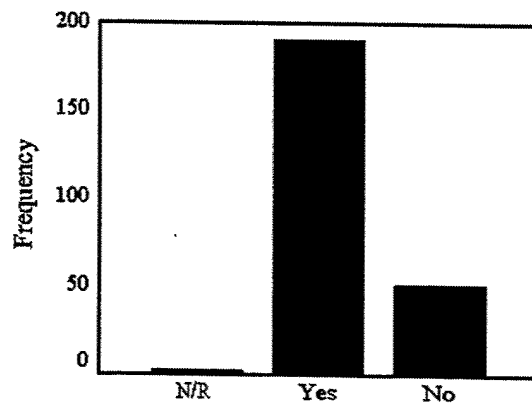
Wear visor down on regular basis

	Yes	No	N/R
Visor down in regular basis	187	51	5

29. Is your visor trimmed to fit your individual HDU placement?

Yes

No

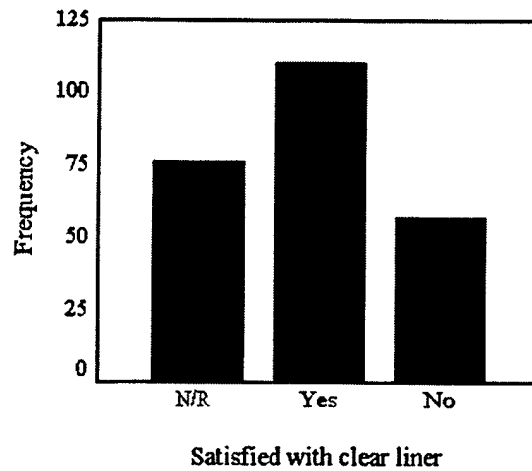


Visor trimmed

	Yes	No	N/R
Visor Trimmed	190	51	2

30. Are you satisfied with the clear liners of your inner helmet components? (circle one): Yes No

Comments: All comments are provided in Appendix B.



	Yes	No	N/R
Satisfied with clear liner	110	57	76

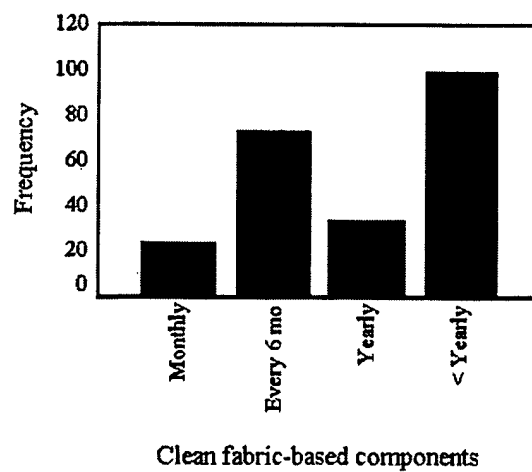
31. How often do you clean (wash) the fabric-based components of your helmet? (circle one):

Monthly

Every 6 months

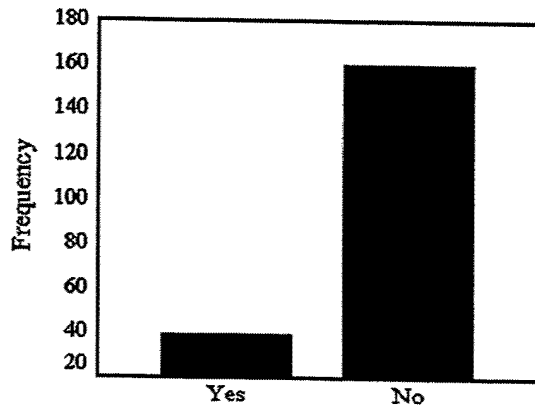
Yearly

Less than once per year

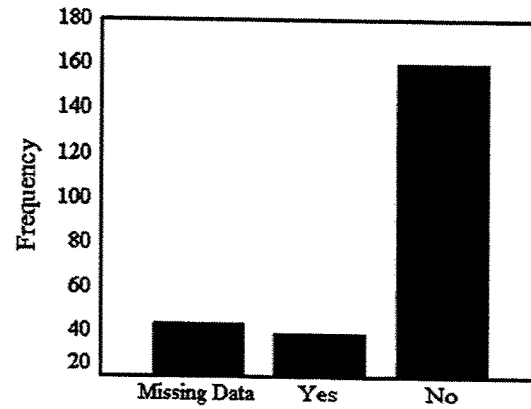


	Monthly	Every 6 months	Yearly	Less than yearly	N/R
Clean fabric-based components	24	73	34	100	12

32. Does cleaning affect the fit of your helmet? (circle one): Yes No
 Comments: All comments are provided in Appendix B.



Cleaning affect the fit of helmet

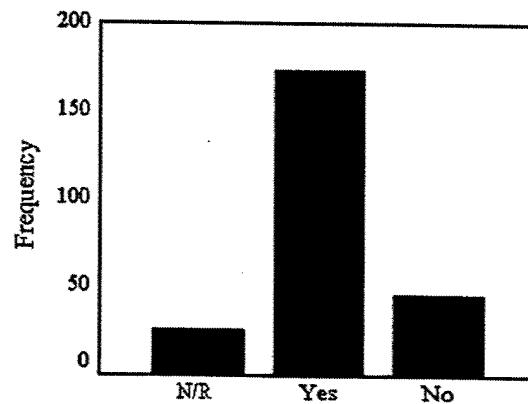


Cleaning affect the fit of helmet

	Yes	No	N/R
Cleaning affect fit	39	160	44

33. Are helmet components (pads, liners, straps, etc.,) readily available in your ALSE shop for replacement and modification when necessary? Yes No

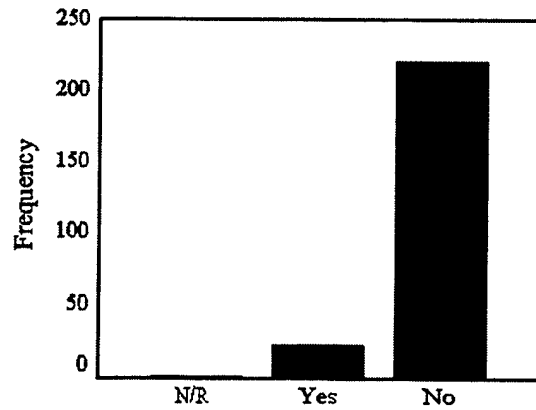
Comments: All comments are provided in Appendix B.



Helmet components available

	Yes	No	N/R
Components available	173	45	25

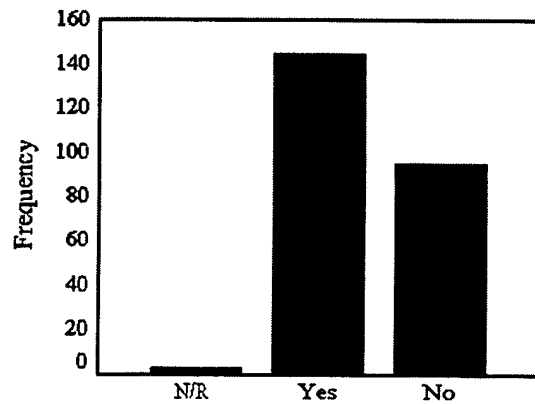
34. Does the visor adversely rub your nose or face when it is extended? (circle one): Yes No



Visor rub nose

	Yes	No	N/R
Visor rub nose/face	22	220	1

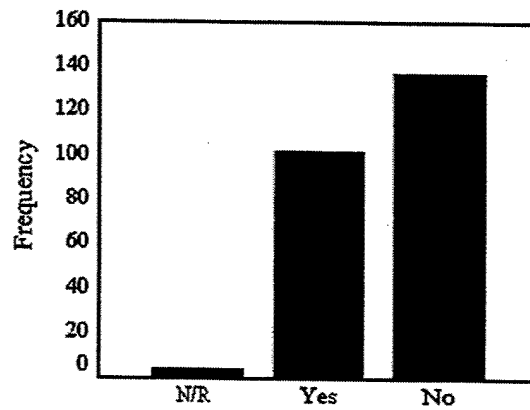
35. Do the ear cups fit comfortably? (circle one): Yes No



Ear cups fit comfortably

	Yes	No	N/R
Ear cups comfortable	145	95	3

36. Do you routinely wear a skullcap with your helmet? (circle one): Yes No



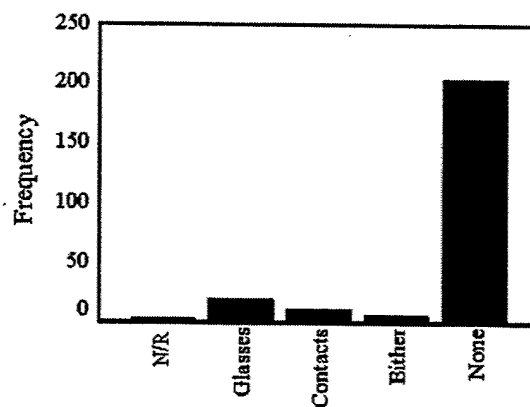
Wear skullcap routinely

	Yes	No	N/R
Wear skullcap routinely	102	137	4

Visual Protection & Use

37. Do you wear glasses or contacts during flight? (please specify):

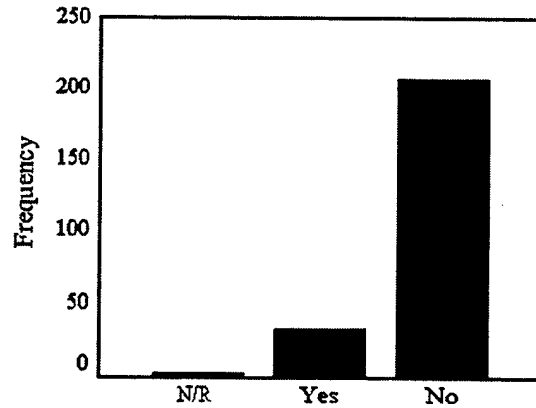
glasses contacts either none



Eyewear during flight

	Glasses	Contacts	Either	None	N/R
Type of eyewear during flight	19	12	5	204	3

38. Do you wear laser protective spectacles on the firing range (or as otherwise required)? Yes No

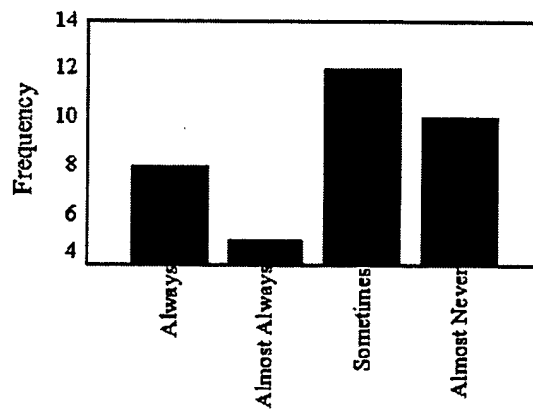


Wear protective eyewear on firing range

	Yes	No	N/R
Wear laser protective spectacles on firing range	34	207	2

38a. If yes, about what percentage of the time when they are needed? (circle one):

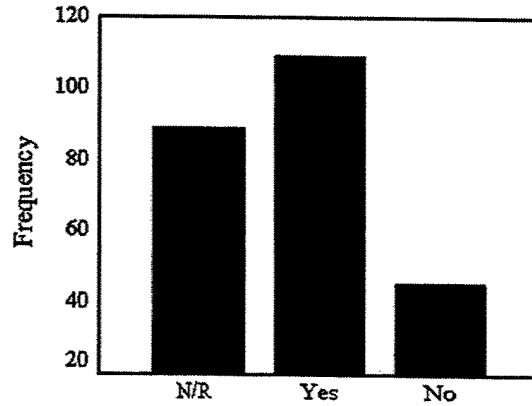
always almost always sometimes almost never never



Laser protective spectacles needed

	Always	Almost Always	Sometimes	Almost Never	Never
How often worn when needed	8	4	12	10	0

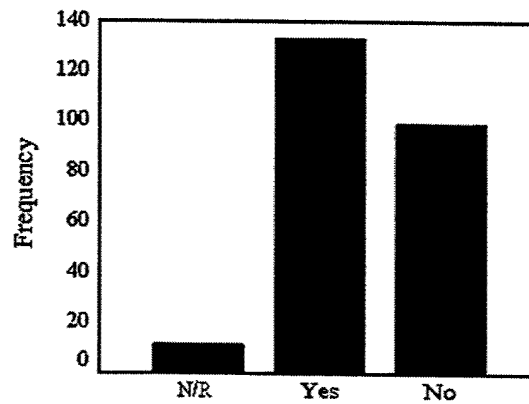
39. Do you feel that the laser spectacles inhibit HDU use? (circle one): Yes No



Laser spectacles inhibit HDU use

	Yes	No	N/R
Laser Spectacles inhibit HDU use	109	45	89

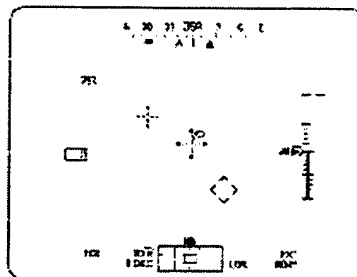
40. Do you achieve full field-of-view (FOV) when flying? (circle one): Yes No



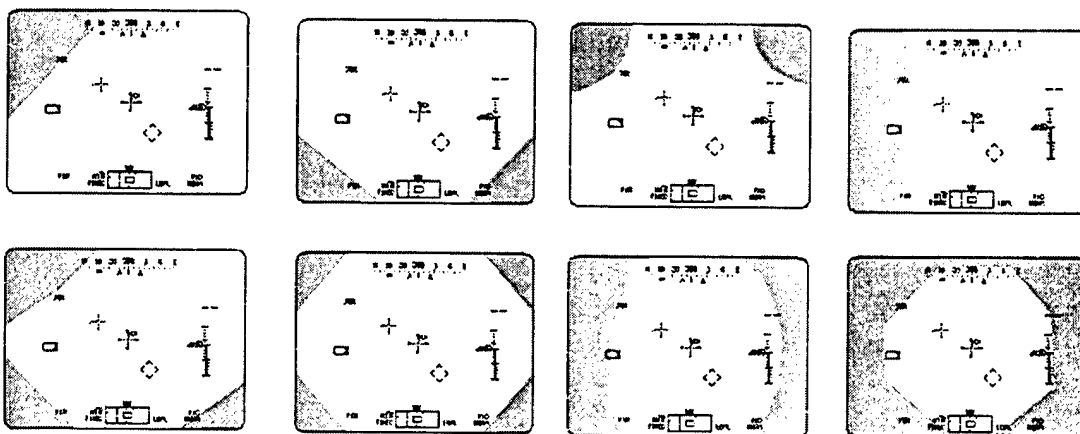
Achieve full field-of-view

	Yes	No	N/R
Achieve full FOV	133	99	11

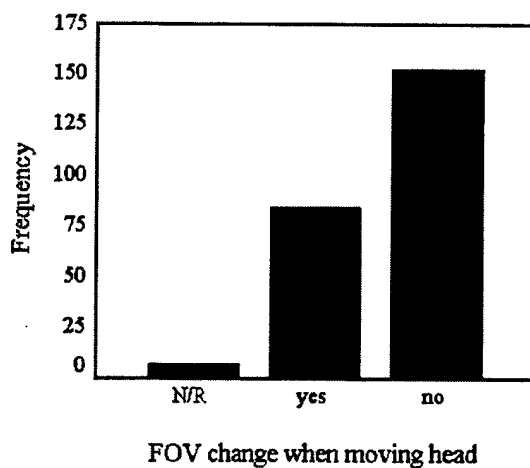
40a. If no, please shade in the area(s) on the diagram to the right that you are unable to view
->



Representative losses:



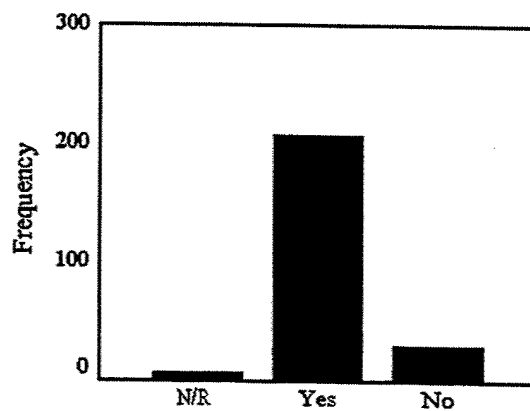
41. Does your FOV change when moving your head during flight? Yes No



	Yes	No	N/R
FOV change when moving head	84	152	7

41a. If yes, please describe what you are unable to view:
All comments are provided in Appendix B.

42. Does the visor come down enough to provide adequate protection? (circle one): Yes No

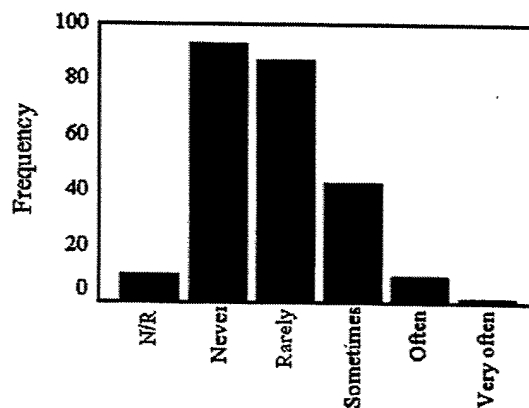


Visor down provides adequate protection

	Yes	No	N/R
Visor adequately protect when down	207	30	6

43. How often has the visor inadvertently retracted? (circle one):

1 2 3 4 5
 Never Rarely Sometimes Often Very often

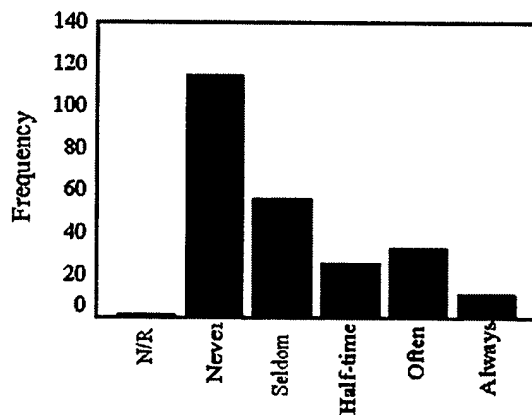


Visor inadvertently retracted

	Never	Rarely	Sometimes	Often	Very often	N/R
How often does visor retract	93	87	43	9	1	10

44. Do you use supplemental NVG's with your IHADSS? (circle one):

1 2 3 4 5
 Never Seldom Half the time Often Always

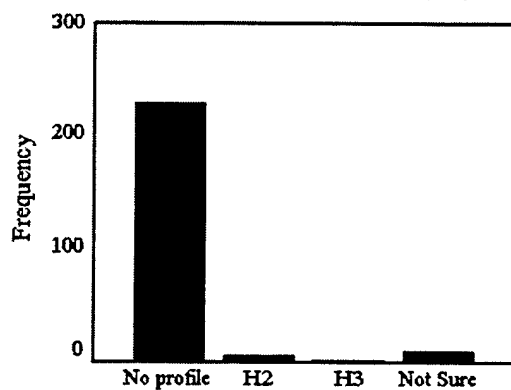


Use supplemental NVG's with IHADSS

	Never	Seldom	Half time	Often	Always	N/R
Use supplemental NVG's	115	56	26	33	11	2

45. Do you have a profile for hearing loss? (circle one):

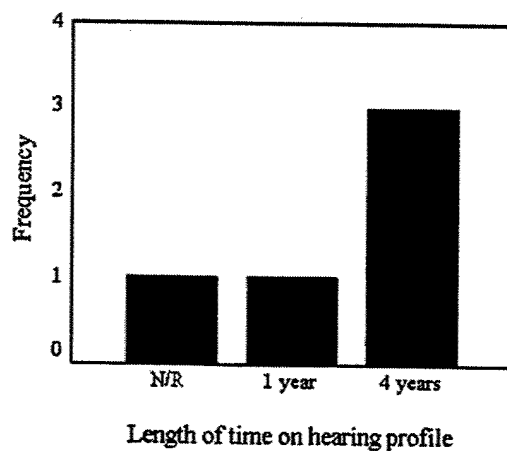
No profile H-2 H-3 Not sure



Hearing profile

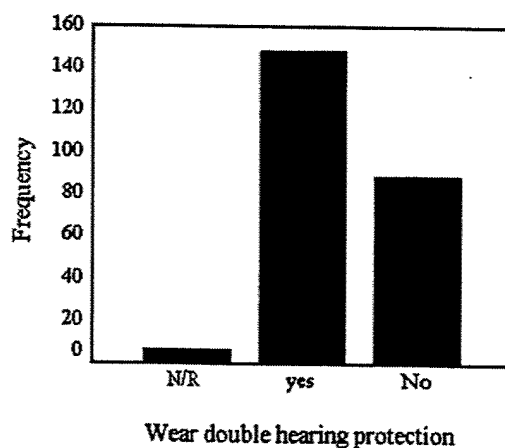
	No profile	H-2	H-3	Not sure	N/R
Profile of hearing loss	227	5	1	9	1

45a. If yes, how long have you been on a hearing profile?



	1 year	4 years	N/R
Hearing profile for how long?	1	3	1

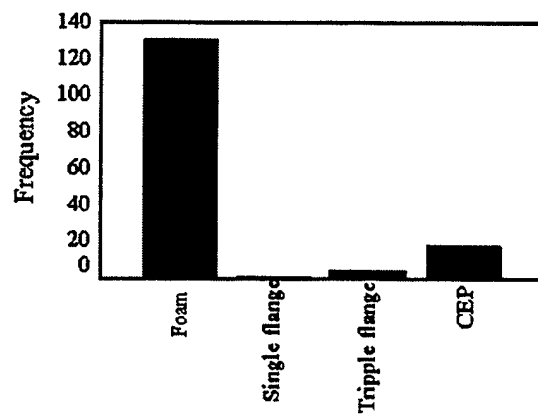
46. Do you wear double hearing protection? (circle one): Yes No



	Yes	No	N/R
Wear double hearing protection	148	89	6

46a. What? (Circle one):

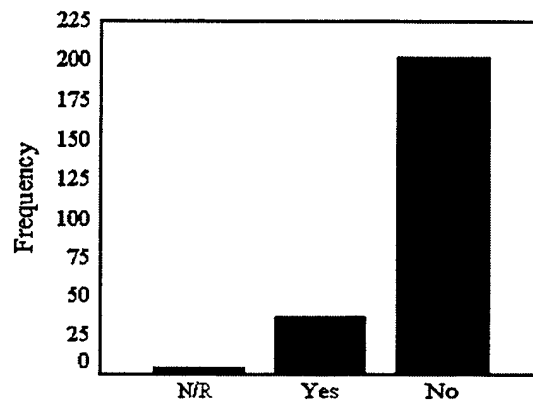
Foam earplugs Single flange earplugs Triple flange ear plugs CEP Other (specify):



Type of hearing protection

	Foam	Single flange	Triple flange	CEP	Other
Type of hearing protection	130	1	4	17	2

47. Do you experience tinnitus (ringing in the ears) during or immediately after flight? Yes No

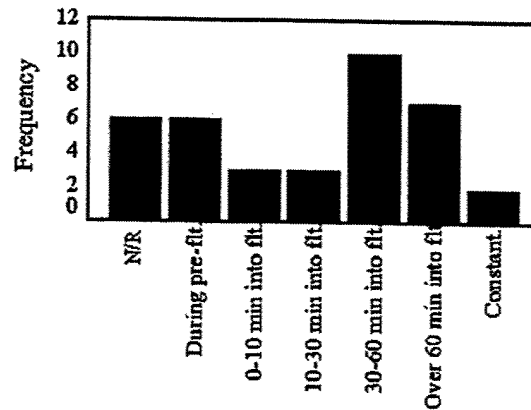


Experience tinnitus

	Yes	No	N/R
Experience tinnitus	37	202	4

47a. If yes, how long before onset of tinnitus? (please check one):

☐ During preflight ☐ 0 - 10 minutes into flight
☐ 10-30 minutes into flight ☐ 30 - 60 minutes into flight
☐ Over 60 minutes into flight

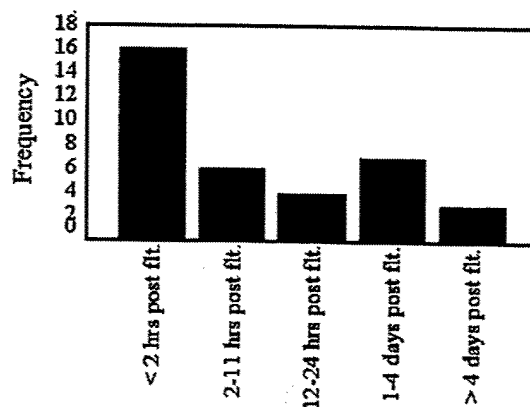


Onset of tinnitus

	During preflight	0-10 minutes into flight	10-30 minutes into flight	30-60 minutes into flight	Over 60 minutes into flight	N/R
Onset of tinnitus	6	3	3	10	9	6

47b. If yes, how long does it last? (please check one):

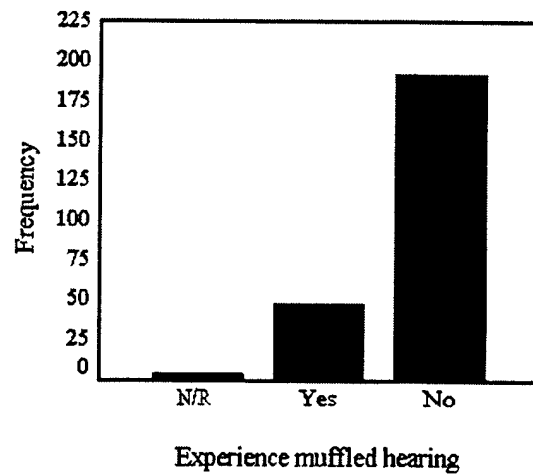
☐ during flight only ☐ 12-24 hours after flight
☐ less than 2 hours after flight ☐ 1-4 days after flight
☐ 2-11 hours after flight ☐ more than 4 days after flight



Duration of tinnitus

	During flight only	Less than 2 hours after flight	2-11 hours after flight	12-24 hours after flight	1-4 days after flight	More than 4 days after flight
Duration of tinnitus-	0	16	6	4	7	3

48. Do you experience muffled hearing (the reduced ability to hear soft sounds) immediately after flight? (circle one): Yes No

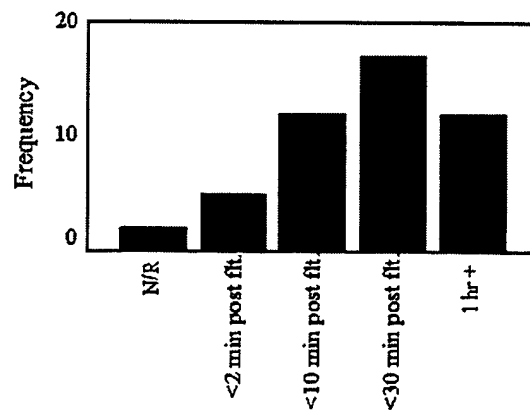


	Yes	No	N/R
Experience muffled hearing	48	192	3

- 48a. If yes, how long? (please check one):

☐ Up to 2 minutes after flight
☐ Up to 30 minutes after flight

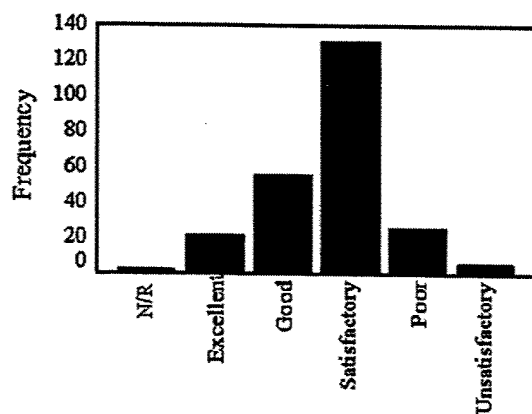
☐ Up to 10 minutes after flight
☐ Up to 1 hour or more after flight



	Up to 2 minutes after flight	Up to 10 minutes after flight	Up to 30 minutes after flight	Up to 1 hour or more after flight	N/R
Duration of muffled hearing	5	12	17	12	2

49. Please rate the quality of noise protection that you use (e.g., helmet alone or helmet with extra protection).

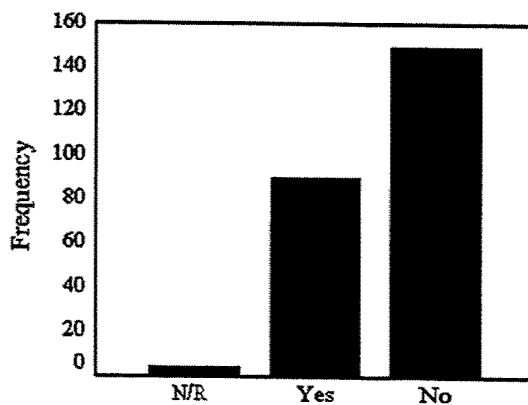
1 2 3 4 5
 Excellent Satisfactory Unsatisfactory



Quality of noise protection						
	1	2	3	4	5	N/R
Quality of noise protection	22	56	131	26	6	2

Man-Machine Interface

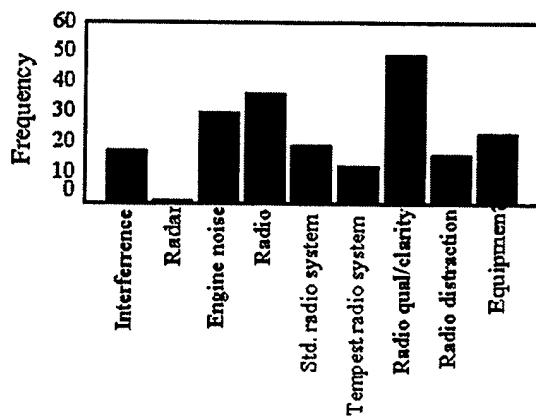
50. Do you have communications difficulty in the aircraft? (circle one): Yes No



Communication difficulty			
	Yes	No	N/R
Communications difficulty	90	148	5

50a. If yes, what is it due to? (circle all that apply):

interference radar engine noise radio volume standard radio system
 tempest radio system radio quality/clarity radio distraction
 equipment (i.e. length of cables) other (please specify):



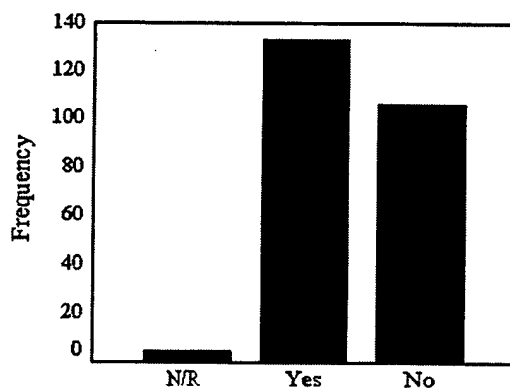
Causes of communication difficulty

Causes of communication difficulty	frequency
Interference	17
Radar	1
Engine noise	30
Radio	36
Std. radio system	19
Tempest radio system	12
Radio quality-clarity	49
Radio distraction	16
Equipment	23
Other	15

50b. If yes, what do you do to improve the situation?

All comments are provided in Appendix B.

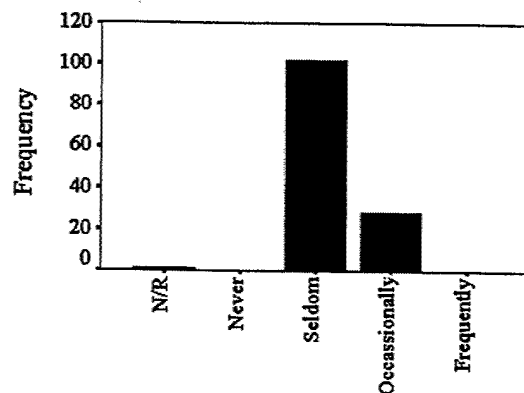
51. Has the HDU ever inadvertently released during flight? (circle one): Yes No



HDU inadvertently released

	Yes	No	N/R
HDU released during flight	133	106	4

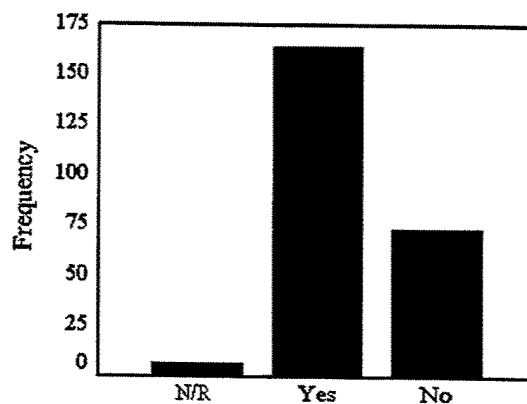
51a. If yes, how often? (circle one): never seldom occasionally frequently



How often HDU inadvertently releases

	Never	Seldom	Occasionally	Frequently	N/R
HDU inadvertent release	1	102	28	1	1

52. Does the HDU position remain the same from aircraft to aircraft? (circle one): Yes No



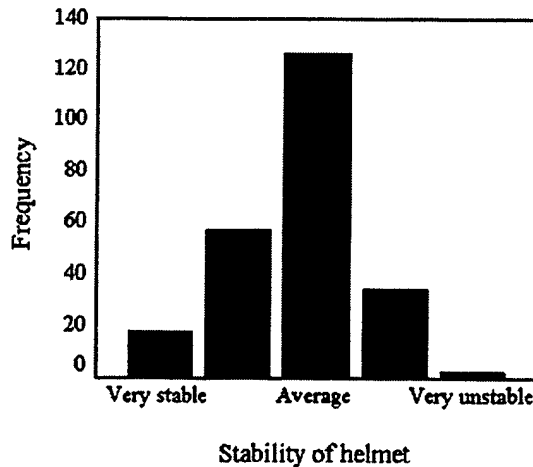
HDU position remain consistent

	Yes	No	N/R
HDU position remain the same	164	73	6

52a. If no, why? All comments are provided in Appendix B.

53. Please rate the stability of the helmet in reference to slippage (circle one):

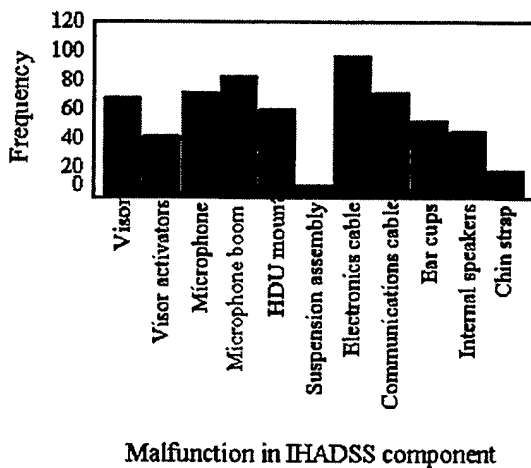
1 2 3 4 5
 Very Stable Average Very Unstable



	1	2	3	4	5	N/R
Stability of helmet	18	57	126	34	2	6

54. Have you experienced any breakage, binding, slippage or any other malfunction with the following IHADSS components (check all that apply):

☐ Visor ☐ HDU mount ☐ Ear cups
☐ Visor activators ☐ Suspension assembly ☐ Helmet internal spkrs
☐ Microphone ☐ Electronics cable ☐ Chin strap
☐ Microphone boom ☐ Communications cable ☐ Other (specify)



Malfunction	Frequency
Visor	68
Visor activators	42
Microphone	72
Microphone boom	83
HDU mount	60
Suspension assembly	9
Electronics cable	97
Communications cable	72
Ear cups	53
Helmet internal speakers	46
Chin strap	19
Other	15

55. Please use the following space to make any remarks regarding your experience with the IHADSS helmet.

All comments are provided in Appendix B.

Appendix B.

Written responses by U.S. aviators to open ended questions.

Question 15: If your current fit is not satisfactory, please explain.

- This has taken 15 years to get satisfactory, but still get an occasional hot spot after 2 hours of flying.
- Tight, hurts above both ears.
- During long flights, loose accurate picture in HDU.
- Cannot see the entire picture.
- With a TPL.
- Inexperienced ALSE personnel.
- I had it for proper HDU use. That fitting does not allow proper sight picture when using ANVIS 6. I now use a compromise fit.
- These aren't custom fit. Mr. Cherry at Ft. Rucker could fit the helmet in 5 minutes. Our ALSE personnel aren't properly trained or given the right equipment.
- ALSE could not get the fit correct. Because of that I have not been able to get a good picture while using FLIR.
- It is difficult to get a good fit for both HDU & NVG's.
- My helmet is not as tight as it could be. I would like it to be tighter but if I make it tighter, it will be too uncomfortable to stand. So, I leave it looser so it doesn't hurt. It is not very comfortable, but it doesn't give me hot spots.
- Concern-fit for protective mask I would have to make small adjustment to fit protective mask for extended mission.
- No current fit.
- Constantly self-changing to fit right.
- Due to weight loss and no annual refit helmet is loose.
- Ear cups too tight.
- Loose ear cups too hard.
- My head size is between XL and L, have no padding in a L helmet. Have to extend HDU full find to see anything.
- Loose, rotates on head when looking more >60 degrees either side.
- It took about 6 months to get it fitted properly.
- I have had to trade my helmet several times to PCS, have never had a good fitting since. ALSE techs don't know how to fit helmets.
- Had to leave my helmet at Ft. Rucker, my helmet in Korea was too big, the one at Ft. Bragg is too small.
- It fits snug, but the IHADSS moves side by side. Also, develop "hotspots." Tried several times to refit and resize at Ft. Bragg; however, to no avail. The best fit I had was at Ft. Rucker.
- Don't have an ALSE officer who is thoroughly trained to fit the IHADSS. Also do not have on completely functional fitting kit.
- Different helmet from the initial fitting at Rucker. After arriving to Ft. Bragg took about 5 times to get helmet fit right. Then switched companies. So I was required to change

helmets. Fitting materials taken out of the old helmets, slapped in new ones, and still haven't been able to get a good fit.

- No one in our unit can fit my helmet properly.
- I've changed helmets so many times due to PCS or property book changes that there's no way to get as good a fit.
- It feels comfortable, but is not a correct fit. We should have kept original fitted helmet.
- Unit did not have correct size helmet when I arrived at the unit.
- First helmet issued was XLG when a large was required.
- But barely satisfactory, depending on the aircraft, often lose sight of some symbology and occasionally get hot spots.
- Cannot see torque value.
- Helmet sags repeatedly requiring adjustments.
- I have a medium sized head, but one measurement requires me to have a large. Therefore, these are too many variables present for a good fit.
- Helmet not fitting correctly, cannot see the IHADSS close enough to my face.
- Ear cups against head not INVG enough & HDU does not have good alignment to provide complete picture (taking into account narrow corners being cut off.).
- Helmet is intrinsically uncomfortable. Adjusting a helmet based on Velcro addition or removal is unsatisfactory.
- Need some adjustments to the helmet fit.
- Have a hard time adjusting helmet fit in order to see the entire HDU picture.
- Not fitted yet.
- After 3 to 4 flights and subsequent adjustments, yes.
- Helmets are now turned in as you PCS. Every 1-3 years you receive a different helmet and start the process all over again. Additionally, Army ALSE personnel have no idea how to properly fit this helmet.
- Too loose, tightening straps results in hot spots.
- For the most part, no trained ALSE personnel to accomplish fitting.
- Uncomfortable, loose, unable to see all symbology with proper sizing, centering.
- When wearing armor looking to the right HDU is push upward loosing symbology or picture.
- Still need minor adjustment.
- Difficulty in seeing left side of HDU display (i.e., torque, airspeed).
- Ear cups don't fit.
- Forehead discomfort at times.
- Still can't get a good fit on top/crown portion of head. Its not a snug fit.
- Current fitting allows good HDU placement with old-style HDUs however new HDUs require complete forward extension of HDU.
- Get hot spots from ear cups and front of head.
- Helmet is too large and all smaller helmets are in use.
- Doesn't fit correctly.
- Have hot spots all the time.
- Individuals can make this best final adjustments based on feel.
- I cannot see the whole HDU display unless I tilt my helmet.

- Uncomfortable, improper fitting.
- Not as good of a FOV as my fit @ Ft. Rucker during AQC.
- I got it refitted when I went back to Fort Rucker for the AH-64D AQC.
- Do not have helmet issued.
- Had harness replaced and have had not spots since.
- Could not match the job done by ALSE at Hanchey (person in charge-- civilian).
- N/A- not issued IHU here.
- Not fitted yet.
- NA - No Helmet.
- Constantly refitting/readjusting.
- Losing FLIR imagery and symbology when turning my head every now and then.
- I have trouble getting HDU to rest on cheek where it is comfortable.
- I do it myself.
- HDU & placement & hot spots.
- It is functional but fit my head properly.
- Consistently have to re-adjust helmet to see through HMD.

Question 16: Why have you changed IHADSS helmet size following a PCS move?

- Finished flight school, went to home duty station.
- Issued an ex large needed a large.
- Only size they have.
- Left Rucker to duty station.
- Had to turn in IHADSS when AQC complete.
- Extra LG little too big changed to LG.
- Ft. Rucker (AQC) didn't have size large available.
- Had large in flight school needed medium.
- No helmets in my size available.
- Did not have size available.
- ALSE doesn't have the proper size.
- Helmet size wasn't available at new duty station.
- The image in the HDU would become unviewable when my helmet moved with an XL helmet.
- Helmet availability.
- Hand receipt issue.
- Unit I arrived at didn't have correct size available.
- Better HDU positioning.
- My head is the same size.
- Lack of availability.
- Turn-in.
- To get a better fit.
- Did try a different size during a duty cycle though.
- I could not take the helmet from Ft. Rucker.
- My head measures indicate L, but I have not fit into a large in 6 yrs (XL).

- Because this was the only helmet that was available.
- Inadequate availability of helmet size.
- Availability of helmets.
- Was not available in my size (unit did not have).
- Not needed.
- 1st duty station.
- I wear a medium & they are hard to get.
- My head size fall between L & XL.
- Rucker game XLG/ Ft. Campbell LG.
- Not enough helmets.
- No IHADSS in my size available.
- Size on hand.
- Head grew.
- HDU positions less than perfect.
- Do not get to keep the helmet.
- No smaller helmets were available.
- Medium could not be adjusted to allow full view of symbology.
- Availability of sizes in units is unsatisfactory.
- Xlarge always fits.
- NA - No Helmet.
- Constantly refitting/readjusting.
- Losing FLIR imagery and symbology when turning my head every now and then.
- I have trouble getting HDU to rest on cheek where it is comfortable.
- I do it myself.
- HDU & placement & hot spots.
- It is functional but fit my head properly.
- Consistently have to re-adjust helmet to see through HMD.

Question 20a: If your current fit is worse, why and what have you done to attempt to improve the fit?

- Nobody is trained well enough to fit it.
- I've played with it but it still doesn't fit like Mr. Cherry.
- Removed some Velcro from the ear section.
- I have made multiple trips to ALSE however the fit when I leave ALSE doesn't seem as good in the A/C.
- Received a helmet that fit rather than using padding of a larger helmet.
- Just can't seem to get it to fit quite right. Tried changing the Velcro and adjusting the ear cups and straps, but can't get it comfortable.
- The civilian tech at Hanchey at Ft. Rucker is best at fitting IHADSS thus far.
- Ear cups too tight; trying to get proper Velcro for fitting.
- Self-adjustments using my copy of TAC (??) no longer available fitment guide.
- The IHADSS fitting at Ft. Rucker was very professionally done. Mr. Cherry did mine and it was the best fit I have ever had.

- Replace/remove Velcro.
- Resize, added more padding.
- Sat down with ALSE officer numerous times to fit.
- Have tried to have it fitted by both battalion and company level ALSE officers.
- Original fitting at Rucker done by a civilian who did it all the time- last by another pilot filling an additional duty.
- Used Velcro pads around the ears.
- Gone to ALSE many times working for better fit.
- Resized ear cups, hot spots.
- Fit it myself.
- Don't get as good of a FOV in the HDU as before.
- Unseen reasons; should be the same. Multiple visits to ALSE for adjustments.
- Trying to get into ALSE to have them correct the problem, my last helmet fit fine at my last duty station.
- Not as snug around the ears, am trying to get correct skullcap for helmet.
- This unit doesn't possess the necessary funding to ensure the proper amount of supplies required to have well fitted or supplied helmets.
- Attended ALSE school.
- Put a Kevlar Pad in my helmet.
- Fit it myself.
- Re-fit/adjust.
- No ALSE tech proficient in fitting helmet- make own adjustments with help from senior pilots.
- Ear cups hurt some; changed spacers & position of cups.
- Moved Velcro tabs myself.
- Adjust it myself.
- Self adjusted.
- Tried to fit it better myself.
- Adjusted ear cups and use head cover.
- More ear cups work with ALSE guy.
- Adjusted HDU mount.
- Added more Velcro/padding.
- Been back to ALSE several times.
- The current fitter.
- Need to have spacer inserted due to inability to hear ICS & radio communication.
- Have had it refit four times here.
- Tried to refit.
- Insert spacers, pads.
- Numerous fitting attempts, personal fitting alterations.
- Knowledge of the ALSE techs.
- Have moved the Velcro around and the ear pieces down.
- Cannot get proper fit around ear cups. Constantly go back to ALSE for refit.
- Refit.
- Line ALSE techs are not trained in IHADSS fitting procedures.

- Helmet just doesn't fit well.
- Doesn't feel good in certain spots (forehead/ear cups), But helmet is not uncomfortable.

Question 24a: Why would you rate your current ALSE shop as better or worse than prior ALSE shops?

- User friendly, familiarity with personnel, personalized service.
- Less personnel to service than Ft. Rucker.
- Does not fit.
- I am not ALSE qualified. I fit my own.
- Our guys take time.
- 1995 ALSE shop at Ft. Rucker did not have a ALSE tech that was capable of working on IHADSS. (Cairns, AAF).
- Would improve if a symbology generator was available in the ALSE shop to help with fitting.
- Care.
- Personalized - not a "number"- get in line mentality.
- Worse because they do not have the ability to show you the FLIR picture while fitting your helmet.
- Worked with you rather than assume you are a uniformed trainee.
- Don't have an ALSE shop. Get support from outside org./unit.
- Less personnel going through so you get personal service.
- Knowledge and experience to fit the IHADSS is insufficient.
- Better in efficiency, but not manning.
- They are not school trained to fit helmets.
- They don't get necessary support or money.
- I can usually find them.
- This ALSE shop doesn't get the support it needs in personnel.
- Does not get the support it needs.
- Lack of experience, constant personnel changes.
- Untrained soldier, in shop, also untrained on IHADSS.
- Not able to get proper fit.
- The only other place I was fitted at took a couple of tries, but it was much better fit than I currently have.
- Why don't we have an enlisted MOS for this? Is this component of the \$15 million helicopter not important?
- An Apache pilot, who took the time to fit me properly with the limited resources.
- I had contract maintenance at Ft. Rucker do it right.
- More knowledgeable personnel.
- Availability of repair parts.
- ALSE personnel are intimidated by old IPs.
- Fit not as good, not enough radios and batteries for radios.
- The shop needs more full-time, school-trained ALSE technicians.
- The system used for fitting at Ft Rucker was better that the one used here in Germany.

- Not as much experience or equipment.
- No or poor equipment ref. Lack of money.
- Parts and supplies.
- Have not had proper time to fit.
- No helmet bags issued with helmet.
- Lack of experience and parts.
- Not enough equipment to repair IHADSS.
- Newly trained personnel.
- Prior ALSE shop had a helmet-fitting guru.
- No tech familiar with IHADSS fitting.
- They don't fit it; up to unit or self.
- There is a person there who is talented at fitting and he asks for feedback to improve his fitting techniques.
- Mr. Cherry at Rucker fit my IHADSS the best. Military kids are not trained enough.
- They stole MP D-rings, dog bone runner, and replaced my PRC-112 with a PRC-90 even though I was en route to Afghanistan.
- Didn't fit helmet for me.
- Turn around too long.
- They have no dedicated technicians.
- More service oriented.
- At Ft. Campbell it is a division run ALSE shop and there is a lack of IHADSS qualified personnel there.
- It's on the division level.
- Seemed like they just wanted to push me through did not do an HDU fit.
- They have more people to deal with.
- Consolidated as Div. Quick turnaround time.
- Rucker was last spot to fit and they fit hundreds of helmets a month (more experience).
- Less fitting equipment/expert personnel.
- Better people, just far, far too busy and stretched too thin additional duties.
- ALSE officers are actual Apache aviators & personally understand the importance of a good fit.
- Mission focus here is better.
- Better trained ALSE tech.
- There is only one soldier in shop who would rather be doing something else.
- Just not enough experience here, ALSE does a great job just needs more helmet fitting experience & better equipment to fit helmets.
- Tech is not trained to fit helmets well, not interested in the job.
- Lack of knowledge/experience.
- Last flying assignment @ Ft. Campbell, the ALSE shop was consolidated at Division level, the technicians weren't very experienced with IHADSS.
- Ft. Rucker (Hanchey) has the best ALSE shop with the civilian in charge.
- Retired military contractors.
- Less institutional knowledge not as many experts.
- Not school trained in IHADSS fitting.

- He does an excellent job.
- Most ALSE personnel are poorly trained in IHADSS.
- Not properly equipped.
- Knows what he is doing, better attention to detail.
- No trained personnel.
- Dedicated ALSE tech.
- Put together helmet right there; did a correct fitting.

Question 30: Are you satisfied with the clear liners of your inner helmet components?

- Don't use, I wear sun glasses.
- Wish they were both on same visor.
- What are you talking about?
- Don't have it.
- Clear liners: I have to original web or mesh liner.
- Don't have clear liner.
- Clear option not available.
- What is a clear liner?
- Not installed.
- W[hat] are you asking- in English.
- Don't know what you are talking about.
- Don't know what you are talking about.
- Not sure what clear liner is.
- Don't understand this question.
- I have no idea what this question means, what clear liner?
- Never used the "bubble wrap" TPL.
- Clear liners? What do you mean – TPLs? This helmet, unlike the HDU-56 does not have her.
- Buy the HDU 56 for Apache guys.
- Can't be cut for HDU if it's a goggle visor.
- Worthless.
- Do not use clear.
- ALSE does not have any liners.
- I don't have a clear visor.
- Never seen them.
- Never seen one.
- No idea what this means.
- Useless - I need a tinted visor.
- Not comfortable.
- Don't have clear liners.
- Don't know what they are.
- Never seen it - Not issued and pain to change on day out night return flights.

Question 32: Does cleaning affect the fit of your helmet?

- No cleaning to date.
- Fitting.
- I don't take my helmet apart to wash it.
- Don't know.
- Slightly.
- Yes of course it will, helmet design makes it so.
- Have not done it, don't know how.
- Don't know.
- Messes up the fit.
- FabreezeTM.
- Wouldn't know, that's why Rucker develops the "hygiene kit."
- Never, to do so messes up the fit.
- Have to refit.
- Have to refit.
- No fabric based components, no longer issued.
- Hard to get components back to fit.
- Never cleaned.
- No IHADSS harnesses, no helmet bags for safe storage.
- Just more comfortably.
- Shrinks a little.
- I use a TRL inside helmet.
- Had to readjust fit.
- Pilots don't clean their helmets.
- I don't know.
- Never cleaned.
- Can't fit a liner in my helmet.
- Anytime you adjust your liner you throw your fit off.
- [Have] never cleaned.
- Hasn't done it.
- [Have] never cleaned.
- I don't know.
- Afraid that it would.
- On initial reinstall.
- All the Velcro has to be readjusted.

Question 33: Are helmet components (pads, liners, straps, etc.,) readily available in your ALSE shop for replacement and modification when necessary?

- Don't know.
- Unknown.
- Usually.
- Very few components.

- Sometimes.
- Don't know.
- Unknown.
- No tinted visors.
- No tinted visors.
- Not usually, need tinted visor over a year.
- Visors are scratched with no replacement.
- Most of the time.
- They even have a hard time getting helmets. Guys have had to wait for a helmet upon arrival.
- Poorly funded.
- Never replaced.
- Unknown.
- Funding levels do not permit " excess."
- Out of stock- even @ Rucker.
- Lack of parts.
- Short availability of liners and straps.
- At least they don't change the ones I have that are worn when the helmet is turned in.
- Usually.
- No TPC.
- Don't know.
- Parts are scarce.
- Don't know.
- Fitting components are available.
- Not sure.
- Parts expensive, hard to get.
- Unknown.
- Fitting components are available.
- Not sure.
- Parts expensive, hard to get.

Question 40a: If no, please shade the area(s) on the diagram to the right that you are unable to view.

- Upper Left.
- Peripheral view.
- Peripheral view.
- Peripheral view.
- Peripheral view.
- Left side peripheral view.
- Peripheral and top/bottom views. You need to update your symbology for 51.55 software.
- Peripheral & and 4 corners view.
- Peripheral & and 4 corners view.
- Peripheral & and 4 corners view.

- Four corners.
- Peripheral & and 4 corners view.
- One side or the other.
- Two symbols on the far left side.
- I have noticed over the past years of instructing that aviators will routinely adjust the Unity Magnification to achieve a full field-of-view. This is an incorrect technique that is strongly discouraged by our unit IP's. The fact remains; aviators will adjust unity magnification to get a full field-of-view. As I understand it, the correct procedure would be to have the IHADSS HDU mount adjusted. If possible unity magnification should be fixed and unadjustable or the HDU mount on the IHADSS should also be adjustable at the user level.
- Periphery - one side at a time is visible but not both.
- Upper left corner.
- All four corners.
- Upper left, bottom right corners.
- Top left corner.
- Four corners.
- Peripheral and a small portion of the top and bottom views.
- Bottom left corner.
- Both bottom corners.
- Top left corner and bottom right corner.
- Peripheral view + four corners.
- Peripheral view + four corners.
- Four corners.
- Peripheral view + four corners.
- Peripheral view + four corners.
- Upper left corner.
- Left side peripheral view.
- Bottom left corner.
- Peripheral view + four corners.
- Bottom left corner + top right corner.
- Four corners.
- Upper left corner.
- Four corners.
- Entire left side.
- Peripheral view + four corners.
- Left top and bottom corners.
- Top and bottom left corners & part of bottom right corner when head is turned.
- Peripheral view + four corners.
- Four corners.
- Four corners.
- Peripheral view + four corners.
- Four corners.
- Four corners.

- Peripheral view + four corners.
- Four corners.
- Peripheral view + four corners.
- Upper left side, not including immediate corner.
- Bottom and top edges + four corners.
- The immediate edges of the symbology picture.
- Whole left side + upper right corner.
- Upper left corner.
- Four corners.
- Four corners.
- Peripheral view + four corners.
- Upper left corner.
- Engine torque, radar alt vertical scale and tape.
- Torque.
- Bottom edge.
- Torque.
- Right top & bottom corners.
- Torque & bottom edge.
- Torque, airspeed, sensor field of regard, radar alt vertical scale.
- Four corners.
- Left side peripheral view.
- Four corners.
- Bottom corners.
- Top and bottom left corners & part of bottom right corner when head is turned.
- Top left corner.
- Left peripheral view; only with newer HDUs.
- Peripheral view + four corners.
- Left peripheral view.
- Top/bottom edges + peripheral views.
- Top edge + both peripheral views.
- Bottom right corner.
- Left peripheral + right top and bottom corners.
- Peripheral view and top edge.
- Four corners.
- Peripheral and top and bottom edges.
- Peripheral view.
- TQ [torque] & bottom left corner.
- TQ.
- TQ & right side.
- Four corners.
- Top left and right corners.
- Top left corner.
- Peripheral and four corners.
- Torque and bottom left corner.

- Upper left corner plus most of the left peripheral view.
- Left peripheral view.
- Upper corners.
- Upper left corner.
- Four corners.
- Peripheral view and four corners missing at least the first digit torque reading, missing upper portion of VSI maybe part of lower portion.
- Peripheral views.
- Torque, bottom left and right corner.
- Top left corner and bottom left and right corners.
- Upper and lower left corner and right peripheral view.
- Upper and lower left corners.
- Some periphery information.
- Periphery.
- Left side and bottom right.
- Four corners.
- Bottom left.
- Upper corners, bottom right.
- Bottom corners.

Question 41a: If yes, (FOV changes when moving your head during flight?), please describe what you are unable to view:

- Only a slight shift in video depending on if look left or right, then get an opposite shift.
- One or the other opposing corner; not every IHADSS seems [illegible] to helmet same?
- Some a/c HDU is worn and can slightly shift with large head movements.
- Torque/airspeed.
- Radio, altimeter.
- Mostly to the right.
- Outside whenever I move more than about 30%.
- While turning > 60 degrees left or right edges depending on which way I turn.
- Sometimes TQ.
- It depends which way I move my head.
- FOV gets wider when moving my head, I think it moves my glasses.
- When head is turned all the way to one side, I lose some of the top corners.
- Look left the combiner lens does not contain all imagery.
- Sometimes, picture completely washes out.
- Edges.
- TQ indication.
- Right side of display.
- Sometimes the right side of the HDU screen.
- Even with helmet straps very tight turning my head far left or right sometimes causes half of the picture to fade.

- Usually start losing the edges and sometimes the bottom. Fit of the helmet doesn't allow the HDU to get close enough to my eye.
- Often when I look 90 degrees right or left my helmet moves and I can only see half of a picture.
- Unless you press the HDU very tightly against your cheekbone you will lose some of the torque symbology. This can be uncomfortable some times.
- TQ HAD.
- Turning right, unless the HDU is dug into my face, altitude disappears and opposite side for turning left.
- Corners when head is turned.
- Just a little at max azimuths.
- Eyelash will on occasion blank out symbology.
- Four corners.
- When looking either left or right at least 90 degrees I lose the opposite side, when looking up and left or right sometimes I will lose the opposite corner.
- Engine torque/TVSI.
- Left side.
- Sometimes I can't view TQ or A/S and adjusting the DAP doesn't help.
- When I move my head specifically then to the right parts of the picture disappear.
- Torque, ends of compass rose, navigation info.
- Torque + airspeed.
- Torque indication.
- Move my head right, right edge becomes lost, move my head left, left edge becomes lost.
- Top left and bottom right.
- Torque.
- When I turn my head all the way left or right (± 90 degrees) I cannot always see the full FOV.
- Turning right hard to view left and vice versa.
- When looking left or right torque, airspeed, VSI.
- Head turns to the right move the picture due to IHADSS catching on right shoulder and new vest.
- If I wear the helmet loose so that I don't get a headache I lose FOV otherwise I don't and I get a headache.
- TQ and sometimes IUSI.
- Upper left corner.
- The sides of my HDU ACT/TQ/ A/S.
- Either TQ or VSI will be unable to be seen.
- If head movement is quick it will change.
- Left and right sides of helmet is not tight enough.
- Unable to see sides of image.
- TQ sometimes goes out of view due to head turning to right.
- Have to choose between viewing torque of airspeed or altitude.
- If I look left I can see my torque indications.
- The corners get cut off sometimes even if helmet is tied down.

- TQ.
- Torque had heading tape.
- Sometimes torque will go out of view when I move my head.
- TQ/TAS.
- Torque reading part of the heading tape.
- Primarily torque and the VSI, these are the most critical things I notice.
- When looking to the left IHADSS cable always seem to ...catch and limit FOV.
- Torque and messages disappear.
- Ear cups move during head movement at night, causing a change in the FOV.
- Top and bottom.
- Helmet must be loose to prevent pain.
- Lower right portion (intermittent).
- Some periphery information.
- A little bit of the HAD when turning head.
- The corners.
- It will shift from to [p] to bottom.
- Opposite side of picture based on which way head is turned.
- Typically upper left corner.
- Lower left corner (1/4 of picture) disappears.
- Looking to the left, I have less range of motion because half of picture disappears.

Question 50b: If you have communications difficulty in the aircraft, what do you do to improve the situation?

- Take out earplugs, turn radios up full.
- Need ability on helmet to adjust ICS & radio audio levels and get noise canceling headsets.
- Have ECS fan not quite so loud.
- Not turn my head as much; I cannot turn my body and head full right to look at #2 ENG without disconnecting. Bad at night NOE.
- Adjust volume continually.
- With reference to speed and airframe noise, I slow down, but I turn up the radios to max volume. The earplugs dampen out the unwanted noise.
- Concentrate more intently.
- Tighten chinstrap to an almost unacceptable level to eliminate noise.
- Turn up radios.
- Decrease radio volume and increase ICS volume.
- ICS and radio volumes are not equal.
- Toggle radios on and off (selective listening).
- Turn radios up, CEPs have increased quality.
- Standard CEP instrumentation or somehow integrate CEPs into IHADSS.
- Tighten my helmet straps.
- Have volume setting adjust both transmit and receive. Master volume does not go high enough.

- Repeat/scream.
- Sometimes I have to take out my foam earplugs to hear better.
- Ask co-pilot and deal with it.
- I adapt.
- Adjust volume levels.
- Have radio and ICS volume full up and unable to wear foam ear plugs.
- Improve the ear speakers and have maintenance put new cables in the aircraft when the cables get [illegible].
- Have them replaced.
- Hold ear cups tighter to head.
- I would like to see a new helmet. (EOHSS or the EMHSS) VRD?
- Unable to increase volume.
- Repeat intercom traffic, speak louder, adjust radio/intercom volume.
- Adjust volumes differently for each radio.
- Max volume on 2 radios, slightly lower on other 2.
- Volume to max.
- Deal with it.
- Started using CEP.
- Lengthen ICS cords allow operates to adjust squelch on radios.
- Turn up master volume and turn down radio pins, but often doesn't help enough-usually have to ask other pilot to repeat things.
- Adjust volume.
- Lower volume of channel.
- Lengthen radio cords, turn down radio.
- Turn down radios.
- Remove ear plugs.
- Sometimes a radio drowns out the ICS; turn down the radio for the brief moment.
- Adjust radio and vox.
- Adjust frequencies; adjust volumes, front/back seat monitor different radios.
- Re-route the cables to the rear of the helmet and the back of the seat.
- Turn volume all the way up, we need to have the CEP issued to every one.
- Wear earplugs and turn the radio way up.
- Get CEPs if available.
- Say again.
- Keep the IHADSS when you PCS.
- Turn radios up.
- CEPs.
- Max volume on all controls.
- Trying to get CEPs.
- Radio full volume & flighter higher.
- Make write-ups in aircraft.
- UHF & VHF in certain aircraft have less clarity and range. (A model experience only.)
- Ask BS to speak up.
- Turn-down noise.

- Yell.
- CEPs.
- Turn up master turn radios down to hear other pilot.
- Use a dynamic microphone.
- Reset Threshold.
- A better fitting helmet that you can keep from station to station.
- Volume up.
- Adjust volume.
- Turn up the radio.

Question 52a: If the HDU position does not remain the same from aircraft to aircraft, why?

- Don't know.
- I don't know.
- Don't know.
- Pilots adjust the unity mag to view all of the symbology (see Q. 40).
- Adjustable bayonet mounts vary between a/c HDU's.
- I believe it is manufacturing tolerance.
- Don't know.
- Rotation collars on some HDUs loose.
- Helmet sometimes seems to sit different requiring me to move HDU to get the best possible picture FOV.
- Image rotation collars do not have the same travel.
- Different sized HDUs or lens position.
- Unknown.
- I don't know for sure; different combiner lens angles?
- Cable length.
- Combiner lens angle differs.
- It may be the same; I usually have to adjust it.
- Offer crewmembers adjust their picture VIA the D.A.P.
- Helmet position, seat position.
- Visor cannot fit properly over HDU.
- Not adjustable enough seems to not align the same.
- Most of the time its ok, some you have to adjust.
- Not sure.
- Don't know.
- Mechanical design, different seat positions.
- Each one is a little different.
- Relatively based on Manufacturer.
- Bent combiner lens.
- Adjustment knobs don't have same adjustments, bent clips, etc.
- Never noticed for sure, but sometime the more time to adjust than others.
- Don't know.
- Always requires adjustments.

- HDU varies from a/c to a/c with lens adjustment.
- I don't know.
- Helmet slips on different days.
- Some new, some worn, some not, some old.
- Manufacturer tolerance.
- Different HDU's, I guess.
- Don't know.
- People have different heads.
- I'm not sure.
- Slight differences.
- All seem different.
- Different HDU's fit differently- some get too close to the eye, i.e., have to bring in too close to see entire picture.

Question 55: Please use the following space to make any remarks regarding your experience with the IHADSS.

- I want CEPs!!!!
- Need ability on helmet to adjust ICS & radio audio levels and get noise canceling headsets.
- Provide little or no noise protector.
- My biggest concern is not being able to see the entire picture and not getting all the information available on the HDU.
- Let the pilot be fit by pros at Rucker and keep your helmet your entire career.
- If I only flew NVG or NVS to fit would be good. The dual use is just a compromise. Sometimes my CEP is uncomfortable (and others) because the ear cup presses on the CEP.
- You need to properly train ALSE personnel to fit these helmets. ALSE also needs proper equipment to fit these helmets.
- Replace visor with NVG off of SPH4, gel ear cups.
- The fit of the IHADSS is comfortable, however the amount of Velcro used to achieve a proper fit is at this time unacceptable. Some aviators have very thick Velcro shims. One has to wonder how this shim is going to perform in the event of a high G impact. I am not an engineer and I have to experience in helmet design. As a user of the IHADSS, I feel the method of using Velcro to achieve a proper fit is an unnecessary risk.
- If it [were] set up for use with a TPL, it would be much better. It is an uncomfortable helmet, and it slips.
- Commo [communications] harness has been replaced four times over the last 13 years.
- Time to improve our helmet like the rest of the Army. The HGU-56/P has been developed for the AH-64 but not purchased for the Army. How about the same for attack head protection as all the lift?
- Monocular picture causes headaches as well as vision impairment after flight for 30-60 min. Helmet is uncomfortable and center of gravity is unequal literally.
- Cable and connector harness went bad.

- I have found that current ALSE school training lacks a significant amount of class time on the IHADSS helmet. As an ALSE tech stationed at Hanchey AAF I constantly trained new techs in different techniques used by both the schoolhouse and PS magazine to repair items not covered in the TM. The school seriously needs to extend the training in a helmet that cost so much so that minor damage does not become a major headache. At least check the XL IHADSS can cost upwards of \$15,000.00 yet an @ \$1.36 eyelet that is not placed in the proper position can keep the sensors from lining up properly. I have also on many occasions noticed that individuals will fit a helmet without guaranteeing the HDU lineup. Without this test there is no telling what the aviator will see when they hookup to the aircraft. These are simple fixes that can be taught at a unit level due to the few attack Bn's that we have, however keep in mind that we trained on both over water gear and not all units use this gear and we never even covered the survival packs in an in-depth manner. I take great pride in the aviation community and especially the aviators and I take their safety seriously. We owe them that much and more.
- It would be nice if you created an NVG visor specifically designed for the IHADSS. Also a lighter weight version of the HDU would alleviate bulk on the right side of an aviator's head.
- I would like to see more sizes available, something between a large and XL.
- Currently yearly fittings for IHADSS are not being accomplished in most active Apache battalions.
- The helmet is very bulky and hard to fit; while being light it is easy for weight of NVGs and HDU to shift in flight even with proper fit.
- The most recent fitting was at Fort Hood by DACs. This is the best fitting I've ever had.
- You need a new AH-64 A/B/D IHADSS.
- My original fitting at Ft Rucker was by far the best. All fittings since have been adequate, but not as good. I believe ALSE training is the reason.
- Need to get rid of LEDs on the IHADSS and go to a magnetic system (as in the LCT). The harnesses are very expensive and they break too often.
- ALSE is not a priority to the unit. It is undermanned and doesn't get the support until an inspection or something is due.
- Wish we could keep the same IHADSS when moving to another post. I think this will help reduce the problem of spending several flights trying to get your helmet to fit properly. A properly fitting helmet is a priority for safe operation of the aircraft.
- I believe you should keep your IHADSS from Ft. Rucker; I have never had better fit. The IHADSS team at Ft. Rucker is the standard for IHADSS fitting and should have teams sent to all AH-64 unit to teach them the standard in IHADSS fitting or give use the IHADSS issued there (Ft. Rucker).
- As company ALSE offices for B Co. 3/229th I would like to say that the training I received at the ALSE course when it came to the IHADSS helmet was inadequate. ALSE officers need to be trained in the proper wear, fitting and function of the helmet. Recommend, someone who works at Hanchey's ALSE shop who actually works with IHADSS on a day-to-day basis get involved with the ALSE course and give instruction on the IHADSS. It is imperative that these helmets are fitted correctly not only for mission readiness but also for safety.
- IHADSS should remain with pilot on individual clothing records. My helmet has not fit properly since giving back my original helmet in 1995.

- My helmet is too small; it causes me to feel pain on long flights. I had a good fitting helmet once, and then had to get rid of it. Wish I could keep my helmet from Ft. Rucker.
- It would be better that after initial fitting at Ft Rucker, for Apache AQC, pilots keep IHADSS helmet throughout their Apache career. The IHADSS that I had at Rucker, fit properly and never had any problems with the helmet. Since I have been at Ft Bragg and Bragg's helmet issue, I can't get the same fit as I did at Rucker.
- Need ALSE personnel trained to properly fit the IHADSS. Once fitting properly, the helmet should be hand carried during PCS. Other possible solution is to have an experienced ALSE tech to visit the units and train ALSE personnel. The tech could also fit helmets.
- I think the helmet should have been made part of my clothing required at Rucker after the initial fitting there. That was the only time it has ever really fit right. Had I been able to PCS with it at that time the fitting problems I have had with the three helmets since wouldn't have existed.
- IHADSS must be fitted by a dedicated company rep. Once issued, a helmet should stay with the user for the duration of flight duties.
- Turning in helmet with PCS is dumb. Just about the time you get it to fit right you end up turning it in and starting over somewhere else (if they happen to have one in your size).
- Why don't we keep the helmets we are issued at AQC? If I had kept that one with the original fit, I would probably have not experienced the hot spots associated with breaking in helmets at new duty stations.
- Turning in excess IHADSS is a bad idea.
- I would like to get the IHADSS at Rucker properly fit by contract maintenance and then added to my CIF so I know I will always have a helmet that fits me.
- I should be able to keep my own IHADSS instead of turning it in at every PCS move. The time involved in refitting, flying, adjusting a new helmet can be alleviated. Some units don't have my size delaying the RL progress.
- Make the visor cover lower to keep from hitting the canopy; make the combiner lines larger to display??
- Make the cables connecting the ICS and HDU components so they don't strangle you and don't prevent some side-to-side movement.
- We need to improve this helmet.
- If ear cups are properly placed HDU will not look into bracket. This requires ear cup to be moved up slightly affecting the proper fit.
- Broken IHADSS cable had to replace entire wiring harness, should be male/female adapter so you could just swap out cable instead replacing entire harness at a high price.
- It's too bulky; I feel that the HGU-56/P helmet with an IR harness would have better comfort.
- I have had electronics cable cannon plug pins bend/break and multiple helmet internal speakers fail.
- I am currently on my 5th wiring (IR) harness. Some are still on their 1st.
- I am the battalion ALSE officer for my unit and I have seen all types of problems with the IHADSS helmet. The failure of the IR detectors is the biggest problem of all and to fix this item you must dismantle the entire helmet to do so. This occurs one/two times a week for the 70 helmets I service. Also the NVG visor mount track is a possible accident

waiting to happen. The visor will stick in place or will dislodge from the guide track. Often it takes two hands to pull the visor down or push it up. The TM 1-1520-238-10 requires an operational helmet visor to accomplish the emergency egress task in chapter 9.

- I always thought it would be great to have an air adjustable helmet liner, i.e. Reebok pump, in order to equalize pressure, provide even support and reduce hot spots.
- Not as snug as flight school, but clearly cooler. I believe that I should not have to change helmets every time I PCS; people would take better care of their helmets if they knew it was theirs... pride in ownership.
- Get this thing redesigned.
- More training for ALSE reps on the IHADSS in school. PCSing with the IHADSS helmet (as part of CIF) will reduce much of the problem for fitting.
- The IHADSS is the largest waste of money for Army aviation (next to Commanche). It is flimsy, uncomfortable and works well on rare occasions. The HGU-56 or SPH-4b is superior.
- I like the IHADSS, but it would be better if we could get one helmet issued and keep it for you career.
- Does not compare to the 56P for comfort. HDU is difficult to see peripheral info, also sight picture moves. PNVIS system can often be deceiving in judging size/distance.
- Needs to be smaller and able to fit a larger group of head sizes like the HGU-56.
- My experience leads me to believe the Army does not train ALSE techs well enough to properly fit the IHADSS. All of my fittings that I rate as excellent have been through contractors. Most "Army" fittings I've had have been substandard.
- I need a helmet bag for helmet in order to keep it in a good, safe useable condition.
- This helmet sucks. Upgrade to the 21st century.
- Visors have a tendency to scratch in the center from retracting it, into and out of the helmets. HDU eyepiece needs to be a bigger diameter.
- ALSE techs need more training in proper fitting. Also, ALSE shops need more money to stock helmet bags, liners, etc.
- With a NVG visor mount I don't have a visor usable with HDU; HDU isn't adjustable enough to obtain optimum position over eye helmet fit changes after every ALSE inspection-should PCS with helmet to help keep a good fit.
- Overall I have had a good experience over the 10 yrs I have been wearing IHADSS. I have had to replace serial wiring harness.
- Helmets should be issued and kept by aviators. At least warrants who remain in flying positions. Helmets issued are 15 yrs old or older and units will not replace then because of cost.
- It is good when fitted by ALSE, when you leave flight school it is up to you to fit your helmet.
- Sucks- outdated- uncrashworthy.
- I wear XLG helmet, on both helmets I have owned, the microphone booms do not hold tight to my lips, and are loose at the mounting point as well.
- Cable's alligator clips get caught on various parts of seat/interior and should be removable.
- Buy the new helmet for Apache pilots. Spend the money to fit it with the harness.

- I wish we could get a custom liner, at least, that could attach to the inside of the IHADSS. Custom fit to each pilot's individual head and that PCSs with the pilot, to put in the IHADSS he/she receives at the next duty station.
- It's a good helmet, but people should be trained to properly fit it and take the time to.
- ALSE personnel don't know how to fit it properly.
- Work great.
- In order to have full field of view with newer HDUs combiner lens must be fully extended which allows no margin if helmet shifts during flight.
- I have a very large head, and a lot of noise is let through my helmet, if I wear earplugs, I cannot hear the radios. I would like to see the CEP fitted into the ALSE program.
- Often have rubbing that causes irritation on neck from chinstrap. Not as easily cleaned, as I would like.
- Should be foam molded, as are airspace helmets.
- Please get us a TPL type system for the IHADSS so we have an exact and comfortable fit. Combined with CEPs this would fix most problems.
- I have no real problems with the IHADSS.
- NVG mount makes it hard to rotate HDU into position combiner lens very subject to damage (scratches & bending).
- Sign and keep your helmet through your career in the Army.
- The IHADSS is by far the most uncomfortable helmet I have ever worn. While wearing the HDU, I must choose which piece of symbology information I can live without because it cannot all be viewed at once.
- Good system, however, they need to be custom fitted to each pilots' head exactly like the other services do it. Foam injection I always feel like I am "rigging" the IHADSS to fit me. Thanks for caring and asking.
- It's not the helmet; it's the FLIR that needs a survey.
- Not NVG friendly. Needs to be manufactured to support both HDU & NVGs better.
- The Apache community needs the IHADSS mod for the HGU-56/P immediately. It offers better noise attention, 15 lighter safer in many impacts (side and frontal).
- I think the ALSE personnel should receive better training on ALSE fit at the ALSE course. They have a basic understanding, but don't have the detailed knowledge or equipment to ensure a proper fit. Mr. Cherry at Hanchey should give classes on proper IHADSS fitting procedures.
- Use goggles with alternate visor. Visor sticks quite often and only able to have one lens installed. I use foam-hearing protection. Would like a helmet that keeps more outside noise out.
- My best helmet fit was by a civilian at Ft. Rucker who had an HDU that was hooked up to a video with symbology. He adjusted the helmet until I could see everything. The units don't have this technology, (equipment), and the pilots pay the price by spending a few months "tweaking" their helmets.
- Helmet uncomfortable to wear with M43 protective mask. Helmet is tight and will cause hot spots with mask that is not experienced without mask.
- Once the inside is adjusted properly all issues with the true IHADSS become components other than the helmet (e.g. a/c helmet cord too short, can't level HDU image.) I have

found that I need to constantly change out HDU mount brackets on my helmet in order to prevent the HDU from falling off during flight.

- IHADSS should be issued like a normal flight helmet and should go with the aviator. Personal helmets would reduce the frequency of fit problems.
- The IHADSS needs to be a one-time issue item. The inexperience and lack of ALSE personnel in a FORSCOM unit changes your fit from unit to unit. The helmet needs to be more form fitting like the SPH-4.
- Use both eyes.
- Heavy, IHADSS harness routinely goes out, requiring disassembly of helmet and refitting.
- We need to keep our IHADSS. Many aviators experience problems when they are issued different IHADSS at each unit. As an IP, I have seen no less than a dozen flights cancelled in the last year due to IHADSS fitting problems with new aviators to the unit. I have also experienced wasted flight time due to improperly fitted IHADSS with new aviators to unit, resulting in the inability to train. Summary: personally-I've had few problems with my IHADSS. Most aviators do have problems though. Normally, problems occur after arriving to a new unit. Fitting/ available sizes/ available helmets are main problems.
- Really designed poorly, with numerous hot spots. Very few pilots fit well. Poor hearing protection.
- Outdated system that provides marginal ballistic protection. Cost is incredibly high and fitting requires too much trial and error. Could be eliminated by a crewmember maintaining one helmet throughout his/her career.
- Ft. Rucker would only give me a large helmet for the MTP course. I wear a med.
- Needs to be kept by aviator when he PCS's.
- I would like to see a better vision system mounted on the helmet.
- Warrant Officers should be issued their helmets once! They should sign for it on their clothing record and keep it for their entire career.
- Either make one helmet that requires less maintenance, or cough up the money to keep all the parts required in stock and train a lot of personnel of how to maintain this one.
- We need a liner [that] we can take with us. That the IHADS[S] fits over.
- A pretty poor design considering technology available if we're stuck with it, we need to PCS with it.
- I'm flying a 28 million dollar Longbow Apache in often dangerous conditions yet I am fitted with a piece of junk helmet because that is all the unit has available despite attempts to acquire new ones. It takes months to finally get the IHADSS to fit properly and yet I have to return it when I PCS and start all over again. The "system" creates shortages based on sizes available. I have pilots flying with defective or wrong size[d] helmets just so they can fly. A "real" inspection of any unit would discover more than 50% defective IHADSS.
- If I had my druthers, I'd be wearing an HGU-56P with the AH-64 harness. The IHADSS is sub par and I suspect is not as protective as the HGU-56P helmet.

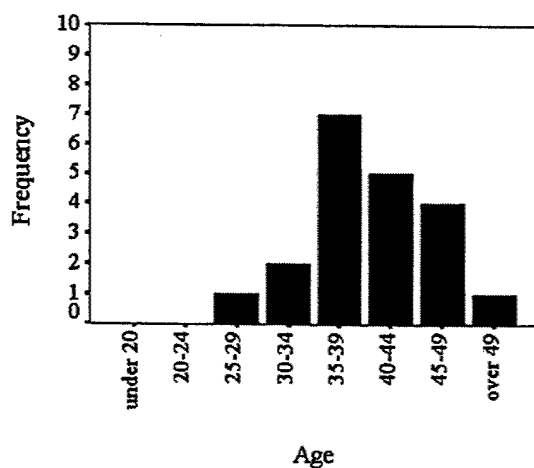
Appendix C.

Questionnaire: Apache Attack Helicopter Integrated Helmet and Display Sighting System (IHADSS) U. K. User Satisfaction Survey.

This appendix includes the questions on the questionnaire and a report of the responses to those questions by respondents in the U.K. The values in the tables correspond to the number of times each rank was reported by the respondents. The bar graphs in the main text converted these numbers to percentages.

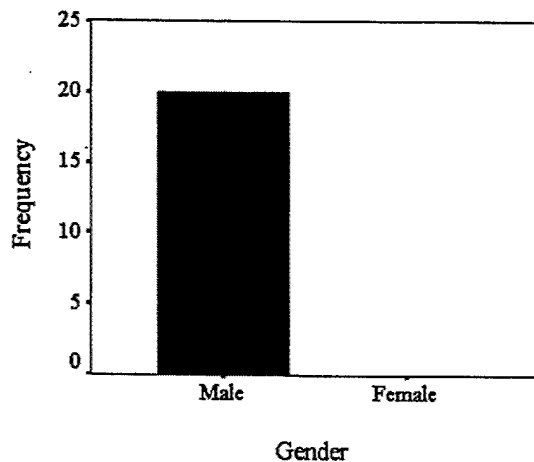
Demographic Information:

1. Age (circle one): Under 20 20-24 25-29 30-34 35-39 40-44 45-49 Over 49



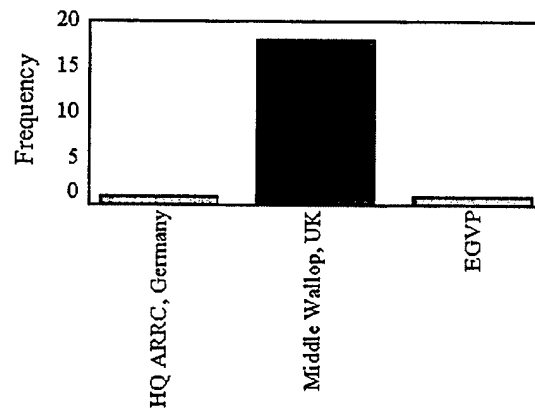
	Under 20	20-24	25-29	30-34	35-39	40-44	45-49	Over 49
Respondents	0	0	1	2	7	5	4	1

1a. Gender (circle one): Male Female



	Male	Female
Respondents	20	0

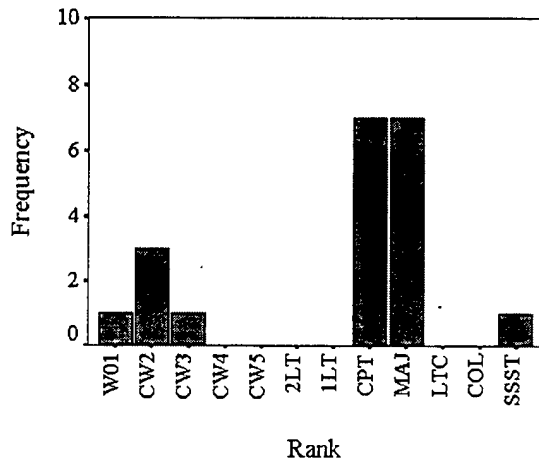
2. Current Duty Station:



Current duty station

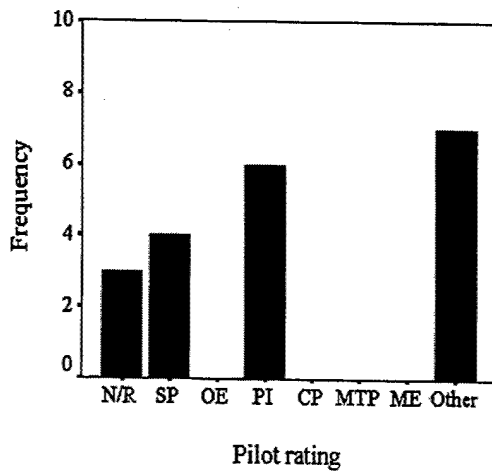
Current duty station	Frequency
HQ ARRC, Germany	1
EGVP	1
Middle Wallop, UK	18

3. Rank: WO1 CW2 CW3 CW4 CW5 2LT 1LT CPT MAJ LTC COL



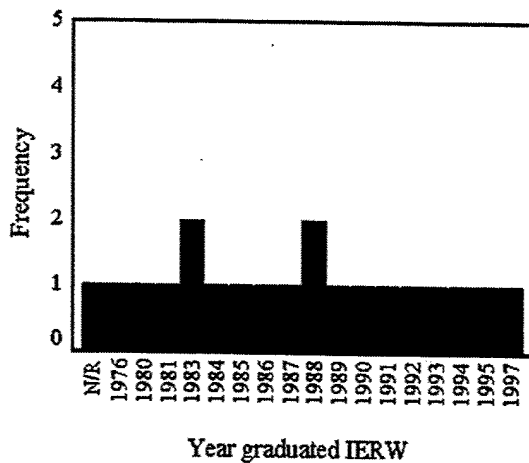
Pilot rank	Frequency
WO1	1
CW2	3
CW3	1
CW4	0
CW5	0
2LT	0
1LT	0
CPT	7
MAJ	7
LTC	0
COL	0
SSST	1

4. Pilot Rating: SP OE PI CP MTP ME Other (specify)

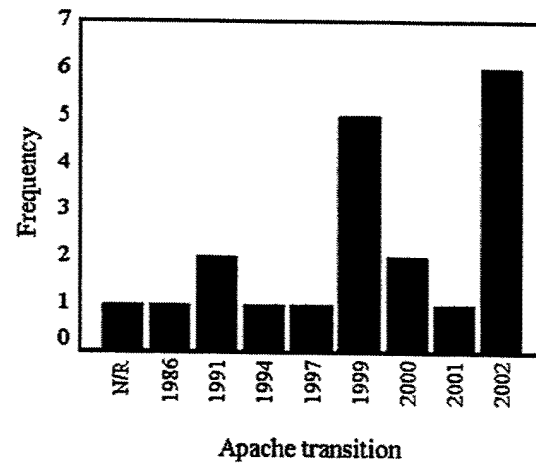


Pilot rating	Frequency
SP	4
OE	0
PI	6
CP	0
MTP	0
ME	0
Other	7
N/R	3

5. Year graduated from flight school:

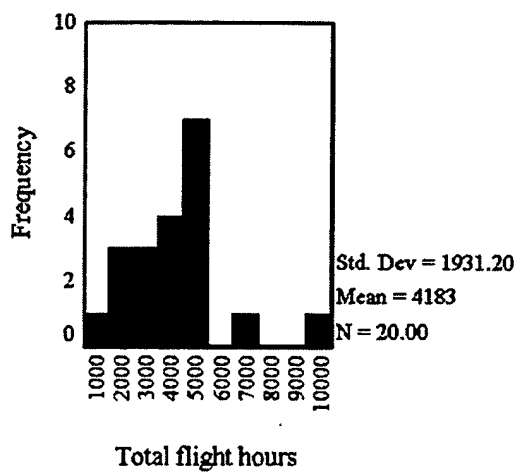


Year graduated Apache transition:



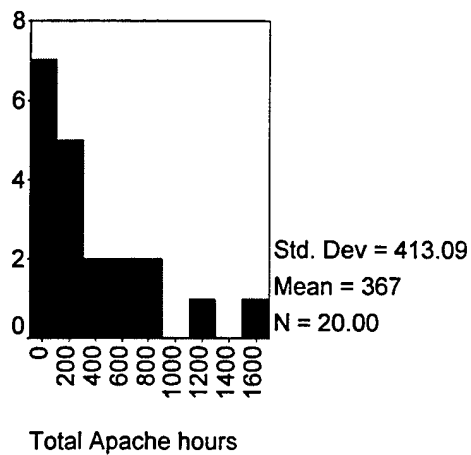
	Minimum	Maximum	Mean	Std Dev	Median
Yr Graduated Flight School IERW	1976	1997	1987	5.541	1988
Yr Graduated Apache Transition	1986	2002	1998	4.569	1999

6. Total number flight hours (include simulator time):



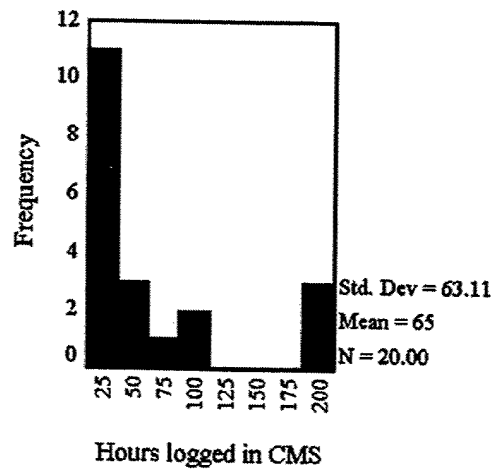
	Minimum	Maximum	Mean	Std Dev	Median	N/R
Total Flight Hours	1300	10000	4182.50	1931.203	4200	0

7. Total number of Apache flight hours (include simulator time):



	Minimum	Maximum	Mean	Std Dev	Median	N/R
Total Apache Flight Hours	60	1500	367.34	413.09	160	0

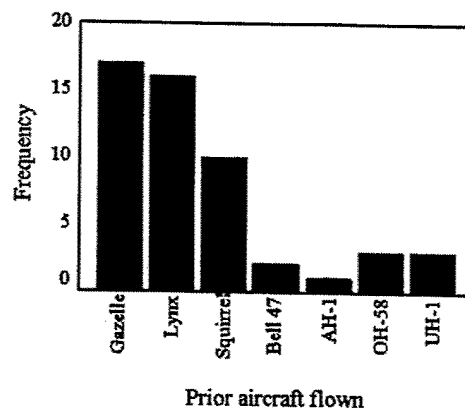
8. Approximate number of Apache hours logged in the CMS:



	Minimum	Maximum	Mean	Std Dev	Median	N/R
Approximate Apache hours logged in CMS	15	200	64.60	63.114	33.25	0

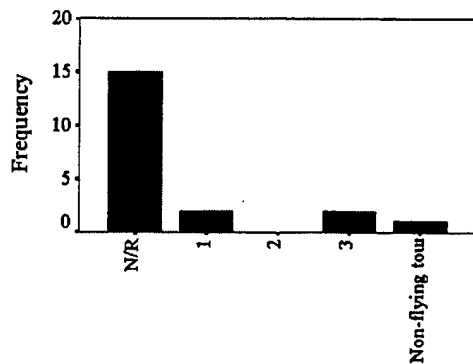
9. Military airframes flown prior:

AH-1 MH-6 CH-47 OH-58 TH-67 UH-1 UH-60 Other (specify)



Airframes flown prior to Apache	Frequency
Gazelle	17
Lynx	16
Squirrel	10
Bell 47	2
AH-1	1
OH-58	3
UH-1	3

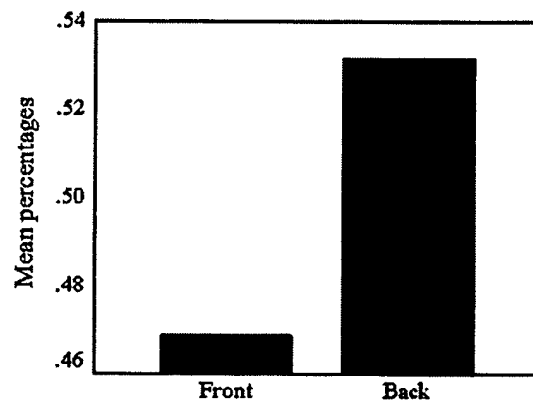
10. Current FAC Level (circle one): 1 2 3 non-flying tour



Current FAC level	Frequency
1	2
2	0
3	2
Non-flying tour	1
No response	15

FAC level

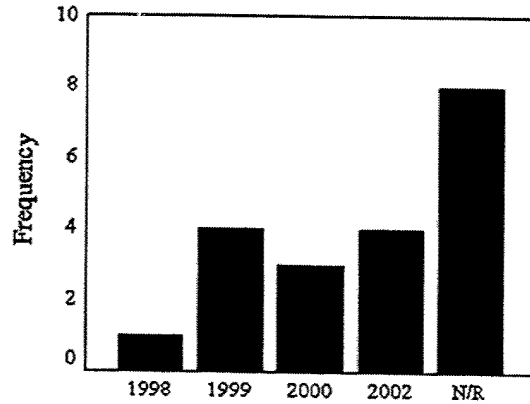
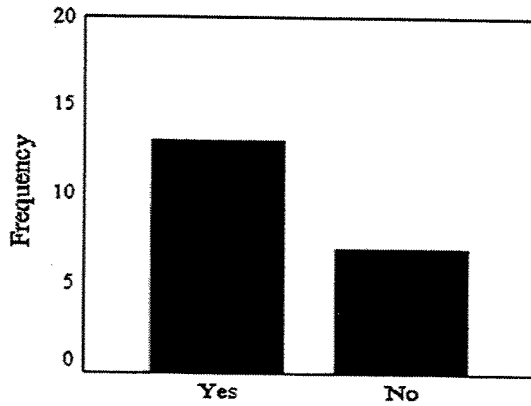
11. Percent of time flying AH-64 in front seat (CPG): back seat:



Seat position during flight

	Mean	Std Dev	Median	N/R
Percent time flying in front seat	47	.21	50	1
Percent time flying in back seat	53	.21	50	1

12. Are you D model trained? (circle one): Yes No If yes, what year?



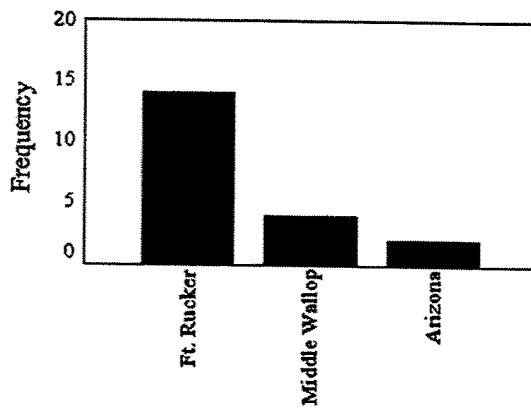
D model trained

Year D model trained

	Yes	No
D-model trained	13	7

Helmet Fit Satisfaction

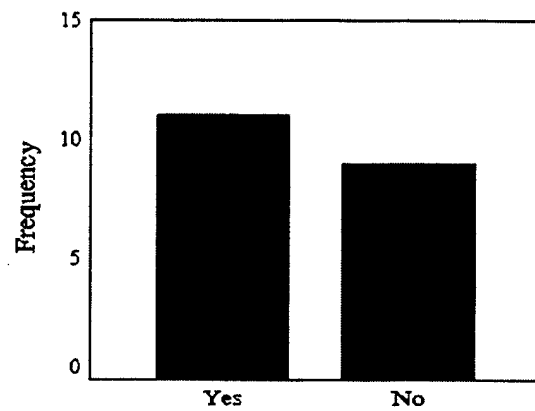
13. Location of initial IHADSS fitting:



Initial location of IHADSS fitting

Location of initial IHADSS fitting	Frequency
Ft. Rucker, AL	14
Middle Wallop, U.K.	4
Arizona	2

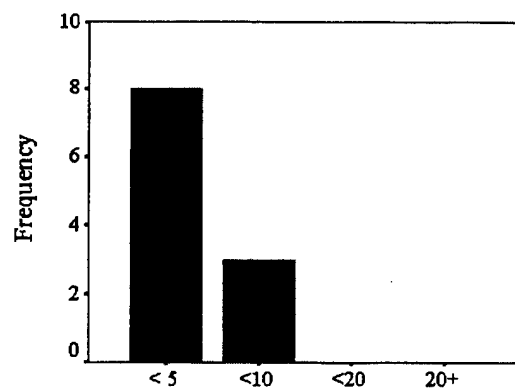
14. Was this initial fitting satisfactory? (circle one): Yes No



Initial fit satisfactory

	Yes	No
Initial Fitting Satisfactory	11	9

14a. If no, how many times did you go back for refitting?: <5 <10 <20 20+



Number of times refitted

	<5	<10	<20	20+
Number of times refitted	8	3	0	0

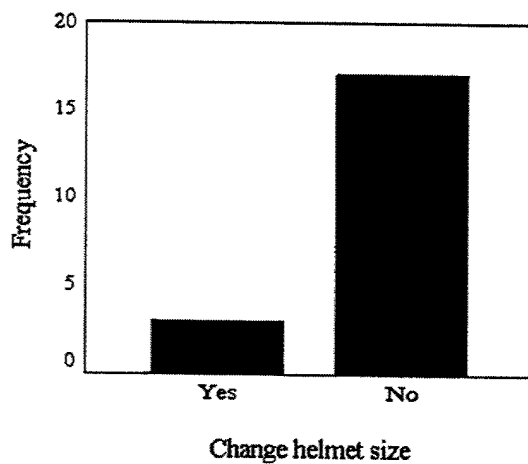
15. Is your current fit satisfactory? (circle one): Yes No



	Yes	No	N/R
Current Fit Satisfactory	16	1	3

If no, please explain: All comments are provided in Appendix D.

16. Have you changed IHADSS helmet size following a PCS move? (circle one): Yes No

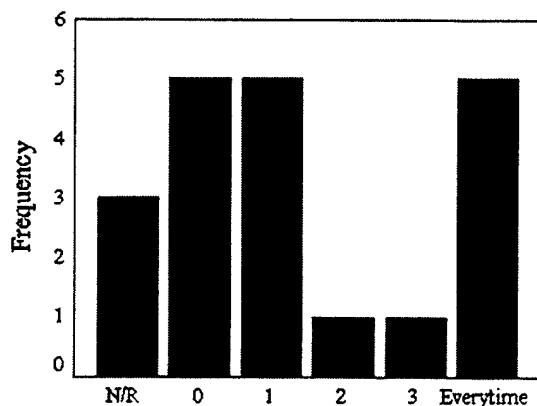


	Yes	No
Change Helmet Size	3	17

16a. Why?

All comments are provided in Appendix D.

17. How many times have you had to change your helmet due to PCS moves?

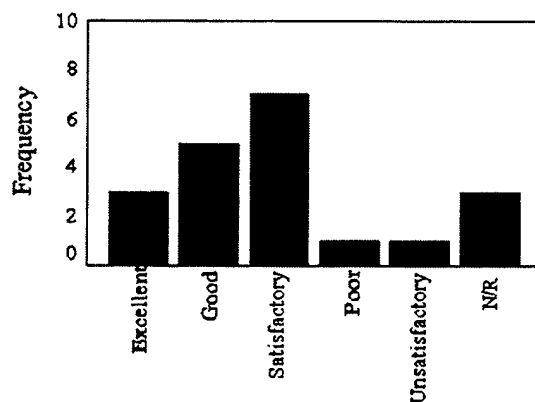


Helmet changes due to PCS moves

Number of helmet changes	0	1	2	3	everytime	N/R
Number of respondents	5	5	1	1	5	3

18. Please rate the quality of your current IHADSS fit (circle one):

1 2 3 4 5
 Excellent Satisfactory Unsatisfactory

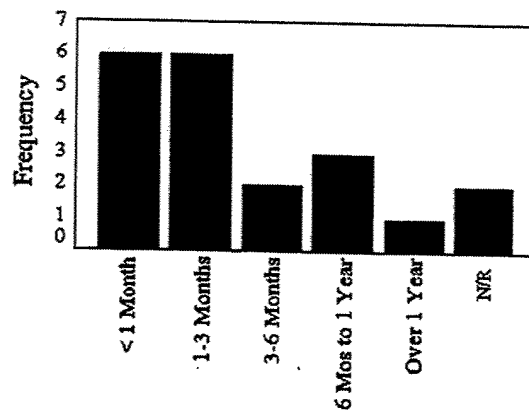


Quality of current IHADSS fit

	Excellent	Good	Satisfactory	Poor	Unsatisfactory	N/R
Quality of current IHADSS fit	3	5	7	1	1	3

19. When was the last time your current IHADSS was fitted? (circle one):

< 1 month ago 1-3 months ago 3-6 months ago 6months – 1 year ago Over 1 year ago

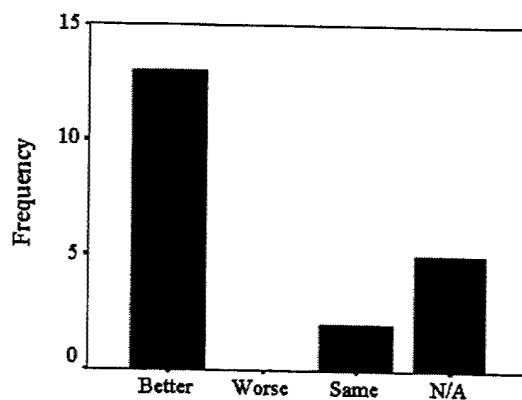


Last time current IHADSS was fitted

	< 1 month ago	1-3 months ago	3-6 months ago	6 months – 1 yr ago	> 1 yr ago	N/R
IHADSS last fit	6	6	2	3	1	2

20. Compared to prior fittings at other posts, would you rate the current fit as (circle one):

better worse same n/a



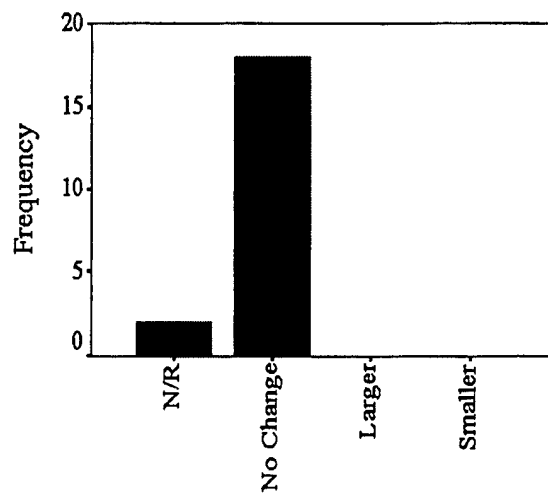
Current fit compared to fittings at prior posts

	Better	Worse	Same	N/A
Quality of current IHADSS fit	13	0	2	5

20a. If worse, why and what have you done to attempt to improve the fit?

All comments are provided in Appendix D.

21. Do you feel that you need a different size? (circle one): Larger Smaller No Change

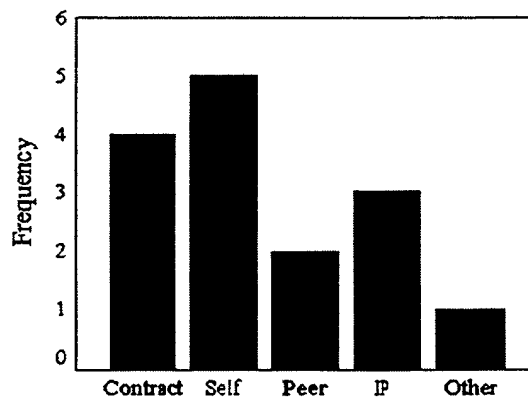


Different size needed

	Larger	Smaller	No Change	N/R
Need different size	0	0	18	2

22. Has anyone modified or adjusted your IHADSS aside from your ALSE shop? (circle all that apply):

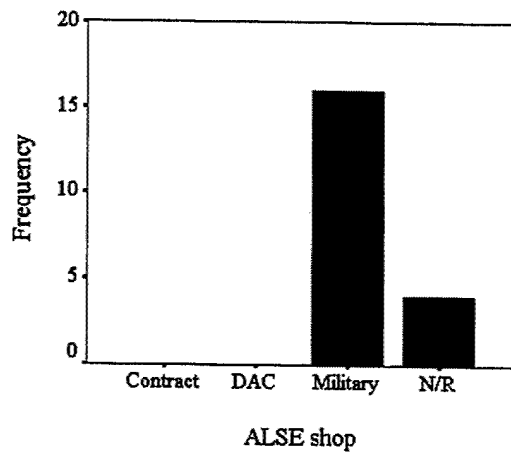
Contract Maintenance Self Fellow Aviator IP Other (please specify)



Modifications made to IHADSS

	Contract Maintenance	Self	Fellow Aviator	IP	Other
Modified/adjusted IHADSS	4	5	2	3	1

22a. Is your ALSE shop (circle one): Military DAC Contract



	Military	DAC	Contract	N/R
ALSE Shop	16	0	0	4

23. Please rate the quality of your current ALSE shop relating to fitting capabilities (circle one):

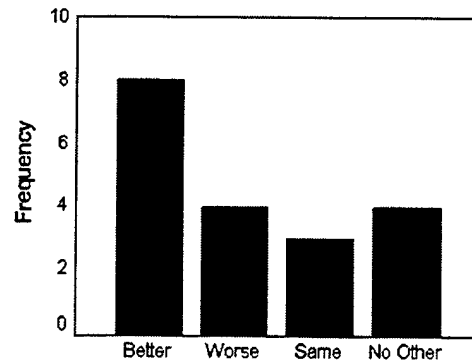
1 2 3 4 5
 Excellent Satisfactory Unsatisfactory



	1	2	3	4	5	N/R
Quality of Current ALSE shop	6	7	3	0	3	1

24. Compared to prior ALSE shops (if applicable), would you rate the current ALSE as (circle one):

better worse same I have not been fit at other ALSE shops



Current ALSE shop

	Better	Worse	Same	Not fit at other shops	N/R
Quality of Current ALSE shop	8	4	3	4	1

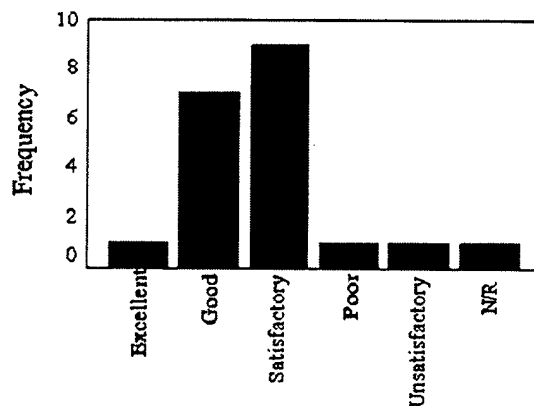
- 24a. If better or worse, why?

All comments are provided in Appendix D.

Helmet Comfort

25. Please rate the comfort of your current IHADSS (circle one):

1 2 3 4 5
Excellent Satisfactory Unsatisfactory

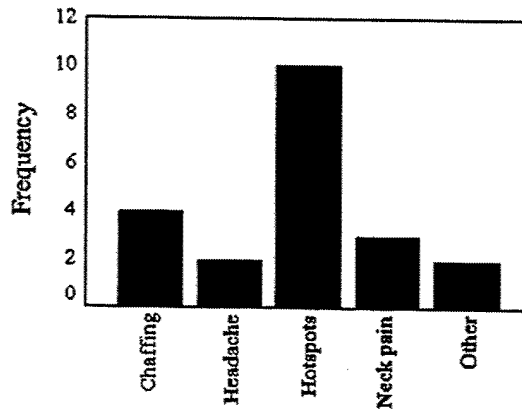


Current IHADSS comfort

	1	2	3	4	5	N/R
Current IHADSS comfort	1	7	9	1	1	1

26. Please indicate type of discomfort, if any? (circle all that apply):

hot spots headache chaffing neck pain other

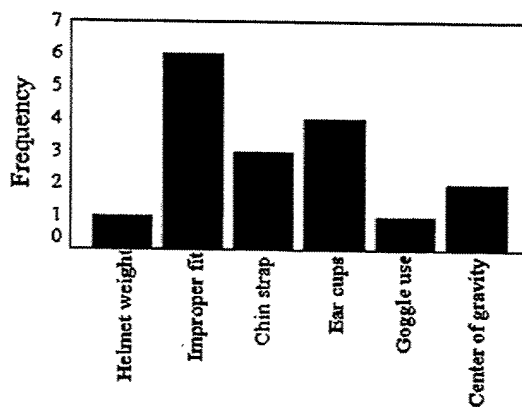


Discomfort

	Hot Spots	Headache	Chaffing	Neck Pain	Other
Type of discomfort	10	2	4	3	2

26a. What causes the discomfort, if any? (circle all that apply):

helmet weight improper fit chin strap ear cups goggle use
center of gravity other (please specify)

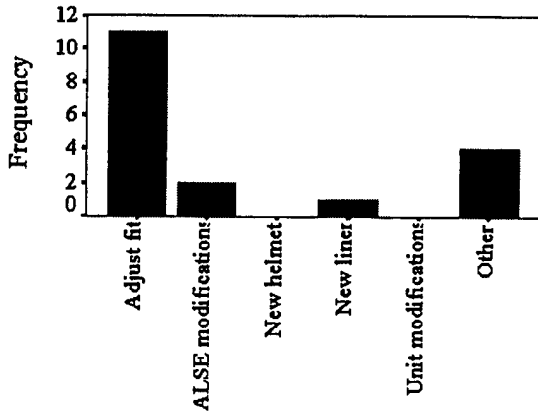


Causes of discomfort

	Helmet weight	Improper Fit	Chin Strap	Ear cups	Goggles	Center of gravity	Other
Causes of Discomfort	0	6	3	4	0	2	0

26b. If you experience discomfort, what do you do to alleviate it? (circle all that apply):

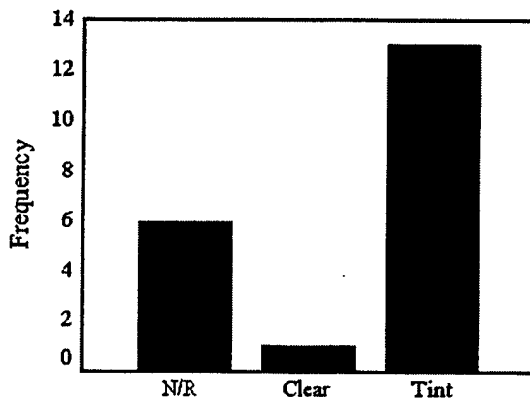
adjust fit obtain new liner(s) get new helmet fit modification through ALSE
fit modification through unit other (specify)



NOTE: Caution should be used in drawing conclusions from this question due to possible intersection or overlapping of allowed responses.

	Adjust fit	Obtain new liner	New helmet	ALSE modification	Unit modification	Other
Alleviate discomfort	11	1	0	2	0	4

27. Do you prefer your clear or tinted visor for normal wear? (circle one): Yes No



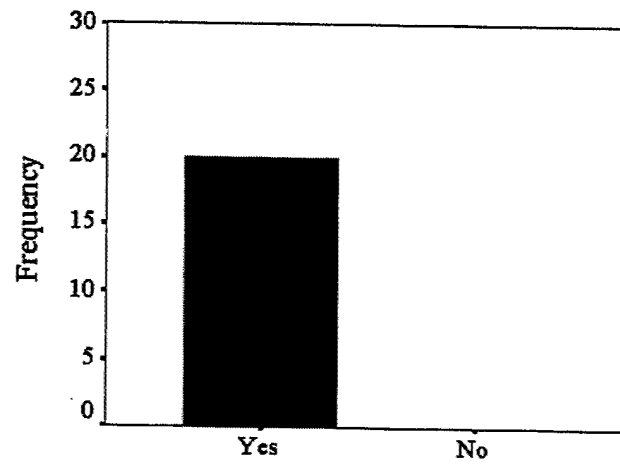
NOTE: Caution should be used in drawing conclusions from this question due to possible intersection or overlapping of allowed responses.

	Clear	Tinted	N/R
Clear or tinted	1	14	5

28. Do you wear your visor down on a regular basis? (circle one):

Yes

No



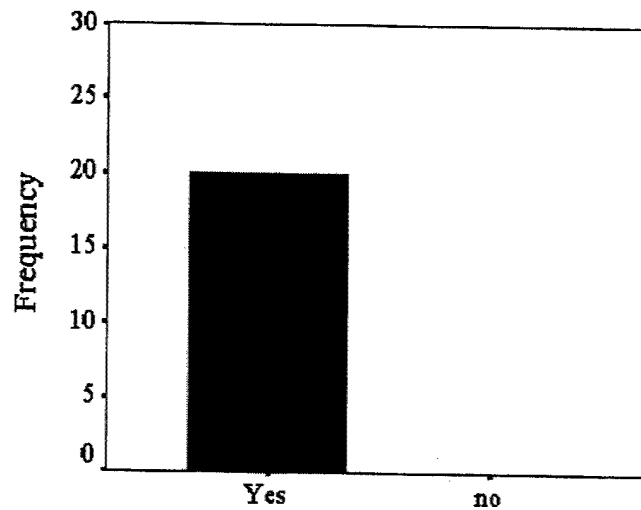
Visor down on regular basis

	Yes	No
Visor down in regular basis	20	0

29. Is your visor trimmed to fit your individual HDU placement?

Yes

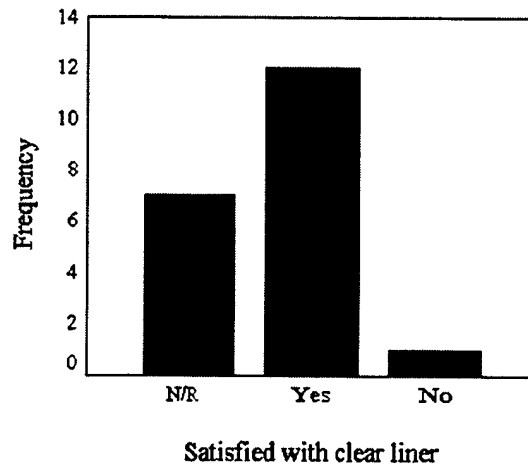
No



Visor trimmed

	Yes	No
Visor Trimmed	20	0

30. Are you satisfied with the clear liners of your inner helmet components? (circle one): Yes No

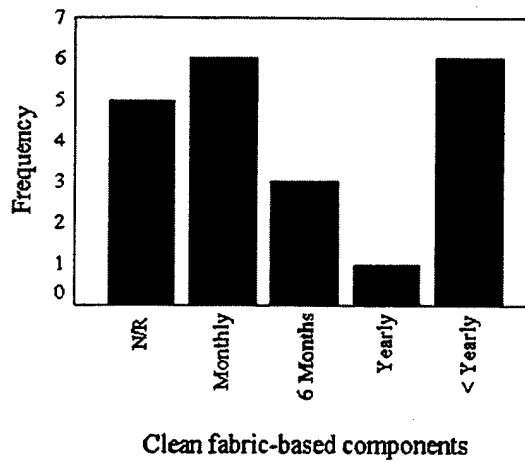


	Yes	No	N/R
Satisfied with clear liner	12	1	7

Comments: All comments are provided in Appendix D.

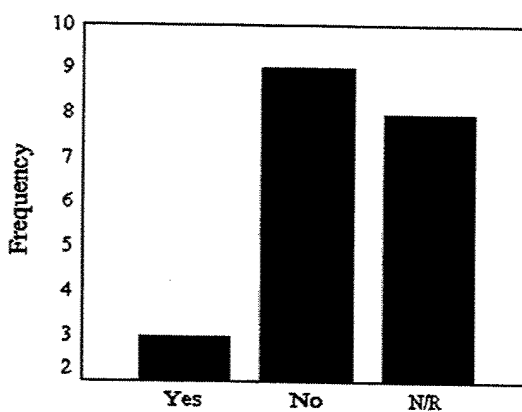
31. How often do you clean (wash) the fabric-based components of your helmet? (circle one):

Monthly Every 6 months Yearly Less than once per year



	Monthly	Every 6 months	Yearly	Less than yearly	N/R
Clean fabric-based components	6	3	5	1	5

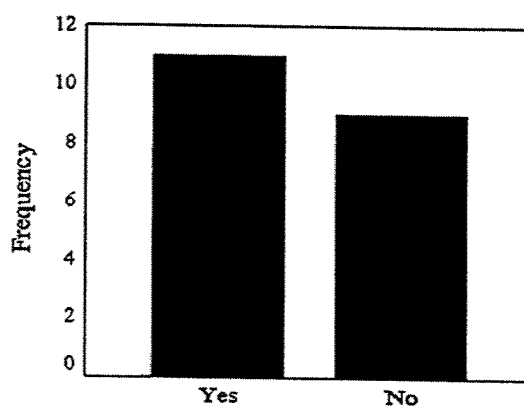
32. Does cleaning affect the fit of your helmet? (circle one): Yes No
 Comments: All comments are provided in Appendix D.



Cleaning affect the fit of helmet

	Yes	No	N/R
Cleaning affect fit	3	9	8

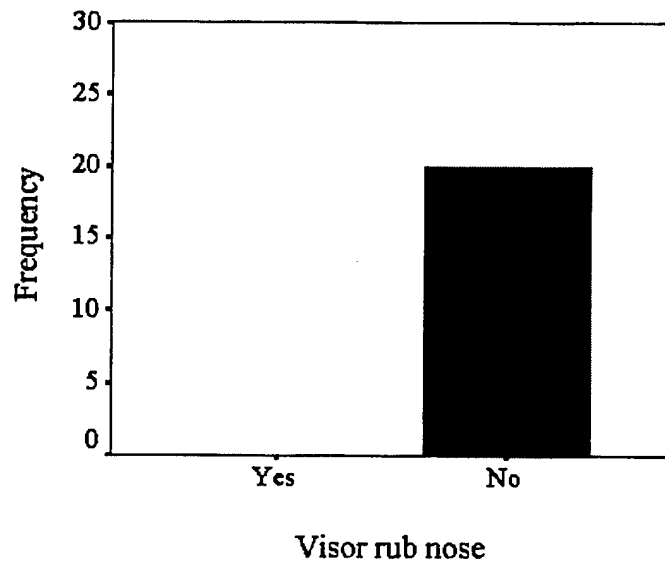
33. Are helmet components (pads, liners, straps, etc.,) readily available in your ALSE shop for replacement and modification when necessary? Yes No
 Comments: All comments are provided in Appendix D.



Helmet components available

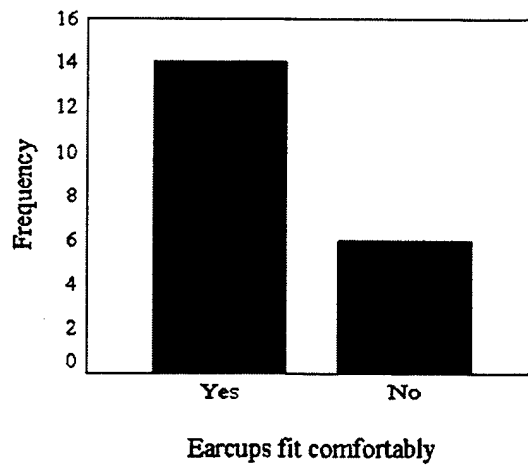
	Yes	No
Components available	11	9

34. Does the visor adversely rub your nose or face when it is extended? (circle one): Yes No



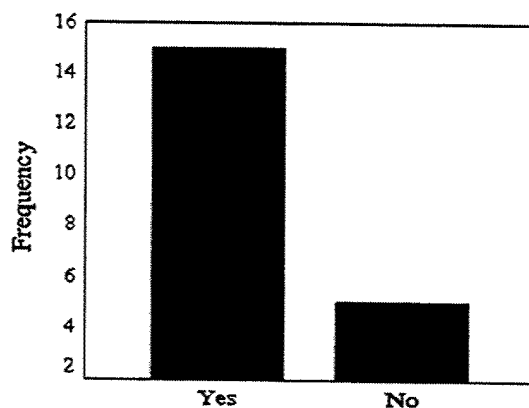
	Yes	No
Visor rub nose	0	20

35. Do the ear cups fit comfortably? (circle one): Yes No



	Yes	No
Ear cups comfortable	14	6

36. Do you routinely wear a skullcap with your helmet? (circle one): Yes No



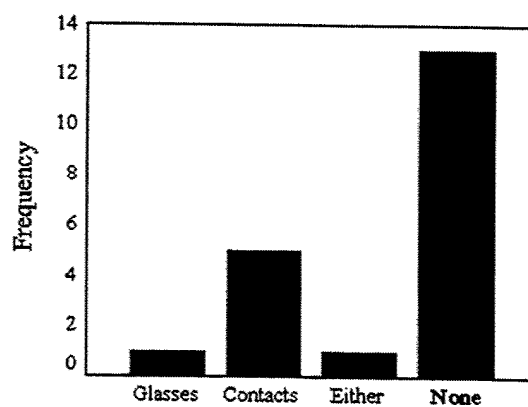
Wear skullcap routinely

	Yes	No
Wear skullcap routinely	15	5

Visual Protection & Use

37. Do you wear glasses or contacts during flight? (please specify):

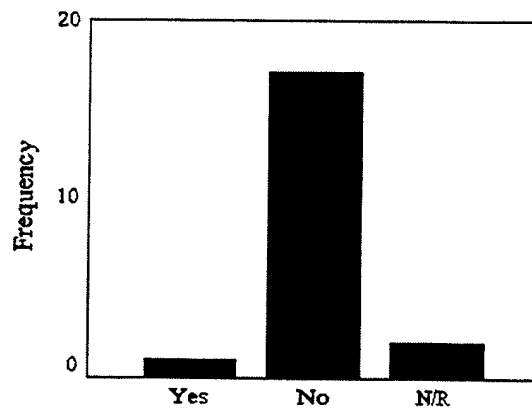
glasses contacts either none



Eyewear during flight

	Glasses	Contacts	Either	None
Type of eyewear during flight	1	5	1	13

38. Do you wear laser protective spectacles on the firing range (or as otherwise required) ? Yes No

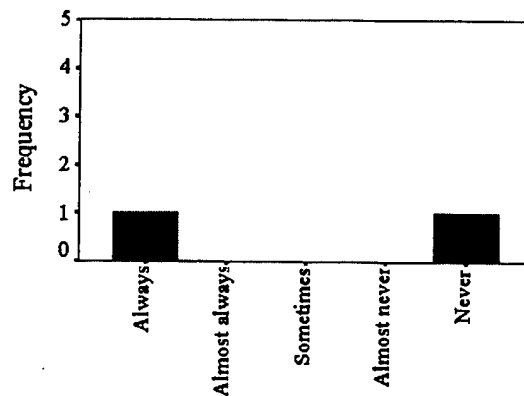


Wear protective eyewear on firing range

	Yes	No	N/R
Wear laser protective spectacles on firing range	1	17	2

38a. If yes, about what percentage of the time when they are needed? (circle one):

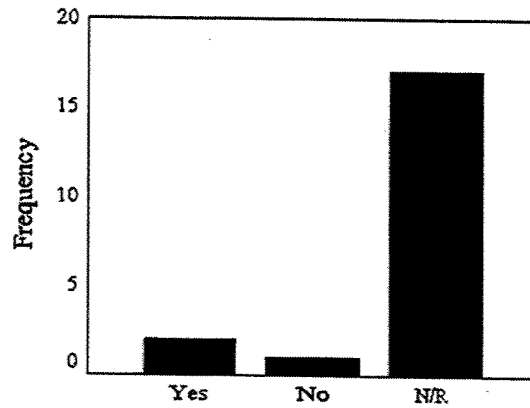
always almost always sometimes almost never never



Laser protective spectacles needed

	Always	Almost Always	Sometimes	Almost Never	Never
How often worn when needed	1	0	0	0	0

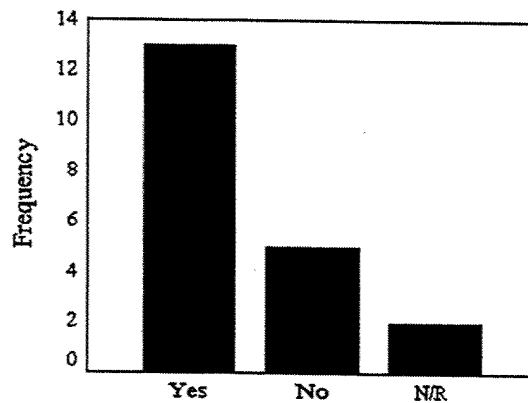
39. Do you feel that the laser spectacles inhibit HDU use? (circle one): Yes No



Laser spectacles inhibit HDU use

	Yes	No	N/R
Laser Spectacles inhibit HDU use	2	1	17

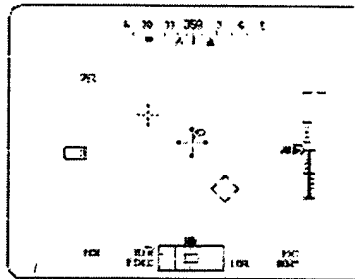
40. Do you achieve full field-of-view (FOV) when flying? (circle one): Yes No



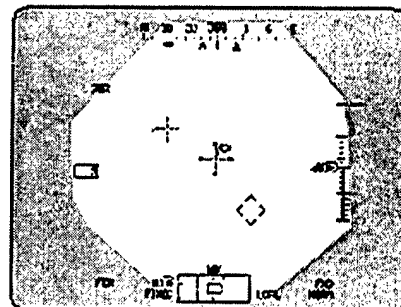
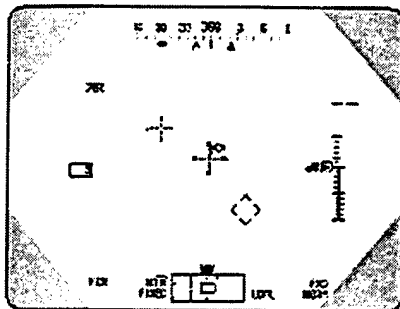
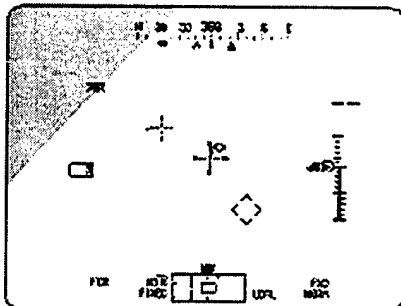
Achieve full field-of-view

	Yes	No	N/R
Achieve full FOV	13	5	2

40a. If no, please shade in the area(s) on the diagram to the right that you are unable to view
->



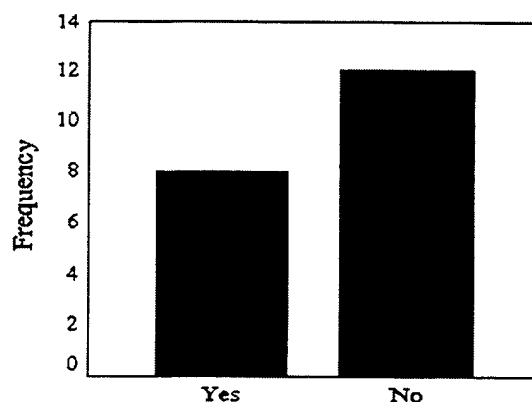
Representative losses:



41. Does your FOV change when moving your head during flight?

Yes

No

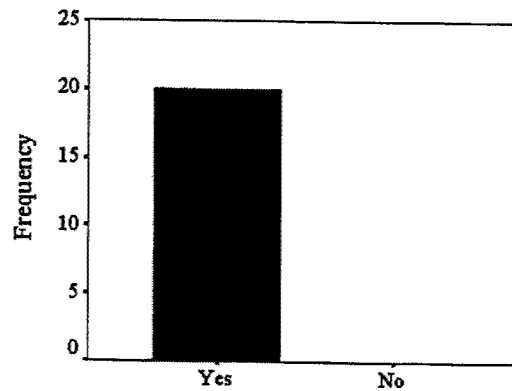


FOV change when moving head

	Yes	No
FOV change when moving head	8	12

41a. If yes, please describe what you are unable to view:
All comments are provided in Appendix D.

42. Does the visor come down enough to provide adequate protection? (circle one): Yes No

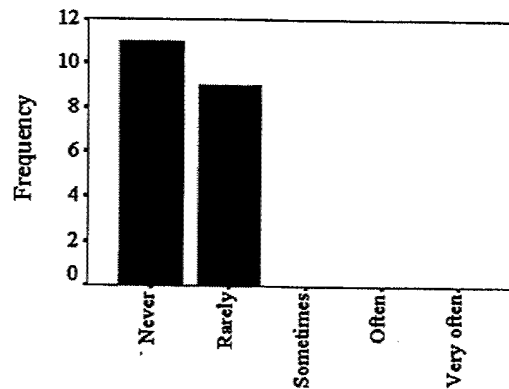


Visor down provides adequate protection

	Yes	No
Visor adequately protect when down	20	0

43. How often has the visor inadvertently retracted? (circle one):

1 2 3 4 5
 Never Rarely Sometimes Often Very often

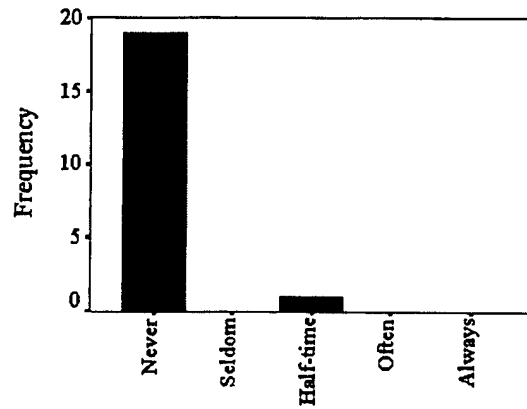


Visor inadvertently retracted

	Never	Rarely	Sometimes	Often	Very often
How often does visor retract	11	9	0	0	0

44. Do you use supplemental NVG's with your IHADSS? (circle one):

1 2 3 4 5
 Never Seldom Half the time Often Always

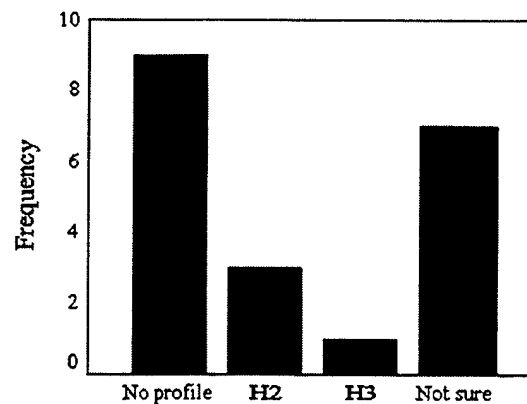


Use supplemental NVGs with IHADSS

	Never	Seldom	Half time	Often	Always
Use supplemental NVG's	19	0	1	0	0

45. Do you have a profile for hearing loss? (circle one):

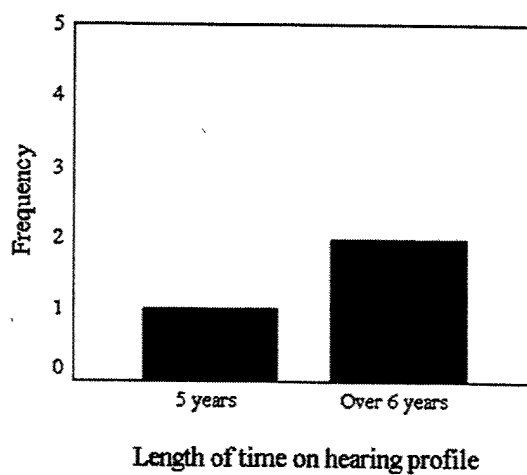
No profile H-2 H-3 Not sure



Hearing profile

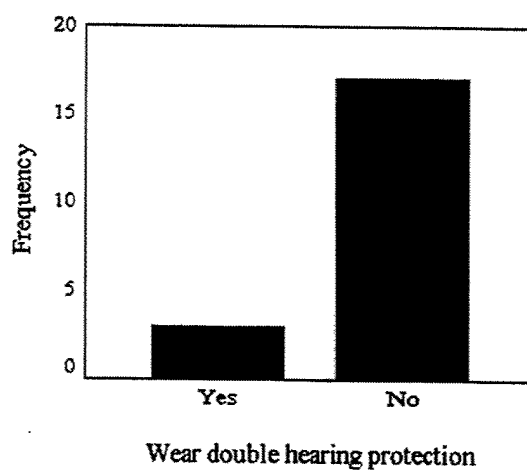
	No profile	H-2	H-3	Not sure
Profile of hearing loss	9	3	1	7

45a. If yes, how long have you been on a hearing profile?



	5 years	Over 6 years	N/R
Hearing profile for how long?	1	2	1

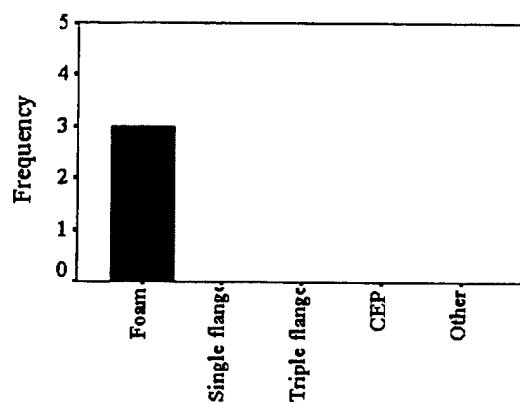
46. Do you wear double hearing protection? (circle one): Yes No



	Yes	No
Wear double hearing protection	3	17

46a. What? (Circle one):

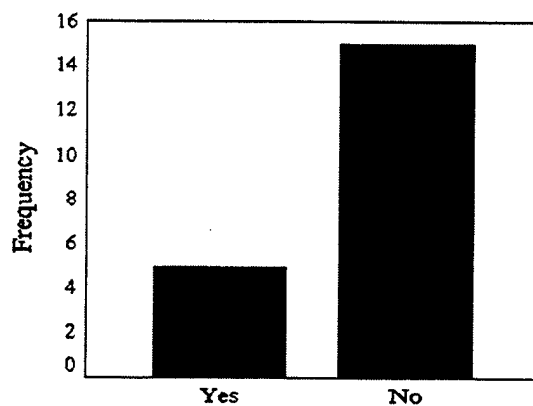
Foam earplugs Single flange earplugs Triple flange ear plugs CEP Other (specify):



Type of hearing protection

	Foam	Single flange	Triple flange	CEP	Other
Type of hearing protection	3	0	0	0	0

47. Do you experience tinnitus (ringing in the ears) during or immediately after flight? Yes No

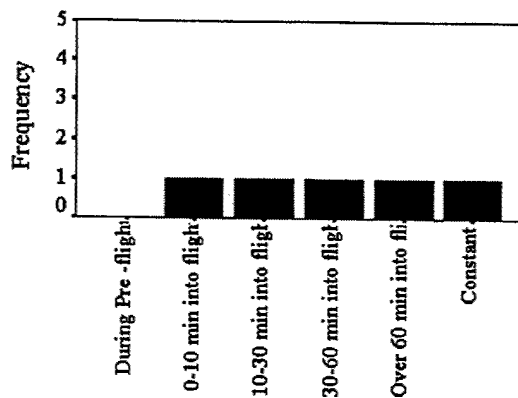


Experience tinnitus

	Yes	No
Experience tinnitus	5	15

47a. If yes, how long before onset of tinnitus? (please check one):

☐ During preflight ☐ 0 - 10 minutes into flight
☐ 10-30 minutes into flight ☐ 30 - 60 minutes into flight
☐ Over 60 minutes into flight

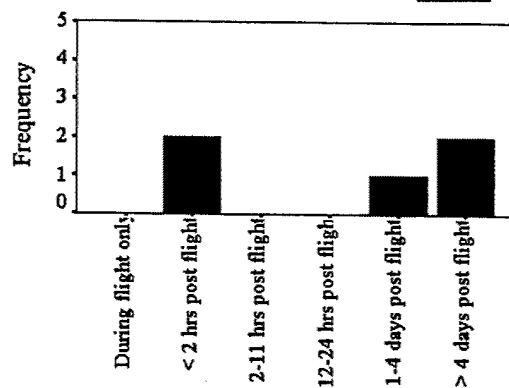


Onset of tinnitus

	During preflight	0-10 minutes into flight	10-30 minutes into flight	30-60 minutes into flight	Over 60 minutes into flight	Constantly
Onset of Tinnitus	0	1	1	1	1	1

47b. If yes, how long does it last? (please check one):

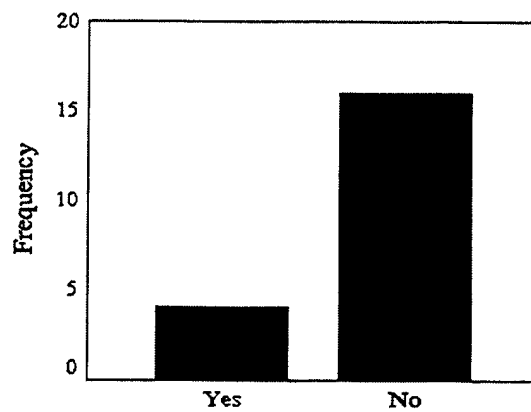
☐ during flight only ☐ 12-24 hours after flight
☐ less than 2 hours after flight ☐ 1-4 days after flight
☐ 2-11 hours after flight ☐ more than 4 days after flight



Duration of tinnitus

	During flight only	Less than 2 hours after flight	2-11 hours after flight	12-24 hours after flight	1-4 days after flight	More than 4 days after flight
Duration of tinnitus	0	2	0	0	1	2

48. Do you experience muffled hearing (the reduced ability to hear soft sounds) immediately after flight? (circle one): Yes No



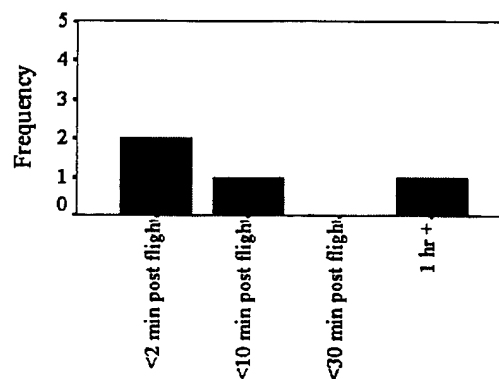
Experience muffled hearing

	Yes	No
Experience muffled hearing	4	16

- 48a. If yes, how long? (please check one):

☐ Up to 2 minutes after flight
☐ Up to 30 minutes after flight

☐ Up to 10 minutes after flight
☐ Up to 1 hour or more after flight

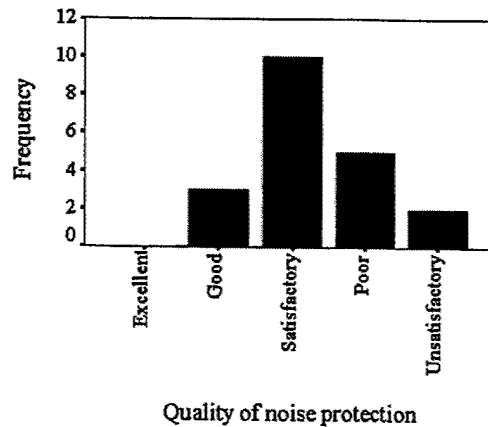


Duration of muffled hearing

	Up to 2 minutes after flight	Up to 10 minutes after flight	Up to 30 minutes after flight	Up to 1 hour or more after flight
Duration of muffled hearing	2	1	0	1

49. Please rate the quality of noise protection that you use (e.g., helmet alone or helmet with extra protection).

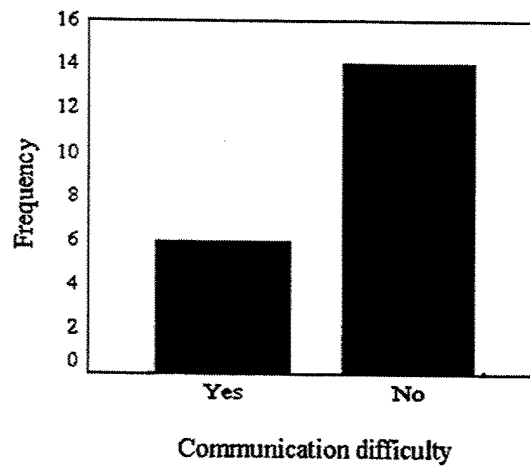
1 2 3 4 5
Excellent Satisfactory Unsatisfactory



	1	2	3	4	5
Quality of noise protection	0	3	10	5	2

Man-Machine Interface

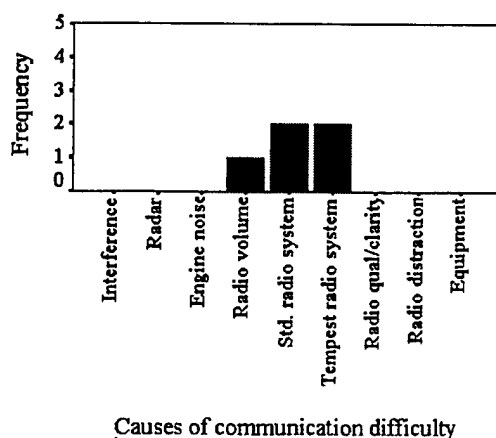
50. Do you have communications difficulty in the aircraft? (circle one): Yes No



	Yes	No
Communications difficulty	6	14

50a. If yes, what is it due to? (circle all that apply):

interference radar engine noise radio volume standard radio system
 tempest radio system radio quality/clarity radio distraction
 equipment (i.e. length of cables) other (please specify):

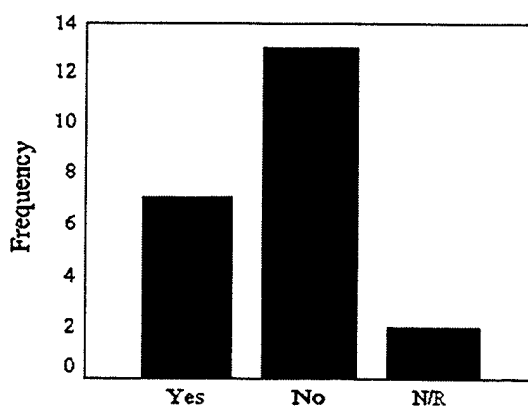


Causes of communication difficulty	frequency
Interference	0
Radar	0
Engine noise	0
Radio	1
Std. radio system	2
Tempest radio system	2
Radio quality-clarity	0
Radio distraction	0
Equipment	0
Other	3

50b. If yes, what do you do to improve the situation?

All comments are provided in Appendix D.

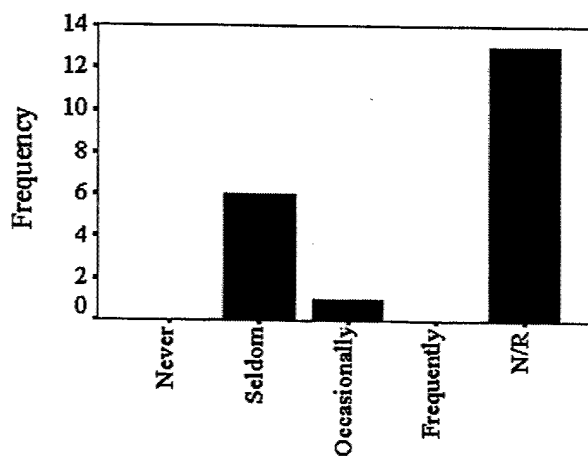
51. Has the HDU ever inadvertently released during flight? (circle one): Yes No



HDU inadvertently releases

	Yes	No
HDU released during flight	7	13

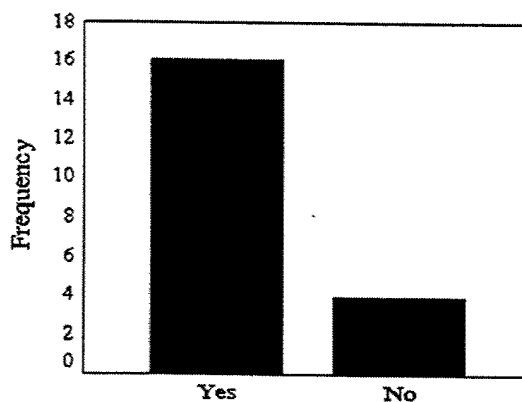
51a. If yes, how often? (circle one): never seldom occasionally frequently



How often HDU inadvertently releases

	Never	Seldom	Occasionally	Frequently
HDU inadvertent release	0	6	1	0

52. Does the HDU position remain the same from aircraft to aircraft? (circle one): Yes No



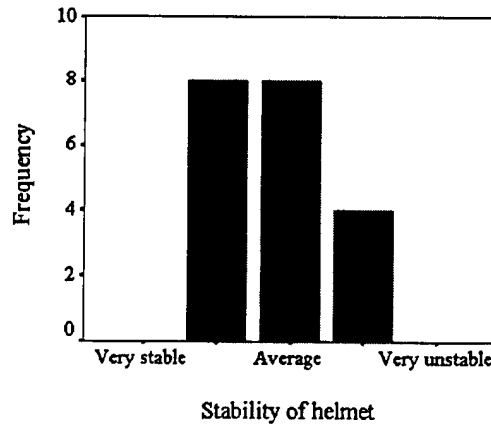
HDU position remain consistent

	Yes	No
HDU position remain the same	16	4

52a. If no, why? All comments are provided in Appendix D.

53. Please rate the stability of the helmet in reference to slippage (circle one):

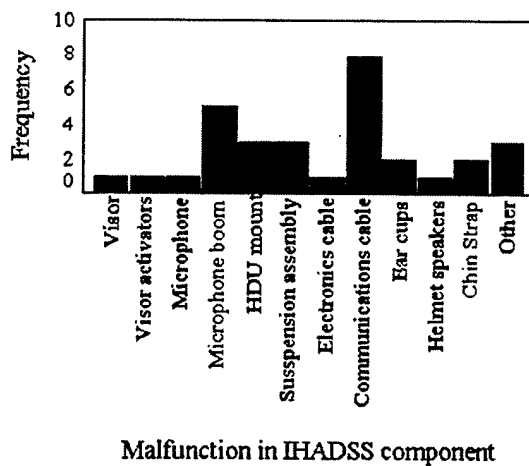
1 2 3 4 5
 Very Stable Average Very Unstable



	1	2	3	4	5
Stability of helmet	0	8	8	4	0

54. Have you experienced any breakage, binding, slippage or any other malfunction with the following IHADSS components (check all that apply):

☐ Visor ☐ HDU mount ☐ Ear cups
☐ Visor activators ☐ Suspension assembly ☐ Helmet internal spkrs
☐ Microphone ☐ Electronics cable ☐ Chin strap
☐ Microphone boom ☐ Communications cable ☐ Other (specify)



Malfunction	Frequency
Visor	1
Visor activators	1
Microphone	5
Microphone boom	3
HDU mount	3
Suspension assembly	1
Electronics cable	8
Communications cable	2
Ear cups	1
Helmet internal speakers	2
Chin strap	3
Other	1

Question 55. Please use the following space to make any remarks regarding your experience with the IHADSS helmet.

Appendix D.

Written responses by U.K. aviators to open ended questions.

Question 15: If your current fit is not satisfactory, please explain.

No comments.

Question 16: Why have you changed IHADSS helmet size following a PCS move?

- U.K. issue.
- U.K. sizing said large instead of X-large.

Question 20a: If your current fit is worse, why and what have you done to attempt to improve the fit?

No comments.

Question 24a: Why would you rate your current ALSE shop as better or worse than prior ALSE shops?

- ALSE Sgt. was doubling up in his duties and was not experienced in fitting IHADSS.
- Better trained technicians.
- The British ALSE equivalent are "by far" better trained and more competent than the U.S.A. version.
- More professional.
- Pay more attention to detail in fitting and HMD location.
- Smaller community to deal with - better customer service.
- No VID for HDU.
- Poor service/lack of knowledge.
- They have no test kit. The operators are v[ery] good, though.

Question 30: Are you satisfied with the clear liners of your inner helmet components?

- Liners not issued, had to purchase cloth cap.
- I wear an IHADSS helmet liner.
- What clear liners?

Question 32: Does cleaning affect the fit of your helmet?

- Don't tumble dry liner or it will shrink!
- Requires refit.
- Never washed, used helmet liner.
- Don't know.
- Never cleaned.

Question 33: Are helmet components (pads, liners, straps, etc.,) readily available in your ALSE shop for replacement and modification when necessary?

- Liners not issued, but should be.
- No.
- Spares shortage.

- No helmet liners in the system!
- Usually taken from 'S' helmets in stores.

Question 40a: If no, please shade the area(s) on the diagram to the right that you are unable to view.

- Circular pattern.
- Four corners.
- Lower left corner.
- Upper right side.
- Four corners.
- Upper right corner.

Question 41a: If yes, (FOV changes when moving your head during flight?), please describe what you are unable to view:

- Difficult to see the left side of FOV when looking 90° to the left.
- Torque if moving head extreme left or right.
- ...either end of heading tape, sight status box, part of weapons status.
- Left ¾ of screen when looking fully left (90°).
- I had to adjust the helmet depending on whether I needed to see the H.A.D. or TQ.
- Mainly the bottom section of HDU.
- Left and right side of FOV when moving head full left and right.
- ½ HDU if helmet slips and needs a re-lift.

Question 50b: If you have communications difficulty in the aircraft, what do you do to improve the situation?

- Replace Microphone.
- Volume on CIU!
- Turn up the IC and radios.
- Place the mike hard against my lips.
- Shout.

Question 52a: If the HDU position does not remain the same from aircraft to aircraft, why?

- Size and centering often incorrect @ Rucker.
- Used by many aircrew.

Question 55: Please use the following space to make any remarks regarding your experience with the IHADSS.

- Microphone boom is prone to loosening over time therefore falling away from face. Needs constant tightening.
- IHADSS is generally good but correct position and secure fit is critical. To make the HDU viewable at all times and the helmet not move fit is tight enough to cause discomfort after a short time. I prefer a loose fit.
- Chin strap used to rub. I have had the MK4 chin strap cover fitted to my IHADSS chinstrap and velcro attached to the strap. Result [equals] comfort and no slip of the chinstrap. Otherwise, most comfortable helmet I have.

- The ear cups are often painful and it is very difficult to attain a comfortable 'fit' which is then lost during servicing!
- Although my hearing is currently high, I have noticed a distinct decrease in my ability to hear some conversations in a noisy room. (Over the last year or so).
- I believe from experience that the standard U.K. helmet has a better fit from the IHADSS helmet.
- Like it. Most comfortable helmet that I have worn.
- If well fitted, other than better ear protection I find it fine.
- Overall, it is quite comfortable. I am very concerned over hearing protection. Also quality control. The mics [microphones] are poor as are IR [infrared] harnesses in [the] moist i.e., U.K. conditions.