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**AIRCREW MODIFIED EQUIPMENT LEADING TO INCREASED  
ACCOMMODATION (AMELIA) SURVEY RESULTS**

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## ABSTRACT

Aviation life support systems (ALSS) equipment is a critical and essential component for mission success in naval aviation. Anecdotal comments by naval aircrews have indicated that ALSS equipment is perceived as ill-fitting and substandard. Additionally, many aircrews in naval aviation are not satisfied with current urine collection devices (UCDs). The Aircrew Modified Equipment Leading to Increased Accommodation (AMELIA) survey was completed by 2,055 U.S. Navy and Marine Corps aircrew. The sample population included 85 women and 1,970 men. According to the survey results, ALSS equipment appears to fit slightly better than "ok" in all but the anti-exposure suit. The overall performance of current ALSS was rated slightly above the median with the exception of the anti-exposure suit (rated below the median). Aircrews identified the flight suit as the number-one priority with respect to safety, thermal protection, and comfort. The helmet was identified as the number-one priority item with respect to survivability. The majority of the sampled aircrew has required the use of urine collection devices (UCDs) during flight. These aircrews selected the piddle pack and relief tube as moderately acceptable solutions for urination during flight.

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## INTRODUCTION

Aviation life support systems (ALSS) equipment is crucial to the aircrew member's success both in the cockpit and the survival environment. For a large percentage of aviators, ALSS equipment has been perceived as ill-fitting. Flight gear was designed to fit the 5<sup>th</sup> through the 95<sup>th</sup> percentiles based on 1964 naval aviator anthropometric study data (Gifford, Provost, and Lazo, 1965). These aviators were primarily white males. With the addition of women aviators and an increase in the number of minorities who now make up the aviation community ranks, it has become apparent that ALSS equipment must be designed to fit a greater range of size. The urgency for better fitting flight equipment is even more critical today due to the growing number of women who, with the revocation of the Combat Exclusion Law, are eligible for combat aviation duties but are encumbered by ill-fitting gear. Personalized custom fitting has corrected a limited number of fit problems, however, this method can be cost prohibitive at the squadron level. Navy-approved modifications to selected ALSS have also provided additional fit corrections for a limited number of aircrews.

In 1993, the Naval Aviation Systems Command (NAVAIRSYSCOM) funded a study to determine problems female aviators were encountering with ALSS equipment. The initial survey netted a 67% reply rate from all female aviators in the Navy and Marine Corps. After the initial study, the project was expanded to include all aviators, both male and female. The current project is an effort sponsored by Naval Air Warfare Command, Aircraft Division (NAWC-AD) and Program Manager Air-202 (PMA-202).

The purposes of this study were to 1) evaluate ALSS fit characteristics; 2) determine aviator ALSS gear priorities with respect to comfort, safety, survivability, and thermal protection; and 3) identify problems associated with urine collection devices (UCDs). The Naval Aerospace Medical Research Laboratory designed a survey, coordinated its administration, and collected and analyzed the results. This report describes and documents perceived ALSS fit problems of current female and male aviators, prioritizes problem areas, and identifies possible solutions.

## METHODS

### QUESTIONNAIRE CONSTRUCTION

The survey used in the study was a six-page individual questionnaire designed to gather information on fit problems, priorities, UCDs, and design problems (Appendix A). The first page consisted of demographic questions (i.e., rank, designator, age, gender, etc.). Page two examined fit problems for 12 pieces of ALSS equipment: flight suit, flight jacket, flight boots, flight gloves, torso harness, integrated torso, SV-2B survival vest, anti-G suit, oxygen mask, helmet, anti-exposure suit, and anti-exposure liner. Respondents were asked about compatibility with other ALSS gear, flight-duty interference, size ranges, and overall performance ratings of ALSS equipment. Addressing what the survey respondents considered priority items for safety, survivability, thermal qualities, and comfort was the purpose of page four. Urine collection devices were discussed on page five. Space was provided on pages three and six of the questionnaire for written comments addressing individual ALSS equipment and cockpit/crewstation design problems (Appendix B).

Aviators at the Naval Air Station, Pensacola, Florida, tested the preliminary version of the survey. No major problems were noted, and minor changes were incorporated into the survey to clarify confusing questions before the final version of the survey was distributed.

### SURVEY IMPLEMENTATION

Data were collected from male and female aviation community personnel of the U.S. Navy and Marine Corps. Because all aviation personnel are required to attend aviation survival training (i.e., refresher physiology and water survival training) every 4 years, questionnaires were sent to the 12 Aviation Survival Training Centers (ASTC's) around the United States for completion: NAS Barbers Point, NAS Brunswick, NAS Cecil Field, MCAS Cherry Point, NAS Corpus Christi, MCAS El Toro, NAS Lemoore, NAS Miramar, NAS Norfolk, NAS Patuxent River, NAS Pensacola, and NAS Point Magu.

The survey respondents were pilots, flight officers, aircrew, medical support officers (i.e., flight surgeons, etc.), and civilians currently on flight status. Following refresher training, participants were asked to complete the six-page questionnaire (Appendix A) before leaving the ASTC.

Completed surveys were returned to NAMRL where they were coded and entered by hand into Microsoft® Excel spreadsheets. These spreadsheets were then imported into SPSS® for statistical analysis. Data were analyzed using frequency analyses. Trends were analyzed by gender, designator, and aircraft type.

## RESULTS

Completed surveys were received from 2,055 U.S. Navy and Marine Corps aviators that included 85 women and 1,970 men (Table 1). All aircraft platforms were represented.

Table 1. Mean ( $\pm$  SD) Descriptive and Physical Characteristics of Respondents.

Variable	Overall	Women	Men
N	2,055	85	1,970
Age (years)	31.9 $\pm$ 5.9	29.2 $\pm$ 5.1	32.0 $\pm$ 5.8
Height (inches)	70.6 $\pm$ 2.9	66.1 $\pm$ 2.4	70.9 $\pm$ 2.6
Weight (pounds)	178.8 $\pm$ 21.7	137.5 $\pm$ 16.6	180.1 $\pm$ 20.2
Total Flight Hours	1942.6 $\pm$ 1441.6	1,337.2 $\pm$ 1,182.9	1,967.6 $\pm$ 1,446.0

Respondents were grouped by designator and by fixed-wing/non-tactical, rotary-wing, and tactical jet communities (Table 2).

Table 2. Respondents, Divided by Designator and Aircraft Community.

Designator/Aircraft Community	Overall	Women	Men
Pilot	1,177	49	1,128
Flight Officer	202	16	186
Aircrew/Enlisted	686	20	666
Support (flt. surgeon, physiologist, etc.)	20	3	17
Civilian	15	0	15
Fixed-Wing/Non-Tactical	854	43	811
Rotary-Wing	890	24	866
Tactical Jet	344	19	325

The results are divided into sections representing the topics addressed in the survey. Section 1 covers fit problems, Section 2 covers priority items, and Section 3 covers responses to the questions related to UCDS.

### SECTION 1

Respondents were asked to answer questions concerning the fit of ALSS equipment. Questions were the same for each piece of gear and covered topics such as fit, modifications to the item, compatibility with other gear, interference with duties, size range adequacy, and overall performance ratings. Respondents scored the fit and provided an overall performance rating for each piece of equipment. For fit, the choices were 1 to 3, with 1 representing a "poor" fit, 2 representing an "okay" fit, and 3 representing that the gear fit "well." Respondents were asked to rate the overall performance of an item by selecting a number from 1 to 5, with 1 being the lowest and 5 the highest. To provide an overall score and performance rating, sample means of fit scores and performance ratings were determined based on the total number of respondents. Below is a review of the findings for each ALSS item. Selected anecdotal comments are also reviewed in this section. Respondents were encouraged to write-in comments regarding ALSS (Appendix B). These write-in comments provided a ready-room type of forum.

**Flight suit.** Two flight suit versions were being used at the time of this survey, the newer version (MEAFFS) and the older version (CWU-27/P). Because both suits appeared in the survey, independent means t tests were run to determine if there were significant differences between the scores of the suits. The level of significance was set at  $p = 0.05$ ; a modified Bonferroni procedure was used to correct for error (Simes, 1986). Significant differences were determined in mean fit scores of these two flight suits for all respondents ( $p = 0.000$ ), men ( $p = 0.000$ ), and women ( $p = 0.036$ ) favoring the CWU-27/P. When grouped by communities, both the fixed-wing/non-tactical community's fit scores for flight suits ( $p = 0.000$ ) and the rotary-wing community's scores ( $p = 0.022$ ) were significantly different favoring the older version. There was no statistical preference in the tactical jet community.

There were significant differences in the mean overall performance ratings for the flight suits, which favored the older CWU-27/P. When all respondents' performance ratings were analyzed together, the difference in means was significant at  $p = 0.007$ . The difference in mean performance ratings for the men ( $p = 0.008$ ) was also significant. Mean fit and performance ratings for the two flight suits can be seen in Table 3.

Table 3. Mean Scores and Ratings for Old and New Flight Suits, by Group.

Flight Suit (by type)	Fit Score <sup>†</sup>		Rating <sup>††</sup>	
	New	Old	New	Old
Overall	2.3	2.7*	3.7	4.2*
Women	2.2	3.0*	3.7	4.5
Men	2.3	2.7*	3.7	4.2*
Fixed-Wing/Non-Tactical	2.2	2.9*	3.6	4.3
Rotary-Wing	2.3	2.7*	3.8	4.2
Tactical Jet	2.3	2.5	3.8	4.0

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

\* Significant, using Modified Bonferroni procedures.

The flight suit, in general (as presented in Table 4), received fit scores of 2.3 (slightly better than ok) for all groups and overall performance ratings of 3.7, except the rotary-wing group (3.8). When grouped by flight suit type, the new flight suit (MEAFFS) received consistently lower fit scores and performance ratings when compared to the older version.

Table 4. Mean Scores, Ratings, Custom-Fit Knowledge, and Anecdotal Information for Flight Suits for All Groups.

Flight Suit (general)	Fit Score	Rating	Custom Fit (%)		Anecdotal Information
			Yes	No	
Overall	2.3	3.7	19.0	81.0	44% request wider range of sizes in CWU-27/P
Women	2.3	3.7	27.5	72.5	
Men	2.3	3.7	18.8	81.2	
Fixed-Wing/Non-Tactical	2.3	3.7	17.8	82.2	
Rotary-Wing	2.3	3.8	19.6	80.4	
Tactical Jet	2.3	3.7	21.7	78.3	

Eighty-one percent of aviators did not realize that the flight suit could be custom fit (Table 5). This percentage was similar for all groups (men, women, and aircraft types).

*Written comments.* Most comments regarding the flight suit were about the new suits (MEAFFS) and were negative (Appendix B). Complaints covered the poor quality (i.e., weak thread, poor zippers), general fit, and the change in pocket placement. With respect to fit, men found the suit to be too baggy and wide in the hips, and too narrow in the

shoulders. Women commented that the flight suit is too snug in the hips if it fits through the shoulders, the length of the rise is too long, and that persons with longer torsos than legs are hard to fit.

A large number of complaints were about the pockets. The lower leg pockets are too narrow to fit items such as the pocket NATOPS and too deep to be able to easily remove items. The elimination of the thigh pockets, including the shroud cutter pocket, was a major complaint of aviators; many people commented about the usefulness of these pockets. The pen pocket on the lower right leg was not favored; a more useful site would be on the right arm for the large number of left-handed aviators. Lastly, there was great confusion about the purpose of the side zippers on the hips. One suggestion was to either remove the side zippers or sew pockets inside. Overall, some descriptive remarks regarding the new flight suit were, "terrible," "new suit fits badly," and "go back to the old style."

**Flight jacket.** The aviation community gave the flight jacket an average fit score of 2.5 overall. The performance rating for the flight jacket was 4.2 out of 5. With respect to gender, men and women gave similar fit scores, however, women gave a lower performance rating than men (3.9 vs. 4.2). Fixed-wing/non-tactical (4.1), rotary-wing (4.3), and tactical jet (4.2) personnel responses were similar (Table 5).

*Written comments.* Poor quality was listed as a problem. Other comments included poor zippers, cuffs falling apart, and seams tearing easily. Jackets were considered too bulky when worn with the survival vest. According to some respondents, the sizing of the jackets is not standardized; winter jackets seemed to be longer than summer jackets. There were several requests for more sizes. Women requested a better fit with some aviators stating that the sleeves are too long and there is not enough shoulder room. Other fit suggestions were to include 'long' sizes and to put a box pleat in the back of the Nomex jackets to increase functional reach (Appendix B).

Table 5. Mean Scores, Ratings, and Anecdotal Information for Flight Jacket for All Groups.

Flight Jacket	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information
Overall	2.5	4.2	
Women	2.3	3.9	
Men	2.5	4.2	
Fixed-Wing/Non-Tactical	2.5	4.1	
Rotary-Wing	2.5	4.3	
Tactical Jet	2.5	4.2	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

**Flight boots.** Aviators scored the fit and overall performance of the flight boot similarly across gender and all communities (2.5 out of 3 and 4.2 out of 5, respectively; Table 6).

Table 6. Mean Scores, Ratings, Custom-Fit Knowledge, and Anecdotal Information for Flight Boots for All Groups.

Flight Boots	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Custom Fit (%)		Anecdotal Information
			Yes	No	
Overall	2.5	4.2	20.7	79.3	
Women	2.5	4.1	22.6	77.6	
Men	2.5	4.2	20.7	79.3	
Fixed-Wing/Non-Tactical	2.5	4.1	19.6	80.4	
Rotary-Wing	2.5	4.2	22.3	77.7	
Tactical Jet	2.5	4.2	19.7	80.3	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

The majority of aviators (79.3%) did not have knowledge of custom-fit procedures for flight boots. When grouped by gender and aircraft community, the percentage of respondents with knowledge of custom-fit availability did not differ greatly.

*Written comments.* Boots were considered very uncomfortable, too cold in freezing weather, too long, too wide, and “not orthopedic.” Aviators complained that the soles wear out too fast and provide poor traction.

Respondents listed several suggestions: 1) speed laces and flap folds for excess lacing, 2) Kevlar® toes instead of steel, 3) non marking soles, 4) wider range of sizes (i.e., narrow to extra wide), 5) water resistant uppers and seams, 6) tread for winter/icy conditions, 7) quick donning capabilities, and 8) lighter, cooler boots (Appendix B).

**Flight gloves.** This piece of equipment received a 2.6 out of 3 for fit and a 4.3 out of 5 for overall performance from the entire respondent sample. When divided into groups by gender and by aircraft communities, the scores and performance ratings were similar (Table 7).

Table 7. Mean Scores, Ratings, and Anecdotal Information for Flight Gloves for All Groups.

Flight Gloves	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information
Overall	2.6	4.3	
Women	2.5	4.1	
Men	2.6	4.3	
Fixed-Wing/Non-Tactical	2.6	4.2	
Rotary-Wing	2.6	4.4	
Tactical Jet	2.6	4.2	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

*Written comments.* Poor quality was again listed foremost (Appendix B). Aviators stated that these gloves tear at the leather palms, are easily saturated with oil and grease, and the stitching comes loose too easily. General complaints were that it is difficult to push buttons or adjust radios while wearing the current-issue gloves. Aviators suggested better insulation for cold weather, heavier leather gloves for preflight inspection, larger sizes (wider ranges) as well as shorter or longer fingers.

**Torso harness.** When asked how the torso harness fit, respondents averaged a score of 2.3. The fixed-wing/non-tactical community provided the low score of 2.2 with the rotary-wing and jet communities and the women scoring the torso harness’s fit at 2.4 out of 3. The overall performance rating for the harness was 3.8 out of 5. Women and the rotary-wing community rated the harness at 3.7 while the tactical jet community was the high rater with 3.9 out of 5 (Table 8). Although the only community to use the torso harness is the tactical jet community, many of the respondents from other communities had used a torso harness prior to their completing this questionnaire. This lends some explanation for responses from the fixed-wing/non-tactical community.

The torso harness has a custom-fit option for those who are not compatible with the pre sized harness. Nearly half (47.5%) of the aviation community who completed questionnaires were unaware of this service.

*Written comments.* Most often, aviators requested a wider range of sizes (Appendix B). Another comment found on surveys was a preference for the USAF version; one respondent stated that the USAF type of harness was “better for standing alerts.”

Table 8. Mean Scores, Ratings, Custom-Fit Knowledge, and Anecdotal Information for Torso Harness for All Groups.

Torso Harness	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Custom Fit (%)		Anecdotal Information
			Yes	No	
Overall	2.3	3.8	52.3	47.5	
Women	2.4	3.7	64.2	33.8	
Men	2.3	3.8	51.6	48.3	
Fixed-Wing/Non-Tactical	2.2	3.6	51.1	48.7	
Rotary-Wing	-	-	-	-	
Tactical Jet	2.4	3.9	58.9	40.8	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

**Integrated torso.** The integrated torso was scored (Fit 2.3, Performance 3.9) similarly to the standard torso harness (Fit 2.3, Performance 3.8). The lowest fit score came from the fixed-wing/non-tactical community (2.2 out of 3); women provided the highest score (2.6 out of 3). The fixed-wing/non-tactical group rated the performance lowest at 3.5, while the women rated the integrated torso a 4.6 out of 5 (Table 9). As with the torso harness, the integrated torso is used only by the tactical jet community but received votes from respondents who were currently associated with other communities.

Table 9. Mean Scores, Ratings, and Anecdotal Information for Integrated Torso for All Groups.

Integrated Torso	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information
Overall	2.3	3.9	
Women	2.6	4.6	
Men	2.4	3.9	
Fixed-Wing/Non-Tactical	2.2	3.5	
Rotary-Wing	-	-	
Tactical Jet	2.4	3.9	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

**Survival vest.** The survival vest received fit scores averaging 2.1 for all groups and a performance rating of 3.3 overall (Table 10). When grouped by communities and gender, the rotary-wing community and women gave the SV-2B the lowest performance rating, while the jet community rated the performance of the vest slightly higher.

Table 10. Mean Scores, Ratings, and Anecdotal Information for Survival Vest (SV-2B) for All Groups.

Survival vest	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information
Overall	2.1	3.3	
Women	2.1	3.2	
Men	2.1	3.3	
Fixed-Wing/Non-Tactical	2.1	3.4	
Rotary-Wing	2.1	3.2	
Tactical Jet	2.2	3.6	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

*Written comments.* The theme for the survival vest was bulkiness. Aviators stated that the vest was too heavy and “had too much stuff” attached. The excess gear and bulkiness create problems by limiting range of motion, increasing fatigue, discomfort, and increasing low back pain. Leg straps often get caught on things (“death loops”) and can potentially hinder egress. The Velcro® and zippers fall apart and do not hold. The life preserver inflation lobes “constantly become unvelcroed” and “inflate too often and come out of the velcro lining.” Wearing a flight jacket under the survival vest was listed as a fit problem. Women complained about the long length of the vest. Another aviator stated that the survival vest is either too loose at the waist or too tight at the chest. Readjustments for use with cold weather gear caused ill-fitting equipment (Appendix B).

Suggested solutions included a wider range of sizes, better HEEDs bottle placement, inclusion of a desalination device, and the use of Camelbacks for dehydration prevention. Many respondents requested the mesh vest instead of the SV-2B survival vest. The main goal among aviators is to have a lightweight piece of equipment containing only what is necessary (“prefer the mesh vest instead of the tangled suspender of the SV-2”). The Japanese, British, and USAF vests were mentioned as alternatives.

**Anti-G suit.** Aviators overall scored the anti-G suit favorably with a 2.5 out of 3 for fit and rated the performance 4.1 (Table 11). The women who completed this questionnaire scored the fit slightly below the overall mean (2.4) and rated the performance lower (3.9). Again, the fixed-wing/non-tactical community provided scores for the anti-G suit when this garment is used only in the tactical jet community.

Table 11. Mean Scores, Ratings, and Anecdotal Information for Anti-G Suit for All Groups.

Anti-G Suit	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information
Overall	2.5	4.1	
Women	2.4	3.9	
Men	2.5	4.1	
Fixed-Wing/Non-Tactical	2.4	3.8	
Rotary-Wing	-	-	
Tactical Jet	2.5	4.1	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

*Written comments.* According to the written responses, there is a long waiting period (3-4 months) to get G-suits from the supply system (Appendix B).

**Oxygen mask.** All groups were similar in fit score and performance rating for the oxygen mask (Table 12). A custom-fit oxygen mask is an option for hard-to-fit personnel, however, 55.9% of aviators did not know that this service was available.

*Written comments.* The Combat Edge mask received praise (Appendix B). Complaints listed for other masks were poor fit causing leaking (especially with visor down) and incompatibility with glasses. Another complaint was that G forces cause the mask to slide. The aviators flying in aircraft equipped with smoke masks complained that these masks fog up easily and are “difficult and time-consuming to don.”

Aircrew using walk-around bottles complained that the masks would not fit with glasses. Also, the placement of the walk-around bottle in the aircraft was listed as hard to reach in an emergency.

Table 12. Mean Scores, Ratings, Custom-Fit Knowledge, and Anecdotal Information for Oxygen Mask for All Groups.

Oxygen Mask	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Custom Fit (%)		Anecdotal Information
			Yes	No	
Overall	2.2	3.5	44.1	55.9	48.1% request wider range of sizes
Women	2.1	3.3	69.3	30.7	
Men	2.2	3.5	44.8	55.1	
Fixed-Wing/Non-Tactical	2.1	3.3	38.4	61.6	
Rotary-Wing	2.4	3.4	44.9	55.1	
Tactical Jet	2.2	3.6	49.3	50.7	

<sup>†</sup> Mean scores out of a maximum 3.

<sup>††</sup> Mean scores out of a maximum 5.

**Helmet.** The helmet was considered to be slightly better than “ok” for fit (2.3) and was rated 3.7 for overall performance. Women scored this item’s fit at 2.1 and averaged its performance at 3.4. Of the women surveyed, 43.5% felt that they would benefit from a wider range of sizes. The jet community gave the highest fit scores and performance ratings with 2.4 and 3.8, respectively (Table 13). The majority of aviators knew of the custom-fit option for the helmet (74.6%).

Table 13. Mean Scores, Ratings, Custom-Fit Knowledge, and Anecdotal Information for Helmets for All Groups.

Helmet	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Custom Fit (%)		Anecdotal Information
			Yes	No	
Overall	2.3	3.7	74.6	25.4	43.5% request wider range of sizes
Women	2.1	3.4	52.5	27.5	
Men	2.3	3.7	74.6	25.3	
Fixed-Wing/Non-Tactical	2.1	3.4	66.0	34.0	
Rotary-Wing	2.3	3.7	77.6	22.4	
Tactical Jet	2.4	3.8	81.9	18.1	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

*Written comments.* Aviators complained that the helmet was too heavy (Appendix B). Other complaints included poorly fitting night vision goggles (NVGs), incompatibility with glasses, discomfort from pressure points, and poor noise attenuation. There was a desire to see custom-poured liners instead of the bubble wrap liners currently being used. One suggestion for improving the helmet consisted of changing the ICS cords to a “curl phone style” in order to take up slack when not stretched and prevent snagging in the cockpit. An NVG compatible lip light incorporated on the helmet system and protective covers on the visor were other written recommendations.

**Anti-exposure suit.** The anti-exposure suit was the low scorer for all equipment rated in this section. The aviation community responded with an average fit score of 1.9 out of 3 and rated its performance at 2.8 out of 5. When grouped by gender and by aircraft community, results were similar. Nearly 49% of all respondents felt that the anti-exposure suit interfered with flight duties (Table 14).

Table 14. Mean Scores, Ratings, and Anecdotal Information for Anti-Exposure Suit for All Groups.

Anti-Exposure Suit	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information...%
Overall	1.9	2.8	Interferes with duties...48.7
Women	1.7	2.5	Interferes with duties...49 Wider range of sizes...52
Men	1.9	2.8	Interferes with duties...48.5
Fixed-Wing/Non-Tactical	1.7	2.7	Interferes with duties...44.5
Rotary-Wing	1.9	2.9	Interferes with duties...49.1
Tactical Jet	1.8	2.7	Interferes with duties...53.7

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

*Written comments.* The majority of comments about the anti-exposure suit were complaints (Appendix B). The anti-exposure suit was considered poorly designed, restrictive, too big, too bulky, too hot, and very awkward when performing duties. Other comments were that it is unrealistic to don this suit in an emergency or to wear it for more than 3 h at a time. The neck and wrist seals were considered too rigid and uncomfortable, cutting off circulation. The zipper was listed as causing chafing under the arms and in the axillary region. Aviators noted discomfort when the suit was worn with the torso harness or survival vest. Reduced arm range of motion during preflight when wearing the anti-exposure suit was also listed.

Suggestions for improvement included changing the zipper to a diagonal placement, and creating a cold-weather suit that would allow an anti-G suit to be worn underneath. Another suggestion was for custom-fit dry suits.

**Anti-exposure liner.** The anti-exposure suit liner averaged a fit score of 2.2 out of 3 and an overall performance rating of 3.4 out of 5 (Table 15). Women scored and rated this item lower than men (2.0 and 2.7, respectively) and requested a wider range of sizes. Separate aircraft communities responded similarly to the overall survey sample.

Table 15. Mean Scores, Ratings, and Anecdotal Information for Anti-Exposure Liner for All Groups.

Anti-Exposure Liner	Fit Score <sup>†</sup>	Rating <sup>††</sup>	Anecdotal Information...%
Overall	2.2	3.4	
Women	2.0	2.7	Wider range of sizes...46.5
Men	2.2	3.4	
Fixed-Wing/Non-Tactical	2.2	3.4	Interferes with duties...41.2
Rotary-Wing	2.2	3.4	
Tactical Jet	2.2	3.4	

<sup>†</sup> Mean scores out of a maximum of 3.

<sup>††</sup> Mean scores out of a maximum of 5.

*Written comments.* The anti-exposure liner was considered to be poorly designed, too short in the seat, and too bulky (Appendix B). One aviator commented that the liner "fits well" but that he "rarely wears it because [he] can't get [his] gear over the liner and the dry suit." He also stated that he has only one anti-G suit and harness instead of two (one for cold-weather gear).

## SECTION 2

Section 2 requested that respondents prioritize ALSS items first through fifth as selected from a list of 13 items with respect to safety, survivability, thermal qualities, and comfort. For the purpose of this report, order of rank was

weighted. Items listed as top priority were given 5 points, second priority items were allotted a weight of 4, so on and so forth. The lowest priority ranking respondents could list was 5; this level was given the weight of 1. Results from Section 2 represent the total ranking after frequencies were weighted for priority. The equipment has been prioritized based on the total number of times the specific piece of gear was listed. Questions were also included about Aero-Medical Safety Officers (AMSOs), and the FAILSAFE Tiger Teams.

*Safety.* The majority of respondents (30.2%) listed flight suits as the number-one safety priority with helmets a close second (29.2%). Also listed as a top safety priority were survival vests (13.7%) and anti-exposure suits (9.5%) (Table 16). Priority levels refer to the ranking levels (one to five) that respondents could assign to each piece of equipment. The items listed in each level are the ALSS equipment that were considered top priority (i.e., level 1), second priority (i.e., level 2), so on and so forth.

Table 16. Safety Priorities by Level of Importance (%).

Safety 1	Safety 2	Safety 3	Safety 4	Safety 5
Flight suit (30.2)	Helmet (21.0)	Boots (16.3)	Gloves/Boots (18.0)	Gloves (15.4)
Helmet (29.2)	Flight suit (15.8)	Gloves (14.7)	Jacket/Survival vest (13.4)	Boots (15.3)
Survival vest (13.7)	Survival vest (15.3)	Helmet (14.1)	Flight suit (10.3)	Flight suit (14.0)
Anti-exposure suit (9.5)	Boots (13.7)	Flight suit (13.5)	Helmet (9.4)	Jacket (12.8)

When grouped by aircraft type, the priorities for safety were similar (Table 17). Fixed-wing/non-tactical aircraft personnel listed flight suits as the top priority and helmets second; rotary-wing personnel listed helmets followed by flight suits. Personnel flying in tactical jet aircraft rated helmets as the first safety priority and anti-exposure coveralls second.

Table 17. ALSS Equipment Priorities With Respect to Safety by Aircraft Communities.

Priority	Fixed-Wing/Non-Tactical	Rotary-Wing	Tactical Jet
1	Flight suit	Helmet	Helmet
2	Helmet	Flight suit	Anti-exposure coverall
3	Flight boots	Survival vest	Flight suit
4	Flight gloves	Flight boots	Survival vest
5	Survival vest	Flight gloves	Oxygen mask

Flight suits were the highest priority with respect to safety for men and women. Women listed, in order, flight jackets, survival vests, helmets, and anti-exposure suits after the flight suit. Men listed helmets, survival vests, anti-exposure suits, and oxygen masks.

*Comfort.* Flight suits were listed as the top priority most often (27.1%) relating to comfort. Helmets (22.2%), anti-exposure suits (22.2%) and survival vests (11.7%) followed flight suits as the items considered to be top priority (i.e., level 1) as related to comfort (Table 18).

Aviators in fixed-wing/non-tactical and rotary-wing aircraft listed the same equipment priorities relating to comfort (flight suit, helmet, flight boots, and survival vest). Fixed-wing/non-tactical personnel also included the flight jacket while rotary-wing personnel listed the anti-exposure coverall. Tactical jet aircraft personnel listed the helmet and anti-exposure suit, flight suit, oxygen mask, and torso harness in order of priority for comfort (Table 19).

Table 18. Comfort Priorities by Level of Importance (%).

Comfort 1	Comfort 2	Comfort 3	Comfort 4	Comfort 5
Flight suit (27.1)	Helmet (18.3)	Helmet (16.8)	Gloves (15.3)	Flight suit (15.6)
Helmet (22.2)	Boots (16.1)	Boots (15.6)	Boots (15.1)	Gloves (15.0)
Anti-exposure suit (19.2)	Flight suit (15.6)	Flight suit/Survival vest (12.2)	Flight suit (11.8)	Boots (12.6)
Survival vest (11.7)	Survival vest (12.9)	Gloves (11.5)	Survival vest (11.0)	Survival vest (12.0)

Table 19. ALSS Equipment Priorities With Respect to Comfort by Aircraft Communities.

Priority	Fixed-Wing/Non-Tactical	Rotary-Wing	Tactical Jet
1	Flight suit	Helmet	Anti-exposure coverall
2	Flight boots	Flight suit	Helmet
3	Helmet	Survival vest	Flight suit
4	Survival vest	Flight boots	Oxygen mask
5	Flight jacket	Anti-exposure coverall	Torso harness

Women and men listed the same items, however, in slightly different order. Both men and women chose flight suits most often. Other items selected by women were survival vests, helmets, flight boots, and anti-exposure suits.

*Survivability.* The top priority items listed by respondents for survivability qualities were helmets (25.4%), survival vests (23.6%), flight suits (19.0%), and anti-exposure suits (11.7%). Table 20 contains the four items mentioned most often as top priority (i.e., survivability 1) through fifth highest priority (i.e., survivability 5).

Table 20. Survivability Priorities by Level of Importance (%).

Survivability 1	Survivability 2	Survivability 3	Survivability 4	Survivability 5
Helmet (25.4)	Flight suit (16.7)	Flight suit (17.5)	Boots (15.7)	Gloves (18.1)
Survival vest (23.6)	Helmet (16.2)	Boots (14.0)	Gloves (15.6)	Boots (16.9)
Flight suit (19.0)	Survival vest (16.0)	Survival vest (13.9)	Flight suit (14.7)	Flight suit (16.7)
Anti-exposure suit (11.7)	Anti-exposure suit (12.6)	Helmet (12.2)	Flight jacket (13.1)	Helmet (12.5)

Aircraft communities were similar in their choices for most important survivability gear. Order of priority, however, differed among groups (Table 21). All groups listed survival vests, helmets, and flight suits. Fixed-wing/ non-tactical and rotary-wing communities agreed on flight boots as well. Flight gloves were included in the fixed-wing group's list while the rotary-wing aviators included the anti-exposure coverall. The tactical jet aircraft aviators felt that the anti-exposure suit was most important; oxygen masks were also listed for this community.

Men and women were in agreement with respect to survivability items. Flight suits, helmets, survival vests, and anti-exposure suits were given highest priority.

Table 21. ALSS Equipment Priorities With Respect to Survivability by Aircraft Communities.

Priority	Fixed-Wing/Non-Tactical	Rotary-Wing	Tactical Jet
1	Flight suit	Helmet	Anti-exposure coverall
2	Survival vest	Survival vest	Survival vest
3	Helmet	Flight suit	Helmet
4	Flight boots	Anti-exposure coverall	Flight suit
5	Flight gloves	Flight boots	Oxygen mask

*Thermal protection.* When asked what items deserved the most attention with respect to thermal protection (Table 22), the number-one priority was flight suits (29.9%). Anti-exposure suits (25.6%), flight jackets (15.4%), and flight boots (9.3%) were also listed as level-one priority items for all aircraft types.

Table 22. Thermal Protection Priorities by Level of Importance (%).

Thermal 1	Thermal 2	Thermal 3	Thermal 4	Thermal 5
Flight suit (29.9)	Flight suit (18.4)	Gloves (20.8)	Gloves (18.8)	Gloves (17.6)
Anti-exp. suit (25.6)	Flight jacket (17.0)	Flight suit (19.5)	Boots (18.6)	Helmet (16.4)
Flight jacket (15.4)	Boots (15.5)	Boots (16.4)	Helmet (15.0)	Boots (16.3)
Boots (9.3)	Anti-exp. liner (15.3)	Flight jacket (16.3)	Flight jacket (14.4)	Flight jacket (14.0)

Grouping by aircraft communities, the fixed-wing/non-tactical and rotary-wing communities listed flight gloves, whereas tactical jet aircraft aviators differed by selecting anti-exposure suit liners as a priority item for thermal protection (Table 23).

Table 23. ALSS Equipment Priorities with Respect to Thermal Protection by Aircraft Communities.

Priority	Fixed-Wing/Non-Tactical	Rotary-Wing	Tactical Jet
1	Flight suit	Flight suit	Anti-exposure coverall
2	Flight jacket	Flight jacket	Flight suit
3	Flight boots	Anti-exposure coverall	Anti-exposure liner
4	Flight gloves	Flight boots	Flight jacket
5	Anti-exposure coverall	Flight gloves	Flight boots

When grouped by gender, the same items were chosen for thermal protection (flight jacket, flight suit, anti-exposure suit, flight boots). Women additionally chose flight gloves while men listed the anti-exposure liner as items deserving the most attention related to thermal protection.

Respondents were allowed to write-in items as they saw fit (Appendix C). Some of the write-in items included HEED bottles, "crashworthy" seats, cold-weather boots, NVGs, and body armor.

Aviator's experiences with AMSOs and the FAILSAFE Tiger Teams were also solicited in this section (Table 24). Overwhelmingly, the responses showed that the resource was either not used or of no benefit. Of those that had contacted their AMSO, 62.3% stated that the AMSO was helpful. Nearly 6% of all participants did not know what an AMSO was or what they did. Over 37% of respondents had not heard of the Tiger Teams. These percentages were similar when grouped by aircraft type, gender, or designator.

Table 24. Responses to Questions Pertaining to AMSOs and FAILSAFE Tiger Teams.

Question	Yes (%)	No (%)	Other
Contacted your AMSO?	29.0	64.4	
Were they helpful?	62.3	32.1	13.6% don't need to 5.8% don't know what it is
Received help from Tiger Teams?	3.0	57.6	37.5% don't know what it is

### SECTION 3

Of the respondents completing this section about UCDs, 73.2% have flown extended missions requiring UCDs, and nearly 81% of them had used UCDs (Table 25). As seen in Table 25, some respondents had used more than one type of UCD. The relief tube was used most often (52.9%). Other items aircrews used as UCDs during flight were soda cans/drink bottles/paper cups (36.4%), sandwich bags/FOD (16.5%), urine containers/honey pots (15.7%), and stand-up urinals (12.4%).

Table 25. Percentage of Respondents who Have Used UCDs and Type Used.

Respondents	UCD Use	O-B Toilet <sup>†</sup>	Relief Tube	Piddle Pack	ACD <sup>††</sup>	Other
Overall	80.4	33.5	52.9	24.6	1.5	9.2
Women	63.8	56.8	31.8	11.4	6.8	18.2
Men	81.3	32.5	53.7	25.0	1.3	8.9
Fixed-Wing/Non-Tactical	92.3	67.2	36.9	10.7	0.9	10.6
Rotary-Wing	72.5	7.5	81.7	14.9	1.6	10.6
Tactical Jet	75.2	8.7	27.8	77.4	3.0	3.5

<sup>†</sup> On-board toilet.

<sup>††</sup> Absorbent containment device.

Aviators were asked to rate six UCDs with respect to their acceptability (1 being lowest and 5 being highest) as an interim and long-term fix (Table 26). Mean scores were determined for all respondents, aircraft platform, and gender. Gender-modified relief tubes were the only UCDs to receive high marks from the aviation community (interim, 3.7 and long-term, 3.8 out of 5). Gender-modified piddle packs also received high marks (interim and long-term 3.2 out of 5); these UCDs, however, also received several 1s (unacceptable) as interim and long-term options.

Problems were listed for several of the UCDs. Listed most often were clogging, leaks and spills, overflowing, and difficulty using the UCD due to restraint harnesses, clothes, and turbulence (Table D1).

Table 26. Mean Acceptability Scores for All Listed UCDs.

Respondents	ACD		Catheter		Cup /Drain		Cup w/o Drain		Relief Tube		Piddle Pack	
	Int*	L-t**	Int	L-t	Int	L-t	Int	L-t	Int	L-t	Int	L-t
Overall	1.4 <sup>†</sup>	1.2	1.3	1.2	1.6	1.5	2.2	2.2	3.7	3.8	3.2	3.2
Women	1.9	1.5	1.3	1.3	1.9	1.7	2.7	2.6	3.4	3.4	3.3	3.1
Men	1.3	1.2	1.3	1.2	1.6	1.5	2.2	2.1	3.7	3.8	3.2	3.2
Fixed-Wing/ Non-Tactical	1.4	1.2	1.3	1.2	1.6	1.5	2.1	2.1	3.3	3.4	2.8	2.8
Rotary-Wing	1.3	1.2	1.3	1.2	1.7	1.6	2.3	2.3	4.1	4.2	3.1	3.0
Tactical Jet	1.5	1.3	1.4	1.4	1.6	1.5	2.1	2.0	3.4	3.4	4.2	4.0

\* Int represents interim fix.

\*\* L-t represents long-term fix.

<sup>†</sup> Mean scores are out of a maximum of 3.

*By gender.* When analyzed by gender, 63.8% of women surveyed had used UCDs, primarily on-board toilets (56.8%) and relief tubes (31.8%). Eighty-one percent of surveyed men had used a UCD in the aircraft. Of the men using a UCD, the relief tube was used most often (53.7%). Seventy-two percent of women and nearly 39% of men felt that a gender-specific UCD would be beneficial in their aircraft. Women and men agreed on the gender-modified relief tube as their first choice for a UCD (Table 26). Their second choice was the piddle pack. It should be noted, however, that the piddle pack was the first choice in the tactical jet community.

The methods women used most often to deal with urination during flight were "holding it" (42.3%), dehydration (26.9%), on-board toilets (7.7%), and paper cups (5.8%) (Appendix D). Men dealt with the need to urinate by using piddle packs (18.7%), "holding it" (18.6%), relief tubes (13.4%), and making a "head call" prior to flight (9.1%). Women aviators suggested gender-specific relief tubes/privacy curtains 34.3% of the time as a solution to current UCD problems (Appendix D). Other suggestions were piddle packs and flushable toilets (17.1%), diapers (i.e., ACDs) (8.6%), and on-board toilets and gender-specific equipment (5.7%). Men's suggestions for UCD development included bigger relief tubes with longer hoses (60.9%), piddle packs (20.8%), flushable toilets (8.3%), and on-board toilets (3.6%).

*By type.* Over 92 percent of fixed-wing/non-tactical personnel who responded have used UCDs. These were predominately on-board toilets (67.2%), relief tubes (36.9%), piddle packs (10.7%), ACDs (9%), and other (10.6%). A need for a gender-specific UCD was shown in 47.4% of the surveys. The gender-modified relief tube received the only positive response from the fixed-wing/non-tactical community (Table 26). Piddle packs modified for gender received a fair amount of positive responses as well.

The majority of the fixed-wing/non-tactical community is able to use on-board toilets (30.1%), while others dealt with urination by "holding it" (16.6%), relief tubes (11.0%), and portable urinals (7.4%). Dehydration, piddle packs, and using the bathroom prior to flight were each listed by 6.7% of the respondents (Table D2). Fixed-wing/non-tactical flyers suggested modified relief tubes and privacy curtains 36.5% of the time (Table D3). Other suggestions were flushable toilets (29.4%), on-board toilets (11.8%), and piddle packs (10%).

Among the rotary-wing community, 72.5% have used UCDs (Table 25). Relief tubes were used most often in rotary-wing aircraft (81.7%) (Table D1). When asked specifically if there was a need for a gender-specific UCD in *their* aircraft, nearly 39% felt there was. The gender-specific relief tube was moderately acceptable for both an interim (4.1) and long-term (4.2) device (Table 26).

The rotary-wing personnel dealt with urination during flight by landing in a field (25.4%), followed by "holding it" (22.5%), relief tubes (15.8%), and using the restroom prior to flight (9.1%) (Table D1). Suggestions for a better

UCD included modifying the relief tube with a bigger funnel, longer hose, or gender-modification device (78.3%). Privacy curtains were also suggested to allow use of the relief tube in a mixed-gender cockpit (Table D3).

A large majority (75.2%) of the tactical jet community has used UCDs (Table 25). The piddle pack was used most often (77.4%) by tactical jet aviators. Thirty-nine percent of the tactical jet respondents felt that a gender-specific UCD would be helpful in the aircraft. The tactical jet community gave the highest marks to the gender-specific piddle pack for both an interim (4.2) and long-term (4.0) device (Table 26). The relief tube also received positive performance ratings from these aviators.

Suggestions from the tactical jet community included a better relief tube (48.3%), a better piddle pack (45.5%), and a UCD incorporated into the seat (1.4%) (table D3). Currently, these aviators are using piddle packs most often to deal with urination (53.0%) (Table D1). Other urination methods utilized were "holding it" (17.9%), dehydration (8.6%), using the bathroom prior to flight (7.9%), and relief tubes (7.3%).

## DISCUSSION

The AMELIA questionnaire was designed and implemented to reach as many aviators as possible. The plan to continue surveying for 4 years was based on the mandatory physiology and water survival training that all aviators must go through every 4 years. A limitation with this type of longitudinal study is that some of the data are outdated due to design change implementations. For example, the MEAFFS flight suit, often referred to as the "new" flight suit in the survey, had all ready been redesigned prior to the conclusion of this report.

A second limitation of this study was the compliance among participants in completing the questionnaire. Often, at least one page of the questionnaire was left blank. Some questionnaires were blank except for page one (the demographics information page). Still others were inaccurately completed. An example of this is a respondent who stated that she was a 22-year-old pilot holding the rank of commander. Women appeared reluctant to answer any questions negatively and, therefore, this may have biased their responses. Participants did not identify specific nomenclature in the spaces provided for the equipment they were ranking. Certain items such as the flight suit, jacket, oxygen mask, and helmet have various models in use. Without listing a model number, only an overall score for the gear could be determined. Lastly, it appeared that the respondents were not adequately briefed on how to complete the questionnaire. This assumption is based on several respondent comments concerning the table on page four as being too hard to understand or not being user-friendly. An inadequate brief would explain why so many questionnaires were inappropriately completed in one or more of the sections.

### SECTION 1

The scores assigned to each ALSS item did not coincide with the written comments by the respondents. For example, respondents included negative comments regarding the new (MEAFFS) flight suits yet the flight suit's mean fit and overall performance rating is higher than the median. More definitive results were not possible because participants did not list specific model numbers.

Historically, flight suits, helmets, and anti-exposure suits have had fit problems. For the individuals who do not fit properly in ALSS equipment, custom fitting is available. Flight suits, flight boots, torso harnesses, oxygen masks, and helmets can all be custom fit for the hard-to-fit aviator. Although this option is available, at least half of those persons surveyed did not know of its existence.

A major complaint of the aviation community was the difficulty attaining certain sizes and replacement gear. Often, the proper size is not available in the supply system and must be open purchased. Another problem is the inability to attain two sets of gear or a replacement for worn out gear. One aviator gave an example of this regarding the replacement of his only pair of worn out boots; he was unable to keep his old boots while breaking in the new boots from supply. This lead to several days of painful, blistered feet for this aviator.

### SECTION 2

The results from section 2 were affected by the low response rate among participants. Another problem with the results in this section was the improper completion of the table. Participants often did not prioritize five items.

Instead, they rated every piece of equipment listed with a priority level. In these cases, there could be four items given a priority of 5 and no items listed as the top priority (i.e., 1).

The percentage of respondents that did not know of an AMSO or the Tiger Teams was excessive. The acronym AMSO was not defined in the questionnaire; this may have elicited some confusion among respondents. Also, there are many air wings that do not have specific AMSO support assigned to them. These facts, however, cannot explain all of the negative responses. The aerospace physiology community is not providing a service to naval aviation if aviators do not know what an AMSO is or what this person does. The AMSO can provide a wealth of information and services to the wing or squadron. Information on the role of the AMSO and the FAILSAFE Tiger Teams needs to be provided to the aviation community in order for these aviation personnel to be aware of their resources.

### SECTION 3

This section was also affected by the low response rate among participants. Those who completed the questionnaire listed a variety of UCDS. The respondents did not like the choices given for interim and long-term UCDS. In fact, the only items receiving higher than median marks were the gender-specific relief tube and piddle pack. Respondents overwhelmingly suggested improving devices that are currently in use, particularly the relief tube and piddle pack. Upgrades in on-board toilets were also suggested.

Several aviators listed dehydration as a method of dealing with the problem of urination while in flight. This method is detrimental to the aircrew's flight performance. Dehydration decreases plasma volume, peripheral blood flow, stroke volume, and circulatory and thermoregulatory efficiency, while increasing heart rate (McArdle, Katch, and Katch, 1996). In dehydrated aviators, these physiological changes are implicated in a reduction in G-tolerance (Dehart, 1986; Reinhart, 1996). These cardiovascular changes are accompanied by a reduction in skeletal muscle endurance (Montain et al., 1998) and deterioration in mental function (Gopinathan, Pichan, and Sharma, 1988). There have also been documented increases in renal stones in military aviators when compared to age and gender-matched controls. (Clark, 1990).

### CONCLUSIONS

According to the AMELIA survey, current ALSS gear fits slightly better than okay. The exception was the anti-exposure suit, which fit poorly. Aircrew's perceptions of ALSS performance were moderately high. It was also determined that approximately 81% of aircrews have used UCDS. According to the survey, interim and long-term solutions for UCD problems can be solved by gender-modified relief tubes and piddle packs.

The written comments from aviators conflicted with the "fit" and "performance" ratings assigned to the gear, however, the anecdotal comments clearly expressed their desires. They are looking for comfortable streamlined gear. The bulkier and more uncomfortable the gear, the harder it is for them to perform their duties.

An overlying problem with attaining properly fitting gear appears to be a supply issue. Aviators want increased availability of gear. The gear needs to be available in the supply system for these persons to replace worn equipment and to attain the proper size.

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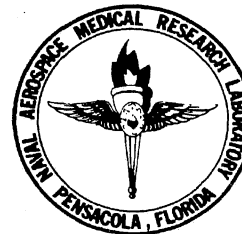
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**APPENDIX A**

**Aviation Life Support Systems Survey**

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## Aviation Life Support Systems Survey

This survey is designed to collect information on function, compatibility, and fit of various items of Aviation Life Support Systems (ALSS). Please take a few moments to complete this brief questionnaire and return it before you leave today. This survey is a very important step in identifying deficiencies in current sizes, and projecting future ALSS needs. The results will be used solely for purposes of ALSS improvements. If you would like a summary of survey results please include your current mailing address at the bottom of the last page.

### PRIVACY ACT

Authority to request this information is granted under Title 5, U.S. Code 301, and Department of the Navy Regulations. License to administer this survey is granted under OPNAV Report Control Symbol: 13520-1 which expires 31 October 1997. Personal identifiers will be used only to match any previous survey information

**PURPOSE:** The purpose of this questionnaire is to collect information on function, compatibility, and fit of various items of Aviation Life Support Systems (ALSS).

**ROUTINE USES:** The information provided in this questionnaire will be analyzed by the Naval Aerospace Medical Research Laboratory (NAMRL). The data files will be maintained by the Navy Personnel Survey System at Navy Personnel Research and Development Command where they may be used for determining changing trends in the Navy.

**ANONYMITY:** All responses will be held in confidence by NAMRL. Information you provide will be considered only when statistically summarized with the responses of others, and will not be attributable to any single individual.

**PARTICIPATION:** Completion of this questionnaire is entirely voluntary. Failure to respond to any of the questions will NOT result in any penalties.

-----

Name (Optional) .....	1. _____
Rank .....	2. _____
Designator (e.g., Pilot, NFO, Aircrew, FS) .....	3. _____
Date of Designation .....	4. _____
Total Flight Hours .....	5. _____
Type of Aircraft Currently Flying.....	6. _____
Squadron/Command (Optional) .....	7. _____
Gender .....	8.   o female                   o male
Age .....	9. _____
Height .....	10. _____
Weight .....	11. _____

Please answer all questions for all pieces of aviation life support equipment you currently wear. If you check "Δ" for any response, please amplify on the following page.

	Type*	Size	Are you aware of custom fit availability?		How does this item fit?			Does this item interfere with pre/post/in-flight duties?		Would a wider range of sizes be beneficial to you?		Is this item incompatible with other ALSS items?		Has this item been modified?		On a scale of 1-5 (5=good) rate the overall fit of this item.
			Yes	No	poor	OK	well	Yes	No	Yes	No	Yes	No	Yes	No	
Flight Suit	___	___	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	___
Flight Jacket	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Flight Boots	___	___	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Flight Gloves	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Torso Harness	___	___	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Integrated Torso	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
SV-2 Survival Vest	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Anti-G Suit	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Oxygen Mask	___	___	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Helmet	___	___	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Anti-exposure Suit	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___
Anti-exposure liner	___	___			<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	___

\*Type refers to the specific designation of each particular item listed (e.g., CWU-27/P for flight suit, MBU-5 for an Oxygen Mask, or CSU-13B/P for a G-suit). These designations can usually be found on a label attached to the particular item, or your Parachute Rigger can be consulted.

**Use this sheet to further expand upon questions from previous page which you made checks on "Δ." Also, use this page to discuss any other fit problems you may have with any item of aviation life support systems. \*\*\*Use other side of this sheet if more space is needed\*\*\***

1. Flight Suit
  
2. Flight Jacket
  
3. Flight Boots
  
4. Flight Gloves
  
5. Torso Harness
  
6. Integrated Torso
  
7. SV-2B
  
8. Anti-G Suit
  
9. Oxygen Mask
  
10. Helmet
  
11. Anti-exposure Suit
  
12. Anti-Exposure Liner
  
13. OTHER

Prioritize the problems you have with the ALSS items discussed in this survey on the basis of safety, survivability, thermal protection, and comfort. Place numbers 1-5 in each column corresponding to the top five problem items (1 being highest priority needing attention). \*\*\*See example\*\*\*

**NOTE: Only rank 5 items per column**

\*\*\*\*\*TABLE EXAMPLE\*\*\*\*\*

	SAFETY	SURV	THERMAL	COMFORT
Fit suit	1	5	1	5
Jacket	4		2	
Gloves		4		
G-suit	3	2	2	4
Helmet			4	3
Mask	5	1		2
Other: arctic boot	2	3	5	1

**EXAMPLE**

For SAFETY column the Flight Suit was determined to be the number 1 priority, the arctic boot the number 2 priority, anti-g suit the number 3 priority, Flight Jacket the number 4 priority, and the Oxygen Mask the number 5 priority.

	SAFETY	SURVIVABILITY	THERMAL	COMFORT
<b>FLIGHT SUIT</b>				
<b>FLIGHT JACKET</b>				
<b>HELMET</b>				
<b>ANTI-G SUIT</b>				
<b>GLOVES</b>				
<b>BOOTS</b>				
<b>ANTI-EXPOSURE COVERALL</b>				
<b>ANTI-EXPOSURE LINER</b>				
<b>OXYGEN MASK</b>				
<b>TORSO HARNESS</b>				
<b>INTEGRATED TORSO</b>				
<b>SURVIVAL VEST</b>				
<b>URINE COLLECTION DEVICE</b>				
<b>Other:</b>				
<b>Other:</b>				
<b>Other:</b>				

Comments:

1. Have you contacted your local AMSO about fit problems? Have they been helpful? Why/why not?
2. Has the FAILSAFE Tiger Team helped you with your fit problems? How?

## URINE COLLECTION DEVICES

**This next page deals with Urine Collection Devices. Many complaints have been received about absence of, or difficulty in using Urine Collection Devices in naval aircraft. Please take a few moments to present your feelings and desires in this area. (use reverse side of this page, if more room is needed)**

1. Do you fly extended missions where a urine collection device would be of benefit? o yes  
o no
- 1a. What type of missions? \_\_\_\_\_
- 1b. How long are these missions? \_\_\_\_\_
2. Have you ever had occasion to use a urine collection device in flight? o yes o no
- 2a. What type of device was it? o on board toilet  
o relief tube  
o "piddle pack"  
o absorbent containment device  
o other: \_\_\_\_\_
- |   |               |                |
|---|---------------|----------------|
| 2b. Describe any problems encountered while using any of the devices in 2a. | <u>device</u> | <u>problem</u> |
|   | _____         | _____          |
|   | _____         | _____          |
3. Would the development of a gender specific urine collection device be of benefit in your aircraft? o yes  
o no
4. Rate the following type of devices on an acceptability scale (i.e., would you use it in the aircraft on extended missions)—Place a number in each of the 12 boxes below.

interim fix	long-term fix	Not acceptable.....acceptable 1.....2.....3.....4.....5
<input type="checkbox"/>	<input type="checkbox"/>	a. Absorbent containment device (e.g., diaper)
<input type="checkbox"/>	<input type="checkbox"/>	b. Internal urinary collection tube (catheter)
<input type="checkbox"/>	<input type="checkbox"/>	c. Externally applied (with adhesive) collection cup; no drain
<input type="checkbox"/>	<input type="checkbox"/>	d. Externally applied (with adhesive) collection cup; with drain adapted for relief tube hook-up
<input type="checkbox"/>	<input type="checkbox"/>	e. Relief tube/Gender modified relief tube
<input type="checkbox"/>	<input type="checkbox"/>	f. Piddle pack/Gender modified piddle pack

5. What type of urine collection device would you like to see incorporated into your aircraft, or as part of issued aviation life support?
- \_\_\_\_\_
- \_\_\_\_\_

6. How are you dealing with this problem now?
- \_\_\_\_\_
- \_\_\_\_\_

## COCKPIT/CREWSTATION DESIGN PROBLEMS

We would like you to give us some feedback on problems you may be having regarding cockpit/crewstation design. During your next few flights, think about any problems you may have due to the way your cockpit/crewstation is designed. Examples of these type of problems would be: reaching something while strapped in; physically turning a switch, pulling a handle, raising a seat, etc.; seeing something inside or outside the aircraft; or any other problems that would necessitate redesign as a fix. Please use as much space as you need to describe these problems. (Comments for this section need not be restricted to the current aircraft you fly)

Your input here is vital if future aircraft are to be designed to accommodate a wider range of aviators. Please return this questionnaire in the envelope provided. Thank you very much for your participation.

-----  
Tear sheet for result feedback.

If you wish this survey to be anonymous but want us to send you a summary report, tear this sheet off and mail back separately.

**COMMANDING OFFICER  
NAVAEROMEDRSCHLAB  
CODE 23  
51 HOVEY ROAD  
PENSACOLA FL 32508-1046**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

**APPENDIX B**

**ALSS Survey Tally Sheets:**

**Flight Suit**  
**Flight Jacket**  
**Flight Boots**  
**Flight Gloves**  
**Torso Harness**  
**Integrated Torso Harness**  
**SV-2B**  
**Anti-G Suit**  
**Oxygen Mask**  
**Helmet**  
**Anti-Exposure Suit**  
**Anti-Exposure Liner**  
**Females**

Intentionally blank.

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Flight Suit	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Breast pockets inaccessible during flight	621	158	193	270	420	72	129
2	Bring back shroud cutter pocket	289	66	79	144	164	41	84
3	Reinforce crotch stitching	262	69	120	73	175	37	212
4	Zipper tabs break easily	251	81	67	103	160	28	63
5	Uncomfortable under G-suit	162	58	40	64	85	18	59
6	Heavier material in seat needed	136	26	60	50	86	15	45
7	Poor supply (supply system)	126	26	41	59	85	14	27
8	Need FOD flap	113	26	34	53	71	9	31
9	Wrist needs more flexibility	53	20	17	16	17	13	23
10	Need separate male/female	42	15	14	13	16	9	17
11	Patches are burn hazard	41	12	11	18	23	5	10
12	Desert suits fit poorly	30	10	10	10	18	2	10
13	Poor pocket position (old suit)	20	5	8	7	10	4	6
14	Need cushioned kneepads	19	10	7	2	8	4	7
15	Zipper on lower leg falls across knee when kneeling	18	3	7	8	2	2	14
16	Missing inner thigh pocket	18	2	5	11	9	2	7
17	New suit pockets useless	16	7	6	3	6	5	5
18	New suit poor quality	15	9	5	1	3	9	3
19	New suit side zippers useless	12	3	0	9	8	0	4
20	New suit cargo pockets too deep	12	3	4	5	6	0	6
21	Prefer older style to new style	8	3	3	2	5	0	3
22	New suit missing thigh pockets	6	3	2	1	5	0	1
23	New suit fits poorly	6	3	2	1	2	2	1
24	Need three weights: light, normal, winter	5	2	2	1	1	2	2
25	Need more sizes	5	1	3	1	1	1	3
26	New suit pocket flap catches	4	1	2	1	1	0	3
27	New suit too short in crotch	3	1	1	1	2	0	1
28	Wears out too easily	3	1	1	1	0	1	2
29	Seams rip/Poor stitching, thread	1	1	0	0	1	0	0
30	Too small for big or tall person	1	0	0	1	1	0	0
31	New suit baggy in hip & crotch	1	0	0	1	0	0	1

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Flight Jacket	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Leather jacket needs a removable liner	82	33	22	27	38	20	22
2	Need 'bi-swing'on nomex	74	20	38	16	30	13	31
3	Water proof	65	18	24	23	34	14	17
4	Winter jacket needs lining	37	9	17	11	27	6	4
5	Integrate low-profile hood into collar	36	11	12	13	25	0	11
6	Snag hazard	31	9	13	9	17	9	5
7	Winter jacket needs collar lining	28	9	11	8	18	7	3
8	Difficult to don/take off in flight	14	2	7	5	7	2	5
9	Leather jackets need a place for earplugs	14	6	1	7	9	1	4
10	Summer jacket needs lining	13	10	2	1	9	3	1
11	Needs FOD flap	13	1	7	5	9	0	4
12	Summer zippers bad	12	4	2	6	9	1	2
13	Issue both winter/summer	10	3	2	5	4	0	6
14	Sleeves are too short	9	2	3	4	7	1	1
15	Jacket too short when seated (torso size)	9	4	2	3	2	2	4
16	More sizes needed	7	0	4	3	5	0	2
17	Difficult to fit under SV-2, other equipment	6	1	3	2	3	0	3
18	Poor quality (seams tear, etc.)	5	1	3	1	2	0	1
19	Need summer and winter versions	5	1	3	1	4	0	0
20	Leather jacket should have side hand pockets	5	0	2	3	1	0	4
21	Winter jacket too bulky	3	1	1	1	0	1	2
22	Doesn't fit/work well in cockpit	2	1	1	0	0	2	0
23	Need larger sizes	2	2	0	0	1	1	0
24	Poor fit	2	0	2	0	0	0	2
25	Poor supply	1	0	0	1	1	0	0
26	Restricts movement	1	0	0	1	0	0	1

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Flight Boots	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Need more custom sizes (widths)	109	28	48	33	55	17	36
2	Uncomfortable	58	15	20	23	34	7	17
3	Steel toes uncomfortable in extreme cold/hi-alt	54	11	15	28	36	3	16
4	Need waterproofing	53	10	17	26	28	5	20
5	Too heavy	50	15	15	20	30	5	13
6	Too stiff	48	12	21	15	24	8	16
7	Need two pairs issued	28	10	8	10	19	4	5
8	Lighter weight boot needed	25	11	5	9	12	6	7
9	Better arch support	19	7	3	9	9	4	4
10	Need softer soles	16	1	8	7	8	1	7
11	Leather strap at base of steel toe uncomfortable	16	4	3	9	11	1	4
12	Need lace flap	12	3	3	6	7	3	2
13	Size not compatible with anti-exp	11	3	5	3	7	1	3
14	Side rips out easily	11	5	2	4	4	3	4
15	Size imprint wears off	9	2	4	3	5	1	3
16	Air vents needed	9	2	4	3	4	1	4
17	Need lining	6	0	1	5	4	4	1
18	Poor supply	6	1	2	3	4	0	2
19	Need winter version	5	3	2	0	4	0	1
20	Need better soles (insert)	4	2	1	1	2	2	0
21	Need better traction	3	1	0	2	2	0	1
22	Sole too wide-interfere with pedals	3	1	1	1	3	0	0
23	Too stiff in ankle/poor rudder pedal "feel"	3	1	1	1	2	0	1
24	Speed laces needed	3	0	2	1	1	1	1
25	Need desert style	2	1	0	1	2	0	0
26	Poor construction/quality	2	0	0	2	0	0	2
27	Scratch too easily	2	0	0	2	1	0	1
28	Need toe joint (for extended kneeling)	2	0	0	2	2	0	0
29	Laces need to be longer	2	0	1	1	2	0	0

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Flight Gloves	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Poor fit in fingers	83	15	31	37	34	5	44
2	Poor dexterity	55	34	9	12	31	13	11
3	Seams fall apart too easily	54	10	16	28	16	3	35
4	Separate gloves needed for preflight	26	11	3	12	11	8	7
5	Gloves too thick for sense of touch	25	4	13	8	7	2	16
6	Fingers tear too easily	24	7	5	12	12	1	11
7	Poor fit in fingers	23	6	8	9	12	0	11
8	Poor supply	22	5	7	10	12	3	7
9	Need longer fingers	21	2	10	9	11	2	8
10	Winter version needed	21	11	6	4	7	7	7
11	Heavy duty gloves needed	21	2	9	10	8	3	10
12	Gloves get hard after getting wet	18	8	6	4	5	5	8
13	Tank glove replacement inadequate	18	5	6	7	7	5	6
14	Fingertips interfere with fittings (parachute, harness, etc)	18	5	2	11	12	2	4
15	More sizes needed	16	2	5	9	9	0	7
16	Poor durability	11	3	4	4	8	0	3
17	Difficult to use switches	11	4	4	3	8	1	2
18	Gloves too wide for finger length	8	0	4	4	2	1	5
19	More flexibility needed	6	1	2	3	6	0	0
20	Prefer British leather gloves	6	2	2	2	5	0	1
21	Seamless fingertips needed	1	1	0	0	1	0	0
22	Need white gloves for signaling	1	0	0	1	1	0	0
23	Prefer British leather gloves	1	1	0	0	0	1	0

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Torso Harness	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Difficult to adjust	38	25	11	2	21	11	6
2	Interferes with preflight	33	25	5	3	19	10	5
3	Need velcro thigh straps	17	10	5	2	8	3	6
4	New release mechanism for quick ejector needed	14	14	0	0	12	1	1
5	Added snaps to hold O2 mask	10	8	1	1	7	2	1
6	Restricts movement	10	7	2	1	5	3	2
7	Very uncomfortable	9	6	2	1	4	2	3
8	Poor sizing/fit	4	3	1	0	4	0	0
9	Difficult to put on	4	3	0	1	4	0	0
10	Not compatible with anti-exposure suit	2	1	1	0	2	0	0
11	Too bulky	2	2	0	0	1	1	0
12	Switch to USAF model	2	2	0	0	2	0	0
13	Longer chest strap needed	1	1	0	0	1	0	0
14	Poor availability	1	1	0	0	1	0	0

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Integrated Torso Harness								
	Comment	Total	Jet	Prop	Helo	Pilot	NFO	AC	
1	Difficult to put on/off	16	10	3	3	11	3	2	
2	Velcro comes undone	8	7	1	0	4	4	0	
3	Still need SV-2 for survival gear	8	4	4	0	4	4	0	
4	Excess hanging straps	7	7	0	0	6	1	0	
5	Leg straps too wide	6	4	2	0	5	0	1	
6	Not enough room for add-ons	6	5	1	0	4	2	0	
7	Poor fit	3	2	0	1	2	1	0	
8	Too bulky	3	3	0	0	2	1	0	
9	Switch to USAF type	2	0	0	2	0	0	2	
10	Custom fit needed	2	2	0	0	2	0	0	
11	Zipper pops out	2	2	0	0	2	0	0	
12	Need adapter for anti-exposure suit	2	2	0	0	2	0	0	
13	Modify harness for OBOGS	1	1	0	0	1	0	0	

## ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	SV-2	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Too heavy	427	75	79	273	227	28	122
2	Poor fit	165	23	56	86	83	14	64
3	Bulky	132	6	8	118	98	3	31
4	Interferes with preflight	112	5	10	97	74	4	34
5	Poor equipment position	78	6	13	59	24	8	46
6	HEEDS bottle interferes with movement	76	30	21	25	45	10	21
7	Doesn't fit over winter jacket	58	5	10	43	42	0	16
8	Flashlight too cumbersome	35	0	3	32	27	0	8
9	Neck lobe straps interfere with parachute risers	20	0	10	10	10	4	6
10	More sizes needed	20	0	6	14	12	3	5
11	Incompatible with chest armor	19	1	8	10	10	5	4
12	Need SV-2 fitted with expansion flap (anti-exposure suit, suit)	17	3	3	11	15	0	2
13	Doesn't fit over anti-exposure suit	16	5	4	7	6	2	8
14	Want mesh jacket	15	1	3	11	10	0	5
15	Too much non-useful gear	15	3	5	7	6	3	6
16	Poor supply	13	1	0	12	10	0	3
17	Air Force version better	12	6	2	4	7	4	1
18	Too hot	11	0	0	11	9	0	2
19	HEEDS needs to be shorter	11	5	0	6	10	1	0
20	Need more room for pistol and ammo	10	8	0	2	8	2	0
21	Remove elastic on back for better fit	10	2	4	4	10	0	0
22	Difficult to operate zippers	10	4	2	4	7	0	3
23	Army vest better	9	4	4	1	4	0	5
24	Not enough space for flares	9	1	2	6	7	0	2
25	Integrate life raft	7	5	2	0	5	1	1
26	Rides over release on gunner's belt	7	3	2	2	6	1	0
27	OBOGS bracket shifts pocket	7	4	0	3	5	1	1
28	Tangles in perforated safety/seat belts	6	3	1	2	3	1	2
29	Lobes come loose under G-stress	6	0	5	1	0	1	5
30	Poor quality	5	0	0	5	4	0	1
31	Need more water use in-flight	5	0	1	4	3	0	2
32	Modified for OBOGS difficult to zip/unsat	4	0	0	4	4	0	0
33	Difficult to adjust leg straps	4	0	2	2	1	0	3
34	Lobes interfere with koch release	4	0	0	4	3	0	1
35	Chest strap too long/need more Velcro	4	0	0	4	4	0	0
36	Velcro ineffective (collar lobes)	4	0	2	2	0	2	2
37	Zipper stick	2	1	0	1	1	1	0
38	Straps can hang up on egress	2	0	2	0	0	2	0
39	Need climate-specific supplies	1	1	0	0	1	0	0
40	Integrate HEEDS bottle	1	1	0	0	0	1	0

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Anti-G Suit	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Need full body suit	28	26	2	0	20	8	0
2	Need lower back support	13	12	0	1	8	5	0
3	Need additional for anti-exposure suit	13	13	0	0	10	2	1
4	Might interfere with ejection	6	6	0	0	5	1	0
5	Poor stitching/bladder leaks	5	5	0	0	4	1	0
6	No quick adjustment feature	5	5	0	0	5	0	0
7	Material pills	4	4	0	0	4	0	0
8	Difficult to put on	4	4	0	0	2	2	0
9	Not compatible with anti-exposure suit	3	3	0	0	3	0	0
10	Incorporate leg restraints into suit	3	3	0	0	3	0	0
11	Need quicker inflate	3	3	0	0	2	1	0
12	Switch to USAF model	3	3	0	0	3	0	0
13	Poor fit	2	1	0	1	1	1	0
14	Need more sizes	2	2	0	0	2	0	0
15	Zippers go bad	2	2	0	0	1	1	0
16	Navy G-suit better than USAF	2	2	0	0	2	0	0
17	Left pocket can catch on power switch	2	2	0	0	2	0	0
18	Want/Need "Combat Edge System"	2	2	0	0	2	0	0
19	Bottom pocket too small	1	1	0	0	1	0	0

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Oxygen Mask	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Poor fit	125	90	35	0	85	32	8
2	Poor quality	42	9	33	0	23	7	12
3	Snap attachment to harness needed	39	24	15	0	26	13	0
4	Better placement for bayonet fittings needed	25	3	22	0	14	2	9
5	Poor comm/O2 integration	22	14	8	0	11	7	4
6	Incompatible with helmet	20	14	6	0	13	6	1
7	Not compatible with glasses	19	18	1	0	13	4	2
8	Smoke mask poor fit	16	13	3	0	11	3	2
9	Incompatible with headset	14	8	5	1	11	2	1
10	Poor fit - quick don	12	6	6	0	7	3	2
11	More sizes needed	11	7	2	2	11	0	0
12	Need quick-don capability	10	3	7	0	4	4	2
13	Seal leaks during G's	10	5	5	0	7	3	0
14	Straps need constant adjustment	10	7	3	0	6	4	0
15	Custom fit required	10	5	5	0	4	4	2
16	Quick don frame catches on switches	10	6	4	0	7	0	3
17	Restricts movements	8	4	4	0	6	0	2
18	OBOGS lower hose too long	7	7	0	0	7	0	0
19	Longer hose for longer seat height	7	6	1	0	5	2	0
20	Use USAF	5	5	0	0	4	1	0
21	Hose too stiff (bulky)	5	3	2	0	3	2	0
22	Comm cord interferes with koch fittings	4	4	0	0	4	0	0
23	Incompatible with helo helmet	3	3	0	0	3	0	0
24	Difficult to valsalva	3	1	1	1	3	0	0
25	Sweat collects and shorts mike	3	1	2	0	2	1	0
26	Uncomfortable	2	2	0	0	2	0	0
27	Restricts visibility (down)	1	0	1	0	1	0	0
28	Too heavy/bulky	1	0	1	0	1	0	0
29	Fog up	1	0	1	0	0	0	1
30	No headphones in mask (P-3)	1	1	0	0	1	0	0
31	Softer material or padding for sizing	1	1	0	0	1	0	0

ALSS Survey Tally Sheet (FY-95-97) NAMRL

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#	Helmet								
	Comment	Total	Jet	Prop	Helo	Pilot	NFO	AC	
1	Standardize helmets	250	58	93	99	142	36	72	
2	Chin strap uncomfortable	127	15	34	78	77	6	44	
3	Need eye protection with NVG	104	8	7	89	69	4	31	
4	Dual visors not compatible with oxygen mask	85	9	11	65	67	2	16	
5	New helmet HAS wire easily broken	71	13	25	33	49	10	12	
6	Make helmet warmer	58	12	18	28	42	1	15	
7	Need to discard NVG's to eject	52	5	7	40	34	3	15	
8	ICS communications difficult	49	12	11	26	31	5	13	
9	Need laser protection	45	15	9	21	29	9	7	
10	Not compatible with AR-5 gas mask	40	14	12	14	24	12	4	
11	UV visor needs better visibility (wider field of vision)	33	8	10	15	25	4	4	
12	Need USAF style	32	9	11	12	14	3	15	
13	Poor hearing protection	31	5	2	24	23	2	6	
14	Too heavy/bulky	26	4	12	10	13	2	11	
15	Hot spots	24	5	10	9	15	2	7	
16	Difficult to adjust in flight	23	6	4	13	22	1	0	
17	Poor molding	23	6	1	16	19	2	2	
18	Need custom fit (for all helmets)	22	2	0	20	14	2	6	
19	New helo helmet needs visor cover/change system	20	4	7	9	10	5	5	
20	Poor availability (supply, new helmet)	19	3	3	13	10	1	8	
21	New helmet not compatible with NVG	11	2	1	8	10	0	1	
22	New helmet poor fit	10	6	2	2	7	1	2	
23	Need better fitting ear cups	9	1	0	8	13	3	6	
24	Poor visibility with helmet	9	1	6	2	6	2	1	
25	Visors easily scratched	8	0	0	8	5	0	3	
26	Visor lifts off in wind stream	8	1	4	3	2	0	6	
27	Need tighter fit	8	3	2	3	4	2	2	
28	Uncomfortable	8	2	6	0	4	2	2	
29	Need more sizes	7	2	5	0	5	2	0	
30	Liner slips on new helmet	6	1	1	4	5	1	0	
31	NVG's shift under G-loads	6	0	2	4	4	0	2	
32	Difficult to preflight while wearing	5	0	1	4	5	0	0	
33	Need air-cooled helmet	5	0	2	3	4	1	0	
34	Pads fall out	3	2	0	1	3	0	0	
35	One prong pigtail system needed	2	0	0	2	2	0	0	
36	Poor construction	2	1	0	1	2	0	0	
37	New helo helmet too many parts (FOD)	2	1	1	0	2	0	0	
38	Cobra helmet attachments should run through one quick dis	1	0	0	1	1	0	0	
39	Visor should be UV protected	1	0	0	1	1	0	0	
40	More sizes needed (new helmet)	1	0	0	1	0	0	1	

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Anti-Exposure Suit	Total	Jet	Prop	Helo	Pilot	NFO	AC
	Comment							
1	Restricted movement, uncomfortable, bulky	431	225	89	117	334	84	103
2	Neck and wrist seals uncomfortable	197	60	24	113	136	33	28
3	Zipper painful on underarms and chest	113	70	11	32	76	22	15
4	Does not fit with other gear	87	47	18	22	59	14	14
5	Difficult to put on	51	14	28	9	26	7	18
6	Difficult to preflight with anti-exposure suit	39	9	8	22	23	5	11
7	Causes dehydration	26	10	3	13	21	4	1
8	Difficult to put on	26	8	9	9	17	5	4
9	More sizes needed	25	6	9	10	12	2	11
10	Need larger size	22	8	2	12	20	1	1
11	Incompatible with SV-2	20	5	4	11	9	4	7
12	Too big for small people/one size fit all	18	2	2	14	15	0	3
13	G-suit incompatible with anti-exposure suit	15	0	13	2	2	3	10
14	Sweat pools in bodies	15	5	7	3	8	1	6
15	Urination impossible (relief fly unusable)	14	7	2	5	11	1	2
16	Not functional in cold water environment	14	6	4	4	6	4	4
17	Difficult to wear boots with anti-exposure suit	13	6	2	5	8	2	3
18	Need CG dry suit	13	7	3	3	7	3	3
19	Seals leak	12	1	10	1	5	2	5
20	Gloves should be separable, attached with Velcro	11	2	3	6	5	4	2
21	Poor fit in shoulder due to zipper	9	3	0	6	7	0	2
22	USAF suit better	8	2	1	5	7	0	1
23	Use Brit/Swedish suit	7	1	1	5	3	0	4
24	Difficult to egress	6	4	1	1	6	0	0
25	Booties bunch	5	1	3	1	3	0	2
26	Poor dexterity with gloves on	4	4	0	0	3	0	1
27	Diagonal zippers more comfortable	4	2	0	2	4	0	0
28	Prefer five fingered glove	2	2	0	0	1	1	0
29	Booties wear out	2	1	1	0	1	0	1

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Anti-Exposure Liner								
	Comment	Total	Jet	Prop	Helo	Pilot	NFO	AC	
1	Uncomfortable/bulky	355	0	1	0	0	0	1	
2	Need longer sizes	73	27	7	39	49	11	13	
3	Restricts movement	37	20	2	15	26	4	7	
4	Size like flight suit	12	7	0	5	8	3	1	
5	Does not fit with other gear	10	3	3	4	8	1	1	
6	Tight	8	5	2	1	7	1	0	
7	Do not like short liner	6	4	0	2	6	0	0	
8	Go back to green mesh	4	0	2	2	2	0	2	
9	Needs to be one piece	4	3	0	1	3	1	0	
10	Need larger wrists	3	1	0	2	3	0	0	
11	Use wet suit	2	1	0	1	2	0	0	
12	Longer zipper needed to urinate easily	1	1	0	0	1	0	0	
13	Poor supply	1	1	0	0	1	0	0	

ALSS Survey Tally Sheet (FY-95-97) NAMRL

#	Females								
	Comment	Total	Jet	Prop	Helo	Pilot	NFO	AC	
1	Flight suit not made for female measurements	20	7	6	7	11	5	4	
2	Glove fingers are too long	14	0	7	7	9	4	1	
3	More boot sizes needed	14	5	3	6	8	3	3	
4	Flight suit requires disrobe for urination	14	2	4	8	11	1	2	
5	Helmet poor fit/hot spots	11	1	6	4	8	1	2	
6	Poor helmet molding	11	4	4	3	4	3	4	
7	Flight suit too long in the crotch	9	2	4	3	5	1	3	
8	More glove sizes needed	8	4	4	0	5	3	0	
9	Boots are too big	8	6	2	0	5	3	0	
10	SV-2 is bulky	7	1	2	4	6	1	0	
11	Oxygen mask poor fit/need quick don	7	3	2	2	2	3	2	
12	SV-2 is too big/poor fit	6	1	4	1	4	2	0	
13	Anti-exposure suit liner fits poorly	5	1	3	1	3	2	0	
14	Glove fingers rip open	5	2	1	2	1	3	1	
15	Anti-exposure suit is difficult to don	5	1	3	1	4	1	0	
16	Helmet hearing protection insufficient	5	0	2	3	4	1	0	
17	SV-2 Heeds bottle a cockpit hazard	5	1	2	2	2	2	1	
18	Anti exposure suit liner shrinks when washed	4	1	3	0	3	0	1	
19	O2 mask not easily compatible w glasses	4	2	2	0	2	1	1	
20	Anti-exposure suit too bulky	3	1	1	1	3	0	0	
21	Smaller size boots not readily available	3	0	1	2	2	1	0	
22	Oxygen mask is a poor fit	3	0	1	2	3	0	0	
23	Extra small sizes needed for jacket	2	0	0	2	2	0	0	
24	Anti-exposure suit shoulder zipper is uncomfortable	2	0	1	1	2	0	0	
25	Exposure fit neck fittings are uncomfortable	2	0	1	1	1	1	0	
26	Flight jacket needs more shoulder room	2	1	0	1	1	0	1	
27	Flight jacket too long	2	0	0	2	2	0	0	
28	Need anti-exposure suit with diagonal zipper	2	0	2	0	0	2	0	
29	Helmet ear pads press too hard	2	1	0	1	1	0	1	
30	Poor pocket placement on new suit	2	1	1	0	1	1	0	
31	Torso harness doesn't fit	1	0	0	1	1	0	0	
32	Glove fingers slick when wet	1	1	0	0	0	1	0	
33	Anti-exposure suit is too big/egress difficult	1	0	0	1	1	0	0	
34	O2 mask ICS hookup w helmet difficult	1	0	0	1	1	0	0	
35	Oxygen snap fittings awkward	1	0	0	1	1	0	0	
36	Anti-G suit fits poorly	1	0	0	1	1	0	0	

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**APPENDIX C**

**Write-in Items for Safety, Comfort, Survivability, and Thermal Protection.**

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Safety (no. of responses)	Comfort	Survivability	Thermal
HEED bottles (23)	HEED bottles (10)	HEED bottles (21)	Cold weather boot (12)
Crashworthy seats (14)	Crashworthy seats (6)	Crashworthy seats (15)	Cold weather glove (2)
Goggles/NVG's (9)	Body armor (4)	Body armor (6)	Thermal underwear (2)
Cold weather boot (7)	Cold weather boot (3)	Goggles/NVG's (5)	ECW gear (2)
Body armor (5)	Flight glasses (3)	Cold weather boot (4)	CSAR boots (1)
Parachute (5)	Goggles/NVG's (3)	Parachute (3)	Anti-exposure hood (1)
Restraint harness (3)	Lumbar support (2)	Restraint harness (3)	Desert boots (1)
Flight glasses (3)	Restraint harness (2)	Raft (2)	Desert flight suit (1)
ECW gear (2)	ECW gear (2)	ECW gear (2)	Desalination pump (1)
Raft (2)	Thermal underwear (2)	Flight glasses (2)	Headset (1)
Lumbar support (2)	Cold weather glove (2)	Controls (impalement) (1)	Crashworthy seats (1)
Cold weather glove (2)	Dry vest (1)	Desalination pump (1)	ICS incompatible w/O <sub>2</sub> (1)
Thermal underwear (2)	Adjustable seats (1)	Lumbar support (1)	
AR-5 (2)	Parachute (1)	Adjustable seats (1)	
Controls (impalement) (1)	Head set (1)	Head restraints (1)	
Dry vest (1)	OBOGS regulator (1)	Cold weather glove (1)	
Adjustable seats (1)	Anti-exposure hood (1)	Thermal underwear (1)	
PRC-90 (1)	CSAR boots (1)	Headset (1)	
ICS incompatible w/O <sub>2</sub> (1)	Desert boots (1)	AR-5 (1)	
OBOGS regulator (1)	Desert flight suit (1)	PRC-90 (1)	
Anti-exposure hood (1)		ICS incompatible w/O <sub>2</sub> (1)	
Desert boots (1)		Anti-exposure hood (1)	
Desert flight suit (1)		CSAR boots (1)	
		Desert boots (1)	
		Desert flight suit (1)	

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**APPENDIX D**

**Urine Collection Devices and Their Associated Problems.  
Methods of Dealing With Urination in the Aircraft.  
Suggestions for UCDs.**

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Table D1. Urine collection devices and their associated problems.

Device (No. of responses)	Problem	Total number/Percentage
Relief Tube (267)	Doesn't drain/clogged	152 (56.9%)
	Harness and clothes in way	31 (11.6%)
	Leaks/spills	21 (7.9%)
	Turbulence	9 (3.4%)
	Can't leave cockpit/hose too short	9 (3.4%)
	Not accessible	9 (3.4%)
Piddle Pack (112)	Leaks/won't seal/spills	34 (30.4%)
	Harness and clothes in way	31 (27.7%)
	Difficult to use	14 (12.2%)
	Overflows	12 (10.7%)
	Disposal	10 (8.9%)
Toilet (32)	Smells	8 (25%)
	Spills/leaks	7 (21.9%)
	Overflows	4 (12.5%)
	Must strip to use (no privacy)	4 (12.5%)
	Doesn't drain	2 (6.3%)
	Turbulence	2 (6.3%)
Urinal (22)	Leaks/won't seal/spills	12 (54.5%)
	Doesn't drain/clogged	4 (18.2%)
	Turbulence	2 (9.1%)
	Smells	2 (9.1%)
	Not sanitary	1 (4.5%)
	Overflows	1 (4.5%)
Urine Container (10)	Leaks/won't seal/spills	5 (50%)
	Smells	2 (20%)
	Turbulence	1 (10%)
	Overflows	1 (10%)
	Not sanitary	1 (10%)
MAF Bag (5)	Leaks/won't seal/spills	2 (40%)
	Disposal	2 (40%)
	Overflows	1 (20%)
Bucket (4)	Leaks/won't seal/spills	2 (50%)
	Disposal	1 (25%)
	Aim	1 (25%)
ACD (2)	Leaks/spills	2 (100%)

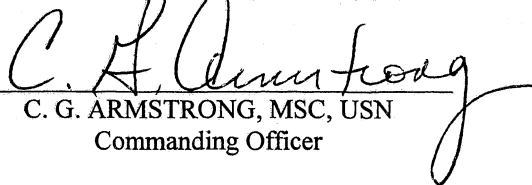
Table D2. Methods of dealing with urination in the aircraft.

Group	Methods of dealing with Urination in the aircraft	Percentage
Overall	“Hold it”	20.4%
	Piddle Pack	17.7%
	Land	13.8%
	Relief Tube	12.4%
	Pre-flight “head call”	8.5%
Women	“Hold it”	42.3%
	Dehydration	26.9%
	On-board Toilet	7.7%
	Paper Cup	5.8%
Men	Piddle Pack	18.7%
	“Hold it”	18.6%
	Relief Tube	13.4%
	Pre-flight “head call”	9.1%
Fixed wing/ Non-tactical	On-board Toilet	30.1%
	“Hold it”	16.6%
	Relief Tube	11.0%
	Portable Urinal	7.4%
	Dehydration	6.7%
	Piddle Pack	6.7%
	Pre-flight “head call”	6.7%
Rotary wing	Land the aircraft	25.4%
	“Hold it”	22.5%
	Relief Tube	15.8%
	Pre-flight “head call”	9.1%
Tactical jet	Piddle Pack	53.0%
	“Hold it”	17.9%
	Dehydration	8.6%
	Pre-flight “head call”	7.9%
	Relief Tube	7.3%

Table D3. Suggestions for UCDs.

Group	Suggestions	Percentage
Overall	Gender specific Relief Tube (bigger, longer hose, and/or privacy curtain)	59.4%
	Piddle Pack	20.5%
	Flushable Toilet	8.8%
	On-board Toilet	3.7%
Women	Gender specific Relief Tube (see Overall)	40.0%
	Piddle Pack	17.1%
	Flushable Toilet	17.1%
	ACD	8.6%
	On-board Toilet	5.7%
Men	Gender specific Relief Tube (see Overall)	60.9%
	Piddle Pack	20.8%
	Flushable Toilet	8.3%
	On-board Toilet	3.6%
Fixed wing/ Non-tactical	Gender specific Relief Tube (see Overall)	36.5%
	Flushable Toilet	29.4%
	On-board Toilet	11.8%
	Piddle Pack	10.0%
Rotary wing	Gender specific Relief Tube (see Overall)	78.3%
	Piddle Pack	14.6%
	Conic Collector w/flexible hose	1.4%
	Flushable Toilet	1.0%
	Plastic Urinal	1.0%
	ACD	1.0%
Tactical jet	Gender specific Relief Tube (see Overall)	48.3%
	Piddle Pack	45.5%
	UCD Incorporated into seat	1.4%

Reviewed and approved 07 Feb 00

  
C. G. ARMSTRONG, MSC, USN  
Commanding Officer



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# REPORT DOCUMENTATION PAGE

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13. ABSTRACT ( <i>Maximum 200 words</i> )  Aviation life support systems (ALSS) equipment is a critical and essential component for mission success in naval aviation. Anecdotal comments by naval aircrews have indicated that ALSS equipment is perceived as ill-fitting and substandard. Additionally, many aircrews in naval aviation are not satisfied with current urine collection devices (UCDs). The Aircrew Modified Equipment Leading to Increased Accommodation (AMELIA) survey was completed by 2,055 U.S. Navy and Marine Corps aircrew. The sample population included 85 women and 1,970 men. According to the survey results, ALSS equipment appears to fit slightly better than "ok" in all but the anti-exposure suit. The overall performance of current ALSS was rated slightly above the median with the exception of the anti-exposure suit (rated below the median). Aircrews identified the flight suit as the number-one priority with respect to safety, thermal protection, and comfort. The helmet was identified as the number-one priority item with respect to survivability. The majority of the sampled aircrew has required the use of urine collection devices (UCDs) during flight. These aircrews selected the piddle pack and relief tube as moderately acceptable solutions for urination during flight.			
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