

**UNITED STATES AIR FORCE
ARMSTRONG LABORATORY**

**PILOT PERSONALITY: GENDER
AND CAREER-LEVEL DIFFERENCES**

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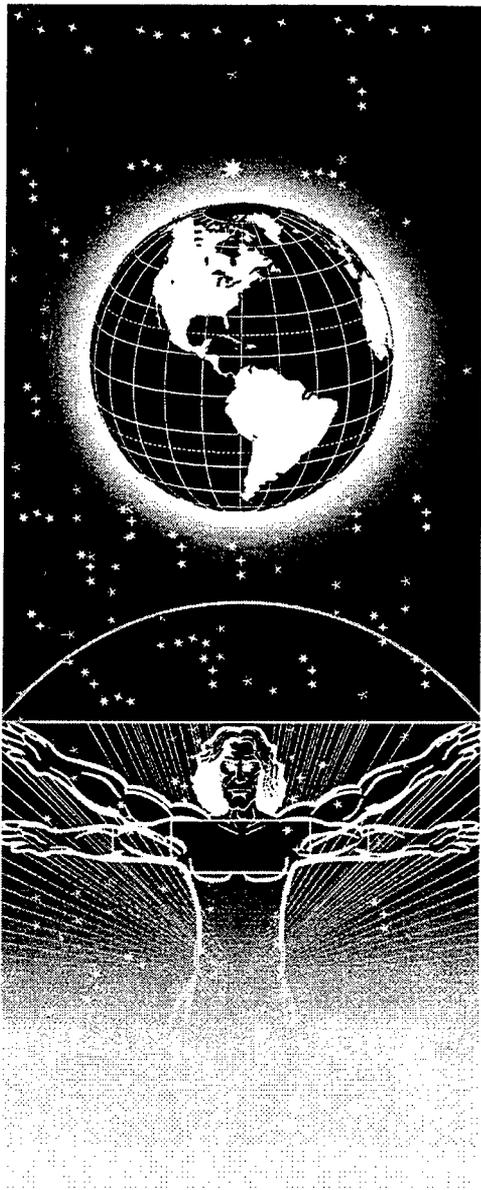
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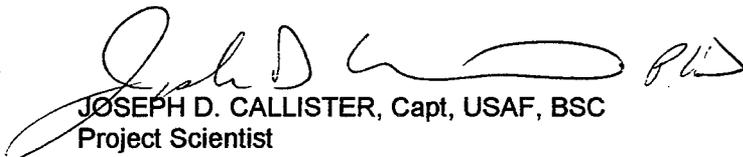


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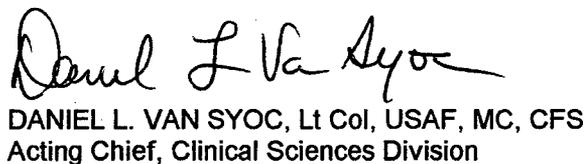
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CONTENTS

	Page
SUMMARY.....	1
INTRODUCTION.....	2
Background.....	2
Purpose.....	3
METHOD.....	4
Subjects.....	4
Procedures.....	4
RESULTS.....	5
Study 1.....	5
Study 2.....	8
DISCUSSION.....	11
REFERENCES.....	14

TABLES

Table Number

1. NEO-PI-R Means and Standard Deviation for Each Group..	6
2. Discriminant Function Summary Table.....	7
3. Discriminant Function Classification Functions.....	7
4. Classification Matrix.....	7
5. ANOVA Summary Tables for NEO-FFI Scales.....	10
6. Means and Standard Deviations of Groups on NEO-FFI....	11

PREFACE

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SUMMARY

Little work has been done to examine personality differences between female and male Air Force pilots. The current study investigates gender differences at beginning and mid-career points. These samples are compared to non-pilot controls. Female pilots differ from control subjects on most variables. Female student pilots are higher on Neuroticism and Openness than male student pilots. Mid-career female pilots are found only to be higher on Agreeableness compared to mid-career male pilots. Finally, differences are also found when comparing female student pilots to female mid-career pilots with the student pilots higher on Neuroticism and lower on Agreeableness.

Pilot Personality: Gender and Career-level Differences

INTRODUCTION

Background:

The mythical paradigm of the "right stuff" (Wolfe, 1980) for military pilots holds that these individuals possess extreme levels of confidence, assertiveness, and competitiveness. The typical lay impression holds that all military pilots have a singular personality type. While this idea may make for good Hollywood movies, it does not make for good science.

Jones (1983) recognized a special need to study female aviators when he published an alert to flight surgeons to be aware of the stress of conflicting roles that female aviators face. He clearly cautioned the aviation community that failure to recognize the needs of female aviators can lead to compromised flight safety. The need for psychological data augments the necessary study of physiologic differences between male and female aviators.

There do seem to be differences within pilot samples and there is not one personality style among all pilots. Retzlaff and Gibertini (1987) found three distinct personality types among student USAF pilots. Only one of these three personality types seemed consistent with the "right stuff" lore. Similarly, Picano (1991) studied U.S. Army pilots and concluded there is no single successful pilot personality dimension. Picano further found experienced pilots to be distributed among three personality clusters, with the "right stuff" type represented by only 16 per cent of his sample.

These studies as well as other collections of psychometric norms are invariably based upon male pilot subjects. Additionally, the subject pools are often severely limited or based on very small, specialized populations such as fighter pilots, test pilots, or astronauts. Data on female aviators has been scarce.

Novello and Youssef (1974) found general-aviation female pilots to be more similar to their male pilot counterparts than to women in the population at large. Specifically, they found female pilots deviate in the same direction as their male counterparts on 15 of 16 Edwards Personality Preference Schedule scales. Novello and Youssef hypothesize pilot personality styles that transcend gender.

The interest in aviation circles about personality is directly related to selection, training, performance, and safety concerns, as well as mental health considerations. Some of the very earliest work on personality and the "big five" framework was done in the Air Force by Tupes and Christal (1961). The "big five" theory holds that most of personality may be explained through five dimensions including neuroticism, extraversion,

openness, agreeableness, and conscientiousness. More recently, Siem and Murray (1994) found experienced pilots rated "conscientiousness" as the most important of the "big five" (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) personality characteristics determining pilot performance. Siem and Murray, therefore, advocate research to further validate the importance of conscientiousness in pilot personality.

Women comprise a small (about 2%), but growing, percentage of United States Air Force (USAF) pilots. Prior to 1993, female pilots were assigned only to tanker, transport, and training aircraft. This was due to the Department of Defense policy of combat exclusion for female military members. Female pilots probably bring different personality styles into the cockpit and understanding those differences is important both medically and operationally.

McGlohn, King, Retzlaff, Flynn, and Butler (1996) completed a study of the personality and stressors of mid-career female US Air Force pilots under a grant from the Defense Women's Health Research Program in FY95. Personality testing and interviews converged on a number of points showing that the female and male pilots were quite different in a number of areas.

King, Retzlaff, and McGlohn (in press) looked at the personality data in depth. Female pilots obtained significantly higher raw scores on the NEO-FFI scales Extraversion, Agreeableness, and Conscientiousness than male pilots. In general, the female pilots scored about one-half of a standard deviation higher than the males on each of these three variables. Both of the last two areas seem to be contrary to the "Right Stuff" of Retzlaff and Gibertini (1987, 1988) lore. These areas, though, do seem to be traits which would make for a successful individual in an operational flight squadron, particularly with multi-crew aircraft.

In order to further define the personality of female pilots, their scores were compared to those of female college students. The data pointed to significant and often very large differences between the female pilots and the female college students on all five variables. Of particular note is the large difference on Neuroticism. Here the female pilots, with a mean raw score of 14, are over a standard deviation below the college students with a mean raw score of 24.

The female pilots were also less "Open to Experience" than the college students. The female pilots, however, were higher on the Extraversion, Agreeableness, and Conscientiousness scales than the students.

Purpose:

The purpose of the current work is to compare the personality profiles using the NEO-PI-R of male and female

student pilots. Secondly, it is to assess differences across career levels, from entry-level student status to mid-career.

The King, Retzlaff, McGlohn (in press) work looked at female mid-career pilots, male mid-career pilots, and a female college student control sample. The first of the two studies here will look at gender differences in student pilot samples. Female student pilots, male student pilots, and a female college student control group will be compared on a comprehensive 35 scale personality test.

The second study here will compare 6 samples on a briefer 5 scale personality test. Female samples will include college students, student pilots, and mid-career pilots. Male samples will include the same three groups.

METHOD

Subjects:

Study 1: Three groups of subjects were contrasted. Each group had 103 subjects. The groups included entry level female student pilots, similar male student pilots, and a control group of female college students. All Air Force subjects were tested during Enhanced Flight Screening (King and Flynn, 1995; Callister and Retzlaff, 1996) and the college sample was collected on the campus of a large, Rocky Mountain, state university.

Study 2: A total of 455 subjects are used. The student pilots are from the study 1 data collection. There were 91 females and 91 males available for this study. The mid-career pilots are from the King, Retzlaff, and McGlohn (in press) study with 48 females and 64 males. Finally, the college students were from the large, Rocky Mountain, state university. There were 103 females and 58 males in these groups.

Procedures:

The two studies in this paper differ on a number of dimensions but get to the same question. Study 1 looks at a large number of psychological variables on 3 samples: female student pilots, male student pilots, and female college students. Study 2 looks at fewer variables but with more subject samples. Here there are female and male samples for college students, student pilots, and mid-career pilots.

Both studies utilized forms of the NEO personality test (Costa and McCrae, 1992). Study 1 used the comprehensive 35 scale version (NEO-PI-R) which included 5 main scales (domains) and 6 sub-scales (facets) under each of the main scales. Study 2 used a shorter version of the test, the NEO-FFI. Here only the 5 main variables may be scored.

It is possible to re-score a NEO-PI-R to reveal NEO-FFI scores. This allowed for the comparison of samples across

testing formats.

College students were all tested in classroom settings. Student pilots were tested as part of EFS medical examinations. Finally, mid-career pilots were tested by the authors at a number of bases as part of a larger study looking at gender issues.

RESULTS

Study 1

Table 1 presents the univariate differences among the three groups. First all three groups are examined. The college females are highest on Neuroticism and the male pilots lowest. These differences were mirrored on the Anxiety, Depression, and Vulnerability sub-scales. No differences were found under any of the Extraversion scales. Male pilots scored lowest on the Openness to Experience factor. Female college students scored particularly high on the Feelings and Values sub-scales. Little was seen in the Agreeableness scales with the exception of Tender-mindedness where college females scored particularly high and male student pilots low. Finally, on the Conscientiousness scales, college females scored the lowest and male student pilots the highest. The subscales include specifically low scores for the college females on Dutifulness, Achievement, and Discipline. In general, the female Air Force student pilots scored between the male student pilots and the female college students on most NEO-PI-R scales where significant differences were found.

Looking just at the two student pilot samples, females student pilots are higher on most of the Neuroticism variables than the male student pilots, higher on several of the Openness variables, higher on the Tender-Mindedness subscale of the Agreeableness variables, and lower on several of the Conscientiousness variables.

This is quite different from the King, Retzlaff, and McGlohn data where the mid-career gender differences included female pilots being higher on Extraversion, Agreeableness, and Conscientiousness. Indeed, the Conscientiousness finding is reversed here.

Tables 2 through 4 provide a discriminant function analysis of the data. Again, from a multivariate perspective, a number of unique variables enter the equations. The female pilots are again usually found to be somewhere between the male pilots and the female students.

TABLE 1

NEO-PI-R Means and Standard Deviation for Each Group

Scale	Air Force Females(1)		College Females(2)		Air Force Males(3)		F(2,306)
	Mean	SD	Mean	SD	Mean	SD	
N	82.52	23.33	97.12	22.64	68.55	17.83	45.85*a
ANXIETY	16.00	5.05	18.75	4.91	12.99	4.40	37.18*a
ANGRY	12.98	5.03	15.49	5.46	12.00	4.93	12.61*c
DEPRESS	13.00	5.75	15.94	6.07	9.99	4.09	31.53*a
SELFCONC	14.42	4.95	16.25	5.48	12.80	4.15	12.79*d
IMPULSIV	16.94	5.17	18.66	4.44	14.32	4.36	22.52*b
VULNER	9.16	3.69	12.01	4.60	6.44	3.01	54.66*a
E	128.35	19.79	126.63	20.63	127.77	17.36	0.21
WARMTH	23.70	4.64	24.21	4.74	22.86	4.11	2.35
GREGAR	18.95	5.82	19.69	5.91	18.35	4.71	1.53
ASSERT	19.18	4.65	17.89	5.60	20.48	4.25	7.28
ACTIVI	21.12	3.40	19.77	4.22	21.68	3.86	6.73
EXCITE	22.29	3.92	21.70	4.91	22.73	3.42	1.60
POSITI	23.09	4.57	23.33	5.11	21.64	4.40	3.92
O	124.32	17.81	128.01	20.13	111.93	19.83	19.65*b
FANTASY	19.85	5.29	21.13	5.44	18.48	4.75	6.76
AESTHET	20.08	5.26	21.75	6.23	16.10	5.84	25.85*b
FEELINGS	22.97	4.19	24.83	3.78	20.42	4.82	27.42*a
ACTIONS	18.73	3.98	16.95	4.03	16.96	4.05	6.74
IDEAS	21.19	4.46	19.97	5.68	21.20	5.61	1.85
VALUES	21.47	3.54	23.36	4.32	18.74	4.44	32.71*a
A	118.39	18.36	121.35	17.04	112.26	17.02	7.25
TRUST	20.59	5.34	19.65	4.93	19.91	4.82	0.96
STRAIT	19.97	4.80	20.61	4.82	19.23	4.04	2.34
ALTRU	24.00	3.80	24.58	3.72	23.00	3.50	4.81
COMPLIAN	16.25	4.32	16.48	5.20	15.98	4.15	0.31
MODESTY	18.28	4.52	18.76	4.72	16.55	4.44	6.69
TENDER	19.30	3.44	21.26	3.23	17.57	3.93	27.86*a
C	124.70	20.17	114.91	21.82	132.65	15.60	21.65*e
COMPET	22.68	3.79	21.60	3.69	24.80	2.88	22.55*g
ORDER	18.82	4.95	17.93	5.33	19.59	4.27	2.99
DUTIFUL	22.72	4.44	20.72	3.96	24.28	3.40	20.81*f
ACHIEVE	22.12	4.05	19.51	4.81	23.39	3.56	23.14*f
DISCIPL	21.38	4.69	19.09	5.70	23.00	3.50	17.87*f
DELIBERA	16.95	4.08	16.03	5.00	17.56	3.97	3.16
N	103		103		103		

NOTE: * DENOTES SIGNIFICANCE AT .0001. TUKEY'S MULTIPLE COMPARISONS at .01 with not significantly different means underlined:
a=2 1 3, b=2 1 3, c=2 1 3, d=2 1 3, e=3 1 2, f=3 1 2, g=3 1 2

TABLE 2

Discriminant Function Summary Table

Step	Variable Entered	F Value to Enter	U	F	DF
1	VULNER	54.662	0.7368	54.662	2,306
2	VALUES	19.503	0.6532	36.184	4,610
3	POSITI	12.729	0.6028	29.188	6,608
4	ACTIONS	7.669	0.5737	24.258	8,606
5	TENDER	6.239	0.5510	20.973	10,604
6	DUTIFUL	4.030	0.5366	18.319	12,602

TABLE 3

Discriminant Function Classification Functions

Variable	Air Force Females	College Females	Air Force Males
VULNER	1.67873	1.82818	1.46736
POSITI	1.08537	1.15520	0.98015
ACTIONS	0.73177	0.55207	0.67162
VALUES	0.93443	1.05241	0.82367
TENDER	0.55128	0.69827	0.49834
DUTIFUL	1.89494	1.79912	1.93419
CONSTANT	-65.06996	-68.61212	-57.71193

Table 4

Classification Matrix

Group	Percent Correct	Number of Cases Classified into Group		
		Air Force Females	College Females	Air Force Males
Air Force Females	38.8	40	28	35
College Females	76.7	15	79	9
Air Force Males	72.8	18	10	75
Total	62.8	73	117	119

Study 2

This study is similar to research study number 1 except that fewer variables are used and that three additional subject samples are used. Study 1 provides extensive data on female and male student pilots as well as a control sample of female college students. Here female student pilots, female mid-career pilots, and female college students are contrasted with 3 like male samples.

Table 5 provides the 2X3 ANOVA's for the work. All main effects were significant. Table 6 provides the cell means and the multiple comparison tests.

A number of gender and career level differences are found upon examining Table 6. Looking at gender differences first among the college student controls, no differences are seen for Neuroticism, Extraversion, or Openness. Female college students, however, are higher on Agreeableness and Conscientiousness than male college students. Deviations from this control situation among either of the pilot career levels would be of interest.

Looking at the student pilots, female student pilots are significantly higher on Neuroticism than male student pilots. No significant differences are found for the Extraversion variable. On the Openness variable, again, female student pilots are higher than male student pilots. On Agreeableness and Conscientiousness, no student pilot differences are found. These last two variables are of interest in that they were the only two variables found to display gender differences in the control sample.

Mid-career pilots in this analysis showed no gender differences for Neuroticism, Extraversion, Openness, or Conscientiousness. Female mid-career pilots are significantly higher on Agreeableness.

Some of these results may appear at odds with the King, Retzlaff, and McGlohn data analysis. In that analysis, female mid-career pilots were found to be higher on Extraversion, Agreeableness, and Conscientiousness than mid-career male pilots. Those results were based upon t -test statistical analysis. The current work only found statistically significant differences between the two mid-career samples on the Agreeableness variable. Here, this data was first analyzed with ANOVA and then multiple comparison tests were calculated with the Tukey statistic. The Tukey procedure is far more conservative than t . This is particularly true when there are a large number of groups and paired comparisons. Therefore, the current analysis has "lost" some of the prior significances due to statistical procedural changes mandated by the larger number of groups.

Looking at the differences across career levels a number of things are seen. First, there are no significant differences between the male student pilots and the mid-career pilots on any

of the variables. This indicates that there is little change in pilots' personality across time and/or that there is little selection of certain personality characteristics in retention.

Female pilots do show differences. Specifically, the student female pilots are higher on Neuroticism than the mid-career female pilots. Secondly, female mid-career pilots are higher on Agreeableness than the female student pilots. This suggests one of three things. First, it may be that female pilots change personalities to some degree across a career by becoming less affective and more agreeable. Second, it could be that agreeable female pilots are retained and the affective female pilots leave the service. Third, it could be that some societal cohort effect is at work. Here it would be hypothesized that females coming into pilot training 10 years ago were less affective and more agreeable than those seeking to serve these days.

Table 5

ANOVA Summary Tables for NEO-FFI Scales

Neuroticism

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	PROBABILITY
GROUP	6434.0899	2	3217.0449	63.81	0.0000
GENDER	1190.3485	1	1190.3485	23.61	0.0000
INTERACTION	747.0566	2	373.5283	7.41	0.0007
ERROR	22635.2678	449	50.4126		

Extraversion

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	PROBABILITY
GROUP	440.6378	2	220.3189	6.06	0.0025
GENDER	305.9738	1	305.9738	8.41	0.0039
INTERACTION	179.7682	2	89.8841	2.47	0.0857
ERROR	16332.8746	449	36.3761		

Openness

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	PROBABILITY
GROUP	228.4601	2	114.2301	3.06	0.0478
GENDER	378.5907	1	378.5907	10.15	0.0015
INTERACTION	198.4494	2	99.2247	2.66	0.0710
ERROR	16748.4920	449	37.3018		

Agreeableness

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	PROBABILITY
GROUP	1095.6904	2	547.8452	16.68	0.0000
GENDER	691.6500	1	691.6500	21.06	0.0000
INTERACTION	225.9184	2	112.9592	3.44	0.0329
ERROR	14746.7954	449	32.8436		

Conscientiousness

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	PROBABILITY
GROUP	4203.8841	2	2101.9421	56.44	0.0000
GENDER	324.3475	1	324.3475	8.71	0.0033
INTERACTION	818.3574	2	409.1787	10.99	0.0000
ERROR	16722.3367	449	37.2435		

Table 6

Means and Standard Deviations of Groups on NEO-FFI.

Scale	1 College	2 Students	3 Career	Tukey

Neuroticism				
Female	24.4 (7.5)	20.0 (8.0)	14.3 (6.1)	1 2 3
Male	22.1 (8.0)	13.1 (6.0)	13.4 (6.4)	1 <u>3</u> 2
sign.	ns	*	ns	
Extraversion				
Female	32.6 (6.5)	33.1 (6.5)	35.0 (5.9)	<u>3</u> <u>2</u> 1
Male	30.0 (5.7)	33.1 (4.8)	32.5 (6.5)	<u>2</u> <u>3</u> 1
sign.	ns	ns	ns	-----
Openness				
Female	31.4 (6.6)	30.8 (5.9)	27.9 (5.8)	<u>1</u> <u>2</u> 3
Male	28.4 (6.2)	27.9 (5.6)	28.1 (6.4)	<u>1</u> <u>3</u> <u>2</u>
sign.	ns	*	ns	
Agreeableness				
Female	31.1 (6.0)	31.8 (6.3)	35.1 (4.9)	3 <u>2</u> <u>1</u>
Male	27.5 (5.5)	31.1 (5.4)	31.7 (5.5)	<u>3</u> <u>2</u> 1
sign.	*	ns	*	
Conscientiousness				
Female	31.7 (7.4)	34.7 (6.4)	37.9 (5.9)	<u>3</u> <u>2</u> 1
Male	27.2 (5.6)	36.4 (4.9)	35.4 (5.6)	<u>2</u> <u>3</u> 1
sign.	*	ns	ns	

N				
Female	103	91	48	
Male	58	91	64	

Note: Tukey multiple comparisons using .01 were done at the cell level across group and across gender. For group, not significantly different means designated by group number are underlined. For gender, * denotes significant differences.

DISCUSSION

In-depth personality assessment comparing female student pilots, male student pilots, and a control group of female college students showed many interesting differences. In general, female and male student pilots are different. The female pilots are also different from the control group. The female pilots are generally half way between the other two groups. It is likely that this data also shows that a certain

personality type among female college students is drawn to service as an Air Force pilot. This could be used with additional work to aid in the selection of female aviators.

Personality data was also collected to contrast female and male college students, student pilots, and mid-career pilots. This data indicated that a particular type of female student pilot ends up in an Air Force pilot career. Across time and/or retention, female pilots tend to become less emotional (affective) and more agreeable. This could be caused by actual personality change across time, retention bias, or cohort effect. These changes are particularly relevant given the fact that male pilots appear not to change across their careers.

Female pilots in the United States Air Force appear to have personalities different from male USAF pilots as well as educated women in general. While male pilots are apt to be characterized as "hot shots" and possessing an egocentric "right stuff," female pilots appear to have more moderate personalities. These differences are important as they may relate to recruitment, training, career satisfaction, performance, and career retention on the operational side and self and commander referrals on the mental health side.

Military aviation has changed from the days of dog fighting to modern multi-crew, highly coordinated missions. In this environment, the higher levels of extraversion, agreeableness, and conscientiousness possessed by current female pilots are perhaps more valuable. Aviation, particularly military aviation, is increasingly an interpersonal endeavor and the traits of female aviators would appear to nicely fit this demand. Agreeableness and conscientiousness personality traits are probably at variance from the "right stuff" of fighter pilot lore.

The differences between the female pilots and the "normal" (female) comparison groups are even more interesting. The markedly lower neuroticism of pilots is particularly striking, attesting to the coolness required of any pilot. In general, one does not want a particularly "neurotic" pilot in any aircraft, nor is it likely that someone with this personality trait could adequately manage the cognitive workload required of a modern military pilot.

The female pilots were, however, higher than the controls on the Conscientiousness scales. Conscientiousness is a critical variable in not only the physical command and control of the aircraft but also in the execution of team oriented combat procedures. These differences between female pilots and college students are not likely to be a consequence of the age differences alone (Feingold, 1994) as these variables do not appear to change much from college to adult age brackets.

Future work should look at how these personality traits directly relate to mental health referrals and stress reactions

as well as to career satisfaction, job performance, and career retention. Additionally, as more female pilots become fighter pilots, comparisons across chosen airframes will be of interest. Given the new emphasis on coordinated, interpersonal flying requirements, it could just be that women possess personality traits that are highly desirable for military aviation.

The current work has shown a number of interesting differences between female and male pilots. It is critical that such work continue as women's roles in military aviation evolve and expand.

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