

Running Head: PILOT PERSONALITY PROFILE

Pilot Personality Profile Using the NEO-PI-R

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Abstract

This paper recounts the qualitative research conducted to determine if a general personality measure would provide a personality profile for commercial aviation pilots. The researchers investigated a widely used general personality inventory, the NEO-PI-R, with 93 pilots. The results indicate that a "pilot personality" does exist. Future research and implications are discussed.

### Pilot Personality Literature

Most current approaches to flight safety and optimization of performance emphasize technical aptitude and proficiency (Chidester, Helmreich, Gregorich, & Geis, 1991). Additional efforts have been made to improve upon the interpersonal aspects of crew coordination in the form of cockpit resource management (CRM) training (Orlady & Foushee, 1987). However, none of these programs consider any stable personality characteristics that may influence crew performance and error management. Therefore, research examining personality characteristics is needed to determine if it can make an impact on crew performance.

The performance of pilots can be construed as a product of skill, attitude, and personality factors (Chidester et al., 1991). The primary focus of this research is personality. Previous studies have indicated several personality factors that are critical to pilot performance. Chidester and associates (1991) have identified two core dimensions: (a) instrumental traits relating to achievement and goal seeking (achievement motivation) and, (b) expressive traits relating to interpersonal behaviors, sensitivity, and orientation. Instrumentality is defined as "person's level of goal orientation and independence" and expressivity is defined as "interpersonal warmth and sensitivity," (Chidester, Kanki, Foushee, Dickinson, and Bowles, 1990 p.3). Chidester and associates (1990) found personality factors, in general, contribute to crew effectiveness, and that both instrumentality and expressivity are important predictors of team performance in aerospace environments.

Hormann and Maschke (1996) found sociability, balance, self-assertiveness, and orientation towards actions and activity as successful characteristics of pilots. Bartram (1995) examined pilots in the UK Army Air Corps and found those who pass training are more stable, extroverted, tough-minded, and independent than those who fail training are. Shinar (1995) found three personality attributes that had a significant affect on pilot achievement: (1) a high need for achievement; (2) a willingness to exert oneself and to face difficulties to fulfill the need; and (3) a self-identity that is able to take success in stride, to experience it positively without dissonance, at least in the context of challenges, missions, and special demands of the piloting profession.

Picano (1991) studied experienced military pilots and found three distinct personality types. The first and most common type was composed of those pilots that were the most affiliative and out-going. These pilots had a structural approach to problem-solving which stresses planning, logical analysis, and attention to detail. The second group consisted of individuals who are emotionally controlled, inhibited, apprehensive and socially retiring. These pilots prefer stability, security, and predictability in their environment. They are reserved and somewhat uncomfortable in social situations and pessimistic in outlook. The third group was made up of pilots described as highly independent, competitive, and decisive. They were the least emotionally sensitive and empathetic and unconcerned with making a good impression.

Such previous research seems to suggest that there is evidence in pilot literature supporting the relevance of personality characteristics for pilot success. Gregorich, Helmreich, Wilhelm, and Chidester (1989) found theoretically meaningful sub-populations existing among aviators. In addition, recommendations have also been made that different training strategies may work more effectively with different personality profiles (Chidester et al., 1991).

These findings indicate that there are typologies of pilots and further research in the area is recommended for practical applications such as enhancing aviation safety. The research on pilot personality has indicated that there are several facets of personality that contribute to pilot performance. However, deficiencies remain in the pilot literature. Most of these measures are

pilot specific and do not examine general personality measures and pilots' results on these measures. Also, past studies have not examined the generalizability of their work to areas outside of aviation (specifically piloting). Therefore, a comprehensive research project is called for that will examine personality in aviation to determine the break down of these sub-populations or typologies of pilots.

### Objective

The objective of this report is to detail qualitative research, which examines a widely used general personality inventory (NEO-PI-R), to determine if a "pilot personality" emerges from the data. The previous section has detailed research indicating the importance of personality and in particular, the pilot personality. As part of a multi-faceted project, we have begun to examine personality in relation to performance and error management. The first phase of this project was to determine the relevant personality dimensions of pilots. Therefore, this report will focus on the response patterns of commercial pilots to determine if a typology emerges.

Whereas previous research on the pilot personality has used pilot specific measures, this research utilizes a general measure of personality. This distinction is important because a general measure of personality allows comparison of pilots to the public. This comparison is important for generalizability. If it is found that pilots differ greatly from the public on certain relevant personality dimensions, then research using a non-pilot sample may not be applicable to the aviation field. It is therefore critical to future research that this general "big five" model of personality is explored to determine where aviation fits. The next section further details this general model of personality and how it has thus far been researched and applied to aviation and pilot behavior.

### Personality Theory and Literature

Personality traits are defined as stable, deep-seated predispositions to respond in particular ways (Chidester et al., 1991). Personality is reflected in behaviors that are relatively stable over time and consistent across situations.

The Five Factor Model of personality was developed by Costa and McCrae (1985), from Cattell's (1979) 16 principal factors (pf). The "Big Five" model consists of the distinct dimensions of, neuroticism (N), extraversion (E), openness to experience (O), agreeableness (A), and conscientiousness (C). Neuroticism is the propensity to experience negative affect, such as anxiety, depression, and hostility. Extraversion is defined as the quantity and intensity of interpersonal interaction. Openness to experience is the proactive seeking and appreciation of new experience. Agreeableness is the quality of one's interpersonal interactions along a continuum from compassion to hostility. Finally, conscientiousness is the amount of persistence, organization, and motivation in goal-directed behaviors (Piedmont & Weinstein, 1994).

Research examining the reliability of the Big Five has demonstrated that the component personality traits remain relatively stable in adults over time. While individual traits do tend to vary throughout the adult life due to maturation and social factors, research has demonstrated that rank ordering remains fairly stable over spans of up to 45 years (Conley, 1984). The explicit personality taxonomy engendered to the Big Five contributes to the increasing ability to detect the influence of traits in the workplace (Tett, Jackson, & Rothstein, 1991). The Five Factor Model is robust across time, observers, instruments, and culture (Barrick & Mount, 1991). In addition, research has established that these five dimensions are sufficient to describe the information comprising other personality plans (McCrae & Costa, 1989a). It has also been

determined by Burke (1995) and Barrick and Mount (1991) that personality measures using the Big Five taxonomy, namely conscientiousness and openness to experience, were positively related to performance.

The Big Five and pilots. Street and Helton (1993) found that numerous researchers have indicated that the five factor model has the greatest potential for pilot selection and training research. They found that use of the five factor model was a significant indicator of training performance. Other research examining personality has found that personality measures were the best predictors of leadership, personal discipline, and military bearing (Siem & Murray, 1994). Many researchers have indicated that conscientiousness is a crucial trait for pilot performance regardless of differences in aircraft and performance dimensions (Barrick & Mount, 1991; Siem & Murray, 1994). Research also found support for agreeableness and its relation to performance in crew aircraft (Chidester, Kanki, Foushee, Dickinson & Bowles, 1990; Siem & Murray, 1994).

Since research has indicated that the five factor model is a potential model for use in aviation, we examined the NEO-PI-R, a common five factor personality measure, to see if it also indicated a "pilot personality profile". The results are detailed in the following sections.

### Methods

#### Participants

93 commercial pilots responded to the questionnaires sent out. Ninety-five percent of the participants were male. The mean age was 42 with a range from 23 to 65 years. These pilots were employed by 14 different commercial airlines, ranging from small to very large. The experience level was also varied, with a range of three months to 33 years and a mean of 12 years. Finally, over 75% of the pilots were captains or first officers. These descriptives indicate a very diverse sample of pilots.

#### Procedure

The pilots completed the NEO-PI-R and several other personality measures as the first stage of a multi-faceted project. The pilots were each paid \$100 to complete the questionnaire. The pilots were told that individualized results would be kept confidential. All results are therefore in aggregate form. The researchers specifically targeted commercial pilots because of multiple stages of this project.

### Results

#### Big Five Dimensions

There was an overwhelming trend of responses to many of the dimensions and facets of the NEO-PI-R. These trends were based on the responses of the 93 pilots. First, on the Neuroticism scale, over 60% of the pilots scored low or very low. Only 13% reported a high level of neuroticism. This indicates that as a group, pilots tend to report being emotionally stable. For the Extraversion scale, 42% of the pilots reported high scores whereas 23% reported low scores. There was a trend towards high score but it was not as strong a trend as for neuroticism. For the Openness scale, the distribution was near normal, with 29% of the pilots scoring high and 37% scoring low on this dimension. The Agreeableness scale mimicked the Openness scale with 27% of the pilots scoring high and 32% scoring low. Finally, on the

Conscientiousness dimension, there was an overwhelming trend towards high scores with 58% of the pilots scoring high or very high. Only 7.5% of the pilots scored low on this dimension. Pilots tend to be highly conscientious (See Table 1, See Figures 1-5).

These dimension scores indicate trends in pilot responses. To further examine these dimensions, the six facets of each dimension were investigated to further tease out these trends.

### Facet Scores

In this section, the facets of each of the five dimensions will be explored. Only those facets with an atypical distribution will be detailed. We focus on these facets because they are more important in determining a pilot profile than the other facets. Table 1 gives a quick overview of the results detailed in this section.

Neuroticism facets. To begin with, the facet of *anxiety* showed a response pattern in which 61% of the pilots reported low levels of anxiety while 15% reported high levels of anxiety. Anxious individuals are more likely to be apprehensive, jittery, fearful, prone to worry, and nervous or tense. Low scores are calm and relaxed; they tend not to dwell on things that might go wrong. In a complex environment, such as a flight deck, it would be necessary for the operator to be calm and collected, especially in a crisis.

Sixty-two percent of the pilots reported low levels of *angry hostility* whereas 15% reported high levels. Angry hostility represents the tendency to experience anger and related states such as frustration and bitterness (Costa & McCrae, 1985). This scale represents an individual's readiness to experience anger. Low scorers on this dimension are easygoing and slow to anger. Having pilots that are slow to anger would be important for interpersonal relations in the cockpit. Studying this facet could be important for research concerning cockpit resource management.

Another interesting finding is that only 13% of the pilots reported high levels of *depression*. Over 60% (61%) scored low on this facet. Low scorers on this facet are less likely to experience feelings of sadness, hopelessness, and loneliness. They are not easily discouraged or dejected. Having populations that are not prone to depression is important. An example of speculation concerning suicide attempts is EgyptAir 990 which crashed in 1999. In this recent tragedy, there has been conjecture that the pilot intentionally crashed the aircraft. If this were the case, then the mental health of this pilot would be relevant.

Forty-seven percent scored low on *self-consciousness* while 15% were high scorers. Self-consciousness refers to feelings of ease in social situations. Low scorers are not disturbed as much by awkward social situations. The relationship of this facet to the domain of aviation is less clear but could become important in teamwork and related areas.

For the facet of *impulsiveness*, 57% of the pilots were low while 17% were high. Impulsiveness in this domain refers to the inability to control cravings and urges. Low scorers have a higher tolerance for frustration. This facet is concerned more with controlling urges as related to drugs, food, etc. There has been evidence in the literature that even low levels of alcohol consumption are detrimental for flying ability (Ross, Yeazel, & Chau, 1992). Thus, it could be important to examine a person's susceptibility to such urges.

Finally, an amazing 71% of the pilots were low on *vulnerability* and only 2% scored highly on this facet. Low scorers perceive themselves as handling themselves in difficult situations. This would be critical in a circumstance where there is an emergency while flying.

Extraversion facets. Forty-four percent of the pilots reported being *gregarious* while 24% reported low levels of this trait. This facet concerns the preference for others' company. Those who are high in the area tend to seek out and enjoy others. Low scorers do not seek or avoid social stimulation. Again, it is unclear how this facet relates to aviation, however, it may become important in a team/group flying environment.

Seventy-one percent of the pilots reported high levels of *assertiveness* while only 4% reported low levels of this trait. High scorers are dominant, forceful, and socially ascendant. These people often speak without hesitation and can become group leaders. This trait could be useful in a flying environment but since the majority of pilots responded highly to being assertive, it could cause conflict amongst those in the cockpit. Thus, being assertive could end up conflicting with successful handling of the flight environment. This facet is one often addressed in cockpit resource management.

For the facet *activity*, 56% of the pilots scored high while only 9% scored low. Active people lead fast paced lives with a rapid tempo and vigorous movement. For the facet of *positive emotions*, 54% were high while 29% were low in this area. This facet concerns the tendency to experience positive emotions such as joy, love, and excitement. High scorers are optimistic and cheerful. Low scorers are less exuberant and high-spirited. These two facets have a less discernable relationship to flying.

Agreeableness facets. For the facet of *trust*, 53% of the pilots reported high levels of trust while only 19% reported low levels of trust. High scorers tend to believe that others are honest and well intentioned. Low scorers are cynical and skeptical. Since trusting one's co-workers is a critical element for successful flight operation, this facet may be important when in a highly ambiguous situation and depending on co-workers is critical.

For the facet of *straightforwardness* over 45% of the pilots scored high on this facet while 23% scored low. High scorers on this facet are frank, sincere, and ingenuous. Low scorers are more willing to manipulate others through flattery, craftiness, or deception. This facet could be important for open communication and group relations.

Pilots tended towards immodesty with 45% of them scoring low on *modesty* while only 27% scored highly. Low scorers believe they are superior people and may be considered arrogant by others. This dimension could be important, especially in relation to the pilot's assertiveness level.

Forty-five percent of the pilots were low on *tendermindedness* while 25% were high on this facet. This scale measures attitudes of sympathy and concern for others. Low scorers are more hardheaded and less moved by appeals to pity. These individuals seem themselves as realists who make rational decisions based on cold logic. This dimension could be relevant in studying pilot decision making styles and information processing.

Conscientiousness facets. Over half the respondents scored high on the facet of *competence* (65%) while only 4% reported low levels of competence. Competence is the sense that one is capable, sensible, and effective. High scorers feel well prepared to deal with life. Having a sense of competence is important in a complex environment such as a flight deck. Pilots need to be sure of their capabilities to fly the aircraft in any type of situation.

Forty-one percent of the pilots reported high levels of *order*. Only 12% reported low levels of this trait. High scorers tend to be neat and tidy. They are well organized. Having order could be important when a pilot needs to find information quickly should the need arise.

For the facet of *dutifulness*, 55% of the pilots scored highly while 11% reported low scores. Dutifulness refers to the adherence to ethics and morals. High scorers adhere strictly to

their ethical principles whereas low scorers are more casual in such matters. Although there is a trend in the response of pilots on this facet, an apparent relationship to aviation is not evident.

Sixty-five percent of the pilots scored highly on the *achievement-striving* facet. Only 9% were low on this facet. High scorers are individuals who have high aspiration levels and work hard to achieve their goals. They are diligent and have a sense of direction. However, very high scores can invest too much in their careers and become workaholics.

Forty percent of these pilots were high in *self-discipline* while 11% were low. Self-discipline is the ability to begin tasks and carry them out to completion despite boredom or distractions. This dimension could be important with high levels of automation in the cockpit. Boredom is a concern. Those individuals who can make safety checks and keep vigilant will be more likely to catch any abnormalities before they turn into major disasters.

In the area of *deliberation*, 61% of the pilots were high while 14% were low. Deliberation is the tendency to think carefully before acting. High scorers are cautious and deliberate. This facet may be appropriate in a normal flying environment but could be impeding in an emergency. Our future work will be addressing this issue.

### Pilot Profile

Upon review of this information, we have developed a "pilot profile" that seems to appropriate given the data. This is a purely descriptive profile and is not based on empirical investigation. Future investigations should empirically validate this descriptive.

The basic "pilot personality profile" is of an emotionally stable individual who is low in anxiety, vulnerability, angry hostility, impulsiveness, and depression. This person also tends to be very conscientious; being high in deliberation, achievement-striving, competence, and dutifulness. They also tend to be trusting and straightforward. Finally, they are active individuals with a high level of assertiveness.

This profile parallels Hormann and Maschke's (1996) characteristics of successful pilots as well as Picano's (1991) first personality type. Our findings may be construed as convergent validation of previous pilot models of personality. It is also important to point out that this data came from commercial pilots. Yet, Picano studied experienced military pilots and his profile coincides with the profile we ascertained. This finding could indicate that there is a universal pilot personality, irrespective of experience or position.

Another important distinction is that both these measures were pilot specific measures. The NEO is a general personality measure used with a variety of populations. The data from all these measures indicate that pilots have a certain profile regardless of the type of personality measure used. It is interesting to note that pilots are scoring differentially from the general population (as indicated by their responses to the NEO-PI-R).

### Discussion

Although this is not empirical data, the results of this study are important for several reasons. First, they confirm past research concerning the existence of a "pilot personality". There were definite trends in response on the NEO. These pilots were consistently responding in a similar fashion to many dimensions and facets that could be critical in an aviation environment.

Secondly, these trends validate the need for future empirical data that will tease out the relevant antecedents and criteria related to these personality dimensions in an aviation domain. There are many areas of flying and error management that could benefit from further understanding of the human operator. Perhaps researchers could begin to speculate on the



relationships of these variables based on the trends presented in this paper. Obviously, this paper does not provide any complete answers. It probably raises more questions than it answers. However, the critical component of this paper is the demonstration that a subset of society (pilots) tend to have personality domains and dimensions that are consistent across background and circumstance. If these types of people are either drawn to this field or selected into it, it is important for researchers of aviation to explore how this finding impacts the field of aviation. This is an exploratory study and we are presently working on an empirical study to confirm the conclusions we have drawn from this study.

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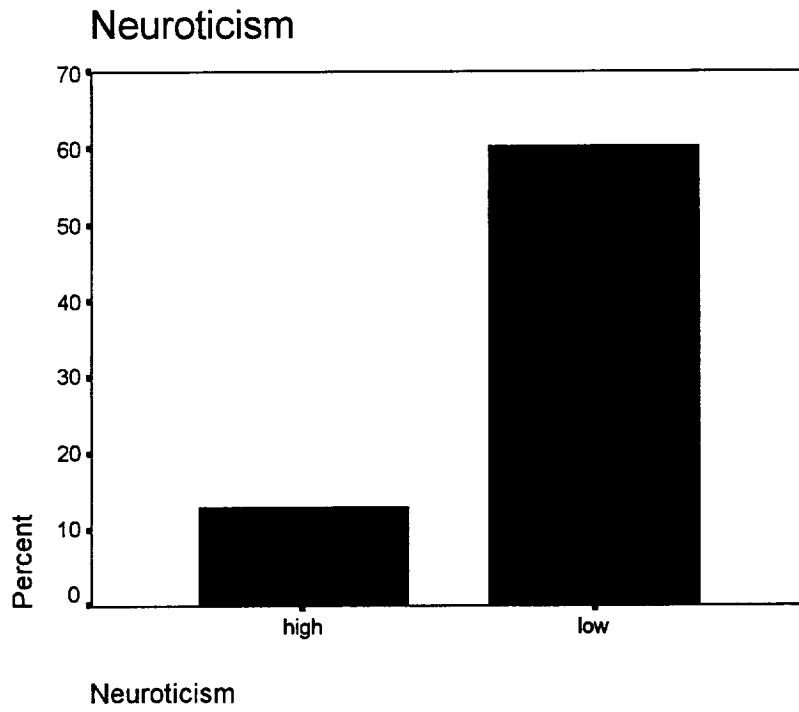
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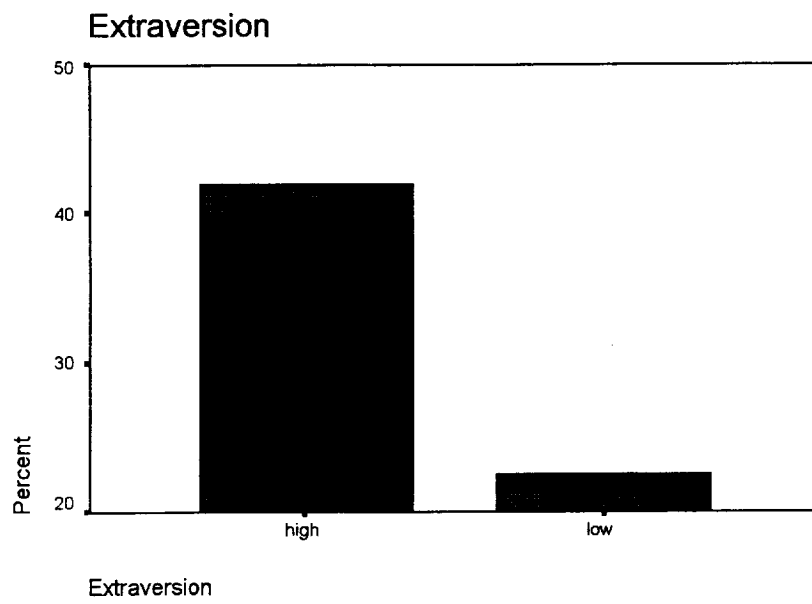
Table 1.  
Dimensions and Facets Pertaining to the Pilot Personality

<b>Dimensions &amp; Facets</b>	<b>Very Low/Low</b>	<b>High/Very High</b>
<b>Neuroticism</b>	<b>60%</b>	<b>13%</b>
anxiety	61%	15%
angry hostility	62%	14%
depression	61%	13%
self-consciousness	47%	15%
impulsiveness	57%	16%
vulnerability	71%	2%
<b>Extraversion</b>	<b>23%</b>	<b>42%</b>
gregarious	24%	44%
assertiveness	4%	71%
activity	9%	56%
positive emotions	29%	54%
<b>Openness</b>	<b>36.5%</b>	<b>29%</b>
<b>Agreeableness</b>	<b>32%</b>	<b>27%</b>
trust	19%	53%
straightforwardness	23%	45%
modesty	45%	27%
tendermindedness	45%	25%
<b>Conscientiousness</b>	<b>7.5%</b>	<b>58%</b>
competence	4%	65%
order	12%	41%
dutifulness	11%	55%
achievement-striving	9%	65%
self-discipline	11%	40%
deliberation	14%	61%

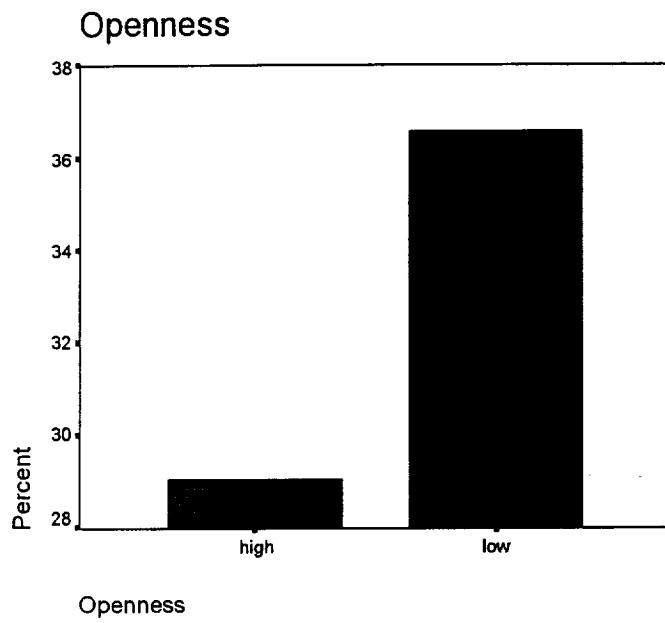
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**

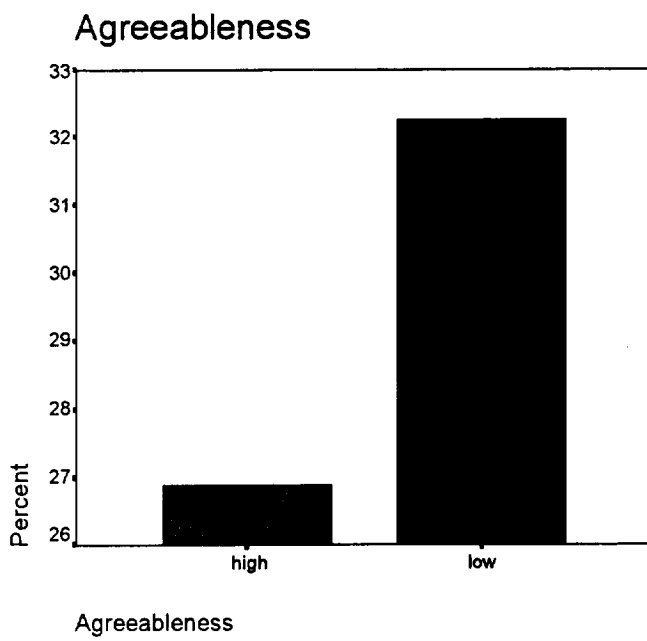
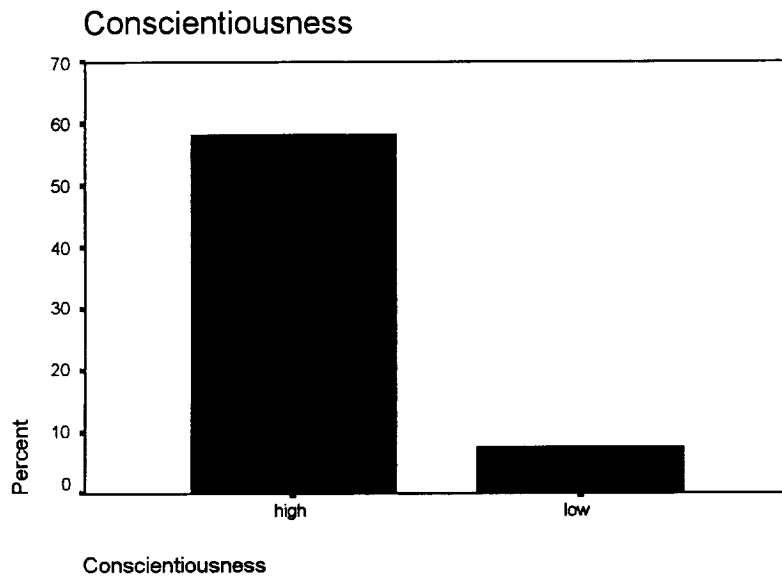


Figure 5





# Old Dominion University Research Foundation

October 5, 2000

R. Todd Lacks, LaRC Grant Officer  
National Aeronautics and Space Administration  
Langley Research Center  
Mail Stop 126  
Hampton, VA 23681-2199

Re: Summary of Research Report  
NASA Langley Research Center Training Grant NGT-1-52193

Dear Mr. Lacks,

Enclosed please find copy of the Summary of Research Report for the above referenced grant for the project entitled "Pilot Personality Profile Using the NEO-PI-R". It is submitted on behalf of Dr. Donald Davis, Principal Investigator.

Should you have any questions, or need further assistance, please contact me at (757) 683-4293 extension 615.

Sincerely,

Claudia McMurray  
Grants and Contracts Administrator

/jmb

enclosure

cc: Paul C. Schutte, LaRC Technical Officer  
NASA Center for Aerospace Information  
ODURF file #182271