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FIELD TEST OF A COMPUTER-DRIVEN TOOL TO MEASURE PSYCHOLOGICAL CHARACTERISTICS OF AIRCREW

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The voluntary, fully informed consent of the subjects used in this research was obtained as required by AFR 169-3.

The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

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Twenty-eight (80%) subjects from a squadron of 36 F-16 pilots voluntarily participated in a newly developed anonymous, self-administered, computerized testing protocol. The test battery consisted of two 2.5-hour blocks that measured personality (MMPI-2), cognitive capacity (MAB), crew coordination skills (PCI), and potential psychiatric diagnoses (C-DIS); it also gathered demographic information. A peer rating survey gathered information about the squadron's top performers and their personal qualities. This pilot project demonstrated the success of the battery to gather aircrew information in a field location. Results also indicated that aviators can agree who are top performers and what personal qualities are important in top performers. Data from individual tests are presented.

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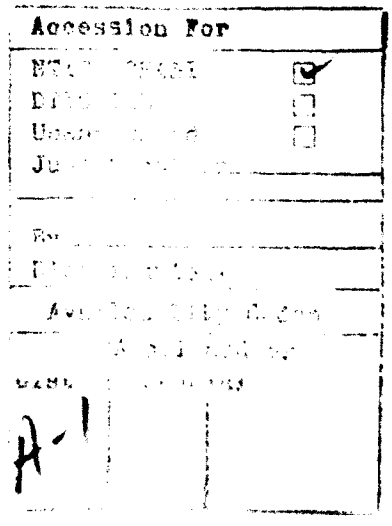

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FIELD TEST OF A COMPUTER-DRIVEN TOOL TO MEASURE PSYCHOLOGICAL CHARACTERISTICS OF AIRCREW

INTRODUCTION

The US Air Force (USAF) expects consistent high performance from aviators throughout their careers. The current reduction of US military forces affects the careers of rated aircrew. Force reductions and technological advances will create a leaner USAF that will have to do more with less. It is known that the pressures of downsizing in private industry increase numerous factors that lead to job dissatisfaction, and decrease job effectiveness (16). If the personal qualities of well-adapted aviators could be defined, perhaps training could enhance pilot performance and retention throughout the USAF.

Psychological information about consistent performers is hard to obtain, because aviators are reluctant to offer details about themselves. There are at least two reasons for this problem. First, their responses on clinical tests might jeopardize their flying status. Second, the USAF has no standardized psychological testing process to generate information. Because there is no routine procedure to gather information, data is usually gathered from select groups. These groups have been grounded aviators seeking waiver, or special "high interest" groups required to undergo medical and psychological testing.

Aviators are reluctant to report any functional deficit. Admitting to mental health problems is a risk—both occupationally, and within group dynamics (11). Several studies have documented greater truthfulness in answering personal questions through computer query (13, 24), and self-administration by a computer would offer privacy. Computerization also offers the flexibility of a consistent approach at any testing location, without needing specialized technical support. Aviators' responses, obtained anonymously, may very well encourage both participation and truthfulness.

Psychological information is needed from a truly "normative" group, the squadron. Although normative data is widely sought for use in psychological evaluations (23), the last normative data derived on USAF aviators was completed by Fine and Hartman (7) in the early 1960's. This data, now more than 25 years old, is based on outdated instruments, and on a select group of aviators that flew quite different aircraft. In the last 10 years, other specialized aviator populations have been studied, such as undergraduate student pilots (19), and US Army helicopter pilots (18).

The typical military flying squadron is not homogeneous. It has aviators that range in experience, motivation, and personality. There has been no research study to collect psychological information covering a USAF squadron of successful aircrew who are at different points in their military and aviation careers. Although Ashman and Telfer (2) reported on a group of 14 Royal Australian Air Force (RAAF) pilots from one Mirage squadron, data was gathered on only the Edwards Personality Questionnaire. Using this approach seemed optimal because such a

study could glean information about a varied group of pilots who know each other well. Information could be collected about their own relative strengths and weaknesses, and about the squadron's top performers.

The current study sought to learn not only about top performers, but also about long-term performers in aviation. The expected psychological resilience of military aviators is a proud heritage (1); however, psychiatric disorders occur in this population. In fact, one mission of the Neuropsychiatry Branch of the USAF Aerospace Medicine Consultation Service (ACS) of Armstrong Laboratory (Brooks AFB, TX) has been to consult with aircrew who have had mental health problems. Over the last 10 years, more than 280 pilots with psychiatric diagnoses have been evaluated for return to flying duties (17). If this battery could increase psychiatric epidemiology data, more specific preventive medicine models might improve retention in this population.

We chose to develop a new approach to solving the problems of testing a normative military aviator sample: anonymous, self-administered, computerized clinical tests. Test selection, and adaptation for computer administration followed. In addition, a peer rating survey was produced to identify (anonymously) top performers in the squadron. Each selected individual's personal qualities would also be recorded on this form. The development and initial field trial of this test battery became the primary goals of this project.

Development of the Test Battery

The subjects in this study completed standard psychological tests, and an epidemiologic survey presented through notebook computer/software technology. The following tests were chosen:

(a) Minnesota Multiphasic Personality Inventory-2 (MMPI-2)
(b) Diagnostic Interview Schedule (C-DIS)
(c) Personal Characteristics Inventory (PCI)
(d) Multi-Dimensional Aptitude Battery (MAB)

These tests offered a broad approach to measure different psychological characteristics of aircrew. The MMPI-2 is the newest version of the MMPI, a personality test that has become the most frequently administered psychological test (12). It is used at the USAF ACS to evaluate psychiatrically grounded aircrew who request a waiver to return to flying duties. Occupational norms have been developed for different populations (3, 8); Butcher (5) reported that at least one US airline uses the MMPI as an adjunctive tool in employee selection. In a counter-balanced, repeated-measures study of the computerized MMPI versus the standard pencil and paper presentation, Honaker et al. (9) supported the software version of the MMPI's equivalency. While not specifically tested, the equivalency of the computerized MMPI-2 is generally accepted (15).

The National Institute of Mental Health's (NIMH) DIS is a widely used epidemiologic survey developed by Robins and Helzer to screen the general

population for the prevalence of psychiatric disorders (20). Up to now, there have been no attempts to define the prevalence of mental health disorders in the professional aviator population. The computerized version (C-DIS) has been validated for test-retest reliability compared to the trained interviewer approach; it has good correlation in most diagnostic areas (3). Acceptance of the instrument as a self-administered questionnaire has been generally good (25).

The MAB is an IQ test developed by Douglas Jackson (10) that has a high correlation (.94-.98) with the WAIS-R. In general, the USAF aviator population has been noted to have above average IQ (7). It was expected that IQ might show a strong correlation to "top performer" aviators. Administered in ten 7-minute blocks by computer with the use of an accompanying booklet, the computerized MAB measures verbal, performance, and full scale IQ. The subtests measure Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Symbol, Picture Completion, Spatial, Picture Arrangement, and Object Assembly.

Helmreich et al. (21) developed the PCI to assess "crew coordination qualities" in aviators. Some commercial airline corporations use it for pilot selection (6). It consists of 254 questions with a Likert scale response pattern. Aircrew responses are categorized into eight groups ranging from the "right stuff" to the "wrong stuff" in crew coordination. Already widely used in aerospace operations, it collects data more specific to aviation skills.

The overall format was arranged into two 2.5-hour blocks, that were not to be taken by the same individual on the same day. Battery 1 consisted of Demographic questions (see Table 1), followed by the MMPI-2 and then by the PCI; Battery 2 contained the MAB followed by the DIS. Programming solutions increased test security, assured test order and also prevented duplicate answers. To confirm confidentiality of answers, each subject's test responses were recorded on an individual 3.5-in. data diskette identified externally by a random number. Test responses could not be accessed or scored without the computer scoring modules, which were unavailable at the squadron.

The peer survey (see Appendix A) was given to each pilot with Battery 2. The aviators were asked to identify the top three pilots (lead and two wingmen) in their squadron with whom they would fly combat. They could not select themselves. For each individual they chose, they also rank ordered in importance four personal qualities from the list in Table 2. These characteristics were a modified grouping from two sources: a NASA peer survey of astronauts (21), and a summary of 'top pilot' characteristics suggested by past aces (14). This survey provided a frequency count of most chosen characteristics, and also offered a rank order of personal qualities in selected pilots.

After testing ended, each pilot's name and random numbers were known only to a disinterested third party (trustee) chosen by the squadron. Each subject's two random numbers were linked. The trustee also replaced the names of the top performers on the peer survey with their respective random numbers. Once completed, the key and the nameless surveys could be used to compare testing responses and personal qualities of top performers.

Table 1. Demographics Questions

Current Military Airframe Hours:	<100, 101-500, >500
Total Military Hours:	<500, 501-1000, 1001-2000, >2001
Total Civilian Hours:	<500, 501-1000, 1001-2000, >2001
Do you have Combat Hours:	Y or N
Rank:	Company Grade or Field Grade
Number of Divorces:	0, 1, 2 or more
Age:	30 or younger, 31-40, 41 or older
Education level:	Undergraduate Degree or Graduate Degree
Previous Active Duty Time:	Y or N
Gender:	M or F

Table 2. Pilot Characteristics

General Knowledge

Job Performance

Stress Tolerance

Leadership

Group Cohesiveness

Teamwork

Personality

Communication Skills

Aggressiveness

METHOD

Subjects

Twenty-nine (29/36=80%) pilot volunteers from a Selfridge Michigan Air National Guard (ANG) F-16 squadron consisting of 36 pilots were recruited as subjects. Computer malfunctions and diskette duplications discovered when data was being scored accounted for varying levels of test completion. Twenty-nine (100%) pilots completed the peer rating survey of top performers, defining characteristics of their selections. Demographic information was available for twenty-three (23/29=79%) of the pilot subjects. Specific demographic information was not collected to ensure the subjects' anonymity. Age groupings for the known pilots spread from under 30 years old to more than 41 years old, and all were male. Fifteen (15/23=65%) had previous active duty time. Distribution was nearly equal between field (10/23=43%) and company (13/23=57%) grade officers. Five (5/23=22%) had combat experience. Flying time for the majority (15/23=65%) was less than 100 civilian hours; an equal number (15/23=65%) had more than 1000 military hours. Twenty (20/23=87%) had less than 500 hours in the F-16. Figure 1 shows the variety of experience in flying time in the F-16 and total military flying hours in the squadron.

Procedures

It was imperative to protect anonymity in the pilots' responses. Therefore, the key that linked aviators' names and random numbers was secured from both squadron members and investigators. A trustworthy individual not connected with the armed services was chosen by the squadron to be a trustee. This person held in confidentiality subjects' names, random numbers, and chosen top performers from the peer survey. In this study, a physician living in another city was chosen by the squadron to be the trustee. After coding the last survey, the trustee shredded any remaining surveys, name sheets or any key linking subjects' names and random numbers. A testing proctor supervised the use of the computers, and prevented two test sections from being completed by any one individual on the same day. Data collection occurred over approximately 4 months, covering 4 active duty ANG weekends.

All subjects initially signed a consent form which described the experiment, the anonymity of their data, and which acknowledged their right to terminate project participation at any time (See Appendix B). Each pilot chose either a blue or a white 3.5-inch data diskette from separate storage bins corresponding to the test battery they were completing. The pilot took the test battery on the notebook computer and by using matched random numbers on peel-off stickers, turned in the data diskette and sealed his name and peer rating in an envelope which was mailed to the trustee. A second set of matched random numbers was used for the second test battery. The trustee matched random numbers for the two separate diskettes and destroyed the names of all the subjects and forwarded the random numbers and peer ratings to the investigators.

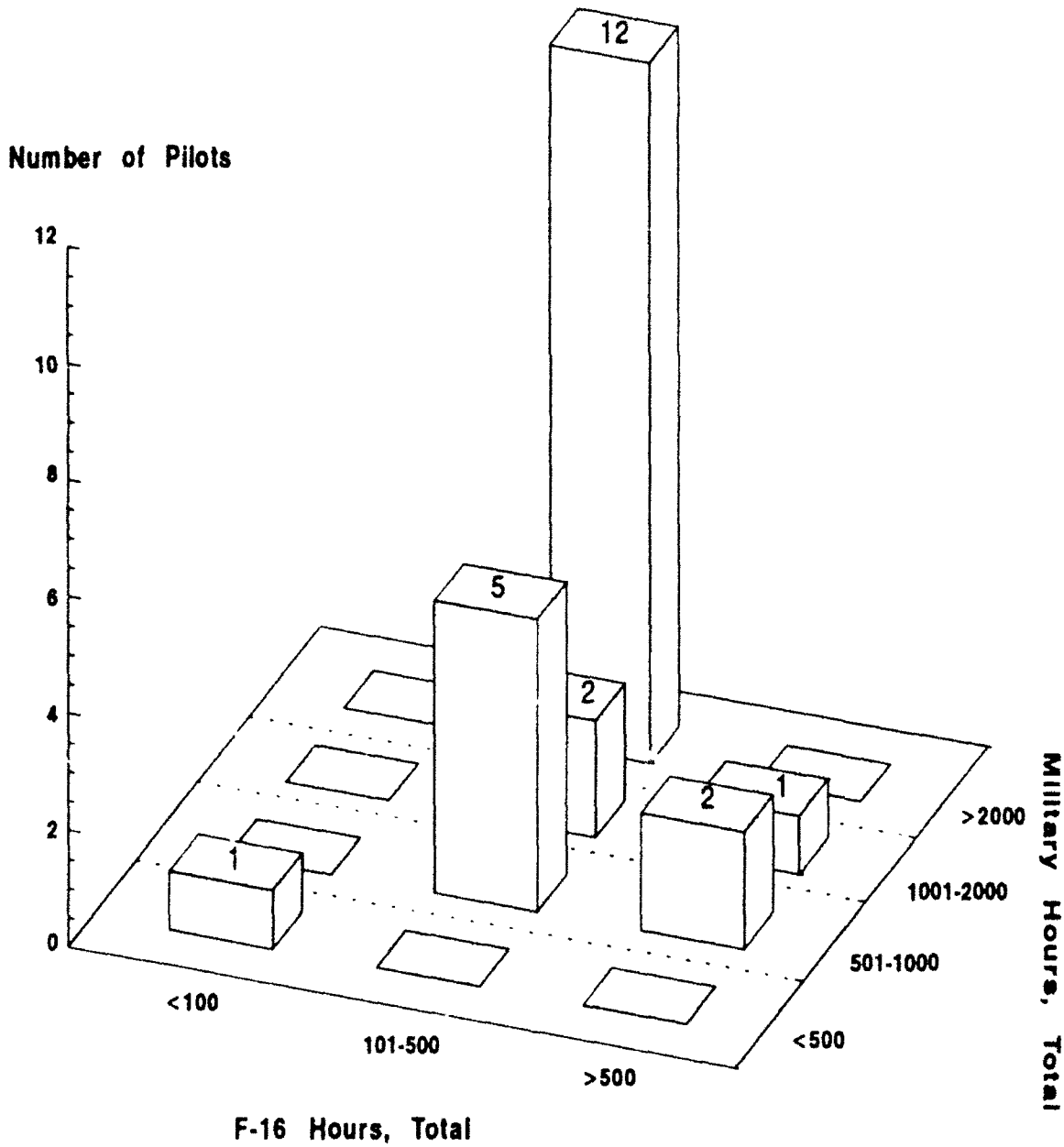


Figure 1. Squadron flying hours/Variety of experience; n=23.

Statistical Analysis

Descriptive statistics were run on the test results, peer surveys and demographics in this "pilot" project. Peer surveys were tabulated for the frequency of chosen top performers and their qualities. A frequency count of qualities and their rank order was also performed. The pilot demographic information and scale scores from the psychometric battery were analyzed with descriptive statistics to begin developing norms. Descriptive statistics were tabulated using the Statgraphics statistical program.

RESULTS

Twenty-nine pilots (80% of the squadron) participated in the computerized testing and completed the peer rating survey for their preferred combat four-ship formation. Results were tabulated, both for the most frequently chosen qualities, and for relative importance through rank ordering. The same two pilots were chosen most frequently for both lead and wing positions, one receiving eighteen (18/29=62%) votes, and the other receiving thirteen (13/29=44%) votes. One individual was chosen for the wing position seven (7/58=12%) times, but not for the lead at all. Possibly, he lacked the upgrade qualification, or he had the most desirable characteristics to fill the wingman position. After these three pilots, votes were scattered for the rest of the aviators by votes of one or two. Nonparticipating pilots got twenty-one votes (21/87=24%) to be in the combat formation. While this diminishes the exact meaning of those chosen, the qualities for all selected aviators are known.

Qualities chosen for the lead and the two wingmen positions showed both similarities and differences. Leadership, job performance, aggressiveness, and general knowledge were the characteristics chosen most frequently for the lead position. Wingman qualities chosen most frequently were job performance, general knowledge, teamwork; there was a tie between personality and aggressiveness. Frequency of choices are shown in Tables 3 and 4. When considering rank order (RO); the most chosen characteristic for lead was, in RO 1, leadership (41%); in RO 2, leadership (21%); in RO 3, aggressiveness (31%); and in RO 4, general knowledge (24%) [See Table 5]. In contrast for wingman, most chosen was, in RO 1, job performance (31%); in RO 2, job performance (21%); in RO 3, teamwork (28%), and in RO 4, general knowledge (24%) [See Table 6]. Figures 2 and 3 summarize both frequency of choice and rank order components.

Scores for fifteen pilots (15/29=51%) were available for the MAB. Mean scores were Verbal IQ 125, Performance IQ 127, and Full Scale IQ 127. These scores are all in the Superior range of intellectual functioning. All of the subtest means were elevated at least one standard deviation higher than the general population normative sample (10). The pilots had mean scores one and one-half standard deviations above the normal population sample mean on three subtests: Arithmetic, Vocabulary, and Digit Symbol. These subtests respectively measure mental computation, knowledge of word meanings, and visual memory with novel nonverbal learning. Two more subtests (Information and Spatial) had means

between one standard deviation and one and one-half standard deviations above the mean. These two subtests respectively measure general fund of knowledge and recognition of two-dimensional rotated figures. MAB scores are summarized in Table 7.

Scores from twenty-three (23/29=79%) MMPI-2 tests were obtained. Mean scores are noted in Table 8. Of note was the reduced level of the fake good scale in this population, with a mean score of 60T. The clinical profile was within normal limits with expected low scores on complaints about physical health (Hs=48T), depressive complaints (D=43T), acknowledging stereotypical gender roles (Mf=41T), and comfort in social settings (Si=40T). Higher scale means were noted on denying any problems, being optimistic (Hy=53T) and being active, outgoing and energetic (Ma=51T). These same clinical scores are commonly seen in aircrew who are evaluated at the ACS Neuropsychiatry Branch (22).

PCI scores in twenty pilots (20/29=69%) were available. The pilots scored in the following clusters. Six (30%) were in the "Group RD" (Responses Desired), scoring extremely high on the positive dimensions and extremely low on the negative dimensions. Two (10%) more scored in the "Group 10" (one of the best profiles), with high scores on overall goal seeking, achievement motivation, and interpersonal orientation. Seven (35%) were in the "Group 00" and did not display profiles that are known to relate to either positive or negative crew resource management behavior ("middle of the road"). One (5%) pilot scored in the "Group 21," one of the less desirable groups with high goal seeking and achievement motivation, but has high verbal aggressiveness. One (5%) pilot was in "Group 20" which is referred to as the "wrong stuff" because of a low interpersonal orientation. The remaining three (15%) pilots scored in "Group 30" where a relative lack of goal seeking, achievement motivation, interpersonal orientation, and mastering new activities is noted. This information is summarized in Figure 4.

When the peer ratings were compared to the PCI scores, the top six pilots picked for the combat four ship scored in the Groups RD, 30, 21 and 00 respectively. Two of the three pilots picked most often for lead scored in the best group (RD). The pilot picked for lead the second most often was in the less desirable group 21. Of the twenty pilots, this pilot was the only one to score in this group. The two pilots chosen most often for wingman scored in the middle groups (Groups 30 and 00). It appears that it takes all kinds of individuals to get the mission completed in spite of their crew resource management style. This trend is summarized in Figure 5.

C-DIS data was obtained from five pilots (5/29=17%). In those respondents, only one showed a psychiatric diagnosis: nicotine dependence. Computer instructions in the initial round of testing unfortunately confused many aviators who erroneously ended testing in Battery 2 before proceeding with the C-DIS.

Table 3. Lead Characteristics *

Quality	Lead Total (% of 116 choices)
Leadership	19.8
Job Performance	17.2
Aggressiveness	16.4
Knowledge	13.8
Stress Tolerance	9.5
Personality	8.6
Teamwork	6.9
Communication	4.3
Group Cohesiveness	3.4

* n=29

Table 4. Wingman Characteristics *

Quality	Wingman Total (% of 232 choices)
Job Performance	19.1
Knowledge	6.5
Teamwork	13.9
Personality	10.8
Leadership	10
Aggressiveness	10
Stress Tolerance	9.1
Group Cohesiveness	6.2
Communication	4.3

* n=29

Table 5. Lead Characteristics *

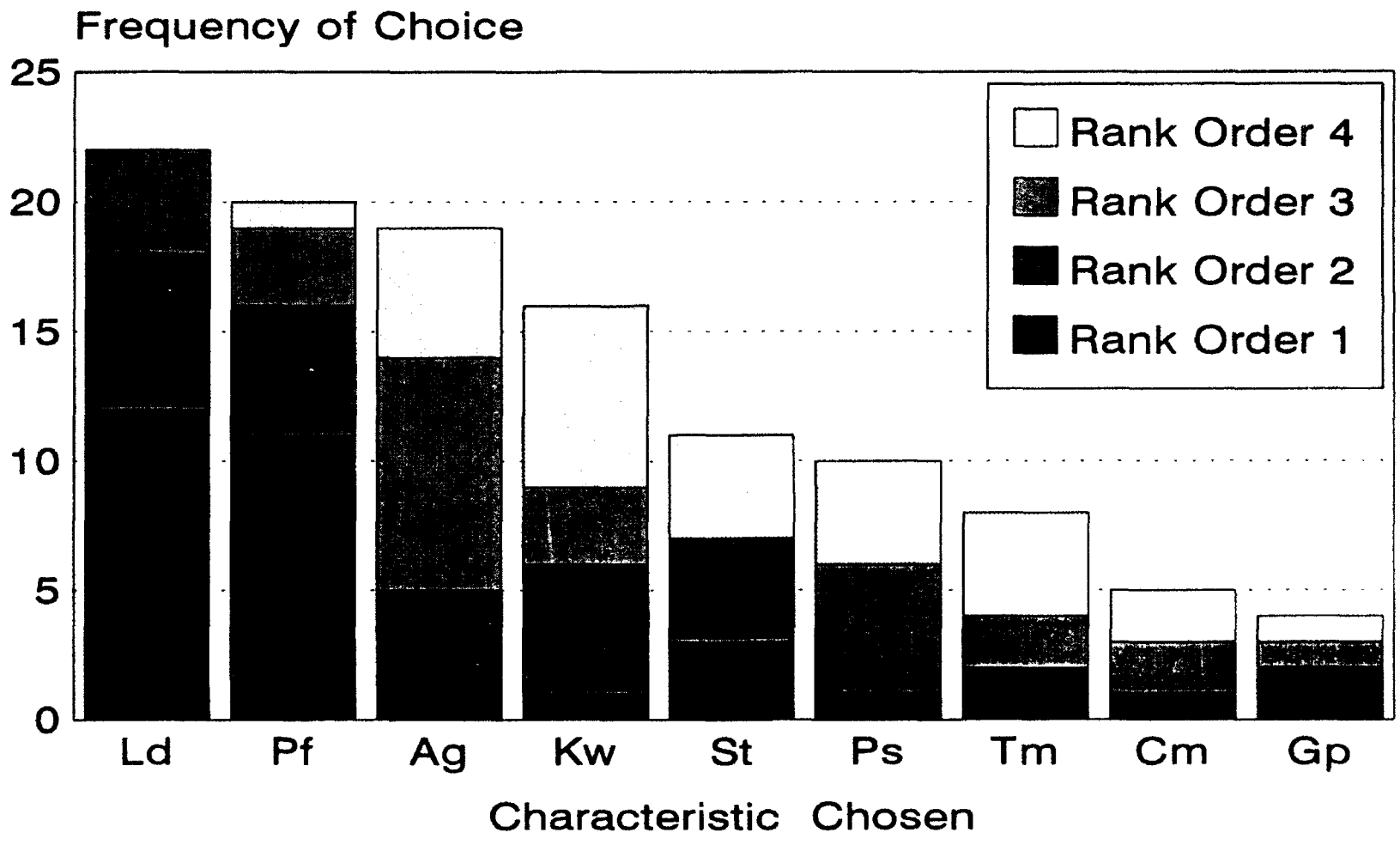
Quality	Rank Order #1 (% of 29 choices)	Rank Order #2 (% of 29 choices)	Rank Order #3 (% of 29 choices)	Rank Order #4 (% of 29 choices)
Leadership	41.4	20.7	13.8	0
Job Performance	37.9	17.2	10.3	3.4
Aggressiveness	0	17.2	31.0	17.2
Knowledge	3.4	17.2	10.3	24.1
Stress Tolerance	10.3	13.8	0	17.2
Personality	0	3.4	17.2	13.8
Teamwork	6.9	0	6.9	13.8
Communication	0	3.4	6.9	6.9
Group Cohesiveness	0	6.9	3.4	3.4

* $n=29$

Table 6. Wingman Characteristics *

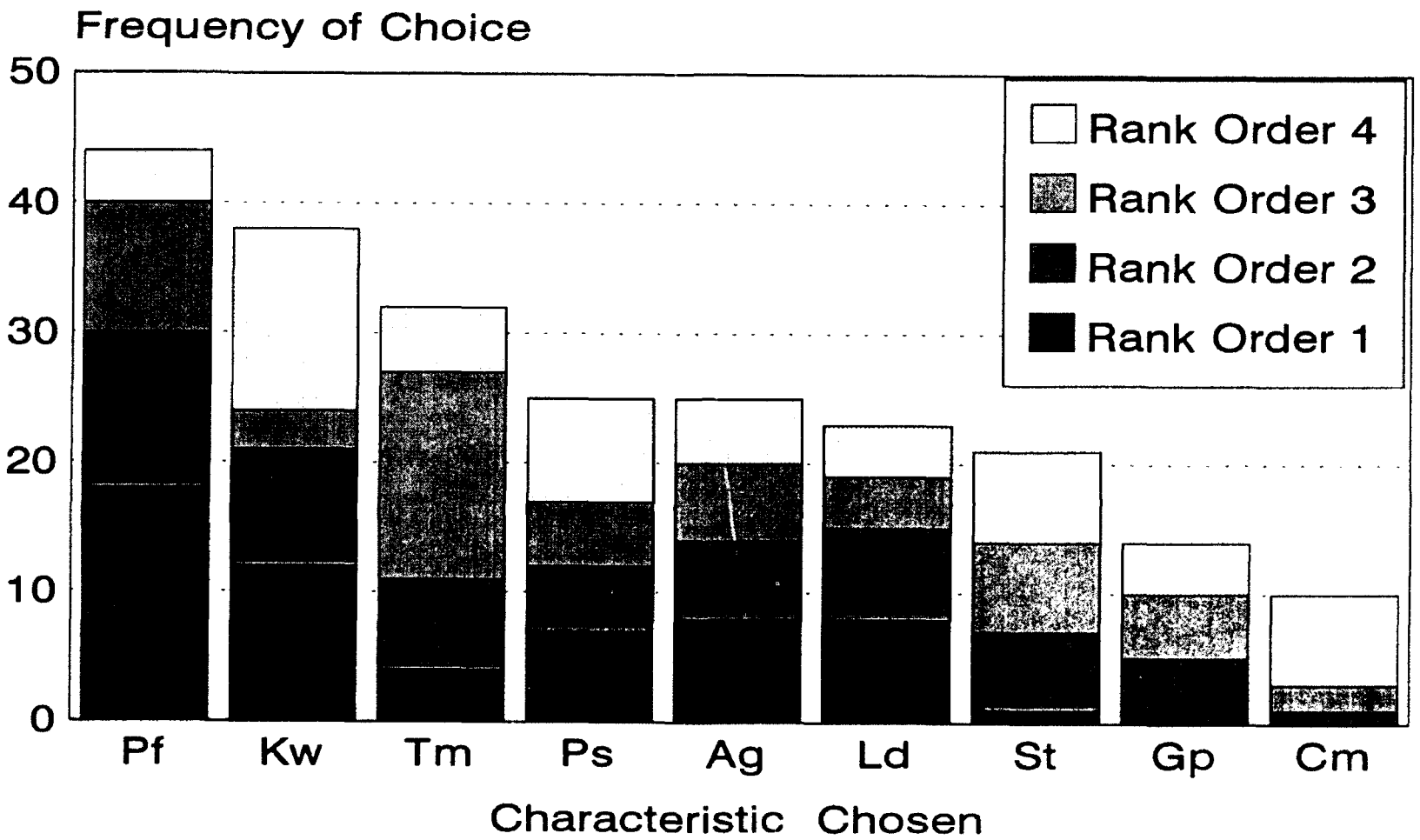
Quality	Rank Order #1 (% of 58 choices)	Rank Order #2 (% of 58 choices)	Rank Order #3 (% of 58 choices)	Rank Order #4 (% of 58 choices)
Job Performance	31.0	20.7	17.2	6.9
Knowledge	20.7	15.5	5.2	24.1
Teamwork	6.9	12.1	27.6	8.6
Personality	12.1	8.6	8.6	13.8
Leadership	13.8	12.1	6.9	6.9
Aggressiveness	13.8	10.3	10.3	8.6
Stress Tolerance	1.7	10.3	12.1	12.1
Group Cohesiveness	0	8.6	8.6	6.9
Communication	0	1.7	3.4	12.1

* n=29



Ld=Leadership, Pf=Performance, Ag=Aggressiveness, Kw=Knowledge, St=Stress Coping
Ps=Personality, Tm=Teamwork, Cm=Communication, Gp=Group Cohesiveness

Figure 2. Lead position/Personal qualities chosen; n=29 (116 responses)



Pf=Performance, Kw=Knowledge, Tm=Teamwork, Ps=Personality, Ag=Aggressiveness
Ld=Leadership, St=Stress Coping, Gp=Group Cohesiveness, Cm=Communication

Figure 3. Wingman position/personal qualities chosen; n=29 (232 responses)

Table 7. MAB Scores *

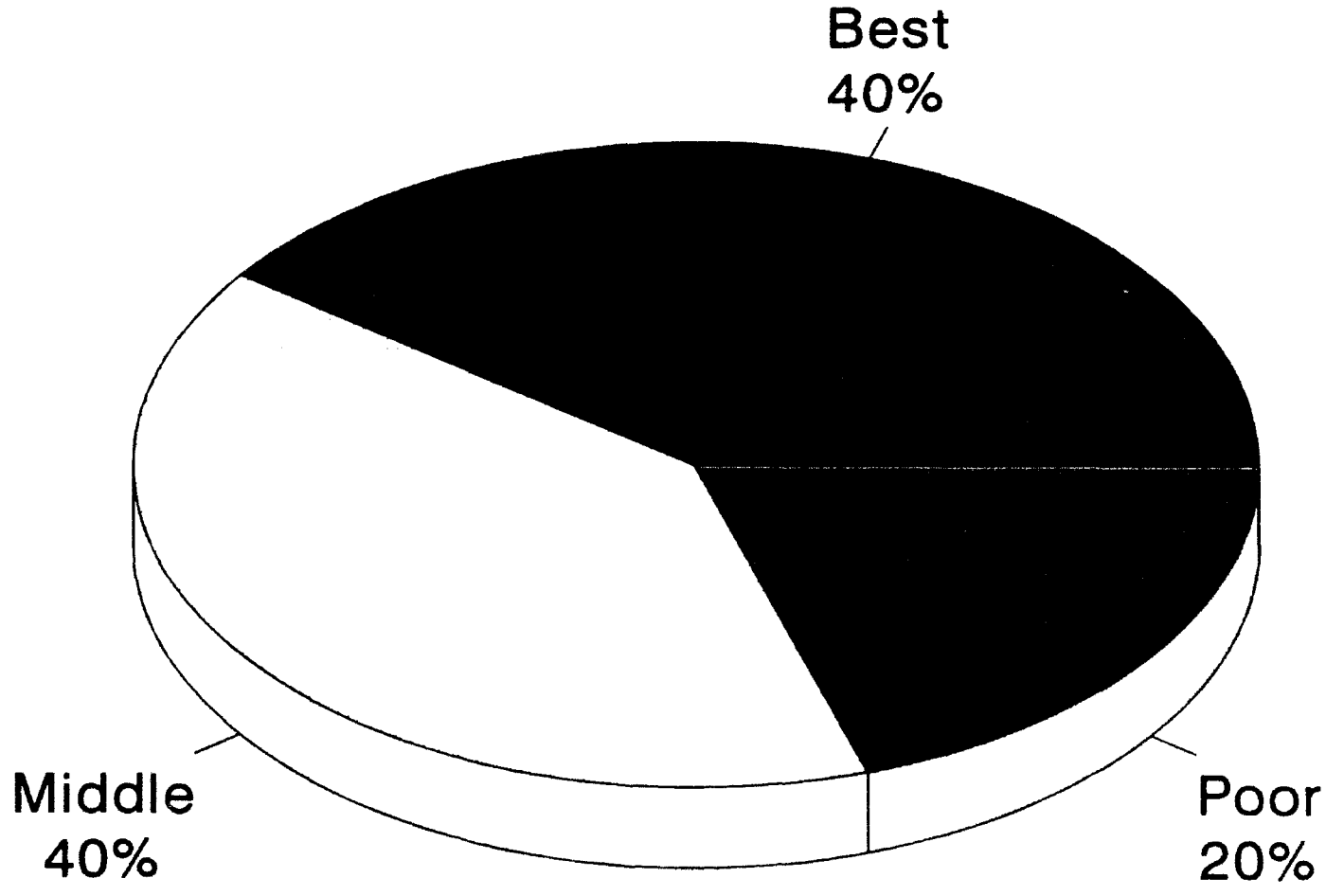
Scale	Mean	S.D.
Information	32.8	3.4
Comprehension	24.4	1.5
Arithmetic	17.4	1.7
Similarities	29.5	3.6
Vocabulary	36.7	5.2
Digit Symbol	28.5	3.8
Picture Completion	27.9	2.8
Spatial	36.5	5.2
Picture Arrangement	12.9	2.5
Object Assembly	16.2	2.9
Verbal Scale IQ	125.0	6.4
Performance Scale IQ	127.1	8.7
Full Scale IQ	127.3	6.6
Raw Scores		

* n = 15

Table 8. MMPI-2 Scores *

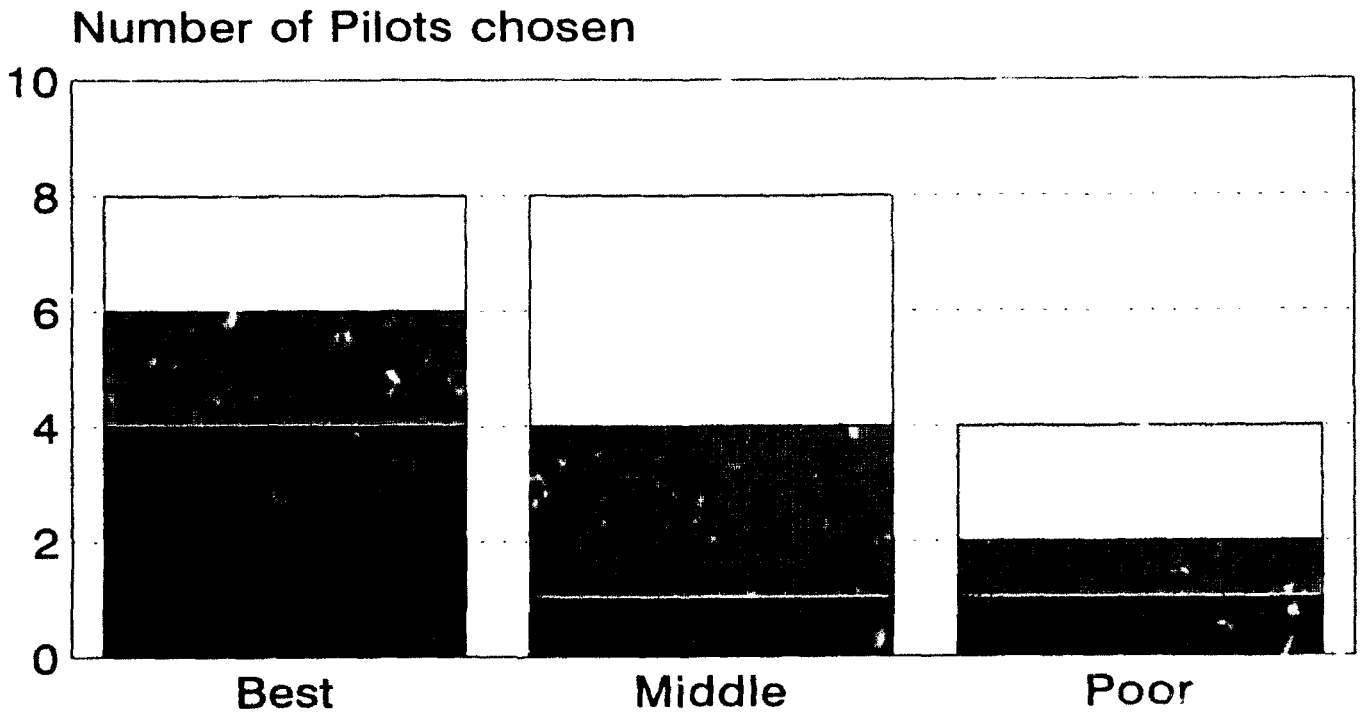
Scale	Raw Scores Mean	Raw Scores S.D.	T Scores Mean
(L) Lie Scale	3.8	1.9	51
(F) Infrequency Scale	2.1	1.9	42
(K) Suppressor Scale	20.4	3.0	61
Hypochondriasis	1.7	1.2	48
Depression	15.3	3.8	43
Hysteria	22.2	3.7	53
Psychopathic Deviance	14.8	2.8	50
Masculinity-Femininity	21.6	4.4	41
Paranoia	9.5	2.2	48
Psychasthenia	4.6	3.0	47
Schizophrenia	5.0	3.4	48
Hypomania	16.2	4.2	51
Social Introversion	17.5	5.9	40

* n = 23



(Best=RD+10+11, Middle=21+00, Poor=20+30, Worst=31)

Figure 4. PCI groups; n=20.



	Best	Middle	Poor
Neither	2	4	2
Wingman	2	3	1
Lead	4	1	1

Number in Flight positions by PCI groups

(Best=RD+10+11, Middle=21+00, Poor=20+30, Worst=31)

Figure 5. PCI groups and flight position ratings; n=20.

DISCUSSION

The major goals of this project were to develop and field test a computerized battery to gather important psychological information about military aviators. To reduce sampling bias, it was optimal to study a squadron of pilots in the field. To attain the goal of gathering normative information on clinical tests, anonymity was considered crucial. An ANG F-16 squadron at Selfridge ANG Base, Michigan with a range of ages and flying experience, offered to participate in this innovative program.

This project considered five questions. First, what instruments should be included in a psychometric test battery for aircrew? Second, would aviators volunteer sensitive information about themselves, if they were assured of anonymity? Third, could aviators agree on their squadron's top performers? Fourth, could they agree on the qualities important in those chosen? Fifth, if truly normative data were gathered, would top performers' profiles be different?

The development of a computerized version of the PCI was one of the major accomplishments of this project. Along with this measure of crew coordination (PCI), measurements of personality (MMPI-2), cognitive capacity (MAB); and one psychiatric epidemiology survey (C-DIS) were combined into a single computerized protocol. This group of tests queried a broad range of mental characteristics. A tremendous effort was needed to combine four different "off the shelf" tests into one computer presentation. The usefulness was demonstrated by making this custom-designed battery of tests that measured intelligence, personality, crew coordination attitudes, and presence/prevalence of psychiatric diagnoses.

Eighty percent of this squadron participated in the testing. Maintaining anonymity by using a self-administered computerized format was another major success in this project. It revealed that pilots would voluntarily offer sensitive information about themselves and their peers. Twenty-nine peer surveys (80%) and 22 MMPI-2 (61%), 20 PCI (55%), 14 MAB (38%), and 5 DIS (13%) tests were collected from the squadron pilot. These lower percentages were caused not by lack of participation, but by technical difficulties causing a loss of data.

MMPI-2 data fell within clinical means. MAB findings confirmed a superior level of cognitive functioning among this group. A curious finding was the elevated means on Arithmetic, Vocabulary, and Digit Symbol subtests. One might expect spatial skills to be in this elevated category since right brain skills are often considered obligatory in flying (24). Likewise, the rapid assimilation of data needed to fly missions in changing environments might be reflected in high mean comprehension scores. The elevations on Arithmetic, Vocabulary and Digit Symbol subtests suggests high left brain skill levels with greater attention to detail and math/language skills.

PCI data demonstrated a range of groups in this squadron; 80% fall within the best and middle groups, and 20% into what is considered the poor group. No pilot scored in the worst group category. Deployed in one or more pairs of aircraft, it is sometimes forgotten that single-seat fighter pilots still need crew

resource management skills. Communication between pilots, and then delegation and division of tasks are critical mission duties. While the results of the top performer survey confirmed more lead pilots (4) chosen from the best group, one lead was chosen from the poor category on the PCI.

Picano (18) has suggested that there is no "one type of personality" identified as best for military pilot selection. While pilot groups may be homogeneous in certain characteristics, they still have areas of uniqueness and diversity. While our data doesn't address selection for pilot training, it does support the premise that individuals chosen to be in a combat flight show a variety of qualities. In short, it takes all different kinds of individuals to fly and complete the mission.

Squadron members did tend to agree about two of their top performers, choosing two individuals for lead and one for wing with a majority (62%, 44%, and 12%, respectively) of their votes. Leadership, job performance, aggressiveness and knowledge were the most frequently chosen characteristics for lead position. Job performance, knowledge, teamwork, and personality were the most frequently chosen characteristics for wing position. This battery can gather important data from a sample as varied as the squadrons that fly the missions. With aviator volunteers, aircrew qualities of top performers can be studied.

Finally, the question of correlations between top performers and their testing results remains to be answered. This testing protocol was a successful approach in obtaining data from a normative aircrew sample. With minor, but necessary refinements; it could be widely implemented for a range of aircrew in varying airframes. Once a larger sample can be studied, attempts can be made to define desirable personal qualities and testing profiles. This project has successfully produced a format that can obtain the information.

Recommendations for Future Research

There are multiple payoffs from this test battery. Psychometric norms could be updated, and aircraft specific norms could be developed. USAF ACS waiver recommendations would benefit from normative data. Baseline cognitive measurements on aviators could be obtained. Gathering information about aviators throughout their careers could yield important information about retention. Primary prevention of mental health difficulties would benefit aircrew (and mission) performance, through data obtained with the C-DIS.

Finally, with sufficient aircrew participation, attempts could be made to correlate top performers' psychological profiles with their personal qualities (as seen by associates). Data from this battery could direct training to prepare future flight leads. Current USAF research into situational awareness, a skill thought to be highly related to combat survivability, could gain from information about top performer qualities and psychological profiles.

As the USAF adapts to face the challenges of the 21st century, one thing will remain constant. The success of the mission will depend upon the capabilities

and performance of the aviator. Payoffs follow the search for understanding of the well-adapted aircrew member. This test battery can gather information that might aid in training the successful pilot of the future. The concept of training cockpit resource management in aviators is one important example of the interface between psychological skills and effective mission performance. By identifying those qualities of successful pilots and those qualities needed for lead and wing positions, the data (personality, intelligence, interpersonal qualities, peer ratings and incidence of psychiatric diagnosis) can tell future managers who to retain in a downsized armed force.

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APPENDIX A
PEER SURVEY

RATING CATEGORIES

1. **GENERAL KNOWLEDGE**
   - *possesses a good fund of information
   - *absorbs new information quickly
   - *reduces complex issues to essential elements
   - *valued for his/her opinions on technical matters

2. **JOB PERFORMANCE**
   - *accomplishes any task thoroughly and efficiently
   - *uses initiative to solve difficult problems
   - *is predictable, consistent, reliable in performance
   - *able to prioritize multiple critical tasks quickly

3. **STRESS TOLERANCE**
   - *demonstrates prompt and accurate reactions
   - *effective in an unexpected emergency
   - *effective under prolonged periods of stress
   - *arrives at practical conclusions in emergencies

4. **LEADERSHIP**
   - *motivates others to complete tasks
   - *delegates work and allows person to complete task
   - *is decisive/flexible when required
   - *has determination and projects decisiveness

5. **GROUP COHESIVENESS**
   - *puts group goals ahead of individual goals
   - *shares credit and accepts blame
   - *tolerant of individual/cultural differences
   - *works effectively with many different people

6. **TEAMWORK**
   - *easy to get along with, good sense of humor
   - *pulls own weight (does own share of undesirable tasks)
   - *gives and accepts feedback/criticism well
   - *good listener

7. **PERSONALITY**
   - *tolerates difficulties and frustration well
   - *few irritating qualities
   - *personable and amiable
   - *self-sufficient, motivated, self-starter

8. **COMMUNICATION SKILLS**
   - *presents self well; speaks clearly and effectively
   - *represents squadron well
   - *concise and focused
   - *gets point across

9. **AGGRESSIVENESS**
   - *pursues goals rather than waiting for them to occur
   - *accepts calculated risks
   - *"makes" opportunities where few seem to exist
   - *desire to excel

PEER SURVEY

Choose from your squadron those three other pilots you would want fill your four-ship for combat, and place their names in the spaces below. Considering those qualities on the facing page, name those that were most important in your choices and rank these in the spaces provided beneath each name (most important 1, next most important 2, etc. 3, 4).

Remember that we are looking for the "best" person you feel will fill each job, but DO NOT choose yourself.

Lead:	**1st Choice Wingman:**	**2nd Choice Wingman:**
_____	_____	_____
(name)	(name)	(name)

[Trustee: remove top portion of this form and destroy]

What qualities were most important in choosing this person?

#1._____	#1._____	#1._____
#2._____	#2._____	#2._____
#3._____	#3._____	#3._____
#4._____	#4._____	#4._____

Trustee use only for random number assignments:

_____ _____ _____

Aircrew member: Trustee will simply separate names from top of page and send bottom of page with assigned random numbers to principal investigator.

APPENDIX B
CONSENT FORM

VOLUNTARY CONSENT STATEMENT

DEVELOPMENT OF A COMPUTER DRIVEN TOOL TO
MEASURE PSYCHOLOGICAL CHARACTERISTICS OF AIRCREW

1. I understand the Neuropsychiatry Branch of the Armstrong Laboratory, Brooks AFB, TX and 127th TAC Clinic, Selfridge ANG, MI are conducting a research study of norms of psychological profiles of well adapted and well functioning aircrew. The purpose of this study is to develop a perspective of the "successful" aviator and gather normative data with a screening battery of psychometric measures. My participation in this study will consist of taking a battery of four psychometric tests on a computer taking approximately 5 hours of total time divided in two equal sessions, on two separate days.

2. I agree to truthfully answer a variety of questions from four standardized psychological tests. I will select random numbers to attach to my disks and will send my name and random numbers in a sealed envelope to a third disinterested party chosen by the squadron aircrew. I will then fill out the "four ship formation" survey identifying my preferences of pilots for flying into combat. I will send my survey in a separate sealed envelope to a disinterested third party where I understand my answers will be held in anonymity. The third party will translate names by the key into random number codes, then destroy the top half of the survey. The trustee will destroy the key after coding the surveys.

3. There are no anticipated hazards or discomfort that I may experience from my participation in this study.

4. I may not receive direct benefit from this research, but the benefits of my participation is helping develop psychological test norms for typical, healthy aircrew. I understand I will not receive individual feedback on my test results.

5. There are no other equivalent alternative procedures to obtain the data sought by this research protocol.

6. Records of my participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 5 U.S.C. 552a, and its implementing regulations. I understand that every possible effort will be made to protect my anonymity. My results will be stored under a random number which I select. The random number will be removed from my disk that would normally allow results to be traced to my name immediately after the data compilation. The data will only be accessible by group results and not by individual data.

7. I understand that my entitlements to medical care or compensation in the event of injury are governed by federal laws and regulations, and if I desire further information, I may contact the Brooks AFB Legal Office or the principal investigator.

8. The decision to participate in this research is completely voluntary on my part. No one has coerced or intimidated me into participating in this program. I am participating because I want to. Major Flynn, Major Sipes or LTC Grosenbach has adequately answered any and all questions I have about this study, my participation and the procedures involved. I understand Major Flynn, Major Sipes or LTC Grosenbach will be available to answer any questions concerning procedures throughout this study. I understand that if significant new findings develop during the course of this research which may relate to my decision to continue participation, I will be informed. I further understand that I may withdraw this consent at any time and discontinue further participation in this study without prejudice to my entitlements. I also understand that the medical monitor of this study may terminate my participation in this study if he or she feels this to be in my best interest, or the best interest of the government.

Volunteer Signature and Social Security Number Date

Witness 1 (not directly involved) Date Witness 2 (not directly involved) Date

Principal Investigator Date